PRODUCTIVE DIVERSIFICATION IN NATURAL RESOURCE ABUNDANT COUNTRIES

Limitations, policies and the experience of Argentina in the 2000s

A dissertation submitted by

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(Argentina)

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To my father

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Doing a PhD degree is not the lonely pursuit that it is commonly believed to be. Certainly, one spends many hours in the library, alone in the office, and working into the night struggling to define the appropriate research question, and searching for answers (which many times turn out to be mistaken). Yet, as the end of this long journey gets closer and one can look back, it is then that the many people have been part of the project come into clear view.

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Abstract

The debate on the pattern of specialization in natural resource abundant countries has re-emerged as demand for raw materials and food products from the rapidly growing East Asian countries, speculation in financial markets, and changes in production techniques augmented the demand and supply of natural resources-related goods.

Up to mid-2008, when the US subprime mortgage crisis gave birth to a world economic meltdown, these transformations promoted a primary commodity boom and a (more) promising future scenario for developing countries: it remains to be seen whether these expectations will materialize. Positive natural resource shocks can be a blessing, but can also be a curse, witness what occurred in many countries after the primary commodity boom of the 1970s.

Using alternative, but complementary methodologies, this research explores the impulses for and limitations to productive diversification associated with a positive natural resources shock, as the one Argentina (and other South American countries) have been experiencing recently. The research investigates some of the policies that have been or could be implemented to manage the effects of the shocks and to promote a more diversified pattern of specialization in resource rich Argentina during the 2000s.

The investigation starts (chapter 2) by evaluating some cross-country empirical regularities in the relation between the patterns of specialization and economic growth. Using up-to-date econometric techniques and alternative indicators of trade specialization patterns, the research questions the (un)avoidability of the so-called resources curse and shows that processing natural resource can be growth enhancing, an effect that is frequently described, but rarely demonstrated.

Most of the chapters in the thesis make an economic-policy oriented and country-case analysis focusing on the interactions among the natural resource sector and other sectors of the economy and how these interactions, in combination with economic policies, can be conducive or not to productive diversification. These complex interactions are explored first using analytical multisectoral models and then through an applied computer general equilibrium model CGE model combined with a small Social Accounting Matrix (SAM) for Argentina, which is updated to to 2004.

The analytical chapters of the research (chapters 3 and 4) extend the standard dependent economy model to incorporate productive linkages and one of Argentina's most relevant structural features, an agricultural sector that has natural competitive advantages and produces wage-goods that are exported and consumed domestically. In contrast to the standard model, the extended models developed in this research suggests that a positive natural resource shock can be beneficial to productive and export diversification if, directly or indirectly, it encourages productive linkages, such as investment in infrastructure. The analytical models are also employed to analyse the effects of Argentina's competitive exchange rate policy. The results suggest that using exchange rate devaluation (with no compensatory policies) to promote structural change is more costly in wage-goods exporting countries such as Argentina, than in countries that have different structural characteristics. They also suggest that exchange rate devaluations, if expansionary, improve the price and non-price competitiveness of the economy since growth in aggregate demand promotes learning and specialization economies through the so-called Kaldor-Verdoorn effect.

Based on the insights from these analytical chapters, Argentina's SAM and an eclectic structuralist CGE model are used to evaluate in chapters 5 to 8 how impulses from positive demand and supply natural resource shocks and economic policies (particularly exchange rate, export tax and government expenditure decisions) have been affecting output growth and the pattern of trade specialization in Argentina in the 2000s.

The research shows in chapter 7 that the recent boom in primary commodity prices, if not coupled with export taxes, can be contractionary in the medium-term, as it constrains the competitiveness of the non-natural resources sectors. This contrasts with the effects of positive supply shock, such as the expansion of Argentina's agricultural sector,

which, in a managed and competitive exchange rate regime, can be expansionary and beneficial for productive and export diversification.

The thesis concludes (chapters 7 and 8) by providing some insights on the role of economic policies in Argentina during the period 2003-2007. It shows that Argentina's competitive exchange rate policy has been one of the factors behind the country's rapid and sustained economic expansion. The exchange rate policy has counteracted Dutch disease adjustments associated with the terms of trade shock and has improved the price and non-price competitiveness of the tradable sector; it therefore has been one of the factors behind the process of productive and export diversification observed in recent years. Finally, the thesis shows that, for this policy to be expansionary, taxes on natural resource exports need to be an integral part of Argentina's competitive exchange rate regime in a wage-goods exporting country such as Argentina,, although additional counter-cyclical policies are also needed to slow down the demand impulses promoted by a competitive exchange rate.

Samenvatting

Het debat over het specialisatiepatroon in landen met veel natuurlijke hulpbronnen is weer opgelaaid omdat de vraag naar en het aanbod van producten op basis van natuurlijke hulpbronnen zijn toegenomen. Dit ligt aan de toegenomen vraag naar grondstoffen en voedingsproducten in de snelgroeiende Oost-Aziatische economieën, aan speculatie op de financiële markten en aan veranderingen in productietechnieken.

Deze ontwikkelingen hebben bijgedragen aan de hausse in grondstoffen, tot de hypotheekcrisis in de Verenigde Staten halverwege 2008 een wereldwijde economische crisis veroorzaakte. Die hausse leidde tot positieve(re) toekomstscenario's voor ontwikkelingslanden, maar het is nog niet duidelijk of deze verwachtingen uit zullen komen. In veel landen is na de hausse in grondstoffen van de jaren zeventig gebleken dat positieve grondstoffenschokken zowel een zegen als een ramp kunnen zijn.

Dit onderzoek gebruikt verschillende complementaire onderzoeksmethoden om de factoren te bestuderen die productieve diversificatie naar aanleiding van een positieve grondstoffenschok stimuleren of belemmeren. Argentinië (en andere Zuid-Amerikaanse landen) hebben recentelijk een dergelijke schok meegemaakt. Het onderzoek richt zich op een aantal beleidsmaatregelen die vanaf 2000 genomen zijn of genomen zouden kunnen worden om de effecten van de schokken te beheersen en om een gediversifieerder patroon van specialisatie te bevorderen in een land met zo veel natuurlijke hulpbronnen als Argentinië.

Dit onderzoek evalueert allereerst een aantal empirische wetmatigheden ten aanzien van het verband tussen specialisatiepatronen en economische groei (hoofdstuk 2). Daarbij wordt gebruik gemaakt van moderne econometrische technieken en verschillende indicatoren van specialisatiepatronen in de handel. Er worden vraagtekens geplaatst bij de onvermijdelijkheid van de zogenaamde 'vloek van de hulpbronnen'. Uit dit

onderzoek blijkt dat de verwerking van natuurlijke hulpbronnen de groei kan bevorderen. Dit effect wordt vaak beschreven, maar is zelden aangetoond.

De meeste hoofdstukken in dit proefschrift bevatten casestudy's van het binnenlands economisch beleid, waarbij de interactie tussen de grondstoffensector en andere economische sectoren centraal staat. De onderzoeksvraag is in hoeverre deze interactie in combinatie met het economisch beleid leidt tot productieve diversificatie. Deze complexe interacties worden eerst geanalyseerd met meersectorenmodellen en vervolgens met een toegepast algemeen evenwichtsmodel (Computer General Equilibrium model of CGE-model) in combinatie met een kleine Sociaaleconomische sectorale weergave van de macro-economische gevolgen van de overheidspolitiek (Social Accounting Matrix, SAM) voor Argentinië, die bijgewerkt is tot 2004.

In de analytische hoofdstukken van het onderzoek (hoofdstuk 3 en 4) wordt het standaardmodel voor afhankelijke economieën uitgebreid met productieve verbindingen en met een van de relevantste structurele kenmerken van Argentinië. Dit is dat het een land is met een landbouwsector die natuurlijke concurrentievoordelen biedt en goederen produceert die zowel voor de export als voor de binnenlandse markt bestemd zijn. In tegenstelling tot het standaardmodel geven de uitgebreide modellen die in dit onderzoek ontwikkeld zijn aan dat een positieve grondstoffenschok gunstige effecten kan hebben. Een positieve grondstoffenschok kan productieve diversificatie en diversificatie van de export bevorderen als productieve verbindingen, zoals investeringen in de infrastructuur, hierdoor direct of indirect worden gestimuleerd. De effecten van het concurrerende wisselkoersbeleid van Argentinië worden ook met de analytische modellen geanalyseerd. Hieruit blijkt dat devaluatie van de valutakoers (zonder compenserende maatregelen) als middel om structurele verandering te bevorderen in exportlanden zoals Argentinië meer kosten met zich meebrengt dan in landen met andere structurele kenmerken. Uit de resultaten blijkt ook dat de prijsconcurrentie en de algemene concurrentiepositie van de economie verbeteren als de devaluatie van de valutakoers expansief is, omdat een groei van de totale vraag het leren en de specialisatie van de economie bevordert. Dit is het zogenaamde Kaldor-Verdoorn effect.

De bevindingen uit de analytische hoofdstukken vormen de basis voor het onderzoek dat in hoofdstuk 5 tot en met 8 beschreven wordt.

Met de SAM voor Argentinië en een eclectisch structuralistisch CGE-model worden de effecten van positieve schokken in de vraag naar en het aanbod van natuurlijke hulpbronnen en de effecten van het economisch beleid (vooral op het gebied van de wisselkoers, exportbelasting en overheidsuitgaven) onderzocht. Het gaat hierbij om de vraag in hoeverre deze twee factoren vanaf het jaar 2000 de productiegroei en de specialisatie in de handel in Argentinië hebben beïnvloed.

Uit de onderzoeksresultaten in hoofdstuk 7 blijkt dat de recente hausse in de prijzen voor grondstoffen op de middellange termijn restrictief kan zijn als deze niet gekoppeld wordt aan exportbelasting, omdat hierdoor de concurrentiepositie van de overige sectoren verslechtert. Effecten van een positieve schok in de vraag, zoals de groei van de Argentijnse landbouwsector, kunnen daarentegen expansief zijn en productieve diversificatie en diversificatie van de export bevorderen, mits er gezorgd wordt voor een concurrerende wisselkoers.

De laatste hoofdstukken van dit proefschrift (hoofdstuk 7 en 8) bieden inzicht in de rol van het Argentijnse economisch beleid in de jaren 2003 tot 2007. Het concurrerende wisselkoersbeleid blijkt een van de oorzaken te zijn van de snelle en duurzame economische groei in Argentinië. Het wisselkoersbeleid is een remedie tegen de Hollandse ziekte, die gepaard gaat met de schok in de ruilvoet. Door dit beleid is de algemene concurrentiepositie van de handelssector verbeterd. Dit beleid is daarom een van de factoren die de laatste jaren hebben bijgedragen aan de productieve diversificatie en de diversificatie van de export. Ten slotte blijkt uit dit onderzoek dat dit beleid alleen expansief is als de exportbelasting op natuurlijke hulpbronnen een integraal onderdeel vormt van het Argentijnse concurrerende wisselkoersbeleid. In een exportland als Argentinië is er echter ook aanvullend anticyclisch beleid nodig om de toename in de vraag die ontstaat door een concurrerende wisselkoers af te remmen.

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Acronyms

AFIP	Administración Federal de Ingresos Públicos
ASLI	Agricultural supply led industrialization
BCRA	Central Bank of the Argentine Republic
BOP tables	Balance of payment tables
CEP	Centro de Estudios de la Producción. Ministerio de la Producción
CGE	Computable General Equilibrium
CPI	Consumer price index
DNCI	Dirección Nacional de Cuentas Internacionales
DNCN	Dirección Nacional de Cuentas Nacionales
DNIAF	Dirección Nacional de Investigación y Análisis Fiscal
ENGE	Encuesta Nacional de Grandes Empresas
ENGHO	Encuesta Nacional de Gasto de los Hogares
EPH	Encuesta Permanente de Hogares
GDP	Gross domestic product
GMM	General Method of Moments
INDEC	Instituto Nacional de Estadísticas y Censos
LHS	Left hand side
MECON	Ministerio de Economía y Producción
MICLY	Michaley's index of inter-industry trade
MIPAr97	Matriz de insumo producto Argentina. 1997
NIPA	National Income and Production Accounts
OLS	Ordinary Least Square
RHS	Right hand side

SAM	Social Accounting Matrix
SCER	Stable and competitive exchange rate
SH	Secretaría de Hacienda
SIF-SH	Document "Sector Público Argentino no Financiero. Cuenta de Ahorro-Inversión-Financia-miento" elaborated by SH
TDIV	Trade diversification index
TFP	Total factor productivity
TRDI	Trade dissimilarity index
TSTD tables	Total supply and total demand tables

1 Introduction

1.1 Structural Change: A Necessary but Elusive Condition for Economic Development in Resource Abundant Countries

The contribution of international trade to economic development is still a contested relation, despite the large and increasing number of theoretical and empirical studies on this topic. Although autarky or a limited integration with world markets has failed to deliver sustained output growth and better living conditions, the opposite is not necessarily true. There is no conclusive evidence of a positive relationship between the degree of openness of an economy and economic growth (Rodriguez and Rodrik, 1999, Rodriguez, 2007), and many experiences of trade liberalization show that reforms provide a rocky road rather than a smooth highway to economic development (Vos, 2001).

The aggregate picture hides many of the channels and mechanisms through which integration with world markets could encourage – or retard – economic development. At an aggregate level of analysis the benefits from international trade arise from improvements in allocation efficiency. However, these advantages are static in nature and imply that the contribution of trade to economic development occurs in a once and for all fashion. Yet, economic development is a dynamic phenomenon that depends on structural change, factor accumulation and productivity growth, whose returns and expansion possibilities vary across different activities and economic sectors (Ocampo, 2005b; Palma, 2005). It is the pattern of specialization – what a country produces and exchanges in the international market–, therefore, and not just trade what matters for economic development (UN-WESS, 2006).

Although there is no consensus on the pattern of trade specialization that is most beneficial for economic development, empirical evidence suggests that specializing in natural resource-related products is detrimental to economic growth. As Murshed (2004) and Sachs and Warner (2001), and many others show, countries that export natural resources, on average tend to grow less than countries with a different pattern of specialization, an empirical regularity known as the resource curse.

There are different and competing explanations of this phenomenon. The one hypothesized and explored in this research, associates this development "paradox" to the question of structural change – and more particularly to the difficulties that most natural resource exporting countries encounter in attempting to diversify their productive and export structure.[1]

The constraints to structural change associated to natural resource abundance have been emphasized in static and dynamic versions of the dependent economy model employed to explain the adjustment to the primary commodities shock that took place during the 1970s and 1980s and affected both developed and developing countries (Corden and Neary, 1982; van Wijnbergen, 1984; Murshed 1999). They have been used to account for the experiences of Argentina and South American countries in several classic and recent works (Diamand, 1972, Schydlowsky 1993; Chena and Perez Candreva, 2008). These accounts do not focus on the response to a particular shock, but point to the structural limitations for productive and export diversification imposed by the competitive advantage[2] of Latin America's agricultural and minerals sectors.

The problem of productive and export diversification is particularly relevant in natural resource-rich Argentina. Once the 7th richest country in the world, Argentina currently lags behind many industrialized and developing countries. Throughout its history, Argentina has experienced spurts of fast economic growth, which came to an end as they led to unsustainable current account deficits. Elasticity-driven stop and go cycles ruled during the period of import substitution in the 1950s and 1960s, and debt-driven balance of payments crises followed the liberalization processes implemented during the 1970s and 1990s.

Despite the role of economic policies leading to unsustainable external positions, Argentina's recurrent balance of payments crises illustrate that, historically, the country has been in need of foreign exchange (to finance imports that are highly elastic to income changes but unresponsive to price variations, as shown in Nicolini-Llosa (2007b), and to repay the interest and capital of Argentina's external debt). Equilibrium in external accounts and sustained growth in Argentina require a dynamic exporting sector.

Argentina has an internationally competitive export sector that produces various agricultural crops (maize, wheat, soybeans, among others) and premium quality meat and fish products. Yet, only during the first era of globalization (1870-1930), this sector provided the foreign exchange required to finance Argentina's international obligations.[3]

The inability of the traditional export sector to ensure a stable and sufficient supply of foreign exchange, alongside other characteristics specific to the sector – such as the limited dynamism of natural resource exports, the limitations that the sector imposes on the development of other tradable sectors, topics explored in this research, and the slow response of agriculture and cattle supply to price signals – are among the fundamental *raisons d'être* that make the competitive diversification of Argentina's productive and export structure a fundamental condition for sustained economic development..

Additional reasons for promoting the competitive diversification of the tradable sector are related to the necessity to improve the socio-economic conditions of Argentina's population[4] (Serino, 2007) and to overcome the growth-retarding effects of natural resources exporting (van der Ploeg, 2008).

1.2 Research Questions and Propositions

This research studies the question of structural change in relation to the limitations, impulses and policies to productive diversification in countries endowed with abundant or highly productive natural resources, as many South American and Argentina in particular are.

An inquiry into the competitiveness hypothesis of the natural resource curse

Debate over the pattern of specialization and the question of structural change in resource abundant countries re-emerged as demand for raw materials and food products from rapidly growing East Asian countries, speculation in financial markets and changes in production techniques augmented the demand and supply of natural resource-related goods. Until mid-2008, when the US subprime mortgage market crisis gave birth to a world economic meltdown, the abovementioned transformations turned Prebisch-Singer's terms of trade hypothesis on its head and created a (more) promising future scenario for resource-rich developing countries.

It remains to be seen whether these expectations materialize. Positive natural resource shocks, as the one developing countries have been facing recently, can be a blessing but may also turn out to be a curse, as occurred in many countries after the primary commodity boom of the 1970s (Auty, 2001). Cross-country empirical evidence and the literature on the resource curse provide reasons to be concerned about the possible negative consequences that positive resource shocks can have for economic development.

The first questions guiding of this research, therefore, are related to this growth "paradox" affecting resource abundant countries. These questions are introductory and exploratory and are aimed at contextualizing the research drawing on insights from a cross-country analysis, before turning to the other two sections of the research: the analytical and applied sections designed to analyse the case of Argentine and other resource abundant South American countries.

These guiding questions try to challenge the unavoidability of the so-called curse of natural resources and to explore the different motives that are supposed to promote slow growth in resource abundant countries. These range from issues linked to physical and human capital accumulation,[5] economic policies and the (mal)functioning of institutions,[6] - especially the limitations of natural resource-exporting countries to diversify their export structure. The first question is:

1. *Do all natural resource exporting countries experience the resource curse? Are all natural resource exporting countries unable to modify their patterns of trade specialization and benefit from trade integration?*

To address this question we conduct an empirical exploration of the competitiveness hypothesis of the resource curse, an explanation which most studies on this topic overlook. To my knowledge only Lederman and Maloney (2003) systematically study this transmission channel.

This hypothesis is linked to the dynamic "Dutch disease" story proposed by Sachs and Warner (1995, 2001) and some of the insights from new trade theory and Keynesian propositions (Serino, 2008). According to this hypothesis, constraints to diversification do not allow resource exporting countries to take advantage of some of the growth-enhancing benefits of international trade. Benefits that countries can obtain through the exchange of specialized industrial goods (intra-industry trade enabling the achievement of scale and specialization economies), and/or the development of a dynamic tradable sector that adapts easily to (or even promotes) the main trends observed in world trade (Amable, 2000, Ros, 2005.)

The dependent economy model revisited:
Productive linkages and productive diversification in wage-goods exporting countries

The cross-country approach demonstrates the importance of export diversification for long-term growth in resource abundant countries, but it does not explain how the structural characteristics of an economy and economic policies can limit or encourage changes in the pattern of specialization. It also provides no information about how the natural resource sector interacts with other economic sectors, a fundamental concern for the design of economic policy.

According to the literature, static competitive advantages in the production of natural resource-intensive products due to abundant or highly productive natural resource endowments, undermines the development of other tradable sectors, where activities conducive to high economic growth take place (see e.g. Matsuyama, 1992). In most static and dynamic multi-sectoral models, the interaction between the natural resource and other tradable sectors leading to Dutch disease adjustments occurs through changes in relative prices, following exchange rate, nominal wage or non-tradable price adjustments.

There are other direct and indirect ways, nevertheless, in which economic sectors are related, which are more complementary than competitive in nature, and which this thesis emphasizes. The natural resource and other tradable sectors may indeed interact positively and in a complementary way when productive linkages are developed, as the natural resource sector demands industrial inputs, its production is processed industrially and/or its expansion encourages the development of producer services, as for instance physical infrastructure, which can be used by other tradable sectors (Hirschman 1958, 1981).

Very few researchers incorporate the positive and complementary interactions between the natural resources and other tradable sectors into their analytical models. One of them is Ragnar Torvik. In his 1997 paper, Torvik shows that the expansion of the agricultural sector improves industrial competitiveness by reducing the price of wage goods, opening the room for what he calls a process of agricultural supply led industrialization.

The others are Eswaran and Kotwal (2002) and Ros (2000), who emphasize the positive indirect interaction between the natural resource and industrial sectors, which is mediated by productive linkages. The competitiveness of the tradable sectors, especially the industrial sector, depends on relative prices, as emphasized in the conventional approach, but is also related to the development of productive linkages. These include especially producer services, which are non-tradable and are characterized by the presence of scale and specialization economies.

The second set of guiding questions takes account of some of these insights and focuses on the interaction among economic sectors, and how the impulses of positive natural resource shocks are transmitted throughout the economy, and are related to economic policies and the characteristics of economic sectors. These questions are associated directly to the analytical models developed in the second section of this thesis.

2. *Under what conditions can a positive shock be beneficial to productive and export diversification and contribute to modifying the pattern of specialization in natural resource exporting countries?*
3. *How do the characteristics of a country's economic sectors affect the adjustment to a positive natural resource shock?*
4. *How do the characteristics of Argentina's natural resource sectors influence the results of diversification policies?*

To address these questions, I extend Ros's (2001) multisectoral model discussing changes to the pattern of specialization in developing countries. The analysis in Ros (2001) studies movements from labour intensive to capital and technologically intensive industries, promoted by the expansion of productive linkages. This research focuses on the experience of Argentina, but may be applicable also to other resource-rich South American countries such as Uruguay, Chile, and Colombia and to a lesser extent Brazil, and analyses the (possibilities of a) transition from natural resource based to modern industrial production and exports, a possibility mentioned but not fully developed by Ros.

A second *proposition of this research is that the implications of natural resource abundance and positive resource shocks for economic diversification depend on how the income from the natural resource sector is spent. And this in turn is linked to the* *characteristics of the natural resource sector and government policies*. Dutch disease adjustments prevail if resource income is used principally to finance consumption. But a positive interaction may arise, whereby the expansion of the natural resource and other tradable sectors reinforce each other, if natural resources income contributes to finance the development of productive linkages.

The analytical model developed in Chapter 3 provides new insights into and propositions on the question of structural change in resource abundant countries, which are explored in the applied section of this thesis in relation to Argentina in the 2000s. Yet, the discussion of productive diversification in Argentina and the impact of natural resource shocks and policies, it is also hypothesized in this research, must take account of one of Argentina's most relevant structural features: a resource sector that due to natural advantages is more competitive than other tradable sectors and that produces wage-goods, which are both exported and consumed domestically.

To answer questions 3 and 4 above, I develop a modified version of the Scandinavian dependent economy model (Dornbusch, 1980; Murshed, 1997) – which is a macro and more policy-oriented model than the one developed in Chapter 3 – that takes into consideration how impulses from the natural resource sector operate in wage-goods exporting countries and how this feature of the Argentine economy affects economic policies. In particular, the exchange rate policy which, in a context of sustained current account surpluses, was preserved deliberately at a competitive level between 2003 and 2008. This policy, which in this thesis is described as the Stable and Competitive Exchange Rate (SCER) policy, was implemented as a development policy, to enhance overall competitiveness (Frenkel and Taylor, 2006), and especially in Argentina's non-traditional tradable sectors.

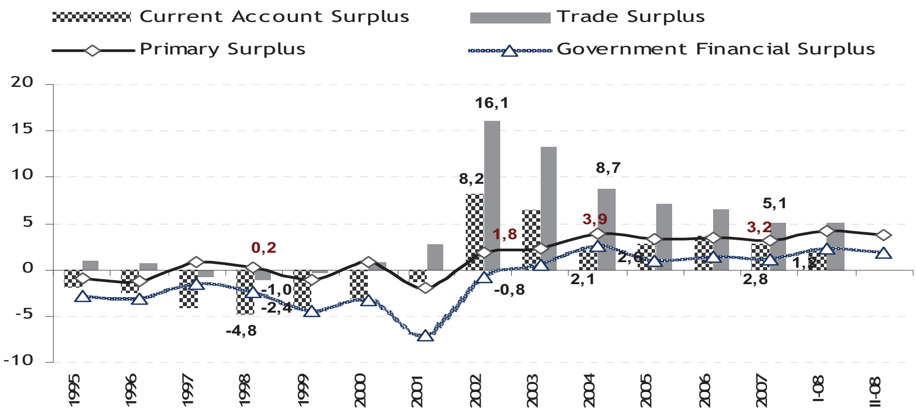
An innovative feature of the model, and the economic policy discussion, relates to the definition of the competitiveness of the non-natural resource sector, which has a price component that is affected by nominal wages and/or the nominal exchange rate, and a non-price component linked to the evolution of labour productivity. This latter effect, it is hypothesized, is influenced by macroeconomic policies, because the expansion in aggregate demand promotes productivity growth, an effect known as the Kaldor-Verdoorn effect, which is rarely taken into account in the analyses of such policy.

Natural resource shocks, exchange rate policy and productive diversification in Argentina during the 2000s

Similar to other resource-rich Latin American countries, Argentina has experienced a sustained expansion of output since 2003[7] In contrast to the historical experience, output growth in Argentina during the period 2003-2008 was not inhibited by either external bottlenecks or fiscal imbalances. As shown in Figure 1.1, in 2003-2008, Argentina experienced sustained fiscal, trade and current account surpluses.

In relation to this growth process, it should be noted that first, as already mentioned, consolidating the growth process and achieving sustained economic development in Argentina requires a competitive and diversified tradable sector (Porta, Bianco and Vismara, 2008).

Figure 1.1
Macroeconomic balances in Argentina. 1995-2008 (% of GDP)



Source: Ministry of Economy and Production of the Argentine Republic

Second, the context and the economic policies associated to this growth process and how they relate to the question of productive and export diversification in Argentina are also important. Of particular significance for this research are the positive demand and supply shocks affecting Argentina's natural resource sectors (Arceo and González, 2008). Positive natural resource shocks can set in motion price adjustments that reduce the competitiveness of the non-traditional tradable sector and thus limit, rather than promote, economic diversification.

Also relevant for this research are the policies designed and implemented to absorb these shocks and the competitive exchange rate policy employed to encourage productive and export diversification in a wage-goods exporting country. The final guiding questions of this research have been particularly designed to evaluate the adjustment of the Argentine economy to the abovementioned shocks and policies:

5. *How have the impulses from positive demand and supply natural resources shocks and economic policies (particularly exchange rate, export taxes and government expenditure decisions) affect the performance of Argentina's non-natural resource tradable sectors in recent years?*
6. *What has been the incidence of the competitive exchange rate policy for Argentina's recent economic recovery and the dynamism of the non-natural resource tradable sectors?*

The answers to these questions are based on counterfactual simulations run with a dynamic structuralist CGE model. A final proposition of the research is that: government policies, especially the exchange rate policy and export taxes, adequately channelled natural resource shocks and prompted additional impulses for output growth and productive diversification.

1.3 Research Methodology

This research discusses the question of productive diversification in resource abundant countries and Argentina using alternative, albeit complementary, methodologies. Chapter 2 provides a cross-country econometric approach evaluating certain empirical regularities in the relation between the pattern of specialization and economic growth relevant to this research. This chapter is exploratory and is designed to contextualize the remaining of the research, which makes an economic-policy oriented and country-case discussion of the problem of structural change.

The remaining of the research uses complementary modelling strategies: analytical multisectoral models first and an applied computer general equilibrium model secondly. In Chapters 3 and 4,[8], the research develops two analytical multisectoral models. These are extensions to of the dependent economy model, and are used to derive propositions – under limiting assumptions common to most analytical models – as to how impulses from the natural resource sector are transmitted to the rest of the economy and how the characteristics of economic sectors and economic policies can promote or retard productive diversification. These analytical propositions are subsequently explored using a general equilibrium framework and a dynamic CGE model in Chapters 5 to 8. The CGE model and the associated Social Accounting Matrix (SAM) provide empirical content and are designed especially to reproduce key aspects of the analytical models and key structural characteristics of the Argentine economy.

The growth econometric analysis employed in Chapter 2 discusses the growth "paradox" affecting countries that are exporters of natural resource-intensive goods, and evaluates the competitiveness hypothesis proposed to explain this empirical regularity.

The econometric analysis looks at long-term growth and, unlike most other similar studies, complements traditional cross-section estimations with dynamic panel-data techniques: the system-General Method of Moment (GMM) methodology that is the most suitable for growth econometric studies (Lederman and Maloney, 2003). The research in this thesis is novel in using long-term disaggregated trade data sets – provided by the United Nations' (UN) COMTRADE and CEPII's (Centre d'Estudes Prospectives et d'Informations Internationales) CHELEM long-term trade databases – to elaborate sophisticated measures of trade specialization that are necessary to explore and properly evaluate the competitiveness hypothesis. These measures distinguish between unprocessed and manufactured natural resource products and are informative about intra-industry trade and the dynamism of the pattern of trade specialization.

Chapter 2 uses a different unit of analysis, cross-country *vis-à-vis* is more country-case oriented, and different theoretical background to the other chapters in this thesis. The cross-country growth econometric approach is based on the one-sector neoclassical growth model, which is different from the structuralist approach taken in this research and looks at changes in the structure of production in a context of underemployment of resources. Despite the limitations of the neoclassical growth model, which can be overcome but not very convincingly by assuming that sector-specific factors affect the total productivity parameter of an aggregate production function, the cross-country approach is employed because it provides proper guidance about how to look for empirical regularities using econometric methods.

Analysis of the interactions among different economic sectors and how this interaction, in combination with economic policies, is conducive or not to productive diversification, is explored first using multisectoral models that extend the standard dependent economy model (see Dornbusch, 1980; Agenor and Montiel, 1996).

In Chapter 3, the research presents a dependent economy model that incorporates productive linkages. This model is based on the analysis in Ros (2000, 2001) and discusses a case, which is not developed in detail by Ros: changes to the pattern of specialization in resource abundant nations.

The model distinguishes between tradable and non-tradable goods and sectors and the tradable sector is disaggregated according to the existence of natural resource endowments. There are two tradable sectors, the natural resource one and the potentially competitive industrial sector. To study the role of productive linkages the non-tradable side of the economy distinguishes two types of products and sectors: consumer-oriented and producer-oriented. The second group includes physical, technological and financial infrastructure and specialized services. These are produced using a technology describing increasing returns to scale and are intensively used in the manufacturing sector. Therefore, productive linkages can be a source of complementarities with implications for the pattern of specialization: if productive linkages are extensive the industrial sector in a resource abundant country can break even enabling diversification.

The analytical section of this thesis also includes an unemployment version of the Scandinavian dependent economy model. The model is presented in Chapter 4 in order to study the macroeconomic implications of positive natural resource shocks and some of the real effects of nominal exchange rate devaluations.

The model is standard in that it has two tradable sectors – a traditional natural resource sector and the industrial one – and a non-tradable sector, but has some innovative features (e.g. Dornbush, 1980 and Murshed, 1997). First, it includes a wage equation linking factor payments to average factor's productivity, as in Rattsø and Torvik (2003); this is an extension showing how Argentina's natural advantages in agricultural production constrain the competitiveness of other tradable sectors. Second, the model assumes that the natural resource sector produces wages-goods, which are both exported and consumed domestically, and thus shows that exchange rate devaluations in wage-goods exporting countries are more costly than in countries with different structural characteristics. Third it includes a productivity equation linking productivity growth to aggregate demand, a relationship known as the Kaldor-Verdoorn effect. This model, therefore, considers the price and non-price dimension of industrial competitiveness, broadening the debate on the effects of the competitive exchange rate policy.

Chapters 5 to 8 in this thesis study the recent experience of Argentina: a South American resource abundant country that has undergone positive natural resource shocks and has implemented a competitive exchange rate policy to diversify its productive and export structure.

The country-case analysis uses a dynamic structuralist CGE – and a small SAM for Argentina[9] – to make counterfactual simulations covering the medium-term period from 2004 to 2007.[10]

The dynamic CGE model draws on existing applied models, which are combined and redefined in order to capture the propositions in earlier chapters of this thesis, and key properties of the Argentine economy. Many aspects of the CGE model have a structuralist background, as for instance the assumption of quantity adjustment in the industrial sector, and the inclusion of wage, trade and investment equations. Their specification has many points in common with the models developed in Gibson (2005), Gibson and van Seventer (2000a, 2000b) and Taylor (1990). Other aspects of the model, such as the behaviour of the natural resource tradable sectors, are defined following the so-called standard trade model, first developed by Dervis, de Melo and Robinson (1982) and further extended by Löfgren, Lee Harris and Robinson (2001). Although the specification in this thesis differs from the one in Chapter 4 – in which wage-goods prices are determined in direct relation to international prices – it is used to make model more flexible.

The relation between the CGE model and other aspects of this research is also related to the classification of economic sectors. The model distinguishes between tradable and non-tradable sectors, and identifies different groups of tradable activities (and commodities). Two of these are linked to natural resource endowments: the primary sector and natural resource-based industries, which differ in terms of the degree of processing of natural resources (as in Chapter 2), and are, especially the second one, the sectors producing wage-goods. A distinction taken into consideration to identify the particular effects of natural resource shocks, and the exchange rate and export tax policies in wage-goods exporting countries, as discussed in Chapter 4.

The remaining tradable sectors are related to industries (and tradable services) in which Argentina does not have a natural competitive advantage. The model and SAM also classify the service sectors in two comprehensive categories, such as the ones identified in the model in Chapter 3: producer oriented and consumer oriented services, depending on whether they are linked to other productive activities, and therefore can be considered to be productive linkages, or are they produce to satisfy final demand. The structuralist CGE model also associates the competitiveness of the non-natural resource tradable sectors to price and non-price factors. The former is to capture conventional Dutch disease adjustments and some of the competitiveness impulses provided by exchange rate devaluations; the latter is to take account of endogenous changes in labour productivity and the contribution of productive linkages to the competitiveness of Argentina's non-natural resource tradable sector, two propositions derived in Chapters 3 and 4.

A final comment should be made in relation to the discussion of changes to the production and export structures based on counterfactual simulations extended over the 2004-2007 and 2004-2010 periods. Changes in the structure of production and exports follow from processes that take time to unfold and may not be fully captured by the counterfactual simulations in this research; and indeed are not expected to do so. Dynamic counterfactual simulations, instead, are employed to study Argentina's responses to positive terms of trade shocks and the competitive exchange rate policy, and how the characteristics of the adjustments create impulses that can constrain or promote the diversification of Argentina's production and export structure.

1.4 Research Findings and Limitations

A general lesson from this research is that generalizations should be avoided. The research shows that *the characteristics of the economic sectors linked to natural resource endowments are a fundamental determinant of a country's economic trajectory and its adjustment to exogenous shocks, and are crucial for the design of economic policies and their results.*

The new insights from the current investigation are related to this general statement. Albeit small, most of the chapters in this thesis make contributions to the current literature. It contributes to the literature on the resource curse, both methodological and empirical, it proposes two different extensions to the dependent economy model and it discusses their particular implications for productive diversification in resource abundant countries and Argentina in particular. And finally, the research constructs a small SAM and an eclectic structuralist CGE model to make a systematic evaluation of two key events in Argentina during the 2000s: the positive demand and supply shocks to the natural resource sector and the implementation of a competitive exchange rate policy.

What follows is a list of the main contributions of the present research. In relation to the cross-country empirical analysis (Chapter 2) note that:

- unlike the bulk of the empirical resource curse literature, this study uses a dynamic panel data methodology and employs long-term trade disaggregated datasets to elaborate indicators that are informative about the dynamic properties of the pattern of trade specialization.
- the research shows that it is only specialization in natural resource products with little or no processing that slows down economic growth, for it impedes profiting from the dynamic benefits of trade integration. The resource curse will not be inevitable for countries that develop competitive industries to process their natural resources.

The extensions to the dependent economy models developed in analytical chapters of the research show that:

- positive natural resource shocks do not only engender Dutch disease adjustments. Shocks affecting a natural resource sector with important productive linkages can be beneficial for the competitiveness of the entire economy, and the same applies also to economic policies, if they encourage linkages in the natural resource sector and/or channel resource revenues to finance the expansion of productive linkages, such as investment in infrastructure (see Chapter 3);
- the conditions for a positive natural resource shock to encourage a "paradoxical" increase in unemployment and/or current account imbalances are: (i) a natural resource sector that is not the largest tradable one and thus cannot ensure that the positive income effect of the shock compensates for its negative substitution effects; (ii) large dif-

ferences between the competitiveness of the natural resource and non-resource tradable sectors; and (iii) imports that are inelastic to price changes (see Chapter 4);

- using exchange rate devaluations (without compensatory policies) to promote structural change is more costly in wage-goods exporting countries, such as Argentina, than in countries with different structural characteristics, as they create a larger reduction in real wages and do not add to the competitiveness of the industrial sector (see Chapter 4);
- expansionary devaluations improve the non-price competitiveness of the economy, as growth in aggregate demand promotes learning and specialization economies through the so-called Kaldor-Verdoorn effect (see Chapter 4).

Counterfactual exercises provide the following new insights into the characteristics of Argentina's adjustment to recent positive natural resource shocks and the competitive exchange rate policy:

- Argentina's fast economic growth in 2004-2007 is related not only to exogenous factors and the exchange rate policy. The recovery of public investment and the dynamics of productivity, two factors that encourage economic development, identified in the analytical chapters in this thesis (Chapters 3 and 4), seem also to have contributed to GDP growth through the promotion of a process in which aggregate demand and economic competitiveness reinforce each other (see Chapter 6);
- positive terms of trade shocks are contractionary in the medium-term, as domestic inflation and the competitive loss of the non-natural resources sectors unfold. These negative dynamic effects in Argentina have been partially offset by export taxes and a competitive exchange rate policy (see Chapter 7);
- in contrast to the terms of trade shock, positive supply shocks, as the expansion of Argentina's agricultural sector, are expansionary and can be beneficial for productive and export diversification, as it contributes to slowdown domestic inflation. In contrast to the hypothesis derived in Chapter 3, the expansion of the natural resource sector does not encourage productive diversification through the expansion of the productive linkages (see Chapter 7).

- Argentina's competitive exchange rate policy has been a factor behind the country's rapid and sustained economic expansion. This exchange rate policy has counteracted the Dutch disease adjustments associated with the terms of trade shock, improved the price and non-price competitiveness of the tradable sector through the effects proposed in Chapter 4, and thus has been expansionary (see Chapters 7 and 8);
- taxes on natural resource exports need to be an integral component in the exchange rate policy regime, as proposed in Chapter 4, but such a policy also requires additional counter-cyclical policies to curb the demand impulses promoted by a competitive exchange rate. If exchange rate policy is aimed at encouraging productive and export diversification without reducing real wages, downward adjustments in government consumption and/or rising income taxes to rich households are the most appropriate tools (see Chapter 8).

The investigation in this thesis answers most of the research questions posed, but also raises some new questions. As stated in the conclusions (Chapter 9), further research on the limitations, impulses and policies for productive diversification will require: a more detailed analysis of Argentina's economic sectors, both the natural resource and other tradable sectors; taking into account the sustainable use of natural resources, and considering other economic policies related to the monetary and financial dimensions of the economy and/or the design and implementation of anti-cyclical funds to manage positive shocks.

A challenge for future research will be to investigate the political economy aspects of the natural resource shocks identified and referred to throughout this thesis. Consideration of these political economy issues, however, will require a multidisciplinary approach with teams of scientists from different fields - economists may be good at identifying where problems lie or disputes stem from and their economic rationale, but generally are not able to successfully move beyond this point.

Notes

[1] Although the term structural changes can be understood in different ways, in this thesis it refers to changes in the structure of production, which is in line with the approach in development economics (see Ocampo, 2005b and Syrquin, 1989). In the case of resource abundant countries, structural change is understood as the emergence of competitive industrial and tradable service sectors.

[2] Throughout this research I use the concept competitive advantage to refer to the ability of a country or firm to produce at a lower cost than another country or firm, rather than to the concept of comparative advantage, which is related to opportunity costs. While the latter meaning is more common in standard trade theory and refers to gains from trade of specializing production of a particular tradable good, in a two-country setting with independence of production costs, the former concept is associated more with the new trade theory and emphasizes absolute cost competitiveness, which, therefore, can be affected by economic policy. The concept of competitive advantage, therefore, is consistent with the aim of this research which is to investigate the ability of Argentina and other natural resource abundant countries to diversify their production structure by developing a competitive industrial sector. This may be based on policies that encourage the price and non-price competitiveness of these sectors. It is also compatible with the methodological approaches in the analytical and applied chapters in this dissertation (Chapters 3 to 8), which assume that the exchange rate is a policy variable that does not adjust to eliminate current account imbalances, in contrast with the concept of comparative advantage which assumes that "real exchange rates will move in such a way as to make nations equally competitive" (Shaik, 1999, p.1).

[3] However, to be fair, it should be acknowledged that international capital flows also helped to pay for imports and to finance Argentina's external debt in this period (Ferrer, 2008).

[4] Although these have been improving in recent years, in 2007 in Argentina unemployment affected 9% of the urban labour force, average real wages were similar to 1998 figures and more than 20% of Argentina's population lived in poverty; see also Latin American standards inequality figures (Table 5.3 in Chapter 5).

[5] Constraints on investment in human capital and innovation are emphasized by Gylfason (2001) and Gerlagh and Papyrakis (2005).

[6] See Sachs and Warner (1999), Auty (2001) and Mansoorian (1991) in relation to the role of economic policies, and Auty (2001), Lane and Tornell (1999), Mehlum, Moene and Torvik (2005) and Murshed (2004) in relation to institutional approaches to the resource curse.

[7] Argentina grew at an average rate of 8% between 2003 and 2008, faster than output growth in other Latin American countries and the industrialized nations and comparable to China's and India's economic growth records.

[8] Chapters 2, 3 and 4 aim at being self-contained and thus include an introductory section with a literature review on the topic, a section developing the empirical methodology and/or the analytical models, a section discussing the results and a concluding section which summarizes the findings of these chapters.

[9] Chapter 6 summarizes Argentina's 2004 SAM, an extended version of which is presented in the appendix to Chapter 6, and discusses the calibration of the model. It presents the values and sources of the models' behavioural and exogenous parameters and discusses the assumptions and possible limitations of the calibration. It presents the base run simulations, compares observed and simulated figures to validate the model and discusses the sensitivity of the simulation results to key parameters values and to alternative macroeconomic closure rules.

[10] Most counterfactual simulations are performed for the period 2004-2007. To validate the functioning of the model and explore how it works over a longer time span, I ran some simulations for the period 2004-2010.

2 An Inquiry into the Competitiveness Explanation for the Resource Curse

2.1 Introduction

In recent years countries richly endowed with natural resources have been said to be subject to a phenomenon known as the resource curse, something which turns nature's bounty into a burden. Several authors argued that these countries, particularly in the post-1973 period, have experienced lower growth rates than their resource poor counterparts (see van der Ploeg, 2008, Murshed, 2004, Sachs and Warner 1995, 2001, Serino, 2004, among many others).

There is a long tradition in economics that frowns upon an extractive natural resource basis for sustaining prosperity, compared to the virtues of relying on human industry, dating back to Adam Smith and David Ricardo in the Anglo-Saxon tradition. Raul Prebisch (1950), Hans Singer (1950) and Albert Hirschman (1958, 1981), among the classical development economists, have also encouraged economic diversification away from natural resource production: to counteract the secular decline in the relative price of primary commodities and to promote growth-enhancing productive complementarities.

In contrast to these classical approaches, more recent concern over the effects of natural resource abundance is empirically-driven and follows from the robust negative association between natural resource exports and long-term economic growth first proposed by Sachs and Warner (1995).

Their finding kicked off a series of studies of this "paradoxical" empirical regularity. They analyse at a theoretical and empirical level the channels and mechanisms through which natural resource abundance may jeopardize economic development. Some authors sustain that natural resource wealth reduces incentives for human capital investment and innovation efforts.[1] Others highlight the negative political economy implications of resource rents.[2] Researchers argue that resource abundance encourages protective economic policies and public indebtedness (Sachs and Warner, 1995; Mansoorian, 1991) and that resource rents lead to corruption and rent seeking in countries with weak institutions. They argue that the elites in these countries deliberately seek to undermine institutions so as to facilitate kleptocracy (for reviews, see Auty, 2001; Lane and Tornell, 1999; Mehlum, et a., 2005; Murshed, 2004).

However, despite all the efforts devoted to envisage and explore the mechanisms through which natural resource wealth can constrain economic development, there are very few empirical works that investigate the competitiveness hypothesis of the resource curse, which links the pattern of specialization to economic development: *it is not just trade, but the way in which a country participates in international trade that counts for economic development.*

The competitiveness hypothesis is linked to what is known as the "Dutch disease". According to this, a competitive advantage in natural resource production, due to positive exogenous shocks or abundant or highly productive natural resource endowments, prevents and/or constrains the development of other tradable sectors (generally manufacturing or industrial) where accumulation of human capital and innovation, which spills over to the rest of the economy and promotes fast economic growth, principally occurs (see, e.g. Matsuyama, 1992; Ros, 2005; van Wijnbergen, 1984).[3]

The competitiveness hypothesis is in line with some of the insights from new trade theory and Keynesian propositions. According to new trade theory, trade in (specialized) industrial products has positive supply-side implications for economic growth since it facilitates the achievement of static and dynamic economies of scale – as there is learning by doing (or not learning/forgetting by not doing) in industrial production (Krugman, 1987).

From a Keynesian point of view, the growth enhancing properties of the pattern of specialization are demand-driven (see e.g. Kaldor, 1981; Thirlwall, 2002). According to Amable (2000: 413):

> industrial (natural resource) production and exports tend to have larger (lower) price and trade elasticities that encourage (restrain) aggregate demand and induce fast (slow) productivity and economic growth through cumulative causation processes.

Taking account of these insights, this chapter investigates the competitiveness explanation of the resource curse and shows that this phenomenon occurs in countries that do not manage to diversify their tradable sectors; an assertion often made but rarely demonstrated, and which is explored analytically and empirically in this chapter.

In conducting an empirical evaluation of the competitiveness hypothesis of the resource curse, this chapter fills a gap in the empirical literature; with the exception of the paper by Lederman and Maloney (2003), to my knowledge, there are no other systematic studies of this transmission channel. This chapter addresses the first guiding questions of this research on the role of the pattern of specialization for economic development, and the unavoidability of the natural resource curse, and presents some stylized facts that contextualize the remainder of this thesis.

In particular, the empirical section of this chapter explores: whether or not all natural resource exporting countries experience the resource curse; whether exporting unprocessed or processed natural resource products has implications for long-term economic growth; and whether natural resource exporting countries are able to modify their pattern of trade specialization and benefit from trade integration.

To address these questions, the empirical analysis focuses on long-term growth, between 1960 and 2005, and explores the dynamic implications of different trade specialization patterns. The empirical analysis incorporates three innovative features. First, it uses a dynamic panel data methodology unlike the bulk of the empirical resource curse literature which is mainly cross-sectional. Second, it employs long-term disaggregated trade data sets to elaborate sophisticated measures of trade specialization that are informative about the dynamic properties of the pattern of trade specialization. These measures distinguish between unprocessed and manufactured natural resource products and capture the countries' trade diversification experiences, their link to world demand trends and involvement in intra-industry trade. The third innovative aspect of the analysis is related to the empirical findings. These suggest that:

a. it is only specialization in natural resource products involving little or no processing that slows economic growth, by impeding the emergence of more dynamic patterns of trade specialization;

b. diversification into natural resource processing, therefore, can be seen as a way to avoid the resource curse.

The chapter is organized as follows. Section 2.2 discusses methodological issues associated with growth econometrics, the database and trade specialization measures; Section 2.3 presents and discusses the empirical results and Section 2.4 concludes.

2.2 Methodology

2.2.1 Growth econometrics

Like most studies on long-term economic growth, in the empirical analysis I estimate Barro-type growth regressions, such as the one described in equation (2.1). These are derived from neoclassical growth theory,[4] which focuses empirically on the question of convergence, and are extended to study the different factors affecting total factor productivity (TFP), thus taking into account hypotheses from new growth theory regarding alternative driving forces of technological change and, thus, output growth.

$$\dot{y}_{j,p} = \ln Y_{j,p} - \ln Y_{j,t-1} = \beta \ln Y_{j,t-1} + \psi S_{j,p} + \pi X_{j,p} + \alpha R_{j,p} + \varepsilon_{j,p} \quad (2.1)$$

In equation (2.1), $\dot{y}_{j,p}$ is the log difference of per capita GDP in period p, which extends from year t_{-1} to year t, and ln $Y_{j,t-1}$ denotes income at the beginning of the period and is associated with the convergence coefficient β. Among the other right hand side (RHS) variables, researchers include traditional Solow regressors like population growth and variables related to physical and human capital accumulation, all summarized by $S_{j,p}$.

When, as in this research, the purpose of the analysis is to explore the determinants or (or deterrents to) growth, rather than to discuss the problem of convergence, empirical studies include additional variables that are considered to be shifters of the aggregate production function. As explained by Durlauf, Johnson and Temple (2005), in this group of studies – to which research on the relation between the pattern of trade specialization and economic growth belongs – the purpose is to investigate to what extent a particular hypothesis finds support in the data. Hence, depending on the underlying theoretical model, variables added to the growth regression can refer to various phenomena, as for instance technology, trade, structures, endowments, economic policies or institutions.

In equation (2.1), the most likely shifters to the production function are represented by $X_{j,p}$; and the variable and hypotheses of interest for this research, linked to trade specialization in natural resource products and their hypothesized jeopardizing effects for economic development, are symbolized by $Rj_{,p}$.

Growth econometrics have several limitations. One of them is of a general character and particular to this study. It results from using an econometric approach based on a neoclassical model to explore the competitiveness hypothesis of the resource curse: this hypothesis is derived from multi-sectoral analytical models, but the empirical analysis is based on a one-sector aggregated model. This conflict is common to other studies emphasizing the Dutch disease explanation for the resource curse (e.g. the many papers by Sachs and Warner or the paper by Amable, 2000) and can only be partially overcome, by assuming that the sector-specific characteristics affect economic growth through the TFP parameter.[5]

The other main limitations are well-known in cross-country growth regressions and are worthy of special attention as they can give rise to biased coefficient estimates. They are endogeneity problems associated with reverse causality and the omission of relevant variables. Endogeneity problems are usually addressed using initial or lagged regressors. Hence, although in equation (2.1) variables S, X and R are presented as period variables (with a p subindex), they are commonly measured at t_{-1} or are lagged variables measured in previous time periods. Alternatively, these problems can be solved through the use of using instrumental variables, but special attention is needed to find an appropriate instrument, given that even geographical variables can be correlated with the dependent variable (Durlauf et al., 2005).

Inconsistent estimates due to omitted variables can also occur in a regression like (2.1) because the natural resource coefficient can reflect the effects of other time-invariant country characteristics, not captured by other regressors. This problem can be addressed using regional or other relevant dummy variables, one of the preferred procedures in Temple (1999), or by using a panel data of countries and specific panel data econometric techniques.

To take into account the problem of omitted variables equation (2.1) needs to be redefined to include a country specific effect, which is denoted by μ_j in equation (2.2):

$$\dot{y}_{j,p} = \ln Y_{j,t} - \ln Y_{j,t-1} = \beta \ln Y_{j,t-1} + \psi S_{j,p} + \pi X_{j,p} + \alpha R_{j,p} + \mu_j + \varepsilon_{j,p} \quad (2.2)$$

Working with panel data resolves the above mentioned econometric problems. A first possibility is to run pooled ordinary least square (OLS) regressions (Temple, 1999), a technique that requires initial or lagged variables to prevent problems associated with reverse causality common to traditional cross-country regressions. This technique benefits from the increased number of observations and enables the inclusion of a significant number of regional dummy variables to capture the effects of variables not explicitly taken into account that may bias the results.[6]

A second possibility, addressing especially the problem of omitted variables, is to use Within Groups estimates and run fixed-effects regressions or take first differences of equation (2.2). However, these techniques also have some limitations. First, fixed-effects estimations eliminate most of the variation in the data, and display coefficient estimates seriously biased downwards (Bond, Hoeffler and Temple, 2001). Second, using first differences to eliminate the country specific effect, creates endogeneity problems, which are specific to dynamic panel data models. To study this in more detail, I derive equation (2.3) below by taking first differences of equation (2.2), in order.

$$\begin{aligned} &\dot{y}_{j,p} = \ln Y_{j,p} - \ln Y_{j,t-1} = \\ &(1+\beta)\Delta \ln Y_{j,t-1} + \psi \Delta S_{j,p} + \pi \Delta X_{j,p} + \alpha \Delta R_{j,p} + \Delta \varepsilon_{j,p} \end{aligned} \quad (2.3)$$

In equation (2.3), Δ stands for first differences, with $\Delta \ln Y_{j,t-1}$ being the difference between $lnY_{j.t-1}$ and $lnY_{j,t-2}$, and the difference between the present and previous periods (p and p_{-1}) applied to the other variables and the error term. Although equation (2.3) no longer has a country specific effect μ_j and therefore no endogeneity problems due to omitted variables, endogeneity problems still persist because $lnY_{j.t-1}$ is correlated with $\Delta\varepsilon_{j,p-1}$. A similar correlation, and source of endogeneity occurs between the other regressors and the error term.

Two econometric methodologies can be used to overcome the problems associated with the presence of μ_j and the use of the lagged dependent variable as a regressor, and other biases that arise from measurement errors and the correlation between explanatory variables and the error term. One technique is first-differenced GMM panel data estimator developed by Arellano and Bond (1991), which uses lagged levels of RHS variables, dated t_{-2} or earlier, as instruments for the differentiated regressors of equation (2.3). Because variables in levels tend to be poor instruments for differenced variables, this methodology has proven deficient in growth regressions.

An alternative econometric technique is the system GMM methodology. According to Lederman and Maloney (2003: 8),

> the system GMM rescues some of the cross-sectional data that is lost in the differenced GMM estimator by estimating a system of equations that also includes equation (2.2) in levels, but with lagged differences of the endogenous variables as instruments.

This means that the system GMM estimates equations (2.2) and (2.3); with equation (2.3) instrumented using lagged level variables dated t_{-2} or earlier, and equation (2.2) instrumented using differenced variables dated at t_{-2}. The additional information provided by equation (2.2) reduces the downward bias found in the first-differenced GMM method, providing better coefficient estimates and resolving the endogeneity problems.

The empirical analysis in this chapter, therefore, complements traditional cross-country regressions with system GMM estimations, the least problematic of the growth econometric techniques

2.2.2 Other methodological issues

Sensitivity analysis, commodity classifications and trade specialization measures

A sensitivity analysis is used to investigate the relationship between the pattern of trade specialization and economic growth.[7] This methodology requires the definition of a *basic regression* including traditional Solow regressors (initial income, and proxies for physical and human capital accumulation), and a proxy for natural resources abundance or a variable measuring the degree of trade specialization in natural resource-intensive products (variables $Y_{j,t-1}$, S, and R in equations (2.1), (2.2) and (2.3)).

Having identified the effect of the primary specialization variable on economic growth, the *basic regression* is extended through the use of additional control variables that are proxies of the mechanisms through which resource abundance is said to impede economic growth. The purpose of the extension is to explore whether the negative growth implications of exporting natural resource-intensive products are linked to the constraints that resource abundant countries find to diversify and develop a more dynamic type of trade specialization. Exploring this channel implies moving beyond the hypotheses in the literature on the resource curse[8] and is expected to provide an answer to the first guiding questions of this research: does the resource curse affect all natural resource exporting countries? Are all natural resource exporting countries unable to modify their pattern of trade specialization and benefit from trade integration?

Answering these questions requires three extensions to previous econometric studies on the resource curse. The *first extension* involves estimating the growth regressions using alternative classifications of trade specialization in natural resource intensive products. The analysis starts using Sachs and Warner's share of natural resource exports (*PXI*), and is extended using specialization measures distinguishing between unprocessed and manufactured natural resource products – a distinction that is absent in Sachs and Warner's variables because their broadly defined trade specialization variable aggregates all natural resource products, irrespective of their degree of processing. If, as suggested in the introduction in this chapter and the analytical model, differences in the supply and demand properties of natural resource and industrial products matter for economic development, the econometric results must then be sensitive to the distinction between unprocessed and manufactured natural resource products.

Trade disaggregated data for the period 1962-2000 (from the UN COMTRADE database) are used to capture this distinction. Data are classified according to the CTP-DATA taxonomy proposed by Peirano and Porta (2000).[9] [10] Depending on the level of processing to which natural resources are subjected, natural resource products are classified as: (i) primary products (*PP*) or (ii) manufactured or industrialized natural resource products (*MNR*). Table 2.1 summarizes the products in each of these categories; Table B.2.3, in the appendix to this chapter, compares the CTP-DATA classification to Sachs and Warner's natural resources commodity group, and shows that the latter classification includes many industrialized products.

Table 2.1
CTP-DATA export classification

PP (Primary Products)	Meat, fish and animal foodstuff; cereals and edible and non-edible agricultural products; unprocessed tobacco; raw hides, leather and skins; silk, jute and other textile fibbers; natural rubber and cork; crude minerals; iron and other mineral ores; coke, coal, crude oil and natural gas; refined petroleum and related products.
MNR (Resource Intensive Manufactures)	Meat, fish and other animal food products; beverages and manufactured tobacco; preserved fruit, vegetables and related preparations; sugar products; cereal products and other edible products and preparations; vegetable and animal oils and fats; pulp, paper, paperboard and related products; articles in wood and rubber; basic organic chemicals and manufactured fertilizers; inorganic chemicals; hydrocarbons and derivatives; synthetic rubber and fibres; precious and semi-precious stones; non-ferrous metals

Source: authors' elaboration based on Porta and Peirano (2000), using SITC Rev 2 at 3 digit-level

The second extension concerns using more sophisticated trade specialization measures. To the extent that these indices consider different aspects of trade, like market penetration efforts or trade diversification, they are more informative about the link between the pattern of specialization and economic development, than trade shares, hence, they provide a better evaluation of the competitiveness hypothesis of the resource curse as well as responding to the research questions.

One of these measures is the index of *comparative advantage* developed by the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII), which uses a category of unprocessed natural resources products (*PRI*) that is similar to the CTP-DATA commodity group, and refers to products with no or limited processing (*PP*). (See Table B.2.3.)

CEPII's comparative advantage indicator is defined as

$$CA_{i,j} = \left[\frac{X_{ij} - M_{ij}}{Y_j} - \frac{X_{ij} + M_{ij}}{X_{.j} + M_{.j}} \frac{X_{.j} - M_{.j}}{Y_j} \right] \cdot \frac{Wi(r) \cdot W()}{W.(r) \cdot Wi()}$$

where X is exports, M is imports, i is the commodity group (CEPII's primary products *PRI*, in this research), j is the relevant country, r is the reference year and W is world trade (X+M). As explained in Amable (2000: 420),

> $CA_{i,j}$ is higher when the trade surplus in industry i, taken relative to the GDP of country j, is higher than the relative trade surplus for all commodities, considering the weight of industry i in country j's foreign trade. This effect is corrected for the weight that industry i has in international trade relative to a benchmark year.

The other trade specialization measure is the *index of trade diversification* employed in the UN *World Economic and Social Survey* for 2006 (UN, 2006), estimated for the CTP-DATA resource commodity groups. The diversification index ($TDIV$) equals

$$TDIV_{ij} = \left[\left(\frac{X_{ij}}{\sum_{i=1}^{n} X_{ij}} \right)_{t+1} - \left(\frac{X_{ij}}{\sum_{i=1}^{n} X_{ij}} \right)_{t} \right] \cdot \left[\frac{X_{ij}}{\sum_{j=1}^{n}} \right]_{t+1} \cdot 100$$

where, X, i, j respectively are exports, commodities and countries, and t is the relevant year. The index shows the change in export shares of a particular product i, between years t and t_{+1}, and the market share of the country's exports for the commodity group under consideration. The index takes account of the country's performance in terms of export diversification, and relative to other countries. In other words, it considers changes in a country's pattern of specialization and market penetration efforts or comparative trade performance.

Whereas, as suggested in the literature, trade shares might be capturing different transmission mechanisms of the resource curse, the above mentioned measures have been designed especially to reflect the characteristics of the pattern of specialization. They contribute to achieving a better assessment of the competitiveness hypothesis, and also distinguishing natural resource products according to their degree of processing.

The *third extension* to previous work is the inclusion of other trade specific measures in the growth regression, to explore the response of the natural resource or primary specialization variable R. This chapter thus explores whether or not resource exporting countries are able to modify their trade specialization patterns.

These measures are obtained from CEPII's CHELEM database; a database that, like COMTRADE, provides long-term disaggregated data.

They capture the relation between a country's trade specialization and the dynamism of world demand on the one hand, and the importance of intra-industry trade on the other. These two measures are considered to be proxies for the positive demand and supply dynamic benefits of trade integration.

To study whether the slow economic growth in natural resource exporting countries is associated with low levels of international demand of the products exported by these countries, the analysis employs the trade dissimilarity indicator (TRDI) used by Amable (2000) and Busson Villa (1997). The index is defined as follows:

$$TRDIj = \frac{1}{2}\sum_{1<i<N}\left|\frac{X_{ij}}{X_j} - \frac{X_{i.}}{X_{..}}\right|$$

where X is exports and $0 \leq TRDIj \leq 1$. $TRDI_j$ compares the pattern of specialization of country j with the characteristics of world demand. A high value of $TRDI_j$ indicates that a country specializes in goods with low international demand, whereas a low value indicates that exports from country j are in line with the trends in international trade. Figure A.1 in the appendix to this chapter shows the average value of the index for the period 1967-2005 and depicts that, as expected, the index is close to 1 in resource abundant countries such as Algeria, Ecuador, Nigeria and Venezuela, which have a pattern of specialization which is at odds with international demand.

The sensitivity analysis is extended using Michaley's index of inter-industry trade.

$$MICLY_j = \frac{1}{2}\sum_{1<i<N}\left|\frac{X_{ij}}{X_j} - \frac{M_{ij}}{M_j}\right|$$

This measures attempts to capture whether the economy has clearly defined export and import industries. The higher the value of $MICLY_j$ the more dissimilar are trade balances between industries, and the opposite is the case of low values of $MICLY_j$. With trade disaggregated across 71 commodity groups, a high value of the index is interpreted as an indication of trade specialization according to static comparative advantages, whereas low values are considered to reflect the presence of intra-industry trade (in the first case countries exchange different products, and in the second, they exchange similar and specialized commodities), which facilitates the achievement of scale and specialization economies. Figure A.2 in the appendix shows a high value of the index in most resource abundant countries which is a clear indication of how difficult it is for them to engage in intra-industry trade.

Sample, other variables definitions and data sources

The empirical analysis uses a sample composed of the 49 developed and middle-income countries for which CHELEM's database provides long-term trade information, dating back to the mid-1960s. (See Table B.2.1 in the appendix for the list of countries.) The sample excludes Middle-Eastern oil exporters and many African countries. Excluding these two groups of resource abundant countries and focusing on industrialized and other developing countries, this analysis complements other studies on the resource curse. The sample is used to run standard cross-country growth regressions for the period 1960-2005 and is employed to construct an (unbalanced) panel database, composed of 9 five-year periods with panels extending from 1960 to 2005, to be used to run the system GMM estimations.[11]

The data are taken from various databases, as described in Table A.2.2 in the appendix to this chapter, which presents the variable definitions and data sources. Information on economic growth, trade and the exchange rate is taken from CHELEM's database. Additional trade information is from the UN COMTRADE and World Bank WDI databases; the latter also contains information on investment and external terms of trade. Data on human capital are from the Barro and Lee database, and information on trade openness and other control variables included in the cross-country regressions (terms of trade, macroeconomic volatility and institutions) are from the Sachs and Warner database. Lack of long-term data on the rule of law means that in the panel data analysis the functioning of institutions is approximated by a polity score that captures the quality of political institutions.[12]

2.3 Econometric Analysis

2.3.1 Does trade specialization in resource intensive products hamper economic growth?

As is traditional in empirical studies of the relation between patterns of specialization and economic growth, the analysis starts by estimating standard cross-country regressions (Table 2.2 summarizes the regression results). Column (1), Table 2.2 shows the results for the *basic regression* of the sensitivity analysis. They includes initial income (Ln Y_{t-1}), the log of physical and human capital accumulation (Ln INV and Ln HK)[13] and the Sachs and Warner primary specialization measure: share of primary exports as a percentage of total exports (PXI). To prevent endogeneity problems due to reverse causality, RHS variables are measured at the beginning of the period.

Regression (1) predicts conditional convergence, accumulation variables have the expected positive sign and all variables are statistically significant. The proxy for trade specialization in natural resource-intensive products, the variable of interest, has a negative sign, which is in line with the hypotheses in the resource curse literature suggesting that this particular pattern of trade specialization deters long-term economic growth.[14] According to the basic regression, a 1 per cent increase in *PXI* reduces the predicted rate of long-term economic growth by 1 per cent.

The *basic regression* is extended adding variables that are said to be transmission mechanisms of the resource curse and analyse how the primary specialization coefficient responds to the inclusion of these variables, as in the traditional empirical literature. Four transmission mechanisms are analysed in a first instance: openness to trade (*SOPEN*); the role of institutions (*INST*); growth in the external terms of trade (*GTOT*); and macroeconomic volatility (*VOLRER*).

Regression (2) adds Sachs and Warner's openness measure to the *basic regression*. Although the coefficient of *PXI* falls, it is still negative and statistically significant, suggesting that slow growth in natural resource exports is not, as argued by some authors (see e.g. Auty, 2001), because these countries are more likely to implement protective measures to promote their industries and employment. Nor does the inclusion of an institutional variable, as in regression (3),[15] modify the growth retarding effects of variable *PXI* to any significant extent. Hence, in contrast to the findings from many studies (Melhumet al., 2005; van der Ploeg, 2008), slow growth in resource abundant countries does not seem to be a consequence only of deficient functioning in the institutional system.

Regression (4) in Table 2.2, includes a measure of growth in the external terms of trade between 1960 and 2000 ($GTOT_p$),[16] and regression (5) adds a measure of macroeconomic instability,[17] suggesting that the negative sign associated with *PXI* is due neither to Prebisch-Singer's terms of trade hypothesis, nor to the volatility of primary commodity prices, emphasized by De Ferranti, Perry, Lederman and Maloney (2003).

Table 2.2
Natural resource abundance and economic growth

	Dependent variable $\Delta \ln Y_{j,t}$ ($\ln Y_{j,2005} - \ln Y_{j,1960}$)						
	Regressors	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
BENCHMARK REGRESSION / BASIC REGRESSION	$\ln Y_{t-1}$	-0.597	-0.597	-0.693	-0.688	-0.676	-0.652
		(0.085)***	(0.087)***	(0.085)***	(0.087)***	(0.094)***	(0.146)***
	Ln Inv $_{t-1}$	0.643	0.624	0.64	0.675	0.65	0.658
		(0.228)***	(0.211)***	(0.208)***	(0.214)***	(0.212)***	(0.206)***
	Ln HK $_{t-1}$	1.431	1.074	0.951	0.87	0.855	0.393
		(0.381)***	(0.316)***	(0.347)***	(0.333)***	(0.340)***	(0.397)***
	PXI $_{t-1}$	-1.057	-0.766	-0.648	-0.611	-0.596	-0.453
		(0.205)***	(0.192)***	(0.206)***	(0.197)***	(0.202)***	(0.209)**
BENCHMARK REGRESSION	SOPEN $_p$		0.435	0.29	0.347	0.323	0.28
			(0.150)***	(-0.182)	(0.200)*	(-0.225)	(-0.214)
	INST$_{t-1}$			0.099	0.094	0.088	0.08
				(0.054)*	(0.054)*	(-0.052)	(0.047)*
	GTOT $_p$				-0.155	-0.135	-0.231
					(-0.122)	(-0.126)	(0.130)*
	VOLRER $_p$					-0.875	0.152
						(-2.11)	(-2.598)
	D_AF						-0.487
							(0.257)*
	D_LAC						-0.324
							(-0.237)
	D_ASIA						-0.061
							(-0.257)
	Adjusted R-square	**0.6**	**0.65**	**0.68**	**0.68**	**0.67**	**0.69**
	Observations	**49**	**49**	**49**	**49**	**49**	**49**

Robust normalized standard errors in parentheses
* significant at 10%; ** 5% and *** 1% level
Source: author's calculations

Regression (5) includes four transmission mechanisms for the resource curse and regression (6) includes regional dummy variables to control for region specific characteristics.[18] These dummy variables define the *benchmark regression* used later in this chapter: specification (6) in cross-country estimations and specification (5) in System GMM panel data regressions, which control for individual characteristics. Thus, the last columns (5 and 6) in Table 2.2 show that trade specialization in natural resource-intensive products retards growth, even taking account of its alleged negative impact on the design of economic policies, the functioning of the institutional system, the evolution of relative prices and macroeconomic instability.[19]

2.3.2 Further exploration of the relation between the pattern of specialization and economic growth

Section 2.3.1 contextualized the empirical investigation and showed that countries producing and exporting natural resource-intensive commodities tend to grow less than countries with a different pattern of trade specialization. It also defined the *benchmark regression* – including most alleged channels of the resource curse – which permits a more in depth study of the relation between the pattern of trade specialization and economic growth. In particular, the hypothesis that slow growth in countries exporting resource intensive products is due to the difficulties these countries find in diversifying their economic and export structure and thus benefit from trade integration.

To explore this hypothesis, the empirical analysis is extended in two ways. First, I run regressions using alternative trade specialization measures, distinguishing resource intensive products according to the extent to which the natural resources are processed. Underlying this distinction is the hypothesis that specialization in unprocessed, resource intensive products is expected to have growth retarding effects in the long-term, due to diminishing returns to scale, but there is no reason a priori to expect this outcome in countries that industrialize their natural resources. This is because, similar to any other industry, natural resource processing industries benefit from human capital, innovation and the achievement of scale and specialization economies.

Second, an additional group of trade specialization measures is used to investigate whether the slow growth characterizing natural resource exporters is linked to the inability of these countries to: (i) adapt to the trends observed in world export demand; (ii) export specialized industrial products that facilitate the achievement of static and dynamic economies of scale. In light of the limitations in traditional cross-country regressions, the analysis here uses dynamic panel system GMM regressions.[20]

In system GMM estimations the distinction between endogenous and predetermined variables is relevant because the former are instrumented with the GMM estimator. The estimations use accumulation, volatility and trade specialization variables as endogenous variables, and openness to trade and external terms of trade as predetermined or exogenous variables. To construct the GMM estimator, I use lagged level information dated at time *t-2* and *t-3* as instruments for the endogenous variables in the differenced equation(2.2), and lagged differences dated at time *t-2* as instruments for the endogenous variables in the level equation (2.3).[21]

A comparison of alternative primary specialization variables

The first extension to the empirical analysis looks at the distinction between unprocessed and industrialized resource intensive products. This is achieved by replacing variable *PXI* in the *benchmark regression* with other trade specialization measures–export shares, CEPII's comparative advantage index and measures of trade diversification – in natural resource intensive products with no or limited processing, and manufactured or industrialized natural resource products, as defined in the CTP-DATA classification.

The regression results are presented in Table 2.3; it presents the basic statistics for the trade specialization variable included in the *benchmark regression* (coefficient value, standard error, statistical significance and validity tests), estimated using cross-section and system GMM econometric methods. Following Arellano and Bond (1991), I use the one step procedure to estimate regression coefficients and the two-step method to calculate the validity tests in the panel data estimates. Tables including all regressors are contained in the appendix to this chapter (Table B2.4a and Table B2.4b).

Table 2.3 shows that the negative relation between Sachs and Warner's specialization variable and economic growth is also present in the panel data regressions (see Table 2.3, row (1)). In addition, Table 2.3 shows that regressions that take account of the distinction in natural resource-intensive products based on degree of processing are in line with expectations. Specialization in primary products, as captured by *PP*, has a negative impact on economic growth; an effect that is larger than, and as statistically significant as, the effect associated with *PXI* (see Table 2.3, row 2). The effect of trade specialization in manufactured resource intensive products, as captured by the variable *MNR*, is unclear. The coefficient of trade specialization is positive in the cross-country regressions and negative in the panel data ones, and in neither case is the effect of this variable statistically significant (see Table 2.3, row 3.)

Table 2.3
Natural resource abundance and economic growth. Comparison of alternative trade specialization measures

		CROSS - COUNTRY Dependent Variable ($\ln Y_{j,2005} - \ln Y_{j,1960}$)		GMM SYSTEM Dependent Variable ($\ln Y_{j,t} - \ln Y_{j,t-1}$)		
		R Coeff.	Adj. R2	R Coeff.	Sargan	AR (2)
	Selected regressors					
	TRADE SHARES					
	Sachs and Warner's trade shares in the benchmark regression					
(1)	PXI	-0.45	0.76	-0.06	0.25	0.77
		(-0.25)**		(0.033)*		
	CTP's trade shares in the benchmark regression /a					
(2)	PP	-0.70	0.68	-0.08	0.44	0.94
		(0.275)**		(0.033)**		
(3)	MNR	0.20	0.71	-0.04	0.29	0.96
		(-0.386)		(-0.087)		
	TRADE SPECIALIZATION MEASURES					
	Estimations using the benchmark regression					
(4)	$CA_{PRI,p}$	-0.470	0.82	-0.03	0.33	0.92
		(-0.41)***		(0.015)**		
(5)	$TDIV_{PP,p}$	-0.25	0.69	-0.09	0.41	0.97
		(0.133)*		(-0.061)		
(6)	$TDIV_{MNR,p}$	-0.03	0.66	0.06	0.31	0.81
		(0.018)		(-0.055)		

Robust normalized standard errors in parentheses
* significant at 10%; ** 5% and *** 1% level

Control variables included in cross-country regressions: ln Y_{t-1}; ln INV_{-1} ln HK_{t-1} $SOPEN_p$ $VOLRER_p$ $GTOT_p$ $INST_{t-1}$, D_Region. *Predetermined variables in the SYS-GMM*: $SOPEN_p$, $GTOT_p$, D_t. *Endogenous variables in the SYS-GMM*: ln Y_{t-1}; ln INV_P; ln HK_P; $VOLRER_P$; $INST_P$, and trade shares or specialization variables. All endogenous variables are used as instruments in the SYS-GMM. For the differenced equation of the SYS-GMM, instruments are level variables dated at t-2 and t-3, whereas instruments used in the level equation are differences dated at t-2

/a CTP-DATA trade shares are measured at the beginning of the period in cross-country regression and as average of the five year panel in SYS-GMM regression

Source: author's calculations

The last two columns in Table 2.3 summarize system GMM validity tests. They suggest that the estimations are well behaved and reject the hypothesis of second order autocorrelation in regressions (1) to (3), which would invalidate the use of instruments dated at *t-2*; and accept the null hypothesis of no over-identifying restrictions, which suggests that the instruments used in the GMM are valid.[22]

Analysis of resource intensive products distinguished according to level of processing is extended further with the inclusion of more sophisticated trade specialization measures. The results in row (4) are estimated using CEPII's comparative advantage indicator in primary products (CA_{PRI}), a commodity group which, as already mentioned, is similar to the group of unprocessed natural resource intensive products *PP* (see Table B2.3).[23] The regression using this more elaborated index of trade specialization, which takes account of sectoral and global trade deficits relative to the size of the economy, and the importance of resource intensive products in world trade, confirms that specializing in natural resource products with limited or no industrial processing has significant jeopardizing effects for economic development.

In addition, the difference between unprocessed and processed natural resources is analysed using the variable *TDIV* – a trade diversification index that considers changes in export compositions and market shares. As the results in row (5) show, the regressions suggest that shocks promoting "diversification" in unprocessed natural resources products will hamper long-term economic growth, although this effect only becomes statistically significant in the cross-country regressions. This is not the case for diversification in industrialized natural resources products: cross-country regressions suggest that diversification into *MNR* has almost no impact on economic growth[24] and system GMM regressions imply that this type of diversification is beneficial for long-term growth, although the effect is not statistically significant. Again, GMM validity tests suggest that the estimations in rows (4) to (6) were run correctly.

In sum, the results suggest that it is the pattern of trade specialization in resource intensive products with limited or no processing, that engenders the resource curse. But there is no empirical evidence of growth failures in countries that have diversified through natural resource processing, a finding that has clear and important economic policy relevance since it suggests that encouraging the processing of natural resources may constitute a way to avoid the resource curse.

Trade specialization in resource intensive products and the dynamic effects of trade integration

The empirical part of this chapter concludes with an investigation of whether the slow growth characterizing natural resource exporters is linked to the inability of the countries involved to: (i) adapt to the trends observed in world trade and thus promote aggregate demand and productivity growth; (ii) engage in intra-industry trade and benefit from static and dynamic economies of scale. To investigate these hypotheses, the sensitivity analysis is extended to enable analysis of the response of natural resource export shares (*PXI* and *PP*) to the inclusion of the variables TRDI and MICLY, which proxy for the above effects, in the *benchmark regression*.

Before embarking on this, however, it should be noted that, as shown in Table B2.6 in the appendix, both the capacity of countries to meet world demand and to participate in intra-industry trade, contribute to improving economic performance. However, the effect is only statistically significant in the case of *MICLY*, the variable measuring the importance of intra-industry trade (see rows (6) and (7) in Table B2.6).[25]

Table 2.4 presents the regressions including measures of trade specialization in resource intensive products (*PXI* and *PP*) and the variables *TRDI* and *MICLY*, as well as the other control variables, thereby extending the sensitivity analysis in the previous sections.[26] Table 2.4 presents only the statistics relevant to the natural resource variable (coefficient value, standard error and GMM validity tests). The grey figures show the value of the natural resources coefficient in the *benchmark regression*; this coefficient is compared to the newly estimated coefficients to perform the sensitivity analysis. The new estimations of the natural resource coefficient, obtained from the regressions including the variables *TRDI* and *MICLY in* the benchmark regression, are shown below. Complete information on all the regressors is contained in the appendix.[27]

Rows (1), (2) and (3) in Table 2.4 illustrate that the Sachs and Warner specialization variable, *PXI,* responds to the inclusion of proxies for the demand and supply properties of the pattern of specialization. *PXI* is no longer statistically significant once I consider the adequacy of a county's exports to the pattern of world demand, and the negative effect of *PXI* is significantly reduced in the system GMM estimations (see row (2)). The same occurs with the inclusion of Michaely's index.[28] According to the estimations summarized in row (3), having clearly defined export and import industries, what was seen as a sign of limited intra-industry trade and specialization according to static competitive advantages, seems to be one of the factors constraining growth in natural resource exporting countries.

I performed a similar sensitivity analysis using the variable PP, share of unprocessed resource intensive exports in total exports, the results of which are presented in the bottom half of Table 2.4.[29] The results are similar to those from the Sachs and Warner specialization measure. The reduction in the natural resource coefficient is particularly large in the system GMM estimations, and (in general) ceases to be statistically significant, especially when the variable that is added to the regression is the variable capturing the importance of intra-industry trade.[30] The econometric results, therefore, suggest that there is a relationship between the resource curse and the inability of these countries to engage in international trade, and especially intra-industry trade, in ways that are growth-enhancing.

Table 2.4
Natural resource abundance and economic growth. Sensitivity of the primary specialization variable to the demand and supply attributes of the pattern of specialization.

		CROSS - COUNTRY Dependent Variable ($\ln Y_{j,2005} - \ln Y_{j,1960}$)		GMM SYSTEM Dependent Variable ($\ln Y_{j,t} - \ln Y_{j,t-1}$)			
		R. Coeff.	S.E.	R. Coeff.	S.E.	Sargan	AR (2)
	Selected regressors						
(1)	PXI in benchmark regression (b.r.)	-0.453	(0.209)**	-0.078	(0.035)**	0.25	0.77
(2)	PXI in b.r. (including TRDI)	-0.424	(-0.266)	-0.011	(-0.03)	0.22	0.8
(3)	PXI in b.r. (including MICLY)	-0.298	(-0.294)	-0.015	(-0.03)	0.25	0.56
(4)	PP in benchmark regression (b.r.)	-0.698	(0.275)**	-0.082	(0.032)**	0.29	0.96
(5)	PP in b.r. (including TRDI)	-0.658	(0.322)**	-0.019	(-0.033)	0.3	0.97
(6)	PP in b.r. (including MICLY)	-0.553	(-0.329)	-0.022	(-0.032)	0.28	0.89

Robust normalized standard errors in parentheses

* significant at 10%; ** 5% and *** 1% level

Control variables included in cross-country regressions and endogenous and exogenous variables in SYS-GMM as stated in Table 2.3

Source: author's calculations

2.4 Conclusions

To conclude, this chapter has re-examined the empirics of the resource curse hypothesis and questioned its inevitability. Countries specializing in the export of natural resource based products fail to grow only if they do not succeed in diversifying their economies and export structures.

This conclusion is based on an exploratory econometric growth analysis which has several innovative features. First, it covers a long-time period (1960-2005) and employs panel-data to complement the standard cross-sectional methodology. Using dynamic panel data methods (system GMM estimates) increases the robustness of the econometric results and corrects for the endemic endogeneity problems that plague standard growth regressions. Second, and more importantly, the analysis uses measures that proxy for attributes in the pattern of trade specialization that promote long-term growth. These are related to differences in returns to scale, which decrease in primary production, but not in industrial activities (including processing of natural resources), and a country's ability to export goods that match trends in world demand, and to engage in intra-industry trade, which is an accepted measure of greater economic development and diversification. Although this introduces some data limitations because coverage of some of these innovative trade measures cannot be extended to all developing countries, the analysis in this chapter provides new findings and contributes to the debate on the relationship between pattern of trade specialization and economic development, which is especially relevant for Argentina and other Latin American countries.

The findings are the third innovative feature provided by this chapter. The empirical analysis shows that:

- natural resource exporting countries grow less than countries with a different pattern of trade specialization, even after taking into account most alleged channels of the resource curse; but
- it is only specialization in unprocessed natural resource products that slows down economic growth, and
- this seems to be linked to the inability of primary commodity exporters to develop more dynamic patterns of trade specialization, and especially engaging in intra-industry trade.

These findings suggest that the resource curse is not unavoidable and that some natural resource exporting countries can successfully diversify their export structure, findings that are consistent with other studies including Brunnschweiler and Bulte (2008), which show that it is *natural resource dependence* and *not natural resource abundance* that slows down economic growth. The findings are also in line with other results in the resource curse literature, including the work of Stijns (2006), who shows that not all resource rich countries systematically under-invest in education; research by Metcalfe (2007), who establishes that the resource curse is not unequivocal for all developing countries in all recent periods; and the study by Findlay and Lundhal (1994) on the Columbus model recalling the cases of Australia, Canada and the USA, where resource abundance assisted industrialization.

The findings in this chapter have clear economic policy implications: countries specializing in the export of natural resource based products fail to grow only if they do not succeed in diversifying their economies and export structure, a process that can start with a move to natural resources processing.

The empirical analysis identifies some stylized facts that contextualize the following chapters. They should be taken with care and considered only as a starting point to this investigation since they are derived from an economic approach based on an aggregate neoclassical model, which contrasts with the approach in this research which is multi-sectoral, and also are subject to the limitations of growth econometrics, such as those discussed in Section 2.3 and in the paper by Rodriguez (2007). Also, they are estimated using a model that very imperfectly captures the sectoral interactions that this research addresses analytically and through country-case, counterfactual simulations in succeeding chapters.

Notes

[1] Constraints on investment in physical and human capital and innovation are emphasized by Gylfason and Zoega (2002) and Papyrakis and Gerlagh (2005). Stijns (2006), however, shows that not all resource abundant countries systematically under-invest in growth enhancing human capital.

[2] Note, also, that some authors explore limitations on growth linked to the dynamism of primary commodity prices in terms of whether their declining trend or volatility promotes an unstable macroeconomic environment that prevents productive investment (De Ferranti, et al., 2001).

[3] In addition to their dynamic implications, positive natural resource shocks matter since they could even cause recession and unemployment (Neary and van Wijnbergen, 1986).

[4] Neoclassical growth theory assumes full-employment and decreasing returns to the factors of production, and especially capital.

[5] Differences in growth rates, therefore, are not caused by economic sectors expanding at different rates, which affects aggregate output growth, but rather because sector specific features, e.g. specialization economies which are characteristic of the manufacturing sector, affect overall productivity growth.

[6] To control for autocorrelation and heteroskedasticity Feasible Generalized Least Squares can be implemented although this technique is most suited to panels where t is larger than j.

[7] This approach was proposed by Levine and Renelt (1992) and has been applied widely in the empirical literature on the resource curse.

[8] Common transmission mechanisms identified in the resource curse literature (summarized by the variable X in the equations in section (2.2.1)) are: (i) trends in the external terms of trade (the Prebisch-Singer hypothesis); (ii) macroeconomic instability (as promoted by the volatility of primary commodity prices); and (iii) the (deficient) functioning of the institutional system.

[9] It is possible to use long-term trade disaggregated data thanks to the work of Feenstra, Lipsey, Deng, Ma and Mo (2005), who converted SITC Rev 1 codes to SITC Rev 2.

[10] The classification used by Peirano and Porta (2000) follows the taxonomy proposed by Pavitt (1984), which was adapted to commodities by Gurrieri (1992, cited in Peirano and Porta, 2000)

[11] It should be noted, however, that for some variables in the 9 periods information is incomplete.

[12] These long-term institutional data are part of the Polity IV project produced by the Centre of International Development and Conflict Management.

[13] The cross-country regressions use Sachs and Warner's human capital variable, the rate of secondary school enrolment in 1970, and average years of schooling in the panel estimations. This avoids (i) losing three observations in cross-country regressions, and (ii) having to use variables similar to those employed by Sachs and Warner. The results of the cross-country regressions using one or the other variable are similar and are available on request.

[14] All regressions were also run using Sachs and Warner's alternative measure of natural resource abundance: *SXP*, share of primary exports as a percentage of national income. The coefficient of *SXP* is negative and statistically significant, as is the coefficient of *PXI*. The sensitivity analysis is performed using the variable

PXI, however, because this is the specialization measure that giving the regression with the highest R-square and the most statistically significant Sachs and Warner specialization measures. Econometric estimations using variable *SXP* are not included in the paper but are available on request.

[15] Regression (3) is estimated using Sachs and Warner's institutional variable capturing respect for the rule of law.

[16] Regression (4) reproduces Sachs and Warner's (1997) preferred regression.

[17] The measure of macroeconomic volatility is the standard deviation in the annual change in the real exchange rate (*VOLRERp*).

[18] Unlike other variables in the basic regression, the human capital coefficient is affected by the addition of variables to the estimated regression. The impact of human capital on output growth largely diminishes with the inclusion of regional dummies in the regression, suggesting that the impact of this variable was capturing regional specific characteristics other than differences in human capital investment.

[19] The results hold after the inclusion of regional dummy variables for African, Latin American and Asian countries (see Column 6) and also for the shorter growth period 1970-1990, indicating robustnessness of the results. For reasons of space, I do not present the results from the regression estimated over a shorter time span. These are however available on request to the author.

[20] Cross-country regressions also include regional dummy variables, and panel data estimations use a different proxy for the functioning of the institutional system: Polity IV's democracy index measuring the quality of political institutions.

[21] Unlike Bond et al. (2001), and to avoid spurious significance, here I do not use all the lagged level information, but only the data dated at *t-2* and *t-3*.

[22] As a further check for autocorrelation the system GMM was estimated with instruments starting at period *t-3* and obtain the same qualitative results. These regressions are not presented in the paper but are available on request.

[23] This variable is estimated as the average for the period 1967-2005 in the cross-country regressions and as averages of the five year periods in the panel database.

[24] Indeed, it has a very small and statistically not significant negative effect.

[25] The negative relation between economic growth and the trade specialization variable is because the lower the value of MICLY (TRDI) the higher is intra-industry trade (the similarity between countries' trade and world trade) and thus the larger the benefits from the pattern of specialization for economic growth.

[26] These variables are linked to initial income, human and physical capital accumulation, institutions, macroeconomic instability and growth in the terms of trade.

[27] See Tables B2.4.a and B2.4b for information on the benchmark regression and Tables B2.4a and B2.4b. for regressions including *MICLY* and *TRDI*.

[28] Whereas in GMM estimations the negative effect of *PXI* is reduced by more than half, in cross-country regression the effect decreases by a third (see row (3))

[29] Because specialization in industrialized resource products is not expected to constrain economic growth, the sensitivity analysis for the variable *MNR* is not included in this table. However, the information is presented in Table B2.5a and Table B2.5b.

[30] GMM validity tests suggest that estimations were run correctly, and Tables B2.5a and B2.5b in the appendix show that, although trade shares and pattern of specialization variables tend to be correlated, the correlation is below 0.8 reducing the risk of multicollinearity.

3 A Dependent Economy Model with Productive Linkages and the Pattern of Specialization in Resource Abundant Countries*

3.1 Structural Change: A Necessary but Elusive Condition for Economic Development in Resource Abundant Countries

Trade and financial liberalization in the 1990s gave place to a policy-induced de-industrialization process in South American countries, especially Argentina, and the others in the southern cone (Palma, 2005). The new scenario of low trade barriers and strong exchange rates (following deregulation of the capital account) reinforced the Latin American countries' pattern of trade specialization in natural resource-intensive products (Dijkstra, 2000).

There are different reasons making productive and export diversification a desirable development outcome in Latin America (and 1990s de-industrialization process a worrisome one. First, as shown in Chapter 2, natural resource exporters tend to grow less than their resource-poor counterparts, especially when they are not able to diversify and develop additional competitive advantages. Second, there are differences in returns to scale and the skill and technological intensities of the sectors producing natural resource and industrial products (Cimoli and Correa, 2005; Kaldor 1981; Katz, 2000; Thirlwall 1995, 2002).[1] The third one is related to the necessity of additional sources of foreign exchange to overcome external bottlenecks, which has been a fundamental constraint to sustained growth in Argentina.

Renewed concern regarding Argentina's and South America's pattern of trade specialization arises as demand for natural resource products has increased in response to the expansion of China and India and primary commodity prices skyrocket. According to the dependent economy and related multi-sectoral models, the analytical tools commonly employed to study the impact of shocks in small open economies, a positive shock, such as that referred to above, will reduce the competitiveness of the non-traditional tradable sectors, strengthening South America's natural resource-based pattern of trade specialization.

As is hypothesized in this research and demonstrated in this chapter, this is not the only possible adjustment to a positive natural resource shock; the shock may also contribute to productive and export diversification. Drawing on Ros (2000, 2001), this chapter develops a multi-sectoral model to discuss the possibility of positive indirect interaction between the natural resources and other tradable sectors.

The model moves beyond conventional approaches and takes into account the heterogeneity characterizing the non-tradable sectors in most economies. It distinguishes between two non-tradable sectors: the consumer-oriented and the producer-oriented. The first provides consumer services (e.g. restaurants, entertainment, etc.); the second provides non-tradable intermediate inputs which, following Hirschman, I refer to as productive linkages. The strength of the productive linkages in the entire economy, depends critically on the quality and extension of non-tradable production of the financial, physical and technological infrastructures. These infrastructures are critical in determining the competitiveness of an economy, and are especially relevant to modern industrial sectors.

Also, productive linkages are a potential source of positive externalities. The expansion of the non-tradable sector that generally follows a positive natural resource shock, may benefit the non-traditional tradable sectors, or set in motion forces that counteract the price adjustments predicted by dependent economy models when (non-tradable) productive linkages expand with a shock and allow other sectors to take advantage of them.

The availability of productive linkages is not a sufficient condition for productive and export diversification in natural resources exporting countries. Yet, in successful staple economies, such as Australia and Canada, impulses from the traditional exporting sector spread through the rest of the economy via a variety of linkages (Fogarty, 1985; Watkins, 1963),[2] and most competitive industries in the Scandinavian countries are linked to the productive linkages in their natural resource exporting sectors (Ramos, 1998; de Ferranti, et al., 2002).

Chapter 3 deals with the second research question regarding the impact of natural resource shocks on the pattern of trade specialization. It shows that the consequences of a positive shock depend on how natural resource revenues are used, and especially whether they finance consumer or producer services. Taking into account the role of productive linkages adds a dimension generally absent in dependent economy models and suggests that a positive natural resource shock does not necessarily constrain the competitiveness of other tradable sectors, as suggested also by Eswaran and Kotwal (2002) and Torvik (2001). The analysis in this chapter has some economic policy implications. It suggest that encouraging the natural resources sector to develop linkages would be beneficial for the entire economy, and also that policies that directly or indirectly promote investment in infrastructure in the context of a positive resource shock will be similarly beneficial.

Section 3.2 presents a dependent economy model extended with productive linkages. The section starts with a conceptual discussion and then turns to the presentation of the model. After this the section analyses the impact of a positive natural resource shock and discusses the conditions for this shock to reinforce or contribute to modify the pattern of specialization of resource abundant countries. Section 3.3 concludes.

3.2 A Linkage Dependent Economy Model

3.2.1 Some conceptual issues

Paraphrasing Hirschman's general notion of linkages "as the attempt to discover how one thing leads to another (Hirschman, 1981), this chapter examines how alternative uses of the revenues from natural resources encourages different patterns of trade specialization. In particular, the chapter explores the possibilities and conditions for a positive resource shock to facilitate productive and export diversification. The analysis focuses on Argentina and other Latin American countries; hence, diversification is conceived of as the development of a competitive manufacturing sector that helps to reduce a country's dependence on natural resource exports.[3]

According to Mayer (1997), manufacturing competitiveness and exports depend on natural resource endowments, macroeconomic and sectoral policies, size and patterns of world trade and the importance of the physical, technological and financial infrastructure. The analysis in this chapter focuses on two out of five of these determinants. The first is the direct and negative relationship between the natural resource and the manufacturing sectors commonly emphasized in dependent economy models. The second is the positive and indirect contribution of resource abundance or a positive resource shock to the competitiveness of the other tradable sectors, indirectly by improving the different types of infrastructure (and productive linkages of the economy).

The model presented in this chapter is similar to the multi-sectoral analytical models employed to study the impact of shocks in small open economies, starting with the dependent economy model (Salter, 1959; Dornbusch, 1980). It is also in line with models developed during the 1980s and 1990s to describe adjustments in relative prices and the economic structure that followed commodity booms and other events that increased inflows of foreign exchange.[4] (See e.g. Corden and Neary, 1982; Corden, 1984; Edwards, 1989; Murshed, 1999; Sachs, 1999.) One such event was the process of de-industrialization experienced in the Netherlands in the 1970s following the discovery of gas fields in the North Sea, a process that was described by *The Economist* as the 'Dutch disease'.

Following Ros (2000, 2001), this chapters incorporates productive linkages to a dependent economy-type model. Productive linkages principally concern the provision of (non-tradable) intermediate inputs like physical, financial and technological infrastructure and other specialized inputs. As Mayer (1997) and the literature recognize, productive linkages are an important (price and non-price) competitiveness determinant and provide inputs that are used intensively in modern industries (see e.g. Chudnovsky and Porta, 1990; Rodriguez-Clare, 1996).

The provision and expansion of productive linkages are critical if economies are to change their pattern of trade specialization. They are a source of positive external effects through the provision of services characterized by the presence of economies of scale, e.g. transportation, communication, and services that are very specialized and can promote economies of specialization, like agricultural and engineering services. In the model, positive external effects are developed as pecuniary externalities.[5] This means that the development and expansion of productive linkages can be translated to lower input prices, which increase the profitability of the tradable sectors using them.

The model in this chapter is also related to the multiple-equilibrium family of studies that followed the seminal paper by Murphy, Shleifer, and Vishny (1989). Murphy et al. (1989) formalize a core proposition of pioneers of development economics: that modern production techniques (characteristic of advanced countries) are a source of pecuniary externality. As externalities create coordination failures, they can prevent developing countries from upgrading from traditional to modern and advanced activities, leading to what is known as a development trap. A 'Big Push', to coordinate economic decisions, is necessary to escape from the development trap. This impulse may come from massive public investment and/or large expansions in private consumption that make modern production techniques profitable (Rosenstein-Rodan, 1943, Murphy et al., 1989, Sachs and Warner, 1999),[6] or any increase in aggregate demand that contributes to establishing and expanding productive linkages (Rodriguez-Clare, 1996).[7] The third channel that is applicable to open economies is emphasized in this chapter.

The analysis in Ros (2001) studies the general case in which economic development is conceived of as a change in the pattern of specialization from labour-intensive to capital and technological intensive industries, sponsored by the expansion of productive linkages. With a focus on the experience of Latin American countries, this chapter analyses the (possibilities of a) transition from natural resources to modern industrial production and exports.[8] Of particular interest is the case where the expansion of productive linkages, which sets up the conditions for economic development, follows from a positive natural resource shock.[9]

The implications of a positive shock for economic development depend on how natural resource income is used, and especially whether it (mainly) increases consumption or contributes to expanding productive linkages, two of the possible uses of resource revenues.[10] Moreover, expansion of the productive linkages following a natural resources shock will be determined by the initial characteristics of the natural resource sector. If the natural resources sector is modern and makes intensive use of financial and research and development services, for instance, then the expansion of productive linkages and ensuing positive externalities for other sectors, will be more likely.[11] Also, the development of productive linkages will depend on economic policies designed to use natural resource income to invest in infrastructure or to encourage an integrated natural resource sector.

The model developed in this chapter has links with dynamic dependent economy models. However, it is more innovative (see e.g. Sachs and Warner, 1995 and other work referred to in Chapter 2) in that expansion of the non-tradable sector following a positive resource shock, expands the productive linkages and may contribute rather than jeopardize economic competitiveness. Only Torvik (2001) and Eswaran and Kotwal (2002) explore this type of adjustment. According to Torvik (2001), dynamic economies of scale arise in both the tradable and non-tradable sectors; as knowledge spillovers are assumed to go in both directions, a resource gift that drives the non-tradable sector may turn out to be beneficial in the long-run. Similar to the model proposed in this chapter, Eswaran and Kotwal's staple-growth model sustains that the non-tradable sector produces both consumption and producer services. They emphasize that as income grows, demand for producer services rises and manufacturing sector costs fall, thereby promoting diversification in resource abundant countries, as it seems to have been the case in Australia, Canada and Scandinavian countries.[12]

3.2.2 The model

The model distinguishes between tradable and non-tradable goods and sectors. The tradable sector is disaggregated according to the existence of natural resource endowments. The tradable sector therefore includes an internationally competitive natural resource sector (*R*) and a potentially competitive manufacturing sector (*M*). Sector *R* is defined as a '*large*' sector producing both unprocessed and industrialized natural resource products.

Sector *M* (henceforth the manufacturing or industrial sector), therefore, includes only non-natural resources industries, which implies that diversification (as it is understood in this chapter) cannot take place through the development of natural resource-based industries (*NRBI*), although this is a valid alternative for Latin American countries, but not necessarily easy to achieve (Roemer, 1979). In fact, the assumption of a 'large' sector *R* is made to illustrate that *NRBI*, which certainly have more productive linkages than primary production, can contribute to developing other competitive industries.

For simplicity, the model assumes that output in sector *R* is exogenous, as shown in equation (3.1).[13] This simplifying assumption is often made in dependent economy models[14] and brings two important advantages. First, it makes the model suitable to analyse the effects of a resource shock, and also adjustment to other foreign exchange shocks associated with debt, aid or other capital inflows. Second, the assumption of an exogenous natural resource sector facilitates discussion on the uses of resource income as being determined by technology or economic policies, while keeping the model analytically tractable.[15] As in Murshed (1999) and Sachs (1999), the model further assumes that natural resource production is entirely for export.[16]

Non-resource manufacturing goods are produced with Cobb-Douglas constant returns to scale technology that combines capital and non-tradable intermediate inputs (*I*) (see eq. (3.2) below). These domestically produced inputs represent backward linkages in sector *M* which provide the infrastructural or specialized inputs mentioned in Section 3.2.1.[17] To emphasize the capital and linkage intensity characteristic of the sector, labour is excluded in eq. (3.2). However, this is not to imply that manufacturing does not use labour, but rather that the sector makes an indirect use of it through productive linkages.

$$\bar{R} \tag{3.1}$$

$$M = {K_M}^{\beta} I^{1-\beta} \tag{3.2}$$

To study the role of productive linkages the non-tradable side of the economy distinguishes two types of products and sectors: consumer-oriented and producer-oriented. The latter encompasses the physical, technological and financial infrastructures and specialized services employed as inputs in the manufacturing sector. These inputs are produced in sector *I* using a technology describing increasing returns to scale. Examples of these inputs are producer services such as consultancy, various types of financial products and research and extension departments, where increasing returns result from economies of specialization and the infrastructures associated with communication and transportation, where increasing returns are derived from scale economies. Sector *I's* production function is described in equation (3.3), which is simpler than the specification in Ros (2001). As shown in equation (3.4), sector *S* produces consumer goods and services – and other non-tradable inputs – using a technology with constant returns to scale.

$$I = {L_I}^{1+\mu} \text{, where } \mu > 0 \tag{3.5}$$

$$S = L_S \tag{3.6}$$

Producers in sector *I* determine prices by a mark-up over variable costs. Prices in this sector equal $p_I = (1+\pi)\cdot\omega$, where π stands for a fixed mark-up and $\omega = w\frac{L_I}{I}$ represents sectoral unit labour costs.[18] The price of non-tradable inputs (p_I) relative to the price of manufacturing products equals

$$\frac{p_I}{p_M} = (1+\pi)\frac{w\cdot L_I}{p_M \cdot I} \tag{3.7}$$

In a monopolistic competition context – or with adequate regulation,[19] increasing returns mean that intermediate input prices fall with the size of sector *I*, improving the profitability of the sectors using these inputs. They also imply that sector *I* is a source of productive complementarities which has implications for the pattern of specialization and the dynamics of the system.

As discussed in Ros (2000), if sector *I* is small, the non-tradable inputs will be expensive and the sectors using them will not be profitable – in our model, the manufacturing sector - because this can only be developed in association with sector *I*. If, on the other hand, producer linkages are relative large input prices (productivity) may turn out to be low (high) enough and render the manufacturing sector competitive. Moreover, once the manufacturing sector breaks even, its interaction with sector *I* will be self-reinforcing. This pecuniary externality can be particularly important in resource abundant countries that are seeking to modify their pattern of specialization, as it provides a channel for the resource sector, if modern and industrialized, to indirectly encourage diversification.

To explore this proposition formally, demand for intermediate inputs is linked to the manufacturing sector and to natural resources income.

$$ED_I = I_M{}^d + I_R{}^d - I = 0 \tag{3.8}$$

In equation (3.8) I_M^d is demand for intermediates from sector *M* and equals $I_M^d = \left[\frac{p_M}{p_I}(1-\beta)\right]^{1/\beta} K_M$. The term I_R^d is exogenous and equals

$I_R^d = t\dfrac{R}{p_I}$, where parameter t represents the percentage of the revenue from natural resources spent on non-tradable intermediate inputs. Working with an exogenous resource sector implies that $I_R{}^d$ can be technology or policy determined.[20] It is possible, therefore, to assume that parameter t represents different policies and mechanisms for the channelling of natural resource revenues to the increasing returns sector, like credit or tax policies to encourage investment in technological infrastructure, or direct public investment in physical infrastructure. Although it is possible to consider other saving-investment decisions,[21] it is assumed that resource income is used only to demand non-tradables: intermediate inputs (tR) or consumption goods and services ($(1-t)R$). Combining (3.7) and (3.8) leads to the following expression of output in sector I.[22]

$$I = \left[\frac{(1-\beta)p_M I}{(1+\pi)wL_I}\right]^{\frac{1}{\beta}} K_M + \frac{t}{(1+\pi)}\frac{RI}{wL_I} \tag{3.9}$$

As shown in equation (3.9), productive linkages are an increasing function of the capital stock from sector M, the magnitude of resource income, and the extent to which natural resource revenues are used to demand non-tradable intermediates, denoted by t. Output in sector I is negatively related to price (w/p_M in eq. (3.9)) .

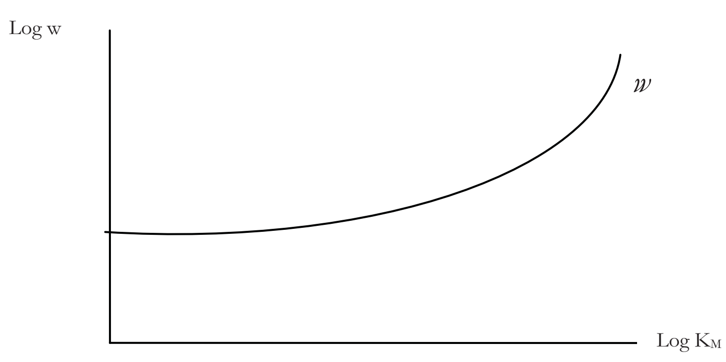
The impact of resource shocks on the pattern of specialization is analysed in terms of the dynamics of the labour market and capital accumulation, as in Ros (2000; 2001). This requires that we substitute labour demand[23] in $L = L_S + L_I$, to obtain the following linearized expression of equilibrium market wages.

$$\ln w = \ln qR + \frac{1}{\beta(1+\mu)}\ln\left[\frac{p_M}{p_I}(1-\beta)\right] + \frac{1}{1+\mu}\ln K_M + \frac{1}{1+\mu}\ln\frac{tR}{p_I} - \ln L \tag{3.10}$$

Equation (3.10) shows that unless there is an unlimited supply of labour resource abundance creates upward pressure on market wages, as predicted by the standard Dutch disease models. This positive association is caused by two different effects. First, higher wages are associated with $(1-t)R$: the so-called *spending effect* capturing the extra expenditure on non-tradable consumer goods and services which higher resource income promotes. Second, the resource sector increases wages via tR, an effect that is similar (though not exactly equal) to the *resource effect* identified in Dutch disease type models. Increases in the size of sector R expand labour demand – indirectly through sector I – and this requires an increase in market wages to restore equilibrium in the labour market. Finally, market wages are positively related to the size of sector I and the capital stock.

Figure 3.1 plots equation (8) in the ($Log\ w; Log\ K_M$) space. Assuming the presence of excess capacity in the short-run[24] or that, due to the lower productivity of sector S compared to sector I, the non-tradable sector producing consumer goods can provide an initially elastic supply of labour,[25] the market wage schedule (*w curve*) has a relatively flat initial segment. This means that the initial expansion of sector I can be achieved at low labour costs. Yet, increases in capital stock and labour demand in sector I make the *w curve* steeper.[26] Alternatively, positive changes in the size of the resource and intermediate sectors shift the *w curve* upwards.

Figure 3.1
Capital accumulation and market wages



Note: Adapted from Ros (2000, chapter 8).

To complete the analytical model, I need to account for the dynamics of capital accumulation. Capital accumulation is assumed to equal the depreciation rate (δ) and to be financed by savings from profits,[27] as shown in equation (3.11). Because the purpose of the model is to emphasize the role of productive linkages, the analysis does not allow for capital accumulation to be financed by resource revenues.

$$\frac{I}{K} = s_M \cdot r_M = \delta \tag{3.11}$$

The profit rate r_M is obtained from profit maximization of equation (2) and equals $\mathrm{r_M} = \beta(I/K_M)^{1-\beta}$. Replacing I in r_M, plugging the new expression of the profit rate into equation (3.11), and rearranging the terms gives an alternative wage curve (*w**): the long-term wage curve, which is compatible with capital accumulation.

$$\ln w^* = \frac{\frac{(1-\beta)}{\beta}\ln\left[\frac{(1-\beta)}{(1+\pi)}\frac{p_M I}{L_I}\right] + (1-\beta)\ln\left[\frac{tRI}{(1+\pi)L_I K_M}\right] - \ln\left(\frac{\delta}{s_M \beta}\right)}{\left[\frac{1-\beta^2}{\beta}\right]} \tag{3.12}$$

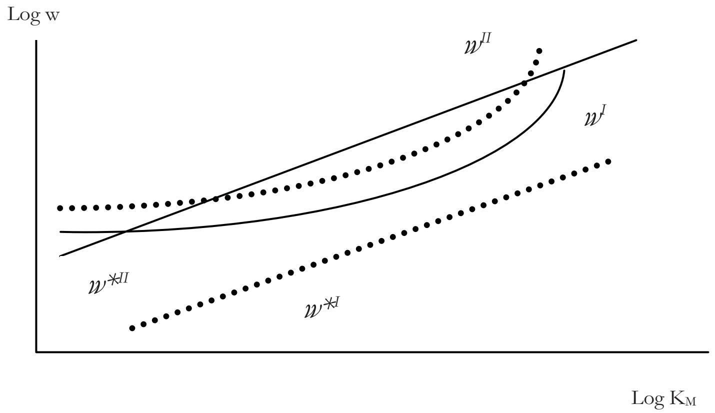
According to (3.12), long-term equilibrium wages are positively associated to the size of the natural resource sector and the percentage of the natural resource revenues used to satisfy demand for intermediate inputs *(t)*. Long-term wages are also positively related to the size of the intermediate sector and the capital stock.[28] Defining equilibrium as a situation where market wages (*w curve)* equal long-term wages (*w* curve*), the model can be used to explore the effect of changes in the size and uses of resource revenues.

3.2.3 Positive natural resource shocks: a curse or a blessing?

Discussion of the implications of a positive resource shock for the pattern of specialization is depicted in Figure 3.2, which combines the market wage schedule (*w curve* associated to (3.10)) and the long-term wage schedule (*w* curve* derived in (3.12)). A remarkable feature of the figure is that multiple-equilibriums are a possibility in this stylized economy. In the *bad equilibrium,* resource abundant countries specialize according to their static competitive advantage, but in the *good equilibrium,* they are capable of developing internationally competitive manufacturing sector.

Multiple-equilibriums arise from the combination of an initially elastic labour supply and increasing returns in sector *I*. For low levels of the capital stock the elastic labour supply makes the market wage curve (*w*) flatter than the long-term wage schedule (*w**) – as production in sector *I* can be expanded at low labour costs. But the market wage schedule becomes steeper than long-term wages for high levels of the capital stock because a large manufacturing increases labour demand (through backward linkages with sector *I*) creating upward pressure on market wages.

Figure 3.2
Natural resource shocks and the pattern of specialization in a context of multiple-equilibriums



Note: Adapted from Ros (2000, chapter 8). K_M stands for the minimum capital stock required to develop a competitive manufacturing sector.

Analytically, multiple-equilibriums require $\frac{1-\beta}{\beta}$ (the slope of the long-term wage curve *(w*)*) to be smaller than $\frac{1}{1+\mu}$, the slope of the market wage curve *(w)*, when labour supply becomes inelastic; these conditions hold for μ<=0.2 and β>0.5. The former is a plausible condition since externality parameters larger than 0.25 are highly unlikely (de Melo and Robinson, 1992). Although the latter condition is compatible with developing countries, especially those in Latin American, where capital represents a large share of total income, the condition follows from the assumption about how capital accumulation is financed in the model. Allowing for capital accumulation to be financed from the income from natural resource reduces the value of β and thus increases the likelihood of multiple-equilibriums.[29]

Figure 3.2 also shows that the two curves may not intersect. This would be the case when the market wage schedule (w) is above the long-term equilibrium wages (w^*). This outcome corresponds to very low values of t, and describes an economy with a natural resources sector with no or very small productive linkages,[30] and no indirect interaction between sectors *R* and *M*. In this hypothetical case of low productive linkages in sector *R*, income from the primary sector mostly finances consumption, leading to higher market wages due to the Dutch disease spending effect. In the context of a small sector *I* – explained in part by the lack of backward linkages in the resource sector – high market wages constrain the development of sector *M*. Hence

> there is a unique stable equilibrium without a manufacturing sector where the economy specialises in the production of primary-commodities (Ros 2000: 232).

Moreover, for low values of t all positive changes in sector R make productive and export diversification less likely. In Figure 3.2, this is the case when the market wage schedule w^I stays above w^{*I}.

Alternatively, for larger values of $\boldsymbol{t}$ it is more likely that the two curves will intersect. Although sector *R* pushes market wages upwards via the Dutch disease *resource effect*, a natural resource sector with productive linkages also pushes the long-term wage curve (w^*) upwards.[31] If the productive linkages in sector *R* are sufficiently large, they will offset the *resource effect* and the development of the manufacturing sector starts to become a possibility. The upward movement of the long-term wage curve is due not only to the direct effect associated with a larger *R* or $\boldsymbol{t}$, as can be determined from equation (3.12). It is also due to the indirect (external) effect that the expansion of sector *R* has on the price of non-tradable inputs (p_I)*:* intermediate inputs demand from sector *R* increases the size of the productive linkages (sector *I*). According to equation (3.7), this translates into lower input prices increasing the profitability of the manufacturing sector, which now may emerge. In Figure 3.2, this outcome of positive externalities between tradable sectors corresponds to a long-term curve w^{*II} intersecting twice with the market equilibrium schedule w^I.

The low intersection in Figure 3.2 shows the minimum conditions (capital stock) for a profitable manufacturing sector. Complementarities among the tradable sectors and productive linkages make this an unstable equilibrium. If $K_M < \underline{K_M}$, sectors *M* and *I* are small, implying high intermediate inputs costs, which make the manufacturing sector unprofitable, and the economy fails to diversify. If, on the other hand, $K_M > \underline{K_M}$ the capital stock will be large enough to reduce production costs in sector *I* and allow the manufacturing sector to break even, leading to a sustained expansion in the capital stock. In other words, as the economy enters the region of multiple equilibriums it is able subsequently to move to dynamic equilibrium – high intersection – characterized by high capital stock and wages, and competitive economic diversification.

The analytical discussion concludes by examining the relation between the minimum conditions for a profitable manufacturing sector and changes in the size of sector *R,* and the uses of natural resource income. In terms of Figure 3.2, this involves considering changes in the *w* and *w** curves. According to the model, changes in sector *R* engender opposite adjustments in the curves. On the one hand, a positive resource shock creates Dutch disease effects shifting the market wages curve upwards, increasing the minimum capital stock necessary for the emergence of a competitive manufacturing sector. Indeed, it is also possible that a large spending effect, as for instance implied by a large value of *(1-t)*, will move the economy to equilibrium without a manufacturing sector.[32] On the other, expansion of sector *R* shifts the *w* curve* upwards, making diversification more likely; an outcome that may also be the result of increases in the size of the productive linkages in sector *R*, as captured by parameter *t*.

3.3 Concluding Remarks

This chapter has presented a dependent economy model extended to consider the role of productive linkages. The so-called *linkage dependent economy model suggests that: resource abundant countries can overcome a development trap and that a positive resource shock can encourage productive and export diversification, modifying Latin America's pattern of trade specialization.*

This conclusion emerges from an analysis of the contribution of the natural resource sector to the expansion of productive linkages, which provide infrastructure and other specialized services that are essential to compete in modern manufacturing production. As discussed, if natural resource income mainly finances consumption, a positive resource shock will basically engender Dutch disease type adjustments, making diversification unlikely. On the contrary, if resource revenues directly or indirectly promote the expansion of productive linkages, a resource shock can bring the economy to the *good equilibrium* of successful structural change and export diversification.

The good equilibrium will thus depend on the characteristics of the natural resource sector and/or economic policies. Diversification may follow/occur directly in countries with natural resource intensive industries with productive linkages, such as Australia, Canada, the USA and the Scandinavian countries. On the other hand, it may require particular policies to promote investment in technology and infrastructure in the natural resources sector, as suggested by Akiyama and Yabuki (1996), Barbier (2004) and Ramos (1998), or economy-wide investment. As noted by Palma (2000) in relation to Chile, avoiding Dutch disease effects and encouraging productive and export diversification may require that the natural resource sector is taxed and the revenue is spent on competitiveness-enhancing projects.

Notes

♣ A preliminary and extended version of this paper was presented at the PhD Summer course "The Resource Curse"; Norwegian University of Science and Technology (NTNU), Trondheim Norway, June 20-24 2005. I received helpful comments from professors M. Karshenas, M. Murshed, J. Ros, R. Torvik and R. Vos. Any possible error is the author's responsibility

[1] Cross-country empirical studies emphasize other disadvantages associated with natural resource abundance. As discussed in Chapter 2, common disadvantages are: Prebisch-Singer terms of trade hypothesis; price and macroeconomic volatility and income distribution and political economy conflicts.

[2] According to Fogarty, all successful staple economies are characterized by the presence of: technological and scientific infrastructures, usually provided by government; a developed marketing system; government finance and modern banking services; significant physical infrastructure (transportation, ports, grain-elevators, etc.).

[3] Throughout this chapter I use the terms manufacturing sector and industrial sector to refer to the non-natural resource tradable sector.

[4] There are static and dynamic dependent economy-type models. Static models focus on how relative price adjustments modify the structure of an economy, emphasizing how certain positive shocks can lead to unemployment and trade deficits. Dynamic models emphasize the growth retarding consequences of a positive resource shock.

[5] Scitovsky (1954) identifies two external effects: technological and pecuniary externalities. Following Scitovsky, a technological externality can be defined as occurring "whenever the output (x1) of a firm depends not only on the factors of production (l1, c1,…) utilized by this firm but also on the output (x2) and factor utilization (l2, c2,…) of another firm or group of firms" while pecuniary externalities arise "whenever the profits of one producer are affected by the actions of other producers" (Scitovsky, 1954: 144-5). To the extent that we are assuming that external effects are translated into price changes, the analytical model is developed along the lines of pecuniary externalities.

[6] Sachs and Warner (1999) set up a "big push" model in which a positive resource shock expands the size of the domestic market and boosts economic development. Such a process is compatible with the big push type industrialization experienced by some of the regions of recent settlement during the 1870-1930 period.

[7] According to Rodriguez-Clare (1996) sustainable development depends on the presence and adequacy of productive linkages.

[8] It is highly unlikely that resource abundant countries develop labour-intensive industries because they "tend to emphasize more capital-intensive industries due to the relative high price of labour in comparison to their degree of industrialization" (Syrquin; 1989, p.218)

[9] Indeed, the analytical framework captures an idea presented in a model developed by Gutiérrez de Piñeres (1999), whereby when the primary sector requires significant investment in infrastructure and knowledge, the sector becomes an important source of externalities and facilitates the development of other exporting sectors. However, rather than considering externalities within the primary sector only, as Gutiérrez de Piñeres (1999) does, the model investigates how the natural resource sector can contribute further to the emergence of a dynamic manufacturing sector.

[10] This means that in this chapter I do not take account of consumption of tradable goods or other savings-investment decisions. For a discussion of savings-investment uses of natural resource revenues, see work on trade shocks by Collier and Gunning (1999).

[11] For a detailed and instructive discussion on the role and characteristics of linkages in primary exporting countries see Hirschman (1981).

[12] A related paper is by Galiani, Heymann, Dabús y Tohmé (2007) which explains human capital accumulation in Argentina. However, as human capital is accumulated to produce high quality services consumed by the elite, it does not generate productive complementarities.

[13] The assumption of an exogenous resource sector excludes analysis of capital adjustments between sector R and other sectors using capital as a factor of pro-

duction. See Sachs and Bruno (1982) and Corden and Neary (1982) for a complete discussion of these adjustments.

14 Murshed (1999) and Torvik (2002) are examples of dependent economy models assuming an exogenous supply for the natural resource sector.

15 Adding the supply side of the natural resource sector and a government sector, will complicate analysis of the model.

16 The implications of a natural resource sector producing for the domestic and export markets are discussed in Chapter 4.

17 Although the model is built around the idea of backward linkages this does not mean that other productive linkages are irrelevant.

18 This specification is simpler than the one employed in Ros (2001), where mark-up is defined over marginal costs rather than over average labour costs.

19 This is to ensure that providers of intermediate inputs do not appropriate a fraction of the natural resource rents, as happened, according to Di Tella (1985), between 1870 and 1930 in the regions of recent settlement.

20 One likely specification of sector *R's* supply function compatible with the idea that *NRBI* and positive resource shocks may promote diversification is $R = T_R^{\ \lambda} I^{1-\lambda}$, where $\lambda > \beta$. The function suggests that sector *R* has productive linkages and the inequality states that these are smaller than those in the manufacturing sector. It also suggests that in resource abundant countries the manufacturing sector is more dependent on dynamic advantages to be competitive.

21 In his study of natural resources-based industrialization in Malaysia, Thoburn (1973) defines linkages as an investment decision, in line with Hirschman's understanding of linkages.

22 An alternative expression of *I* is given by $I = \left[\frac{(1-\beta)p_M}{p_{I\text{ç}}}\right]^{\frac{1}{\beta}} K_M + t\frac{R}{p_I}$. This and equation (3.9) are used in this chapter.

23 To obtain expressions for labour demand I follow the procedure in Ros (2000). For simplicity I assume that demand for non-tradable consumer goods and services *(S)* comes from natural resources income only, and labour demand from sector *S* equals $L_S = \frac{(1-t)\cdot R}{w}$. From equation (3.5) we know that labour demand in sector *I* equals $L_I = I^{1/1+\mu}$. Substituting *I* into this expression, labour demand can be expressed as

$L_I = \left\{\left[\frac{(1-\beta)p_M}{p_I}\right]^{\frac{1}{\beta}} K_M + \frac{t \cdot R}{p_I}\right\}^{\frac{1}{1+\mu}}$, which is then included in the excess labour market equilibrium identity.

[24] The assumption of excess capacity in the short-run is theoretically consistent with the mark-up specification of sector *I*. It is also compatible with the labour market characteristics of many Latin American countries during the 1999s - and especially Argentina.

[25] A possibility is to assume that sector *S* comprises the informal sector of the economy, as in Ros and Skott (1998).

[26] It is possible to obtain a similar curve without the assumption of short-run excess capacity or hidden unemployment. As in Ros (2001), the curve will be relatively flat when sector *M* is small as is the case for the backward linkages sector *I*.

[27] This means assuming a stationary labour force and no exogenous technical change, as well as the common assumption that workers do not save.

[28] Long-term wages and capital stock in the manufacturing sector are positively related because through *I* capital stock enters twice in the numerator offsetting the negative effect arising from its presence in the denominator. Some tedious algebra makes it is possible to obtain the slope of the *w* curve* in the log w, log K space, which equals $\frac{1-\beta}{\beta}$.

[29] Allowing for capital accumulation to be financed from natural resource rents makes the slope of the *w* curve* equal to $\frac{1-2\beta}{\beta}$. In this case, the condition for multiple-equilibriums is equal to β >=0.35; values that are also consistent with figures for the capital shares in developed countries.

[30] According to Ros (2000), no intersection is also possible in resource abundant countries with small labour forces. Because the analysis focuses on middle-income countries, the case is not discussed in the text.

[31] The same will apply if government channels resource revenues to enlarge productive linkages, through public investment in infrastructure.

[32] This occurs when the two curves no longer intersect and market wages *(w)* are above long-term wages *(w*)*.

4 Competitive Diversification in Wage-Goods Exporting Countries[Ψ]

4.1 Introduction

In economic terms, Argentina is a special case. It occupies a central place in accounts of economic history and financial newspaper headlines. The beginning of the 21st century saw Argentina's longest and largest economic crisis, which has been followed by recovery and expansion at rates of economic growth equalling those of China.

This recovery has reopened the debate on Argentina's long-term development strategy. Several authors emphasize the need to strengthen and promote Argentina's non-traditional tradable sectors, to consolidate the recent economic process and to finally overcome Argentina's recurrent internal and external imbalances (Gerchunoff and Ramos, 2005; Kacef, 2004; Porta, 2005).[1]

Between 2003 and 2008 positive international conditions and the competitive exchange rate policy followed by the government are both said to have encouraged strong macroeconomic fundamentals in Argentina (see Chapters 5 to 8). The implications of global conditions and the exchange rate policy for productive and export diversification, however, need to be discussed in more detail - especially as Argentina's structural features, commonly overlooked in aggregate macroeconomic studies, do play a role.

Discussion of productive diversification in Argentina and the impact of natural resource shocks and policies hypothesized in this research, needs to take account of one of the country's most important structural features: a resource sector whose natural advantages make it more competitive internationally than other tradable sectors, and which produces wage-goods that are exported and consumed domestically. These structural characteristics matter for two reasons. First, the high productivity in Argentina's agriculture sector (and the recently developed mining sector) poses limitations on the development of other tradable sectors and therefore hampers competitive diversification (for classical and recent literature focusing on Argentina and other Latin America's countries see Chena and Perez Candreva, 2008; Chena and Feliz, 2008; Diamand, 1972; Nicolini-Llosa, 2007a, 2007b; Schlydlowsky, 1993). Although, as discussed in Chapter 3, the interaction between the natural resource and industrial sectors is complex and its effects can work in different directions.

Second, because exchange rate devaluations can have particular effects in countries which, like Argentina, are exporters of wage-goods. Nominal devaluations can be contractionary, as emphasized in traditional and recent macroeconomic studies of Argentina (see e.g. Braun and Joy, 1968; Porto, 1975; Keifman, 2005). On the other hand, they can be expansionary, as noted by Frenkel and colleagues (see Frenkel and Taylor, 2006; Frenkel and Ros, 2006; Frenkel and Rapetti, 2007).

The second group of studies emphasizes many implications of nominal devaluation (i.e. the contribution to employment growth and the achievement of macroeconomic balances, Central Bank's sterilization capacity). However, it does not analyse the impact of a competitive exchange rate policy that takes account of Argentina's particular structural features. Although there has been much discussion in Argentina on the impact of devaluations in a wage-goods producing country, there are no macroeconomic studies discussing this issue with the proper analytical and sectoral detail.

This chapter develops (an unemployment version) of the Scandinavian dependent economy model, which is used to discuss how the recently mentioned structural features of Argentina constrain industrial competitiveness and determine the impact of the competitive exchange rate policy that has been pursued to encourage productive and export diversification among other things.

The model presented in this chapter has two novel features compared to the traditional Scandinavian model (see e.g. Dornbush, 1980; Murshed, 1997). First, it includes a wage equation, linking factor payments to average factor productivity, as in Rattsø and Torvik (2003). This extension shows how Argentina's natural advantages in agricultural production constrain the competitiveness of other tradable sectors and the macroeconomic implications this can have. It illustrates that a positive shock in the agriculture sector can increase unemployment and create current account imbalances, thus becoming an issue of concern for the economic authorities.

This make a new contribution to the work of classical authors such as Diamand, Kaldor and Schylidowski, within a macroeconomic framework, and also exemplifies the conditions required for a positive shock to promote internal and external imbalances: (i) a natural resource sector that is not the largest tradable sector and cannot ensure that the positive income effects of the resource shock predominate over the negative substitution effects; (ii) countries have a high propensity to import; (iii) there are large productivity differences between the natural resource and other tradable sectors, and (iv) industries that are very dependent on price competitive advantages.

The second innovative feature of the model is the inclusion of a productivity equation linking productivity growth to aggregate demand. The model in this chapter, therefore, considers the price and non-price dimensions of industrial competitiveness, and discusses how they are affected by a competitive exchange rate policy, such as that implemented in Argentina in 2003 to 2007.

Focusing on real-side issues, this chapter analyses the impact of exchange rate devaluations in countries with different structural characteristics. It shows that, for productive and export diversification to be achieved not at the expense of falling real wages, devaluations in wage-goods exporting countries like Argentina need to be implemented together with export taxes.

Another novelty of this model is that it incorporates Kaldor-Verdoon effects through a productivity equation. It shows that, by encouraging aggregate demand, exchange rate devaluations can boost productivity growth and improve non-price competitiveness in the tradable sector.

Neither the implications of nominal devaluations in wage-goods exporting countries nor their contribution to productivity growth, to my knowledge, have been considered from this perspective in discussions relating to Argentina's competitive exchange rate policy in the early 2000s. The analytical propositions regarding the exchange rate policy discussed in this chapter are incorporated within a stylized CGE model – linking the price of wage-goods to nominal exchange rates and linking productivity growth to capacity utilization and, thus, to aggregate demand – and studied through counterfactual simulations in succeeding chapters (see Chapters 5, 6 and 8).

Chapter 4 is organized as follows. After a brief conceptual discussion, the model is presented in Section 4.2. Section 4.3 is devoted to analysis of the adjustment to a positive resource shock and Section 4.4 analyses economic policy and discusses the general impact of exchange rate devaluation and its impact in wage-goods exporting countries. Section 4.5 extends the model to discuss the productivity aspects of the competitiveness problem and Section 4.6 summarizes the findings from this chapter.

4.2 The Scandinavian Model

4.2.1 Some conceptual issues

To understand the structural limitations to competitive diversification associated with resource abundance and to discuss alternative policies contributing to structural change, this chapter presents a simple analytical model along the lines of the Scandinavian model. The Scandinavian version of the dependent economy model is a Ricardian-type model in which labour is the only factor of production (see Dornbusch 1980, ch. 5; Murshed 1997, ch. 3).[2] The version developed in this chapter assumes that there is factor unemployment for this permits a discussion of Latin America's competitiveness issues that takes into account some of the propositions Diamand, Kaldor and Schydlowsky (henceforth refereed as classical authors) within a macroeconomic framework.

According to these authors, the relatively high productivity of Latin America's agricultural or mineral sector handicaps competitive diversification because:

> these sectors can operate profitably at an [appreciated] exchange rate at which other [less productive] producers [sectors] in the economy would make losses (Schydlowsky, 1993: 28, parentheses added).

Though largely discussed, macroeconomic issues, such as the achievement of full-employment and external balances, are not considered formally by classical authors.

To work within a macroeconomic framework, the model considers the nominal exchange rate as a policy variable and assumes that factor prices reflect the productivity of the tradable sector(s).[3] Prices reflecting the (high) productivity of the (natural resource) tradable sectors do not necessarily clear the factors market, an assumption that is in line with the propositions from classical authors. Another implication of the assumption of factor unemployment, combined with the linear production function, is that the model explicitly takes account of the competitiveness of the tradable sectors.[4] Industrial competitiveness is analysed, therefore, in terms of the relation between factor productivity and prices, whether nominal wages or the exchange rate.

This competitive measure is highly simplified. As acknowledged in the literature, a sector's competitiveness depends on many other factors than the exchange rate, wages and productivity variables, like for instance the presence of specialized inputs and other relevant production costs.[5] There is a trade-off between analytical simplicity, and tractability with analytical completeness. As the purpose of this chapter is to give the competitiveness discussion within a macro context, the option for simplicity ruled. The price and productivity variables, therefore, are conceived in a broad sense, to imperfectly represent other price and non-price competitiveness determinants.[6]

4.2.2 The model

The Scandinavian model is a three goods-sectors model that distinguishes between tradables and non-tradables. To keep the model simple, labour, *L,* is the only factor of production in this economy and is labelled *L*. The model does not consider factors' accumulation, neither investment. Economic sectors differ in terms of their factor productivity – it is equivalent to their total factor productivity (*TFP*) and is assumed to capture differences related to natural resource endowments and capital intensity, which, for simplicity, are assumed away.

Two of the three sectors in the economy are tradables: the natural resource sector, *R*, and the non-resource or manufacturing sector, *I*. The third sector is the non-tradable sector, *N*.

The following assumptions are defined to simplify the analysis; some of them will be removed as the discussion progresses. First, it is assumed that, due to competition, *TFP* in the tradable sectors is higher than in the non-tradable one. A second (temporary) assumption is that that all the production from sector *R* is exported. This is a useful assumption to study the effects of structural factors for competitive diversification. For this analysis, what the sector produces is irrelevant, and *R* can alternatively be rent. In the discussion on economic policies, however, this assumption is removed so as to consider the case of countries specialized in the production of food products.

The third assumption is that natural resource commodity prices are determined in the international market and that, at such prices the country can sell all its production abroad. The fourth assumption is that manufacturing goods produced at home and abroad are imperfect substitutes. Therefore, it is the external terms of trade for the goods produced in sector *I*, and not the law of one price that matters in this sector. The fifth and sixth assumptions are that: imports only compete with production from sector *I* and intermediate inputs are non-tradable in nature. This implies that there are no imported intermediate inputs. Although imported intermediate inputs can have important macroeconomic implications, as recognized in the literature (see e.g. the seminal paper by Krugman and Taylor, 1978), they are not taken into account in this chapter to keep the algebra simple and to maintain the focus of the discussion on the effects of nominal devaluations on industrial competitiveness and real wages.[7]

Supply in the natural resource sector depends on labour and *TFP*, as indicated in equation (4.1) by L_R and A_R, correspondingSupply in the natural resource sector depends on labour and *TFP*, as indicated in equation (4.1) by L_R and A_R, correspondingly

$$R = R(\underset{+}{A_R}; \underset{+}{L_R}) \tag{4.1}$$

Output is demand-driven in the other two sectors, and the price of these domestically produced goods in terms of their unitary factor costs equals

$$P_i^h = \frac{1}{A_i} \cdot W + \bar{H} \tag{4.2}$$

Subscript *i* refers to sectors *I* and *N*; superscript *h* is the price of domestically produced goods; A_i is the average product of labour in sector *i* and constitutes the productivity variable; *W* is the average wage or factor price, and $\bar{H}$ is other non-tradable input costs, assumed to be constant for the sake of simplicity.

Normalizing to 1 the international price of tradable goods P_i^{int}, this price in domestic currency units equals the nominal exchange rate *E*

$$P_i^f = E \tag{4.3}$$

The nominal exchange rate is defined as domestic currency units per unit of foreign currency, so that E increases (falls) with devaluations (revaluations). In the equation above subscript i concerns sectors R and I. The previous assumption regarding the natural resource sector implies that the law of one price prevails and that, at this particular time, this is the only price that counts in sector R.[8] For goods produced in sector I, P_i^f denotes the price for the imperfect manufacturing substitutes produced in the rest of the world.

Nominal factor prices or wages are defined as in Rattsø and Torvik (2003) and equal

$$W = \omega \cdot Q^{\tau} \tag{4.4}$$

In eq.(4.4) ω relates wages to factor productivity, as approximated by A_i, and defined by

$$\omega = A_R^{\gamma R} \cdot A_I^{\gamma I} \cdot A_N^{1-\gamma R-\gamma I} \tag{4.5}$$

Where exponents γ_i weight sectoral productivity according to the relative size of the sector (with $\sum_i \gamma_i = 1$). Variable Q in equation (4.4) indexes wages to the evolution of the consumer price index (CPI), which equals

$$Q = \left(P_I^f\right)^{\alpha_{If}} \cdot \left(P_I^h\right)^{\alpha_{Ih}} \cdot \left(P_N^h\right)^{1-\alpha_{If}\alpha_{Ih}} \tag{4.6}$$

with prices as defined above and exponents indicating weights in the consumption basket reproduced in the price index. Note, that, due to the assumption regarding the external destination of natural resource products their price does not enter the index. This is one of the assumptions that is removed in subsequent sections.

The degree of wage indexation depends on the value of τ, which varies between *0* and *1*. If τ equals 0 there is no indexation and nominal wage rigidity; if τ equals 1, there is full-indexation of price changes and real wage rigidity. Intermediate values represent imperfect indexation. The value of the indexation parameter can be negatively associated to the level of unemployment or the degree of excess capacity. Although this point is not explicitly modelled, it will be taken into account during the discussion.

Two relevant points are worth making regarding labour market dynamics. First, factor prices follow productivity, as would be expected over the long-run. Second, according to institutional arrangements there is one wage in this economy, and this is determined in relation to average factor productivity and changes in the cost of living. As a consequence, significant sectoral productivity differences (a point that is emphasized in this thesis) or indexation can make tradable sectors uncompetitive, allowing for structural unemployment, as emphasized by the classical authors.

Real income is defined as

$$Y = \frac{W \cdot L}{Q} \tag{4.7}$$

In this model both the internal and the external terms of trade matter. This is because, as industrial output is demand-driven, the external terms of trade affect demand for the tradable commodity *I* in the domestic and international markets and, therefore, they affect output in this sector. Note that the model differs from full-employment specifications of the dependent economy models where prices are flexible and the internal terms of trade between tradable and non-tradable goods are the key relative prices since they determine the incentives to produce in one or the other sector.[9]

The external terms of trade for goods produced in sector *I* (p_I^*) are defined as the ratio of foreign to domestic prices of these imperfect substitute goods

$$p_I^* = \frac{P_I^f}{P_I^h} \tag{4.8}$$

The internal terms of trade p_D are shown below and are defined as the ratio between the tradable and non-tradable goods prices.

$$p_D = \frac{P_T}{P_N^h} \tag{4.9}$$

Depending on whether the price of non-tradable goods is compared to the imperfectly substitute manufacturing goods produced abroad or at home, the internal terms of trade equals $p_D^f = \frac{P_I^f}{P_N^h}$ or $p_D^h = \frac{P_I^h}{P_N^h}$. The assumption that productivity in the tradable sectors is higher than in the non-tradable sector implies that the latter is the most labour-intensive sector,[10] and that an increase in wages will raise the price of non-tradable goods P_N^h relative to the price of manufacturing goods produced domestically P_I^h.

On the demand side, output is defined as:

$$Y = C_I(\underset{+}{Y}; \underset{-}{p_D^h}; \underset{+}{p_I^*}) + C_N(\underset{+}{Y}; \underset{+}{p_D^h}; \underset{+}{p_D^f}) + T \tag{4.10}$$

In eq. (4.10), C_I denotes demand for manufacturing goods produced domestically, C_N stands for the demand for non-tradables, and T represents the current account, which, in this model, equals the trade balance. Domestic demand in the two sectors depends positively on real income Y. Demand for goods produced in sector I is negatively linked to internal and positively linked to external terms of trade in the corresponding sector, p_D^h and p_I^* respectively. Non-tradable demand rises with p_D^h and p_D^f due to substitution effects.

The external balance T is determined by the country's import and export performances and the evolution of export and import prices.

$$T = P_R^f \cdot X_R(\underset{+}{R}; \underset{+}{Y^f}) + P_I^f \cdot X_I(\underset{+}{Y^f}; \underset{+}{p_I^*}) - P_I^f \cdot M_I(\underset{+}{Y}; \underset{-}{p_I^*}) \tag{4.11}$$

The model assumes a fixed exchange rate regime, thus the nominal exchange rate E is a policy variable. This raises issues like the long-term sustainability of the current account and monetary issues not considered in the present analysis, to focus on other real-side effects of nominal devaluations.[11]

The two assumptions regarding the natural resource sector imply that $R=X_R$: supply equals export demand for natural resource products. Natural resource exports (X_R) in turn are positively related to domestic supply (R) and foreign income (Y^f). Exports from sector I (X_I) also depend positively on foreign income, and are positively affected by the external terms of trade in sector (p_I^*). Imports are the final component of the trade balance. Imports of manufacturing goods (M_I) (which are assumed to equal total imports) are negatively related to the external terms of trade in sector (p_I^*) and positively linked to changes in domestic income (Y).

The internal balance is analysed in terms of labour market equilibrium. As defined in equation (4.12), quantity adjustments prevail in the labour market and employment (L) equals labour demand from the tradables (R, I) and non-tradable sectors (N), and a_i (equals $\frac{1}{A_i}$) represents sectoral factor intensities.

$$\begin{aligned} L &= a_R \cdot X_R(\underset{+}{R};\underset{+}{Y^f}) + a_N C_N(\underset{+}{Y};\underset{+}{p_D{}^h};\underset{+}{p_D{}^f}) \\ &+ a_I\left(C_I(\underset{+}{Y};\underset{-}{p_D{}^h};\underset{+}{p_I{}^*}) + X_I(\underset{+}{Y^f};\underset{+}{p_I{}^*})\right) \end{aligned} \tag{4.12}$$

4.3 Structural Constraints to Productive Diversification in Resource Rich South American Countries

This section discusses the constraints on productive diversification associated with natural resource abundance. The analysis is expected to show some specificities of the economic adjustment to a positive natural resource shock and to illustrate why this could be a matter of concern for the economic authorities. The model assumes that, as usual in the Latin American countries, the tradable natural resource sector is the most competitive one. Given the previous assumptions, the productivity ordering is as follows $A_R > A_I > A_N$.

The analysis assumes an increase in the productivity of the natural resource sector (A_R) to discuss the implications of a positive natural resource shock. Assuming no indexation of prices into wages (τ=0)[12], the increase in A_R affects real and nominal wages, which in turns affects the internal and external equilibrium of the economy. From equations (4.4) and (4.5) it follows that

$$\frac{\partial W}{\partial A_R} = \gamma_R \left(\frac{A_I A_N}{A_R} \right)^{1-\gamma_R} \tag{4.13}$$

Eq. (4.13) has a positive sign and states that high productivity in sector R, due to a resource discovery, technical change or because such a gift of nature is a structural characteristic of the country, leads to higher nominal and real wages, an increase that is positively related to the size of the natural resource sector, as denoted by γ_R. This result is in line with the arguments proposed by the classical authors, is equivalent to the Balassa-Samuelson effect; and it is also consistent with the predictions of Dutch disease type models.[13]

4.3.1. Positive natural resource shocks and the internal balance

Studying the consequences of an increase in A_R for internal balance or labour market equilibrium requires totally differentiating equation (4.12). It is also necessary to differentiate real income, as expressed in (4.7), in order to disentangle the changes associated with variations in real wages and labour demand. This latter aspect is investigated in the appendix (see equations (C.4.1) to (C.4.4)). After some manipulation, the expression in equation (4.14) emerges and shows that expansion in the natural resource sector has ambiguous effects on the labour market. The sign for the partial derivatives representing the different effects of the change in A_R are shown below each term.

$$\frac{\partial L}{\partial A_R} = \frac{1}{1-\phi}\left[\underset{-}{\frac{\partial aR}{\partial A_R}} + a_R \cdot \underset{+}{\frac{\partial X_R}{\partial R}}\,\underset{+}{\frac{\partial R}{\partial A_R}} + \underset{-}{\frac{\partial p_D^h}{\partial A_R}}\left(a_N \cdot \underset{-}{\frac{\partial C_N}{\partial p_D^h}} + a_I\,\underset{+}{\frac{\partial C_I}{\partial p_D^h}}\right)\right] +$$
$$\frac{1}{1-\phi}\left[a_N \cdot \underset{+}{\frac{\partial C_N}{\partial p_D^f}}\,\underset{-}{\frac{\partial p_D^f}{\partial A_R}} + a_I\,\underset{-}{\frac{\partial p_I^*}{\partial A_R}}\left(\underset{+}{\frac{\partial C_I}{\partial p_I^*}} + \underset{+}{\frac{\partial X_I}{\partial p_I^*}}\right) + \phi\,\underset{+}{\frac{\partial Y\left(\frac{W}{Q}\right)}{\partial A_R}}\right] \gtrless 0 \qquad (4.14)$$

In eq. (4.14)

$\phi = \left(a_N \frac{\partial C_N}{\partial Y} + a_I \frac{\partial C_I}{\partial Y}\right)$, $\quad \frac{\partial Y\left(\frac{W}{Q}\right)}{\partial A_R} = \frac{\left[1-\alpha_I^f(a_I - a_N) - aN(1-\alpha_I^f)\right]}{1-A}\frac{\partial W}{\partial A_R}$ and

$1-A = 1-\tau\cdot\alpha_I^h(a_I - a_N) - \tau\cdot a_N(1-\alpha_I^f)$

The second expression represents changes in real income associated with variations in wages. Equation (4.13) and the assumption that sector

N is more labour-intensive than sector I ($a_I < a_N$) guarantees that real wages rise with a productivity shock.

Positive effects on employment result from: (i) the expansion in output and exports from sector *R;* and (ii) the increase in real wages (the second and last terms in the square brackets in eq. (4.14)).

Increases in the productivity of sector *R* also have negative consequences for employment. These are associated with: (i) the reduction in sector *R*'s labour requirements; (ii) the substitution of non-tradable goods for manufacturing goods, produced either in the less factor-intensive sector *I* or abroad, and the substitution of goods produced in sector *I* ; for (iii) competitive imports; and (iv) foreign products, in the domestic and international markets respectively.[14]. The last two substitution effects arise because the increase in wages that follows the productivity shock in sector R reduces the external terms of trade in sector *I* $\left(\frac{\partial p_I^*}{\partial A_R} < 0\right)$.

Since the natural resource sector is the less *factor-intensive,* and substitution between tradable and non-tradable goods is expected to be small, employment will expand (contract) if the positive income effect of the shock is larger (smaller) than the substitution effect crowding-out sector *I*. Table 4.1 at the end of this section summarizes the conditions favouring one or the other outcome.

As shown in eq. (4.13) and eq. (4.14) the expansion in employment is positively associated with the size of sector *R* (γ_R). Therefore, in countries with a large natural resource sector, e.g. the oil-exporting countries, employment will expand following a positive resource shock. If, as is the case in the Latin American countries, sector *R* is not the largest tradable sector a positive resource shock may lead to a 'paradoxical' disequilibrium situation in the labour market.

Large productivity differences between tradable sectors are another factor favouring the emergence of unemployment in the context of a resource shock. The larger the productivity differences the larger will be the mismatch between wages and labour productivity in sector *I*. This means that, for given intermediate input costs ($\bar{H}$), sector *I* will have high unit labour costs (and low sectoral external terms of trade p_I^*), making it harder, if not impossible, for the sector to compete internationally or take off in an open domestic market.

An additional factor promoting labour market disequilibrium (not explicitly modelled) is the degree of backwardness and dependence on price competitive advantages in sector *I*. Whereas the damaging effects of a positive natural resource shock may be large in countries with nascent industries or industries with low productivity, the same shock may have only limited effects in countries producing sophisticated industrial products, as Canada or the Scandinavian counties.

4.3.2. Positive natural resource shocks and the external balance

To study the adjustment in the external balance it is necessary to totally differentiate equation (4.11). As shown in equation (4.15), a positive productivity shock in sector *R* increases primary exports, although the final effect on the trade balance is ambiguous.

$$\frac{\partial T}{\partial A_R} = p_R^f \cdot \underset{+}{\frac{\partial X_R}{\partial R}} \underset{+}{\frac{\partial R}{\partial A_R}} + \underset{+}{\frac{\partial p_I^{\,h}}{\partial A_R}} X_I + \underset{-}{\frac{\partial p_I^{\,*}}{\partial A_R}} \left(p_I^{\,h} \underset{+}{\frac{\partial X_I}{\partial p_I^{\,*}}} - p_I^{\,f} \underset{-}{\frac{\partial M_I}{\partial p_I^{\,*}}} \right) - p_I^{\,f} \underset{-}{\frac{\partial M_I}{\partial Y}} \underset{+/-}{\frac{\partial Y}{\partial A_R}} \gtrless 0 \quad (4.15)$$

The first term in equation (4.15) stands for a positive impact on the overall trade balance from higher exports from sector *R*. The second term is also positive and shows the price-income effect of the chain productivity, nominal wages, manufacturing exports price (P_I^h). However, the shock reduces competitiveness and export levels from sector *I*, and this has negative effects on the balance of trade.[15]

The last two terms in eq. (4.15) refer to import dynamics. These increase, worsening the trade balance, because lower external terms of trade (p_I^*) make imported goods cheaper than their domestic substitutes. Also, imports may increase if the productivity shock is expansionary and increases real income.[16]

Although it might be expected that high(er) productivity in the natural resource sector will lead to an improved balance of trade or to a new equilibrium with higher imports, under certain circumstances this may fail to occur. The following factors make a "paradoxical" external imbalance more likely: high marginal propensities to import; large productivity differences between sector *R* and sector *I* promoting unfavourable terms of trade (and terms of trade changes), and dependence on price competitive advantages.

Table 4.1 below summarizes the findings from this section. The analysis shows that:

- resource abundance and positive resource shocks hinder competitive diversification through substitution effects;
- countries try to diversify and modify what is a priori a favourable structural condition because, under certain conditions, resource abundance and a positive shock can lead to internal and external imbalances;
- imbalances are more likely to occur when: (i) the size of sector R or the magnitude of the shock does not ensure that positive income effects predominate over negative substitution effects; (ii) countries have a high propensity to import; (iii) there are large productivity differences between the natural resource and industry sectors; and (iv) industries are very dependent on price competitive advantages. Many of these conditions echo Latin America's structural features, as identified by Bielschowsky (1998).

Table 4.1
Labour market and external adjustment to a positive natural resource shock. Conditions leading to internal and external disequilibria

Results	**Conditions**
$\partial L / \partial A_R$ −	• The shock has small positive income effects, favoured by small sector *R* • There are large negative substitution effects, promoted by large sectoral productivity differences
$\partial T / \partial A_R$ −	• There are large substitution of sector's *I* products in the domestic and external market, promoted by large sectoral productivity differences, and/or • The economy has a high marginal propensity to import

4.4 Macroeconomic Diversification Policies

This section analyses the effects of macroeconomic policies to improve the competitiveness of the non-natural resource tradable sector *I*. Special attention is paid to the effects of nominal devaluations; a fundamental development policy that is expected to enhance the overall competitiveness of the economy, increasing employment and improving the external balance (Frenkel and Taylor, 2006).[17]

Two additional reasons justify the emphasis in this policy. One is that a competitive exchange rate policy has been in place in Argentina since 2003. The other is that nominal devaluations can have particular effects in countries that: already have an internationally competitive sector and that, as Argentina, export the least substitutable goods of the consumption basket: food products.

The comparative static exercises consider four cases. The first case studies the general impact of nominal devaluations, while the other three cases take account of specificities that are relevant to an analysis of Argentina. These are related to: the impact of devaluations in wage-good exporting countries, the emergence of a devaluation rent and the compensated devaluation regime combining nominal devaluations and export taxes. Before turning to the comparative statics exercise it should be noted that the analysis: (i) does not address the monetary aspects of the devaluation; (ii) looks only at the impact of nominal devaluations in the labour market (for reasons of simplicity); (iii) allows for wage indexation. The most relevant findings are summarized in Table 4.2 at the end of this section.

4.4.1 Exchange rate devaluations: the 'general' case

The analysis assumes for the moment that all production from sector R is exported. Totally differentiating equation (4.12) with respect to E gives

$$\begin{aligned}\frac{\partial L}{\partial E} = {} & \frac{1}{1-\phi}\left[\underset{-}{\frac{\partial p_D^h}{\partial E}}\left(a_N \cdot \underset{+}{\frac{\partial C_N}{\partial p_D^h}} + a_I \underset{-}{\frac{\partial C_I}{\partial p_D^h}}\right) + a_N \cdot \underset{+}{\frac{\partial C_N}{\partial p_D^f}}\, \underset{+}{\frac{\partial p_D^f}{\partial E}}\right] + \\ & + \frac{1}{1-\phi}\left[a_I \underset{+}{\frac{\partial p_I^*}{\partial E}}\left(\underset{+}{\frac{\partial C_I}{\partial p_I^*}} + \underset{+}{\frac{\partial X_I}{\partial p_I^*}}\right) + \phi \underset{-}{\frac{\partial Y\left(\frac{W}{Q}\right)}{\partial E}}\right] \geq\leq 0\end{aligned} \tag{4.16}$$

As before, $\phi = \left(a_N \dfrac{\partial C_N}{\partial Y} + a_I \dfrac{\partial C_I}{\partial Y} \right)$ and $\dfrac{\partial Y\left(\dfrac{W}{Q}\right)}{\partial E} = \dfrac{(\tau - 1)}{1 - A}\alpha_I^f$. Changes in real income due to variations in real wages are negative insofar as there is imperfect wage indexation ($\tau < 1$).[18]

The impact of devaluation on the internal balance is ambiguous: it has two positive and two negative effects on employment. Expansion in employment is the result of substitution effects, which occur because the devaluation modifies the corresponding terms of trade (p_D^f and p_I^*). Therefore, employment rises due to: (i) substitution of imported for non-tradable goods; and (ii) substitution favouring production in the tradable sector *I* and thus tradable diversification. As shown by the third term in the square brackets, devaluation promotes the substitution of imported for domestically produced goods and encourages non-traditional exports.

The ambiguity of the final result is associated with the negative effects of devaluation. These negative effects are the result of: (i) substitution of non-tradable goods with products from sector *I* (because the former are more labour intensive than the latter);[19] and (ii) the reduction in real wages caused by the devaluation; these two effects are captured by the first and last terms in equation (4.16). The falls in real wages and domestic demand are positively associated to the share of imported goods in the consumption basket (α_{If}), which are the only tradable goods fully increasing in price, and negatively related to the degree of wage indexation τ.

A first result from the static analysis is that the promotion of tradable diversification with devaluations requires falling real wages. Assuming low substitution between non-tradable and tradable goods, equation (4.16) suggests that export competitiveness and the export component of aggregate demand expands at the expense of domestic demand.

4.4.2 Exchange rate devaluations in wage-goods exporting countries

This section extends the analysis removing the assumption that natural resources are only exported. This assumption is useful to clarify the link between resource abundance and the competitiveness of sector *I*. It is a valid assumption for countries exporting mineral products that cannot be used at home, such as precious stones from African countries. It is worth removing it, however, to analyse some of the particular effects of devaluation in countries which, like Argentina, specialize in the production of wage-goods that are both exported and consumed domestically.

Three more points can be put forward to further justify the examination of this structural feature of the Argentine economy. First, according to Engels law, food products are among the less, if not the least, substitutable products in the household consumption basket. Second, wage-goods tend to represent a significant part of the basket, which measures the evolution of the *CPI*,[20] in contrast to other Latin American countries, Argentina exports many of the food products consumption basket.[21] Finally, in countries with different endowments, such as resource-poor East Asian countries, food products are expected to be more easily substitutable or rather will be non-tradable and thus not directly affected by movements in the exchange rate.

The analysis in this section is straightforward. As already mentioned, food products represent a major part of the household consumption basket, and are reflected in the CPI. This implies that the price index Q must include, among the prices of tradable goods, the price of natural resource goods. The index will then equal:

$Q^R = \left(P_R^f\right)^{\alpha_{Rf}} \left(P_I^f\right)^{\alpha_{If}} \cdot \left(P_I^h\right)^{\alpha_{Ih}} \cdot \left(P_N^h\right)^{1-\alpha_{If}\alpha_{Ih}}$, where supraindex R indicates the variables and terms affected by this extension to the model.

Domestic consumption of natural resource products adds a new term to the internal balance. This term reflects domestic demand for tradable natural resource products (C_R), which responds positively to changes in real income and negatively to variations in the relevant terms of trade of the sector $p_D^{f^R} = \dfrac{P_R^f}{P_N^h}$ and $p_I^{*^R} = \dfrac{P_R^f}{P_I^h}$. The effects of the devaluation when the products of sector R are consumed domestically are now given by eq.(4.17):

$$\frac{\partial L^R}{\partial E}=\frac{1}{1-\phi^R}\left[\underset{-}{\frac{\partial p_D^h}{\partial E}}\left(a_N\cdot\underset{+}{\frac{\partial C_N}{\partial p_D^h}}+a_I\underset{-}{\frac{\partial C_I}{\partial p_D^h}}\right)+a_N\cdot\underset{+}{\frac{\partial C_N}{\partial p_D^f}}\underset{+}{\frac{\partial p_D^f}{\partial E}}+\underset{+}{\frac{\partial p_D^{f^R}}{\partial E}}\left(a_R\cdot\underset{-}{\frac{\partial C_R}{\partial p_D^{f^R}}}+a_N\underset{+}{\frac{\partial C_N}{\partial p_D^{f^R}}}\right)\right] \tag{4.17}$$

$$\frac{1}{1-\phi^R}\left[\underset{+}{\frac{\partial p_I^{*R}}{\partial E}}\left(a_R\cdot\underset{-}{\frac{\partial C_R}{\partial p_I^{*R}}}+a_I\underset{+}{\frac{\partial C_I}{\partial p_I^{*R}}}\right)+a_I\underset{+}{\frac{\partial p_I^*}{\partial E}}\left(\underset{+}{\frac{\partial C_I}{\partial p_I^*}}+\underset{+}{\frac{\partial X_I}{\partial p_I^*}}\right)+\phi^R\underset{-}{\frac{\partial Y\left(\frac{W}{Q^R}\right)}{\partial E}}\right]\geq\leq 0$$

where $\phi^R=\left(a_R\frac{\partial C_R}{\partial Y}+a_N\frac{\partial C_N}{\partial Y}+a_I\frac{\partial C_I}{\partial Y}\right)$ and changes in real income following variations in real wages equal $\frac{\partial Y\left(\frac{W}{Q^R}\right)}{\partial E}=\frac{(\tau-1)\left(\alpha_I^f+\alpha_R^f\right)}{1-C}$.[22]

The internal balance equation includes two new terms (that can be recognized by the supraindex *R*) which have positive effects on labour demand. This is because devaluation changes the domestic terms of trade between the natural resource and other domestically produced goods, promoting the substitution of food products with goods produced in the other more labour-intensive sectors.

Despite these new positive terms, which can be assumed to be quite small to the extent that they refer to substitution between food and other products, the aim is to highlight the negative income effects of the devaluation.

As shown by $\frac{\partial Y\left(\frac{W}{Q^R}\right)}{\partial E}$, which reflects changes in real wages associated with the devaluation; with natural resource commodity prices determined in the international market, a higher and more devalued exchange rate increases the price of natural resource (food) products, further reducing real wages. This reduction is larger, the larger the number of exported products which are also consumed domestically, as expressed by the new term α_{Rf}, and is negatively associated to τ, the wage indexation parameter.

This particular effect has been emphasized in the traditional and more recent macroeconomic literature on Argentina. This is first because it implies that the domestic consumption of exported commodities increases the possibility of contractionary devaluations which will occur if the negative wage effect dominates the positive substitution effects

(Porto, 1975). Second, because as emphasized in a recent paper by Keifman (2005), allowing for some appreciation of the "devalued" Argentine peso will increase real wages and expansion in domestic demand will promote employment.

A second result of this comparative statics exercise is that *since the larger decrease in real wages does not bring any additional improvement in the competitiveness of sector I, using the nominal exchange rate to promote tradable diversification is more costly in Argentina than in countries that have different structural characteristics.*

Finally, it should be stressed that, unless there is some compensating expansion in employment, the devaluation will reduce real income. In this context, employment growth will depend principally on substitution effects in sector *I*, which require favourable changes in the external terms of trade in sector (p_I^*). Engineering these changes and thereby securing the effectiveness of devaluation to promote an export-led regime, requires a low or null indexation parameter. As suggested (but not explicitly modelled) in section *4.2.2*, this is likely to occur in a context of high unemployment rates, as in Argentina since the 1990s, but this has not always been the case. As noted by Gerchunoff and Llach (2003), due to its high costs in terms of real wages, devaluations in Argentina historically have engendered political-economy conflicts that have restored real wages and reduced the economy's competitiveness.

4.4.3 Exchange rate devaluations and devaluation rents

This section considers one of the consequences of devaluation often overlooked in the literature: the creation of a devaluation rent favouring the most productive sector *R*. The rent will rise because devaluation makes international commodity prices higher than domestic production costs. Assuming equation (4.2) is a valid approximation of the unitary production costs in sector *R*, and assuming that prior to the devaluation these costs were equal to international prices as defined by equation (4.3), the rent will equal the difference between these two equations, as defined below:

$$\Gamma = E - W \cdot \frac{1}{A_R} - \bar{H} \tag{4.18}$$

With commodity prices in domestic currency units larger than production costs, nominal wages will be

$$W = a_R\left(\omega Q^{\tau} + \Gamma\right) + (1 - a_R)\omega Q^{\tau}$$

The new wage expression denotes factor payments as determined in equation (4.4) plus the devaluation rent, making wages higher than the average wage in previous sections.

Although this extension does not add any terms to the balance equation, it modifies the terms of trade and real wage expressions. Taking into account the presence of a devaluation rent implies that: (*i*) there is a lower reduction (and the possibility of an increase) in real wages (see equations (C.4.7))[23], and therefore (*ii*) there are smaller changes in the external terms of trade (p_I^*) and lower incentives for tradable diversification, because the competitiveness gain from the devaluation decreases with the rent it creates (see equations (C.4.10) and (C.4.11)) in the appendix).

The presence of a devaluation rent reduces the possibilities of a contractionary devaluation. This may change, however, if the rent is not distributed across the factors of production in all economic sectors, as implied by the wage setting mechanism in the model. Under different institutional arrangements in the labour market, the devaluation will worsen the distribution of income, and the final impact of this policy will depend on the characteristics of the saving and consumption patterns characteristic of households, an issue that is not explored in this chapter.

4.4.4 A compensated devaluation regime

The detailed discussion above exemplifies the various (and ambiguous) effects of nominal devaluations and a competitive exchange rate regime. They are clearly positive, as they promote employment through tradable diversification, reducing a common disequilibrium in Argentina since the 1990s, and are a clear feature of other (resource rich) Latin American countries. The promotion of structural change, however, comes at the cost of lower real wages, an adjustment that is larger in wage-goods exporting countries. Moreover, in countries that already have a sector with significant natural advantages the creation of a devaluation rent counteracts and puts at risk the competitiveness gains that the devaluation seeks to promote.

Partly as a consequence of these conflicting effects, structural change is promoted using alternative and complementary policies, such as import tariffs (and quotas) and production, wages and export subsidies. As these policies are now banned by international trade agreements, they are not studied in the model.[24] Nevertheless, the model is used to analyse the effects of another policy: taxes on exports of natural resources, which commonly accompany nominal devaluations in resource abundant countries. According to Schydlowsky (1993), the combination of these two policies creates a compensated devaluation regime, which is the regime that has been in place in Argentina in 2000s, and is considered to promote the non-traditional sector without major income distribution effects.

Table 4.2
Labour market adjustment to exchange rate devaluations

Result	Conditions
(1) Exchange rate devaluations: the 'general' case	
$\partial L / \partial E$ +	• Substitution of: imported with non-tradable goods (expected to be small) and sector's *I* goods • Increase in manufacturing export demand
$\partial L / \partial E$ −	• Substitution of: non-tradables with sector's *I* goods (expected to be small) • Reduction in domestic demand due to fall in real wages (positively linked to share of imported goods in the CPI)
(2) Exchange rate devaluations in wage-goods exporting countries	
$\partial L / \partial E$ +	• Effects in (1) • Substitution of food products for other domestically produced goods (expected small)
$\partial L / \partial E$ −	• Effects in (1) • Larger reduction in domestic demand from fall in real wages larger than in (1) (positively linked to share of wage-goods in the CPI)
(3) Exchange rate devaluations and devaluation rents	
$\partial L / \partial E$ +	• Effects in (2), with smaller substitution effects promoting diversification
$\partial L / \partial E$ −	• Effects in (2), smaller reduction in real wages due to devaluation rent
(4) A compensated devaluation regime	
$\partial L / \partial E$ +	• Substitution effects as in (1)
$\partial L / \partial E$ −	• Effects in (3), with smaller negative real wage adjustment and income redistribution to the government

The combination of nominal devaluations and export taxes has three main effects. First, it separates the domestic and international prices of natural resource commodities from international ones. In this way, the export tax reduces or avoids the negative effects of the devaluation on real wages (see equations (C.4.8)). Export taxes not only limit the reduction in real wages, they also reduce the impact of any wage indexation in the external terms of trade for sector I (p_I^*) (see equations (C.4.10) and (C.4.11) in the appendix). As a consequence, *the compensated devaluation regime can ensure that the devaluation effectively creates a price competitive advantage favouring sector I, while limiting its negative consequences on real wages.*[25]

Second, a compensated devaluation regime creates a system of dual exchange rates, where the less productive tradable sector I works at a high and competitive exchange rate, whereas sector R works at a lower and stronger exchange rate, which is intended to reflect its competitiveness. In this way, the export tax avoids the most productive sector R from gaining an unnecessary price advantage, and limits income transfers among the different agents in the economy and the deterioration in the distribution of income (not explored in this chapter).

Finally, export taxes redirect the rent created by devaluation to the government. This income transfer – which also can prevent devaluation from worsening the distribution of income – has important fiscal effects and constitutes a source of income to finance alternative diversification policies, the topic of the next section in this chapter.[26]

4.5 Do Macroeconomic Policies Suffice?

Section 4.4 discussed the contribution of macroeconomic policies to the complex task of competitive diversification in resource abundant economies. But are macroeconomic policies sufficient? Do they tackle the central constraint on competitive diversification in countries like Argentina?

The answers to these questions are yes, and no. Yes, macro policies can make the non-resource sector competitive, and do so by tackling the price aspect of competitiveness. However, the productivity aspect of competitiveness is overlooked. If I study the problem dynamically, the answers are still yes and no. Macroeconomic policies can contribute to increasing the productivity of the industrial sector, but these policies may not be sufficient to resolve the competitiveness handicap of the sector.

The analytical framework is extended in two directions in order to discuss these points in more detail. The first extension is linked to the proposition that reductions in sectoral productivity differences and decreases in non-wage production costs are a fundamental condition for competitive and sustainable diversification in resource abundant countries. Productive and export diversification due to a stagnant agricultural sector or due to the presence of structural unemployment and low wages, cannot be considered a viable or sustainable option.

The second extension is the addition of an equation that captures the dynamics of productivity in sector *I*.[27] TFP is modelled as in Thirlwall (2002) and Rada and Taylor (2004) and presented in (4.19)

$$A_I = \Lambda + \delta Y\left(X_I\right) \tag{4.19}$$

Equation (4.19) states that productivity depends on exogenous factors, captured by the term Λ. Human capital accumulation and/or access to foreign technology are clear examples of these factors. The equation also includes a Kaldor-Verdoorn component linking productivity growth to output or demand growth.[28]

Productivity is expected to increase with aggregate demand because, as it enlarges, demand facilitates the achievement of static and dynamic economies of scale. The creation, expansion (and in certain circumstances protection) of demand promotes experience and with it learning, as well as the achievement of economies of specialization, with positive effects on industrial productivity. Because in reality the importance of complementarities and economies of scale, both static and dynamic, tend to be larger in firms and sectors operating on a global scale, the model associates the Kaldor-Verdoorn component with the evolution of exports in the non-resource tradable sector (X_I).[29]

The exchange rate, tariffs and subsidy policies have no direct incidence on productivity. Yet, they may contribute indirectly to productivity growth by increasing demand. It is possible, therefore, to reassess the contribution of macroeconomic policies to productive competitive diversification and the internal equilibrium of the economy. In line with the analyses in the previous sections, the comparative statics exercise focuses on the effects of nominal devaluations, and presents the results only for the last case of a compensated devaluation regime.

The employment response to devaluation when productivity is endogenous is given by

$$\frac{\partial L^R}{\partial E} = \frac{1}{1-\phi^R}\left[\begin{array}{l} \underset{+/-}{\frac{\partial p_D^h}{\partial E}}\left(a_N \cdot \underset{+}{\frac{\partial C_N}{\partial p_D^h}} + a_I \underset{-}{\frac{\partial C_I}{\partial p_D^h}} \right) + a_N \cdot \underset{+}{\frac{\partial C_N}{\partial p_D^f}} \underset{+}{\frac{\partial p_D^f}{\partial E}} + \\ \underset{-}{\frac{\partial p_D^{f^R}}{\partial E}}\left(a_R \cdot \underset{-}{\frac{\partial C_R}{\partial p_D^{f^R}}} + a_N \underset{+}{\frac{\partial C_N}{\partial p_D^{f^R}}} \right) \end{array}\right] + \tag{4.20}$$

$$\frac{1}{1-\phi^R}\left[\begin{array}{l} \underset{+/-}{\frac{\partial p_I^{*R}}{\partial E}}\left(a_R \cdot \underset{-}{\frac{\partial C_R}{\partial p_I^{*R}}} + a_I \underset{+}{\frac{\partial C_I}{\partial p_I^{*R}}} \right) + a_I \underset{+}{\frac{\partial p_I^{*}}{\partial E}}\left(\underset{+}{\frac{\partial C_I}{\partial p_I^{*}}} + \underset{+}{\frac{\partial X_I}{\partial p_I^{*}}} \right) \\ + \phi^R \underset{+/-}{\frac{\partial Y\left(\frac{W}{Q^R}\right)}{\partial E}} + \underset{-}{\frac{\partial a_I}{\partial A_I}} \underset{+}{\frac{\partial A_I(X_I)}{\partial E}} \end{array}\right] \geq\leq 0$$

where ϕ^R is as in equation (4.17) and, as before, the supraindex *R* indicates that products from sector *R* are consumed domestically and exported, and designates the variables and terms concerned.

Endogenizing productivity growth adds a new term to the internal balance, which is the last term in eq. (4.20). It also affects real wages, which increase because the devaluation promotes industrial exports and this productivity growth, an effect that feeds back through equation (4.4) .[30] The impact of the devaluation on average wages will depend positively on γ_I, which denotes the size of sector *I*, and on the Kaldor-Verdoorn coefficient, which is commonly assumed to be 0.5.[31] In turn, these effects modify real income and the different terms of trade of equation (4.20).

Considering all these effects it is possible to disentangle how employment responds to nominal devaluations when this also contributes to productivity growth. As in previous cases, the final effect of the devaluation is ambiguous. The negative effects on employment result from: (i) substitution between non-tradable and food products;[32] and (ii) reduction in the factor intensity of sector *I*, as indicated by the third and last terms within the square brackets. The positive effects on employment are associated with: (iii) substitution of imported goods for non-tradables, and (iv) increases in the competitiveness of sector *I* and associated import substitution and export growth. As the *devaluation promotes learning and productivity growth, the increased competitiveness of sector I has a price and a non-price component and is larger than in the cases analysed before.*

Indeed, this adjustment is the reverse of the effects of exchange rate appreciations emphasized in dynamic Dutch disease models.[33] Whereas exchange rate appreciations may cause permanent losses when the knowledge accumulated in a particular sector or firm disappears; devaluations may, on the contrary, create long-term competitiveness gains. This can occur if exchange rate devaluations allow new firms to enter foreign markets, and overcome the set up costs associated with exporting. This dynamic effect of exchange rate devaluation is rarely considered.

As shown in equation (4.20) some effects can be positive or negative depending on parameter values.[34] The most important for this discussion is the response of real wages, which can be positive or negative and equals

$$\frac{\partial Y\left(\dfrac{W}{Q^R}\right)}{\partial E}=\frac{1}{1-F}\left\{\begin{array}{l} a_R(1-\Omega)+\left[\tau\left(1-a_R^{\;2}\right)\right]\alpha_I^f+ \\ \delta\dfrac{\partial A_I(X_I)}{\partial E}\left[\gamma_I\left(\dfrac{A_R A_N}{A_I}\right)^{1-\gamma_I}\left(1-a_R^{\;2}\right)(1-\Omega)-\left[\tau\left(1-a_R^{\;2}\right)-1\right]\alpha_I^f\right]\end{array}\right\},$$

where $\Omega=\left[\alpha_R^h\left(a_R-a_N\right)+\alpha_I^h(1-a_N)+(1-\alpha_I^f)a_N\right]$ and $1-F=1-\left(1-a_R^2\right)\cdot\tau\cdot\Omega$, and are both positive.

The main consequence of considering Kaldor-Verdoorn effects is the addition of the second large term within the curly brackets. This is positive due to the increase in nominal wages and the reduction in P_I^h that results from the rise in A_I.[35] Therefore, the Kaldor-Verdoorn effect reduces the negative consequences of devaluations on real wages and may even augment real wages. Indeed, increases in real wages are possible for plausible parameter values like a Kaldor-Verdoorn effect of 0,3, a manufacturing sector representing 20% of total output, food products constituting 30% of the consumption basket and an indexation parameter of 0,2. Yet, the rise in real wages also results from the presence of a devaluation rent and export taxes.[36]

4.6 Some Final Comments

To contribute to the ongoing debate on Argentina's long-term development strategy, this chapter discusses the problem of competitive economic diversification in resource abundant countries, and in countries which, like Argentina, are producers and exporters of wage-goods. This chapter concludes the analytical part of the thesis and complements the discussion in earlier chapters: it focuses on macroeconomic adjustment and discusses shocks and policies emphasizing specificities relevant to Argentina and other Latin American countries.

The analysis in Section 4.3 showed (again) that natural resource abundance creates a "price" handicap for the emergence of a competitive manufacturing sector. Most importantly, the analysis showed that a positive natural resource shock can promote internal and external imbalances. The conditions encouraging these outcomes are: (i) the natural resource sector is not the largest tradable sector and cannot ensure that the positive income effects of a resource shock predominate over the negative substitution effects; (ii) countries have a high propensity to import; (iii) there are large productivity differences between the natural resource and other tradable sectors; and (iv) industries are very dependent on price competitive advantages.

Section 4.4 discussed the contribution to competitive (productive and export) diversification of exchange rate devaluations and the competitive exchange rate policy in place in Argentina. The analysis showed that devaluations can promote structural change, but at the cost of falling real wages. The reduction in real wages is larger in wage-goods exporting countries, hence the policy tends to be more costly in Argentina than in those with different structural characteristics. To prevent large reductions in real wages and to ensure that devaluation is effective in providing a price competitive advantage for the manufacturing sector, the model was used to show that nominal devaluations need to be implemented in combination with export taxes on natural resource exports.

The final section of this chapter addressed the productivity side of the competitiveness problem adding a productivity equation to the model. This extension represents an innovation over other versions of the dependent economy model, and serves to broaden the economic policy debate by showing that macroeconomic policies can promote productive and export diversification through price and non-price channels. Nominal devaluations, tariffs and subsidies have no direct effects on productivity, but they can improve it indirectly by increasing demand, and hence producing second round positive competitiveness effects that limit the reduction and can even lead to a rise in real wages.

However, it is important to note that, in order to contribute to competitive diversification exchange rate policy, as well as other tariff and subsidy policies, needs to be implemented as a temporary and selective measure. The reason for this is that the productivity of sector *I* depends on other factors such as innovation and the development of competitive linkages, in which producers will have no incentives nor will they be compelled to invest if government guarantees them a permanent price competitive advantage.

Notes

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1 The former is associated with the declining but still high unemployment rates and an unequal income distribution; the latter is associated with the frequently present external constraint (Porta, 2005).

2 The dependent economy model was developed by the Australian economists, W.E.G. Salter and T.W. Swan, in the late 1950s and early 1960s (see Salter, 1959; Swan, 1960). The traditional version of the dependent economy model, in contrast to the Scandinavian version, has two factors of production and a concave production function and is referred to as the Australian model. This model is commonly used to study real exchange determination and the pattern of trade specialization in small open economies (industrialized and developing), and countries' responses to exogenous shocks and commercial or exchange rate policies.

3 In this respect the analysis differs from classical authors, in that the authors consider that the exchange rate is the variable that reflects the productivity of the tradable sector. Their argument can be stated formally as follows. Let there be two tradable economic sectors, the traditional natural resource sector *R* and the industrial sector *I*, where sector *R*'s factors productivity (A_R) is larger than that in sector I (A_I). For given factor prices *W*, production costs ($1/A_i \cdot \overline{W}$, with i=R and *I*) in sector *R* will be lower as a consequence than those in sector *I*. As well as comparing between economic sectors, the core of the argument concerns the comparison of domestic production prices P_i^b (determined by domestic production costs), with international prices expressed in domestic currency ($E \cdot P_I^{\text{int}}$, where *E* denotes the nominal exchange rate and P_i^{int} stands for the prices prevail-

ing in the international market). In a country with large sectoral productivity differences, the nominal exchange rate will only guarantee equality between P_i^h and $E \cdot P_I^{\text{int}}$ and, thus, the law of one price in one of the two sectors. If, as is claimed by classical authors, the exchange rate reflects the productivity of the most competitive and largest tradable sector *R*, this value of *E* will make $P_R^h = E \cdot P_R^{\text{int}}$ and $P_I^h > E \cdot P_I^{\text{int}}$. The non-traditional sector *I,* therefore, will either not exist or its competitiveness will be seriously reduced.

4 In full-employment versions of the dependent economy model the only price that counts is the one that clears the non-tradable market and, therefore, competitiveness aspects are not taken into account.

5 This point becomes clear in Chudnovsky and Porta's (1990) review of the different approaches to the competitiveness problem.

6 It is possible to think of an adjusted productivity variable, which increases (decreases) in relation to the presence (absence) of other non-price competitiveness factors, e.g. innovation capabilities, and logistics or publicity services.

7 The main implications of imported intermediate inputs for the discussion in this chapter would be to limit the price competitiveness gain achieved through nominal devaluations. This effect is excluded here to keep the algebra simple, but will be taken into account in the CGE analysis elaborated in subsequent chapters.

8 It is important to bear in mind that the international price can be higher than the costs of production of natural resource commodities in the home economy, since it can be approximated, e.g. by its unitary production costs. This is relevant to the economic policy discussion in the following section.

9 See La Marca (2004) for a comprehensive analysis of real exchange rate adjustments in macroeconomic, trade and general equilibrium models.

10 This is a realistic and common assumption in analyses of resource abundant countries.

11 The discussion on the sustainability of the current account is omitted because the analysis is concerned with changes that are expected to release external constraints on the economy. Regarding the monetary aspects of the fixed exchange rate regime it should be noted that, in a context of capital inflows (e.g. associated with the expansion of exports in response to a devaluation), the monetary authority is able to avoid a revaluation of the exchange rate. This requires accumulation of reserves and sterilization of the money supply using the methods discussed in Frenkel (2005).

12 Allowing for wage indexation will only reinforce the adjustment. The same will apply if price adjustments prevail in the non-tradable sector or if non-tradable inputs costs are flexible.

[13] This effect predicts that increases in the productivity of the tradable sector will lead to higher non-tradable prices or a real exchange rate appreciation.

[14] These effects are captured by the 1st, 3rd, 4th and 5th terms in the square brackets in equation (4.14).

[15] This is the first effect captured in the 3rd term in equation (4.15).

[16] Real income will increase due to higher real wages. Yet, as discussed in the previous section, employment may well increase, further increasing real income and demand for imported goods, or may decrease and counteract the effect of higher real wages on import demand.

[17] Williamson (2008, 2003) also makes a case in favor of a policy of exchange rate devaluation in developing countries. The articles by Prasad, Rajan and Subramanian (2007), Montiel and Serven (2008), Gala (2007) and Hausmann, Pritchett and Rodrik (2004), on the other hand, provide empirical support for this argument.

[18] The derivation of changes in real wages is provided in the appendix to this chapter (see equations (C.4.3) and (C.4.5). The assumption regarding factor intensities $\left(a_N > a_I\right)$ ensures that the denominator is positive.

[19] This effect requires some wage indexation and is captured by the 1st term in the square brackets in equation (4.16)

[20] In Argentina food products are the group of commodities that has the highest weight (30%) in the basket used to measure changes in consumer prices.

[21] As explained by Gerchunoff and Llach (2003), Argentina, in this respect, differs from Colombia and Brazil where increases in the price of coffee following an exchange rate devaluation will have no significant impact on real wages.

[22] Where $1-C=1-\tau\cdot\alpha_I^h(a_I-a_N)-\tau\cdot a_N(1-\alpha_I^f-\alpha_R^f)$, which is positive and larger than 1-A.

[23] The extreme case of higher real wages with low indexation, however, requires that imported and natural resource products are not relevant in the consumption basket.

[24] Tariffs promote tradable diversification only in the domestic market and, unless there are exceptions to specific imported commodities, they reduce real wages. On the other hand, subsidies promote tradable diversification in the domestic and international market. Since this diversification implies the expansion of exports and has no or positive effects on real wages, subsidy policies are superior to exchange rate and tariff diversification policies. However, they are costly and need to be financed.

[25] This model assumes that the government saves the income collected via export taxes. Yet, as explored in the applied section, export tax revenues can finance increases in government consumption and thus fuel other sources of inflation.

[26] An additional implication of the compensated devaluated regime, related to the wage-setting mechanism but not formally explored in the model, is its contribution to the equalization of factor prices. Without this effect the devaluation may not suffice to promote sector *I*, its original purpose.

[27] The analysis considers only endogenous productivity changes in sector *I*. This is because this is the variable and sector of interest in this study,and also because, as often stressed in the literature, the manufacturing sector shows the highest endogenous productivity growth. See papers by Torvik (2001) and Rattsø and Torvik (2003) for an extended discussion of this issue.

[28] A comprehensive list of productivity and competitiveness determinants must include: (i) human and physical capital accumulation; (ii) access to foreign technology; (iii) technological policies; (iv) the degree of backwardness or gap with the best international practice; (v) Kaldor-Verdoorn effects; (vi) innovation capacity; (vii) infrastructure, and (viii) the presence of competitive productive linkages.

[29] Martin (2002) finds that it is the exporting sectors and firms that experience the highest productivity growth, providing support for this argument.

[30] The derivative of equation (4.4) with respect to E equals:

$$\frac{\partial \omega}{\partial E} = \gamma_I \left(\frac{A_R A_N}{A_I} \right)^{1-\gamma_I} \delta \frac{\partial A_I (X_I)}{\partial E}.$$

[31] The devaluation also has a negative impact on nominal wages because the productivity increase reduces prices and this translates into wages through the indexation mechanism.

[32] This effect takes place because there are export taxes and thus the devaluation does not affect the domestic price of food products. Without export taxes the relative price change and substitution effects would be reversed.

[33] See, e.g. Matsuyama (1992) and Sachs (1999).

[34] The first concerns the response of $p_D{}^b$, which will be negative similar to the employment effects resulting from the substitution between goods produced in sectors N and I, unless the devaluation has no or very limited effects on productivity growth. The second is related to the change in relative prices and substitution between food and domestically produced industrial goods, an effect which, according to Engels law, is expected to be low.

[35] These are denoted by the 1st and 2nd terms within the second set of large curly brackets.

[36] The share of imported and domestically produced manufactured goods in the *CPI* is considered to be 0.2. With similar parameter values but no devaluation rent or export taxes, devaluation reduces real wages.

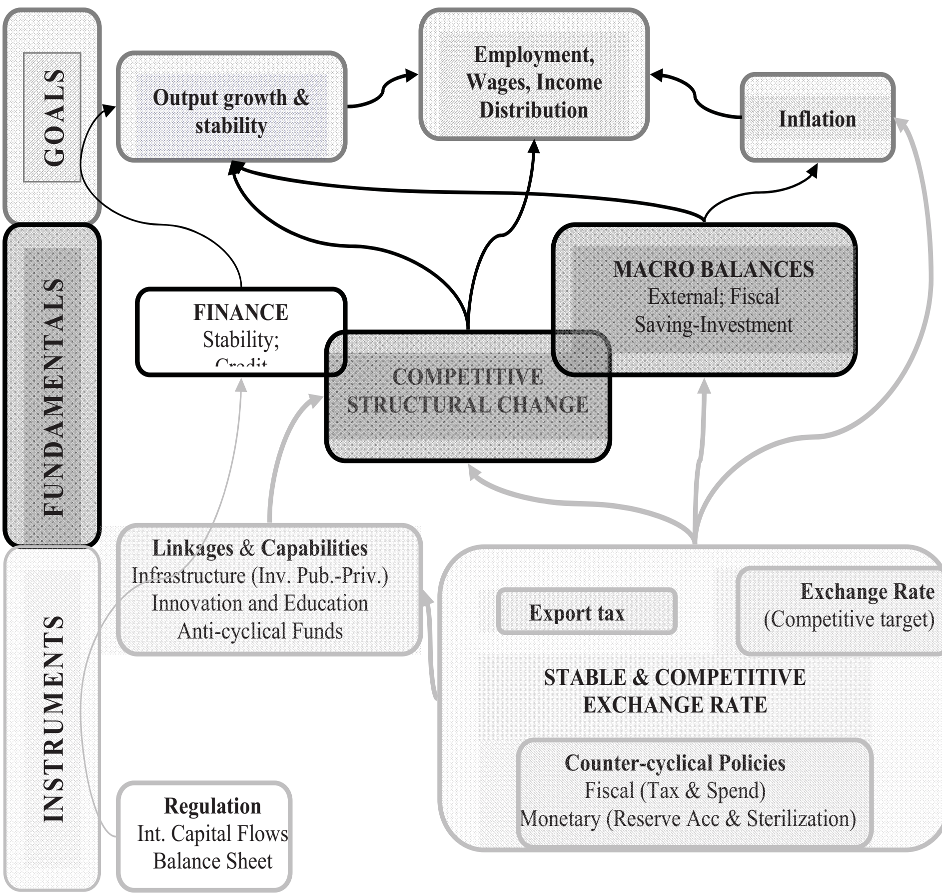
5 Sustained Economic Development in Argentina

5.1 Economic Diversification in Argentina: Needs, Challenges And Opportunities

For the first time in many decades output in Argentina has grown for five years in a row. Since 2003, the economy has expanded steadily, with GDP growing at over 8% on average in the period 2002-2007. This economic expansion has come about in part through the recovery from the 2001-2002 economic crisis and the deflationary years which preceded the collapse of the convertibility regime. Yet, real GDP in 2005 surpassed the previous peak and in 2007 was almost 25% larger than in 1998, the previous peak. Table 5.1 describes the evolution of the main components of aggregate demand. It shows that investment (although starting from low levels) and exports expanded faster than output during this period, and private consumption grew at a similar rate of output between 2004 and 2007 and has accelerated since 2006.

A new consensus aiming to promote economic development, at least in practice, seems to have emerged in Argentina in recent years. This involves a broad and integrated approach, which contrasts with the 1990s' development model which focused exclusively on price stability. To understand some of the key features of Argentina's recent development experience – and identify some of the economic dimensions considered in the CGE model simulations in subsequent chapters of this thesis – Figure 5.1, which is based on Ocampo (2005a), defines the goals, fundamentals and instruments of what is referred to in this research as a process *Sustained Economic Development*.[1]

Figure 5.1
Sustainable economic development



Source: authors' elaboration based upon Ocampo (2005)

The main objectives of this process are described at the top of Figure 5.1. They concern achievement of: (i) positive and stable rates of economic growth; (ii) low or moderate levels of inflation; and (iii) improvements in socio-economic conditions resulting from more and better employment, higher real wages and a more equal distribution of income. The goals of this integrated development strategy take into account price stability, for it matters for poverty alleviation and to reduce uncertainty and encourage risky investment decisions, among other things. However, it does not consider price stability as a goal to be accomplished at any cost. Indeed, price increases (though moderate and/or controlled) are inherent to any development process that brings about transformations in the productive structure and is required continuously to face, overcome and create supply bottlenecks (Abeles and Borzel, 2004).

Table 5.1
Growth in output and aggregate demand: Selected years and periods

	millions of ARG $ at 1993 prices						
	GDP	**CONSUMPTION**		**INVESTMENT**		**EXPORTS**	**IMPORTS**
		Public	Private	Public	Private		
1993	236 505	163 676	31 953	41 064	4 005	16 341	22 028
1998	288 123	197 557	35 249	56 090	4 691	30 838	38 904
2001	263 997	181 290	35 629	38 812	2 937	32 129	29 659
2002	235 236	155 267	33 820	24 811	1 722	33 123	14 812
2003	256 023	167 951	34 314	33 551	3 108	35 108	20 376
2004	279 141	183 906	35 247	44 532	4 748	37 957	28 551
2005	304 764	200 317	37 403	53 220	7 239	43 083	34 301
2006	330 565	215 882	39 365	61 036	10 402	46 242	39 575
2007	359 189	235 262	42 268	n.a.	n.a.	50 360	47 757
	Annual average percentage change						
1993-1998	4.03	3.83	1.98	6.43	3.21	13.54	12.05
1998-2002	-4.94	-5.84	-1.03	-18.45	-22.16	1.80	21.45
2002-2004	8.93	8.83	2.09	33.97	66.06	7.05	38.84
2004-2007	8.77	8.56	6.24	17.07 (a)	48.02 (a)	9.88	18.70

Source: Secretary of Economic Policy, MECON (Ministry of Economy and Production)

Notes: (a) Final year is 2006; n.a. = not available

There are certain requisites or fundamentals to promoting a process with the abovementioned characteristics. As also shown in Figure 5.1 (middle section), sustained development requires: (a) a stable and healthy financial system; (b) high savings and investment rates; and (c) sustained macroeconomic balances in terms of both external and fiscal accounts. In addition to these fundamentals in Argentina (but also in order to achieve them), *sustained economic development requires a competitive and diversified tradable sector*, an issue already studied in previous chapters and which will be analysed further in Chapters 6, 7 and 8.

Table 5.2
Growth in selected macroeconomic variables. Selected years and periods

	RER (1)	CPI (2)	TOT (2)	TRADE BCE (1) /a	CC AA (1) /a	GOV ACC PRIM (1) /a
	2001=100	1999=100	1993=100	% GDP	% GDP	% GDP
1993	100.5	93.19	100	-1.0	-3.5	1.42
1998	118.59	101.98	102	-1.04	-4.84	0.22
2001	100.00	98.78	105.3	2.7	-1.41	-1.96
2002	241.9	124.34	105	16.1	8.20	1.84
2003	215.71	141.05	114.6	13.2	6.41	2.3
2004	218.23	147.26	116	8.7	2.11	3.9
2005	222.08	161.48	114	7.2	2.80	3.3
2006	228.08	179.08	121	6.5	3.61	3.51
2007	234.5	194.89	125	5.1	2.77	3.21
	Annual Average Percentage Change			**Period Average /b**		
1993-1998	3.4	1.8	0.4	-0.05	-3.36	-0.29
1998-2002	19.5	5.1	0.7	3.67	-1.08	-0.05
2002-2004	-5.0	8.8	5.1	12.67	5.57	2.68
2004-2007	2.27	9.79	2.53	6.89	2.82	3.48

Note: RER = Real Exchange Rage (multilateral); CPI = Consumer Price Index; TOT= External Terms of Trade; CCAA = Current Account; GOV ACC PRIM = Government Primary Surplus;

a/ Positive (negative) values stand for surplus (deficit); b/ 1995-1998 period

Source: (1) Secretary of Economic Policy, MECON (Ministry of Economy and Production); (2) INDEC (National Bureau of Statistics)

In Argentina, which is a country richly endowed with natural resources, tradable and competitive diversification requires the development of industry and service sectors able to compete internationally. The enlargement and diversification of the tradable sector is indispensable for ensuring that output growth is not undermined by Argentina's historical external imbalances in the first place, and for reducing the country's falling but still high unemployment, poverty and inequality levels in the second place (Porta, 2005; Bianco, et al. 2008).

Although both the external accounts and socio-economic conditions have improved significantly since 2002, further progress is still required. In the external front, progress is necessary because the trade and current account surpluses of recent years – which as shown in Table 5.2 amounted respectively to 6.9% and 2.8% of GDP during the 2004-2007 period, but are falling – may deteriorate as a consequence of future external debt payments, or Argentina's high income elasticity of imports[2], or due to changes in international conditions (see Table 5.4 for information regarding the evolution of Argentina's the external terms of trade).

Internally, productive diversification is desirable to improve socio-economic conditions since most industry and modern service sectors tend to create formal employment and make intensive use of skilled workers and, thus, may contribute to reducing unemployment and improving real wages.[3] Table 5.3 shows that unemployment, poverty and inequality have all been falling in Argentina's urban areas, and especially the first two socio-economic measures, which in 2007 fell to less than half their values in 2003. Nevertheless, in 2007, unemployment was affecting 9% of the labour force and real wages were still below 1998 figures (see Table 5.3).

Table 5.3

Changes in labour market conditions and socio-economic indicators in Argentina

	UN R (2)	**RW (2)**	**POVERTY (1)**	**INEQUALTY (1)**
		Oct 01= 100	Headcount ratio	Gini Coefficient
1993	9.90	n.a	20,20	n.a.
1998	13.20	105.21	30,90	0,497
2001	16.40	100.00	54,60	0,522
2002	15.60	70.60	53,00	0,518
2003	19.10	76.23	47,70	0,5
2004	14.60	77.16	39,90	0,495
2005	12.50	85.78	33,80	0,485
2006	10.90	98.05	26,90	0,485
2007	9.20	101.98	20,60	0,490

Note: UN R= unemployment rate; RW = real wages; all figures refer to Argentina's urban areas. Urban areas in Argentina stand for 90% of total population and the household survey covers approximately 70% of urban population.

Source: (1) INDEC (National Bureau of Statistics); (2) CENDA, *El Trabajo en Argentina: Condiciones y Perspectivas*, No. 8, 11 and 13

The promotion of Argentina's traditional tradable sector, the design of policies to redistribute income and the provision of safety nets constitute alternative mechanisms to dealing with Argentina's external and internal disequilibria. This alternative route to development, however, is not explored in this research for the following reasons. First, because the expansion of traditional exports and associated export concentration make the country vulnerable to the volatility of primary commodity prices and may not suffice to prevent imbalances in the external accounts. Second, because the promotion of natural resource exports can lead to falling real wages or may engender trade and labour market imbalances (Serino, 2007). Third, because the design and implementation of redistributive mechanisms have attracted little political support in either Argentina or in the other Latin American countries (Engerman and Sokollof, 2002). And fourth, because redistributive policies can be dismantled if political coalitions change. Although this also applies to policies to promote non-traditional exports – which is desirable if these exports are to be competitive – it is likely (and desirable) that the economy enjoys new competitive industries and sectors that provide employment and income once productive or trade policies are removed. However, this may not happen if redistributive policies are removed or modified, and there is a risk that the economy will return to the situation that encouraged the creation of safety nets.[4]

The bottom section of Figure 5.1 depicts the different policy instruments used to promote sustained economic development. These involve: (i) active regulation of capital flows and the financial system, to reduce and prevent developing countries' vulnerability to international capital flows, which were in the 1990s were so damaging especially (but not only) to Latin American countries. They also include: (ii) the rate of exchange, which should be targeted at a competitive level; (iii) trade policies, principally to smooth the impact of positive shocks to primary commodities; and (iv) counter-cyclical monetary and fiscal policies (see e.g. Ocampo, 2005a; Frenkel and Taylor, 2006). Indeed, the combination of these last three (a low – read competitive or undervalued – nominal exchange rate, export taxes and counter-cyclical monetary and fiscal policy) shapes the policy of *Stable and Competitive Exchange Rate Regime* (SCER) promoting some of the objectives and requisites for sustained economic development (see Frenkel and Rapetti, 2007).

In succeeding chapters, Argentina's recent economic experience is analysed using a CGE, which takes account of the adjustments and interactions among the different dimensions of the economy. The dimensions summarized in Figure 5.1 are employed to organize the GCE analysis and the information obtained from the model simulations, although not all of them are considered here. Based on the analyses in previous chapters, the *purpose of the research and therefore the objective of the* *counterfactual simulations is to explore the response of Argentina's tradable sectors to positive natural resource shocks and policies to encourage productive diversification, like the SCER implemented in Argentina.*

In recent years, Argentina's economic prospects can be seen as a "blessing" to promote economic diversification. The expansion in external and domestic demand and the presence of government and current account surpluses (see Tables 5.1 and 5.2), have encouraged capital accumulation and, together with the *SCER*, generated a favourable environment for investment in the tradable sectors.

Indeed, Argentina's exports have been growing and diversifying since 1990 and especially in the 2004-2007 period (CEP, 2008). And, although all export groups have been growing, there has been a significant increase in the value of manufacturing exports with an agricultural and industrial origin (see Figure 5.2). Table 5.2 shows the evolution of export quantities and prices in these commodity groups and illustrates that, price effects aside, industrial exports (*MOI*) were the fastest growing commodity group during the 2002-2007 period, and the second fastest growing group in the rather more "normal" 2004-2007 period.

Table 5.4
Export growth in Argentina: main commodity groups.
Selected years and periods (1993=100)

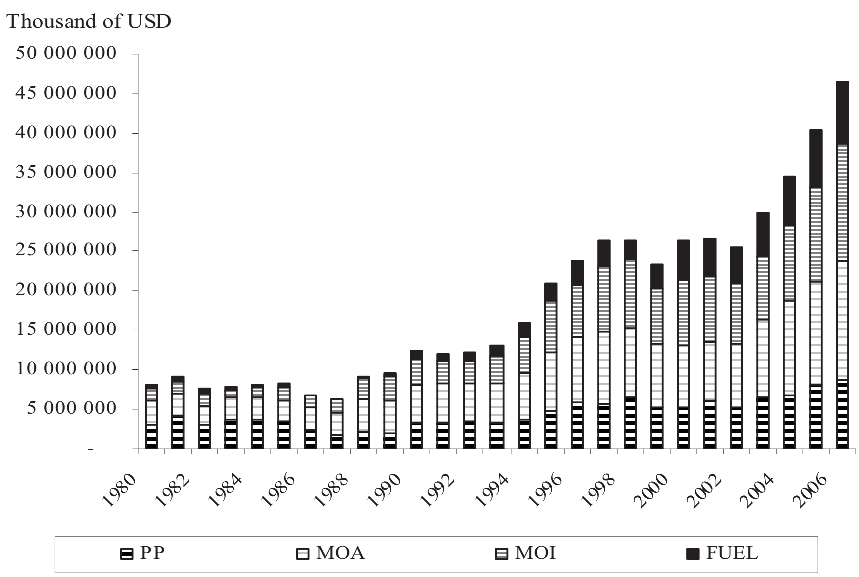
	EXPORT PRICE INDEX				EXPORT QUANTITY INDEX			
	PP	MOA	MOI	FUEL	PP	MOA	MOI	FUEL
1998	106	101	105	76	191	176	224	260
2002	88	80	91	129	185	207	229	291
2004	108	97	96	201	194	249	271	250
2005	99	91	108	271	251	292	303	214
2006	110	99	115	327	240	314	350	192
2007	133	123	119	361	286	318	399	154
				Annual Average Percentage Change				
1998-2002	-3.7	-4.6	-2.8	11.2	-0.6	3.3	0.4	2.3
2002-2007	8.78	8.87	5.47	22.92	9.15	9.00	11.79	-11.98
2004-2007	7.23	7.98	7.31	21.59	13.92	8.51	13.79	-14.98

Note: TOT = Terms of Trade; PP = primary products; MOA = manufactures of agricultural origin; MOI = manufactures of industrial origin

Source: (1) Secretary of Economic Policy, MECON (Ministry of Economy and Production)

Although there has been some diversification (see Figure 5.2), there is need for caution in predicting the prospects for further diversification. As the experiences of many developing countries show, positive external shocks may be a *blessing,* but can also turn out to be a *curse*. Chapter 2 and the literature on the natural resources curse provides abundant evidence of the country experiences of different countries and the channels through which increases in primary commodity prices, similar to those benefiting Argentina (see Table 5.4),[5] and the emergence and expansion of costless sources of foreign exchange, can hinder economic development.[6]

Figure 5.2
Export growth in Argentina 1980-2007.
Total export value and main commodity groups



Source: INDEC (National Bureau of Statistics)

Note: PP = primary products; MOA = manufactures of agricultural origin; MOI = manufactures of industrial origin.

Argentina's economic situation in 2007, and the possibilities of further diversification of exports and the tradable sectors, raises two questions. The first is the possibility of Dutch disease type adjustments associated with the expansion of Argentina's agricultural production and improvements in primary commodity prices.[7] Positive natural resource shocks, as discussed in previous chapters, can set in motion price adjustments that reduce the competitiveness of the non-traditional tradable sector and, thus, limit rather than promote, economic diversification.

The second question related to the diversification of Argentina's tradable sector and sustained economic development is linked to the exchange rate policy. The competitive exchange rate in place so far has prevented Dutch disease adjustments and has been crucial for the recovery and expansion of Argentina's industrial sector. But the effectiveness of this policy, as discussed in Chapter 4 and as will be analysed further in succeeding chapters, requires moderate increases in domestic prices. Low or moderate inflation is necessary for the exchange rate policy to be effective in improving the competitiveness of the non-natural resources sectors, and to avoid an expansionary scenario with falling or stagnating real wages and household incomes that will reduce political support for this economic policy.

5.2 A Structuralist CGE Model to Analyse the Process of Sustained Economic Development in Argentina

The rest of this chapter presents the dynamic CGE model employed to study the domestic adjustment to positive natural resource shocks and economic policies in Argentina. As discussed in previous chapters, the interactions among economic sectors with different characteristics and their particular response to shocks and policies are central to this research.

Models in the structuralist tradition pay special attention to the technological and institutional attributes of economic sectors and agents in the economy (Taylor, 2004). They are, therefore, more appropriate for this analysis than neoclassical CGE models, which do not emphasize differences among economic sectors, agents and/or the functioning of particular markets.

The conception of some of properties of the CGE model is based on the previous chapters of this thesis. They concern the classification of economic sectors. In particular:

- the distinction of tradable sectors according to whether or not they are linked to Argentina's natural resource endowments (Chapters 2, 3 and 4), a fundamental distinction used to discuss the problem of productive diversification in Argentina;
- the identification of different natural resource sectors, which are distinguished in relation to the degree to which they process natural resources. This distinction is considered in Chapter 2 and shows that countries industrializing their natural resources do not experience the resource curse, suggesting that productive diversification through natural resource processing may have growth enhancing effects;
- the distinction between natural resource sectors and others, together with the assumption that processed natural resource products are basically food products, is used to identify the particular effects of natural resource shocks and the exchange rate and export tax policies in wage-goods exporting countries, one of the key points discussed in Chapter 4;
- the distinction between producer and consumer oriented non-tradable sectors, a difference that is shown in Chapter 3 to have an effect on how the economy responds to exogenous shocks and economic policies.

Other relevant features of the CGE model are related to the assumption of quantity adjustments to excess demand in the non-natural resource tradable sectors. This assumption, as discussed in Chapter 4, is fundamental to a comprehensive analysis of the factors that affect the competitiveness of these sectors and the implication of positive terms of trade shocks and policies designed to encourage productive diversification.

The CGE model allows for price changes leading to conventional Dutch disease adjustments as in standard dependent economy models. But, in line with the analytical discussions in Chapters 3 and 4, the competitiveness of the non-natural resources sectors in the CGE model is affected by price and non-price factors. Price effects are considered through sector-specific real exchange rates (as in Chapter 4). Non-price effects are considered through a productivity equation that varies in relation to demand changes and takes into account the Kaldor-Verdoorn effects discussed in Chapter 4, and through extended export and import demand equations linking the competitiveness of the non-natural resources sectors to productive linkages and public infrastructure, as in analysed in Chapter 3.

To explore these issues, the dynamic CGE model draws on existing applied models. It defines the behaviour of the natural resource tradable sectors following the so-called standard trade model, first developed by Dervis, de Melo and Robinson (1982) and extended by Löfgren, Lee Harris and Robinson (2001). In this specification the price of natural resource products, and especially wage-goods, is determined according to excess demand equations in their particular markets. Although this specification differs from the one in Chapter 4 – where wage-goods prices are determined in direct relation to international prices – it is used to make the model more flexible. The close link between domestic and international prices of wage-goods is not excluded from the CGE model, but rather is included via a high sensitivity of domestic supply to changes in relative prices.

Other features of the model, however, have a structuralist background, as for example the above mentioned assumption of quantity adjustment in the industrial sector and the inclusion of wage, trade and investment equations. Their specification has many points in common with the models developed in Gibson (2005), Gibson and van Seventer (2000a, 2000b) and Taylor (1990).[8]

5.2.1 Classification of economic activities, commodities and productive diversification in Argentina

The classification of economic sectors and definition of their characteristics are of particular importance for the analysis of economic diversification. Table 5.5 presents the commodities and economic sectors included in the SAM and the applied model of the Argentine economy. As mentioned in the introduction to this chapter, economic sectors and products are defined based on the previous chapters in this thesis.

Primary and industrial products are classified using the CTP-DATA taxonomy proposed by Peirano and Porta (2000).[9] This classification – used in Chapter 2 – distinguishes products and sectors according to their main competitiveness factors (endowments, economies of scale, economies of specialization, technological intensity, etc.) and their reliance on price and non-price competitiveness advantages.

As shown in Table 5.5, the SAM identifies five commodity groups and the five economic sectors that produce them: (i) primary products

(PP); (ii) resource intensive manufacturing products (MR); (iii) other manufacturing products (MO); (iv) producer services (PS); and (v) consumer services (OS). Products and sectors PP, MR and MO are the standard tradable sectors and are the ones defined according to the CTP-DATA classification.

Table 5.5
Commodity and sector classification

Commodities and Sectors		Observations
TRADABLE TRADITIONAL	PP – Primary	Price competition; flexible prices and supply determined exports, according to Constant Elasticity of Transformation function.
TRADABLE NON-TRADITIONAL	MR – Manufacturing Resource Intensive	Price competition; flexible prices and supply determined exports, according to Constant Elasticity of Transformation function.
	MO – Manufacturing Other	Non-price competition; excess capacity and mark-up pricing
	PS – Producer Services	Non-price competition; excess capacity and mark-up pricing
NON - TRADABLE	OS – Other Services	Price adjustment

Source: Author's classification, based on CTP-DATA taxonomy for tradable products and sectors.

Sectors PP and MR are the sectors linked to Argentina's abundant and highly productive natural resource endowments, which in the SAM and CGE model are distinguished according to the degree to which they process natural resources.

Although the country has a price competitiveness advantage in these two sectors and products, the research considers only sector PP as the traditional sector because, historically, Argentina has been an important exporter of different agricultural crops. Diversification of Argentina's tradable sector therefore can take place in sectors MR, MO and PS.

Productive and export diversification is fundamental to avoid the so-called natural resource curse, described in Chapter 2, and to prevent or overcome internal and external imbalances described in Chapter 4. Argentina can diversify in the following two ways:

- by industrializing its natural resources – to an extent already achieved due to the country's natural advantages, but which is relevant as it can be a source of externalities, as discussed in Chapters 2 and 3, and because the sector adds more value and uses more employment than the primary sector (PP);

- by developing the other tradable sectors: the industries intensive in scale, science and technology and specialized providers that are grouped in sector MO, and exportable services produced in sector PS.[10]

Table 5.5 presents some key characteristics of the different economic sectors. Following the tradition for multisectoral models of the Argentine economy,[11] the sectors linked to Argentina's natural resources (PP and MR) are assumed to: (i) have a price competitiveness advantage; (ii) operate at full-capacity; and (iii) sell to the domestic or international market depending on the relative profitability of one or the other product destination.

Excess capacity and quantity adjustments, on the other hand, are the norm in the non-natural resource manufacturing sector MO and in sector PS. As discussed in Serino (2007) and Chapter 4 of this thesis, this structuralist feature of the model implies that output in these sectors is demand-determined. Hence, it depends on domestic and world income and the price and non-price competitiveness (and the events affecting them) of these sectors. This specification is especially relevant to the present research because it permits comprehensive analysis of the response of the non- natural resource tradable sectors to external shocks and macroeconomic (diversification) policies. Besides the assumption about the destination of natural resource production, which is included to make the model more flexible, the characteristics of the tradable sectors are similar to those in Chapter 4.

Two types of services and the sectors providing them are identified in the SAM and the CGE model, following the sectoral classifications in Chapter 3: sector PS, principally making and providing producer-oriented services, as for example public utilities, construction, and communication, finance, transportation and other specialized producer services, and sector OS providing services, e.g. commerce, restaurants, tourism, leisure and informal services. The main difference between the two sectors is that the services provided by sector OS are principally for consumption, a difference captured in 1997 Argentina's input-output table, which was employed to update the SAM. Although many services from sector PS are inputs from other domestic activities, services as for instance software, transportation and financial services, they are service that can also be exported, which is why they are also considered as a tradable sector.

The reason for this particular classification of Argentina's service sector is to distinguish between two adjustments to a positive resource shock with opposite effects for the competitiveness of sectors MO and PS. As discussed in Chapter 3, a positive resource shock can encourage an expansion in the demand of consumer services (OS) which leads to higher non-tradable prices and Dutch disease type adjustments; alternatively, it may, at the same time, promote the expansion of sector PS. This second adjustment may occur because the natural resource sector makes intensive use of producer services and hence its expansion propels the development of productive linkages, or it may be the result of public policies to promote investment in the sector providing producer and infrastructure-type services. Most importantly, expansion of sector PS – to the extent that it implies improvements in the provision of commercial, scientific and transportation services, for example – can augment the competitiveness of the non-traditional tradable sectors and thus encourage economic diversification.

As discussed in Chapter 3, this is an important distinction often omitted from multi-sectoral models, which needs to be taken into account since not all expansions in the service sector are necessarily detrimental to the medium-term competitiveness of the non-natural resource tradable sectors.

5.2.2 The structuralist CGE model

A synthetic description of the model is provided in this section; its full specification is provided in the appendix to this chapter. Where applicable, the description discusses the link between the CGE model and the propositions derived in previous chapters and highlights other features of the model that are relevant to the applied analysis.

Together with the commodities and economic sectors (denoted with supraindex ***c*** and ***a***), the model distinguishes seven factors of production (one capital and nine labour categories, characterized with supraindices *k* and *l*), and identifies three types of institutions: households (*H*), government (*G*) and rest of the world (*W*).

Equation (5.1) shows the material balance equation (D.2.21)

$$XC_{c,t} = AINTD_{c,t} + \sum_{h} CDH_{c,h,t} + IO_{c,t}^{priv} + IO_{c,t}^{gov} + CDG_{c,t} + E_{c,t} - M_{c,t} \quad (5.1)$$

In the equation, XC_c is commodity c demand, $AINTD_c$ is domestic intermediate inputs, $CDH_{c,h}$ refers to household consumption, IO_c^{priv} and IO_c^{gov} to private and public investment, CDG_c to government current expenditure, E_c stands for exports and M_c for imports.

The external sector: exports supply and demand, and the competitiveness of the non-natural resource tradable sectors

The economic rationale for exporting natural resource products is different from that for other exports and therefore they are modelled differently. In Argentina, the sectors linked to natural resources have a price competitiveness advantages and are able to sell their production at given international prices.

The model in Chapter 4 and the traditional multisectoral models assume that the natural resources sectors are indifferent about the destinations for their production since they can charge international prices in the domestic market and export their surpluses (Porto, 1975; Serino, 2007). Modelling-wise, this specification implies fixed price and quantity adjustments for these sectors. This specification, however, is not included in the CGE model since it would reduce its flexibility – with four sectors adjusting through quantities to excess demand. An alternative specification for the natural resource sectors, with price adjustments to excess demand in the domestic market and sectoral exports, defined according to the Constant Elasticity of Transformation (CET) function, is therefore employed in this CGE model.

Exports of natural resource-related products (PP or MR) are therefore supply-determined and producers decide the destination of production according to relative profitabilities. The decision between exporting or selling to the domestic market is modelled using a CET function that links exports and domestic supply to the relative price prevailing in the external and domestic market. This function is defined in equation (5.2)

$$\frac{E_{c,t}}{QDDA_{c,t}} = \left(\frac{PE_{c,t}}{PDC_{c,t}} \cdot \frac{\left(1-\psi_c^{cet}\right)}{\psi_c^{cet}} \right)^{1/\rho_c^{cet}-1} \tag{5.2}$$

where $E_{c,t}$ and $QDDA_{c,t}$ are exports and domestic sales respectively, $PE_{c,t}$ and $PDC_{c,t}$ are export and domestic prices respectively, and ψ_c^{cet}

and ρ_c^{cet} respectively are the share and exponent parameter of the CET function. The exponent parameter depends on the elasticity of transformation between the domestic and export supply, which captures the ability of producers to shift from one market to another. To reproduce the capacity of Argentina's natural resource sector to export its surpluses, the model assumes high elasticity of transformation, which permits an easy reallocation of production between the domestic and external markets. The flexibility to change the allocation of production increases the pass-through of international to domestic prices and, thus, serves to evaluate the hypothesis from Chapter 4 regarding the adjustment to positive terms of trade shocks and exchange rate devaluations in wage-goods exporting countries.

For products where the country does not have a natural advantage, as the products from sectors MO and PS in Argentina, their competitiveness is a fundamental determinant of export. To take this into account, output in sectors MO and PS is assumed to be demand-determined, following the specification of industrial products in Chapter 4. Output in non-natural resources tradable sectors depends, among other things, on the demand for exports. Equation (5.3) defines the export demand equation for MO and PS products.

$$E_{c,t} = E_{c,t-1} \cdot (RERE_{c,t})^{\xi_{EP}} \cdot (y^W)^{\xi_{EY}} \cdot \left(\frac{ID_{a,t}^{priv}}{ID_{a,t-1}^{priv}}\right)^{\xi_{ENP1_c}} \cdot \left(\frac{QA_{APS,t}}{QA_{APS,t-1}}\right)^{\xi_{ENP2_c}} \tag{5.3}$$

The export demand equation goes beyond traditional specifications,[12] as that employed by Serino (2007) and in Chapter 4 of this thesis. Exports are function of conventional factors, as changes in world income (y^W) and the price competitiveness of the products concerned, as captured by the sector-specific real exchange rate (RER_c). Yet, in this CGE model, the competitiveness of exports depends on factors other than prices.

Following Leon-Ledesma's (2002) Kaldorian growth model, the equation incorporates two non-price determinants of competitiveness. The first links the competitiveness of production to sector-specific private investment $\left(\frac{ID_{a,t}^{priv}}{ID_{a,t-1}^{priv}}\right)$, which enters the equation to account for factors facilitating access to foreign markets, as embodied technical progress, investment in machinery and equipment, and sector specific innovation. The second associates export competitiveness with output increases in sector PS $\left(\frac{QA_{APS,t}}{QA_{APS,t-1}}\right)$. This is included to capture the contribution of productive linkages and different types of infrastructure to the competitiveness of exports, an effect emphasized in the analytical model developed in Chapter 3.

The price competitiveness of non-traditional exports is defined by the sector-specific real exchange rate

$$RERE_{c,t} = \frac{NER_t \cdot pwe_c}{PDC_{c,t}} \tag{5.4}$$

with pwe_c denoting world prices, NER the nominal exchange rate and PDC_c denoting the domestic price of goods produced in sectors *MO* and *PS* and depending on domestic production costs as indicated in equation (5.5)

$$PDA_{a,t} = (1 + TAUV_{a,t})VC_{a,t} \tag{5.5}$$

Production costs, in turn, depend on the mark up rate $TAUV_a$, which changes according to sectoral output, and variable production costs (VC_a), which are a function of intermediate input prices and unitary labour costs, as defined by nominal wages W_l and labour productivity.

To reflect the specific features of the Argentine economy, the model also assumes that the price of labour is institutionally determined, depending on labour productivity growth, the evolution of consumer prices, changes in the rate of unemployment and an exogenous policy variable (*wpol*), to account for and/or simulate changes in government wage policy. In the wage equation below, hat (^) denotes growth or percentage change, and $\acute{\omega}_1$, $\acute{\omega}_2$, $\acute{\omega}_3$ and $\acute{\omega}_4$ capture the sensitivity of nominal wages to the dynamics of productivity, prices, unemployment and wage policies.

$$WL_{fl,t} = WL_{fl,t-1} \cdot \left[\begin{array}{l} 1 + \omega_1 \cdot \dfrac{\sum_a LPRODG_{fl,a,t}}{a} \\ + \omega_2 \cdot \hat{CPI}_t - \omega_3 \hat{UN}_{fl,t} + \omega_4 wpol \end{array} \right] \tag{5.6}$$

Other particular feature of the model is the endogeneity of the labour output coefficient and labour productivity, as defined in equations (5.7) and (5.8).

$$LOCF_{fl,a,t} = LOCF_{fl,a,t-1} \cdot (1 - LPRODG_{fl,a,t}) \tag{5.7}$$

$$LPRODG_{fl,a,t} = lstc_{fl,a} + \alpha_{1fl,a} \cdot \hat{UAV}_t \tag{5.8}$$

As discussed in Chapter 4 and in Serino (2007), labour productivity growth is determined by demand and supply factors. Demand-determined productivity growth is referred to in the literature as the Kaldor-Verdoorn effect and links productivity growth to learning and specialization economies that arise with expansion in demand. These are captured by α_1 in equation (5.8), which links productivity to changes in the economy-wide capacity utilization. Supply-side determinants of productivity growth, on the other hand, are related to factors such as human capital accumulation, access to foreign technologies and the available infrastructure, and are captured by the exogenous term *lstc*, which stands for labour saving technical change, and is assumed to be exogenous in the model.

The specification of imports resembles the export demand equation.

$$M_{c,t} = M_{c,t-1} \cdot \left(\frac{YAGR_t}{YAGR_{t-1}}\right)^{\xi_{MY}} \cdot \left(\frac{1}{RERM_{c,t}}\right)^{\xi_{MP}} \cdot \left(\frac{ID^{priv}_{a,t-1}}{ID^{priv}_{a,t}}\right)^{\xi_{MNP1}} \cdot \left(\frac{IDT_{APS,t-1}}{IDT_{APS,t}}\right)^{\xi_{MNP2}} \tag{5.9}$$

In equation (5.9) *YAGR* is real GDP, $RERM_c$ is sector-specific exchange rates and the last two ratios account for the non-price competitiveness determinants discussed above.

The specification of the external sector takes into account many of the points discussed in the analytical models that are part of this research. First, the model differentiates between exports from the natural resource sectors and those from other sectors, for Argentina has a clear competitiveness advantage in relation to the former and needs to develop or improve its competitiveness to increase non-natural resource exports and diversify its external sector. Second, the model specifies a CET function to determine the supply of natural resource exports and assumes high flexibility to reallocate supply between the domestic and external markets, which is intended to reflect the country's capacity to export its production surplus, as emphasized in multisectoral models of the Argentine economy.[13]

The extended export demand equation, incorporates in the CGE model, most of the factors affecting the competitiveness of the non-natural resource sectors discussed in Chapters 3 and 4. The equation links export competitiveness to the evolution of prices – the nominal exchange rate, wages and intermediate input prices – establishing a mechanism to investigate the impact of exogenous natural resource shocks and certain economic policies. But the equation also establishes a link between the competitiveness of exports and factors not often taken into account.

One of these factors is the endogeneity of productivity growth and its relation to the evolution of demand. This implies that an exchange rate devaluation that is expansionary [14](or a policy of stable and competitive exchange rate, as the one in place in Argentina between 2003 and 2007), will improve the price and non-price competitiveness of sectors MO and PS. This is an effect which, as noted in Serino (2007), is rarely considered, and is equivalent to the effects emphasized in dynamic Dutch disease models, but the other way round. The other factor is the contribution of intermediate inputs with public goods characteristics – as the goods produced by sector PS – to the competitiveness of the non-natural resources tradable sectors; an effect discussed extensively in Chapter 3 and by Eswaran and Kotwal (2002) in relation to the externalities associated with the productive linkages in the natural resource sector or the economic policies designed to promote them.

Domestic demand

The specification of domestic demand, to a large extent, follows the traditional structuralist CGE models. *Demand for intermediate inputs* is based on a Leontief function and *consumption demand* is defined according to a linear expenditure system (LES), as defined in equations (5.10) and (5.11) below,

$$INTD_{c,a,t} = iocf_{c,a} \cdot XA_{a,t} \tag{5.10}$$

$$CDH_{c,h,t} = \theta_{c,h} + \frac{\mu_{c,h}}{PINDEX_{c,t}} \cdot \left[EXPH_{h,t} - \sum_{c} PINDEX_{c,t} \cdot \theta_{c,h} \right] \tag{5.11}$$

In equation (5.11), $\theta_{c,h}$ is 'basic needs' of household H, $\mu_{c,h}$ denotes the marginal propensities to consume and the term in brackets represents household expenditure after satisfying "basic needs".

In structuralist-type models, output responds to changes in demand. Demand impulses follow changes in investment and government expenditure, which thus are determined according to particular behavioural equations or are defined as exogenous and determined by economic policies.

Private investment is defined in equation (5.12) below

$$ID_{a,t}^{priv} = ID_{a,t-1}^{priv} \cdot \begin{bmatrix} 1 + \gamma_{1a} \hat{UAV}_t + \gamma_{2a} \hat{ID}_t^{gov} \\ + \gamma_{3a} \hat{PRFR}_{a,t} - \gamma_{5a} \hat{RIR}_t \end{bmatrix} \cdot IADJ_t \tag{5.12}$$

The model defines an investment equation for each economic sector, which resembles the investment equation in Gibson (2005) and the Macroeconometric Structuralist Model (MSM) developed by Argentina's Ministry of Economy and Production.[15] Each equation incorporates an accelerator parameter γ_1, linking capital accumulation to changes in economy-wide capacity utilization, and a crowding-in parameter γ_2 that relates private investment to changes in public investment. Investment is also a positive function of the profit rate $\hat{PRFR}_{a,t}$ and is negatively linked to the real interest rate $\hat{RIR}_t$, which accounts for the cost of borrowing.[16] The equation incorporates additional (endogenous) effects on the model, such as the accelerator and crowding-in parameters. However, in terms of endogenous effects, the emphasis in this research is on the dynamics of non-natural resource exports and productivity growth.

Government current expenditure and public investment are the remaining components of aggregate demand. The benchmark specification of the model assumes that *government consumption* is exogenous and evolves according to a pre-defined rule (*cdgrule*) - a rule that is calibrated to reproduce the evolution of government consumption in recent years, although it can be modified so as to simulate the impact of alternative government expenditure policies. As shown in equation (5.13), the model allows for alternative specifications of government consumption, for this also can be endogenous and adjust to balance government accounts

(*GCADJ*), or can be a function of government income from export taxes (*$CDGTC_c$*).[17]

$$CDG_{c,t} = \left[CDG_{c,t-1} \cdot (1 + cdgrule) + CDGTC_{c,t} \right] \cdot GCADJ_t \tag{5.13}$$

Public investment is defined as government consumption and is assumed to be exogenous, evolving according to a predetermined rule (*igrule*), although it can also be endogenous and depend on the government balance or be linked to a particular source of income (*IGTI*).[18]

$$ID_t^{gov} = ID_{t-1}^{gov} \cdot \left[(1 + igrule) + IGTI_t \right] \cdot GIADJ_t \tag{5.14}$$

In the model, public income is invested exclusively to improve the provision of infrastructure. It occurs, therefore, in sector *PS* and represents the type of public expenditure that could increase the overall competitiveness of Argentina's tradable sector (see equations (5.3) and (5.9)).[19]

This characterization of public expenditure enables the analysis of the implications of alternative government policies for economic development, since public investment not only increases domestic demand, but also can have positive externalities that benefit the non-traditional tradable sectors. Also important is that the government equations include a variable to study the impact of alternative uses of the income provided by export taxes, the "extraordinary" source of finance that Argentina's government has enjoyed since 2002. In this respect, the CGE model adds new ingredients for the analysis of external shocks and the competitive exchange rate policy discussed in Chapter 4 and at the beginning of the present chapter.

Production and factors market

In the model, supply depends on capital accumulation and, thus, on investment, as defined in Gibson (2000a) and equation (5.15). Based on the assumption of price adjustment in sectors PP, MR and CS, equation (5.15) determines effective output in these sectors. In sectors MO and PS, where output is demand-determined, the equation defines potential output.

$$QA_{a,t} = \left(\kappa_a \cdot K_{a,t-1} + QA_{a,t-1} \right) \tag{5.15}$$

In (5.15) κ_a is the sector-specific incremental capital-capacity ratio, and $K_{a,t-1}$ and $QA_{a,t-1}$ respectively denote capital stock and output in the previous period. The rate of capacity utilization ($U_{a,t}$) equals

$$U_{a,t} = \frac{XA_{a,t}}{QA_{a,t}} \tag{5.16}$$

Capacity utilization equals 1 in sectors PP, MR and CS, the sectors for which the model assumes full-employment and price adjustment, and is defined as the ratio of demand-determined ($XA_{a,t}$) to potential output ($QA_{a,t}$) in the other two sectors.

Sectoral labour demand depends on the endogenous labour output coefficients and output, as shown in equation (5.17).

$$LD_{fl,a,t} = LOCF_{fl,a,t} \cdot XA_{a,t} \tag{5.17}$$

The model defines nine labour categories according to the skills of the labour force and whether they are protected or not by the social security system. Labour's unemployment works as an adjustment mechanism as it affected 14% of Argentina's labour force in the starting year for the simulations.

Labour supply ($LS_{fl,t}$) changes according to

$$LS_{fl,t} = LS_{fl,t-1} \cdot \left(1 + gls_{fl,t}\right) \cdot \left[\frac{WL_{fl,t}}{WL_{fl,t-1}}\right]^{\eta_{fl}} \tag{5.18}$$

where $gls_{fl,t}$ is the exogenous growth rate of the labour force and $\left[\frac{WL_{fl,t}}{WL_{fl,t-1}}\right]^{\eta_{fl}}$ is added to model changes in the labour supply in response to wage differentials among labour categories. Because labour categories differ in terms of the skills of the labour force, which are acquired through working experience or participation in the education system, the model assumes low values for the parameter η_{fl}, to take account of the time and efforts required to obtain new skills and move from one labour category to another.[20]

Macroeconomic balances

Total current expenditure by the government equals the sum of what it spends to provide public services, the subsidies it provides to economic sectors ($SUBSA_{a,t}$) and the transfers it makes to other institutions, whether the households ($TRGH_{h,t}$) or the rest of the world ($TRGW_t$)

$$EXPG_t = \sum_c CDG_{c,t} \cdot PINDEX_{c,t} + \sum_h TRGHV_{h,t} + TRGWV_t + \sum_a SUBSA_{a,t} \qquad (5.19)$$

Government income comes from direct taxes on households (*TTHOU*), taxes on factors of production (*TTFAC*), indirect taxes (*TTIND*), and trade taxes on imported and exported commodities (*TTRADE*). In addition, government receives transfers from households ($trhg_h$) and the rest of the world (*trwg*), both assumed to be exogenous (see equation (5.20) below).

$$YG_t = TTHOU + TTFAC + TTIND_t + TRADE_t + \sum_h TRHGV_{h,t} + TRWGV_t \qquad (5.20)$$

Government savings (SG_t) are the difference between current income and current expenditure (see equation (5.21)), whereas government borrowing requirements (GBR_t) take account of public investment and represent the effective financial needs of the government to cover all its expenses (see equation (5.22)).

$$SG_t = YG_t - EXPG_t \qquad (5.21)$$

$$GBR_t = EXPG_t + \sum_c PINDEX_{c,t} \cdot IO_{c,t}^{gov} - YG_t \qquad (5.22)$$

Equation (5.23) defines the external macroeconomic balance and foreign savings

$$SW_t = \frac{\sum_c PM_{c,t} \cdot M_{c,t}}{(1+tm_c)} + \sum_h TRHWV_{h,t} + TRGWV_t - \sum_{ctp} \frac{PE_{c,t} \cdot E_{c,t}}{(1-te_c)} - \sum_{cmup} PDC_{c,t} \cdot E_{c,t} - \sum_h TRWHV_{h,t} - TRWGV_t \quad (5.23)$$

In equation (5.23), SW is foreign savings; the first three terms on the RHS, indicate payments to the rest of the world and the last three terms are payments from abroad. Household transfers to and from abroad are assumed to be exogenous, but government transfers to the rest of the world can be endogenous and adjust to achieve the government balance, or exogenous and change according to an exogenous rule (see the corresponding equation in the appendix), such as the one included in the government consumption and investment equations.

The remaining macroeconomic balance captures the equilibrium between saving and investment, and is shown in equation (5.24) below

$$\sum_h MPS_{h,t}(1-ty_h)Y^H_{h,t} + SG_t + SW_t = \sum_c PINDEX_{c,t}(IO^{priv}_{c,t} + IO^{gov}_{c,t}) \quad (5.24)$$

System Constraints and Closure Rules

To solve applied CGE models it is necessary to define closure rules that specify how the factor and commodity markets adjust to excess demand and how the economy achieves the various macroeconomic balances, and also a *numeraire* to express relative prices.[21] A summary of the main characteristics of the dynamic CGE model is presented in Table 5.6 below. As shown in the table, the nominal wage for unskilled and informal labour is defined as the numeraire, and a fix-flex closure rule characterizes the commodity market, with mark-up sectors MO and PS showing quantity adjustments, and sectors PS, MR and OS adjusting to excess demand via price adjustments, as in the model developed in Chapter 4. Consistent with the still high (though falling) unemployment levels observed in Argentina quantity adjustments are the regulating mechanism in the labour market.

In the case of macroeconomic balances, the benchmark specification of the model assumes a fixed exchange rate and that investment is determined according to the investment equations. The assumption concerning the adjustment in the external balance is consistent with the managed exchange rate regime implemented in Argentina and the model is calibrated so as to reproduce observed changes in the nominal exchange rate. In relation to the savings-investment balance, the assumption of a Keynesian closure rule, where output adjusts to ensure the savings required to finance the exogenously determined investment, is compatible with the presence of excess capacity and the fast response of output to changes in demand conditions that has been observed in Argentina. In relation to the government balance, the model assumes that government expenditure is exogenous and evolves according to observed trends in consumption, investment and transfers in the public sector.

Table 5.6
Main features of the dynamic CGE model

MICRO CLOSURE		
MARKET	**ADJUSTMENT MECHANISM**	**OTHER PROPERTIES**
Commodity markets		
PP & MR	Price adjustment to excess demand	Price competition; full capacity utilization and CET function
MO & PS	Quantity adjustment	Non-price competition; excess capacity and mark-up pricing
OS	Price adjustment to excess demand	
Labour Market	Quantity adjustment	Institutionally determined wages
MACRO CLOSURE		
Foreign Exchange Market	Fixed / Flex exchange rate regime	
Saving-Investment Balance	Investment driven / Saving driven	
NUMERAIRE		
FWLNP1	Nominal wage of unskilled and informal wage labour	

The model simulations and counterfactual exercises, however, take into account alternative micro and macroeconomic closure rules and explore the implications of a flexible exchange rate policy and the neoclassical assumption of saving-driven investment and the Kaldorian assumption that household savings vary to balance the savings-investment equation.

5.3 Final Remarks

This chapter discussed the needs, challenges and opportunities related to productive diversification in Argentina. It described Argentina's economic performance in the period 2003-2007 and proposed that sustained economic development in this country requires, among other things, a competitive and diversified tradable sector. This is a necessary condition to promote long-term growth, to overcome Argentina's historical external imbalances and to improve socio-economic conditions in the country.

The research shows, and particularly the first section of this chapter, that Argentina's exports have been growing and diversifying. This has occurred in a context of increasing primary commodity prices and a policy of stable and competitive exchange rate. Taking into account the propositions in Chapters 3 and 4 this chapter presented the dynamic CGE model that is used to explore how the Argentine economy has responded to positive natural resource shocks and economic policies.

Many aspects of the CGE model have been defined in relation to the previous chapters in this thesis. These concern the classification and functioning of the economic sectors. The model assumes quantity adjustments in the non-natural resource tradable sectors MO and PS (as in the model developed in Chapter 4), since this enables a discussion of how price and non-price competitiveness factors affect the performance of these sectors and, thus, productive and export diversification.

In the CGE model, factors relevant to the price competitiveness of non-natural resource production include terms of trade shocks – through their impact on domestic prices, which is translated into nominal wages and sectoral-specific exchange rates – and nominal exchange rate devaluations. The negative and positive effects of these factors are also related to changes in export taxes and to how the government uses export tax revenues, an issue that was touched upon but not explored in detail in Chapter 4. Simulations of increases in export prices and different adjustment policies will be used to evaluate the role of export taxes and the exchange rate regime to prevent conventional Dutch disease adjustments, while simulations of nominal exchange rate devaluations and their relation with export taxes will be performed to explore the necessity of a compensated devaluation regime for a competitive exchange rate policy to effectively encourage productive diversification in wage-goods exporting countries, as proposed in Chapter 4.

Additional factors affecting the competitiveness of the industrial and service tradable sectors are the expansion of productive linkages and Kaldor-Verdoorn effects. The simulations of terms of trade shocks and alternative patterns of government expenditure are run in Chapter 7 to evaluate whether, as suggested in Chapter 3, positive resource shocks can promote productive linkages and indirectly benefit the non-natural resource sectors.

As in Chapter 4, Kaldor-Verdoorn effects enter the CGE model through a labour productivity equation. The model's calibration and base-run simulations performed in Chapter 6 and the counterfactual simulations of nominal exchange rate devaluations developed in Chapter 8 explore the importance of this effect.

Notes

[1] The notion of a sustained economic development process is based upon Ocampo's "Broad View of Macroeconomic Stability". The classification of the different dimensions of the process and the proposition of the intermediate dimension of fundamentals or requisites between goals and instruments, crucial in this research, is not provided in Ocampo's paper. As the analysis in this research does not take account of environmental factors, I refer to sustained economic development rather than sustainable development, which is a broader concept that also considers inter-generational, environmental factors.

[2] Recent estimations by Nicolini-Llosa (2007b) show that imports in Argentina have expanded more than three times faster than output and are not responsive to changes in relative prices.

[3] As shown, in CENDA's 2007 labour market report, the recovery of employment was particularly significant in Argentina's industrial sector and, at least in these sectors, real wages and employment conditions also improved (see CENDA, 2007).

[4] It should be noted that the design and implementation of policies to redistribute income remains a valid and necessary issue in countries like Argentina that deserves consideration, irrespective of being or not a superior development strategy. It has not been explored, however, because it would have required a detailed study of fiscal policies in Argentina an issue that goes beyond the scope and purpose of the research and that cannot be studied with the stylised Social Accounting Matrix used in this research.

[5] As shown in Table 5.4, the prices of all Argentina's exports, but especially those of resource-intensive products (PP, MOA and FUEL), have grown fast since 2002.

[6] See Murshed (2004), Sachs and Warner (1999), Serino (2008) and Van der Ploeg (2008) for a discussion and an empirical investigation of the so-called resource curse.

[7] According to Bisang (2008), Argentina's agricultural production (mainly cereals and soybeans) increased from 40m tons to close to 100m tons between 1995 and 2006.

[8] Diao, Rattsø and Stokke (2006, 2005) construct a Ramsey growth model to simulate Thailand's long-term economic growth record and show that structural change has been the fundamental vehicle of growth. Although their research questions and findings have some similarities with the present research, I opted for a different modelling strategy. This is because the Ramsey model these authors use does not adequately identify the propositions put forward in the analytical chapters of the current research.

[9] This classification follows the taxonomy proposed by Pavitt (1984), adapted by Gurrieri (1989, 1992, quoted in Porta and Peirano, 2000), and used in the SELA study (1994, quoted in Porta and Peirano, 2000) to analyse the pattern of trade specialization in Latin American countries. Table 2.1 in Chapter 2 of this thesis summarizes products corresponding to each natural resource commodity group.

[10] Following the CTP-DATA classification, sector MR includes resource intensive and labour intensive industries, since price represents their main competitiveness advantages, and sector MO includes industries with intensive economies of scale, specialized inputs and R&D.

[11] For different analytical specifications of Argentina's agricultural sector as the main exporting sector operating at full-capacity, see papers by Diamand, (1972), Canitrot (1975), Kostzer (1994). Nicolini-Llosa (2007a ,2007b), Porto (1975), Serino (2007) and Visintini and Calvo (2000).

[12] See e.g. Dervis et al. (1982: Ch. 7).

[13] See references in endnote 13.

[14] In many cases devaluations can be contractionary since they reduce domestic demand as in Braun and Joy (1968), Diaz Alejandro (1963, 1965) and Sidrauski (1968), and in the dynamic version developed by Larraín and Sachs (1986); they increase the price of intermediate inputs as in Krugman and Taylor (1978). They can also be contractionary due to negative wealth effects as in the paper by Cespedes, Chang and Velasco (2002). See also Bebczuk, Ricardo, Galindo and Panizza (2006), for an empirical evaluation of thess hypotheses.

[15] The specification of the investment equation in the MSM model incorporates additional variables to capture (i) whether the economic regime is profit or wageled, as in Bhaduri and Marglin (1990); (ii) the role of macroeconomic volatility; (iii) the cost of imported capital goods.

[16] Variable IADJ is included to allow for alternative saving-investment closure rules: it is endogenous under the neoclassical closure and exogenous with alternative closure rules.

[17] Variable $CDGTC_c$ is defined as

$CDGTC_{c,t} = strcdg_c \cdot (taxcon \cdot \frac{TTEX_t}{TTEX_{t-1}}) \cdot \frac{1}{CPI_t}$, where TTEX stands for total export tax and *taxcon* denotes the percentage of this income that finances government current consumption.

[18] Variable IGTI is defined as

$IGTI_t = taxinv \cdot \frac{TTEX_t}{TTEX_{t-1}} \cdot \frac{1}{CPI_t}$, where, as with current government expenditure, *TTEX* stands for total export taxes and *taxinv* denotes the proportion of this income that is invested.

[19] Larraín, Sachs and Warner (2000) emphasize the importance of public investment in infrastructure in Chile to prevent Dutch disease adjustments in. Their argument also is applicable to the Argentine case.

[20] A proper specification would require the inclusion of an equation to model changes in skills and education; but this specification is beyond the scope of this thesis research.

[21] See Robinson (1989) and Sánchez Cantillo (2004) for a general and complete discussion of closure rules, and Taylor (1990) for an exposition of fix-flex closure rules.

6 The Social Accounting Matrix and Model's Calibration and Validation

6.1 Introduction

This chapter moves to the CGE counterfactual simulation analysis. As a preliminary to the discussion of the implications of natural resource shocks and economic policies, I provide a short review of Argentina's 2004 SAM and discuss the calibration and validation of the model. The chapter presents the values and sources of the behavioural and exogenous parameters of the model. As many parameter values are borrowed or are "guesstimates", Section 6.3 presents the range of parameter values giving a stable dynamic solution and discusses the assumptions and possible limitations of the model calibration. Following this the base run simulations are presented. To validate the model, simulated and observed figures for 2004 to 2007, the period to which most of the simulations refer, are compared and the sensitivity of the simulation results to the value of key parameters and to alternative macroeconomic closure rules is discussed. As a further check on the functioning of the model, simulation results for the extended period 2004-2010 are presented.[1]

6.2 Argentina's SAM

All CGE models are linked to a SAM, which provides the model's accounting framework and is employed to calibrate the average and distribution model parameters (Pyatt, 1988). The dynamic CGE model in this research is associated with a small SAM for Argentina updated for 2004, and built using all available data sources and the top-down cross-entropy methodologies.[2] A schematic SAM is presented in Table 6.1 to illustrate the main dimensions of the Argentine economy that are considered.

Table 6.1
A Schematic Social Accounting Matrix

			EXPENDITURE							
			Production			**Institutions**				**Total**
						Current Transfers		**Capital Tr..**		
			ACT	**COM**	**FOP**	**HHLD**	**GOV**	**INV**	**ROW**	
			5 ACT - COM (PP, MR, MO, PS, OS)		9 L 1 K	5 HHLD (quintile pci)		Priv. (by act.) & Pub.		
INCOME	**Production**	**ACT**		Dom. Production						**Gross output**
		COM	Int. consumption			Priv. consumption	Gov. consumption	Investment	Exports	**Tot. demand**
		FOP	Value added							**Tot. FOP income**
	Institutions – **Current Tr.**	**HHLD**			V.A to Hhld.		Gov. tr. Hhld.		Tr. from ROW to HHLD	**Tot. HHLD income**
		GOV	Indirect Tax		Tax to FOP	Direct tax & Hhld. Tr. to Gov.			Tr. from ROW to GOV	**Tot. GOV income**
	Capital Tr.	**SAV**				Priv. savings	Gov. savings		Foreign savings	**Tot. savings**
	Rest of the world			Imports		Hhld. Tr. to ROW	Gov. Tr. to ROW			**Tot. outflows FC**
	Total		**Total costs**	**Total supply**	**Tot. FOP Exp**	**Tot. Hhld. exp**	**Tot. Gov. exp.**	**Tot. investment**	**Tot inflows FC**	

ACT = activities; COM = commodities; FOP = factors of production; HHLD = households; GOV = government; ROW = rest of the world; FC = foreign currency; Tr. = transfers Priv = private; Pub = public ; EXP = expenditure; Int. = intermediate; L = labor; K = capital; PP = primary production; MR = resource base manufacture; MO = other manufacture; PS = producer and exportable services; OS = consumer services

The appendix to this chapter provides a complete description of the data sources and construction process of the SAM. The SAM includes accounts for the following commodities, sectors, factors, institutions[3] and transactions:

1. Five commodities and economic sectors: the traditional primary sector (PP), natural resource and non-natural resource based industries and products (MR and MO), producer and exportable services (PS), and consumer services (OS) (see also Table 5.5);
2. Ten factors of production. One aggregated capital and nine labour categories. Labour groups classify the labour force according to skills levels (skilled, semi-skilled and unskilled) and the characteristics of workers' labour relationships (self-employed, formal or informal wage labour –depending on whether they are covered or not by the social security system).[4]
3. Five household groups, classified according to per capita income;[5]
4. Indirect taxes (value added and sale taxes), trade taxes (import and export), taxes on factors of production and direct taxes on households.
5. Accounts for public and private sector investment.
6. Transfers to and from households and the government, and transfers between domestic institutions and the rest of the world.[6]

6.3 Model Calibration

6.3.1 Behavioural parameters

Calibration of the CGE model is the next step after the construction of the SAM and the definition of the behavioural and accounting equations for the CGE model. This includes assigning values to the model parameters to reproduce the initial equilibrium in the SAM and discussing the plausibility of these parameter values. Tables 6.2a and 6.2b present the values and data sources employed to calibrate the model parameters. Average and distribution parameters are calibrated using information from the SAM, and represent the largest group of parameters, and include household saving rates, household income and expenditure structure, input-output coefficients and tax rates, among others (see Table 6.2b). In the static calibration to the 2004 SAM for Argentina, most exogenous parameters and policy variables are also calibrated to the SAM or take the value of 1, as in the case of international import and export prices.

Table 6.2a
Behavioural parameter: parameter values, stability ranges and sources

Behavioural Parameters	**PV**	**Range of PV a/**		**Source**
		Max.	Min.	
Elasticity of transformation CET Fn. (c=PP and MR)	**5.00**	0.10	55	Guesstimate
Export Equation (EE) Price Elasticity (c=MO and PS)	**1.00**	0.00	7.00	Guesstimate
EE Income Elasticity (c=MO and PS)	**0.94**	-5.00	5.00	Senhadji and Montenegro (1999)
EE Elasticity to sector specific investment c=MO (c=PS)	**0.25 (0.15)**	0.00	1.00	Guesstimate
EE Elasticity Infrastructure and productive linkages c=MO (c=PS)	**0.2 (0.15)**	0.00	3.00	Guesstimate
Import equation (IM) Price Elasticity (c)	**0.2 (0.15)**	0.00	3.00	Guesstimate
IM Income Elasticity (c)	**0.25**	0.00	4.00	Catao and Falcetti (2002)
IM Elasticity to sector specific investment (c)	**2.25**	0.00	5.00	Catao and Falcetti (2002) c/
IM Elasticity infrastructure and productive linkages (c)	**0.025**	0.00	1.50	Guesstimate
Labour Saving Technical Change	**0.025**	0.00	1.50	Guesstimate
Kaldor-Verdoorn Parameter 2004-07 (2010)	**0.80 (0.5)**	0.00	1.50	Guesstimate d/
Intercept LES Consumption Fn				Based on Berges and Casellas (2002)
Mg. Propensity to Consume LES Fn.				Based on Berges and Casellas (2002)
Wage equation (WE), Productivity	**0.50**	-1.00	5.00	Estimated wit MECON b/ (MIN=-3.2/MAX = 2.37)
WE, change in CPI	**0.82**	-0.75	2.00	Estimated wit MECON b/(MIN=-1.42/MAX = .8)
WE, change in unemployment	**0.28**	0.10	1.70	Estimated wit MECON b/(MIN=-.63/MAX = 2.07)
WE, Wage Policy	**1.00**			
Investment equation (IE), response to changes in capacity utilization	**0.03**	-2.00	2.00	Estimated wit MECON b/(MIN=0/MAX =.03)
IE, changes in public investment	**0.13**	-0.50	0.85	Estimated wit MECON b/ (MIN=-.17/MAX = .04)
IE, changes in the sectoral profit rate	**2.05**	-0.70	3.25	Estimated wit MECON b/ (MIN=-0.55/MAX = 3.6)
IE, changes in real interest rate	**0.01**	-2.00	1.25	Estimated wit MECON b/ (MIN=-.06/MAX = .01)
Labour supply adj. to wage differentials	**0.05**	0	2	Guesstimate
Mark-up elasticity to changes in total demand for MO (PS) commodities	**0.1 (0.085)**	0	3	Guesstimate

***Table 6.2a** (Continuation)*

BEHAVIOURAL PARAMETERS
Note: PV = Parameter value; MECON = Ministry of Economy and Production; adj.=adjustment
a/ Range of parameters values giving a stable dynamic solution for the period 2004-2007; b/ Maximum and minimum parameter values according to MECON Macroeconometric Structuralist Model; c/ Adjusted upwards in line with Nicolini-Llosa (2007) estimations. Catao and Falcetti elasticity parameter equal 1.92; d/ The value of the Kaldor-Verdoorn parameter for the period 2004-2007 is in line with estimations by Narodowski and Panigo (2007), whose estimated coefficient for the period 2002-2005 equals 0.92;

Behavioural parameters, on the other hand, are *borrowed* from other studies or are *guesstimates*. Parameter values for the CGE model export demand and supply equations, nominal wages and productivity equations and the private investment equation are presented in Table 6.2a. This table presents parameter values, the studies and data sources providing them and the range of values giving a stable dynamic solution to the CGE model. Section 6.5 presents a sensitivity analysis of the simulation results for the values of the key parameters in this research (i.e. endogenous productivity parameters and determinants of non-price competitiveness).

Previously discussed differences regarding the model specification and the rationale behind Argentina's exporting sectors are included in the model calibration. The model assumes a high elasticity of transformation (sigma = 5) for natural resource related products (PP and MR). Although high parameter values may overestimate the economic or sectoral response to changes in international conditions or trade policy (Vos, 2007), a high elasticity of transformation is a realistic and relevant assumption to describe the behaviour of Argentina's natural resource sectors. As mentioned in Chapter 5, high CET parameter values imply that sectors PP and MR are flexible, and able to reallocate supply between the domestic and external markets and reflect the country's capacity to export its production surplus. The flexible reallocation of production also increases the pass-through of changes in international to domestic prices, a phenomenon that has affected the Argentine economy and is explored in the CGE model.

Exports from the capital and knowledge intensive sectors (*MO* and *PS*), as discussed in the model presentation, are determined using an export demand equation. The parameters concerned, therefore, are not related to the allocation of supply, but to the variables and factors that affect the demand of these particular products. The income elasticity of exports, mediating the relation between exports and changes in the incomes of trading partners, equals 0.94, which is the short run elasticity for Argentina's exports estimated by Senhadji and Montenegro (1999). This elasticity value is higher than the cross-country elasticity estimated by these authors and, to some extent, captures the sensitivity of Argentina's exports to changes in the incomes of other Latin American countries (especially Brazil), which are the destinations of more than 50% of Argentina's non-agricultural industrial exports according to recent figures from the National Bureau of Statistics.

Demand for Argentina's non-natural resource exports is assumed to have unitary price elasticity. This is a reasonable assumption for a country that exports medium technology products in a regional market. This value is also compatible with the figures provided by Catao and Falcetti (2002), who estimated a unitary elasticity of Argentina's exports to changes in unitary labour costs.

The dynamic CGE model innovates over existing applied models by establishing a link between (the competitiveness of) exports and two additional factors. Sector specific capital accumulation, in the first place, and the expansion of productive linkages –supplied by sector PS in the CGE model– providing specialized inputs and other more general and competitiveness enhancing services, as for example communication, finance and transportation services, in the second place. Calibration of the model, therefore, requires the definition of parameter values for these two additional variables entering the export demand equation.

Although the inclusion of these factors is not common in empirical studies, the econometric estimations in Leon-Ledesma (2002), for the OECD countries, and Catao and Falcetti's (2002) econometric study of Argentina's trade determinants, provide insights that are relevant to the calibration. In both these studies, non-standard factors –other than relative prices and foreign income– are found to be an important and statistically significant determinant of export performance in the long-run. This is the case for the variable for the non-price competitiveness determinants of exports and the investment-output ratio included in Leon-Ledesma's extended cumulative growth model. It also applies to capital accumulation in Catao and Falcetti's export supply and demand system.

These studies provide evidence of the economic relevance of the two additional export determinants added to the CGE model export equation. Their parameters estimations, however, cannot be *borrowed* to calibrate the CGE model because the above mentioned studies perform long-run estimations, and the CGE model calculates exports on a yearly basis and thus needs to be fed with short-run parameters.

In line with Catao and Falcetti's findings that capital accumulation influences exports in the long-run but not in the short-run, low parameter values are employed to calibrate the CGE model's export equation. The parameter capturing the elasticity of exports to capital accumulation is assumed to have a value of 0.25 (0.2 for sector PS) and elasticity of productive linkages and provision of infrastructure is assumed to equal 0.15. Two factors justify the differences in the non-price elasticity parameters. First, the model calibration assumes a higher elasticity to capital accumulation because the bulk of Argentina's non-natural resource exports are capital intensive and, thus, tied to the dynamism of investment. Second, the calibration assumes lower export elasticity to the expansion of productive linkages and infrastructure to reflect that their development is a lengthy process, which does not have an immediate effect but rather an effect that unfolds over time.[7]

The dynamic CGE model includes four import demand equations, one for each tradable commodity. These equations are analogous to the export demand equations and link imports to the evolution of real GDP, relative prices and non-price competitiveness determinants. One particular characteristic of the Argentine economy is its high propensity to import; a feature that is better captured using import demand equations rather than the Armington system frequently used in trade-related models.[8]

Price and income import elasticities are calibrated taking into account Catao and Falcetti's (2002) estimations. According to this study, the short term price elasticity of imports is 0.25 and the income elasticity of imports has the value 1.92. Because some recent econometric estimations find a stronger relationship between Argentina's imports and output growth (see e.g. Nicolini-Llosa, 2007b),[9] the income elasticity of imports used in the model is 2.25. In all cases, these values illustrate the strong connection between Argentina's imports and the economic cycle and their unresponsiveness to changes in relative prices, especially in the short-term.[10] Due to a lack of empirical estimations, and to reflect Argentina's structurally high import dependency, the elasticity of imports to the determinants of non-price competitiveness is assumed to have very low values.[11]

Labour productivity growth, together with exports from sectors *MO* and *PS*, is another variable that shows cumulative effects. Labour productivity grows due to labour-saving technical change, which is assumed to be exogenous and increases by 2% per year, but also varies according to changes in aggregate demand, increasing when it expands and falling otherwise. The relation between demand and productivity growth is captured by the so-called Kaldor-Verdoorn parameter, named after the authors who first estimated and established this relationship.

Several authors have attempted to estimate the importance of demand as a source of productivity and output growth. Using less and more sophisticated econometric techniques, authors have suggested that the Kaldor-Verdoorn coefficient fluctuates around 0.6 (see e.g. Ros, 2000; Leon-Ledesma, 2002; Rada and Taylor, 2004). Recent estimations of the Kaldor-Verdoorn coefficient for Argentina find higher values. According to Narodowski and Panigo (2008), the impact of aggregate demand on productivity growth was 0.92 in 2002-2005, the period nearest to the CGE model simulations.

Estimations commonly are performed for medium and long-term periods, and as single equation estimations (with the exception of León-Ledesma's cumulative causation model) and include aggregate or sectoral output as the sole determinant of productivity growth. Because, in the first place, regressions including only one independent variable are likely to overestimate the impact of demand on productivity growth –due to omitted variables, and because in the second place labour productivity growth in the CGE model depends on supply-side determinants, the model is calibrated assuming a Kaldor-Verdoorn parameter lower than the estimated effect. For simulations covering the period 2004-2007, the coefficient is 0.8, lower than recent estimates for Argentina, and takes the value of 0.5, close to standard estimations, in simulations covering the extended period 2008-2010 (when excess capacity is expected to decrease).[12]

A Kaldor-Verdoorn coefficient of 0.8 is larger than the values commonly found in the literature. But it is not only compatible with the abovementioned recent estimations for Argentina, it also is necessary to approximate observed increases in the real output and employment ratio. According to data from Argentina's Ministry of Economy and Production (MECON), the output-employment ratio increased by more than 25% between 2004 and 2007, an expansion enabled by the high unemployment and excess capacity levels observed in Argentina after the 2001-2002 crisis.

Indeed, to the extent that the counterfactual analysis is performed with a dynamic model, the model is calibrated to reproduce the initial equilibrium, but also to replicate, as best as possible, the evolution of key macroeconomic variables for the years for which information is available. The close relation between observed macroeconomic trends and simulated trends for the period 2004-2007 (presented in the next section), suggests, therefore, that the Kaldor-Verdoorn coefficient and non-price trade elasticities, for which reliable estimations are not available, are calibrated using plausible figures.

The remaining behavioural parameters are taken from existing studies and estimations obtained using alternative models. Price and income elasticities of household demand are taken from Berges and Casellas (2002) and are employed to calibrate the intercept and marginal propensities of the household linear expenditure system according to the Frisch methodology.[13] [14]

The parameters of the wage and investment equation were defined in collaboration with Argentina's Ministry of Economy and Production, using an internal and unpublished dynamic macroeconometric model. The government's model is adjusted to approximate the wage and investment equation in the dynamic CGE model used in this research and provides maximum and minimum parameter values of these equations. To take account of the structural break associated with 2001-2002 crisis, most estimated parameters correspond to the period 2003-2006. Although the Argentine Government's model specifications are not equivalent to the CGE model's wage and investment equation –the former estimates aggregate wages and investment and the latter works with labour and sector specific equations– they constitute the best approximation available for the effects taken into account in CGE the model.

Table 6.2a presents the parameter values used to calibrate the model (column (1)) and the maximum and minimum values defined in joint collaboration with MECON (columns (4) and (5)). The calibration of the wage equation is based on what was considered by government officials to be the best estimation. This suggests: (i) an intermediate response of wages to labour productivity growth, with the respective coefficient taking a value equal to 0.5; (ii) an indexation parameter equal to 0.82, consistent with a period of fast output and labour demand growth, accelerating inflation and an increase in the negotiating power of the labour unions; and (iii) a moderate elasticity to the situation of the labour market, since the coefficient linking wage growth to changes in unemployment equals 0.28.[15]

Collaboration with MECON also enabled calibration of the private investment equation. MECON's parameter values are obtained using an aggregate investment equation, where investment growth is a function of output growth, public investment, changes in aggregate profits and the domestic real interest rate, and is then employed to calibrate the CGE model's sectoral equations. This implies no sectoral differences in investment behaviour, an assumption that perhaps sounds unrealistic. Lack of information on these differences, however, makes aggregate estimations the best approximation for private investment decision making.

The econometric estimations suggest a very weak response of total investment to output growth, public investment and increases in the cost of capital. The CGE model, therefore, is calibrated assuming the maximum values obtained for these parameters. As shown in Table 6.2a, the CGE model assumes an acceleration parameter equal to 0.03, a crowding-in parameter equal to 0.13[16] and a real interest rate coefficient equal to 0.01. While the low impact of the first two effects is somewhat surprising, the limited impact of the real interest rate on investment reflects the reduced ability of monetary policy, especially changes in interest rates, to affect aggregate demand (Frenkel, 2007a, 2007b; 2008).

Increases in profits, therefore, are the main driving force behind investment. In contrast to other variables entering the investment equation, the CGE model is calibrated not taking the maximum parameter value, but rather using an intermediate value equal to 2.05. In a context of highly volatile international prices, domestic price controls and varying subsidies and compensatory transfers affecting sectoral profits, the model is calibrated using an intermediate rather than the maximum value –as with other RHS variables– to reduce the volatility of investment. As with the Kaldor-Verdoorn coefficient, parameter values are also defined in relation to the dynamics of the economy and the model's capacity to replicate the trends observed in aggregate macroeconomic variables.

Together with parameter values and sources, Table 6.2a shows the range of values for which the dynamic CGE model works. None of the model's parameters, as shown in columns (2) and (3) of Table 6.2a, is at bound, but rather is distant from the values that make the dynamic CGE model unstable. This suggests that the functioning and stability of the dynamic CGE model do not depend on any particular parameter value and that the model works for values close to those defined in this calibration.

6.3.2 Exogenous parameters in the dynamic CGE model

To calibrate the dynamic model requires information on the evolution of exogenous and policy variables for 2004-2007, the period for most of the simulations. It is necessary also to make assumptions about the evolution of exogenous variables for 2008, 2009 and 2010 to enable some simulations over an extended time period. Table 6.2b presents the average and distribution parameters calibrated to the SAM, and shows the values taken by the exogenous parameters and the sources of information for these exogenous variables.

Data on growth in labour supply, base run capacity utilization and on the evolution of import and export prices are from the National Bureau of Statistics (INDEC). Labour supply is assumed to grow at an average rate of 1.9%, equal to the annual rate of growth of Argentina's population, an assumption customary in CGE modelling. According to INDEC, capacity utilization in 2004 was equal to 67%, a value that reflects the severe slow down in economic activity that occurred in connection with the 2001-2002 crisis and previous recession, and facilitates the expansion of production as demand regains strength.

The evolution of international import and export prices is calibrated using the average rate of growth in 2004-2007. Period average rather than yearly changes are employed to ensure the stability of the model in a context of drastic price changes, but without affecting the main trends characterizing the period: the sustained expansion in Argentina's primary commodity and resource intensive manufacturing exports, which underlie the improvement in the terms of trade observed in recent years. In 2008-2010, growth in international import and export prices is assumed to slowdown 30% per year, as world supply responds to the price increases observed in 2004-2007. World output growth, in turn, is assumed to grow at the average rate for member countries of ALADI (Latin American Integration Association), the destination for more than 50% of Argentina's industrial exports. Yearly growth rates are calibrated to observed rates for the period 2004-2007, and the average for this period is the growth rate assumed for the extended period 2008-2010 (see Table 6.2b).

Table 6.2b
SAM calibrated parameters and exogenous and policy variables

Exogenous Variables	Year / Period					Source
	2004	2005	2006	2007	2008-10 a/	
Export price growth (%) **b/**						
Primary commodities (PP)		7.2	7.2	7.2	30% annual red.	MECON
Resource-based manufactures (MR)		8.0	8.0	8.0	30% annual red.	MECON
Non-resource products (MO, PS)		7.3	7.3	7.3	30% annual red.	MECON
Import price growth (%) **b/**						
Primary commodities (PP)		24.0	24.0	24.0	30% annual red.	MECON
Resource-based manufactures (MR)		4.7	4.7	4.7	30% annual red.	MECON
Non-resource products (MO, PS)		5.0	5.0	5.0	30% annual red.	MECON
World income growth (%)		5	4.4	3.9	3.9	CEPAL
Growth in government (GOV) consumption (%)		6.12	5.25	7.37	6.25	MECON
Growth in GOV investment /a (%)		53.00	44.00	47.50	30% annual red.	MECON
Growth in GOV transfers to rest of world (ROW) (%)		-43.4	-31.7	21.8	8.00	MECON
Growth in GOV transfers to households (HHLD)	Constant in real terms, adjust with CPI					
Growth in HHLD transfers to GOV	Constant in real terms, adjust with CPI					
Growth in HHLD transfers to ROW (%)		22.37	22.37	22.37	22.37	MECON
Growth in transfers from the ROW to GOV (%)		37.19	37.19	37.19	3.90	MECON
Growth in transfers from ROW world HHLD (%)		10.35	10.35	10.35	10.35	MECON
Growth in subsidy sector MR (%)		100	100	100	0	Guesstimate
Capacity output ratio 2004 (%)	67					INDEC
Base run unemployment rates (%)	13.6					INDEC
Nominal interest rate	10,8%	10,5%	12,9%	13,4%	2% annual inc.	MECON
Nominal exchange rate (2004=1)	1.00	0.99	1.05	1.06	constant	BCRA
Labour force growth (%)	1.92	1.92	1.92	1.92	1.92	INDEC
Depreciation rate (%)	8.8	8.8	8.8	8.8	8.8	Maia and Nicholson

***Table 6.2b** (Continuation)*

Note: PV = Parameter value; MECON = Ministry of Economy and Production; INDEC = National Bureau of Statistics and Census; GOV=government; ROW=rest of the world; HHLD=household; red.=reduction; inc.=increase

a/ Figures for the period 2008-2010 are previous period averages or guesstimates about future trends (see text)

b/ data for PP corresponds to Argentina's primary commodity products; data for MR corresponds to Argentina's MOA (Manufactures of agricultural origin) products and data for MO & PS corresponds to Argentina's MOI (manufactures of industrial origin)household saving-rate; export, import, factor (labour and capital) and direct and indirect taxes; weights (consumer, capital and tradable) price indices; input-output coefficient; output coefficient; incremental capital-capacity ratio; public and private investment demand proportions; export share and shift parameter from CET function; Share factor (labour and capital) income to households; structure government consumption.

A special remark has to be made about these data, for there are differences in terms of the boundaries and the universes covered by the CGE exogenous parameters and the variables that provide information on their trends. Economy-wide capacity utilization is approximated using information on the industry sector, the only sector with data on excess capacity. The evolution of international import and export prices in the model is approximated based on INDEC's price estimations. Although the commodity classifications in the model and INDEC refer to similar but not identical products,[17] meaning that the calibration could be imperfect or biased, INDEC prices are an inaccurate, although the best, proxy for the trend in exogenous international prices in the CGE model.

Data on the evolution of interest and exchange rates are from Argentina's Central Bank statistics. As shown in Table 6.2b, these two nominal variables have experienced small increases in recent years, in part, reflecting the stable and competitive exchange rate policy implemented in Argentina, which requires small nominal devaluations to maintain a real competitive exchange rate and changes in the interest rate to sterilize the Central Bank's interventions in the foreign exchange market.[18] Interest rates are assumed to grow at a moderate (2%) rate in the future (2008-2010) and, as no major changes in the orientation of Argentina's macroeconomic policies are envisaged in the near future, the nominal exchange rate is assumed to remain constant. However, these rates are two of the model's policy variables and will take different values in the simulations to evaluate the effects of policies linked to the exchange rate regime and/or to control domestic inflation.

The evolution of government consumption, investment and transfers is calibrated using data from MECON, which also provide the information about transfers between domestic institutions and the rest of the world. Yearly official data are used to calibrate government consumption and investment for the period 2004-2007. As shown in Table 6.2b, these categories of government expenditure have expanded at annual rates respectively of close to 6% and 50%, increases that are analysed via the model simulations, and which have important implications for the adjustment of the economy to resource shocks and the exchange rate policy. In subsequent years (2008-2010), the CGE model is calibrated assuming a slow down in the rate of growth of public investment (30% per year, similar to the reduction assumed for other exogenous variables) and that government consumption evolves at the average rate observed in 2004-2007.

Due to lack of data, the SAM and the CGE model do not take into account intra household transfers. Transfers between households and the government, on the other hand, are assumed to be constant in real terms, adjusting according to the evolution of the consumer price index.[19] Also due to lack of reliable empirical information, the calibration assumes that subsides to food producers (sector MR in the model) double year on year, between 2005 and 2007,[20] (but do not grow between 2008 and 2010), capturing the effect of Argentina's discretionary subsidies policies to compensate for rising input costs and to ensure domestic supply of wage-goods and the partial elimination of this policy in 2008. This policy is also analysed via the simulations.

Transfers between domestic institutions (households and government) and the rest of the world have been very volatile in recent years, partly as a consequence of Argentina's default in 2002 on its external debt and the debt restructuring process that ensued. In the case of transfers between households and the rest of the world, to smooth the functioning of the model, the evolution of transfers to and from abroad are calibrated using average growth rates for the period 2004-2007. In the case of transfers from the government to abroad, these are calibrated using yearly data for the 2004-2007 period, to capture the significant slowdown in these government transfers that occurred in 2005 and 2006, and their recovery starting in 2007 following Argentina's debt restructuring process. In subsequent years (2008-2010), government transfers to the rest of the world are assumed to growth at the average rate of growth of real output, for Argentina linked its interest payments to the evolution of output. Finally, transfers from abroad to the government during 2004-2007 are calibrated to the average growth rate for the period, and are assumed to grow in line with the rate of growth in world output for the period 2008-2010.

6.4 The Base Run Scenario and Model Validation

This section presents the base run simulation of the dynamic CGE model. Its main purpose is to validate the model and to identify some of the key events characterizing Argentina's recent economic performance, which is explored further in succeeding sections.

The base run simulation uses the calibrated model and benchmark closure rules: quantity adjustments in factor markets; exogenous government expenditure; a fixed nominal exchange rate calibrated to reproduce the annual average nominal exchange rate figures resulting from Argentina's managed exchange rate regime; and the Keynesian adjustment for the savings-investment balance whereby output adjusts to provide the savings required to finance investment. Two sets of simulations are presented in this chapter. The first covers the period 2004-2007 and enables comparison between observed and simulated trends in selected macroeconomic variables. This set of simulations is used to validate the model and to explore the sensitivity of results to alternative key parameter (Kaldor-Verdoorn coefficient and the parameters of the excess demand equation) values and closure rules. The second set covers a longer time period (2004-2010) and basically explores the functioning of Argentina's economy in the near future, assuming that –as discussed in the previous section– most exogenous factors behave as in the period 2004-2007, or that their rate of growth decelerates.

Combined with information on behavioural parameters, the calibration feeds the model with data on the exogenous variables and parameters. Trends in international export and import prices, changes in the nominal exchange rate and the evolution of government consumption and investment are among the main exogenous impulses affecting the Argentine economy and, therefore, constitute some of the fundamental events and information that are considered in the analysis.

Table 6.3 shows that export prices, in particular the prices for natural resource products, whether primary commodities or manufactured, grew at an annual rate of nearly 8% between 2004 and 2007. This underlies the improvement in Argentina's terms of trade and illustrates the positive demand shock associated with expansion in China and India and other recent events. Small nominal exchange rate devaluations in 2006 and

2007, rapidly growing public investment and low or moderate growing government consumption –mostly before the 2007 elections– according to official data, expanded at average annual rates of around 50% and 6% respectively between 2004 and 2007. These factors stand out as some of the main policy variables affecting the domestic adjustment in the Argentine economy.

Table 6.3
Annual growth in selected exogenous variables. 2004-2007

			EXPORT PRICE INDEX (2)			GOV. EXPENDITURE (1)	
	NER (1)	TOT (2)	PP	MOA	MOI	GOV. CONS.	GOV. INV.
2005	-0.6 %	-1.9 %	-8.5 %	-6.1 %	12.2 %	6.1 %	53.0 %
2006	5.8 %	6.1 %	11.1 %	7.9 %	7.1 %	5.3 %	44.0 %
2007	1.4 %	3.6 %	21.3 %	24.2 %	2.9 %	7.4 %	n.a.
			Annual average percentage change				
2004-2007	2.2 %	2.5 %	7.2 %	8.0 %	7.3 %	6.2 %	48.0 %

Source: (1) Secretary of Economic Policy, MECON (Ministry of Economy and Production); (2) INDEC (National Bureau of Statistics);

NER = nominal exchange rate; TOT = terms of trade; PP = primary products; MOA = manufactures of agricultural origin; MOI = manufactures of industrial origin; GOV= Government; CONS = consumption; INV = investment

Fast growth in output and the components of aggregate demand characterize the response of the Argentine economy to exogenous impulses and endogenous transformations. It is expected, therefore, that the dynamic CGE model will replicate the trends observed in Argentina's macroeconomic variables. Table 6.4. shows base run scenario simulations for Argentina's annual average growth rates. The information is based on growth in real GDP and the main components of aggregate demand, consumption, investment, exports and imports, and other relevant macroeconomic data such as total employment, the CPI and average real wages. Although inaccuracies in the model specification, missing information and "unobservable" factors (or factors not considered by the model) influence the simulations, Table 6.4 shows that, in the case of most variables, the baseline simulation projects growth rates similar to those reported in official statistics.

As shown in Table 6.4, the model shows rapid real output, consumption and exports growth, and even faster growth in total investment and imports, which in all cases differ from official trends by in less than 10%. According to the figures in the table, the model simulates inflation rates very similar to those observed between 2004 and 2007. However, the figures for employment and real wages exceed or fall short of observed trends by higher margins.

The presence of significant excess capacity in Argentina after the long slowdown and serious crisis that occurred between 1998 and 2002 is the main reason for the model's overestimation of total employment growth. Despite the assumption of "reasonable" and large labour-saving technical change and Kaldor-Verdoorn parameters, the model fails to reproduce the fast expansion in average labour productivity growth observed in Argentina between 2004 and 2007.[21] Two factors that may explain the model's underestimation of real wage growth are the abovementioned underestimation of labour productivity growth, and the moderate wage response of nominal wages to improvements in labour market conditions.

Table 6.4
Model validation: observed and simulated trends in selected macroeconomic variables. Annual average growth 2004-2007

Selected Macroeconomic Variables	Observed Trends (1)	Base Run Scenario (2)
Gross Domestic Product	8.8 %	7.9 %
Total Consumption	8.2 %	8.2 %
Total Investment	18.4 %	17.0 %
Total Exports	9.9 %	10.2 %
Total Imports	18.7 %	19.6 %
Total Employment	3.2 %	5.3 %
Consumer Price Index	9.8 %	9.9 %
Av. Real Wage	9.7 %	4.9 %

Source: Column (1): INDEC (National Bureau of Statistics), Ministry of Economy and Production. Secretary of Economic Policy, and and CENDA, El trabajo en Argentina: condiciones y perspectivas, No. 8, 11 and 13 (for real wages)

Column (2): model computations

Because period average figures from official estimations and the base run simulation may be similar, but at the same time show differences in short-term changes, validating the model requires a comparison of yearly

Figure 6.1 *Observed and simulated trends in real GDP. 2004-2007 (2004=100)*

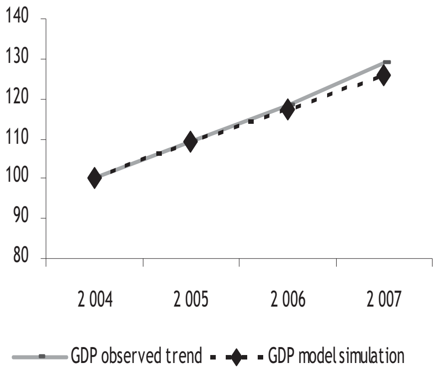


Figure 6.2 *Observed and simulated trends in private consumption. 2004-2007 (2004=100)*

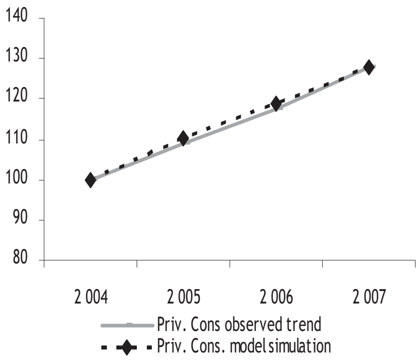


Figure 6.3 *Observed and simulated trends in private investment. 2004-2007 (2004=100)*

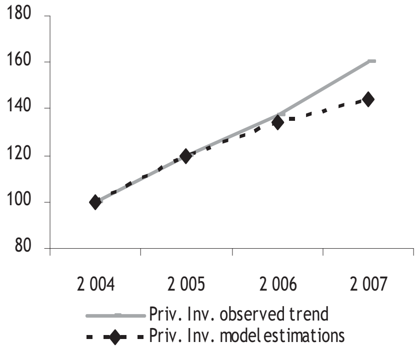


Figure 6.4 *Observed and simulated trends in total exports. 2004-2007 (2004=100)*

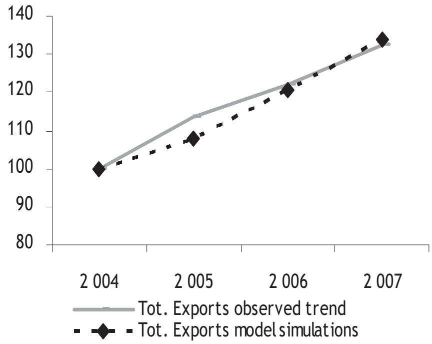


Figure 6.5 *Observed and simulated trends in total imports. 2004-2007 (2004=100)*

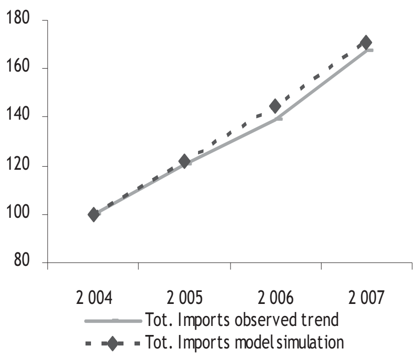
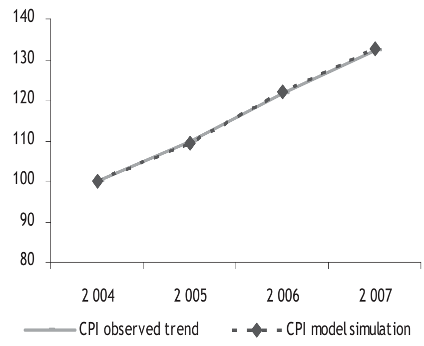


Figure 6.6 *Observed and simulated trends in consumer price index. 2004-2007 (2004=100)*



figures as well. Figures 6.1 to 6.6 compare the evolution of the macroeconomic variables for 2004 to 2007. They show that the model replicates the evolution of private consumption, import demand and changes in consumer prices with significant precision, but is less accurate about yearly changes in real GDP, private investment and total exports. In these last three cases the simulated and real trends are very similar, but inaccuracies arise because the model: (i) fails to reproduce the increases in private investment observed between 2006 and 2007; and (ii) does not display the smooth fluctuations observed in total exports. The small inaccuracies in the evolution of these variables may well be associated with the calibration in the model of export prices based on period averages rather than yearly figures. As Table 6.3 shows, export prices experienced significant increases in 2006 and 2007 which, if translated into higher profits, would further expand investment and output. However, these changes are smoothed by the use of period average figures to improve the overall functioning of the model.

6.5 The Base Run Scenario: Sensitivity Analysis

The dynamic CGE model was designed to capture a number of propositions about the functioning and characteristics of the Argentine economy which, in combination with economic policies, influence its economic performance and how it responds to economic shocks. Prior to analysing these shocks and policies, the topics of Chapters 7 and 8, an evaluation is required of the model's sensitivity to certain key parameter values and alternative assumptions about macroeconomic adjustments, as reflected in the model's closure rules.

One of the propositions of this research is that the competitiveness of the non-natural resources tradable sectors (MO and PS), especially in relation to exports, depends on relative prices, but also on capital accumulation and the development of productive linkages and infrastructure. To study the role played by these factors, the base run simulation assumes that exports from sectors MO and PS depend on price competitiveness and foreign income, but that factors determining the non-price competitiveness mentioned above play no role. Column (3.a) in Table E6.1 summarizes the response of the Argentine economy under this alternative assumption. The change has a small negative impact in most real macroeconomic variables, but is more significant in the case of total exports, which fall more than 10% in relation to the base run simulation, reflecting the reduction in non-natural resource exports (see Table E6.1. columns (2) and (3.a) rows (4), (22) and (23)).

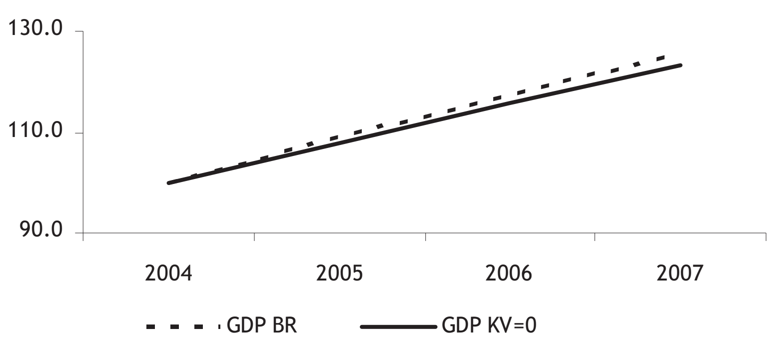
Given the changes in international prices, nominal exchange rate and world income, estimated by various sources, and the borrowed price and income elasticity parameters, the simulation shows that the model's results capture the proposition developed in Chapter 3 on the importance of productive linkages and infrastructure for export competitiveness.[22]

A second proposition of the research incorporated in the CGE model is that labour productivity growth is linked to the evolution of demand (as discussed in Chapter 4). To evaluate the endogenous and cumulative relation between these two variables and to evaluate the sensitivity of the results to this characteristic of the model, the baseline simulation is repeated assuming the Kaldor-Verdoorn parameter to be zero.

Column 4 in Table E6.1 summarizes the results of this simulation. The results show that the model captures the cumulative effects discussed in Serino (2007) and Chapter 4. Also, and importantly, the simulation suggests that the endogeneity of labour productivity could have contributed to creating a virtuous circle-type process whereby recovery in demand encourages labour productivity growth, improving the competitiveness of mark-up sectors MO and PS, accelerating exports, employment, real wages and output growth. Comparison of columns (2) and (4) reveals these changes. According to the figures in Table E6.1, in the absence of endogenous productivity growth, the price competitiveness of non-natural resources exports, as captured by the exchange rate linked to commodities MO and PS, experiences a significant reduction (see rows (14) and (15)). This follows in part from rising unit labour costs in these sectors, which increase by more than 10% vis-à-vis the base run (see rows (24) and (25)). Consequently, exports and output in sectors MO and PS fall, reducing real output and consumption growth by more than 8% and 5% respectively in relation to the base run (see Table E6.1. columns (2) and (4)).[23]

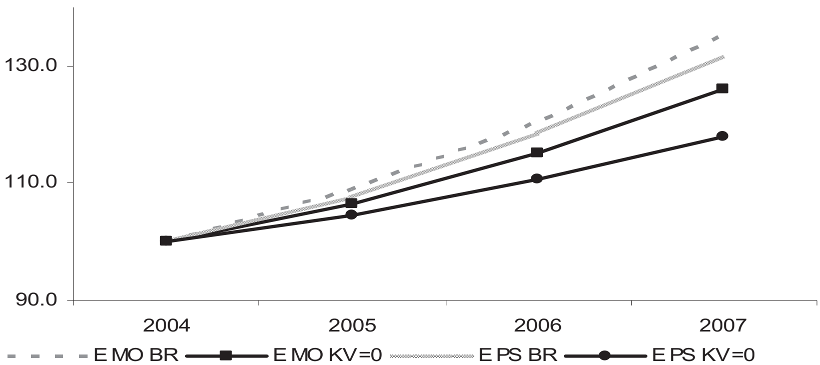
The implications of the Kaldor-Verdoorn effects for the dynamism of output and non-natural resource exports can be depicted graphically (see Figures 6.7 and 6.8). In these figures, the dotted line is the base run simulation and is always above the alternative simulation assuming no endogenous productivity growth. The importance of this effect, as discussed above, is greater in the case of exports.

Figure 6.7
GDP in the base run simulation (GDP BR) and assuming no Kaldor-Verdoorn effects (GDP KV=0). 2004-2007, 2004=100



Even though these last three estimations may overestimate the role of non-price competitiveness factors and endogenous productivity growth, they suggest that not only shocks and policies but also cumulative processes under pin Argentina's recent economic process.

Figure 6.8
Exports from sectors MO and PS in the Base Run (BR) and assuming no Kaldor-Verdoorn effects (KV=0) 2004-2007, 2004=100



6.6 The Base Run Scenario: Alternative Closure Rules

How an economy responds to shocks and economic policies is influenced by the modeller's assumptions about the mechanisms required to balance macroeconomic identities. The closure rules for external balance and government deficit tend to be context specific. They are in general defined to capture the characteristics of the exchange rate regime, in the first place, and public finance requirements and the government's capacity to obtain the necessary funds to pay for its expenditures, in the second place. Although assumptions concerning the balance between savings and investment need also to be consistent with the macroeconomic environment, the saving-investment closure rule reflects the theoretical backgrounds of both the researcher and the model.

The benchmark specification of the model assumes a fixed exchange regime and exogenous government expenditure, both assumptions that are in line with Argentina's competitive exchange rate policy and the surpluses observed in government accounts in recent years. The benchmark specification also assumes a Keynesian closure rule for the saving-investment balance, where output adjustments generate the savings that are needed to finance investment; an assumption that is compatible with both the structuralist characteristics of the model and the presence of excess capacity in Argentina during the simulated period.

Analysing the model results under alternative closure rules is good modelling practice and, in relation to the base run simulation, contributes to completing validation of the benchmark specification of the CGE model. Observed and base run trends, therefore, are compared to the trends obtained using: (i) the neoclassical closure rule, where investment adjusts to be in accordance with available savings, as determined by the household, government and external-income expenditure balances; and (ii) the so-called Kaldorian closure rules, which assume that investment decisions are exogenous and the savings rates of the richest households adjust and provide the savings required to finance investment.

Columns (3) and (4) in Table E6.2 show how, given the values of exogenous parameters, the Argentine economy would have behaved under the neoclassical savings-driven investment and the Kaldorian closure rules. Although the model displays fast rates of economic growth under these alternative closure rules (with output expanding more than 7% a year during 2004-2007), growth rates are lower than observed in national accounts and slower than those obtained via the base run simulation performed under the Keynesian closure rule. Moreover, the model fails to replicate the observed dynamism of investment under the neoclassical closure rule (it is close to 15% lower than in the base run, see Table E6.2 columns (1), (3) and (4), rows (1) to (4)). The evolution of investment is not so different from the observed trends under the Kaldorian closure rule. Yet total real consumption and exports do differ from observed trends (falling short and surpassing Argentina's trends by more than 20%) (see Table E6.2 columns (1), (3) and (4) rows (1), (3) and (4)).

Under the neoclassical closure rule, external sector performance explains the limited dynamism of investment: in savings-driven models a current account surplus(deficit) reduces(increases) the amount of savings available in the economy and thus reduces(increases) domestic investment. In consequence, any policy or shock that improves the current account, diminishes investment. Indeed, in savings-driven models fast export growth can only be accompanied by fast growing investment if the current account is brought into balance or deficit through a higher propensity to import and/or high interest payments to the rest of the world which attract foreign savings to the country. It should be noted that these conditions, and especially the second one, are not compatible with Argentina' experience in recent years.

On the other hand, the differences between real trends in consumption and exports and simulated trends under the Kaldorian closure rule are due to the increase in household savings required to finance investment. Higher household savings in the richest quintile brings a reduction in consumption that increases all types of exports. This is because lower domestic demand reduces the price of domestically produced goods, increasing the incentives to export in the case of natural resource products, and improving the competitiveness of exports from sectors MO and PS. Export growth also expands vis-à-vis the base run for similar reasons – lower domestic demand, prices and exchange rate appreciation– under the neoclassical closure rule, though the expansion in this case is much lower than under the Kaldorian closure rule (see Table E6.2 columns (1), (3) and (4)).

6.7 The Base Run Scenario: Future Trends

This section presents the simulations results for the extended period of time, in order to investigate and discuss future trends in the Argentine economy and to provide further validation for the model. In line with current debate, and projects designed to celebrate Argentina's bicentenary, the model simulations are extended to cover the period 2004-2010. The simulations are presented in Table E6.3. They are run using the benchmark specification of the model, assuming quantity adjustments in factor markets, exogenous government expenditure, a fixed exchange regime, the Keynesian closure rule and exogenous parameter values as described in section 6.3 and Tables 6.2a. and 6.2b.

The model functions for this extended time period and simulations (2004-2010) show similarities and differences with the "medium-term" simulations (2004-2007). As shown in Table E6.3, medium-term and medium-term "plus" simulations coincide in relation to changes in the composition of aggregate demand, since in both simulations investment and export grow faster than consumption and output (see Table E6.3, columns (1) and (2), rows (1) to (4)).

However, the simulations differ in relation to growth rates since output, consumption, investment, employment and domestic prices in the "long-run" grow slower than in the 2004-2007 period. These differences are significant in the case of investment and domestic inflation whose growth rates are 40% lower than in the medium-term scenario, and are linked to the reduction in the rate of expansion of the exogenous parameters (the rates of growth of key variables such as the international price of Argentina's exports and imports and public investment, as presented in previous sections, are assumed to slow down their fast rates of growth 30% per year since 2008). Figure 6.9 depicts the evolution of a selected group of macroeconomic variables for the period 2004-2010, and shows that the slowdown in exogenous impulses has a particularly strong impact on investment and domestic prices, curving down their trends after 2007.

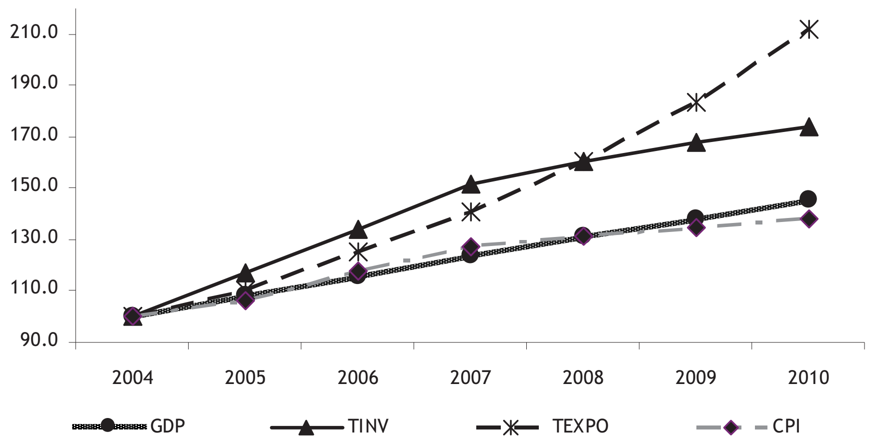
Investment falls because with lower international export prices private profits shrink, and domestic prices slow down as "exogenous" sources of inflation diminish. It should be remembered, however, that the model assumes imperfect indexation and does not take into account the role of expectations; thus it might be underestimating increases in domestic prices, especially in 2007 and 2008, when inflation seems to be accelerating.[24]

Another important difference related to the middle-term base run simulation is the acceleration of export growth. In contrast to other macroeconomic variables, there are endogenous factors underlying the expansion of exports. Exports of natural resources products (PP and MR) grow slightly faster than in the previous simulations because with lower domestic demand exporting becomes more profitable, even if international prices fall. Industrial and service exports, not related to the natural resource sectors, growth faster than in medium-term simulations because they experience almost no price competitiveness loss, especially in the case of industrial exports (MO) (see Table E6.3, columns (1) and (2), row (4) and (20) to (23)).

As shown in Table E6.3, the slower expansion in economic activity leads to lower employment growth (see Table E6.3, columns (1) and (2), row (6) and (24) to (29)). By contrast, real wages grow by more than 5% per year, a faster expansion than the one observed in the medium-term due to lower inflation.[25]

Overall, the simulations show that the model is stable in the long-term and, as Table E6.3 and the following chapters show, functions correctly for different parameter values, economic shocks and policies.

Figure 6.9
2004-2010. Base run simulation selected macroeconomic variables: GDP, Total Investment (TINV), Total Exports (TEXPO), Consumer Price Index (CPI). (2004=100)



6.8 Final Remarks

This chapter presented the main characteristics of Argentina's SAM, described the calibration of the CGE model's parameters and the baseline simulation that will be employed in succeeding chapters. Although most parameter values are guesstimates or are borrowed from other studies, they are plausible figures and ensure the model's dynamic stability.

The dynamic CGE model behaves well and reproduces the evolution of most macroeconomic variables for the period 2004-2007 with relative accuracy. Yet, due to differences in the definitions, and boundaries between the data and the model's classifications, the calibration of sector or factor-specific equations using aggregate estimations and assumptions to make the functioning of the model more parsimonious, certain inaccuracies arise, e.g. in the behaviour of private investment.

This chapter demonstrates the plausibility and significance of key parameter values in this research. According to the sensitivity analysis, endogenous productivity growth (and thus cumulative type processes) seem to be a factor behind Argentina's recent macroeconomic performance, and non-price competitiveness determinants appear to be related to growth in non-natural resource exports.

A final comment is needed on the analysis of structural change with counterfactual simulations for the 2004-2007 and the extended 2004-2010 periods. Changes in the structure of production and exports, among other things, require significant resource mobilization, the development of new capabilities and the opening-up of new markets. These are processes that take time to unfold, and are unlikely (and not expected) to be captured by the counterfactual simulations in this research. Instead, counterfactual simulations are employed to study the characteristics of Argentina's response to positive terms of trade shocks and a competitive exchange rate policy and how these adjustments tend to constrain or promote the diversification of Argentina's production and export structure. This is discussed in Chapters 7 and 8.

Notes

[1] As the world economy turned up-side down since mid-2008 most of the assumptions regarding the dynamics of exogenous parameters became unrealistic. They are still useful, however, to test the functioning of the model over a longer period of time in a context of positive natural resource shocks and particular economic policies, which are the focus of this research.

[2] For a description of the cross-entropy methodology, refer to the papers by Robinson, Cattaneo and El-Said (1998, 2001).

[3] For simplicity, the CGE model does not include an enterprise sector. Although traditional in structuralist CGE models it is not necessary for the purposes of this research. Although the SAM accounts for enterprises, this collects only capital income and transfers it to household.

[4] Although the SAM includes nine labour categories, the results of the counterfactual simulations are presented for six labour categories since, for simplicity, semi-skilled and unskilled workers are grouped together.

[5] Households are classified according to per capita income in 2004. As the modelling exercises do not include microsimulations, shocks and policies do not generate changes in the household classification.

[6] Due to lack of data, the SAM does not include intra household transfers.

[7] Note that both parameter values are significantly lower than the 0.8 non-price elasticity of exports estimated by Leon-Ledesma (2002).

[8] See, e.g., the so-called standard model developed at the International Food Policy Research Institute (Lögfren et al., 2001).

[9] Nicolini-Llosa estimates an income elasticity of imports equal to 3.3 or 3.5, depending on the econometric methodology employed (Nicolini-Llosa, 2007b).

[10] In the long-term, imports are more responsive to changes in relative prices and show an even stronger association with the evolution of output according to Catao Falcetti (2002) and Nicolini-Llosa (2007b).

[11] As shown in Table 6.2(a), import elasticities to capital accumulation and productive linkages are assumed to equal 0.025.

[12] To avoid piling-up effects, which can arise due to the inclusion of parameters obtained from single equation regressions into a multi-equation general equilibrium model, and can make the model unstable or lead to overoptimistic or over pessimistic economic trajectories in the medium and long-term, the model assumes that the mark-up in sectors MO and PS responds to increases in aggregate demand for the goods produced in these sectors. Otherwise increases in labour productivity will be translated only into falling domestic prices. As shown in Table 6.2.a the elasticity of the mark-up to demand changes is assumed to equal 0.1 and 0.085 in sectors MO and PS respectively. Because many small firms producing intermediate inputs belong to sector PS, the elasticity of the mark-up to changes in demand is assumed to be lower than in the industrial sector.

[13] See Annabi, Cockburn and Decalwe (2006) for a summary and description of alternative calibration methodologies for Linear Expenditure Systems.

[14] Because this study distinguishes only between poor and non-poor households, the parameters for poor households included households in to the first two quintiles and the parameters for non-poor households include those households in the richest three quintiles.

[15] This value is larger than the 0.1 estimated by Damill, Frenkel and Maurizio (2002) for the 1990s, when, in contrast to the period after the 2001-2002 economic crisis, unemployment exerted downward pressure on nominal wages.

[16] The crowding-in parameter is calibrated using long-term figures since the relation between public and private investment is a long-term relationship that could be underestimated in post-crisis years (the crowding-in parameter for the period 2003-2006 had a significantly low value of 0.04)

[17] Primary commodities and natural resource and non-natural resource based industrial products in the CGE model, and primary commodities and agricultural based and industrial based manufactures in the case of INDEC.

[18] Increases in the interest rate are also linked to the evolution of domestic prices and transformations observed in the international financial market since 2007.

[19] Transfers from household to the government refer to payments other than direct taxes (which are not particularly large). These transfers, as well as government transfers to households, grew between 2004 and 2007, but there is very little reliable data on their evolution. They are assumed to move in line with the CPI since this represents a "criterion" that ensures growing nominal transfers and government expenditures during the simulated period.

[20] Disaggregated information on transfers and subsidy schemes in Argentina's agricultural sector can be found at ONCCA (National Office of Agricultural Control) http://www.oncca.gov.ar/

[21] According to data from Argentina's Ministry of Economy and Production, the ratio of real GDP to total employment expanded at an annual rate of 8% in recent years, and by 2.5% per year in the model simulations.

[22] Although commodity groups are not comparable because they are defined independently, it is useful to compare the evolution of non-natural resource industrial exports, which according to Argentina's statistics expanded at an annual rate of 13.8% between 2004 and 2007, and simulated changes in exports from sector MO –the commodity groups in the model that are most similar to those for which official data are available – during this period. Whereas the *base run simulation* underestimates observed industrial export (CMO) growth by 20%, the simulation assuming that capital accumulation and the expansion of infrastructure and linkages do not affect export competitiveness falls short of official figures by more than 40% (see Table E6.1. columns (1), (2) and (3a), rows (22) and (23)). If, on the other hand, only the impact of productive linkages is excluded from the simulation, growth in exports from sector MO is lower than observed trends by 30% and 10% respectively, than in the base run simulation (see Table E6.1. columns (1), (2) and (3b), rows (22) and (23)).

[23] In addition, the alternative scenario with no endogenous productivity growth has a small negative effect on employment and real wages, an adjustment that is more significant for skilled and formal workers, suggesting that these groups are more heavily involved in the non-natural resource sectors (see Table E6.1. columns (2) and (4)).

[24] Due to the Argentine government's intervention in the National Bureau of Statistics operations, official statistics from January 2007 are said to underestimate inflation.

[25] Real wages grow at a higher rate in the case of skilled and informal workers (see Table E6.3, columns (1) and (2), row (6) and (30) to (34)).

7 Positive Natural Resource Shocks and Domestic Adjustments in Argentina

7.1 Introduction

Rapid economic growth in China and India, changes in energy markets and speculation have reverted the declining trend in the price of most natural resource products between 2005 and mid 2008. This change (in principle) represents a positive shock for a country like Argentina, which, historically, has specialized in the production and export of agricultural goods, since it represents an increase in the price of traditional exports.

Much has been written about Argentina's economic recovery and the role of the positive terms of trade shock. It is possible to identify two positions in this debate. One claims that Argentina's growth record is principally the consequence of unique, favourable international conditions and the transformation of the country's agricultural sector.[1] The other emphasizes the role of economic policies. It does not deny that demand and supply changes have affected Argentina's traditional exporting sector, rather it maintains that the exchange rate regime –involving the exchange rate, export taxes and, to some extent, fiscal and monetary policies– has correctly channelled these shocks and provided additional impulses for output growth.[2]

The debate in the media has been intense and rich, with economists and policy makers presenting –and in many cases exaggerating– their points of view; however, but there have only been few attempts to make an analytical or applied evaluation of the recent transformations in Argentina.[3] This research uses the dynamic CGE model developed in the previous chapters to analyse the impact of positive demand, and supply shocks in this chapter –the former associated with the terms of trade shock and the latter related to increases in the production of primary and resource-intensive products– and Chapter 8 discusses Argentina's exchange rate policy.

In addition to their impact on aggregate output, the simulations are used to (especially) investigate how demand and supply shocks affecting Argentina's agricultural sector impact on other tradable sectors whose production is not intensive in natural resources. Do these positive shocks constrain productive and export diversification, as emphasized in standard approaches? Or, as hypothesized in Chapter 3 –and suggested by Eswaran and Kotwal (2002), Ros (2000) and Torvik (1997)– does a positive resource shock encourage the expansion of the non-natural resource tradable sectors? As is hypothesized in this research and discussed in previous chapters, many factors related to the characteristics of the sector in which the shock occurs, Argentina's historical trade specialization as a producer and exporter of wage-goods and its economic policies, as for instance export taxes, the characteristics of government expenditure and the exchange rate regime, influence domestic adjustments. The purpose of this chapter, therefore, is to disentangle the role of these different factors and, in so doing, to evaluate some of the propositions derived in the analytical chapters of this research in relation to the factors mentioned above.

The chapter is organized as follows. Section 7.2 presents a brief overview of Argentina's main economic trends based on the base run simulation, included to contextualize the counterfactual exercises. Although CGE models can be used to analyse the different and many dimensions of an economy, this overview and ensuing analysis are organized along the lines of some of the objectives and fundamentals for sustainable economic development discussed in Chapter 5. In particular, the achievement of: positive and stable rates of economic growth, moderate domestic inflation and improvements in socio-economic indicators, and changes in Argentina's productive structure and aggregate demand.

Section 7.3 studies the impact of a positive demand shock, simulated as increases in the international prices of Argentina's natural resource exports. The analysis discusses static and dynamic economic adjustments to the shock and the implications of this positive terms of trade shocks in wage-goods exporting countries. Section 7.4 addresses economic-policy issues related to shock management. It discusses the rationale for and impact of export taxes, alternative uses of export tax revenue, and exchange rate adjustments to cope with the inflationary impulses of the shock.

Section 7.5 studies the impact of a positive natural resource shock originating on the supply-side, which is simulated as an increase in the productivity of the natural resource sector. The analysis discusses the consequences of the shock in relation to the diversification of Argentina's tradable sector and identifies differences between supply and demand shocks, and shocks taking place in the primary sector or the natural resource-intensive industries. The chapter concludes by comparing adjustments under different closure rules and summarizing the findings of the simulation exercises.

Unless otherwise stated, the simulations in this chapter assume the benchmark closure rules: quantity adjustments in factor markets, exogenous government expenditure, a fixed nominal exchange rate and Keynesian adjustment to the savings-investment balance.

7.2 An Overview of Argentina's Economic Trends

The dynamic CGE model reproduces accurately the evolution of most macroeconomic variables, showing a rapid expansion in output and all the components of aggregate demand. In addition to these results, presented in Chapter 6 (see section 6.4, Table 6.4), this overview discusses the base run simulation in relation to some of the dimensions of a sustainable economic development process, discussed in Chapter 5, which are relevant to this research: positive and stable output growth; moderate inflation and improvements in socio-economic indicators, better living conditions, and the factors that contribute to the achievement of these goals, principally the diversification of Argentina's tradable sectors.

Achieving positive and stable rates of economic growth requires faster expansion of investment and exports than consumption because this helps to avoid external bottlenecks that are characteristic of Argentina and other Latin American countries. Table 6.4 and Table F7.1 show that this condition was met in Argentina in recent years, since, as well as imports, investment and exports, but especially investment, have been expanding much faster than private and public consumption.

The promotion of sustainable economic development finds additional support in the evolution of macroeconomic balances. Since 2002, Argentina experienced fiscal, trade and current account surpluses that represented more than 3%, 5% and 2.5% of GDP, correspondingly, in 2007 and as an average for the period 2004-2007. (See Table 5.2 in chapter 5.) The government surplus emerged and increased due to a significant expansion in tax revenues, associated with the expansion in economic activity and the application of export taxes. Trade and current account surpluses emerged as a result of higher export prices, increased volumes of exports, and a temporary reduction in transfers abroad –associated with Argentina's default and debt renegotiation– all of which have been larger than the fast growing import bill, though these surpluses have begun to fall (see Table F7.1 columns (1) and (2), rows (7) and (8)).

Argentina's macroeconomic baseline scenario (and recent economic process), however, is characterized also by the reappearance of inflation, an uncomfortable event for a country with a history of inflation and an undesirable phenomenon for the sustainability of a competitive exchange rate and to encourage productive diversification. According to official data and the model's base run simulation, the CPI grew at an annual average rate of 10% between 2004 and 2007; yet inflation accelerated in 2007 and 2008 (see Table F7.1. columns (1) and (2), row (10)).

Although this is one of the issues that will be explored via the counterfactual simulations, it should be noted that the model identifies only two sources of inflation: wage-goods inflation associated with changes in the prices of natural resource products, and inflation due to differences in the composition of domestic supply and demand, linked to the economic cycle. Inflation associated with changes in agents' expectations or due to monetary factors are not taken into account since the dynamic CGE model considers only the real side of the economy. [4]

Wage-goods inflation is linked to developments in the international market for primary and other natural resource products and to Argentina's exchange regime. Increases in the international price of Argentina's natural resource exports, especially in 2006 and 2007 (see Table 6.3), and the implementation of a stable and competitive exchange rate since 2002, have been pushing prices upwards. In terms of the CGE model, this occurs because higher international prices and a competitive exchange rate –read devalued exchange rate– increase the profitability of exporting and, thus, reduce the number of goods offered in the domestic market.[5] Increases in the demand for non-tradable goods, in excess of available supply, associated to the (observed and) simulated increases in demand, employment and real wages are the other cause of inflation identified in the model (see Table F7.1. columns (1) and (2), rows (10) to (13)).

Different sets of policies to control inflation can be (and historically have been) implemented in Argentina. They include export taxes, price controls, subsidies, exchange rate adjustments, active participation of government in wage setting negotiations, and contractionary fiscal and monetary policies.

The development of a competitive and diversified tradable sector is one of the key conditions for sustainable economic development because it contributes to preventing Argentina's historical external imbalances and increases employment and real wages. According to the baseline simulation, production and exports from sectors MO and PS expand at rates similar to those in other sectors (see Table F7.1, column (2), rows (16) to (23)). Although sectoral exchange rates appreciate by a small amount due to domestic inflation, reducing the competitiveness of sectors MO and PS, the expansion of domestic and international demand, rising international prices, Argentina's exchange rate policy and the recovery of public and private investment has encouraged production and exports in the non-traditional sectors (see Table F7.1 column (2), rows (14) to (23)).

This brief overview concludes by looking at changes in the labour market and the distribution of income. According to the base run simulation, Argentina's recovery and growth process has encouraged progress in these areas; however, advances have been less significant than the ones observed in macroeconomic indicators. Productivity growth has promoted output and wage growth, but has led to an expansion in employment lower than the expansion in output. Employment growth and growth in real wages has been faster among skilled workers (see Table F7.1 column (2), rows (1), (6) and (26) to (36)). In contrast to labour market outcomes, the changes in income inequality are mixed in the base run simulation. The model suggests a 0.7% annual increase in the wage share, improving the distribution of income among the factors of production, but a small deterioration in the distribution of personal income. The poorest:richest households ratio falls by 0.2% a year, as the incomes of the rich households grow faster than the incomes of poor ones (see Table F7.1 column (2) and rows (37) and (38)).

In sum, the base run simulation reproduces some key features of Argentina's recent economic performance:

- fast output and aggregate demand growth (led by investment and exports), accompanied by fiscal and current account surpluses;
- balanced growth in natural resource and non-natural resource production and exports;

- (the reappearance of) domestic inflation and improvements in social indicators.

7.3 Positive Demand Shocks: Increases in the Price of Argentina's Natural Resource Exports

7.3.1 Dynamic adjustments to an improvement in Argentina's external terms of trade

The remaining sections in this chapter analyse Argentina's economic response to positive natural resource shocks. The first two simulations provide a general overview of the effects of positive terms of trade shocks in Argentina. They are performed using the dynamic CGE model for the medium-term and medium-term "plus" periods extended between 2004 and 2007 and between 2004 and 2010. Most of the analysis in this chapter and Chapter 8, however, focuses on the 2004-2007 period.[6]

The simulations assume that the world price of Argentina's natural resource exports (PP and MR) increase by 10% over all the simulated period, an expansion in international prices slightly larger than the average expansion for 2004-2007, but smaller than 2007 price changes, which expanded at around 8% and 20% respectively (see Tables 5.4 and 6.3 in Chapters 5 and 6).

Simulation results for a selected group of variables are summarized in Table 7.1. Columns (1) and (2) present the baseline simulations and columns (3) and (4) display the adjustment to the terms of trade shock. The former are annual average growth rates over the simulated periods and the results for the terms of trade shock are presented as percentage changes from the baseline.

According to the structuralist dynamic CGE model developed in this research, *a sustained increase in the international price of natural resource products, as the one observed in recent years, is not expansionary but contractionary*, slowing GDP growth by 2.2% (6.9%) *vis-à-vis* the base run simulation in the 2004-2007 (2004-2010) period. This result, which initially may appear "counterintuitive", does not imply that Argentina's recent expansion has been independent of improvements in the external terms of trade. As is shown later in this chapter, it suggests that, unless complemented by economic policies – e.g. export taxes and the exchange rate– the positive terms of trade shock could not bring about output growth.

Table 7.1
Positive terms of trade shocks. A 10% increase in the price of exported goods. Dynamic simulations a/

		Base Run (BR)		Positive Terms of Trade Shock 10% inc. PWE PP & PWE MR	
		2004-2007	2004-2010	2004-2007	2004-2010
		Annual Av. growth		% change from BR b/	
		(1)	(2)	(3)	(4)
	Macroeconomic Data				
1	Real GDP	7,93	6,42	-2,2	-6,9
2	Tot. Consumption	8,20	6,12	5,5	-1,2
3	Tot. Investment	16,98	9,66	3,8	5,6
4	Tot. Exports	10,18	13,30	-10,2	-8,8
5	Tot. Imports	19,56	16,00	7,9	2,1
6	Tot. Employment	5,29	4,26	3,8	-1,7
7	Current Account (surplus) / GDP	-24,05	16,96	-8,22	17,3
8	Gov. Savings (deficit) / GDP	35,39	25,84	38,10	27,0
9	Consumer Price Index	9,93	5,50	18,6	8,7
10	Dom. Price PP	9,83	6,44	32,1	23,1
11	Dom. Price MR	8,77	5,26	28,2	17,7
12	Dom. Price OS	10,76	4,89	14,9	4,3
13	Av. Real Wage	4,86	5,19	-3,4	-12,3
	Sectoral Competitiveness, Output and Exports				
14	Real Exchange Rate CMO	-0,74	-0,14	159,3	80,6
15	Real Exchange Rate CPS	-2,06	-1,22	77,8	18,9
16	Output APP	8,06	7,35	3,7	1,3
17	Output AMR	7,26	6,29	5,0	3,0
18	Output M-up Sectors (MO + PS)	7,48	5,28	-16,4	-26,9
19	Domestic supply PP	7,91	9,88	-7,6	-17,4
20	Domestic supply MR	6,34	7,71	-7,0	-20,1
21	Imports PP	9,93	2,08	21,5	64,1
22	Imports MR	19,19	15,63	11,6	7,4
23	Exports PP	9,00	9,28	11,3	6,7
24	Exports MR	11,30	12,65	25,0	16,6
25	Exports MO	10,61	18,01	-67,6	-31,0
26	Exports PS	9,59	15,51	-73,7	-34,9
27	Consumption (YHQ1) / Consumption YHQ5	0,55	1,16	-49,9	7,0

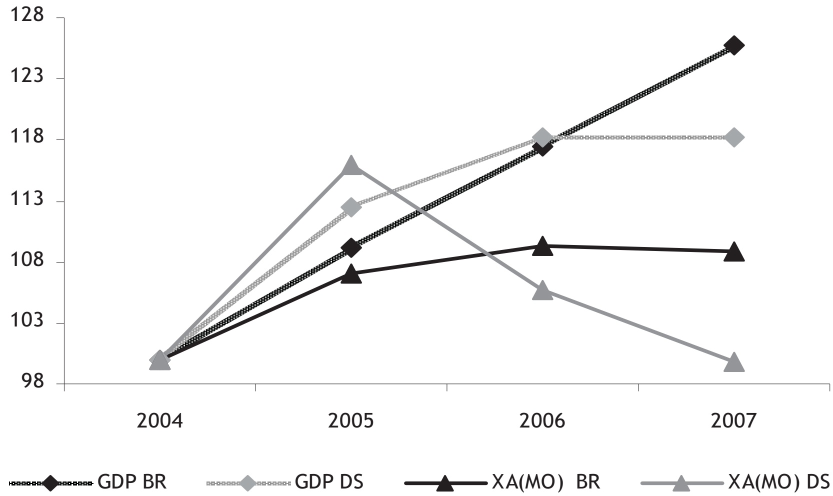
Source: model computations. % change from base run
a/ The base run simulation assumes a Keynesian closure rule for the saving-investment balance; b/ Macroeconomic balances are presented as annual average growth rather than % change from base run
PP= primary products; MR= resource intensive manufacturing; MO=other manufacturing products; PS= producer and exportable services; OS= other (consumer) services

Dutch disease effects are the fundamental explanation for the adjustment, although the reduction in real wages and foreign savings also slows aggregate demand and thus contributes to making the terms of trade shock contractionary in this demand-driven model.[7] Although the positive terms of trade shock increases consumption and investment, the shock also reduces net exports, as growth in international prices prompts increases in domestic prices reducing the competitiveness of Argentina's non-natural resources sectors. The contraction in output occurs not only because total exports decrease –as the contraction in export growth in sectors MO and PS more than compensates the expansion of natural resource exports– but also because, as domestic products become less competitive, they are substituted by imports, and output growth in mark-up sectors slows down (see rows 4, 18 and 23 to 26). Indeed, as Figure 7.1 shows, the shock leads to an absolute reduction in output from sector MO –XA(MO) DS in Figure 7.1– which is not compensated by the positive impact of the shock on other sectors.

In Argentina's managed exchange regime, where the government aims at maintaining a competitive exchange rate, the revaluation occurs via increases in domestic prices, which expand at close to 20% overall (Table 7.1, column 3, row 9). Prices expand due to rising costs in mark-up sectors, both because the demand for non-tradables grows faster than supply, but fundamentally because the shock increases the profitability of exporting and reduces the fraction of total production of natural resource products offered in the domestic market. Table 7.1 shows that in a context of growing natural resource production, domestic supply of products from sectors PP and MR falls by 7%, but PP exports expand by 11% and MR exports grow by around 25% vis-à-vis the baseline (Table 7.1, column 3, rows 16, 17, 19, 20, 23, 24). Because the model assumes a high elasticity of transformation[8] and does not allow for substitution among natural resource products,[9] price changes may overestimate the effect of the terms of trade shock, although the adjustment is consistent with the behaviour of the Argentine economy.

There are two additional points worth mentioning regarding the dynamic adjustment. The first is that the medium-term contractionary effects of the terms of trade shock may not take place if non-natural resource exports are extremely price inelastic, an unlikely assumption for these types of products.[10] The second is that increases in international prices can cause a deterioration in socio-economic conditions through their negative impact on real wages and some measures of income distribution (Table 7.1, columns 3 and 4, rows 13 and 27).

Figure 7.1a
Evolution of aggregate and sectoral output (2004-2007). Base run simulation and demand shocks (10% Increase in the international price of natural resource exports (PP & MR))



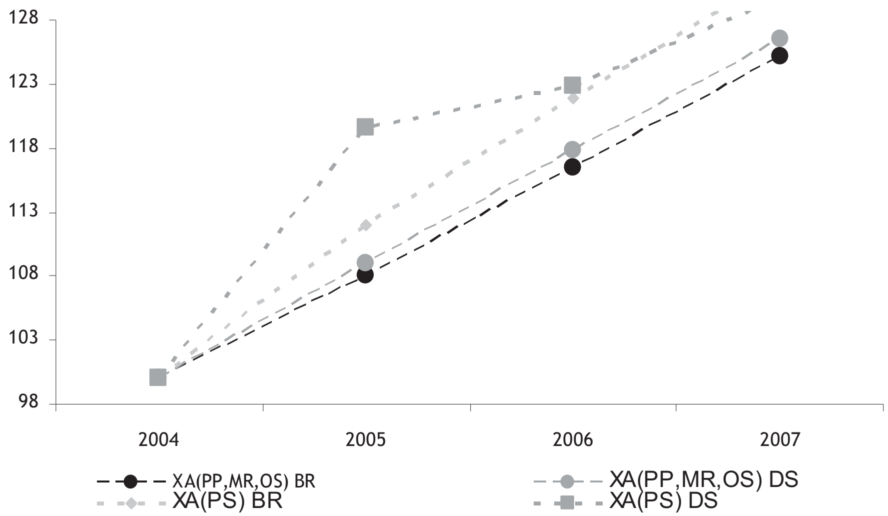
Source: model simulation
Note: BR = Base Run; DS = Demand Shock (10% Increase in the International Price of Natural Resource Exports (PP & MR)); XA (MO) = output sector MO; XA (PP, MR, OS) = output in sectors PP, MR, OS

The first two simulations illustrate that positive *terms of trade shocks can be contractionary when analysed through a dynamic lens because they crowd-out the industrial sector and hinder productive and export diversification. Unless they are managed adequately to avoid a currency revaluation, positive terms of trade shocks may fail to convert current wealth into future and sustainable rewards* – a claim that is explored further below.

7.3.1 Terms of trade shocks in wage-goods exporting countries. Is the adjustment in Argentina different than in other countries?

In addition to analysing the general effects of positive natural resource shocks and the response of other tradable sectors, this research also aims to analyse how the characteristics of the sectors linked to Argentina's

Figure 7.1b
Evolution of aggregate and sectoral output (2004-2007). Base run simulation and demand shocks (10% Increase in the international price of natural resource exports (PP & MR))



Source: model simulation
Note: BR = Base Run; DS = Demand Shock (10% Increase in the International Price of Natural Resource Exports (PP & MR)); XA (MO) = output sector MO; XA (PP, MR, OS) = output in sectors PP, MR, OS

natural resource endowments influence the economic adjustment to these shocks. Does a positive price shock to agricultural and food products, Argentina's traditional exports, differ from a price or demand shock affecting other type of natural resource products, as for instance raw materials and mineral products?

To investigate whether being an exporter of wage-goods has implications for the adjustment to a positive terms of trade shock, this section compares the simulation results for a 10% increase in international prices affecting the products from sector PP with a similar shock in sector MR. Although Argentina's natural resource exports include mineral, fuel and agricultural products, the analysis assumes that the price shock to PP products represents an increase in mineral prices and the price shock affecting MR products represents an increase in wage-goods prices because processed natural resource exports to a large extent consist of food-products.[11]

Table F7.1 in the appendix to this chapter shows the results of simulations using the dynamic model for the period 2004-2007. As shown in columns (2), (3) and (4), the medium-term contractionary effects of a positive price shock to MR products are larger than the effects of a similar shock affecting primary products (PP). A key factor explaining this difference is the response of domestic prices to each shock: whereas the primary commodity shock increases overall inflation by 5% vis-à-vis the base run, domestic prices expand by more than 10% when the shock affects food or other processed natural resource products (see Table F7.1, columns (2), (3) and (4), row (10)).

There are two factors underlying the differences observed in the acceleration of domestic inflation and the subsequent reduction in real wages, real exchange rate appreciation and crowding-out effects, as discussed in section 7.3.1 (see Table F7.1. columns (3) and (4), rows (14, 15, 18, 22, 23, 24 and 25)). First, food prices have a higher weight than primary commodity prices in the consumption basket; therefore, increases in the former have a larger impact on the overall price index. Second, non-tradable prices (OS) increase more when the shock affects food products than when it is related to primary products. This is because, as the shock is more contractionary in wage-goods exporting countries, the expansion in the supply of non-tradable goods is smaller than when the shock affects primary or "mineral" exporters (see Table F7.1, columns (3) and (4), rows (13 and 19)).

The positive shock to natural resource-intensive manufacturing products increases exports from sector MR and therefore diversifies Argentina's natural resource exports, one of the two export diversification possibilities identified in Chapter 5, because higher export prices encourage natural resource processing and greater supply of MR products, and also in part because higher prices reduce domestic demand. Yet, "export diversification" occurs in a context of falling total exports, because Dutch disease adjustments reduce exports from sectors MO and PS (see Table F7.1, columns (3) and (4), rows (4), (17) and (21)).

An additional and important difference between the two shocks is that in the medium-term positive terms of trade benefiting "mineral" products improve real wages, but constrain household purchasing power when the price shock affects wage-goods. A similar external shock, therefore, may have different implications for Argentina and Chile (one exporting wage-goods and the other copper), in both aggregate and sectoral terms and also in terms of changes in socio-economic conditions (see Table F7.1, columns (3) and (4), rows (32 to 39)).

7.4 Managing Positive Terms of Trade Shocks

7.4.1 Increases in export taxes

The previous simulations show that positive terms of trade shocks, in a fixed or managed exchange rate regime, increase domestic prices and constrain export diversification, an adjustment that is larger when the shock is in a country that is a wage-goods exporter, as Argentina. To counteract these effects the Argentine government has implemented various policies, and others have been suggested by analysts and policy makers.[12]

One such policy is export taxation. The impact of export taxes was discussed in Chapter 4.[13] Export taxes were implemented in 2002 in Argentina to moderate the impact of the large devaluation that followed the collapse of the convertibility regime, but have been raised in recent years to ameliorate the impact of escalating international prices. The following analysis simulates a 100% increase in export taxes in addition to the price shock affecting the products from sectors PP and MR.

The simulation results are presented in Table F7.1 in the appendix to this chapter, in columns (5) and (6), depending on the sector concerned (PP or MR). As expected, export taxes contribute to reducing overall inflation, especially as they are applied to wage-goods –growth in annual consumer prices is 8%(1%) lower than in the base run simulation and 20%(5%) lower than if the terms of trade shock to sector MR (PP) is not accompanied by higher export taxes (see rows (10) to (13)). Yet, for this policy to foster an increase in domestic supply sufficiently large to reduce domestic prices and offset the medium-term contractionary effects of the shock, export taxes will have to be substantially increased.[14] A large increase, as the recent experience in Argentina shows, may meet with strong resistance from agricultural producers and may not be politically feasible.

Indeed, inflation due to increases in primary commodity and food prices is not a problem that concerns exporting countries exclusively, it also affects countries that are importers of these products. Exporting countries are a priori better placed to face the shock, as they can use export taxes to increase or modify domestic supply and prices, a strategy that is not available to importing countries. This technical advantage of exporting countries, however, is not a guarantee of success, as political economy factors can condition economic policies. In wage-goods importing countries it may be in the interests of the entire society to agree on the design and financing of subsidy schemes to offset or mitigate increases in international prices. But, in wage-goods exporting countries, where policies will involve transfers from the beneficiaries of price increases to the rest of society, political agreement over the implementation of policies might be more difficult to achieve.

Political-economy issues aside, it should be noted that rising export taxes prompts diversification of Argentina's export and tradable sectors since they contribute to mitigating the inflation-labour costs-real appreciation channel, According to Table F7.1, annual export growth from sectors MO and PS is larger than in the base run simulations and significantly larger than when the terms of trade shock is not accompanied by increases in export taxes; the same applies to total exports (see columns (2) to (6), rows (4), (20) to (23)). In addition, as taxes on primary commodity exports (PP) reduce the domestic price of these products, the policy increases the profitability of natural resource processing and encourages all types of export diversification: diversification within the natural resource sector, for it promotes natural resource processing, and diversification in other industrial products and services (see Table F7.1, columns (3) and (5), rows (20) to (23)).[15]

It has been shown that export taxes contribute to mitigating domestic inflation by increasing the domestic supply of natural resources products because the ratio between export and domestic prices falls. But export taxes also help to reduce domestic prices as they take money out of the economy, reducing the demand for non-tradable goods. This mechanism, however, depends on government expenditure decisions: on the government not spending the additional income it collects via export taxes, as in the previous simulations, and on how the government spends these resources, which is discussed in the next section.

7.4.2 Tax and spend: production subsidies, government consumption and public investment

Analysis of export taxes draw attention to government expenditure since if government spends the income derived from export taxation its policy for controlling inflation and offsetting Dutch disease adjustments will be less effective. Yet, the characteristics of government expenditure decisions also determine domestic adjustments and can contribute to preventing or counteracting Dutch disease adjustments through alternative channels; this was suggested by Palma (2000), in relation to the adjustment to a positive copper shock in Chile at the beginning of the twentieth century.

In relation to the medium-term responses of sectors MO and PS –the non-natural resource tradable sectors–, three different uses of income from export taxes are worth analysing. The first is subsidising production in sector MR, a policy designed by the Argentine government to reduce inflation. The other two policies refer to changes in government investment and consumption because, as discussed in Chapter 3, public investment in infrastructure can contribute to productive and export diversification, but increases in government consumption may have the opposite effect because they increase domestic prices.

The analysis of these policies is elaborated using the dynamic CGE model and –in most cases– relates to the period 2004-2007.[16] To simplify the exposition, I define an *alternative base run simulation* considering the simulation of a 10% increase in the international price of wage-goods (MR) accompanied by a 100% increase in export taxes. Therefore, the simulations compare alternative public expenditures decisions financed by the annual increase in government tax income against this alternative base run.

Production subsidies for natural resource-intensive industries

In addition to export taxes, the Argentine government has been subsidizing the natural resource-intensive industries to deal with the terms of trade shock.[17] Subsidies have been allocated to sector MR to promote increases in the domestic supply of wage-goods and to reduce inflationary pressures.

Column (2) in Table F7.2 simulates annual changes in export tax income devoted to expanding production subsidies, which is used to increase the price received by domestic producers in sector MR. Comparison with column (1) –the simulation of higher international prices for MR products and the higher export taxes discussed above– suggests that *production subsidies do increase the domestic supply of wage-goods, but are ineffective in reducing domestic inflation* (which is close to 3% higher than in the simulation with no subsidies). This is because subsidies are an injection of income into the economy, which increases demand more than supply, increasing the prices of wage-goods and (especially) non-tradables[18] (see Table F7.2. columns (1) and (2), and rows (10) to (13) and (17)).

Tax and spend: increases in public consumption and investment

A particular feature of Argentina during the period analysed is the sharp contrast observed between rapidly growing public investment and government consumption, which have expanded at average annual rates of more than 45% and 6% respectively between 2004 and 2007. To extend the discussion on the consequences of different government expenditure decisions, this section simulates that annual changes in export tax income are alternatively used to finance government consumption or investment.

First, I simulate that changes in export tax income –due to higher international prices of MR products and the increase in export taxes in the *alternative base run simulation*– finance higher government consumption. As Table F7.2., columns (1) and (3) show, higher government consumption has some positive real effects: it further increases total consumption and employment vis-à-vis the *alternative base run scenario* used in these simulations (see columns (1) and (3), and rows (2), (6)).

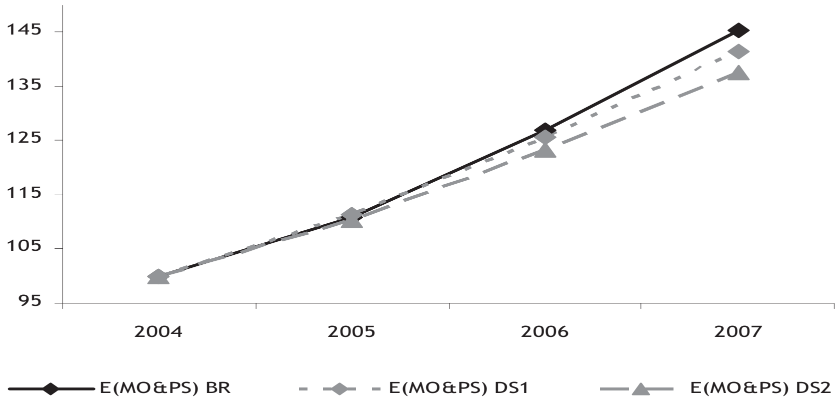
In the period 2004-2007, higher government consumption accelerates domestic inflation and slightly reduces the growth rate of aggregate output. Table F7.2 shows that the inflationary consequences of government consumption reduce the price competitiveness of industry and services exports vis-à-vis the *alternative base run*, leading to a slowdown in total exports[19] and investment, which more than compensates for the expansion in total consumption (see Table F7.2 columns (1) and (3), and rows (1),(3),(4) and (20 to 23)).[20]

The next simulation explores the adjustment in Argentina would public investment further expand with changes in export tax income. Table F7.2 shows that, in contrast to the medium-term effect of larger government consumption, higher public investment is expansionary, increasing the annual growth rate of output and consumption by more than 4%

and further expanding total investment, vis-à-vis the *alternative base run scenario* (see columns (1) and (4), rows (1) to (3)). Total employment and domestic inflation, especially of non-tradable goods, also expands with economic activity, as shown in Table F7.2 (see columns (1) and (4), rows (6) and (10) to (13)).

Exports undergo a particular adjustment and grow slower than if income from export taxes were not used to finance public investment. Total exports decelerate because public investment is an expansionary impulse that increases domestic demand and prices. As a consequence, first, total exports growt slow down as more natural resource products are allocated to the domestic market, and second because domestic inflation jeopardizes the price competitiveness of non-natural resource exports (see Table F7.2, columns (1) and (4), rows (20) to (23)).[21]

Figure 7.2
Terms of trade shocks, export tax and non-natural resource exports



E(MO&PS) BR = Non-natural resource exports in the alternative base run (10% inc. PWE_{MR} & 100% inc. in export tax MR); **E(MO&PS) DS1 =** Non-natural resource exports in the alternative base run and increases in export tax revenue finance public investment; **E(MO&PS) DS2** = E(MO&PS) DS1 and export elasticity to sector PS (capital accumulation and productive linkages) = 0

Source: model simulation

The slowdown in non-natural resource exports at first sight may seem surprising if one considers that these results suggest that the development of productive linkages associated with public (and private) investment in infrastructure are not relevant to export diversification. The situation is somewhat different, as Table F7.2 and Figure 7.2 show in comparing the abovementioned simulation to an alternative simulation that assumes that exports are absolutely independent of output changes in sector PS. The results in both Table F7.2 and Figure 7.2 show that non-natural resource exports would have grown slower were they irresponsive to non-price competitive determinants (see Table F7.2, columns (4) and (5), rows (22) and (23) and Figure 7.2, lines E(MO&PS) DS1 and E(MO&PS) DS2).[22]

The simulation results do not question the importance of public investment policies, but do call the attention to the timing of these policies. In the context of a positive shock, public investment is pro-cyclical and engenders price adjustments that counteract their positive (non-price) effects for export competitiveness. Indeed, to increase the effectiveness of public policies it may be preferable –and recommended– to take advantage of times of abundance to create a countercyclical fund (Ocampo, 2005a). This fund could be used finance public investment, but in a continuous, smooth and sustainable manner. Alternatively, it could be used to smooth the economic cycle financing alternative policies when demand impulses are weak.

Despite the effects on aggregate demand, the results of the simulations summarized in Table F7.2 are interesting in terms of medium-term economic adjustment to different types of government expenditure. Alternative allocations of export tax income suggest that:

- production subsidies are ineffective to control overall domestic inflation;
- expansion in government consumption creates additional inflationary pressures that engender Dutch disease adjustments in the medium-term;
- public investment promotes two opposite types of adjustments: increases in the non-price competitiveness of the non-natural resource sector on the one hand, and reductions in the price-competitiveness of these sectors on the other, when public investment projects are promoted in a context of positive terms of trade shocks.

7.4.3 An alternative response to the positive terms of trade shocks: a nominal exchange rate revaluation

Although the Argentine government is at present deliberately preventing changes to the nominal exchange rate (the implications of which are analysed in Chapter 8), it is worth investigating how the Argentine economy would adjust if economic authorities accompany positive terms of trade changes with a nominal exchange rate revaluation. The simulation results are presented in Table F7.4 in the appendix to this chapter and assume a 10% increase in the international prices of wage-goods (PWE_{MR}), and that the nominal exchange rate falls, or revalues, by 10%. Although the table presents a broad set of simulations, run using the dynamic models and covering the 2004-2007 and 2004-2010 periods and comparing the terms of trade shock to the shock accompanied by an exchange rate adjustment, the analysis focuses on the results from the dynamic model for the period 2004-2007.

The exchange rate adjustment manages to curve down inflation, as the CPI falls by close to 50% in relation to the simulation of no changes in the nominal exchange rate (see Table F7.4, columns (3) and (4), and rows (9) to (12)).[23] According to the simulation, real exchange rate revaluation has negative real effects: the rate of growth of aggregate output and investment falls by 8% and export growth decreases by more than 12% vis-à-vis the simulation run considering observed changes in the nominal exchange rate (see Table F7.4, columns (3) and (4), and rows (1) to (4)).[24] Therefore, the simulation results suggest that, together with export taxes, Argentina's exchange rate policy has been contributing to the economic expansion observed in recent years, as it prevented Dutch disease effects associated with domestic price and nominal exchange rate adjustments.

The simulations also show why exchange rate revaluations tend to be accepted by households in the short and medium terms. Despite their negative impact on aggregate demand and employment (larger for formal and skilled workers employed in the industrial sector), revaluations improve real wages, which expand at an annual rate 15% higher than in the base run simulation (see Table F7.4, column (3), and rows (19) to (26)).[25] Over the longer term, however, the contraction of aggregate variables and employment linked to the real exchange rate revaluation offsets the benefits of lower domestic inflation since they lead to a reduction in real wages, as shown in column (6), which displays the results for the period 2004-2010.

7.5 Positive Supply Shocks: Increases in the Productivity of Argentina's Natural Resource Endowments

A positive natural resource shock can arise due to changes in international demand and world prices, or can occur because discoveries, capital accumulation or technological change increase the supply of natural resource-intensive products. In recent years, Argentina experienced both types of shocks: demand shocks, such as those discussed above, and supply shocks such as the extension of the land frontier and new production techniques that increased production in sectors PP and MR and which are explored in this section (Bisang, 2008; Arceo and Rodriguez, 2006; Arceo and González, 2008). The analysis focuses on the period 2004-2007, but to check and validate the simulation results and for purposes of comparison, some of the simulations are also run with the model covering the period 2004-2010.

The analysis starts by investigating the overall impact of an increase in the supply of natural resource intensive products resulting from a 10% increase in the capital-output ratio in sectors PP and MR. The change in the capital-output ratio, which can be seen as the result of exogenous technical change, increases output in the natural resource-intensive sectors by almost 2% vis-à-vis output in the base run. The results of the simulations for the supply shock are presented in Table F7.5 column (3). To enable a comparison of the consequences of positive demand and supply shocks, column (1) presents the results of the base run simulation and column (2) the medium-term adjustment to a terms of trade shock.

According to the results in Table F7.5, increases in the domestic production of resource-intensive products have positive real effects, as the rates of growth of output, consumption, investment and exports grow faster than in the base run. It should be emphasized that the growth accelerating response to the supply shock is in sharp contrast to the medium-term response to demand shocks and is the consequence of two interrelated changes (see Table F7.5 columns (1), (2) and (3), rows (1) to (4)).

First, GDP growth accelerates as a result of new and more efficient production techniques which increase production in the natural resource sector vis-à-vis the base run. Second, output growth accelerates because increases in the supply of natural resources-intensive products prevent Dutch disease effects –such as those that make terms of trade shocks contractionary in the medium-term (see Table F7.5, columns (1), (2) and (3), rows (10) and (16 to (23)).

The positive supply shock increases the CPI in relation to the base run. The overall price increase, however, is significantly lower than in the case of demand shocks and principally is the result of changes in non-tradable prices since the domestic price of resource-intensive goods falls (see Table F7.5, columns (1), (2) and (3), rows (10) to (13)). The rise in domestic prices does bring any increase in production costs and creates a small loss of competitiveness in the tradable sectors MO and PS, although exports from these sectors do not lose much of the dynamism displayed in recent years, and captured in the base run simulation (see Table F7.5, columns (1), (2) and (3), rows (14), (15), (22) and (23)).

Indeed, the results are in line with the Agricultural Supply Led Industrialization (ASLI) strategy proposed by Torvik (1997), which sustains that the dynamism of the agricultural sector is crucial for industrial competitiveness in economies where nominal wages are institutionally determined and (perfectly or imperfectly) indexed to the evolution of domestic prices.[26] This implies that export diversification in Argentina may not occur if the agricultural sector stagnates.

In addition to the differences mentioned above, demand and supply shocks differ in two other respects. The first relates to employment growth, which grows faster with demand shocks –despite these shocks being contractionary in the medium-term– since the terms of trade shock promotes a larger expansion in the labour-intensive non-tradable sector OS than do supply shocks (see Table F7.5, columns (1), (2) and (3), row (6)). The second relates to the evolution in real wages. In contrast to employment growth, real wages expand only vis-à-vis the base run simulation in the case of supply shocks.[27] [28]

Sector-specific differences in supply shocks

The analysis is extended to compare how the economy responds when a positive supply shock occurs in one (PP) or the other (MR) natural resource sectors. The purpose is to investigate whether, as discussed in the analytical model of Chapter 3, expansion in sector MR produces positive and significant externalities for the rest of the economy. Simulation results showing a 10% increase in the capital-output ratio over the period

2004-2007 in each sector are presented in columns (4) and (5) of Table F7.5. As shown in the table, there are no significant differences in the response of the aggregate variables, which, in most cases, expand.

Expansion of the primary sector (PP) accelerates output growth more than expansion of natural resource processing industries (MR) (see Table F7.5, columns (1), (4) and (5), rows (1) to (4)). The simulation results, therefore, are not consistent with the hypothesis proposed in Chapter 3 because there are many other factors that enter the CGE model that were not taken into account in the analytical model in that chapter. In particular, the impulses that promote sector PS others than intermediante demand. Whereas in the analytical model in Chapter 3 output from sector PS depends exclusively on intermediate demand, in the CGE model other demand components are involved, for instance public and private investment and net exports.

The expansion of resource-based industries, however, has advantages over the expansion of the primary sector, which are evident as one looks at other macro, meso and socio-economic indicators. The first advantage of natural resource processing is that, as it directly reduces the price of wage-goods, contributes to controlling inflation (see Table F7.5, columns (1), (4) and (5), rows (10) to (13) and (32)). A second advantage, which is related in part to the previous one, is that the expansion of total exports that occurs when sector MR expands is the consequence of the diversification within the natural resource sector –exports of processed products with a higher percentage of value added expand while exports of unprocessed products slow down– in contrast to supply increases in sector PP which concentrates the composition of exports (see Table F7.5, columns (1), (4) and (5), rows (20) to (23)).[29]

7.6 Alternative Closure Rules: Positive Natural Resource Shocks in Savings-Driven Models

In the analysis of demand and supply shocks so far, the simulations have been run using the Keynesian closure rule to achieve equilibrium in the savings-investment balance. Table F7.6 presents the simulation results for growing terms of trade and technical change in the natural resource sectors PP and MR with the alternative neoclassical assumption that investment adjusts to available savings –and a fixed exchange rate regime, covering the medium-term period 2004-2007. Columns (1) and (2) present the percentage differences from the base run simulation of a positive demand shock under the Keynesian and neoclassical closure rules, and columns (3) and (4) illustrate the adjustment in the case of a positive supply shock.

As shown in Table F7.6, there are no major qualitative differences in the adjustments under one or other closure rule, although the changes tend to be larger under the neoclassical closure rule. This is because demand and supply shocks modify the trade and current account balance affecting foreign and available savings, aggregate investment and thus macro, sectoral and socio-economic variables. According to the results in Table F7.6, a 10% increase in the international price of natural resource products has larger contractionary effects vis-à-vis the base run simulation under the neoclassical closure rule than under the Keynesian rule. This is because it reduces investment growth and further slows growth in total exports (see Table F7.6, columns (1), (2), rows (1) to (4)). For similar reasons, although working in the reverse direction, supply shocks are more expansionary in the simulations that use the neoclassical closure.[30]

7.7 Summing Up

To sum up, this chapter has provided an applied study of the positive demand and supply shocks in Argentina's natural resource sectors and some of the policies implemented to cope with them. The analysis was designed to evaluate the propositions derived in the analytical chapters of this thesis.

Evaluation of the positive external terms of trade shock shows that they do engender Dutch disease type adjustments that limit the competitiveness of the non-natural resource sector. It also showed that Argentina's exchange rate policy has been contributing to counteracting these adjustments and that export taxes have the same effect, as discussed in Chapter 4, thereby contributing to productive and export diversification.

In addition, the applied analysis enriched with new findings the understanding of the economic adjustments to the positive natural resource shock. In particular, the counterfactual exercises show that:

1. when analysed through a dynamic model, positive terms of trade shocks can be contractionary in the medium-term as domestic inflation and the competitive loss of the non-natural resource sector unfolds, and no economic policies are implemented to counteract this adjustment;

2. wage-goods exporting countries may not only experience larger Dutch disease-type adjustments, they may also experience a reduction in real wages, in contrast to 'mineral' exporting countries where a positive terms of trade shock increases the average purchasing power of workers;
3. counteracting the inflationary and crowding-out effects of the terms of trade shock requires large increases in export taxes, which may not be feasible politically;
4. in a context of strong demand impulses spending the income collected with export taxes has inflationary consequences that fuel or reinforce Dutch disease adjustments that the tax originally aimed to counteract. This has two major implications for government spending. First, it implies that subsidies to producers of wage-goods are ineffective to control overall domestic inflation. Second, it implies that optimizing the contribution of public investment in infrastructure to improve the competitiveness of the economy requires special attention to the timing of public investment to avoid overheating the economy.
5. exchange rate revaluations reduce the inflationary impulses of the terms of trade shock. They increase real wages in the short to "medium" terms, but reduce total export growth and export diversification. Yet, if exchange rate revaluations are extended over time, the contraction of aggregate variables and employment linked to the real exchange rate revaluation offsets the benefits of lower domestic inflation, and leads to a reduction in real wages, as seems to have occurred in Argentina during the 1990s.

Positive supply shocks as opposed to terms of trade shock, in a context of a managed exchange rate regime are expansionary and do not crowd-out sectors where Argentina does not have natural competitive advantages.

Moreover, the counterfactual exercise suggests that the expansion of the natural resource sector can be beneficial for productive and export diversification. Yet this does not take place through the productive linkages channel proposed in Chapter 3, but rather is because expansion of the agricultural sector in Argentina contributes to keeping the prices of wage-goods low and thus controls or prevents upward adjustments in nominal wages.

It should be noted as a preliminary to Chapter 8, that while Chapter 7 looked at the impact of a particular shock and Chapter 8 investigates a particular policy, there is no single, exclusive determinant of Argentina's fast economic growth in recent years. This rather occurred due to the combination of several factors: the recovery from the 2001-2002 crisis and the positive fiscal effects of the external debt renegotiation, booming commodity prices complemented by export taxes and a competitive exchange rate policy to counteract the negative effects of the terms of trade shock, and a fast growing government investment and transfer programme to keep up domestic demand. Because many factors have determined output dynamics in Argentina in recent years, it is difficult to know how the slowdown in primary commodity prices associated with the 2008 global economic meltdown, will affect economic growth. Although, as shown in this chapter, positive terms of trade shocks under certain circumstance can be contractionary, a negative shock need not be expansionary –nevertheless some simulations, not reported in the thesis, point in this direction. First, because domestic prices may not fall, thus preventing improvements in net exports; and second, because, unless government makes some provisions via an anti-cyclical fund, some of the expansionary policies implemented in Argentina recent years may not be in place to promote aggregate demand.

Notes

[1] The papers by Bastourre, Carrera and Ibarlucia (2007), studying the impact of the recent reversion in Argentina's trend terms of trade, and Argentina's exports elastic response to income growth in the country's trading partners and more limited response to price changes, as estimated by Streb (2005), can be associated to this position. Bianco et al. (2008), on the other hand, emphasize improvements in Argentina's terms of trade as a mechanism permitting a historically unique combination of fast economic growth without foreign exchange constraints; although they do not consider international price dynamics to be the main driving force of Argentina's recent development process. Finally, Bisang (2008) and Bisang and Gutman (2005) emphasize the importance of transformations in Argentina's agricultural sector, which has been found to be the country's most dynamic sector (Bisang, 2008: 187). Yet, as the transformations occurring in other Latin American countries show, growth is not always accompanied by the development of local productive linkages (Bisang and Gutman, 2005).

[2] This second argument is emphasized by Frenkel and Rapetti (2007) and Plan-Fenix (2006).

[3] The papers by Cicowiez, Díaz-Bonilla C. and E. Díaz (2008) and Nogués et al. (2007) are among the few studies that deal with these issues using modelling techniques. They use general equilibrium and partial equilibrium approaches to study the impact of demand shocks and export tax policies on poverty and income distribution. Serino (2008b) uses a Walrasian general equilibrium model developed by Argentina's economic authorities to study the macro and socio-economic implications of changes in terms of trade shocks and export taxes. Finally, Visintini and Salto (2004, 2005) focus on the macroeconomic impact of improvements in Argentina's external sector.

[4] For a discussion of the various causes of inflation in Argentina see the analyses in CENDA (2008) and Frenkel (2006)

[5] However, there are other mechanisms linking domestic and international prices, all of them valid to a certain extent. Domestic prices may increase because the price of primary commodities and many processed natural resources goods are determined in the international market. Or they can augment because the increased profitability of some exportable crops, e.g. soybeans in Argentina, reduces the supply of other products that are consumed in the domestic market, with a subsequent impact on prices and inflation. The latter explanation cannot be explored with this model because the natural resource sector is not sufficiently disaggregated. And the former explanation is not accounted for because, as explained in Chapter 5, the natural resource sector in the CGE model is defined using a flexible price formulation.

[6] This in part is because recent changes in international conditions make assumptions for years 2008, 2009 and 2010 unrealistic.

[7] Without the reduction in real wages, consumption might have expanded further than the 5% resulting from the simulation. The reduction in foreign savings following the improvement in the current account surplus associated with the shock diminishes disposable income and thus aggregate demand. The link between the availability of foreign savings and output growth, however, is not straightforward and depends very much on exchange rate adjustments. As the Argentine experience in the 1990s shows, increases in foreign savings can also be contractionary, whenever inflows are associated with exchange rate appreciations and engender a process of de-industrialization. The reverse applies to reductions in foreign savings, in Argentina as in many other developing countries during the 2000s, and Japan and Germany before that, have often been linked to the experiences of fast economic growth pulled by tradable production and investment. Indeed, what most developing countries (including Argentina) are in need of is foreign exchange rather than foreign savings. This can be obtained from abroad in the form of loans and increases in foreign savings, or can be obtained by developing a competitive economy, which takes place in a context of falling foreign savings.

[8] Alternative simulations assuming an elasticity of transformation equal to 1.8, not reported in the table, but available on request, lead to lower price increases; nevertheless, the overall impact of the shock remains contractionary.

[9] Whereas substitution among natural resource products would have permitted a smoothing of domestic price changes, the price increases from the simulation cannot be explained because there was no substitution between domestic and imported natural resource products. The latter, as shown in Table 1, expanded significantly after the shock (column 3 and 4, rows 21 and 22).

[10] Simulations of terms of trade shocks were run for different parameter values – not reported in this chapter but available from the author on request – of labour productivity growth and income and price trade elasticities. In all these cases the increase in international prices had aggregate contractionary effects in the medium-term.

[11] Indeed, it would be incorrect to assume that wage-goods are only processed products. Most crops produced in Argentina should also be considered wage-goods as they are the inputs to sector MR and increases in their prices will be reflected in food prices. This relationship, however, cannot be taken into account because, to gain flexibility, the model assumes that prices in sector MR are determined according to market conditions and not in relation to production costs.

[12] A number of policies to control inflation, in addition to export taxes, have been discussed, recommended and, in some cases, already implemented in Argentina. Among these: contractionary fiscal policies to slowdown the fast expansion in aggregate demand, the development of institutions to channel and control the conflict between firms and workers (which has increased with economic activity), exchange rate appreciations and price controls. See Albrieu and Corso (2008), CENDA (2008), Frenkel (2008), Plan Fenix (2007), Olivera (2006) for recent contributions to and perspectives on this debate.

[13] In addition to the previously mentioned papers studying the distributive impact of export taxes (see endnote 3), others discuss the many other dimensions of this policy. Zincenko (2005) estimates the contribution of export taxes to controlling domestic prices; Asiain (2008) addresses this and other economic implications of export taxes, and Piffano (2007) analyses them as part of Argentina's tax system. The political-economy dimensions of this policy are extensively discussed in the Dossier "*Retenciones, dólar alto, inflación y rentabilidad agrícola en Argentina*", organized by IADE in 2008.

[14] E.g. a 50% increase in export taxes to wage-goods, not reported in the table, reduces the inflationary impact of the terms of trade shock, but is not sufficient to reduce Dutch disease effects making the shock contractionary, nor does it impede a reduction in real wages. The increase in export taxes, however, may be overestimated since in this model export taxes affect domestic prices through

increases in domestic supply. Export taxes were implemented in Argentina to disconnect domestic from international prices, and as the relation between export taxes and prices is direct rather than indirect, as in the model used in this research, export taxes may not need to be increased that much to bring down domestic prices.

[15] When combined with export taxes on MR products, positive terms of trade shocks increase real wages, but do not increase employment. This is because the application of export taxes modifies the sectoral composition of output against the labour-intensive non-tradable sector OS. Labour demand in the simulation of a positive terms of trade shock accompanied by export taxes on the products from sector MR fall vis-à-vis the base run simulation and the simulation of a positive terms of trade shock without changes in export taxes, as shown in Table A.7.1 (columns (2), (4) and (6), rows (6), (26) to (31)). Because many informal activities take place in sector OS, the reduction in employment is larger among unskilled and informal workers. Changes in the composition of output in favour of mark-up sectors MO and PS, where production makes intensive use of human and physical capital and workers are engaged in regulated labour relationships, implies that real wages of skilled and formal workers grow faster than those for unskilled and informal workers (see Table A.7.1. columns (1), (3) and (5), rows (32 to 36)). In addition, labour market transformations prompt changes in income distribution of different signs: increasing the wage share and reducing the ratio of income of poor to rich households vis-à-vis the base run (see Table A.7.1 columns (2), (4) and (6), rows (37 to 39)). Because many informal activities take place in sector OS, the reduction in employment is larger among unskilled and informal workers. Changes in the composition of output in favour of mark-up sectors MO and PS, where production makes intensive use of human and physical capital and workers are engaged in regulated labour relationships, imply that real wages for skilled and formal workers grow faster than those of unskilled and informal workers (see Table A.7.1. columns (1), (3) and (5), rows (32 to 36))

[16] Simulations over the period 2004-2010 are presented in Table A.7.3, though they are not analysed in this section.

[17] As mentioned in an article in *La Nacion* (10th March 2008), the Argentine government developed a larger compensation scheme to promote wage-goods supply, which will demand ARG $3,000 million (around US$900 million). These subsidies and other anti-inflationary policies, according to the article, were not sufficient to control inflation in food products.

[18] As expected, the acceleration in inflation reduces the competitiveness of exports from sectors MO and PS, and also slows down exports from these sectors (see Table A.7.2. columns (1) and (2), and rows (22) to (23)).

[19] The slowdown in total exports occurs because growth in all kinds of exports falls. Natural resources exports fall because with higher prices encourage producers to sell a larger percentage of their production in the domestic market, and exports from MO and PS because they are less competitive.

[20] In addition, higher government consumption reduces the trade and fiscal surplus (see Table A.7.2, columns (1) and (3), rows (8) and (9)).

[21] As shown in Table A.7.3., the adjustment in total and non-natural resources exports does not change when an extended time span is considered (see Table A.7.3, columns 3 and 4, rows 4 and 15 to 18.)

[22] Indeed, non-natural resource exports slowdown because their price elasticity is larger than their elasticity to changes in sector PS.

[23] The reduction in domestic inflation is associated not only to the reduction of tradable prices, but also to the slowdown verified for non-tradable prices, an adjustment that is directly related to the evolution of aggregate variables.

[24] The reduction in export growth occurs because real exchange rate revaluation works to reduce all types of exports. Growth in primary commodity and resources-intensive manufacturing exports falls because with lower tradable prices the rate of profit, investment and supply of natural resource products falls. Growth in exports and output from sectors MO and PS also slow as changes in exchange rate policy increase labour costs and appreciate the exchange rate relevant for these sectors, a competitiveness loss that is reinforced by the reductions in productivity growth, capital accumulation and domestic productive linkages (see Table A.7.4, columns (3) and (4), rows (13) to (18)).

[25] Note that due to its effects on tradable prices, but especially on the price of wage-goods, real exchange rate appreciation improves the distribution of income, as for households in the lowest quintile the share of income and consumption increases relative to the richest households (see Table A.7.4, columns (3) and (4), and row (24)).

[26] Dual economy models –first developed by Lewis (1979)– also stress the importance of having a growing and dynamic agricultural sector to provide cheap wage goods in addition to labour. See Lewis (1979), and Temple (2005) for a traditional and a modern presentation of some dual economy models.

[27] Real wages grow –faster for unskilled and informal workers– partly because of falling domestic prices and partly due to higher labour demand as production in the resource-intensive sectors expand (see Table A.7.5, columns (1), (2) and (3), rows (10), (26) to (36)).

[28] The bottom of Table A.7.5 (rows (38) and (39)) show that supply shocks also improve the distribution of income.

[29] Although there are no clear differences in terms of employment growth and changes in income distribution, the expansion of sector MR leads to a larger expansion in real wages (see Table A.7.5, columns (1), (4) and (5), rows (32) to (36)).

[30] The expansion of output in sectors PP and MR increases imports faster than exports and, since this reduces the trade surplus and the amount of savings transferred to the rest of the world, it increases growth in aggregate investment. Faster investment growth has positive effects on real GDP and household consumption, but reduces growth in total exports as the expansion of domestic demand makes exporting natural resources products less profitable in relative terms (see Table A.7.6, columns (3) and (4), rows (1) to (4), (7), (16) and (17)).

8 Argentina’s Stable and Competitive Exchange Rate Regime

8.1 Introduction

The rapid economic growth experienced by Argentina in recent years has not been independent of economic policies. While, as pointed out in Chapter 7, some authors link fast income growth in Argentina to positive terms of trade shocks, others associate the country’s economic record with the SCER policy. This is said to increase aggregate demand and employment and to promote surpluses in macroeconomic balances (Berrettoni and Castresana, 2007; Frenkel and Rapetti, 2007; Plan Fenix, 2006).[1]

This exchange rate policy also enhances the competitiveness of Argentina’s tradable sector and is expected to promote structural change, and diversification in the country’s productive structure. This –as the sustainability of the policy–, however, requires low or moderate levels of domestic inflation. It hence demands policies in addition to nominal devaluations. First, policies to reduce or prevent increases in the domestic price of wage-goods, which, as discussed in Serino (2007) and Chapter 4 of this theses, tends to increase with nominal exchange rate devaluations in wage-goods producing countries as Argentina. And second, policies to prevent aggregate demand from expanding faster than domestic supply (Frenkel, 2008). But the SCER regime involves additional policies. Figure 5.1 shows that, the regime requires capital controls and an active coordination between the Central Bank and government economic authorities to achieve the government’s objectives for exchange rate and inflation policies.[2] The analysis in this chapter, however, focuses on the first two groups of policies, the third group of policies being beyond the scope of the CGE model

The analysis of the SCER policy is based on counterfactual simulations and does not consider its many implications; rather it focuses on the aspects discussed in the analytical chapters in this thesis (principally Chapters 4 and 5). These chapters examined the contribution of SCER policy (combining nominal devaluations, export taxes and other counter-cyclical policies) to productive and export diversification, the impact of this policy in wage-goods exporting countries, and the exchange rate policy as a source of non-price competitiveness.

8.2 Argentina's Stable and Competitive Exchange Rate Regime

8.2.1 Nominal exchange rate devaluations

The first exercise simulates that the nominal exchange rate devalues 10% a year, which is equal to the average consumer price inflation observed between 2004 and 2007. This simulation is run with the medium (2004-2007) and medium-term "plus" (2004-2010) versions of the dynamic CGE model, using the benchmark closure rules: quantity adjustments in the labour market, fixed exchange rate regime, exogenous government spending and Keynesian adjustments to the savings-investment balance.

Table 8.1 presents the percentage changes for of a selected group of variables in relation to the base run simulation. It shows that the nominal devaluation is expansionary and promotes the acceleration in GDP growth in the "medium-term" dynamic simulations. In the two simulations, the devaluation promotes faster total exports and employment growth and, since exports expands faster than imports, improves the country's external accounts (not shown in the table). Sales abroad accelerate, principally as a result of faster non-natural resource manufacturing exports (especially in dynamic simulations), thus promoting diversification in Argentina's external sector, one of the main purposes of the policy (see Table 8.1, columns (1)-(3), rows (1), (4)-(6), (15)-(18)).

Table A.8.1 in the appendix displays the simulation results (for the 2004-2007 period) of the nominal devaluations using the Keynesian and the alternative neoclassical saving-driven investment closure rules (see Table A.8.1, columns (2) and (6)). Although the analysis in this chapter does not include a detailed comparison of the results from applying one or the other closure rule, it is useful to highlight a particular result of the simulation using the neoclassical closure rule. Nominal devaluations in a neoclassical context are contractionary, which contrasts with the results obtained if a Keynesian approach is adopted and, more importantly, contrasts with Argentina's recent growth record.[3 4]

Table 8.1
A 10% nominal exchange devaluation a/

		Dynamic SIM (2004-2007) b/	Dynamic SIM (2004-2010) b/
		(1)	(2)
		% change from base run (br) c/	
1	Real GDP	4.84	1.74
2	Tot. Consumption	2.80	1.72
3	Tot. Investment	3.83	-0.11
4	Tot. Exports	8.49	1.99
5	Tot. Imports	3.38	1.11
6	Tot. Employment	3.87	1.61
7	Current Account (surplus) / GDP d/	-20,3 (br=-24)	39,2 (br=36,8)
8	Gov. Savings (deficit) / GDP d/	37,3 (br=35,4)	58,8 (br=58,4)
9	Consumer Price Index	32.40	12.51
10	Dom. Price CPP	36.05	10.65
11	Dom. Price CMR	38.60	12.65
12	Dom. Price COS	28.84	14.18
13	Av. Real Wages	-7.75	1.55
14	Output Mark-up sectors (MO + PS)	7.66	2.75
15	Exports CPP	3.51	0.87
16	Exports CMR	7.08	0.95
17	Exports CMO	11.23	2.37
18	Exports CPS	18.46	3.98

Source: model computations;

a/ All simulations run using the benchmark closure rule: quantity adjustment the labour market; fixed exchange rate regime; exogenous government expenditure and Keynesian closure rule for the saving-investment balance; b/ % change between annual average growth rate in the base run dynamic simulation and annual average growth rates in simulation of 10% nominal devaluation; c/ Macroeconomic balances are presented as annual average growth rather than % change from base run; d/ base run macroeconomic balances in parenthesis

SIM = simulation; PP= primary products; MR= resource intensive manufacturing; MO=other manufacturing products; PS= producer and exportable services; OS= other (consumer) services ULC = Unitary labour costs;

Returning to the Keynesian approach, it should be noted that the nominal devaluation accelerates domestic inflation. In the medium term, the acceleration of inflation is faster in natural resource intensive products because with the devaluation exporting wage-goods is more profitable than selling them in the domestic market (and thus the domestic supply of these goods falls short of domestic demand).[5] The dynamics of domestic prices in these two scenarios have negative implications for real wages, which, in the short-term, even lead to a reduction in domestic consumption (see Table 8.1, columns (2); rows (9) to(13)).[6] The promotion of structural change with nominal devaluations, as suggested in Chapter 4, is accompanied by (or even achieved at the expense of) lower real wages.

Compensated nominal exchange rate devaluations

Increases in wage-goods prices have been a historical cause of inflation in Argentina. They are politically relevant in a context of rising international prices and because nominal devaluations mean higher domestic prices for already expensive wage-goods products. Because the devaluation reduces or slows real wage growth and deteriorates the distribution of income, as measured by the income:consumption ratio for poor and rich households, devaluations in Argentina tend to be compensated with export taxes. To investigate the effects of this policy and to discuss some of the propositions put forward Chapter 5, Table A.8.1 in the appendix to this chapter presents the simulation results for a 10% nominal devaluation that is accompanied by a 50% increase in export taxes, in the first place, and by the elimination of export taxes, in the second one. The table presents the simulation results for the period 2004-2007 only, for results for the 2004-2010 period are not qualitatively different.

As shown in Table A.8.1, columns (2) and (3), export taxes contribute to reducing wage-goods and overall domestic inflation associated with the devaluation (see Table A.8.1, columns (2) and (3), rows (10) to (12)). *The compensated devaluation further increases total exports through export diversification in non-natural resource products.* Exports from sectors MO and PS grow 60% faster than in the base run simulation and more than 30% faster than if the devaluation was implemented without changes to export taxes (see Table A.8.1, columns (1), (2) and (3), rows (22) and (23)).

On the other hand, would the nominal exchange rate be increased –read devalued– an export taxes eliminated –a policy that is demanded by agricultural producers in Argentina–, as simulated in column (4), domestic inflation will further accelerate, reducing the competitiveness and export growth in sectors MO and PS (see Table A.8.1, columns (2) and (4), rows (4), (10), (22), (23)). Although the elimination of export taxes increases exports of natural resource-intensive goods (and therefore promotes some diversification within the sector in which Argentina has natural competitive advantages), total export growth slows down because the devaluation without export taxes creates strong Dutch disease adjustments in the non-natural resource sectors. Moreover, output and real wages growth will fall in relation to the alternative devaluation experiments (with constant and increasing export taxes). (See Table A.8.1, columns (1) to (4), rows (1) and (32).)

According to the simulations, the compensated devaluation promotes production and exports in the non-natural resource sectors and therefore, increases employment for skilled and formal workers[7] (see Table A.8.1, columns (1) to (4), rows (16) to (23) and (26) to (31)). And, as these workers belong to the richest household groups, the compensated devaluation increases the share of income received by these households, thus worsening the income distribution vis-à-vis the base run simulation (see Table A.8.1, columns (1) to (4), rows (38)).

The simulations so far illustrate the need for compensated devaluations in Argentina to encourage the diversification of production and exports in the tradable sectors and to moderate the negative impact of nominal devaluations on real wages, in line with the proposition in Chapter 4.

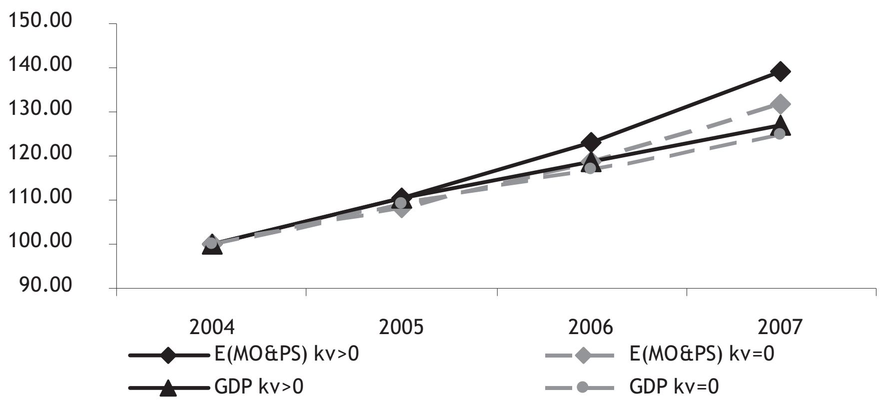
Non-price effects of nominal exchange rate devaluations

The second proposition in the analytical model in Chapter 4 concerns the contribution of an exchange rate devaluation and the SCER regime to improve the non-price competitiveness of sectors MO and PS.

This, frequently omitted, dynamic effect of the SCER is presented in Table A.8.1. Column (5) simulates a 10% nominal devaluation and assumes that the Kaldor-Verdoorn parameter equals 0 and that there is no link between aggregate demand and labour productivity. As shown in Table A.8.1, the endogenous and positive relationship between labour productivity and output growth especially, promotes exports and investment (see Table A.8.1, columns (2) and (5), rows (1), (3), (4)). Total exports grow slower in the absence of a Kaldor-Verdoorn effect, as this effect reduces unitary labour costs, promoting export diversification through a genuine competitiveness channel[8] (see Table A.8.1, columns (2) and (5), rows (14)-(15) and (20)-(25)).

Figure 8.1 complements the information provided in Table A.8.1. It illustrates the productivity effects of the exchange rate devaluations on output and non-natural resource exports. The graph shows that both output and especially exports from sectors MO and PS expand slower if the positive demand impulses from a competitive exchange rate policy do not exert pressures to increase productivity growth (the grey dashed line assume a zero Kaldor-Verdoorn effect is placed below the alternative simulation considering a positive Kaldor-Verdoorn effects).[9]

Figure 8.1
10% Nominal ER devaluations and productivity growth.
GDP and Non-natural resource exports. 2004=100



Source: model computations;
Note: E(MO&PS) = exports from sectors MO and PS; kv= Kaldor-Verdoorn coefficient

The SCER regime: balancing demand impulses

The SCER promotes many of the conditions favouring sustainable economic development (output increases as a result of investment, export growth and diversification, improving the external and fiscal accounts and employment growth for skilled and formal workers), but at the cost of higher domestic inflation and slower or more limited improvements in real wages. Export taxes serve to reduce overall inflation. But export taxes do not eliminate the problem, for increases in domestic prices are also a consequence of the expansionary effects of the nominal devaluation and hence have to be addressed using additional policies.

Table 8.2 and Tables A.8.2 and A.8.3 in the appendix, present the simulation results (for the period 2004-2007) of policies that could be (or have been) implemented to curb down inflation. Policies aiming to counteract the impulses associated with nominal exchange rate devaluations include subsidies for resource-intensive products and counter-cyclical fiscal and monetary measures to reduce demand impulses, in line with Frenkel (2008), Ocampo (2005a, 2007) and Ocampo and Griffith-Jones (2007). These policies are not addressed in detail here, but are discussed in relation to their contribution to reducing domestic inflation. The first columns in Tables 8.2 and A.8.3 display the simulation results for the previously discussed 10% nominal devaluation (without changes in export taxes), which acts as an *alternative base run simulation*.

As discussed in Chapter 7 and presented in Table A.8.2 (see column (3), which presents the simulation results for a 25% increase in yearly subsidies to natural resource goods producers in addition to the 10% nominal devaluation), subsidies for resource-intensive industries are expansionary and, therefore, do not make any significant contribution to reducing domestic prices.

In addition to export taxes and subsidies for resource-intensive products, policies to control the acceleration of domestic inflation need to moderate the expansion of all or some of the components of aggregate demand. The problem then becomes one of: defining which component(s) of aggregate demand can be adjusted given the government's development objectives, and which instruments or policy should be used. If, as in this research, the fundamental goal of the government and the SCER regime is to improve the competitiveness of Argentina's tradable sector in order to diversify exports, the main options will include: reductions in government expenditure (consumption, subsidies or other transfers, and investment) and reductions in private consumption, and/or downward adjustments to some or all of these demand impulses.

Adjustments to nominal interest rates are one of the instruments the government can use to slow demand. Raising the cost of borrowing is expected to reduce private investment –an undesirable adjustment since sustainable development processes require capital accumulation,– and private consumption, although in the CGE model only the first adjustment is considered. Column (4) in Table A.8.2 summarizes the simulation results for a 100% increase in the nominal interest rate. This table shows that economic activity and domestic prices are rather unresponsive to changes in interest rates. Investment demand and output show marginal reductions vis-à-vis the *alternative base run simulation*, and consumer prices increase rather than fall because, in the medium-term, a contractionary monetary policy reduces domestic supply more than demand (see Table A.8.2, columns (1) and (4), rows (1), (3), (10)-(13)). Although the model does not include a link between the interest rate and private consumption and may underestimate the impact of this contractionary monetary policy, it should be remembered that simulation results are determined using estimated parameters in an aggregate investment demand equation.

Various additional counter-cyclical fiscal measures designed to reduce aggregate demand and compensate for the positive impulses deriving from the SCER policy –which indeed are more efficient than the effects of monetary policy in Argentina– are presented in Table 8.2 and Table A.8.3 in the appendix. The first is a 15% and 25% increase in direct income taxes on households in the two richest household groups. This policy reduces growth in private consumption and consumer prices and, hence, contributes to export diversification and to accelerating investment and export growth (see Table 8.2, columns (1) and (2), rows (1)-(3), (9)-(12), (15)-(18)). Not only is this policy expansionary, it also contributes to improving the competitiveness in Argentina's tradable sector, complementing and reinforcing one of objectives of the nominal devaluation. Yet, changes in the composition of aggregate demand in favour of exports and investment have different and ambiguous implications for socio-economic conditions vis-à-vis the *alternative base run* simulation of increases in the nominal exchange rate: employment and real wage growth (in all labour types) slows down, and income inequality, captured by the share of wages and relative income of poor and rich households, increases (see Table A.8.3, columns (1) and (2), rows (26)-(39)).[10]

Columns (3) to (5) in Table 8.2 and Table A.8.3 display the simulation results for three alternative reductions in government expenditure: a 25% fall in subsidies to sector MR; a 25% reduction in government consumption; and a 12% reduction in public investment.[11] The three policies are contractionary and reduce domestic prices vis-à-vis the alternative base run simulation. But there are differences in the magnitude of the adjustment, which have implications for export growth and the diversification of the tradable sector.

Table 8.2

SCER: Nominal devaluations and complementary policies II: household *income tax and government expenditure (producer subsidies, consumption and investment). Annual average growth 2004-2007 and percentage change to base run a/*

		ALTERNATIVE BASE RUN 10% Nominal devaluation (1)	(1) & 25 %(15%) inc. TAX YHQ5 (YHQ4) (2)	(1) & 25% inc. red. subsidies PP & MR (3)	(1) & 25% inc. in red GOV consumption (4)	(1) & 12% red PUB investment (5)
				% change to Alternative Base Run b/		
1	Real GDP	8.32	0,83	-1,35	-0,39	-2,58
2	Tot. Consumption	8.43	-3,56	-3,62	-3,48	-2,58
3	Tot. Investment	17.63	2,04	-2,90	-0,33	-6,71
4	Tot. Exports	11.04	6,28	4,34	4,66	2,01
5	Tot. Imports	20.22	-0,57	-2,10	-1,28	-3,11
6	Tot. Employment	5.49	-0,88	-1,30	-1,02	-2,18
7	Curr. Acc. (s) / GDP	-20,3	-64,48	-69,40	-59,15	-61,49
8	Gov. Sav. (d) / GDP	37,3	18,49	9,97	11,02	-1,45
9	Consumer Price Index	13.14	-2,39	-2,98	-4,08	-1,94
10	Dom. Price CPP	13.37	-0,25	-0,60	-0,36	-0,43
11	Dom. Price CMR	12.15	-1,07	-1,24	-1,12	-0,68
12	Dom. Price COS	13.87	-4,01	-5,07	-7,56	-3,04
13	Av. Real Wages	4.49	-0,15	-1,94	0,38	-6,16
14	Output Mark-up sectors (MO + PS)	8.05	4,12	-1,83	0,25	-4,38
15	Exports CPP	9.32	1,48	2,32	1,51	0,79
16	Exports CMR	12.10	4,65	4,58	4,67	2,31
17	Exports CMO	11.80	10,74	4,85	6,26	2,69
18	Exports CPS	11.36	12,13	6,64	7,84	2,42

Source: model computations;

a/ All simulations run using the benchmark closure rule: quantity adjustment the labour market; fixed exchange rate regime; exogenous government expenditure and Keynesian closure rule for the saving-investment balance;

b/ Macroeconomic balances are presented as annual average growth rather than % change from base run

inc. = increase; red = reduction; GOV = government = PUB = public; PP= primary products; MR= resource intensive manufacturing; MO=other manufacturing products; PS= producer and exportable services; OS= other (consumer) services ULC = Unitary labour costs; YHQ5(4) household quintile 5(4) richest; Curr. Acc. (s)= current account (sursplus); Gov. Sav. (d)= government savings (deficit)

According to the simulation results, reduction in government consumption stands out as the preferred adjustment to government expenditure. This policy makes the biggest contribution to the slowdown in domestic prices and the acceleration in export growth in sectors MO and PS, while, at the same time, having the least contractionary impact on total investment and employment growth[12] (see Table 8.2, and Table

A.8.3, columns (1) and (3) to (5), rows (1), (4), (10)-(13), (20)-(23)). In addition, the adjustment in government consumption is the only counter-cyclical fiscal policy that increases real wages vis-à-vis the alternative base run simulation (see Table 8.2, columns (1) to (5), row (13)).

8.1 Some Final Observations

Analysis of the stable and competitive exchange rate regime addresses some of the propositions derived in the analytical chapters of this thesis (Chapters 4 and 5) and provides important insights for policymaking in Argentina. It illustrates the expansionary effects of nominal exchange rate devaluations, suggesting that Argentine's competitive exchange rate policy has been one of the factors behind the country's rapid and stable economic expansion. This is because the devaluation increases the price and non-price competitiveness in sectors MO and PS, as proposed in Chapter 4; but also because the competitive exchange rate policy has prevented the negative real implications of an exchange rate appreciation, one of the impulses associated with the terms of trade shock discussed in Chapter 7.

Also, the simulations show that the SCER cannot be a single policy but rather a set of economic policies. Taxes on natural resource exports, as suggested in Chapter 4, need to be an integral part of the policy regime in order to prevent domestic inflation due to higher wage-goods prices. An effective SCER regime also requires additional counter-cyclical policies to slow down the demand impulses promoted by a competitive exchange rate; otherwise domestic inflation could undermine or even eliminate the competitiveness advantage that nominal exchange devaluation aims to achieve. Different monetary and fiscal counter-cyclical policies, it has been shown, can be designed and implemented. Deciding among these policies depends on government objectives. If the purpose of the SCER regime is to encourage tradable and export diversification without reducing real wages, downward adjustments to government consumption and/or increased income taxes on rich households are the policies that would seem to be the most effective.

Notes

[1] Cetrángolo, Heymann and Ramos (2008) also mention the competitive exchange rate as one of the factors behind Argentina's economic recovery. How-

ever, these authors do not establish a causal link between the competitive exchange rate and economic growth, which is also considered to be fuelled by domestic demand and extremely favourable international prices.

[2] See Albrieu and Corso (2008) for a discussion of the economic policy dilemmas that arise when government has multiple objectives, and Frenkel (2007) for an analysis of sterilization policies.

[3] Devaluation is contractionary in the savings-driven model because, by improving the current account, it reduces available savings in the domestic economy and thus reduces investment and output growth.

[4] Simulation results under the Keynesian closure rule are in line with econometric studies that find a positive link between competitive exchange rates and economic growth (Gala, 2007; Prasad, Rajan, and Subramanian, 2007).

[5] The economy also experiences an increase in the production costs of industrial goods, and non-tradable prices increase in response to an expansion of aggregate demand.

[6]In the period 2004-2010 wage-goods inflation slows down and real wages expand, by contrast to the simulations for period 2004-2007. Yet, this is in part because the simulation extended between 2004 and 2010 assumes that the international price of wage-goods decelerates as from 2008, and not necessarily due to a special change in the dynamics of the economy (see chapter 6 for detail on the values of exogenous variables)

[7] Yet, the expansion of total employment is lower than when the government devalues without changing export taxes (see Table A.8.1, columns (2) and (3), row (6)).

[8] Fanzylber (1990) is one of the first authors, in the Latin American tradition, to emphasize the need to gain genuine competitiveness. This is linked to innovation activities and labour productivity growth. Fernandez Bugna and Porta (2008) and Bianco et al. (2008) emphasize that non-price competitiveness needs to improve further in Argentina in order for structural change to take place and the current growth process to consolidate.

[9] In the absence of an endogenous relationship between labour productivity and aggregate demand growth the economy will experience faster employment growth, although the expansion in employment will be faster for unskilled and informal workers. The characteristics of Argentina's labour market, as represented by the wage equation and model parameters, imply that real wages will expand despite falling labour productivity, and income distribution will improve vis-à-vis the simulation for a 10% nominal devaluation assuming positive Kaldor-Verdoorn effects (see Table A.8.1, columns (2) and (5), rows (26)-(39)).

[10] As shown in Table A.8.3, the wage share increases less than in the alternative base run simulation and the ratio of income between poor and rich households falls.

[11] The simulated reductions in public consumption and investment represent very similar adjustments in the absolute amount of income spent by the government.

[12] This in part is because falling public investment negatively impacts on private investment and exports from sectors MO and PS.

9 Final Thoughts

9.1 Research Findings

The problem of structural change is central to development economics, in both theory and practice. This research studied this topic in relation to the limitations, impulses and policies for productive diversification in countries endowed with abundant or highly productive natural resources, as many South American and Argentina in particular are. The relevance of this topic, always present in economic development debates, has been increasing as demand for raw materials and food from the rapidly growing East Asian countries, speculation and changes in production techniques have increased demand for and supply of natural resource products.

Until mid-2008, when the U.S subprime mortgage crisis gave birth to a world economic meltdown, the abovementioned transformations turned Prebisch-Singer's terms of trade hypothesis on its head and created a (more) promising future scenario for resource-rich developing countries. It is to be seen, however, whether these expectations materialize. Positive natural resource shocks, as those faced by developing countries in the early twenty-first century, can be a blessing but may also become a curse -as was the case in many countries after the primary commodities boom of the 1970s.

This research began by investigating the so-called natural resource curse. Using different and up to date econometric techniques (traditional cross-country and system-GMM panel data regressions), Chapter 2 confirmed that a pattern of trade specialization in which natural resource intensive products predominate is not conducive to rapid and sustained economic growth. The analysis of this empirical regularity, however, was extended in different ways to achieve a better understanding of the problem affecting resource-rich countries and to question the (un)avoidability of the resource curse.

The research shows that slow growth in natural resource exporting countries is not a problem exclusive to low income countries or countries from a particular region; it can also affect middle income and developed countries -the database used for the analysis does not include many poor countries.

The empirical analysis showed that, although institutional factors matter, as has been (probably over)emphasized in recent years, the characteristics of the pattern of trade specialization are the key factors underlying economic development in natural resource exporting countries. However, this is a problem that affects countries exporting natural resources with no or very limited processing, but not countries that manage to process their natural resources: an aspect of the resource curse that has been overlooked in most empirical studies on this topic.

As shown in Chapter 2, countries exporting natural resources face significant difficulties in engaging in intra-industry trade and are unable to follow or adapt to the trends of global trade (or to create new trends). Two aspects of trade integration that are conductive to economic growth: intra-industry trade by facilitating the achievement of economies of scale and specialization, and export growth by promoting aggregate demand and productivity growth.

These empirical findings have a clear policy implication. They suggest that productive diversification leading to changes in the pattern of trade specialization can be growth enhancing in resource abundant countries, something that has been proposed but rarely demonstrated. Moreover, according to the econometric results in Chapter 2, export diversification does not have to take place in sectors and products where countries have no or very limited expertise or potential. Upgrading from primary production into natural resource processing seems to be a feasible way to avoid the resource curse and to start exploiting the dynamic benefits of trade.

Making recommendations about productive and export diversification, however, is easier than their achievement. Factor endowments, external shocks, technological know how, distance to markets, access to finance and resource mobilization, specific economic policies and the capacity and possibilities to define and implement them are some of the many factors and conditions facilitating and/or constraining structural change.

Not all these factors are taken account of in this thesis. The analytical and applied sections of the investigation studied the implications for productive and export diversification of positive natural resource shocks and a stable and competitive exchange rate policy, which represent the shocks and policies respectively faced and implemented in Argentina in recent years.

A central proposition of this research, discussed and analyzed in the analytical and applied chapters, is that positive resource shocks can be beneficial for economic diversification, in contrast to the proposition of standard economic models. It was hypothesized and demonstrated that the characteristics of the economic sectors linked to natural resource endowments and economic policies are key determinant of how an economy responds to resource shocks. Moreover, as is also hypothesized and demonstrated in this research in relation to the Argentine case, the characteristics of the natural resource sector need to be taken into account in the design of macroeconomic policies to encourage economic diversification, and are fundamental to policy outcomes.

Analysis and discussion of these questions has provided new knowledge on certain issues, highlighted areas that are often overlooked, and provided guidance for decisions among alternative policies.

Chapter 3 analysed the implications of a positive natural resource shock from an analytical standpoint. Building on recent work by Ros (2000, 2001), Chapter 3 extends the conventional knowledge showing that a positive natural resource shock can be beneficial to productive and export diversification and thus can contribute to modifying the pattern of trade specialization in resource abundant countries. It is well known that positive resource shocks engender Dutch disease type adjustments and constrain diversification. But this is not their only outcome. As discussed in Chapter 3, if positive resource shocks promote productive linkages in addition to or instead of consumption, they will indirectly improve the competitiveness of other tradable sectors.

The findings in Chapter 3 add up to the very short list of studies emphasizing positive and complementary interactions between the natural resource and other tradable sectors. The model developed in Chapter 3 highlights a limitation of the dependent economy model. This and most Dutch disease type models generally consider that the non-tradable sector is not related to production activities. A closer look at real economies, however, shows that the non-tradable sector is not homogeneous and, in addition to informal or consumption services, provides intermediate inputs to other sectors. Moreover, the production of many non-tradable inputs, which includes most infrastructural services, is characterized by the presence of economies of scale or economies of specialization. The expansion in the producer-oriented, non-tradable sector, therefore, can have very different implications for the competitiveness of the tradable sectors than the expansion in the non-tradable sector which satisfies consumption.

The findings in Chapter 3 are not only relevant in theoretical or analytical terms. They are also relevant for the design of the applied part of the research by providing insights into the analysis and design of economic policies. As discussed in Chapter 3, a positive resource shock can contribute to an economy's overall competitiveness in two ways. It contributes directly if the natural resource sector makes intensive use of non-tradable intermediate inputs and has important production linkages, and indirectly through tax and spend-type of policies that channel part of the resource income to investments in infrastructure or other competitiveness-enhancing projects.

Chapter 4 presented a Scandinavian version of the dependent economy model, which takes account of some important structural features of the Argentine economy: a resource sector that due to its natural advantages is more internationally competitive than the other tradable sectors and that produces wage-goods, which are both exported and consumed domestically. The analysis of natural resource shocks with this macroeconomic model illustrates that, in countries with characteristics similar to those of Argentina and many South American countries, positive resource shocks can increase unemployment and deteriorate the trade balance. These characteristics are: (i) a natural resource sector that is not the largest tradable sector; (ii) large competitiveness differences between the natural resource and the non-natural resource tradable sectors; and (iii) imports inelastic to price changes

In terms of economic policy, Chapter 4 stresses two implications of nominal devaluations. First, the analysis shows that in wage-goods exporting countries exchange rate devaluations have to be implemented together with export taxes. Were devaluations not compensated for in Argentina, they would not provide the competitive advantages that they seek to promote and would reduce real wages, hence reducing the political support for and sustainability of the policy.

The research identifies an additional (and often overlooked) dynamic implication of nominal exchange rate devaluations. When they are expansionary, they increase aggregate demand for tradable goods and, therefore, promote learning, specialization economies and productivity growth. Exchange rate devaluations, therefore, provide price and non-price competitive advantages for the tradable sectors. As discussed in Chapter 4, compensated devaluations in wage-goods exporting countries can even lead to increases in real wages. However, to ensure the contribution of a competitive exchange rate to productivity growth, it does not have to be permanent, for producers may not have incentives to invest or innovate, other two relevant factors for industrial competitiveness.

The final chapters of the thesis investigate the propositions derived in the analytical model using a small SAM of the Argentine economy and a structuralist dynamic general equilibrium model. The applied analysis puts the debate into a broader and economy-wide context and promotes a more realistic and complete discussion and evaluation of exogenous shocks and economic policies.

Natural resource shocks in the applied analysis are distinguished in two ways. First, as demand and supply natural resource shocks, a distinction generally omitted in discussions on this topic. Second, according to the characteristics of the natural resource sector, primary producers (extracting and selling natural resources with very limited processing) and resource-intensive industries (processing and adding value to Argentina's natural resource endowments).

Positive demand shocks are linked to the terms of trade shock experienced by Argentina and were simulated as increases in international export prices. A first relevant result of the applied analysis is that positive terms of trade shocks can be contractionary in the medium-term if not accompanied by policies to counteract Dutch disease effects.

A second finding of the analysis of terms of trade shocks relates to the specificities of the adjustment to these shocks in wage-goods producing and exporting countries. Chapter 7 shows that positive terms of trade shocks have a larger impact on domestic inflation and thus larger Dutch disease type adjustments in countries like Argentina than in a country like Chile, a mineral exporter. Moreover, they can reduce real wages in Argentina but not in countries with a different natural resource sector.

Managing positive terms of trade shocks requires: export taxes to reduce domestic inflation (though this policy may not be sufficient to prevent a reduction in real wages); a competitive exchange rate policy, and other competitiveness measures (e.g. public investment in infrastructure), to improve or preserve the competitiveness of the non-natural resource tradable sectors and avoid contractionary dynamic adjustments.

The adjustment to a positive supply shock in the natural resource-intensive sectors, however, differs from the response to demand shocks because it is expansionary. More importantly, positive supply natural resource shocks do not jeopardize the competitiveness of the industry and services tradable sectors and, in some cases, may even improve it. This positive and indirect relation between the tradable sectors, however, is not due to the expansion of productive linkages, as hypothesized in Chapter 3. Rather it is because increases in the domestic supply of wage-goods serve to control domestic inflation and nominal wages, improving (or preventing a deterioration in) the competitiveness of the non-natural resource tradable sectors, as in the ASLI strategy proposed by Torvik (1997).

Although the expansion in the natural resource sector is a necessary condition for productive diversification, it is not a sufficient one. For positive interaction between the agricultural and non-natural resource sectors suggested by the ASLI strategy to take place, increases in agricultural production need to expand domestic supply. And this, like increases in export taxes to fully control domestic inflation, is subject to political-economy considerations not captured in the simulations, and most of the time not controlled by the economic authorities.

Counterfactual simulations enabled a complete analysis and evaluation of the stable and competitive exchange rate policy put in place in Argentina. Monetary issues aside, the simulations show the expansionary effects of nominal devaluations and their contribution to productive and export diversification, through both the direct price and the indirect productivity channels.

However, the promotion of structural change via the exchange rate is only effective and economically and politically sustainable (especially in the historical context of Argentina), if domestic inflation is under control. Export taxes are needed to complement exchange rate variations, as proposed in Chapter 4 and demonstrated in Chapter 8. They may not suffice, however, as export taxes also have to be substantially increased and export tax revenues may not have to be spent to avoid an acceleration of inflation.

Additional policies are therefore needed. The analysis of different and alternative economic policies, either those implemented by the government or solutions proposed and discussed by various scholars, complete the research simulations. This analysis illustrates that: (i) producer subsidies are inflationary, in contrast to government objectives and expectations; and (ii) increases in taxes on rich households and reductions in government consumption are the preferred fiscal adjustments, if and when the objective is to promote the competitiveness of the non-traditional sectors with the least real wage and employment costs. Yet, depending on government and societal objectives a mix of policies will probably be the most effective option.

Overall, the findings support the hypothesis that the characteristics of the economic sectors linked to natural resource endowments are a fundamental determinant of countries' economic trajectories, and adjustments to exogenous shocks and are crucial for the definition of economic policies and their results.

9.2 Caveats and Limitations

The research shows the relevance of productive and export diversification, especially in resource abundant countries. It has identified and discussed the constraints to diversification linked to the structural features of these countries. But the analytical and applied analysis shows that structural change is not unfeasible. Indeed, contrary to what is commonly supposed, structural change can be achieved in a context of positive natural resource shocks, if these shocks are managed appropriately. In the case of Argentina, structural change can also be encouraged using the country's actual competitive exchange rate policy if some of the effects of nominal devaluations are complemented by export taxes and an adequate set of countercyclical fiscal and monetary policies.

The analysis in this thesis has opened up new questions which need to be answered in future investigations. One of the limitations of this research is related to the level of sectoral aggregation of the SAM and the CGE model. Although it captures the main propositions of the research, more detail would have been useful and would have enriched the discussion. To acquire more knowledge about the natural resource sector and discuss the implications of changes within the sector, such as the shift in agricultural production from traditional crops (i.e. wheat and maize) and cattle rearing, to the production of soybeans. The analysis in this thesis does call the attention to some likely implications of these changes. But, given the relevance of the transformations for the present and future in Argentina, a more in-depth discussion and analysis is required of the consequences of these phenomena for the evolution of domestic prices and real wages, sectoral profitabilities, agricultural diversification policies, and their fiscal and monetary implications.

The classification and analysis of the other tradable sectors also requires further investigation. A distinction between resource-intensive industries, capital and knowledge intensive industries and tradable services is sufficient for the present research. But some additional detail would have been helpful and is required to study the technological characteristics of economic sectors and analyse the implications of shocks and policies for employment, wages and income distribution, and to extend the discussion of competitiveness and diversification policies. One of the lessons from this research is the importance of complementing applied general equilibrium analysis with sectoral studies; however, such an effort is beyond the capabilities of an individual researcher and would require team work.

At the economic policy level, the research has identified and analysed a set of policies key to dealing with positive natural resource shocks and to complement nominal devaluations, comparing and deciding among different fiscal policies to prevent domestic price increases. Many other policies were not taken into consideration, in some cases because they are beyond the scope of this research. However, future work should take account of some or all of the following policy dimensions. First the monetary one, particularly the design and application of policies to absorb foreign exchange and sterilize the domestic currency employed to buy them, without damaging domestic investment. Second, the sustainable use of natural resources, a dimension that needs to be included in the technology of the natural resource sectors.

Third, the implementation and use of anti-cyclical funds. The counterfactual analysis in this thesis clearly illustrates that a positive demand impulse, associated with terms of trade shocks and a competitive exchange rate policy, needs compensation if it is to contribute to sustainable economic development. Smoothing positive shocks, as discussed in some of the earlier chapters in this thesis, demands a combination of higher taxes on the natural resource sector and the richest households, along with prudent government consumption and investment. Indeed, a context of positive shocks and rising government revenues, as was the case in Argentina in 2004 to 2007, calls for rational (rather than prudent) public spending decisions. Anti-cyclical funds can definitely contribute to take rational decisions, especially in relation to public investment in infrastructure projects. As these are crucial for increasing the overall competitiveness of the economy and promoting productive diversification, it is fundamental to prevent these projects to be pro-cyclical, for this inflates their costs and in many cases leave them unfinished.

Overall, the research is optimistic in that the so-called natural resource curse is not inevitable and discusses various economic policies that would contribute to sustainable economic development. These policies, however, are easier to identify and simulate than to implement. Efficient execution of economic policies requires government capabilities, which, in many developing countries, require time to be developed.

More importantly, economic policies also (and fundamentally) have to be politically feasible. Government interventions demand political will on the side of government in the first place, and the development and promotion of coalitions and consensus among different economic and political interest groups in the second place. As recent experience in Argentina shows, policymaking can become very complex in a growing economy experiencing positive natural resource shocks. In contrast to previous periods of recession (when the political parties agreed to support an economically unsustainable model), the current conflicts over income distribution may transform an economically sustainable development process into a politically unsustainable one. This process is still unfolding and one of the main objectives of this research is that the comprehensive discussion of some of Argentina's economic development challenges should contribute directly to policymaking.

Appendices

A Updating a Social Accounting Matrix for Argentina Using the Cross-Entropy Methodology

A1.1 Introduction

This appendix presents the 2004 Social Accounting Matrix for Argentina used in the counterfactual simulation exercises of this research and provides a description of the methodology and data employed to construct the SAM.

The SAM is constructed using the top-down approach and cross-entropy methodology developed by Robinson, Cattaneo and El-Said (1998, 2001). The top-down methodology has the advantage of being consistent with macroeconomic aggregates published by official national accounts, which are known by scholars and policy-markers. Its disadvantage is linked to the inaccuracies that can emerge at the microeconomic level, as sectoral and household information is forced to be consistent with macroeconomic aggregates.

The construction process of the social accounting matrix starts with a macroeconomic SAM (Macro SAM), built with macro data obtained from official National Income and Production Accounts (NIPA). The Macro SAM is subsequently opened-up to incorporate microeconomic considerations using all available information, as for instance input-output tables, household, industrial, tax and trade surveys and official records. This information is added to the Macro SAM in two steps. The first step opens up the Macro SAM with information for activities and commodities and constructs a first microeconomic SAM (Micro SAM 1). The second step adds microeconomic information to the Micro SAM 1 for factors of production and household accounts, as sectoral employment according to workers attributes, household income and expenditure characteristics, giving place to the a microeconomic SAM (Micro SAM 2), which is also the final SAM. To obtain a consistent SAM the cross-entropy methodology is used in each step to adjust discrepancies and balance the social accounting matrix.

The appendix is organised as follows. In section A.2, the appendix provides a short introduction to Social Accounting Matrices and the cross-entropy methodology. Section A.3 turns to Argentina's Social Accounting Matrix. It describes first the main features of Argentina's Macro SAM, the data used to construct the matrix and the adjustments and constraints that were implemented to balance the Macro SAM. Section A.3.2 relates to the microeconomic SAM. It describes the microeconomic features of the activities, commodities, factors of production and household accounts and the data and adjustments procedures and constraints implemented to build and balance the MICRO SAM 1 and the final Micro SAM 1 and the Micro SAM 2 or final SAM.

A1.2 Social Accounting Matrix and Cross-Entropy Methodology

A SAM is a square matrix that records the circular flow of income in a country or region during a particular period, commonly one year. Columns in the SAM represent expenditures and rows record receipts by different economic agents. A SAM has three blocks accounts. A production block with accounts for economic activities, factors of production and the commodities that are produced and used as inputs by economic activities. A block of domestic institutions including households, enterprises[1] and government accounts. And a final block of accounts for the rest of the world to record for international trade and transfers among domestic institutions, factors of productions and the rest of the world.

Each cell in the SAM records a particular transaction and T in equation (A.1.1) is the matrix of SAM transactions, where Tij stands for the payment from a column account j to a row account i.

$$T = Tij \tag{A.1.1}$$

Identity (A.1.2) states that a SAM must satisfy the general equilibrium consistency condition that total income equals total expenditure and equation (A.1.3), where y_j stands for the column sum, defines the elements of the SAM coefficient matrix A.

$$y_i = \underset{ROWSUM}{\sum_j T_{i,j}} = \underset{COLSUM}{\sum_j T_{j,i}} \tag{A.1.2}$$

$$A_{i,j} = \frac{T_{i,j}}{y_j} \tag{A.1.3}$$

The cross-entropy methodology is a flexible approach developed by Robinson et al (1998) to estimate a consistent SAM starting from inconsistent data. The main proposition of the cross-entropy approach is to "use all, and only, the information available" to update the SAM (Robinson et al, 1998: 5).

This methodology is based on information theory and considers recent and prior data as probability distributions. This data is used to find new coefficient and transaction matrices, A_t and T_t, that minimizes the (entropy) distance between prior coefficients and transaction matrices, A_{t-1} and T_{t-1}, and the new estimated ones. The minimization problem is solved using all available information, as that coming from recent data about macroeconomic aggregates, other microeconomic transactions or coefficients and row and column sums, previous SAMs and input-output tables. The minimization problem also uses information provided in the form of inequality, zero and other constraints.[2]

The cross-entropy approach to update social accounting matrices involves three steps. The first step estimates a prior or proto SAM and their corresponding coefficients and transaction matrices (*A's* and *T*) using all available information. As information come from different sources and can be estimated with errors, the prior SAM will be unbalanced. The second step concerns estimating the standard errors of the SAM coefficients *A*, the transaction matrix *T*, column sums and macro aggregates. And the third and final step involves estimating a new and balanced SAM incorporating the "best" information as constraints, as for instance from macroeconomic identities, column sums, reliable microeconomic information and inequality and zero constraints (i.e. imposing that exports from non-tradable sectors equal zero).

A1.3 Argentina's Social Accounting Matrix

The social accounting matrix used in this research is constructed for year 2004, for this represents the first "normal" year after Argentina's 2001-2002 economic meltdown. It is constructed using the top-down approach, which starts from macroeconomic figures and adds microeconomic information in subsequent steps, and the cross-entropy methodology to balance the SAM.

Argentina's SAM is built in three steps. The top-down approach starts with a macroeconomic SAM (Macro SAM), built with macro data obtained from official National Income and Production Accounts (NIPA) and other aggregated data, which is assembled and balanced using the cross-entropy methodology. Once a balanced Macro SAM is obtained, information about the SAM's microeconomic structure is added to the matrix using all available information, as for instance input-output tables, household, industrial, tax and trade surveys and official records.

In the second step, I extend the Macro SAM with information for economic activities and the commodities. The result of this extension is the Micro SAM 1, which is first unbalanced and thus adjusted using the cross-entropy method. The Micro SAM 1 is subsequently extended with microeconomic information for Argentina's factors of production (i.e. employment and wages for workers with different attributes) and income and expenditure information for different household groups. This third step gives the Micro SAM 2, which is the final SAM used as a support of the CGE model. As in the previous steps, the unbalanced matrix that is obtained as is added is adjusted using the cross-entropy approach.

A1.3.1 Argentina's Macro SAM

Table A.1 describes Argentina's macroeconomic SAM. In the SAM economic activities, factors of production, commodities domestic institutions and the rest of the world have their own row-column account, where columns (labeled with numbers) designate payments from an agent to others and rows (labeled with letters) indicate their income sources.

The production block distinguishes productive activities from commodities. As shown in Table A.1, there is an account providing information about the production process (row/column A/1) and another account with information about the supply and demand of goods and services (row/column B/2), and the corresponding taxes charged on commodities (column 2, rows H.1, H.4 and H.5). Additional production accounts of the MACRO SAM relate to factors of production (rows/columns C/3), with information about value added or payments from economic activities (cells C-1) and its distribution to households and other institutions (cells D, E-3). In the SAM, I consider two main factors of production, labor and capital (which includes payments to land and/or other natural resources). Labor is subdivided in wage and non-wage labor (row C.3), with the former being in turn divided in wage labor that is protected by the social security (row C.1) and wage labor that it is not (row C.2).

To record current transfers of domestic institutions, the Macro SAM includes accounts for: households (row/column D/4), enterprises (row/column E/5) and the government (row/column F/6). The Macro SAM includes two accounts for capital transfers (rows/columns G.1-G.2/7.1-7.2) to record for public and private savings and investment and an account for the rest of the world (ROW) (row/column Q/9).

Table A1.1
A Schematic Social Accounting

					1	2	3.1	3.2	3.3	3.4
							3			
					Production					
							Factors of Production			
					ACT	**COMM**	**VA W L P**	**VA WL not P**	**VA Non W-L**	**VA GOS**
	A	**Production**		**ACT**		Domestic production				
	B			**COMM**	intermediate consumption					
	C.1		**FOP**	**VA W-L P**						
	C.2			**VA W-L not P**	VA labour					
	C.3			**VA Non W-L**						
	C.4			**VA GOS**	VA GOS					
	D	**Institutions**	**Current trt.**	**HHLD**			Labour income to HHLD			
	E			**ENT**						Capital income to enterprise
	F			**GOV**						
G	G.1		**pl ta I**	**S-I PRIV**						
	G.2			**S-I PUB**						
H	H.1	Tax		**T IND**		indirect tax (value added and sale tax)				
	H.2			**T FOP**			FOP tax labor		FOP tax labor	
	H.3			**T DIR**						
	H.4			**T IMP**		net imp tax				
	H.5			**T Export (net)**		export tax				
	I		Rest of the World							
	J		Total Receips		Total Costs	Total Supply	Total FOP Expenditure			

ACT= Activity ; COMM= Commodity; VA W-L P= Value added wage-labor protected by the social security; VA W-L not P = Value added wage-labor not protected by the social security; VA Non W-L= Value added payments to labor other than wage labor; VA GOS =Value added gross operating surplus, FOP =Factor of production; HHLD=Households , ENT= Enterprise ; GOV=Government; S-I= Saving - investment account; PRIV=private; PRIV=private T IND= indirect tax; T FOP=tax factor of production ; T DIR= direct tax; T IMP= import tax; T export (net) = export tax net of export subsides; ROW =rest of the world ; Exp =expenditure ; tr = transfers. ; trt = transactions.

Table A1.1 (Continuation)

					4	5	6	7.1	7.2
					Institutions				
					Current trt.			Capital trt.	
					HHLD	ENT	GOV	S-I priv	S-I pub
	A	Production		ACT					
	B	Production		COMM	Private consumption		GOV consumption	Priv. Inv.	Pub. Inv.
	C.1	Production	FOP	VA W-L P					
	C.2	Production	FOP	VA W-L not P					
	C.3	Production	FOP	VA Non W-L					
	C.4	Production	FOP	VA GOS					
	D	Institutions	Current trt.	HHLD		ENT to HHLD	Tr GOV to HHLD		
	E	Institutions	Current trt.	ENT					
	F	Institutions	Current trt.	GOV	Tr HHLD to GOV				
G	G.1	Institutions	Capital trt.		HHLD savings				
G	G.2	Institutions	Capital trt.				GOV Savings		
H	H.1	Tax		T IND					
H	H.2	Tax		T FOP					
H	H.3	Tax		T DIR	Direct tax HHLD				
H	H.4	Tax		T IMP					
H	H..5	Tax		T Export (net)					
	I	Rest of the World			HHLD Tr. to ROW		GOV tr to ROW		
	J	Total Receips			TOT Exp HHLD	TOT Exp ENT	TOT Exp GOV	Tot. Investment	

Column group 7 comprises columns 7.1 and 7.2.

ACT= Activity ; COMM= Commodity; VA W-L P= Value added wage-labor protected by the social security; VA W-L not P = Value added wage-labor not protected by the social security; VA Non W-L= Value added payments to labor other than wage labor; VA GOS =Value added gross operating surplus, FOP =Factor of production; HHLD=Households , ENT= Enterprise ; GOV=Government; S-I= Saving - investment account; PRIV=private; PRIV=private T IND= indirect tax; T FOP=tax factor of production ; T DIR= direct tax; T IMP= import tax; T export (net) = export tax net of export subsides; ROW =rest of the world ; Exp =expenditure ; tr = transfers. ; trt = transactions.

Table A1.1 (Continuation)

				8 8.1-8.5 Tax	9 ROW	10 Total Outlays
A	Production		ACT			Gross ouput
B			COMM		Exports	Total demand
C.1		FOP	VA W-L P			Tot FOP's income
C.2			VA W-L not P			
C.3			VA Non W-L			
C.4			VA GOS			
D	Institutions	Current trt.	HHLD		Tr. from ROW to HHLD	Tot. HHLD income
E			ENT			Tot. ENT income
F			GOV	Tax income to Gov	Tr. from ROW to GOV	TOT GOV income
G G.1		Capital trt.	S-I PRIV		Foreign savings	Tot. Savings
G.2			S-I PUB			
H H.1	Tax		T IND			
H.2			T FOP			
H.3			T DIR			
H.4			T IMP			
H.5			T Export (net)			
I	Rest of the World					Tot. FOREX outflows
J	Total Receips				Tot. FOREX inflow	

ACT= Activity ; COMM= Commodity; VA W-L P= Value added wage-labor protected by the social security; VA W-L not P = Value added wage-labor not protected by the social security; VA Non W-L= Value added payments to labor other than wage labor; VA GOS =Value added gross operating surplus, FOP =Factor of production; HHLD=Households , ENT= Enterprise ; GOV=Government; S-I= Saving - investment account; PRIV=private; PRIV=private T IND= indirect tax; T FOP=tax factor of production ; T DIR= direct tax; T IMP= import tax; T export (net) = export tax net of export subsides; ROW =rest of the world ; Exp =expenditure ; tr = transfers. ; trt = transactions.

Households receive income from factors of production (cell D-3.i)[3], enterprises (cell D-5), the government (cell D-6) and the rest of the world (cell D-9), which is used to consume (cell B-4), to pay direct taxes (cell H.3-4) and other transfers to the government (cell F-4), to transfer abroad (cell I-4) or with saving purposes (cell G.1-4). Governments obtain their income from taxes (cells F-8.1 to 8.5) and transfers by households (cell F-4) and the rest of the world (cell F-18). This is used for consumption (B-6) and to be transferred to households (D-6) and the rest of the world (cell Q-6), the rest of it being saved (cell G-6).

The institutional account for enterprises is not constructed with specific data concerning income-expenditure decisions by firms, hence it only collects income form non-labor factors of production (gross operation surplus) (cell E-3.4), transfers it to households (cell D-5).

The ROW account reflects transactions with the rest of the world: i- imports and exports of goods and services (cells J-2 and B-9, correspondingly), ii- transfers to and from abroad by institutional sectors (cells I-4 and I-6), and iii- foreign savings or disavings (cell I-9). In the Macro SAM, I do not record transfers between factors of production and the rest of the world (to and from) because Argentina's national accounts do not provide this data. All private transactions with the rest of the world, therefore, are assumed to be done by households.

The capital accounts in the SAM record current savings from all institutions (row G, cells G.1-4, G.2-6 and G-9) row-wise and investment columnwise; the latter is opened-up in private and public investment (cells B-7.1 and B-7.2 correspondingly) and includes variations in stocks.

The SAM also contains various specific *tax accounts*, which collect different taxes (and pay subsidies) (rows H.1 to H.5) and transfer this income to the government (columns 8.1 to 8.5).

Methodological remarks

To construct the MACRO SAM I use the 'best' information from official data sources: the National Bureau of Statistics (INDEC) and different secretaries at the Ministry of Economy and Production (MECON): the Treasury Secretary (SH), the National Office of National Accounts (DNCN), the National Office of International Accounts (DNCI) and the National Office of Fiscal Research (DNIAF). (See Table A.7 for a detail of the acronyms used in this chapter).

For reasons of definitions and boundaries, different assumptions were made so as to match available data with the accounts defined in the Macro SAM. One of these assumptions is that, besides the Central Bank, the financial sector receiving or making transfers abroad is private. With the description of the data used to fill-up the cells of the MACRO SAM I refer to the other assumptions that were implemented.

Similar data was provided by different government offices. The following are the most relevant choices that were taken in relation to the data sources used to build the Macro SAM:

- Most macroeconomic data (valued added, private and government consumption, investment, and export and import figures) is taken form DNCN's total supply and demand (TSTD);
- Savings figures come from DNCN's report "Agregados macroeconómicos de cuentas nacionales";
- Transfers to and from the rest of the world taken from DNCI's Balance of Payment tables.

Data sources of the Macro SAM

Below I present the data used to fill each of the cells of the Macro SAM (with letters and numbers corresponding to those from Table A.1).

[B.1] Intermediate consumption: obtained by residual after subtracting value added at basic prices (cell [C-1] from domestic production [A-2]).

[C-1] Gross value added: data on total payments to factors of production is taken from 'Cuadro 5.3' provided by the DNCN. Data is considered at basic costs (after deducting value added, trade and specific taxes).

I opened up value added figures in wages and gross operating surplus using the structure of payments to factors of production elaborated by DNCN's "Cuenta de Generación del Ingreso e Insumo de Mano de Obra". Payments to factor of production labor are divided in wage-labor and non-wage labor, with the first group further subdivided in labor that is protected by the social security and labor which is not. The Macro SAM thus has the following four value added accounts.

[C.1.-1] Value added wage-labor, protected by the social security: gross valued added at basic prices times the share of labor income paid to this labor group.

[C.2-1] Value added wage-labor, not protected by the social security: as in [C.1.-1].

[C.3-1] Value added non wage-labor: as in [C.1.-1].

[C.4-1] Value added gross operating surplus: as in [C.1.-1].

[A-2] Marketed output (or gross production GP): obtained using: i- a sectoral value index of gross production (GP) for the 124 sectoral accounts of Argentina's 1997 input-output table (MIPAr97), constructed by the DNCN, and ii- the MIPAr97 symmetric table. I applied the 2004 sectoral GP value index to the 1997 sectoral GP at basic prices, as provided by MIPAr97, and add the 2004 sectoral GP to arrive at the aggregate GP in 2004.

[H.1-2] Value added tax and other indirect taxes: value added tax is obtained from DNIAF, table 'Recaudación Nominal 1980-2004'. Indirect taxes other than value added tax include i- specific taxes on goods and services; ii- other specific taxes on services; iii- production and sale taxes by provinces and are obtained by residual.[4]

[H.4-2] Import tax*:* obtained from DNIAF, table 'Recaudación Nominal 1980-2004'. It includes: i- import taxes, and ii- tax on exchange operations.[5]

[H.5-2] Export tax (net of export subsidies): taken from DNIAF, table 'Recaudación Nominal 1980-2004'.

Two points are worth mentioning regarding data on indirect taxes. First, although the DNCN provides aggregate data on indirect taxes, I opted to use most tax data from the same data source and thus I work using the information produced by DNIAF. Second, I do not distinguishing specific taxes to activities (cell [H.I-2]), therefore all indirect taxes are included in the commodity column.

[I-2] Imports: imports data is taken from TSTD tables, 'Cuadro 6' produced by the DNCN.[6]

[D-3.1 to 3.3] and [E-3.4] Factors of production (FOP) transfers to households and enterprises: obtained after deducting taxes paid by factors of production (cells [H.2-3.1] and [H.2-3.3]) from value added paid to factors of production, as presented in cells [C.1-1 to C.3-1].

[H.2-3.1] Tax paid by protected wage labor: contributions to the social security paid by wage labor protected by the social security system, as provided by DNIAF in the table 'Recaudación Nominal 1980-2004'. It includes taxes paid by employees and employers.

[H.2-3.3] Tax paid by non-wage labor: contributions to the social security paid by non-wage labor, as provided by DNIAF in the table 'Recaudación Nominal 1980-2004'. Tax paid by autonomous workers and other workers contributing to the simplified tax regime (Monotributo).

Due to lack of data, all transfers to and from the rest of the world are done by households and the government.

[B-4] Private consumption: taken from TSTD tables, 'Cuadro 6' produced by the DNCN.

[F-4] Transfers from Households to the government (other government current income*).* This accounts records all government income not coming from taxes, contributions to the social security and transfers from ROW. I call this income *'other government current income'*. Income assigned to this cell is the sum of the following government current income accounts: i- non-tributary income; ii- sales of public goods and services; iii- property rents; iv- other income; v- current domestic transfers, and vi- public enterprises surplus.[7] These data is obtained from the document "Sector Público Argentino no Financiero. Cuenta de Ahorro-Inversión-Financiamiento" produced by the SH (henceforth referred as SH-SIF) (http://www.mecon.gov.ar/onp /html/series/Serie1961-2004.pdf, p.89).[8]

[G.1-4] Household savings: taken from the report "Agregados macroeconómicos de cuentas nacionales"; Cuadro 5 'ahorro nacional y privado a precios corrientes', produced by the DNCN.

[H.3-4] Direct income tax paid by households: taken from DNIAF, table 'Recaudación Nominal 1980-2004'. Direct taxes include: i- national taxes on interests, profits and capital gains paid by households and enterprises; ii- national taxes on property (including taxes on current account transfers[9]) paid by households; iii- province property taxes, assumed to be paid by households, and iv- other taxes (excluding MONOTRIBUTO).

[I-4] Household transfers to ROW: obtained from Balance of Payments (BOP) tables produced by the DNCI; 'Summary table 1' and table 4: 'investment income'.[10]

[D-5] Transfers from enterprises to households: transfers income from cell [E-3.4] to households.

[B-6] Government consumption: taken from TSTD tables; 'Cuadro 6' produced by DNCN.

[D-6] Government transfers to households: current domestic transfers by the government include: i- current expenditure in social security; ii- current transfers to the private sector; iii- interest for debt in LCU, and iv- other rents (assumed to be paid to the domestic private sector). They are obtained by residual deducting government consumption, savings, transfers to ROW and export subsidies from total government income.

[G.2-6] Government savings: data provided by the DNCN in the report "Agregados macroeconómicos de cuentas nacionales"; Cuadro 5 'ahorro nacional y privado a precios corrientes'.

[I-6] Government transfers to ROW: I obtain this information from BOP tables produced by the DNCI; 'Summary table 1' and table 4: 'investment income'.[11]

[B-7] Private investment demand and [B-8] Public investment demand: aggregate investment (including stock variations) is taken form TSTD tables; 'Cuadro 6'.This is opened up in private and public investment using DNCN's investment estimations (http://www.mecon.gov.ar/secpro/dir_cn/inversion/septiembre2005/default1.htm, "Cuadro 1. Inversión Bruta Interna Fija Pública y Privada a precios corrientes").

[B-9] Exports: taken from TSTD tables; 'Cuadro 6'.

[D-9] Transfers to households from ROW: obtained from BOP tables produced by the DNCI; 'Summary table 1' and Table #.4: 'investment income'.

Transfers to the domestic private sector equal: i- interest gained by the financial sector not considering the Central Bank (assuming that interest from this sector are only private); ii- interest gained by the non-financial private sector; iii- profits gained by the private sector (financial and non-financial), and v- other rents and current transfers.[12]

[F-9] Transfers to the government from ROW: obtained from BOP tables produced by the DNCI; 'Summary table 1' and Table 4: 'investment income'). Transfers from abroad to the government correspond to interest gained by: i- the Central bank, and ii- the non-financial public sector.

[G-9] Foreign savings: data provided by the DNCN in report "Agregados macroeconómicos de cuentas nacionales" (Cuadro 5 'ahorro nacional y privado a precios corrientes.

Balancing the Macro SAM

The combination of different data sources and differences in exchange rates used to convert dollar data into local currency units, account boundaries and the various assumptions made to put the information together give an unbalanced Macro SAM, where foreign exchange outflows exceed foreign exchange inflows by less than 1% and households income surpasses household expenditures by a similar amount.

This unbalanced Macro SAM is adjusted using the cross-entropy methodology. In the cross-entropy balancing procedure, the unbalanced Macro SAM is taken as the prior SAM and is adjusted imposing the following constraints:

- The general equilibrium consistency condition that total income equals total expenditure and row and column sums are equal.

- Linear restrictions for macroeconomic aggregates to respect information provided by NIPA accounts. In particular: GDP at factors costs, GDP at market prices, private and government consumption, private and public investment, exports and imports.
- Zero constraints for capital transfers to the rest of the world.

The final balanced Macro SAM is presented in Table A1.2 below.

***Table A1.2** Macro SAM*

			Production					
					Factors of Production			
			ACT	COMM	VA W L P	VA WL not P	VA Non W-L	VA GOS
Production		ACT		727.488.587				
		COMM	350.707.871					
	FOP	VA W-L P	115.186.380					
		VA W-L not P	22.226.499.					
		VA Non W-L	51.456.880					
		VA GOS	187.910.955					
Institutions		HHLD			102.652.029	22.226.500	49.894.215	
		ENT						187.910.956
		GOV						
	Capital trt..	S-I PRIV						
		S-I PUB						
Tax		T IND		52.166.014				
		T FOP			12.534.351		1.562.666	
		T DIR						
		T IMP		3.371.173				
		T Export (net)		8.712.345				
Rest of the World				81.761.525				
Total Receips			727.488.587	873.499.643	115.186.380	22.226.500	51.456.880	187.910.956

Table A1.2 *(Continuation)*

			Institutions				
			Current trt.			Capital trt.	
			HHLD	ENT	GOV	S-I PRIV	S-I PUB
Production		ACT					
		COMM	276.175.345		49.669.704	76.948.378	7.739.775
	FOP	VA W-L P					
		VA W-L not P					
		VA Non W-L					
		VA GOS					
Institutions	Current trt.	HHLD		187.910.956	45.340.329		
		ENT					
		GOV	6.879.919				
	Capital trt.	S-I PRIV	81.237.638				
		S-I PUB			10.964.535		
Tax		T IND					
		T FOP					
		T DIR	39.776.586				
		T IMP					
		T Export (net)					
Rest of the World			15.146.342		20.742.551		
Total Receips			419.215.829	187.910.956	126.717.119	76.948.378	7.739.775

VA W-L P = Value added wage-labor protected by the social security ; VA W-L not P = Value added wage-labor not protected by the social security; VA Non W-L = Value added payments to labor other than wage labor VA GOS = Value added gross operating surplus; FOP = Factor of production; HHLD= Households; ENT= Enterprise; GOV= Government; S-I =Saving - investment account; PRIV = private; PUB = public; T IND = indirect tax; T FOP = tax factor of production; T DIR = direct tax; T IMP= import tax; T export (net) = export tax net of export subsides; ROW =rest of the world; Exp = expenditure; tr. =transfers; trt.= transactions

Table A1.2 (Continuation)

			Tax				
			T IND	T FOP	T DIR	T IMP	T Export (net)
Production		ACT					
		COMM					
	FOP	VA W-L P					
		VA W-L not P					
		VA Non W-L					
		VA GOS					
Institutions	Current trt.	HHLD					
		ENT					
		GOV	52.166.014	14.097.016	39.776.586	3.371.173	8.712.345
	Capital trt.	S-I PRIV					
		S-I PUB					
Tax		T IND					
		T FOP					
		T DIR					
		T IMP					
		T Export (net)					
Rest of the World							
Total Receips			52.166.014	14.097.016	39.776.586	3.371.173	8.712.345

VA W-L P = Value added wage-labor protected by the social security ; VA W-L not P = Value added wage-labor not protected by the social security; VA Non W-L = Value added payments to labor other than wage labor VA GOS = Value added gross operating surplus; FOP = Factor of production; HHLD= Households; ENT= Enterprise; GOV= Government; S-I =Saving - investment account; PRIV = private; PUB = public; T IND = indirect tax; T FOP = tax factor of production; T DIR = direct tax; T IMP= import tax; T export (net) = export tax net of export subsides; ROW =rest of the world; Exp = expenditure; tr. =transfers; trt.= transactions

Table A1.2 *(Continuation).*

			ROW	Total Outlays
Production		ACT		727.488.587
		COMM	112.258.570	873.499.643
	FOP	VA W-L P		115.186.380
		VA W-L not P		22.226.500
		VA Non W-L		51.456.880
		VA GOS		187.910.956
Institutions	Current trt.	HHLD	11.191.801	419.215.829
		ENT		187.910.956
		GOV	1.714.066	126.717.119
	Capital trt.	S-I PRIV	-4.289.259	76.948.378
		S-I PUB	-3.224.759	7.739.775
Tax		T IND		52.166.014
		T FOP		14.097.016
		T DIR		39.776.586
		T IMP		3.371.173
		T Export (net)		8.712.345
Rest of the World				117.650.418
Total Receips			117.650.418	

VA W-L P = Value added wage-labor protected by the social security ; VA W-L not P = Value added wage-labor not protected by the social security; VA Non W-L = Value added payments to labor other than wage labor VA GOS = Value added gross operating surplus; FOP = Factor of production; HHLD= Households; ENT= Enterprise; GOV= Government; S-I =Saving - investment account; PRIV = private; PUB = public; T IND = indirect tax; T FOP = tax factor of production; T DIR = direct tax; T IMP= import tax; T export (net) = export tax net of export subsides; ROW =rest of the world; Exp = expenditure; tr. =transfers; trt.= transactions

A1.3.2 Microeconomic features of Argentina's SAM

Microeconomic features of the SAM concern the classification of economic activities, the goods that are produced domestically and imported from the rest of the world, factors of production and households.

Classification of commodities and economic sectors[13]

The Social Accounting Matrix includes accounts for five commodities and economic sectors: the traditional primary sector (PP), natural resource and non-natural resource based industries and products (MR and MO), producer and exportable services (PS), and consumer services (OS). Tradable commodities and economic sectors PP, MR and MO are defined according to the CTP-DATA classification taxonomy proposed by Peirano and Porta (2000). The SAM also includes a group of producer services PS, which can also be exchanged internationally, providing utilities (electricity, gas and water), transportation and communication services and financial and other specialized services, as well as construction services. The fifth sector included in Argentina's SAM produces and provides services that are consumed by domestic institutions.

Factors of production

Argentina's microeconomic SAM has ten factors of production. One aggregated capital and nine labour categories. In the Macro SAM labor is divided into wage and non-wage labor, with the former divided in wage-labor that is protected by the social security and wage-labor that it is not. In the microeconomic social accounting matrix I additionally classify these three types of labor according to their skills, as: unskilled, semi-skilled and skilled labor, as shown in Table A1.3 below.

Table A1.3
Employment classification

<table>
<tr><td rowspan="6">Wage-labour</td><td rowspan="3">Protected by the social security system</td><td>Unskilled</td></tr>
<tr><td>Semi-skilled</td></tr>
<tr><td>Skilled</td></tr>
<tr><td rowspan="3">Not Protected by the social security system</td><td>Unskilled</td></tr>
<tr><td>Semi-skilled</td></tr>
<tr><td>Skilled</td></tr>
<tr><td rowspan="3">Non-wage labour</td><td rowspan="3"></td><td>Unskilled</td></tr>
<tr><td>Semi-skilled</td></tr>
<tr><td>Skilled</td></tr>
</table>

Two attributes of the workforce are combined to classify employees according to their skills: their level of education and their experience. The level of education is defined as *high (H)* when workers completed their tertiary education, *medium (M)* or *intermediate* if secondary education is complete and/or tertiary incomplete, and *low (L)* otherwise. In terms of experience, I classify employees in the following three groups: *experienced (E)*, *semi experienced* or with *intermediate experience (SE)* and *inexperienced (I)*.

Workers experience is defined in relation to the difference between the workers' age and the age they were supposed to have when they achieved their maximum level of education.[14] Experienced workers are those that are five years older than the age associated to level of education they achieved (henceforth education-age), semi-experience workers are employees that are between one and five years older than their education-age and workers that are less than one year older than education-age are classified as inexperienced.[15] For example, a worker that completed the tertiary education – which is assumed to be finished at the age of 23 – is classified as experienced if she has 28 years old and as semi-experienced in case she has 25 years old.[16]

The rationale of this classification is that formal education is not the only determinant of workers skills, as learning and on the job training, can be as important, or even more, than formal education to determine the workers ability and remuneration. The matrix below indicates how the two attributes are combined to classify workers according to their skills.

As shown in the matrix, workers with the same levels of each attribute are classified with an equivalent level of skills – i.e. workers that completed tertiary education and have more than five years of experience are defined as skilled workers. In other cases, however, the level of skills is defined differently. When workers have the highest level of one attribute and the intermediate or lowest of the other, their skills are defined as one level higher than the lowest level of the two attributes. For example, if a worker has high education but no experience, she is classified as a semi-skilled worker.[17] By contrast, when workers have the lowest level of one attribute and an intermediate level of the other, their skills are equal to the lower of the two attributes.

		EXPERIENCE		
		EXPERIENCED	**SEMI-EXP**	**INEXPERIENCED**
EDUCATION	**HIGH**	SKILLED	SKILLED	SEMI-SKILLED
	MEDIUM	SKILLED	SEMI-SKILLED	UNSKILLED
	LOW	SEMI-SKILLED	UNSKILLED	UNSKILLED

Domestic institutions

The microeconomic SAM includes information for five household groups, which are classified according to their per capita income in 2004. A final feature of the microeconomic SAM is the inclusion of accounts for private investment by economic sectors.

A1.3.3 Argentina's Microeconomic SAM

Microeconomic information is added to the MACRO SAM in the second and third steps of the top-down approach, giving place to the Micro SAM 1 and the Micro SAM 2, which is also the final Social Accounting Matrix. To build the Micro SAM 1 I open the commodity and activity accounts using information about structures or values from all available data sources. Once this account is balanced, I open the accounts corresponding to factors of production and households, using household and expenditure surveys.

The micro SAM 1

Opening the commodity and activity accounts affects the following cells of the schematic SAM presented in Table A1.1: [B-1] Intermediate inputs demand; [C.1 to C.4-1] Payments to factors of production;

[A-2] Domestic production; [H.1, H.4 and H.5-2] Indirect, import and net export taxes; [I-2] Imports; [B-4 and 6] Household and government consumption; [B-7.1 and 7.2] Private and public investment by destination, [B-7.1] Private investment by origin and [B-9] exports.

[B-1] Intermediate consumption: The structure of intermediate inputs demand is obtained from Argentina's 1997 input-output tables (MIPAr97 Use Table), and total intermediate consumption by economic sector is estimated by residual after subtracting value added from gross output by economic sector.

Argentina's input-output tables are adjusted to the taxonomy employed in this research. Commodities are adjusted first and economic activities secondly. Tradable commodities are adjusted to the CTP-DATA taxonomy (sectors PP, MR and MO) using different correspondence tables.[18] Non-tradable goods and services from Argentina's input-output tables defined as producer services (PS) are: construction, utilities (electricity, gas and water), transportation and communication services and financial and specialized producer services[19], including education and research and development. And the remaining services are classified as consumer services and involve health and social services, retail trade, administrative services, real state and other informal services.

Once the commodities in Argentina's input-output tables were adjusted, I employed MIPAr97 supply tables to classify tradable anod non-tradable economic activities. Sectors are classified as PP, MR, MO, PS and OS if the main activity they produce has such characteristics.

[C.i-1] Payments to factors of production

[C.1-1], [C.2-1], [C.3-1] Payments to wage-labor protected; wage-labor not-protected, and non-wage labor by economic sectors: The structure of factor payments to different labor types by economic sectors are taken from DNCN's "Generación del Ingreso e Insumo de Mano de Obra" and personal income earnings data from Argentina's household survey (EPH).[20]

[C.4-1] Gross operating surplus by economic sector: Figures in these cells are obtained by residual, after deducting payments to different labor types from value added by economic sector.

I use sectoral value added information produced by the DNCN to obtain sectoral structures and apply these structures to the data form the MACRO SAM to obtain value added for sector PP, MR, MO, PS and OS.

[A-2] Domestic production (or gross production GP) by economic sector: gross production for year 2004 is obtained using the sectoral value index of gross production for the activities in Argentina's input-output tables constructed by the DNCN. Total gross production is opened up with the marketed output structure obtained from MIPAr97 supply to obtain the information corresponding to these cells. [21]

[H.1-2] Indirect tax by commodity: data of value added tax by commodity is taken from the Public Income Federal Administration (AFIP) yearly statistical report (http://www.afip.gov.ar/institucionales/estadisticas/estadisticas.asp, table 2.1.1.1), whereas the structure of other indirect taxes paid by activities is estimated using information about specific taxes paid by economic activities provided in DNCN sectoral value added tables. These structures are applied to indirect tax cell of the Macro SAM.

[H.4 and H.5-2] Import and (net) export[22] tax by commodity: obtained from AFIP's yearly statistical report (http://www.afip.gov.ar/institucionales/estadisticas/estadisticas.asp), table c.1.10.2 for imports and table c.1.9.2 for exports. Commodity tax figures are adjusted to the taxonomy employed in this research and to match the values of the MACRO SAM.

[I-2] Imports ([B-9] Exports): Imports (exports) for the different commodity groups are obtained as follows:

- First I divide total imports (exports) in goods and service imports (exports) using information provided in the Balance of Payments tables produced by the DNCI (http://www.mecon.gov.ar/cuentas/internacionales/series_anuales.htm#I). See Summary Table 1.
- Service imports (exports) are assigned to the commodity group PS, and
- Goods imports (exports) are further divided according to the CTP-DATA taxonomy using disaggregated data from UN's COMTRADE database. The structure of goods imports (exports) in 2004 is applied to the value of total imports obtained in the first step.

[B-4] Household consumption by commodity group: obtained applying the structure of total private consumption from MIPAr97: Use Matrix to the value of private consumption from the Macro SAM.

[B-6] Government consumption by commodity group: as household consumption.

[B-7.1] Private Investment by origin

Alternative data sources were combined to obtain an (imperfect) approximation to the structure of investment by economic sector. These are: CEP's sectoral investment database, INDEC's Big Corporations Survey[23] (ENGE) and data of imports of capital goods by economic sectors produced by MECON. Most information (for sectors MR, MO, PS and OS) is taken from CEP.[24] Yet, as CEP's database seems to underestimate investment in agriculture and cattle raising activities[25], the share of investment by the agricultural primary sector is taken from MECON and is assumed to equal the percentage of capital goods imports from this sector.

[B-7.1] and [B-7.2] Private and public investment by destination: the structure of investment by destination is obtained as described below.

- The percentage of investment in constructions in 2004 total private and public investment is taken from the tables produced by DNCN (See http://www.mecon.gov.ar/secpro/dir_cn/inversion/septiembre2005/default1.htm, Table 3 and Table 5)
- The structure of non-construction private and public investment is obtained from 1997 input-output tables (MIPAr97 M2: Use Matrix)
- These structures are applied to total public investment and to private investment by origin (assuming that private investment from different sectors is spent on the same type of goods) and adjusted to the value investment form the Macro SAM.

To finish the first the microeconomic SAM (Micro SAM 1) the remaining information is taken from the Macro SAM. This concerns the following cells: [D-3.1 to 3.3, labor income to households], [E-3.4, capital income to enterprises]; [H.2-3.1 and 3.2, tax paid by labor]; [D-5, enterprise transfers to households]; [D-6, government transfers to households]; [F-4, household transfers to the government]; [G.1-4, private savings]; [G.2-6, government savings]; [H.3-4, direct tax]; [I-4, household transfers to ROW]; [I-6, government taxes to ROW]; [D-9, transfers to households from ROW]; [G-9, transfers to the government from ROW].

An unbalanced Micro SAM 1 is obtained in the first instance and is adjusted using the cross-entropy methodology. The following constraints have been used at this stage:

- Equality between row and column sums;
- Linear restrictions to reproduce the values of the Macro SAM;
- Gross production by economic activities, the structure of trade (goods vis-à-vis services); the structure of investment by destination (investment in constructions vis-à-vis investment in other commodities considered in the SAM); zero constraints for imports and exports from sector OS, and zero constraints for export and import tax from sectors PS and OS.

Table A1.4
Payment from activities to labour types

	ECONOMIC SECTOR				
	pp	**MR**	**MO**	**PS**	**OS**
C/3.1.1. Protected wage-labor. Unskilled	0,75	1,67	2,98	2,64	2,21
C/3.1.2. Protected wage-labor. Semi skilled	44,61	49,02	39,39	29,33	33,23
C/3.1.3. Protected wage-labor. Skilled	54,64	49,31	57,62	68,04	64,56
	100	**100**	**100**	**100**	**100**
C/3.2.1. Not protected wage-labor. Unskilled	10,58	12,38	10,77	7,75	7,30
C/3.2.2. Not protected wage-labor. Semi skilled	72,23	60,32	44,99	54,92	56,11
C/3.2.3. Not protected wage-labor. Skilled	17,19	27,30	44,24	37,33	36,59
	100	**100**	**100**	**100**	**100**
C/3.3.1. Non wage-labor. Unskilled	2,39	1,38	0,64	1,11	1,86
C/3.3.2. Non-wage labor. Semi skilled	17,43	33,08	30,76	30,00	34,58
C/3.3.3. Non-wage labor. Skilled	80,18	65,54	68,60	68,89	63,56
	100	**100**	**100**	**100**	**100**

The final SAM

In the third and final step of the top-down approach I add microeconomic information about payments to labor with different skills and households disaggregated by quintile of per capita income. The following accounts are adjusted using information from Argentina's household survey (EPH).

[C.i.j -1 open by activity] Payments by activity to labor according to skills (where i=labor type and j=skills, see Table A1.4 for details):

I use Argentina's household survey (EPH) to obtain the percentage of total labor income[26] that each economic sector pays to workers from each of the 9 labor categories identified in Argentina's microeconomic SAM, as illustrated in the Table A1.4 below. This structure is applied to the figures obtained from the balanced Micro SAM 1.

[D.i-3.i.j] Transfers from factors of production to households (where i= household by quintile and labor types, and j=workers skills);

I also employ the EPH to estimate the distribution of factor's income to households classified by quintile of per capita income. Income is distributed using Table A1.5, which provides information about the structure of the transfers from each labor type to each household group and the distribution to households of non-labor income. The latter is used to distribute gross operating surplus to households.

Table A1.5
Factors's income transfers to households

	Labor income by Labor type and skills									Non-labor income
	Wage-labor protected			Wage-labor not-protected			Non wage-labor			
Households	**Unsk**	**Semisk**	**Skld**	**Unsk**	**Semisk**	**Skld**	**Unsk**	**Semisk**	**Skld**	
Quintile 1	1,4	5,4	1,1	17,7	24,8	7,3	24,1	17,6	2,0	6,3
Quintile2	12,1	19,3	6,4	22,1	25,6	12,5	15,5	20,1	4,5	11,5
Quintile3	14,1	24,1	12,8	21,5	20,8	12,7	11,5	19,9	8,3	16,6
Quintile4	29,3	25,4	24,1	21,5	18,3	18,1	25,6	18,8	18,0	22,6
Quintile5	43,1	25,7	55,6	17,3	10,4	49,4	23,4	23,6	67,1	43,0
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: own estimations using EPH

[H.2-3.i.j] Factor (labor) tax (where i=labor types, and j=workers skills);

Wage labor not protected by the social security does not pay factor taxes. Taxes corresponding to the other two labor types (protected wage labor and non-wage labor) are distributed in proportion to the percentage of labor income received by each category or worker's skills.

[B-4.i] Household consumption (where i=household by quintile): the structure of household consumption from different quintiles is obtained from 1996-1997 Argentina's Expenditure Survey (ENGHO).

[F-4.i] Household transfers to the government (where i=household by quintile): values from the Macro SAM are distributed proportionally to the weight of each household type on total income.

[G-4.i] Household savings by quintile (where i=household by quintile): aggregate private savings are distributed to households using information from 1996-1997 Argentina's Expenditure Survey produced by INDEC (ENGHO, see Table 13).[27]

[H.3-4.i] and [I-4.i] Direct tax paid by households and transfers from households to ROW by household group (where i=household by quintile): the structure of household savings is employed to open these cells of the Macro SAM.

[D.i-5; 6 and 9] Transfers from enterprises, the government and the rest of the world to households (where i=household by quintile): transfers to households are distributed using the structure of non-labor income received by each household. This is obtained from EPH and presented in Table A.1.5 above.

The addition of this data to the Micro SAM 1 gives a new unbalanced SAM where household income exceeds (household groups 2 to 4) or falls short (household groups 1 and 5) from household expenditures by less than 1%. This is once more balanced using the cross-entropy methodology with the constraints also employed to balance the Micro SAM 1: row and column sum consistency conditions, linear restrictions to reproduce the values from the Macro SAM, gross production by activity, structures for trade and investment by destination and zero constraints zero constraints for imports and exports from sector OS, and zero constraints for export and import tax from sectors PS and OS. The final SAM for Argentina's is presented in Table A1.6 below.

Table A1.6 Argentina's Microeconomic SAM

			Production Activities PP	MR	MO	PS	OS
Production	ACT	PP					
		MR					
		MO					
		PS					
		OS					
	COMM	PP	21.296.709	40.573.261	2.234.447	10.303.839	1.829.114
		MR	6.467.965	42.158.677	9.806.789	8.659.290	10.231.176
		MO	2.801.211	13.060.750	28.504.000	13.447.506	4.743.651
		PS	11.300.541	19.415.392	10.203.661	29.106.290	28.311.183
		OS	1.038.655	4.163.438	2.299.881	8.512.763	16.585.694
Factors of Production	VA W-L P	FWLP1	37.953	199.278	279.905	1.061.999	1.074.434
		FWLP2	2.206.274	5.855.840	3.697.098	11.890.677	16.270.918
		FWLP3	2.711.257	5.920.081	5.422.554	27.738.794	31.781.289
	VA W-L not P	FWLNP1	405.221	272.411	77.423	507.982	650.970
		FWLNP2	2.774.499	1.331.361	321.825	3.620.500	5.031.678
		FWLNP3	658.791	600.244	315.581	2.447.485	3.264.094
	VA Non W-L	FNWL1	125.741	97.621	25.655	164.712	377.526
		FNWL2	916.221	2.327.861	1.203.095	4.469.259	7.077.615
		FNWL3	4.218.774	4.624.689	2.686.125	10.296.853	13.049.510
	VA GOS	FACG	51.137.127	28.458.219	21.698.583	50.283.921	38.802.352
Institutions – Current transfers	HHLD	HOUQ1					
		HOUQ2					
		HOUQ3					
		HOUQ4					
		HOUQ5					
	ENTERPRISE						
	GOVERMENT						
Institutions – Capital transfers	Private Investment	PP					
		MR					
		MO					
		PS					
		OS					
	Public Investment						
Tax		T IND					
		T FOP					
		T DIR					
		T IMP					
		T Export (net)					
	Rest of the world						
Total Recips		TOTAL	108.096.941	169.059.123	88.776.624	182.511.871	179.081.203

A1.6 (Continuation)

				Production				
				Commodities				
				PP	MR	MO	PS	OS
Production		ACT	PP	104.455.114	1.525.840	25.275	2.037.474	53.239
			MR	3.642.212	159.140.474	2.505.297	3.369.110	402.031
			MO	378.895	3.011.811	82.106.045	3.207.771	72.102
			PS	3.777.490		3.928	170.091.899	8.638.554
			OS				6.367.069	172.714.134
		COMM	PP					
			MR					
			MO					
			PS					
			OS					
	Factors of Production	VA W-L P	FWLP1					
			FWLP2					
			FWLP3					
		VA W-L not P	FWLNP1					
			FWLNP2					
			FWLNP3					
		VA Non W-L	FNWL1					
			FNWL2					
			FNWL3					
		VA GOS	FACG					
Institutions	Current transfers	HHLD	HOUQ1					
			HOUQ2					
			HOUQ3					
			HOUQ4					
			HOUQ5					
		ENTERPRISE						
		GOVERMENT						
	Capital transfers	Private Investment	PP					
			MR					
			MO					
			PS					
			OS					
		Public Investment						
		Tax	T IND	12.403.353	13.870.487	5.374.646	16.152.889	4.244.681
			T FOP					
			T DIR					
			T IMP	131.143	448.132	2.792.906		
			T Export (net)	3.749.124	4.969.786			
		Rest of the world		3.038.260	13.142.707	45.708.740	19.859.965	
		Total Recips	TOTAL	131.575.591	196.109.237	138.516.838	221.086.177	186.124.740

A1.6 (Continuation)

			Production					
			Factors of Production					
			VA W-L P			VA W-L not P		
			FWLP1	FWLP2	FWLP3	FWLNP1	FWLNP2	FWLNP3
Production	ACT	PP						
		MR						
		MO						
		PS						
		OS						
	COMM	PP						
		MR						
		MO						
		PS						
		OS						
	Factors of Production: VA W-L P	FWLP1						
		FWLP2						
		FWLP3						
	VA W-Lnot P	FWLNP1						
		FWLNP2						
		FWLNP3						
	VA Non W-L	FNWL1						
		FNWL2						
		FNWL3						
	VA GOS	FACG						
Institutions	Current transfers: HHLD	HOUQ1	33.988	1.961.110	760.677	339.316	3.266.928	535.435
		HOUQ2	284.784	6.746.541	3.975.162	421.817	3.332.573	907.419
		HOUQ3	332.930	8.480.947	8.068.194	410.348	2.715.551	924.812
		HOUQ4	693.184	9.028.961	15.495.291	411.964	2.388.155	1.313.102
		HOUQ5	1.019.997	9.352.235	37.375.955	330.561	1.376.657	3.605.429
	ENTERPRISE							
	GOVERMENT							
	Capital transfers: Private Invest-ment	PP						
		MR						
		MO						
		PS						
		OS						
	Public Investment							
Tax		T IND						
		T FOP	288.687	4.351.014	7.898.696			
		T DIR						
		T IMP						
		T Exp (net)						
Rest of the world								
Total Recips		TOTAL	2.653.570	39.920.808	7.573.975	1.914.007	13.079.864	7.286.196

A1.6 (Continuation)

				Production		
				Factors of Production		
				VA Non W-L		VA GOS
			FNWL1	FNWL2	FNWL3	FACG
Production	ACT	PP				
		MR				
		MO				
		PS				
		OS				
	COMM	PP				
		MR				
		MO				
		PS				
		OS				
Factors of Production	VA W-L P	FWLP1				
		FWLP2				
		FWLP3				
	VA W-L not P	FWLNP1				
		FWLNP2				
		FWLNP3				
	VA Non W-L	FNWL1				
		FNWL2				
		FNWL3				
	VA GOS	FACG				
Institutions – Current transfers	HHLD	HOUQ1	184.567	2.738.764	684.950	
		HOUQ2	119.023	3.090.990	1.493.413	
		HOUQ3	88.312	3.074.354	2.751.635	
		HOUQ4	196.077	2.916.418	5.999.194	
		HOUQ5	179.235	3.687.546	22.897.658	
	ENTERPRISE					190.380.202
	GOVERMENT					
Institutions – Capital transfers	Private Invest-ment	PP				
		MR				
		MO				
		PS				
		OS				
	Public Investment					
Tax		T IND				
		T FOP	24.041	485.981	1.049.101	
		T DIR				
		T IMP				
		T Exp (net)				
Rest of the world						
Total Recips		TOTAL	791.255	15.994.052	34.875.950	190.380.202

A1.6 (Continuation)

				HOUQ1	HOUQ2	HOUQ3	HOUQ4	HOUQ5
				Institutions Current Transfers Households				
Production		ACT	PP					
			MR					
			MO					
			PS					
			OS					
		COMM	PP	1.878.134	2.684.801	3.144.163	3.911.792	4.821.965
			MR	10.322.694	13.898.595	15.362.735	17.728.887	22.659.603
			MO	2.148.279	3.667.239	4.553.388	6.050.715	8.753.207
			PS	4.241.699	6.795.489	8.195.833	10.508.564	16.263.698
			OS	6.516.778	12.143.716	16.457.676	25.527.676	51.313.801
	Factors of Production	VA W-L P	FWLP1					
			FWLP2					
			FWLP3					
		VA W-L not P	FWLNP1					
			FWLNP2					
			FWLNP3					
		VA Non W-L	FNWL1					
			FNWL2					
			FNWL3					
		VA GOS	FACG					
Institutions	Current transfers	HHLD	HOUQ1					
			HOUQ2					
			HOUQ3					
			HOUQ4					
			HOUQ5					
		ENTERPRISE						
		GOVERMENT		415.375	862.387	1.174.480	1.583.474	2.879.610
	Capital transfers	Private Invest-ment	PP		1.039.220	3.601.699	6.358.858	22.361.259
			MR		331.874	1.149.469	2.028.954	7.130.085
			MO		229.298	793.885	1.401.178	4.922.791
			PS		585.081	2.027.247	3.578.740	12.580.312
			OS		348.188	1.206.021	2.128.797	7.481.164
		Public Investment						
Tax			T IND					
			T FOP					
			T DIR		735.988	2.506.484	4.314.459	13.811.462
			T IMP					
			T Exp (net)					
Rest of the world					472.408	1.636.667	2.889.185	10.155.913
Total Recips			TOTAL	25.522.959	43.794.284	61.809.746	88.011.280	185.134.871

A1.6 (Continuation)

				Institutions Current Transfers	
				ENT	GOV
Production		ACT	PP		
			MR		
			MO		
			PS		
			OS		
		COMM	PP		
			MR		
			MO		
			PS		11.583.182
			OS		38.208.953
	Factors of Production	VA W-L P	FWLP1		
			FWLP2		
			FWLP3		
		VA W-L not P	FWLNP1		
			FWLNP2		
			FWLNP3		
		VA Non W-L	FNWL1		
			FNWL2		
			FNWL3		
		VA GOS	FACG		
Institutions	Current transfers	HHLD	HOUQ1	11.345.822	2.941.668
			HOUQ2	17.461.423	4.775.706
			HOUQ3	26.142.610	7.066.780
			HOUQ4	37.200.669	9.910.581
			HOUQ5	79.819.800	20.429.126
		ENTERPRISE (ENT)			
		GOVERMENT (GOV)			
	Capital transfers	Private Investment	PP		
			MR		
			MO		
			PS		
			OS		
		Public Investment			10.966.878
Tax			T IND		
			T FOP		
			T DIR	18.409.878	
			T IMP		
			T Exp (net)		
		Rest of the world			20.759.356
Total Recips			TOTAL	190.380.202	126.642.230

A1.6 (Continuation)

			Institutions Capital Transfers Private Investment PP	MR	MO	PS	OS
Production	ACT	PP					
		MR					
		MO					
		PS					
		OS					
	COMM	PP	558.336	176.673	121.852	312.567	185.404
		MR					
		MO	11.710.917	3.745.262	2.587.102	6.600.879	3.929.383
		PS	17.963.803	5.730.684	3.957.134	10.109.132	6.012.757
		OS	1.351.968	424.374	292.351	752.960	445.429
	Factors of Production: VA W-L P	FWLP1					
		FWLP2					
		FWLP3					
	Factors of Production: VA W-L not P	FWLNP1					
		FWLNP2					
		FWLNP3					
	Factors of Production: VA Non W-L	FNWL1					
		FNWL2					
		FNWL3					
	Factors of Production: VA GOS	FACG					
Institutions	Current transfers: HHLD	HOUQ1					
		HOUQ2					
		HOUQ3					
		HOUQ4					
		HOUQ5					
	Current transfers: ENTERPRISE(ENT)						
	Current transfers: GOVERMENT						
	Capital transfers: Private Invest-ment	PP					
		MR					
		MO					
		PS					
		OS					
	Capital transfers: Public Investment						
Tax		T IND					
		T FOP					
		T DIR					
		T IMP					
		T Exp (net)					
Rest of the world							
Total Recips		TOTAL	31.585.024	10.076.993	6.958.439	17.775.538	10.572.973

A1.6 (Continuation)

				Institutions Capital Transfers Public Investment
Production		ACT	PP	
			MR	
			MO	
			PS	
			OS	
		COMM	PP	36.995
			MR	50.179
			MO	730.772
			PS	6.833.806
			OS	88.628
	Factors of Production	VA W-L P	FWLP1	
			FWLP2	
			FWLP3	
		VA W-L not P	FWLNP1	
			FWLNP2	
			FWLNP3	
		VA Non W-L	FNWL1	
			FNWL2	
			FNWL3	
		VA GOS	FACG	
Institutions	Current transfers	HHLD	HOUQ1	
			HOUQ2	
			HOUQ3	
			HOUQ4	
			HOUQ5	
		ENTERPRISE		
		GOVERMENT		
	Capital transfers	Private Investment	PP	
			MR	
			MO	
			PS	
			OS	
		Public Investment		
Tax			T IND	
			T FOP	
			T DIR	
			T IMP	
			T Exp (net)	
Rest of the world				
Total Recips			TOTAL	7.740.380

A1.6 (Continuation)

				TAX				
				T IND	T FOP	T DIR	T IMP	T Export (net)
Production	Activities		PP					
			MR					
			MO					
			PS					
			OS					
	Commodities		PP					
			MR					
			MO					
			PS					
			OS					
	Factors of Production	VA W-L P	FWLP1					
			FWLP2					
			FWLP3					
		VA W-L not P	FWLNP1					
			FWLNP2					
			FWLNP3					
		VA Non W-L	FNWL1					
			FNWL2					
			FNWL3					
		VA GOS	FACG					
Institutions	Current transfers	HHLD	HOUQ1					
			HOUQ2					
			HOUQ3					
			HOUQ4					
			HOUQ5					
		ENTERPRISE						
		GOVERMENT		52.046.058	14.097.520	39.778.272	3.372.181	8.718.910
	Capital transfers	Private Invest-ment	PP					
			MR					
			MO					
			PS					
			OS					
		Public Investment						
Tax			T IND					
			T FOP					
			T DIR					
			T IMP					
			T Exp (net)					
Rest of the world								
Total Recips			TOTAL	52.046.058	14.097.520	39.778.272	3.372.181	8.718.910

A1.6 (Continuation)

				ROW	Total Outlays
Production		ACT	PP		108.096.941
			MR		169.059.123
			MO		88.776.624
			PS		182.511.871
			OS		179.081.203
		COMM	PP	37.505.539	131.575.591
			MR	38.762.647	196.109.237
			MO	21.482.577	138.516.838
			PS	14.553.329	221.086.177
			OS		186.124.740
	Factors of Production	VA W-L P	FWLP1		2.653.570
			FWLP2		39.920.808
			FWLP3		73.573.975
		VA W-L not P	FWLNP1		1.914.007
			FWLNP2		13.079.864
			FWLNP3		7.286.196
		VA Non W-L	FNWL1		791.255
			FNWL2		15.994.052
			FNWL3		34.875.950
		VA GOS	FACG		190.380.202
Institutions	Current transfers	HHLD	HOUQ1	729.734	25.522.959
			HOUQ2	1.185.434	43.794.284
			HOUQ3	1.753.273	61.809.746
			HOUQ4	2.457.685	88.011.280
			HOUQ5	5.060.673	185.134.871
		ENTERPRISE		729.734	190.380.202
		GOVERMENT		1.713.962	126.642.230
	Capital transfers	Private Investment	PP	(1.776.012)	31.585.024
			MR	(563.389)	10.076.993
			MO	(388.712)	6.958.439
			PS	(995.843)	17.775.538
			OS	(591.197)	10.572.973
		Public Investment		(3.226.499)	7.740.380
Tax			T IND		52.046.058
			T FOP		14.097.520
			T DIR		39.778.272
			T IMP		3.372.181
			T Exp (net)		8.718.910
Rest of the world (ROW)					117.663.202
Total Recips			TOTAL	117.663.202	

A1.6 (Continuation)

PP=Primary products ; MR= Resource-intensive manufactures ; MO= other manufacture; PS= Producer services; OS = Other services; VA W-L P= Value added wage-labor protected by the social security; VA W-L not P= Value added wage-labor not protected by the social security; VA Non W-L= Value added payments to labor other than wage labor; VA GOS= Value added gross operating surplus; FWLP1= Protected wage-labor. Unskilled; FWLP2= Protected wage-labor. Semi skilled; FWLP3= Protected wage-labor. Skilled; FWLNP1= Not protected wage-labor. Unskilled ; FWLNP2= Not protected wage-labor. Semi skilled; FWLNP3= Not protected wage-labor. Skilled; FNWL1= Non wage-labor. Unskilled; FNWL2= Non-wage labor. Semi skilled; FNWL3= Non-wage labor. Skilled; FOP= Factor of production; HHLD=Households; ENT= Enterprise; GOV= Government; S-I= Saving - investment account; PRIV= private; PUB = public; T IND= indirect tax; T FOP= tax factor of production; T DIR= direct tax; T IMP= import tax; T export (net) = export tax net of export subsides; ROW= rest of the world; HOUQ1= Household quintile 1; HOUQ2= Household quintile 2; HOUQ3= Household quintile 3; HOUQ4= Household quintile 4; HOUQ5= Household quintile 5; COMM= Commodities ; ACT= Activities.

Table A1.7
List of Acronyms and Data Sources

Acronyms		English translation (when pertinent)
BCRA	Banco Central de la República Argentina	Central Bank of the Argentine Republic
MECON	Ministerio de Economía y Producción	Ministry of Economy and Production
INDEC	Instituto Nacional de Estadísticas y Censos	National Bureau of Statistics
DNCN	Dirección Nacional de Cuentas Nacionales	National Secretary of Nacional Accounts
DNCI	Dirección Nacional de Cuentas Internacionales	National Secretary of Internacional Accounts
BOP tables	Balance of payment tables	
SH	Secretaría de Hacienda	Treasury Secretary
DNIAF	Dirección Nacional de Investigación y Análisis Fiscal	National Secretary of Fiscal Research
SIF-SH	Document “Sector Público Argentino no Financiero. Cuenta de Ahorro-Inversión-Financiamiento” elaborated by SH	
NIPA	National Income and Production Accounts	
TSTD tables	Total supply and total demand tables	
MIPAr97	Matriz de insumo producto Argentina. 1997	1997 Argentina’s Input-Output Matrix.
EPH	Encuesta Permanente de Hogares	Household Survey.
AFIP	Administración Federal de Ingresos Públicos	Public Income Federal Administration
CEP	Centro de Estudios de la Producción. MECON	Research Centre of Production
ENGHO	Encuesta Nacional de Gasto de los Hogares	Household Expenditure survey
ENGE	Encuesta Nacional de Grandes Empresas	Big Corporations National Survey

Notes

[1] Although the simplified SAM in Table A1.1 below does not include an enterprise account, this is commonly included in many SAM’s, and associated general

equilibrium models. Argentina's SAM does include an enterprise account, but this only collects factors income and transfers it to households.

[2] The cross-entropy methodology uses more information than the alternative RAS methodology commonly used to balance matrices using information from columns and row sums.

[3] Subindex i denotes different factors of production. Where i=1 stands for protected wage labor, i=2 for not-protected wage labor, i=3 for non-wage labor and i=4 for capital and other factors of production or gross operating surplus

[4] Indirect taxes others than value added tax are obtained subtracting gross production, value added tax, import and export taxes and current imports from total supply figures.

[5] Spanish tax headings as presented in official data tables are: i- derechos de importación; ii- operaciones cambiarias y otros.

[6] I use data from TSTD instead of the data from Balance of Payment tables produced by the DNCI because: i- I want to make extensive use of all available data from TSTD tables; and ii- DNCI provided trade information in dollars, and I assume the conversion into local currency units is more accurately done by government offices.

[7] Original Spanish labels as presented in the tables by SH's are: i- ingresos no tributarios; ii- ventas de bienes y servicios de la administración pública; iii- rentas de la propiedad; iv- otros ingresos; v- transferencias corrientes; vi- superávit operativo de empresas públicas.

[8] The data presented in the SH document was adjusted to avoid considering transfers from abroad as transfers from domestic institutions. Due to differences in valuation methodologies between the DNCI and the SH this adjustment can a source of inaccurate in the Macro SAM. Inaccuracies can result from: i- the assumption that *other current transfers* to the government, as recorded in SH-SIF are made by domestic institutions only, and ii- assuming that *other government current income* in SH-SIF are transfers from households to the government.

[9] This tax is known as the 'impuesto al cheque' in Argentina.

[10] Private transfers to ROW, as provided by BOP tables, are assumed to be made by households. According to balance of payments estimations private transfers abroad are the sum of: i- interest payments done by the financial sector, excluding the Central Bank, ii- interest payments done by the non-financial private sector; iii- private profits (paid by the financial and non-financial sector). Values are converted into local currency units (LCU) using the annual average nominal exchange rate provided by the Central Bank of the Argentine Republic (BCRA). To obtain this figure I assume that, besides the Central Bank, all the financial sector which operates with the rest of the world is private.

[11] Values are converted into LCU using the annual average nominal exchange rate produced by the Central Bank. Government transfers to ROW are the sum of: i- interest payments by the Central Bank; ii- interests paid by the non-financial public sector. It is assumed that other interest payments done by the financial sector are private.

[12] Balance of payments data produced by the DNCI only provides information on net transfers about other rents and current transfers, they are assumed to be received by the private sector

[13] See chapter 5 for a discussion of the main characteristics of the sectors included in the SAM and the relation to the propositions of this research.

[14] The classification assumes that the tertiary and/or university education is finished at the age of 23 and the secondary school is finished at the age of 17.

[15] All workers under the age of 23 and are making their studies are classified as inexperienced workers.

[16] There are various important points regarding the computation of the variable education-age worth noting. The first one relates to the assumption that all work provides experience, irrespective of the type of activity the worker has been doing. Similarly, it is also assumed that all workers have an experience equal to the difference between their age and the education-age, have they been working in a continuous manner or not. I also define a minimum and a maximum number of years of education. The minimum is equal to 15, the age of the youngest members of the workforce, and the maximum equal to 23, the age at which a person is expected to finish her tertiary education. Finally, it is worth noting that for people under the age of 24 I not only consider the level of education but also if the worker is following studies. In case she does, I assume that studying constitutes her most important activity and I classify her as an inexperienced worker. On the contrary, I assume that above this age working becomes the main activity, and workers will gain experience even if they are enrolled in an educational program and continue studying.

[17] A similar reasoning is applied to workers with high education and an intermediate experience and to experienced workers with intermediate or low education, which are classified as skilled, skilled and semi-skilled workers, correspondingly.

[18] Correspondence tables are necessary to establish an equivalence between the CTP-DATA taxonomy, which is defined using UN's SITC Rev 3 (at 3 digit levels), and commodities in Argentina's input-output tables that are defined in relation to UN's CPC Prov. (Provisional Central Product Classification).

[19] As for instance agricultural services, publicity, research and development, maintenance services, etc.

[20] The EPH is employed to adjust labour income from industrial sectors as produced by the DNCN to the classification employed in this research, an adjustment concerning sectors MR and MO.

[21] As the other information related to Argentina's input-output tables, gross production by activity is adjusted to the SAM's commodity classification employed in this research.

[22] Export subsidies are distributed according to Argentina's 2004 export structure.

[23] ENGE collects investment (as well as other) information for the 500 biggest companies operating in Argentina. As this survey covers the 1993-2003 it is used for comparative purposes basically.

[24] CEP's investment database is built on the basis of firms investment plans as stated in the media. This is the only available data source with disaggregated investment information covering the period 1993-2007, though figures should be considered with cautious.

[25] Investment by agricultural primary sectors in CEP's database represents only 1% of total investment. This is much lower than the sector's weight in total value added (10%) and gross production (7%) and lower than the share of capital goods imported by the sector, which amounts to 8%.

[26] Total labor income equals income from workers principal activity (variable P21 from EPH) and income from other occupations (variable TOT_P12 from EPH).

[27] The richest household provides almost 70% of total private savings and the poorest one does not save.

B Appendix Chapter 2

Table B2.1
Country List

Algeria (DZA)	Germany (DEU)	Pakistan (PAK)
Argentina (ARG)	Greece (GRC)	Peru (PER)
Australia (AUS)	Hong Kong (HKG)	Philippines (PHL)
Austria (AUT)	Iceland (ISL)	Portugal (PRT)
BLEU (Belgium & Luxembourg)	India (IND)	Singapore (SGP)
Brazil (BRA)	Indonesia (IDN)	South Korea (KOR)
Canada (CAN)	Ireland (IRL)	Spain (ESP)
Chile (CHL)	Israel (ISR)	Sweden (SWE)
China (CHN)	Italy (ITA)	Switzerland (CHE)
Colombia (COL)	Japan (JPN)	Taiwan (TWN)
Denmark (DNK)	Malaysia (MYS)	Thailand (THA)
Ecuador (ECU)	Mexico (MEX)	Tunisia (TUN)
Egypt (EGY)	Morocco (MAR)	Turkey (TUR)
Finland (FIN)	Netherlands (NLD)	United Kingdom (GBR)
France (FRA)	Nigeria (NGA)	United States (USA)
Gabon (GAB)	Norway (NOR)	Venezuela (VEN)

Table B2.2
Variables definitions and data sources

NAME	VARIABLE DEFINITION	DATA SOURCE
$\Delta \ln Y_{j,t}$	Real GDP growth (ln Yj,t - ln Yj,t-1); 1960-2005 in cross-country (C-C) and five year periods in system GMM (SYS-GMM). ln Yj,t. Log of GDP per capita expressed in PPPs (purchasing power parities) in international prices and converted in constant US dollars (base year 1995)	CEPII's CHELEM database
Trade specialization variables		
Export shares a/		
PXI	Share of primary exports in total exports. Primary exports defined as Non-fuel (SITC Rev I cat 0, 1, 2, 4, 68) plus fuel exports (SITC Rev I cat 3)	Sachs and Warner 1997 Database. Database available at: http://www.cid.harvard.edu/ciddata/ciddata.htm
PP	Share of primary products in total exports. CTP-DATA classification	UN's COMTRADE data; adapted by Feenstra et al (2005) and processed by UN's DPAD/DESA
MNR	Share of manufactured natural resource products in total exports. CTP-DATA classification	UN's COMTRADE data; adapted by Feenstra et al (2005) and processed by UN's DPAD/DESA
Trade specialization measures (see text for analytical specification) b/		
CA_{PRI}	CEPII's comparative advantage indicator in primary products. Primary products as defined in CHELEM's database. See Table A.2.3 for further details	CEPII's CHELEM database
$TDIV_i$	Trade diversification indicator, where i = PP and MNR	Author's estimation using UN's COMTRADE data
TRDI	Trade dissimilarity indicator. Estimated using 71-products defined in CHELEM database	Author's estimation using CEPII's CHELEM database
MICLY	Michaely's index of inter-industry trade; estimated using 71-products defined in CHELEM database	Author's estimation using CEPII's CHELEM database
Additional control variables and transmission mechanisms		
$\ln Y_{t-1}$	Initial income. Log of GDP per capita in 1995 PPP	CEPII's CHELEM database
$\ln INV_{t-1}$	Log of the ratio of gross domestic investment to real GDP; Measured at the beginning of the period the C-C and panel database	World Bank WDI database
$\ln HK_{t-1}$	Log of secondary school enrolment in 1970 in C-C regressions. Average years of schooling in panel data's SYS-GMM estimations. Measured at the beginning of the period in the panel database	Sachs and Warner 1997 Database & Barro and Lee (1994) database
SOPEN	Percentage of years with an open economy regime as defined in Sachs and Warner (1995)	Sachs and Warner 1997 Database.
INST	Rule of Law index. The variable reflects the degree to which citizens are willing to accept the established institutions to make and implement laws and adjudicate disputes. Scored 0 (low) to 6 (high). Measured in 1982. Combined Polity Score. Estimated subtracting the Autocracy score from the Democracy score. Range = -10 to 10 (-10 = high autocracy; 10 = high democracy).	Sachs and Warner 1997 Database. & Polity IV Project. Center for International Development and Conflict Management
VOLRER	Standard deviation of annual change in the real exchange rate	Author's estimation using CEPII's CHELEM database
GTOT	Growth in the external terms of trade; external terms of trade defined as the ratio of an export and an import price index	Author's estimation using World Bank WDI database
D_R	Regional dummy variables. R= AF (Africa); LAC (Latin American countries); ASIA (Asian countries, excluding Japan) and OECD (OECD countries)	
D_T	Time dummy in SYS-GMM estimations	

a / measured in 1970 in C-C and as average of the period in SYS-GMM regressions
b / Specialization indicators measured as period averages in C-C and SYS-GMM regressions

Table B2.3
Comparison of natural resource products classifications

Code SITCREV_2	CTP-DATA	Sachs and Warner	CEPII
1	PP	SXP / PXI	PRI
11	PP	SXP / PXI	other
12	MNR	SXP / PXI	other
14	MNR	SXP / PXI	other
22	MNR	SXP / PXI	other
23	MNR	SXP / PXI	other
24	MNR	SXP / PXI	other
25	MNR	SXP / PXI	PRI
34	PP	SXP / PXI	other
35	MNR	SXP / PXI	other
36	MNR	SXP / PXI	other
37	MNR	SXP / PXI	other
41	PP	SXP / PXI	PRI
42	PP	SXP / PXI	PRI
43	PP	SXP / PXI	PRI
44	PP	SXP / PXI	PRI
45	PP	SXP / PXI	PRI
46	MNR	SXP / PXI	other
47	MNR	SXP / PXI	other
48	MNR	SXP / PXI	other
54	PP	SXP / PXI	PRI
56	MNR	SXP / PXI	other
57	PP	SXP / PXI	PRI
58	MNR	SXP / PXI	other
61	MNR	SXP / PXI	other
62	MNR	SXP / PXI	other
71	PP	SXP / PXI	PRI
72	PP	SXP / PXI	PRI
73	MNR	SXP / PXI	other
74	PP	SXP / PXI	PRI
75	PP	SXP / PXI	PRI
81	MNR	SXP / PXI	other
91	MNR	SXP / PXI	other

Table B2.3 *(Continuation)*

Code SITCREV_2	CTP-DATA	Sachs and Warner	CEPII
98	MNR	SXP / PXI	other
111	MNR	SXP / PXI	other
112	MNR	SXP / PXI	other
121	PP	SXP / PXI	PRI
122	MNR	SXP / PXI	PRI
211	PP	SXP / PXI	PRI
212	PP	SXP / PXI	PRI
222	PP	SXP / PXI	other
223	MNR	SXP / PXI	other
232	PP	SXP / PXI	PRI
233	MNR	SXP / PXI	other
244	PP	SXP / PXI	PRI
245	PP	SXP / PXI	PRI
246	MNR	SXP / PXI	other
247	PP	SXP / PXI	other
248	MNR	SXP / PXI	other
251	MNR	SXP / PXI	other
261	PP	SXP / PXI	PRI
263	MNR	SXP / PXI	PRI
264	PP	SXP / PXI	PRI
265	MNR	SXP / PXI	PRI
266	MNR	SXP / PXI	other
267	MNR	SXP / PXI	other
268	MNR	SXP / PXI	other
269	other	SXP / PXI	other
271	PP	SXP / PXI	PRI
273	PP	SXP / PXI	PRI
274	PP	SXP / PXI	PRI
277	PP	SXP / PXI	PRI
278	PP	SXP / PXI	PRI
281	PP	SXP / PXI	PRI
282	MNR	SXP / PXI	PRI
286	PP	SXP / PXI	PRI
287	PP	SXP / PXI	PRI
288	MNR	SXP / PXI	PRI
289	PP	SXP / PXI	PRI

Table B2.3 (Continuation)

Code SITCREV_2	CTP-DATA	Sachs and Warner	CEPII
291	PP	SXP / PXI	PRI
292	PP	SXP / PXI	PRI
322	PP	SXP / PXI	PRI
323	PP	SXP / PXI	PRI
333	PP	SXP / PXI	PRI
334	PP	SXP / PXI	other
335	PP	SXP / PXI	other
341	PP	SXP / PXI	PRI
351	n.e	SXP / PXI	other
411	MNR	SXP / PXI	other
423	MNR	SXP / PXI	other
424	MNR	SXP / PXI	other
431	MNR	SXP / PXI	other
511	MNR	other	other
512	MNR	other	other
513	MNR	other	other
514	MNR	other	other
515	MNR	other	other
516	MNR	other	other
522	MNR	other	other
523	MNR	other	other
524	MNR	other	other
562	MNR	other	other
628	MNR	other	other
633	MNR	other	other
634	MNR	other	other
635	MNR	other	other
641	MNR	other	other
667	MNR	other	other
681	PP	SXP / PXI	other
682	PP	SXP / PXI	other
683	PP	SXP / PXI	other
684	PP	SXP / PXI	other
685	PP	SXP / PXI	other
686	PP	SXP / PXI	other
687	PP	SXP / PXI	other
688	PP	SXP / PXI	other
689	PP	SXP / PXI	other
941	n.e	other	PRI

Table B2.4a
Natural resource abundance and economic growth. Comparison of alternative trade specialization measures. Cross-country regressions

	Dependent variable $\Delta \ln Y_{j,t}$ ($\ln Y_{j,2005}$ - $\ln Y_{j,1960}$)							
Regresors	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
ln Y $_{t-1}$	-0.65	-0.70	-0.65	-0.68	-0.63	-0.63	-0.72	-0.67
	(0.146)***	(0.143)***	(0.173)***	(0.132)***	(0.168)***	(0.177)***	(0.164)***	(0.172)***
ln INV $_{t-1}$	0.66	0.85	0.75	0.84	0.77	0.72	0.83	0.80
	(0.206)***	(0.217)***	(0.218)***	(0.212)***	(0.212)***	(0.214)***	(0.199)***	(0.220)***
ln HK $_{t-1}$	0.39	0.56	0.21	0.54	0.10	0.13	0.46	0.34
	(-0.40)	(-0.42)	(-0.43)	(-0.38)	(-0.39)	(-0.44)	(-0.47)	(-0.44)
SOPEN $_{p}$	0.28	0.31	0.39	0.42	0.36	0.39	0.27	0.31
	(-0.21)	(-0.20)	(0.187)**	(0.155)**	(0.175)**	(0.191)**	(-0.19)	(-0.20)
INST $_{t-1}$	0.08	0.08	0.10	0.08	0.11	0.10	0.11	0.11
	(0.047)*	(0.048)*	(0.049)**	(0.042)*	(0.048)**	(0.050)**	(0.050)**	(0.053)**
VOLRER $_{p}$	0.15	-0.04	0.26	1.51	0.77	0.40	1.37	0.97
	(-2.60)	(-2.43)	(-2.82)	(-1.82)	(-2.53)	(-2.81)	(-2.68)	(-2.73)
GTOT$_{p}$	-0.23	-0.14	-0.28	-0.25	-0.38	-0.30	-0.29	-0.30
	(0.130)*	(-0.13)	(0.148)*	(0.108)**	(0.151)**	(0.144)**	(0.124)**	(0.135)**
D_AF	-0.49	-0.29	-0.55	-0.15	-0.52	-0.58	-0.42	-0.46
	(0.257)*	(-0.29)	(0.261)**	(-0.21)	(0.244)**	(0.265)**	(-0.27)	(-0.28)
D_LAC	-0.32	-0.21	-0.45	-0.30	-0.55	-0.47	-0.35	-0.40
	(-0.24)	(-0.26)	(0.213)**	(-0.19)	(0.213)**	(0.220)**	(-0.22)	(0.224)*
D_ASIA	-0.06	-0.04	-0.05	-0.10	-0.14	-0.05	-0.06	-0.01
	-(0.26)	(-0.27)	(-0.32)	(-0.26)	(-0.33)	(-0.31)	(-0.31)	(-0.32)

Table B2.4a (Continuation)

	Dependent variable $\Delta \ln Y_{j,t}$ ($\ln Y_{j,2005} - \ln Y_{j,1960}$)							
Regresors	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
EXPORT SHARES								
Sachs and Warner's trade shares								
PXI t-1	-0.45							
	(0.209)**							
CTP trade shares								
PP		-0.70						
		(0.275)**						
MNR			0.20					
			(-0.39)					
TRADE SPECIALIZATION INDICES								
$CA_{PRI,p}$				-0.47				
				(0.129)***				
$TDIV_{PP,p}$					-0.25			
					(0.133)*			
$TDIV_{MNR,p}$						-0.03		
						(0.018)*		
$MICLY_p$							-0.398	
							(0.189)**	
$TRDI_p$								-0.595
								(-0.475)
Adjusted R-square	**49**	**49**	**49**	**49**	**49**	**49**	**49**	**49**
Observations	**0.69**	**0.68**	**0.71**	**0.66**	**0.69**	**0.66**	**0.69**	**0.67**

Robust normalized standard errors in parentheses
* significant at 10%; ** 5% and *** 1% level

Source: author's calculations

Table B2.4b
Natural resource abundance and economic growth. Comparison of alternative trade specialization measures. System GMM panel data estimations

	Dependent variable Δln $Y_{j,t}$ (ln $Y_{j,2005}$ - ln $Y_{j,1960}$)							
Regressors	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
ln Y $_{t-1}$	-0.05	-0.05	-0.05	-0.07	-0.04	-0.05	-0.06	-0.06
	(0.018)***	(0.014)***	(0.016)***	(0.015)***	(0.016)**	(0.014)***	(0.016)***	(0.014)***
ln INV $_{t-1}$	0.16	0.15	0.14	0.15	0.19	0.17	0.14	0.16
	(0.037)***	(0.036)***	(0.036)***	(0.037)***	(0.043)***	(0.036)***	(0.032)***	(0.034)***
ln HK $_{t-1}$	0.08	0.07	0.10	0.10	0.09	0.09	0.10	0.09
	(0.033)**	(0.030)**	(0.033)***	(0.025)***	(0.032)**	(0.029)***	(0.029)***	(0.029)***
SOPEN $_p$	0.02	0.02	0.02	0.02	0.01	0.02	0.01	0.02
	(-0.01)	(-0.01)	(-0.02)	(-0.02)	(-0.02)	(-0.02)	(-0.02)	(-0.01)
INST $_{t-1}$	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	0.00	0.00
	(-0.001)	(-0.001)	(0.001)*	(-0.001)	(-0.001)	(-0.001)	(0.001)*	(0.00)
VOLRER $_p$	(-0.52	-0.51	-0.53	-0.52	-0.52	-0.53	-0.56	-0.59
	(0.114)***	(0.123)***	(0.106)***	(0.114)***	(0.126)***	(0.107)***	(0.107)***	(0.104)***
GTOT$_p$	0.10	0.08	0.09	0.09	0.11	0.09	0.08	0.09
	(0.028)***	(0.028)***	(0.028)***	(0.029)***	(0.031)***	(0.028)***	(0.031)**	(0.030)***
EXPORT SHARES								
Sachs and Warner's trade shares								
PXI t-1	-0.060							
	(0.033)*							
CTP trade shares								
PP		-0.08						
		(0.032)**						
MNR			-0.04					
			(-0.09)					
TRADE SPECIALIZATION INDICES								
CA$_{PRI,p}$				-0.03				
				(0.015)**				
TDIV$_{PP,p}$					-0.09			
					(-0.06)			
TDIV$_{MNR,p}$						0.06		
						(-0.06)		
MICLY$_p$							-0.05	
							(-0.03)	
TRDI $_p$								-0.05
								(-0.07)
Observations	**255**	**256**	**256**	**256**	**242**	**245**	**256**	**256**
Sargan	**0.25**	**0.29**	**0.53**	**0.33**	**0.41**	**0.31**	**0.20**	**0.39**
A R (2)	**0.77**	**0.96**	**.94**	**0.92**	**0.97**	**0.81**	**0.952**	**0.856**

Robust normalized standard errors in parentheses

* significant at 10%; ** 5% and *** 1% level

Predetermined variables in the SYS-GMM: SOPEN$_p$; GTOT$_p$; D_t. *Endogenous variables in the SYS-GMM:* ln Y$_{t-1}$; ln INV$_P$; ln HK$_P$; VOLRER$_P$; INST$_P$, and trade shares or specialization variables.

All endogenous variables are used as instruments in the SYS-GMM. For the differenced equation of the SYS-GMM, instruments are level variables dated at t-2 and t-3, whereas instruments used in the level equation are differences dated at t-2

Source: author's calculations

Table B2.5a
Natural resource abundance and economic growth. Sensitivity of the primary specialization variable to demand and supply attributes of the pattern of specialization. Cross-country regressions

	Dependent variable $\Delta \ln Y_{j,t}$ ($\ln Y_{j,2005}$ - $\ln Y_{j,1960}$)					
Regressors	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
ln Y $_{t-1}$	-0.69	-0.66	-0.73	-0.70	-0.73	-0.68
	(0.159)***	(0.151)***	(0.150)***	(0.147)***	(0.168)***	(0.176)***
ln INV $_{t-1}$	0.74	0.68	0.88	0.86	0.87	0.85
	(0.237)***	(0.242)***	(0.211)***	(0.225)***	(0.216)***	(0.242)***
ln HK $_{t-1}$	0.46	0.40	0.60	0.56	0.43	0.32
	(-0.45)	(-0.42)	(-0.45)	(-0.43)	(-0.48)	(-0.45)
SOPEN $_p$	0.25	0.28	0.26	0.30	0.27	0.31
	(-0.21)	(-0.21)	(-0.19)	(-0.19)	(-0.19)	(-0.19)
INST $_{t-1}$	0.09	0.08	0.09	0.08	0.11	0.11
	(0.047)*	(0.044)*	(0.048)*	(0.048)*	(0.051)**	(0.053)**
VOLRER $_p$	0.80	0.28	0.57	0.14	1.36	1.02
	(-2.72)	(-2.68)	(-2.57)	(-2.53)	(-2.70)	(-2.72)
GTOT$_p$	-0.25	-0.24	-0.17	-0.15	-0.26	-0.26
	(0.130)*	(0.138)*	(-0.13)	(-0.14)	(0.126)**	(0.134)*
D_AF	-0.43	(-0.47	-0.27	-0.28	-0.37	-0.39
	(-0.27)	(0.278)*	(-0.30)	(-0.30)	(-0.26)	(-0.28)
D_LAC	-0.31	-0.32	-0.21	-0.21	-0.34	-0.38
	(-0.24)	(-0.24)	(-0.27)	(-0.26)	(-0.22)	(0.215)*
D_ASIA	-0.06	-0.05	-0.04	-0.03	-0.05	0.01
	(-0.28)	(-0.26)	(-0.28)	(-0.28)	(-0.32)	(-0.35)
EXPORT SHARES						
Sachs and Warner's trade shares						
PXI t-1	-0.298	-0.42				
	(-0.294)	(-0.27)				
CTP trade shares						
PP			-0.55	-0.66		
			(-0.33)	(0.322)**		
MNR					0.31	0.31
					(-0.37)	(-0.37)
TRADE SPECIALIZATION INDICES						
MICLY$_p$	-0.22		-0.20		-0.42	
	(-0.26)		(-0.21)		(0.185)**	
TRDI $_p$		(-0.10		-0.14		-0.71
		-0.60)		(-0.50)		(-0.52)
Adjusted R-square	**49**	**49**	**49**	**49**	**49**	**49**
Observations	**0.69**	**0.69**	**0.71**	**0.70**	**0.69**	**0.67**

Robust normalized standard errors in parentheses

* significant at 10%; ** 5% and *** 1% level

Source: author's calculations

Table B2.5b
Natural resource abundance and economic growth. Sensitivity of the primary specialization variable to demand and supply attributes of the pattern of specialization. System GMM regressions

	Dependent variable (ln Yj,t - ln Yj,t-1)					
Regressors	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
ln Y $_{t-1}$	-0.06	-0.06	-0.05	-0.05	-0.06	-0.06
	(0.020)***	(0.020)***	(0.018)***	(0.015)***	(0.018)***	(0.016)***
ln INV $_{t-1}$	0.17	0.18	0.16	0.16	0.14	0.15
	(0.034)***	(0.037)***	(0.032)***	(0.033)***	(0.032)***	(0.031)***
ln HK $_{t-1}$	0.06	0.06	0.05	0.06	0.08	0.08
	(0.030)**	(0.033)*	(0.029)*	(0.028)**	(0.030)**	(0.029)***
SOPEN $_p$	0.01	0.01	0.01	0.01	0.01	0.02
	(-0.02)	(-0.01)	(-0.02)	(-0.01)	(-0.01)	(-0.01)
INST $_{t-1}$	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
VOLRER $_p$	-0.48	-0.47	-0.48	-0.49	-0.46	-0.47
	(0.108)***	(0.103)***	(0.110)***	(0.108)***	(0.108)***	(0.105)***
GTOT$_p$	0.10	0.10	0.08	0.08	0.08	0.09
	(0.027)***	(0.028)***	(0.027)***	(0.028)***	(0.028)***	(0.028)***
EXPORT SHARES						
Sachs and Warner's trade shares						
PXI t-1	-0.0150	-0.011				
	(-0.030)	(-0.030)				
CTP trade shares						
PP			-0.022	-0.019		
			(-0.032)	(-0.033)		
MNR					-0.02	-0.02
					(-0.07)	(-0.08)
TRADE SPECIALIZATION INDICES						
MICLY$_p$	-0.06		-0.04		-0.04	
	(0.035)*		(-0.03)		(-0.04)	
TRDI $_p$		-0.11		-0.07		-0.06
		(-0.08)		(-0.07)		(-0.10)
Observations	**266**	**266**	**267**	**267**	**267**	**267**
Sargan	**0.22**	**0.25**	**0.30**	**0.28**	**0.21**	**0.28**
AR (2)	**0.80**	**0.56**	**0.97**	**0.89**	**0.99**	**0.96**

Robust normalized standard errors in parentheses

* significant at 10%; ** 5% and *** 1% level

Predetermined variables in the SYS-GMM: SOPEN$_p$; GTOT$_p$; D_t. *Endogenous variables in the SYS-GMM:* ln Y$_{t-1}$; ln INV$_P$; ln HK$_P$; VOLRER$_P$; INST$_P$, and trade shares or specialization variables.

All endogenous variables are used as instruments in the SYS-GMM. For the differenced equation of the SYS-GMM, instruments are level variables dated at t-2 and t-3, whereas instruments used in the level equation are differences dated at t-2

Source: author's calculations

Table B2.6
Economic growth and the pattern of specialization

		CROSS- COUNTRY REGRESSIONS Dependent Variable *($\ln Y_{j,2005}$ - $\ln Y_{j,1960}$)*		GMM SYSTEM Dependent Variable *($\ln Y_{j,t}$ - $\ln Y_{j,t-1}$)*	
	Regressors	**(1)**	**(2)**	**(7)**	**(8)**
1	**$\ln Y_{t-1}$**	-0.75	-0.70	-0.05	-0.04
		(0.145)***	(0.153)***	(0.017)***	(0.016)**
2	**$\ln INV_{t-1}$**	0.80	0.77	0.11	0.16
		(0.202)***	(0.211)***	(0.033)***	(0.037)***
3	**$\ln HK_{t-1}$**	0.70	0.59	0.04	0.03
		(-0.495)	(-0.475)	(-0.035)	(-0.03)
4	**$SOPEN_p$**	0.18	0.23	0.03	0.04
		(-0.193)	(-0.197)	(-0.022)	(0.022)*
5	**$INST_{t-1}$**	0.12	0.12	-0.002	-0.001
		(0.054)**	(0.061)*	(-0.001)	(-0.001)
6	**MICLYp**	-0.41		-0.08	
		(0.183)**		(0.030)***	
7	**TRDI p**		-0.62		-0.07
			(-0.442)		(-0.092)
8	**D_AF**	-0.37	-0.40		
		(-0.275)	(-0.292)		
9	**D_LAC**	-0.26	-0.32		
		(-0.19)	(0.189)*		
10	**D_ASIA**	-0.09	-0.05		
		(-0.3)	(-0.32)		
	Observations	**49**	**49**	**317**	**317**
	Adj. R-2	**0.68**	**0.66**		
	Sargan			**0.13**	**0.13**
	AR(2)			**0.55**	**0.55**

Robust normalized standard errors in parentheses; * significant at 10%; ** 5% and *** 1% level

Predetermined variables in the SYS-GMM: $SOPEN_p$; $GTOT_p$; D_t. *Endogenous variables in the SYS-GMM:* $\ln Yt_{-1}$; $\ln INV_P$; $\ln HK_P$; $VOLRER_P$; $INST_P$, and trade shares or specialization variables.

All endogenous variables are used as instruments in the SYS-GMM. For the differenced equation of the SYS-GMM, instruments are level variables dated at t-2 and t-3, whereas instruments used in the level equation are differences dated at t-2

Table B2.7a

Correlation matrix. Cross-country database

	$\Delta \ln Yj_{,t}$	$\ln Y_{t-1}$	$\ln INV_{t-1}$	$\ln HK_{t-1}$	$SOPEN_{p}$	$INST_{p}$	$VOLRER_{p}$
$\Delta \ln Yj_{,t}$	1						
$\ln Y_{t-1}$	-0.340	1					
$\ln INV_{t-1}$	0.165	0.445	1				
$\ln HK_{t-1}$	-0.019	0.700	0.225	1			
$SOPEN_{p}$	0.405	0.409	0.285	0.480	1		
$INST_{p}$	0.155	0.722	0.371	0.637	0.671	1	
$VOLRER_{p}$	-0.423	-0.255	-0.310	-0.333	-0.557	-0.535	1
$GTOT_{p}$	-0.038	-0.043	0.114	-0.111	0.143	-0.051	0.173
PXI_{p}	-0.460	-0.398	-0.382	-0.389	-0.632	-0.612	0.535
PP	-0.390	-0.437	-0.155	-0.445	-0.552	-0.604	0.483
MNR	-0.081	0.214	-0.136	0.252	-0.021	0.123	0.011
$MICLY_{p}$	-0.325	-0.473	-0.212	-0.442	-0.660	-0.583	0.582
$TRDI_{,p}$	-0.272	-0.421	-0.132	-0.400	-0.612	-0.530	0.517

	$GTOT_{p}$	PXI_{p}	PP	MNR	MICLY	TRDI
$\Delta \ln Yj_{,t}$						
$\ln Y_{t-1}$						
$\ln INV_{t-1}$						
$\ln HK_{t-1}$						
$SOPEN_{p}$						
$INST_{p}$						
$VOLRER_{p}$						
$GTOT_{p}$	1					
PXI_{p}	0.047	1				
PP	0.187	0.806	1			
MNR	-0.281	0.204	-0.270	1		
$MICLY_{p}$	-0.022	0.787	0.759	-0.016	1	
$TRDI_{,p}$	-0.027	0.720	0.705	0.056	0.928	1

Table B2.7b
Correlation matrix. Panel database

	Δln $Yj_{,t}$	**ln Y_{t-1}**	**ln INV_{t-1}**	**ln HK_{t-1}**	**$SOPEN_p$**	**$INST_p$**	**$VOLRER_p$**
Δln $Yj_{,t}$	1						
ln Y_{t-1}	-0.224	1					
ln INV_{t-1}	0.345	0.084	1				
ln HK_{t-1}	-0.116	0.798	0.057	1			
$SOPEN_p$	0.077	0.566	0.115	0.553	1		
$INST_p$	-0.193	0.550	-0.104	0.564	0.360	1	
$VOLRER_p$	-0.325	-0.124	-0.141	-0.070	-0.207	-0.193	1
$GTOT_p$	0.125	-0.010	-0.032	-0.017	0.040	-0.046	-0.004
PXI_p	-0.082	-0.452	-0.098	-0.423	-0.398	-0.292	0.174
PP	-0.093	-0.484	-0.097	-0.444	-0.410	-0.295	0.200
MNR	-0.016	0.048	-0.102	0.121	-0.058	0.009	-0.051
$MICLY_p$	-0.023	-0.650	0.007	-0.527	-0.534	-0.410	0.209
$TRDI_p$	-0.036	-0.595	-0.006	-0.445	-0.481	-0.371	0.169

	$GTOT_p$	**PXI_p**	**PP**	**MNR**	**$MICLY_p$**	**$TRDI_p$**
Δln $Yj_{,t}$						
ln Y_{t-1}						
ln INV_{t-1}						
ln HK_{t-1}						
$SOPEN_p$						
$INST_p$						
$VOLRER_p$						
$GTOT_p$	1					
PXI_p	-0.079	1				
PP	-0.081	0.948	1			
MNR	0.057	-0.043	-0.139	1		
$MICLY_p$	-0.028	0.687	0.716	0.108	1	
$TRDI_p$	-0.002	0.639	0.658	0.221	0.899	1

Figure B.1
Trade dissimilarity index, average 1967-2005

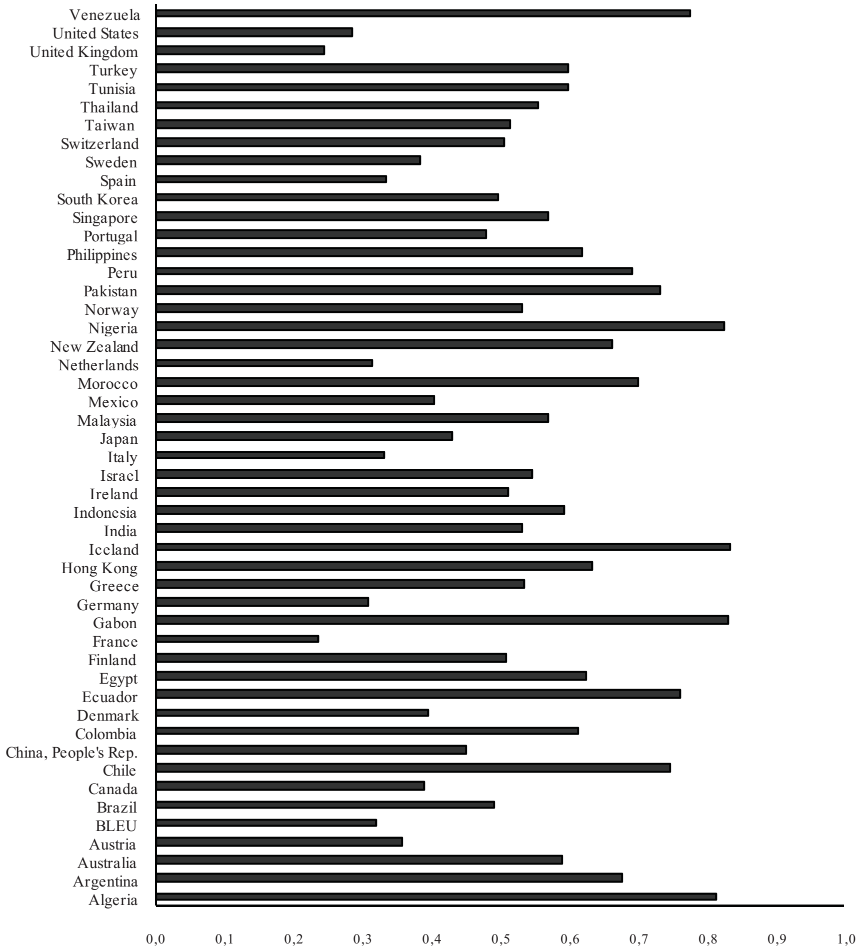
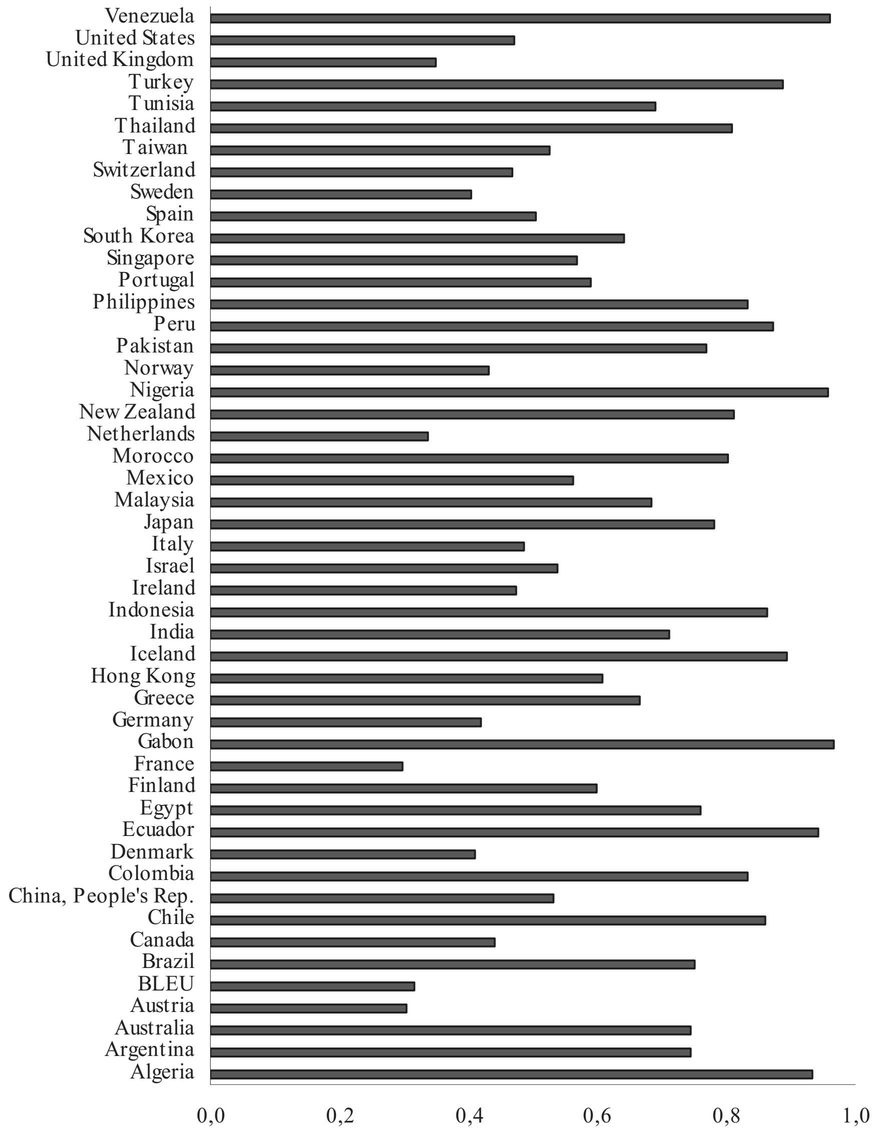


Figure B.2
Michaely's index, average 1967-2005



C Appendix Chapter 4

C4.1 Changes in Real Income and Real Wages

To know the response of real income to changes in exogenous variables we use of equation (4.7). In logarithm form the equation equals

$$\ln Y = \ln\omega + (\tau - 1)\ln Q + \ln L \tag{C.4.1}$$

Using equation (4.6), substituting into it the price expressions as defined in equations (4.2) and (4.3) and nominal wages as defined in equation (4.4), we obtain the following expression of the CPI in logarithm form:

$$\ln Q = \frac{\alpha_I^f \cdot \ln E + \left[\alpha_I^h \cdot (a_I - a_N) + a_N \cdot (1 - \alpha_I^f)\right] \cdot \ln\omega + (1 - \alpha_I^f) \cdot \ln \bar{H}}{1 - A} \tag{C.4.2}$$

where $1 - A = 1 - \tau \cdot \alpha_I^h \cdot (a_I - a_N) - \tau \cdot a_N \cdot (1 - \alpha_I^f)$, which is positive due to our assumption about factor intensities ($a_I < a_N$).

Plugging (C.4.2) into (4.1) we thus obtain

$$\ln Y = \left[\begin{array}{l} \dfrac{\left[1 - \alpha_I^h \cdot (a_I - a_N) + a_N \cdot (1 - \alpha_I^f)\right] \ln\omega}{1 - A} + \\ \dfrac{(\tau - 1) \cdot \left[\alpha_I^f \ln E + (1 - \alpha_I^f) \cdot \ln \bar{H}\right]}{1 - A} \end{array}\right] + \ln L \tag{C.4.3}$$

The first two terms in equation (C.4.3) represent changes in real wages and the third one income changes due to variations in labour demand.

Differentiating (C.4.3) with respect to A_R we know how increases in the productivity of sector R affects real wages (equation (C.4.4) below shows the result for $\tau = 0$).

$$\frac{\partial Y\left(\dfrac{W}{Q}\right)}{\partial A_R} = \frac{\left[1-\alpha_I^f \cdot (a_I - a_N) - a_N.(1-\alpha_I^f)\right]}{1-A} \cdot \frac{\partial W}{\partial A_R} > 0 \quad \text{(C.4.4)}$$

with $\dfrac{\partial W}{\partial A_R} = \gamma_R \left(\dfrac{A_I A_N}{A_R}\right)^{1-\gamma_R}$, as defined in equation (4.13).

Differentiating equation (C.4.3) with respect to E we obtain the effects of nominal devaluations on real wages, when all products from sector R are exported (equation (C.4.5) shows the result for $\tau \langle 1$).

$$\frac{\partial Y\left(\dfrac{W}{Q}\right)}{\partial E} = \frac{(\tau-1)}{1-A} \cdot \alpha_I^f < 0 \quad \text{(C.4.5)}$$

To know the impact of nominal devaluations when products from sector R are exported and consumed domestically we use $Q^R = \left(P_R^f\right)^{\alpha_{Rf}} \left(P_I^f\right)^{\alpha_{If}} \cdot \left(P_I^h\right)^{\alpha_{Ih}} \cdot \left(P_N^h\right)^{1-\alpha_{If}\alpha_{Ih}}$ to obtain a new expression of real income. Differentiating it with respect to E gives

$$\frac{\partial Y\left(\dfrac{W}{Q^R}\right)}{\partial E} = \frac{(\tau-1)\left(\alpha_I^f + \alpha_R^f\right)}{1-C} < 0 \quad \text{(C.4.6)}$$

where $1-C = 1-\tau\cdot\alpha_I^h\cdot(a_I - a_N) - \tau\cdot a_N(1-\alpha_I^f - \alpha_R^f)$ which is positive and larger than 1-A, because there is a new price increasing with the devaluation.

When there is a devaluation rent and natural resource goods are exported and consumed domestically response of real wages to a nominal devaluation equals

$$\frac{\partial Y\left(\dfrac{W}{Q^R}\right)}{\partial E} = \frac{1}{1-D}\left\{a_R\left[1-\alpha_I^h(a_I - a_N) + a_N(1-\alpha_I^f - \alpha_R^f)\right] + \left[\tau\cdot\left(1-a_R^{\,2}\right)-1\right](\alpha_I^f + \alpha_R^f)\right\} \quad \text{(C.4.7)}$$

where $1-D = 1-(1-a_R^2)\cdot\tau\cdot\left[\alpha_I^h(a_I - a_N) + a_N(1-\alpha_I^f - \alpha_R^f)\right]$. Equation (C.4.7) can be positive or negative; therefore wages fall less than in previous cases due to the presence of a devaluation rent, whereas increases in real wages are only possible for low values of α_I^f and α_R^f.

When the government imposes a tax to natural resource exports the price of natural resource goods in the domestic market will equal their production costs. Approximating this with equation (4.2), using this new expression instead of $P_R^{\ f}$ in the consumer price index Q^R doing some manipulations and differentiating with respect to E we obtain

$$\frac{\partial Y\left(\dfrac{W}{Q^R}\right)}{\partial E}=\frac{1}{1-E}\left\{\begin{array}{l} a_R \cdot 1-\alpha_R^h(a_R-a_N)-\alpha_I^h(a_I-a_N)-a_N(1-\alpha_I^f)+ \\ \left[\tau\left(1-a_R^{\ 2}\right)-1\cdot\alpha_I^f\right] \end{array}\right\} \tag{C.4.8}$$

where $1-E=1-(1-a_R^2)\cdot\tau\cdot\left[\alpha_R^h(a_R-a_N)+\alpha_I^h\left(a_I-a_N\right)+a_N(1-\alpha_I^f)\right]$. Real wages decrease less or increase more than when there are no export taxes.

C4.2 Changes in the External Terms of Trade of Sector

To know the effects of exogenous changes in the external terms of trade we use equation (4.8) and its components as given by equations (4.2) and (4.3). Taking logs of this expression and differentiating with respect to E we obtain the effects of the devaluation when goods from sector R are exported and consumed domestically.

$$\frac{\partial p_I^*}{\partial E}=\left[1-\frac{a_I\cdot\tau\cdot\left(\alpha_I^f+\alpha_R^f\right)}{1-C}\right]>0 \tag{C.4.9}$$

When there is a devaluation rent and natural resource commodities are consumed domestically the effects of the devaluation equal

$$\frac{\partial p_I^*}{\partial E}=\left[1-\frac{a_I\cdot\left[a_R+\tau\cdot(1-a_R^2)\cdot\left(\alpha_I^f+\alpha_R^f\right)\right]}{1-D}\right]>0 \tag{C.4.10}$$

Due to the presence of the new terms a_R and $(1-a_R^2)$ the competitiveness gain is smaller than in (C.4.9).

In presence of a devaluation rent, natural resource products exported and consumed domestically and export taxes, the response of the terms of trade to changes in E is given by

$$\frac{\partial p_I^*}{\partial E}=\left[1-\frac{a_I\cdot\left[a_R+\tau\cdot(1-a_R^2)\cdot\alpha_I^f\right]}{1-E}\right] \tag{C.4.11}$$

where *1-E* as defined in equation (C.4.8). Because the domestic price of natural resource products is not affected by the devaluation equation (C.4.11) is larger than (C.4.10).

The final case corresponds to the compensated devaluation regime considering Kaldor-Verdoorn effects. The response of p_I^* to the devaluation is now given by

$$\frac{\partial p_I^*}{\partial E} = \frac{1}{1-F}\left[a_R + \tau \cdot (1-a_R^2) \cdot \left(\alpha_I^f\right)\right] + \delta \frac{\partial A_I(X_I)}{\partial E}\left[1 - \frac{(1-a_R^2)}{1-F}\left(\gamma_I\left(\frac{A_R A_N}{A_I}\right)^{1-\gamma_I} - \tau \cdot \alpha_I^h\right)\right] \tag{C.4.12}$$

Due to the presence of a new positive term, associated to the Kaldor-Verdoorn effect, the devaluation further increases the competitiveness of sector *I*.

D Appendix Chapter 5

D5.1 Mathematical Statement of the CGE Model

Table D5.1
Model sets

Symbol	Explanation
T	Time t1 to t5
PRODUCTION: Activities-sectors (a); Commodities (c); Factors of production (F)	
a, c	Activity-sectors and commodities = P (primary), MR (manufacturing resource intensive), MO (manufacturing other), PS (producer services), OS (other services)
Tb	Tradables activity-sectors and commodities = PP, MR, MO, PS
Tbnr	Tradable natural resources activity-sectors and commodities = PP, MR
Mup	Mark-up activity-sectors and commodities = MO, PS
n-mup	Non mark-up activity-sectors and commodities = PP, MR, OS
Fl	Factor labour (6 labour categories) = wage labour skilled (formal / informal); wage labour unskilled (formal / informal); non-wage labour skilled or unskilled
Fk	Factor capital (1 capital)
INSTITIONS	
H	Households (classified by quintile of per capita income)
G	Government
W	Rest of the world
OTHERS	
^	Growth rate or percentage change
UPPERCASE	Endogenous variables
lowercase	Exogenous and policy variables
Greek characters	Model parameters

Table D5.2
CGE model equation blocks

COSTS AND PRICE

(D.5.1)	$VC_{a,t} = \sum_{fl} LOCF_{fl,a,t} \cdot W_{fl,t} + \sum_{c} PINDEX_{c,t} \cdot iocf_{c,a}$	a
(D.5.2)	$PM_{c,t} = NER_t \cdot pwm_c \cdot (1+tm_c)$	For c $\in$ tb
(D.5.3)	$PE_{c,t} = NER_t \cdot pwe_c \cdot (1-te_c)$	For c $\in$ tbnr
(D.5.4)	$PDCBIS_{c,t} \cdot QDC_{c,t} = PDC_{c,t} \cdot QDDA_{c,t} + PE_{c,t} \cdot E_{c,t}$	For c $\in$ tb
(D.5.5)	$PDCBIS_{c,t} = PDC_{c,t}$	For c=OS
(D.5.6)	$PDA_{a,t} = \sum \Xi_{a,c} \cdot PDCBIS_{c,t}$	For a $\in$ n-mup
(D.5.7)	$PDA_{a,t} = (1+TAUV_{a,t})VC_{a,t}$	For a $\in$ mup
(D.5.8)	$TAUV_{a,t} = TAUV_{a,t-1}\left[\frac{XC_{c,t}}{XC_{c,t-1}}\right]^{\zeta tau_a}$	For a $\in$ mup
(D.5.9)	$PDC_{c,t} = PDA_{a,t}$	For c $\in$ mup
(D.5.10)	$PINDEX_{c,t} \cdot QDSC_{c,t} = \left[PDC_{c,t} \cdot (QDDC_{c,t} - M_{c,t}) + PM_{c,t} M_{c,t}\right] \cdot (1+tind_c)$	c
(D.5.11)	$RERM_{c,t} = \frac{PM_{c,t}}{PDC_{c,t}}$	For c $\in$ tb
(D.5.12)	$RERE_{c,t} = \frac{NER_t \cdot pwe_c}{PDC_{c,t}}$	For c $\in$ mup

(D.5.13) $$CPI_t = \sum_c cwts_c \cdot PINDEX_{c,t}$$

(D.5.14) $$KPI_t = \sum_c kwts_c \cdot PINDEX_{c,t}$$

(D.5.15) $$RIR_t = nir_t - \hat{CPI}_t$$

(D.5.16) $$PTI_t = \sum_c ptwts_c \cdot PINDEX_{c,t}$$

(D.5.17) $RER_t = \dfrac{PTI_t}{PINDEX_{\cos,t}}$

PRODUCTION AND FACTOR MARKETS

(D.5.18)	$QA_{a,t} = \left(\kappa_a \cdot KSA_{a,t-1} + QA_{a,t-1}\right) \cdot YADJ$	For a $\in$ n-mup
(D.5.19)	$QA_{a,t} = \left(\kappa_a \cdot KSA_{a,t-1} + QA_{a,t-1}\right)$	For a $\in$ mup
(D.5.20)	$XA_{a,t} = QA_{a,t}$	For a $\in$ n-mup
(D.5.21)	$XA_{a,t} = \left(\sum_a \Xi bis_{a,c} \cdot XC_{c,t}\right) \cdot YADJ_t$	For a $\in$ mup
(D.5.22)	$QDC_{c,t} = \sum_a \Xi_{a,c} XA_{a,t}$	For c $\in$ n-mup
(D.5.23)	$QDC_{c,t} = XC_{c,t}$	For c $\in$ mup
(D.5.24)	$QDC_{c,t} = \lambda_c^{cet}\left[\psi_c^{cet} \cdot E_{c,t}^{\rho_c^{cet}} + \left(1-\psi_c^{cet}\right) \cdot QDDA_{c,t}^{\rho_c^{cet}}\right]^{1/\rho_c^{cet}}$	For c $\in$ tbnr
(D.5.25)	$\dfrac{E_{c,t}}{QDDA_{c,t}} = \left(\dfrac{PE_{c,t}}{PDC_{c,t}} \cdot \dfrac{\left(1-\psi_c^{cet}\right)}{\psi_c^{cet}}\right)^{1/\rho_c^{cet}-1}$	For c $\in$ tbnr
(D.5.26)	$U_{a,t} = \dfrac{XA_{a,t}}{QA_{a,t}}$	a
(D.5.27)	$UAV_t = \sum_a \dfrac{XA_{a,t}}{QA_{a,t}}$	
(D.5.28)	$LS_{fl,t} = LS_{fl,t-1} \cdot \left(1 + gls_{fl,t}\right) \cdot \left[\dfrac{WL_{fl,t}}{WL_{fl,t-1}}\right]^{\eta_{fl}}$	Fl
(D.5.29)	$LD_{fl,a,t} = LOCF_{fl,a,t} \cdot XA_{a,t}$	Fl, a
(D.5.30)	$LOCF_{fl,a,t} = LOCF_{fl,a,t-1} \cdot (1 - LPRODG_{fl,a,t})$	Fl, a
(D.5.31)	$LPRODG_{fl,a,t} = lstc_{fl,a} + \alpha_{1fl,a} \cdot \hat{UAV}_t$	Fl,a
(D.5.32)		Fl

$$WL_{fl,t} = WL_{fl,t-1} \cdot \left[1 + \omega_1 \cdot \frac{\sum_a LPRODG_{fl,a,t}}{a} + \omega_2 \cdot \hat{CPI}_t - \omega_3 \hat{UN}_{fl,t} + \omega_4 wpol \right]$$

(D.5.33) $$YFL_{fl,t} = \left(WL_{fl,t} \cdot \sum_a LD_{fl,a,t} \right) \cdot (1 - tfl_{fl})$$ Fl

(D.5.34)

$$YFK_t = \left[\sum_a ((1 + sa_{a,t}) \cdot PDA_{a,t} - VC_{a,t}) \cdot XA_{a,t} \right] \cdot (1 - tfk)$$ Fk

(D.5.35) $$PRFR_{a,t} = \frac{\left((1 + sa_{a,t}) \cdot PDA_{a,t} - VC_{a,t}\right) \cdot XA_{a,t} \cdot \left(1 - tfka_a\right)}{KPI_t \cdot KSA_{a,t}}$$ where

$$tfka_a = tfk \cdot \frac{XA_{a,t0}}{\sum_a XA_{a,t0}}$$ a

(D.5.36) $$KSA_{a,t} = (1 - \delta_a) KA_{a,t-1} + ID^{priv}{}_{a,t}$$ For a=PP, MR,MO,OS

(D.5.37) $$KSA_{a,t} = (1 - \delta_a) KA_{a,t-1} + ID^{priv}_{a,t} + ID^{gov}_t$$ For a= PS

INSTITUTIONS AND DEMAND

(D.5.38)

$$YH_{h,t} = \sum_{fl} shryfl_{h,fl} \cdot YFL_{fl,t} + shryfk_h \cdot YFK_t + TRGHV_{h,t} + TRWHV_{h,t}$$ h

(D.5.39) $$TRWHV_{h,t} = NER_t \cdot trwh_{h,t}$$

where $$trwh_{h,t} = trwh_{h,t-1} \cdot (1 + gtrwh_{h,t})$$ h

(D.5.40)

$$EXPH_{h,t} = (1 - MPS_{h,t})(1 - ty_h) YH_{h,t} - TRHGV_{h,t} - TRHWV_{h,t}$$ h

(D.5.41) $$TRHGV_{h,t} = trhg_{h,t} \cdot CPI_t$$

where $$trhg_{h,t} = trhg_{h,t}(1 + gtrhg_{h,t})$$ h

(D.5.42) $$TRHWV_{h,t} = trhw_{h,t} \cdot NER_t$$ h where $trhw_{h,t} = trhw_{h,t-1} \cdot (1 + trhwrule_{h,t})$

(D.5.43)

$$CDH_{c,h,t} = \theta_{c,h} + \frac{\mu_{c,h}}{PINDEX_{c,t}} \cdot \left[EXPH_{h,t} - \sum_{c} PINDEX_{c,t} \cdot \theta_{c,h} \right] \quad \text{c,h}$$

(D.5.44) $INTD_{c,a,t} = iocf_{c,a} \cdot XA_{a,t}$ c,a

(D.5.45) $AINTD_{c,t} = \sum_{a} INTD_{c,a,t}$ c,a

(D.5.46)

$$CDG_{c,t} = \left[CDG_{c,t-1} \cdot (1 + cdgrule) + CDGTC_{c,t} \right] \cdot GCADJ_t \quad \text{c}$$

(D.5.47) $CDGTC_{c,t} = strcdg_c \cdot (taxcon \cdot \frac{TTEX_t}{TTEX_{t-1}}) \cdot \frac{1}{CPI_t}$ c

(D.5.48) $ID^{priv}_{a,t} = ID^{priv}_{a,t-1} \cdot \begin{bmatrix} 1 + \gamma_{1a} \hat{UAV}_t + \gamma_{2a} \hat{ID}^{gov}_t \\ + \gamma_{3a} \hat{PRFR}_{a,t} - \gamma_{5a} \hat{RIR}_t \end{bmatrix} \cdot IADJ_t$ a

(D.5.49) $ID^{gov}_t = \left[ID^{gov}_{t-1} \cdot (1 + idgrule) + IGTI_t \right] \cdot GIADJ_t$

(D.5.50) $IGTI_t = taxinv \cdot \frac{TTEX_t}{TTEX_{t-1}} \cdot \frac{1}{CPI_t}$

(D.5.51) $IO^{gov}_{c.t} = \Delta^{gov}_{c} ID^{gov}_t$ c

(D.5.52) $IO^{priv}_{c,t} = \Delta^{priv}_{ac} ID^{priv}_{a,t}$ c

(D.5.53) $IDT_{APS,t} = ID^{gov}_t + ID^{priv}_{APS,t}$ For a=PS

(D.5.54)

$$E_{c,t} = E_{c,t-1} \cdot (RERE_{c,t})^{\xi_{EP}} \cdot (y^W)^{\xi_{EY}} \cdot \left(\frac{ID^{priv}_{a,t}}{ID^{priv}_{a,t-1}} \right)^{\xi_{ENP1_c}} \cdot \left(\frac{QA_{APS,t}}{QA_{APS,t-1}} \right)^{\xi_{ENP2}} \quad \text{For } c \in \text{mup}$$

(D.5.55)

$$M_{c,t} = M_{c,t-1} \cdot \left(\frac{YAGR_t}{YAGR_{t-1}} \right)^{\xi_{MY}} \cdot \left(\frac{1}{RERM_{c,t}} \right)^{\xi_{MP}} \cdot \left(\frac{ID^{priv}_{a,t-1}}{ID^{priv}_{a,t}} \right)^{\xi_{MNP1}} \cdot \left(\frac{QA_{APS,t-1}}{QA_{APS,t}} \right)^{\xi_{MNP2}} \quad \text{For } c \in \text{tb}$$

MATERIAL BALANCE AND SYSTEM CONSTRAINTS

(D.5.56) c

$$XC_{c,t} = AINTD_{c,t} + \sum_h CDH_{c,h,t} + IO_{c,t}^{priv} + IO_{c,t}^{gov} + CDG_{c,t} + E_{c,t} - M_{c,t}$$

(D.5.57) c

$$MSH_{c,t} = \frac{M_{c,t}}{AINTD_{c,t} + \sum_h CDH_{c,h,t} + CDG_{c,t} + IO_{c,t}^{gov} + IO_{c,t}^{priv}}$$

(D.5.58) $YAGR_t = \sum_c XC_{c,t} - \sum_c INTD_{c,t}$

(D.5.59) $YAGN_t = \sum_c \left(PDC_{c,t} \cdot XC_{c,t} - PINDEX_{c,t} \cdot AINTD_{c,t} \right)$

(D.5.60)

$$YG_t = TTHOU + TTFAC + TTIND_t + TRADE_t + \sum_h TRHGV_{h,t} + TRWGV_t$$

(D.5.61)

$$TTIND_t = \sum_c tind_c \cdot \frac{PINDEX_{c,t}}{(1+tind_c)} \left[\sum_h CDH_{c,h,t} + AINTD_{c,t} + CDG_{c,t} + IO_{c,t}^{gov} + IO_{c,t}^{priv} \right]$$

(D.5.62)

$$TTRADE_t = \sum_c \frac{tm_c PM_{c,t} M_{c,t}}{(1+tm_c)} + \sum_{ctp} \frac{te_c PE_{c,t} \cdot E_{c,t}}{(1+te_c)} + \sum_{cmup} \frac{te_c PDC_{c,t} \cdot E_{c,t}}{(1+te_c)}$$

(D.5.63) $TTEX_t = \sum_{ctp} \frac{te_c PE_{c,t} \cdot E_{c,t}}{(1+te_c)} + \sum_{cmup} \frac{te_c PDC_{c,t} \cdot E_{c,t}}{(1+te_c)}$

(D.5.64) $TTHOU_t = \sum_h ty_h YH_{h,t}$

(D.5.65) $TTFAC_t = \sum_{fl} \frac{tf_{fl} \cdot YF_{fl,t}}{(1-tf_{fl})} + \frac{tfk \cdot YF_{k,t}}{(1-tfk)}$

(D.5.66) $TRWGV_t = trwg_t \cdot NER_t$

where $trwg_t = trwg_{t-1} \cdot (1 + gtrwg_t)$

(D.5.67)

$$EXPG_t = \sum_c CDG_{c,t} + \sum_h TRGHV_{h,t} + TRGWV_t + \sum_a SUBSA_{a,t}$$

(D.5.68) $TRGHV_{h,t} = trghr_{h,t} \cdot CPI_t \cdot GTRGHADJ_t$ H

where $trghr_{h,t} = trghr_{h,t-1}(1 + trghrule_{h,t})$

(D.5.69) $TRGWV_t = trgw_t \cdot NER_t \cdot GTRGWADJ_t$

where $trgw_t = trgw_{t-1} \cdot (1 + trgwrule_t)$

(D.5.70) $SUBSA_{a,t} = sa_{a,t} \cdot PDA_{a,t} \cdot XA_{a,t}$ a

Government balance

(D.5.71) $SG_t = YG_t - EXPG_t$

(D.5.72) $GBR_t = EXPG_t + \sum_c PINDEX_{c,t} \cdot IO_{c,t}^{gov} - YG_t$

External balance

(D.5.73)

$$SW_t = \frac{\sum_c PM_{c,t} \cdot M_{c,t}}{(1 + tm_c)} + \sum_h TRHWV_{h,t} + TRGWV_t - \sum_{ctp} \frac{PE_{c,t} \cdot E_{c,t}}{(1 - te_c)} - \sum_{cmup} PDC_{c,t} \cdot E_{c,t} - \sum_h TRWHV_{h,t} - TRWGV_t$$

Saving investment balance

(D.5.74)

$$\sum_h MPS_{h,t}(1 - ty_h)Y_{h,t}^H + SG_t + SW_t = \sum_c PINDEX_{c,t}(IO_{c,t}^{priv} + IO_{c,t}^{gov})$$

Labour market equilibrium

(D.5.75) $UNL_{fl,t} = LS_{fl,t} - \sum_a LD_{fl,a,t}$ F

Commodity market equilibrium

(D.5.76) $QDSC_{c,t} = QDC_{c,t} - E_{c,t} + M_{c,t}$

(D.5.77) c

$$QDDC_{c,t} = \left[\sum_c INTD_{c,t} + \sum_h CDH_{c,h,t} + IO_{c,t}^{priv} + IO_{c,t}^{gov} + CDG_{c,t}\right]$$

(D.5.78) $QDSC_{c,t} = QDDC_{c,t}$ c

Table D5.3
Model parameters and variables definitions

	Endogenous variables	
	Ψ (endogenous or exogenous according to closure rule)	
COST AND PRICES		
VC $_{a,t}$	Variable costs	a
PINDEX $_{c,t}$	Composite commodity prices (including indirect tax) for commodities sold domestically	c
PDC $_{c,t}$	Price for commodity c produced domestically	c
PDCBIS $_{c,t}$	Composite price for commodity c produced domestically	c
PM $_{c,t}$	Domestic import price	tb
PE $_{c,t}$	Domestic export price	tbnr
PDA $_{a,t}$	Producer price	a
NER $_{t}$ Ψ	Nominal exchange rate	
RERM $_{c,t}$	Real exchange rate imports	tb
RERE $_{c,t}$	Real exchange rate exports	mup
WL $_{fl,t}$ Ψ	Nominal wage by labour type	fl
CPI $_{t}$	Consumer price index	
KPI $_{t}$	Capital price index	
RIR $_{t}$	Real interest rate	
PTI $_{t}$	Tradable price index	
RER $_{t}$	Ratio tradable to non-tradable prices	
TAUV $_{a,t}$	Mark up	
PRODUCTION AND FOP MARKET		
QA $_{a,t}$	Supply determined output activity-sector	a
QDC $_{c,t}$	Supply commodity c produced domestically	c
XA $_{a,t}$	Demand determined output activity-sector	a
YADJ $_{t}$ Ψ	Adjustment variable for output, endogenous in Keynesian closure rule	
U $_{a,t}$	Capacity utilization by activity-sector a	a
UAV $_{t}$	Aggregate capacity utilization	
LD $_{fl,a,t}$	Labour demand by activity-sector and labour type	fl a
LS $_{fl,t}$	Labour supply by labour type	fl,t
UNL $_{fl,t}$ Ψ	Excess labour supply by labour type	fl
LOCF $_{fl,a,t}$	Labour output coefficient by activity-sector and labour type	fl a
LPRODG $_{fl,a,t}$	Labour productivity	fl a
YFL $_{fl,t}$	Labour income by labour type	fl
YFK $_{t}$	Capital income	fk
PRFR $_{a,t}$	Profit rate by activity-sector	a
KSA $_{a,t}$	Capital stock by activity-sector	a
INSTITUTIONS AND DEMAND		
YH $_{h,t}$	Household income	h
TRWHV $_{h,t}$	World transfers to households	h
EXPH $_{h,t}$	Households expenditure	h

TRHWV $_{h,t}$	Household transfers to the rest of the world	h
TRHGV $_{h,t}$	Household transfers to the government	h
MPS $_{h,t}$ Ψ	Marginal propensity to save (endogenous in Kaldorian closure rule)	h
CDH $_{c,h,t}$	Household consumption	c,h
INTD $_{ac,t}$	Demand intermediate inputs	c
AINTD $_{c,t}$	Aggregate intermediate input demand	c
CDG $_{c,t}$	Government consumption	c
CDGTC $_{c,t}$	Government consumption out of export tax	c
GCADJ $_{t}$ Ψ	Adjustment variable government consumption	
ID $^{priv}{}_{a,t}$	Private investment by destination	a
IADJ $_{t}$ Ψ	Adjustment variable for investment (endogenous in saving-driven closure rule)	
ID $^{gov}{}_{t}$	Public investment	aps
IGTI $_{t}$	Public Investment out of export tax	
GIADJ $_{t}$ Ψ	Adjustment variable public investment	
IDT $_{aps,t}$	Total investment in sector PS	aps
IO $^{priv}{}_{c,t}$	Private investment by origin	c
IO $^{gov}{}_{c,t}$	Public investment by origin	c
E $_{c,t}$	Exports	tb
M $_{c,t}$	Imports	tb
QDDA $_{c,t}$	Quantity of domestic output sold domestically	tbnr
MATERIAL BALANCE AND SYSTEM CONSTRAINT		
XC $_{c,t}$	Domestic demand commodity c	c
MSH $_{c,t}$	Import share	ct
YAGR $_{t}$	Real GDP	
YAGN $_{t}$	Nominal GDP	
YG $_{t}$	Government income	
TTHOU $_{t}$	Total direct tax	h
TTFAC $_{t}$	Total factor tax	fl, fk
TTEX $_{t}$	Total export tax	
TTRADE $_{t}$	Total trade tax	
TTIND $_{t}$	Total indirect tax	
TRWGV $_{t}$	World transference to the government	
EXPG $_{t}$	Government expenditure	
TRGHV $_{h,t}$	Government transfers to households	h
GTRGHADJ $_{h,t}$ Ψ	Adjustment variable government transfers to households	
TRGWV $_{t}$	Government transfers to the rest of the world	
GTRGWADJ $_{t}$ Ψ	Adjustment variable government transfers to households	
SUBSA $_{a,t}$	Subsidy by activity-sector	a
SG $_{t}$	Government savings	
GBR $_{t}$	Government borrowing requirements	
SW $_{t}$	Foreign savings	
QDSC $_{c,t}$	Domestic supply composite commodity c	c
QDDC $_{c,t}$	Domestic demand composite commodity c	c

Model parameters and exogenous variables	
COST AND PRICES	
pwm_c	World price imports
pwe	World price exports
nir_t	Nominal interest rate
ζtau_a	Mark-up elasticity to demand growth
$cwts_c$	Weight consumer price index
$kwts_c$	Weight capital price index
$ptwts_c$	Weight tradable price index
PRODUCTION AND FOP MARKET	
κ_a	Incremental capital capacity ratio
$iocf_{c,a}$	Input-output coefficient
$\Xi_{a,c}$	Output coefficient
$\Xi bis_{a,c}$	Demand coefficient
λ_c^{cet}	Shift CET function
ψ_c^{cet}	Export share
ρ_c^{cet}	Exponent CET function
$gls_{fl,t}$	Labour force growth
η_{fl}	Sensibility labour supply to relative wages
$lstc_{fl,a}$	Labour-saving technical change
$\alpha_{1fl,a}$	Kaldor-Verdoorn coefficient productivity equation
ω_1	Wage equation, sensibility wages to labour productivity
ω_2	Wage equation, indexation coefficient
ω_3	Wage equation, sensibility to changes in unemployment
ω_4	Wage equation, sensibility to wage policy

$wpol$	Government wage policy
δ_a	Depreciation rate
INSTITUTIONS AND DEMAND	
$shryfl_{h,fl}$	Share labour income to household h
$shryfk_h$	Share capital income to household h
$trwh_{h,t}$	Transfers to household from rest of the world
$gtrwh_{h,t}$	Changes in transfers to household from rest of the world
$trhg_{h,t}$	Household transfer to the government
$gtrhg_{h,t}$	Growth in household transfers to the government
$trhw_{h,t}$	Household transfers to the rest of the world
$trhwrule_{h,t}$	Growth in household transfers to the rest of the world
$\theta_{c,h}$	Intercept LES consumption function
$\mu_{c,h}$	Marginal propensity to consume LES fn
$cdgrule$	Exogenous growth government consumption
$strcdg_c$	Structure government consumption
$taxcon$	% of changes in export tax used to finance government consumption
γ_{1a}	Investment equation, coefficient capacity utilization
γ_{2a}	Investment equation, crowd-in parameter
γ_{3a}	Investment equation, coefficient profit rate
γ_{5a}	Investment equation, coefficient real interest rate
$idgrule$	Exogenous growth in public investment
$taxinv$	% of changes in export tax used to finance public investment
Δ_c^{gov}	Public investment coefficient (investment by destination to investment by origin)
Δ_{ac}^{priv}	Private investment coefficient (investment by destination to investment by origin)
y^W	World output

ξ_{E_P}	Price elasticity exports
ξ_{E_Y}	Income elasticity exports
$\xi_{E_{NP1_c}}$	Non-price elasticity exports 1 (sensibility to capital accumulation)
$\xi_{E_{NP2_c}}$	Non-price elasticity exports 2 (sensibility to infrastructure)
ξ_{MY}	Price elasticity imports
ξ_{MP}	Income elasticity imports
ξ_{MNP1}	Non-price elasticity imports 1 (sensibility to capital accumulation)
ξ_{MNP2}	Non-price elasticity imports 2 (sensibility to infrastructure)
ty_h	Direct income tax
tfl_{fl}	Tax factor labour fl
$tfka_a$	Tax factor capital by activity-sector
tfk	Tax factor capital
tm_c	Import tax
te_c	Export tax
$tind_c$	Indirect tax
$trwg_t$	Transfers to the government from the rest of the world
$gtrwg_t$	Growth in transfers to the government from the rest of the world
$trghr_{h,t}$	Government transfers to households
$trghrule$	Growth in government transfers to households
$trgw_t$	Government transfers to the rest of the world
$trgwrule_t$	Growth in government transfers to the rest of the world
$sa_{a,t}$	Government subsidy to activity-sector

E Appendix Chapter 6

Table E6.1

Base run simulation and sensitivity analysis. Annual Av. growth 2004-2007 and percentage change from base run

		Observed trends	Base Run (BR) a/	BR & Export Elasticity 1 b/	BR & Export Elasticity 2 c/	BR & Endo-genous Y/L d/
		(1)	(2)	(3 a)	(3 b)	(4)
				% change from Base Run e/		
	Macroeconomic Data					
1	Real GDP	8.8	7.9	-3,5	-1,0	-8,8
2	Tot. Consumption	8.2	8.2	-3,6	-1,1	-5,5
3	Tot. Investment	18.4	17.0	1,1	0,4	-0,5
4	Tot. Exports	9.9	10.2	-11,8	-3,5	-20,5
5	Tot. Imports	18.7	19.6	-4,5	-1,3	-5,4
6	Tot. Employment	3.2	5.3	-2,8	-0,8	-1,2
7	Current Account (surplus)/GDP		-24,0	54,8	14,0	40,3
8	Trade Balance (surplus) / GDP		-22,2	10,7	3,1	12,3
9	Gov. Savings (deficit) / GDP		35,4	1,3	0,9	-3,0
10	Consumer Price Index	9.8	9.9	-1,4	-0,4	9,0
11	Dom. Price CPP	13.4	9.8	-0,4	-0,1	0,5
12	Dom. Price CMR	11.4	8.8	-0,4	-0,1	4,3
13	Dom. Price COS	8.6	10.8	-1,8	-0,5	13,8
	Sectoral Competitiveness, Output and Exports					
14	Real Exchange Rate CMO		-0.7	-26,3	-8,1	84,3
15	Real Exchange Rate CPS		-2.1	-13,9	-4,1	45,8
16	Output APP		8.06	-1,8	-0,6	-6,8
17	Output AMR		7.26	-2,1	-0,6	-8,1
18	Output Mark-up sectors (MO + PS)		7.48	-5,3	-1,6	-9,8
19	Output AOS		8.06	-3,0	-0,9	-9,8
20	Exports CPP	13.92	9.00	-0,7	-0,3	-9,9
21	Exports CMR	8.51	11.30	0,2	0,0	-19,6
22	Exports CMO	13.79	10.61	-28,2	-10,1	-24,2
23	Exports CPS		9.59	-46,4	-9,7	-41,2
24	ULC AMO		12.34	-5,5	-1,4	12,2
25	ULC APS		12.30	-3,5	-0,4	12,3

Table E6.1 (Continuation)

		Observed trends	Base Run (BR) a/	BR & Export Elasticity 1 b/	BR and Export Elasticity 2 c/	BR and Endoge-nous Y/L d/
		(1)	(2)	(3 a)	(3 b)	(4)
				% change from Base Run		
	Socio-economic indicators					
26	Total Employment unskilled		5.21	-2,7	-0,8	-1,1
27	Total Employment skilled		5.34	-2,9	-0,8	-1,3
28	WL Employment Informal		5.44	-2,2	-0,6	-0,8
29	WL Employment Formal		5.47	-2,6	-0,7	-1,3
30	WL Employment unskilled		5.22	-2,7	-0,8	-1,0
31	WL Employment skilled		5.40	-2,9	-0,8	-1,4
32	Av. Real Wage	9.7	4.9	-8,8	-2,7	-2,0
33	WL Real Wage unskilled		4.38	-8,8	-2,7	-1,3
34	WL Real Wage skilled		5.28	-9,1	-2,7	-3,2
35	WL Real Wage informal		4.36	-7,3	-2,1	2,2
36	WL Real Wage formal		5.01	-9,2	-2,8	-3,3
37	Wage labour share	6.99	0.73	-125,2	-12,4	45,9
38	Income (YHQ1) / Income YHQ5		-0.22	-21,3	-6,8	-19,9
39	Cons. (YHQ1) / Cons. YHQ5		0.55	13,0	4,2	46,1

Source: Column 1: INDEC (National Bureau of Statistics) and Secretary of Economic Policy. Columns (2) to (4) model computations;

a/ benchmark closure rule: quantity adjustment the labour market; fixed exchange rate regime; exogenous government expenditure and Keynesian closure rule for the saving-investment balance;

b/ Export elasticity to sector specific capital accumulation and to infrastructure and productive linkages (sector PS) equal 0;

c/ Export elasticity to infrastructure and productive linkages (sector PS) equal 0;

d/ Kaldor-Verdoorn coefficient equal 0;

e/ Macroeconomic balances are presented as annual average growth rather than % change from base run

Y/L= Productivity; PP= primary products; MR= resource intensive manufacturing; MO=other manufacturing products; PS= producer and exportable services; OS= other (consumer) services ULC = Unitary labour costs WL = wage labour; YHQ1(5) household quintile 1 poorest (5 richest); Cons = consumption

Table E6.2
The Base Run Simulation and Alternative Closure Rules. Annual Av. Growth 2004-2007

		Observed trends (1)	Base Run (BR) a/ (2)	BR and Neo-classical S-I Closure b/ (3)	BR and Kal-dorian S-I Closure c/ (4)
	Macroeconomic Data				
1	Real GDP	8.8	7.9	7.5	7.7
2	Tot. Consumption	8.2	8.2	7.8	6.3
3	Tot. Investment	18.4	17.0	14.7	16.5
4	Tot. Exports	9.9	10.2	10.5	13.4
5	Tot. Imports	18.7	19.6	18.3	18.0
6	Tot. Employment	3.2	5.3	5.0	5.0
7	Current Account (surplus) / GDP		-24,0	-1,7	31,1
8	Trade Balance (surplus) / GDP		-22,2	-15,4	-1,7
9	Gov. Savings (deficit) / GDP		35,4	33,9	40,4
10	Consumer Price Index	9.8	9.9	9.6	7.2
11	Dom. Price CPP	13.4	9.8	9.7	9.5
12	Dom. Price CMR	11.4	8.8	8.7	7.8
13	Dom. Price COS	8.6	10.8	10.3	5.7
	Sectoral Competitiveness, Output and Exports				
14	Real Exchange Rate CMO		-0.7	-0.4	0.6
15	Real Exchange Rate CPS		-2.1	-1.6	-0.1
16	Output APP		8.06	7.83	7.91
17	Output AMR		7.26	7.02	7.09
18	Output Mark-up sectors (MO + PS)		7.48	6.86	7.39
19	Output AOS		8.06	7.71	7.53
20	Exports CPP	13.92	9.00	9.03	10.12
21	Exports CMR	8.51	11.30	11.51	15.55
22	Exports CMO	13.79	10.61	10.92	14.40
23	Exports CPS		9.59	10.83	14.31
24	ULC AMO		12.34	11.50	9.60
25	ULC APS		12.30	11.52	9.69

Table E6.2 (Continuation)

		Observed trends	Base Run (BR) a/	BR and Neo-classical S-I Closure b/	BR and Kal-dorian S-I Clo-sure c/
		(1)	(2)	(3)	(4)
	Socio-economic indicators				
26	Total Employment unskilled		5.21	4.98	4.93
27	Total Employment skilled		5.34	5.09	5.05
28	WL Employment Informal		5.44	5.24	5.15
29	WL Employment Formal		5.47	5.23	5.15
30	WL Employment unskilled		5.22	4.99	4.94
31	WL Employment skilled		5.40	5.14	5.09
32	Av. Real Wage	9.7	4.9	4.3	5.0
33	WL Real Wage unskilled		4.38	3.84	4.55
34	WL Real Wage skilled		5.28	4.61	5.29
35	WL Real Wage informal		4.36	3.87	4.53
36	WL Real Wage formal		5.01	4.37	5.07
37	Wage labour share	6.99	0.73	0.36	0.91
38	Income (YHQ1) / Income YHQ5		-0.22	-0.16	-0.20
39	Cons. (YHQ1) / Con. YHQ5		0.55	0.62	4.96

Source: Column 1: INDEC (National Bureau of Statistics) and Secretary of Economic Policy. Columns (2) to (4) model computations;

a/ benchmark closure rule: quantity adjustment the labour market; fixed exchange rate regime; exogenous government expenditure and Keynesian closure rule for the saving-investment balance;

b/ Neoclassical closure rule, saving-driven investment;

c/ Kaldorian closure rule, household savings adjust to balance the saving-investment equation;

PP= primary products; MR= resource intensive manufacturing; MO=other manufacturing products; PS= producer and exportable services; OS= other (consumer) services ULC = Unitary labour costs; WL = wage labour; YHQ1(5) household quintile 1 poorest (5 richest); Cons.=consumption

Table E6.3
The base run simulation. Annual average growth 2004-2007 and 2004-2010 and percentage change from base run

		Observed trends	Base Run (BR) 2004-2007 a/	Base Run (BR) 2004-2010 a/	BR 2004-2010 and Export Elasticity 1 b/	BR 2004-2010 and Endogenous Y/L c/
		(1)	(2)	(3)	(4)	(5)
					% Change from Base Run d/	
	Macroeconomic Data					
1	Real GDP	8.8	7.9	6.4	-3,1	-4,9
2	Tot. Consumption	8.2	8.2	6.1	-4,4	-5,5
3	Tot. Investment	18.4	17.0	9.7	2,4	10,8
4	Tot. Exports	9.9	10.2	13.3	-6,4	-9,3
5	Tot. Imports	18.7	19.6	16.0	-4,8	-2,2
6	Tot. Employment	3.2	5.3	4.3	-2,6	-5,7
7	Current Account (surplus) / GDP		-24,0	17,0	14,5	6,7
8	Trade Balance (surplus) / GDP		-22,2	8,3	6,5	1,3
9	Gov. Savings (deficit) / GDP		35,4	25,8	26,5	26,8
10	Consumer Price Index	9.8	9.9	5.5	-3,8	3,5
11	Dom. Price CPP	13.4	9.8	6.4	-0,7	0,2
12	Dom. Price CMR	11.4	8.8	5.3	-1,1	2,2
13	Dom. Price COS	8.6	10.8	4.9	-6,6	9,8
	Sectoral Competitiveness, Output and Exports					
14	Real Exchange Rate CMO		-0.7	-0.1	-179,2	-74,3
15	Real Exchange Rate CPS		-2.1	-1.2	-33,2	-14,2
16	Output APP		8.06	7.35	-1,2	-4,7
17	Output AMR		7.26	6.29	-1,4	-6,0
18	Output Mark-up sectors (MO + PS)		7.48	5.28	-5,8	-2,5
19	Output AOS		8.06	6.78	-2,7	-7,0
20	Exports CPP	13.92	9.00	9.28	0,0	-5,2
21	Exports CMR	8.51	11.30	12.65	1,1	-7,0
22	Exports CMO	13.79	10.61	18.01	-10,3	-9,0
23	Exports CPS		9.59	15.51	-17,8	-16,6

Table E6.3 (Continuation)

		Observed trends	Base Run (BR) 2004-2007 a/	Base Run (BR) 2004-2010 a/	BR 2004-2010 and Export Elasticity 1 b/	BR 2004-2010 and Endogenous Y/L c/
		(1)	(2)	(3)	(4)	(5)
					% Change from Base Run	
	Socio-economic indicators					
24	Total Employment unskilled		5.21	4.25	-2,5	-5,9
25	Total Employment skilled		5.34	4.27	-2,7	-5,6
26	WL Employment Informal		5.44	4.95	-1,7	-5,2
27	WL Employment Formal		5.47	4.17	-2,5	-5,4
28	WL Employment unskilled		5.22	4.19	-2,5	-5,5
29	WL Employment skilled		5.40	4.25	-2,8	-5,5
30	Av. Real Wage	9.7	4.9	5.19	4,68	4,56
31	WL Real Wage unskilled		4.38	4.94	-9,3	-11,9
32	WL Real Wage skilled		5.28	5.32	-10,6	-12,6
33	WL Real Wage informal		4.36	5.78	-7,6	-9,3
34	WL Real Wage formal		5.01	5.04	-10,7	-13,1
35	Wage labour share	6.99	0.73	2.21	-13,1	-3,7
36	Income (YHQ1) / Income YHQ5		-0.22	0.06	78,4	70,9
37	Cons. (YHQ1) / Cons. YHQ5		0.55	1.16	7,8	15,7

Source: Column 1: INDEC (National Bureau of Statistics) and Secretary of Economic Policy. Columns (2) to (5) model computations;

a/ benchmark closure rule: quantity adjustment the labour market; fixed exchange rate regime; exogenous government expenditure and Keynesian closure rule for the saving-investment balance;

b/ Export elasticity to sector specific capital accumulation and to infrastructure and productive linkages (sector PS) equal 0;

c/ Kaldor-Verdoorn coefficient equal 0;

d/ Macroeconomic balances are presented as annual average growth rather than % change from base run

Y/L = productivity; PP= primary products; MR= resource intensive manufacturing; MO=other manufacturing products; PS= producer and exportable services; OS= other (consumer) services; WL = wage labour; YHQ1(5) household quintile 1 poorest (5 richest)

F

Appendix Chapter 7

Table F7.1

Positive demand shocks and export taxes. Annual Av. growth 2004-2007 and percentage change to base run simulation a/

		Ob-served values	Base Run (BR)	10% Increase (inc.) PWE_{PP}	10% inc. PWE_{MR}	10% inc. PWE_{PP} & 100% inc. in export tax PP	10% inc. PWE_{MR} & 100% inc. in export tax MR
					% change BR b/		
		(1)	(2)	(3)	(4)	(5)	(6)
	Macroeconomic Data						
1	Real GDP	8.8	7,93	-0,73	-2,58	0,21	2,01
2	Tot. Consumption	8.2	8,20	2,76	2,22	-0,56	-0,88
3	Tot. Investment	18.4	16,98	2,18	-0,05	-0,57	-0,24
4	Tot. Exports	9.9	10,18	-6,36	-5,24	1,55	4,02
5	Tot. Imports	18.7	19,56	2,91	4,01	-0,64	-2,32
6	Tot. Employment	3.2	5,29	2,01	1,75	-0,53	-1,35
7	Current Account (surplus) / GDP		-24,0	-17,90	-10,64	0,08	4,47
8	Trade Balance (surplus) / GDP		-22,2	-21,04	-19,36	-15,12	-13,26
9	Gov. Savings (deficit) / GDP		35,4	37,72	35,73	41,81	44,89
10	Consumer Price Index	9.8	9,9	4,69	13,46	-1,01	-8,07
11	Dom. Price CPP	13.4	9,8	30,22	1,71	-6,97	-1,01
12	Dom. Price CMR	11.4	8,8	1,60	26,57	-0,34	-16,93
13	Dom. Price COS	8.6	10,8	2,89	10,89	-0,54	-5,88
	Sectoral Competitiveness, Output and Exports						
14	Real Exchange Rate CMO		-0,7	50,21	110,21	-11,96	-71,24
15	Real Exchange Rate CPS		-2,1	31,65	47,07	-7,58	-30,79
16	Output APP		8,06	3,79	-0,35	-0,86	0,35
17	Output AMR		7,26	-0,13	4,63	0,04	-3,13
18	Output Mark-up sectors (MO + PS)		7,48	-7,05	-11,91	1,76	8,91
19	Output AOS		8,06	3,53	2,66	-0,83	-1,82
20	Exports CPP	13.92	9,00	18,94	-7,67	-4,57	4,76
21	Exports CMR	8.51	11,30	-5,79	30,45	1,23	-22,57
22	Exports CMO	13.79	10,61	-25,84	-43,70	6,13	30,00
23	Exports CPS		9,59	-32,44	-44,02	7,85	30,58
24	ULC AMO		12,34	5,39	10,71	-1,36	-8,20
25	ULC APS		12,30	5,63	10,58	-1,26	-6,98

Table F7.1 (Continuation)

		Ob-served values	Base Run (BR)	10% Increase (inc.) PWEPP	10% inc. PWEMR	10% inc. PWEPP & 100% inc. in export tax PP	10% inc. PWEMR & 100% inc. in export tax MR
					% change BR b/		
		(1)	(2)	(3)	(4)	(5)	(6)
	Socio-economic indicators						
26	Total Employment unskilled		5,21	2,23	2,13	-0,58	-1,64
27	Total Employment skilled		5,34	1,87	1,51	-0,49	-1,17
28	WL Employment Informal		5,44	3,66	3,39	-0,92	-2,57
29	WL Employment Formal		5,47	2,75	2,56	-0,70	-1,94
30	WL Employment unskilled		5,22	2,18	2,01	-0,57	-1,55
31	WL Employment skilled		5,40	1,74	1,36	-0,46	-1,06
32	Av. Real Wage	9.7	4,9	1,79	-5,33	-0,66	2,69
33	WL Real Wage unskilled		4,38	2,15	-5,53	-0,74	2,77
34	WL Real Wage skilled		5,28	1,17	-5,78	-0,52	2,98
35	WL Real Wage informal		4,36	6,55	-2,07	-1,70	0,39
36	WL Real Wage formal		5,01	0,70	-6,29	-0,42	3,32
37	Wage labour share	6.99	0,73	0,00	-37,33	0,00	12,40
38	Income (YHQ1) / Income YHQ5		-0,22	-27,13	-36,18	5,61	23,08
39	Consumption (YHQ1) / Consumption YHQ5		0,55	-8,63	-42,77	2,70	31,70

Source: model computations;

a/ All the simulations are run using the benchmark closure rule: quantity adjustment the labour market; fixed exchange rate regime; exogenous government expenditure and Keynesian closure rule for the saving-investment balance; **b/** Macroeconomic balances are presented as annual average growth rather than % change from base run

$PWE_{PP(MR)}$ = export price primary products (resource-intensive products); inc. = increase; WL = wage labour; YHQ1(5) household quintile 1 poorest (5 richest)

Table F7.2

Managing positive demand shocks. dynamic simulations. Annual average growth 2004-2007 and percentage change to base run simulation a/

		10% inc. PWEMR & 100% inc. in export tax MR ALT BR	(1) & produc-tion subsidies b/	(1) & Gov. consump-tion c/	(1) & Public investment d/	(1) & Export elasticity e/
				% change to Alternative Base Run f/		
	Macroeconomic Data	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
1	Real GDP	8.09	0,7	-0,1	4,1	3,1
2	Tot. Consumption	8.13	2,7	2,5	4,6	3,4
3	Tot. Investment	16.94	1,7	-0,4	11,4	11,9
4	Tot. Exports	10.58	-3,7	-3,9	-4,5	-8,0
5	Tot. Imports	19.10	1,5	0,7	5,7	4,2
6	Tot. Employment	5.22	1,1	0,9	4,8	4,0
7	Current Account (surplus) / GDP	4,47	-3,58	-2,01	-14,17	-16,66
8	Trade Balance (surplus) / GDP	-13,26	-16,26	-15,67	-19,61	-20,23
9	Gov. Savings (deficit) / GDP	44,89	41,98	41,78	45,71	46,22
10	Consumer Price Index	9.12	2,7	3,7	3,6	3,0
11	Dom. Price CPP	9.73	0,5	0,2	0,7	0,6
12	Dom. Price CMR	7.28	1,3	1,2	1,4	1,2
13	Dom. Price COS	10.13	4,2	6,4	4,6	3,9
	Sectoral Competitiveness, Output and Exports					
14	Real Exchange Rate CMO	-0.21	69,0	77,0	147,9	116,3
15	Real Exchange Rate CPS	-1.43	15,8	18,5	39,1	32,6
16	Output APP	8.09	0,5	0,2	2,2	1,6
17	Output AMR	7.03	1,2	0,2	2,5	1,8
18	Output Mark-up sectors (MO + PS)	8.14	0,3	-1,4	4,7	3,2
19	Output AOS	7.92	1,2	1,2	3,4	2,4
20	Exports CPP	9.43	-1,4	-0,8	-0,2	-0,4
21	Exports CMR	8.75	-4,1	-4,3	-3,4	-3,0
22	Exports CMO	13.79	-4,3	-5,2	-8,0	-15,9
23	Exports CPS	12.52	-5,5	-6,5	-7,4	-14,8
24	ULC AMO	11.33	3,0	4,5	8,9	6,0
25	ULC APS	11.45	2,7	2,7	7,5	5,5

Table F7.2 (Continuation)

		10% inc. PWEMR & 100% inc. in export tax MR ALT BR	(1) & production subsidies b/	(1) & Gov. consumption c/	(1) & Public investment d/	(1) & Export elasticity e/
			% change to Alternative Base Run f/			
		(1)	(2)	(3)	(4)	(5)
	Socio-economic indicators					
26	Total Employment unskilled	5.13	1,1	0,9	4,4	3,6
27	Total Employment skilled	5.28	1,1	0,8	5,0	4,2
28	WL Employment Informal	5.30	1,1	1,1	4,6	4,0
29	WL Employment Formal	5.37	1,2	1,1	5,2	4,5
30	WL Employment unskilled	5.14	1,1	0,9	4,4	3,7
31	WL Employment skilled	5.34	1,1	0,9	5,3	4,5
32	Av. Real Wage	5.00	1,6	0,0	12,4	9,7
33	WL Real Wage unskilled	4.50	1,5	-0,2	11,8	9,1
34	WL Real Wage skilled	5.43	1,7	0,1	13,6	10,8
35	WL Real Wage informal	4.37	1,7	0,4	13,5	11,5
36	WL Real Wage formal	5.18	1,6	-0,1	12,8	10,0
37	Wage labour share	0.82	-11,0	11,0	65,8	54,9
38	Income (YHQ1) / Income YHQ5	-0.27	-0,2	-1,7	22,5	16,2
39	Consumption (YHQ1) / Consumption YHQ5	0.73	2,5	12,0	-9,4	-5,9

Source: model computations;

a/ All the simulations are run using the benchmark closure rule: quantity adjustment the labour market; fixed exchange rate regime; exogenous government expenditure and Keynesian closure rule for the saving-investment balance;

b/ annual increases in export tax used to subsidize producers in sector MR;

c/ annual increases in export tax finances increases in government consumption;

d/ annual increases in export tax finances increases in government investment;

e/ annual increases in export tax finances increases in government investment and export elasticity to sector PS (capital accumulation and productive linkages) = 0

f/ Macroeconomic balances are presented as annual average growth rather than % change from base run

ALT BR = alternative base run; PWEPP(MR) = export price primary products (resource-intensive products); inc. = increase; WL = wage labour; YHQ1(5) household quintile 1 poorest (5 richest)

Table F7.3
Positive demand shocks, export tax and public investment. Dynamic simulations. Annual Av. growth 2004-2010 and percentage change to base run simulation a/

		Base Run	10% Increase (inc.) PWE_{MR}	(2) + 100% inc. export tax MR	(3) + Public Investment b/
			% change to Base Run c/		
		(1)	(2)	(3)	(4)
	Macroeconomic Data				
1	Real GDP	6.42	-5,0	3,7	3,8
2	Tot. Consumption	6.12	-1,4	2,1	3,9
3	Tot. Investment	9.66	1,2	-0,9	12,0
4	Tot. Exports	13.30	-4,9	3,5	-2,1
5	Tot. Imports	16.00	1,2	-0,1	2,0
6	Tot. Employment	4.26	-0,9	0,9	3,1
7	Current Account (surplus) / GDP	16,96	18,27	23,94	17,39
8	Trade Balance (surplus) / GDP	25,84	26,53	29,12	29,27
9	Consumer Price Index	5.50	6,2	-2,6	-1,0
10	Dom. Price CPP	6.44	2,1	-1,3	-1,3
11	Dom. Price CMR	5.26	16,3	-10,0	-9,7
12	Dom. Price COS	4.89	3,3	0,7	1,8
	Sectoral Competitiveness, Output and Exports				
13	Real Exchange Rate CMO	-0.14	70,3	-18,4	84,6
14	Real Exchange Rate CPS	-1.22	11,4	-2,3	28,9
15	Exports CPP	9.28	-8,1	5,5	6,0
16	Exports CMR	12.65	21,2	-16,5	-17,1
17	Exports CMO	18.01	-20,7	13,0	3,6
18	Exports CPS	15.51	-20,8	13,2	2,5
	Socio-economic indicators				
29	WL Employment unskilled	4.19	-0,6	0,5	2,5
20	WL Employment skilled	4.25	-1,5	1,2	3,9
21	Av. Real Wage	5.19	-7,6	5,6	14,9
22	WL Real Wage unskilled	4.94	-5,9	4,4	13,1
23	WL Real Wage skilled	5.32	-9,8	7,1	18,0
24	Income (YHQ1) / Income YHQ5	0.06	259,6	-178,5	-99,7

Source: model computations;

a/ All the simulations are run using the benchmark closure rule: quantity adjustment the labour market; fixed exchange rate regime; exogenous government expenditure and Keynesian closure rule for the saving-investment balance; **b/** annual increases in export tax finances increases in government investment; **c/** Macroeconomic balances are presented as annual average growth rather than % from base run.

ALT BR = alternative base run; $PWE_{PP(MR)}$ = export price primary products (resource-intensive products); inc. = increase; PP= primary products; MR= resource intensive manufacturing; MO=other manufacturing products; PS= producer and exportable services; OS= other (consumer) services; WL = wage labour; YHQ1(5) household quintile 1 poorest (5 richest)

Table F7.4
Demand shocks and nominal exchange rate adjustments. Dynamic Simulations 2004-2007 and 2004-2010. Annual average growth and percentage change to base run a/

		2004-2007			2004-2010		
		Base Run (BR)	10% inc. PWE_{MR}	(2) & 10% NER app.	Base Run	10% inc. PWE_{MR}	(5) & 10% NER app.
			% change to BR b/			% change to BR b/	
		(1)	(2)	(3)	(4)	(5)	(6)
	Macroeconomic Data						
1	Real GDP	7,51	2,94	-5,65	6,4	-5,00	-11,17
2	Tot. Consumption	7,78	7,82	2,77	6,1	-1,38	-6,71
3	Tot. Investment	14,70	15,48	5,46	9,7	1,20	-0,31
4	Tot. Exports	10,49	-8,10	-19,54	13,3	-4,87	-11,94
5	Tot. Imports	18,26	11,37	4,89	16,0	1,16	-2,72
6	Tot. Employment	5,05	6,61	-0,01	4,3	-0,94	-6,63
7	Current Account (surplus) / GDP	-1,72	-10,6	-11,2	17,0	18,3	14,9
8	Trade Balance (surplus) / GDP	33,88	35,7	32,4	25,8	26,5	25,5
9	Consumer Price Index	9,59	17,44	-39,08	5,5	6,15	-42,41
10	Dom. Price CPP	9,74	2,65	-57,06	6,4	2,11	-42,29
11	Dom. Price CMR	8,67	28,02	-37,60	5,3	16,33	-36,18
12	Dom. Price COS	10,25	16,41	-35,58	4,9	3,27	-48,26
	Sectoral Competitiveness, Output and Exports						
13	Real Exchange Rate CMO	-0,41	279,83	417,35	-0,1	70,29	136,50
14	Real Exchange Rate CPS	-1,56	94,47	151,87	-1,2	11,43	23,97
15	Exports CPP	9,03	-7,92	-12,87	9,28	-8,08	-11,75
16	Exports CMR	11,51	28,10	18,15	12,65	21,19	16,21
17	Exports CMO	10,92	-45,31	-61,30	18,01	-20,68	-28,81
18	Exports CPS	10,83	-50,45	-72,89	15,51	-20,76	-34,72
	Socio-economic indict-ors						
29	WL Employment unskilled	4,99	6,68	0,38	4,19	-0,56	-6,01
20	WL Employment skilled	5,14	6,50	-0,59	4,25	-1,46	-7,33
21	Av. Real Wage	4,27	7,87	25,12	5,2	-7,61	-9,21
22	WL Real Wage unskilled	3,84	7,63	29,98	4,94	-5,90	-6,35
23	WL Real Wage skilled	4,61	7,88	21,51	5,32	-9,79	-12,18
24	Income (YHQ1) / Income YHQ5	-0,16	-12,72	-55,64	0,06	259,58	284,08

Source: model computations;

a/ All the simulations are run using the benchmark closure rule: quantity adjustment the labour market; fixed exchange rate regime; exogenous government expenditure and Keynesian closure rule for the saving-investment balance; **b/** Macroeconomic balances are presented as annual average growth rather than % change from base run

Dyn.=dynamic; Sim.=simulation; $PWE_{PP(MR)}$ = export price primary products (resource-intensive products); inc. = increase; app = appreciation; NER = nominal exchange rate; PP= primary products; MR= resource intensive manufacturing; MO=other manufacturing products; PS= producer and exportable services; OS= other (consumer) services; WL = wage labour; YHQ1(5) household quintile 1 poorest (5 richest)

Table F7.5
Positive supply shocks. Dynamic simulation. Annual Av. growth 2004-2007 and percentage change to base run simulation a/

		Base Run	10% inc. PWE_{PP} & PWE^{MR}	10% inc. ∆Y/K PP & MR	10% inc. ∆Y/K PP	10% inc. ∆Y/K MR
			% change to Base Run			
		(1)	(2)	(3)	(4)	(5)
	Macroeconomic Data					
1	Real GDP	7.9	-2,2	2,3	1,3	1,0
2	Tot. Consumption	8.2	5,5	2,5	1,4	1,1
3	Tot. Investment	17.0	3,8	0,8	0,8	0,0
4	Tot. Exports	10.2	-10,2	5,2	2,8	2,5
5	Tot. Imports	19.6	7,9	2,8	1,7	1,1
6	Tot. Employment	5.3	3,8	1,9	1,0	1,0
7	Current Account (surplus) / GDP	-24,0	-8,22	-20,06	-22,91	-21,08
8	Trade Balance (surplus) / GDP	-22,2	-18,99	-21,49	-22,10	-21,59
9	Gov. Savings (deficit) / GDP	35,4	38,10	35,68	35,46	35,63
10	Consumer Price Index	9.9	18,6	2,4	1,6	0,8
11	Dom. Price CPP	9.8	32,1	-1,0	-2,6	1,7
12	Dom. Price CMR	8.8	28,2	-1,4	0,8	-2,2
13	Dom. Price COS	10.8	14,9	5,3	3,0	2,3
	Sectoral Competitiveness, Output and Exports					
14	Real Exchange Rate CMO	-0.7	159,3	17,5	11,4	6,3
15	Real Exchange Rate CPS	-2.1	77,8	12,4	6,9	5,7
16	Output APP	8.06	3,7	8,6	8,8	-0,2
17	Output AMR	7.26	5,0	8,4	-0,2	8,6
18	Output Mark-up sectors (MO + PS)	7.48	-16,4	-1,0	-0,8	-0,2
19	Output AOS	8.06	6,3	0,0	0,1	-0,1
20	Exports CPP	9.00	11,3	11,2	17,8	-6,8
21	Exports CMR	11.30	25,0	10,4	-2,9	13,3
22	Exports CMO	10.61	-67,6	-4,7	-3,4	-1,3

Source: model computations;

a/ All the simulations are run using the benchmark closure rule: quantity adjustment the labour market; fixed exchange rate regime; exogenous government expenditure and Keynesian closure rule for the saving-investment balance; **b/** Macroeconomic balances are presented as annual average growth rather than % change from base run

inc. = increase; ∆Y/K = incremental capital output ratio; PWE = international export price; inc. = increase; PP= primary products; MR= resource intensive manufacturing; MO=other manufacturing products; PS= producer and exportable services; OS= other (consumer) services ULC = Unitary labour costs;

Table F7.5 (Continuation)

		Base Run	10% inc. PWE_{PP} & PWE^{MR}	10% inc. ∆Y/K PP & MR	10% inc. ∆Y/K PP	10% inc. ∆Y/K MR
		(1)	(2)	(3)	(4)	(5)
	Sectoral Competitiveness, Output and Exports					
23	Exports CPS	9.59	-73,7	-6,3	-3,8	-2,6
24	ULC AMO	12.34	16,0	1,4	1,4	1,4
25	ULC APS	12.30	16,1	1,9	1,9	1,3
	Socio-economic indicators					
26	Total Employment unskilled	5.21	4,3	2,4	1,1	1,3
27	Total Employment skilled	5.34	3,5	1,7	0,9	0,8
28	WL Employment Informal	5.44	6,7	3,7	2,9	0,9
29	WL Employment Formal	5.47	5,2	1,9	1,3	0,6
30	WL Employment unskilled	5.22	4,1	2,4	1,2	1,2
31	WL Employment skilled	5.40	3,2	1,2	0,6	0,6
32	Av. Real Wage	4.9	-3,4	4,0	1,7	2,4
33	WL Real Wage unskilled	4.38	-3,3	5,7	2,5	3,3
34	WL Real Wage skilled	5.28	-4,4	2,0	0,6	1,4
35	WL Real Wage informal	4.36	4,3	8,2	6,2	1,9
36	WL Real Wage formal	5.01	-5,4	2,5	0,5	2,1
37	Wage labour share	0.73	-49,8	0,0	0,0	12,4
38	Income (YHQ1) / Income YHQ5	-0.22	-60,4	-26,7	-22,3	-4,1
39	Consumption (YHQ1) / Consumption YHQ5	0.55	-49,9	28,0	14,9	13,0

Source: model computations;

a/ All the simulations are run using the benchmark closure rule: quantity adjustment the labour market; fixed exchange rate regime; exogenous government expenditure and Keynesian closure rule for the saving-investment balance; **b/** Macroeconomic balances are presented as annual average growth rather than % change from base run

inc. = increase; ∆Y/K = incremental capital output ratio; PWE = international export price; inc. = increase; PP= primary products; MR= resource intensive manufacturing;; WL = wage labour; YHQ1(5) household quintile 1 poorest (5 richest)

Table F7.6
Positive demand and supply shocks under alternative closure rules. Dynamic simulation (2004-2007) period a/, b/

		10% inc. PWE PP & PWE MR		10% inc. ∆Y/K PP & MR	
		% change BR Keynesian CR	% change BR Neoclassical CR	% change BR Keynesian CR	% change BR Neoclassical CR
		(1)	(2)	(3)	(4)
	Macroeconomic Data				
1	Real GDP	-2,23	-4,58	2,33	4,36
2	Tot. Consumption	5,49	3,25	2,48	4,28
3	Tot. Investment	3,83	-0,28	0,76	5,89
4	Tot. Exports	-10,25	-11,95	5,21	3,99
5	Tot. Imports	7,87	4,23	2,82	5,01
6	Tot. Employment	3,78	-0,40	1,93	2,90
7	Current Account (surplus) / GDP	-8,22	11,78	-20,1	-4,8
8	Trade Balance (surplus) / GDP	38,10	34,51	35,7	34,4
9	Consumer Price Index	18,57	23,95	2,38	4,56
10	Dom. Price CPP	32,10	33,12	-0,98	-0,50
11	Dom. Price CMR	28,21	31,17	-1,42	-0,58
12	Dom. Price COS	14,86	24,86	5,25	9,09
	Sectoral Competitiveness, Output and Exports				
13	Real Exchange Rate CMO	159,26	300,24	17,54	59,19
14	Real Exchange Rate CPS	77,76	100,05	12,43	25,96
	Output mark-up sectors (MO & PS)	-16,39	-13,04	-1,01	3,61
15	Exports CPP	11,32	5,11	11,21	9,97
16	Exports CMR	24,96	13,59	10,42	7,72
17	Exports CMO	-67,59	-53,16	-4,73	-2,82
18	Exports CPS	-73,72	-52,44	-6,29	-6,61
	Socio-economic indicators				
29	Total Employment unskilled	4,30	-0,14	2,37	3,22
20	Total Employment skilled	3,45	-0,56	1,65	2,71
21	Av. Real Wage	-3,37	-19,34	4,04	6,35
22	WL Real Wage unskilled	-3,26	-21,16	5,71	7,84
23	WL Real Wage skilled	-4,40	-18,77	1,98	4,54
24	Income (YHQ1) / Income YHQ5	-60,44	-55,99	-26,66	-19,49

Source: model computations;

a/ % change between annual average growth rate in the base run dynamic solution and annual average growth rates in simulations of demand and/or supply shocks **b/** Macroeconomic balances are presented as annual average growth rather than % change from base run

BR = base run; CR = closure rule = PWE = international export price; inc. = increase; ∆Y/K = incremental capital output ratio; PP= primary products; MR= resource intensive manufacturing; MO=other manufacturing products; PS= producer and exportable services; OS= other (consumer) services; WL = wage labour; YHQ1(5) household quintile 1 poorest (5 richest)

G Appendix Chapter 8

Table G8.1
Stable and competitive exchange rate (SCER). Nominal devaluations, export taxes and Kaldor-Verdoorn effects. Annual average growth and percentage change to base run simulation 2004-2007 a/

		Base Run (BR)	10% Nom. Devalua-tion	(2) & 50% inc. export tax	(2) & no export tax	(2) & Endoge-nous Y/L b/	BR Sav-ing-driven
		(1)	(2)	(3)	(4)	(5)	(6)
			% change to Base Run c/				
	Macroeconomic Data						
1	Real GDP	7.9	4,84	8,55	2,00	-2,88	-6,69
2	Tot. Consumption	8.2	2,80	0,78	10,22	-1,64	-8,04
3	Tot. Investment	17.0	3,83	3,17	8,54	-4,38	-24,91
4	Tot. Exports	10.2	8,49	18,24	-4,20	-2,80	14,38
5	Tot. Imports	19.6	3,38	-0,25	13,87	-2,37	-10,38
6	Tot. Employment	5.3	3,87	1,22	7,98	7,90	-5,25
7	Current Account (surplus) / GDP	-24,0	-20,3	-2,1	-170,5	-20,0	16,5
8	Trade Balance (surplus) / GDP	-22,2	-21,3	-15,3	-37,3	-21,2	-8,3
9	Gov. Savings (deficit) / GDP	35,4	37,3	43,6	22,6	34,4	34,4
10	Consumer Price Index	9.9	32,40	20,21	58,88	36,57	24,70
11	Dom. Price CPP	9.8	36,05	16,74	73,40	35,84	33,98
12	Dom. Price CMR	8.8	38,60	17,00	80,30	40,33	35,98
13	Dom. Price COS	10.8	28,84	20,97	50,94	33,65	17,57
	Sectoral Competitiveness, Output and Exports						
14	Real Exchange Rate CMO	-0.7	-45,05	-159,16	165,90	23,52	-135,96
15	Real Exchange Rate CPS	-2.1	-25,70	-81,34	74,68	14,16	-74,91
16	Output APP	8.06	2,99	1,39	7,22	-1,25	-2,95
17	Output AMR	7.26	3,47	0,10	10,83	-1,43	-3,15
18	Output Mark-up sectors (MO + PS)	7.48	7,66	24,46	-12,90	-5,96	-11,18
19	Output AOS	8.06	3,92	-0,15	11,69	-1,51	-4,84
20	Exports CPP	9.00	3,51	-2,67	13,38	-0,68	4,52
21	Exports CMR	11.30	7,08	-17,03	43,84	-1,86	11,57
22	Exports CMO	10.61	11,23	63,77	-77,20	-5,04	14,14

Table G8.1 (Continuation)

		Base Run (BR)	10% Nom. devalua-tion	(2) & 50% inc. export tax	(2) & no export tax	(2) & Endoge-nous Y/L b/	BR Sav-ing-driven
		(1)	(2)	(3)	(4)	(5)	(6)
					% change to BR c/		
	Sectoral Competitiveness, Output and Exports (cont.)						
23	Exports CPS	9.59	-76,20	76,63	-76,20	-6,30	42,98
24	ULC AMO	12.34	42,68	9,39	42,68	33,94	8,06
25	ULC APS	12.30	43,27	9,35	43,27	33,99	8,73
	Socio-economic indicators						
26	Total Employment unskilled	5.21	3,71	0,53	8,47	8,22	-4,95
27	Total Employment skilled	5.34	3,96	1,65	7,67	7,71	-5,44
28	WL Employment Informal	5.44	3,14	-2,20	10,93	8,33	-3,95
29	WL Employment Formal	5.47	3,66	-0,21	9,57	7,80	-4,93
30	WL Employment unskilled	5.22	3,73	0,69	8,29	8,18	-4,98
31	WL Employment skilled	5.40	4,07	2,01	7,51	7,50	-5,66
32	Av. Real Wage	4.9	-7,75	-5,77	-14,46	-4,28	-31,52
33	WL Real Wage unskilled	4.38	-10,08	-8,32	-16,65	-5,48	-33,71
34	WL Real Wage skilled	5.28	-6,10	-3,26	-14,28	-4,02	-30,82
35	WL Real Wage informal	4.36	-12,89	-16,77	-9,69	-5,58	-34,07
36	WL Real Wage formal	5.01	-6,68	-3,21	-16,06	-4,38	-31,53
37	Wage labour share	0.73	-62,33	-37,33	-150,55	49,46	-150,55
38	Income (YHQ1) / Income YHQ5	-0.22	14,53	59,63	-67,12	0,85	-41,60
39	Consumption (YHQ1) / Consumption YHQ5	0.55	-18,07	26,41	-82,26	1,66	3,47

Source: model computations;

a/ Simulations (1) to (5) run using the benchmark closure rule: quantity adjustment the labour market; fixed exchange rate regime; exogenous government expenditure and Keynesian closure rule for the saving-investment balance;

b/ Kaldor-Verdoorn coefficient equal 0;

c/ Macroeconomic balances are presented as annual average growth rather than % change from base run

Non.=nominal; inc.=increase; Y/L = productivity; PP= primary products; MR= resource intensive manufacturing; MO=other manufacturing products; PS= producer and exportable services; OS= other (consumer) services ULC = Unitary labour costs; WL = wage labour; YHQ1(5) household quintile 1 poorest (5 richest) ; Curr. Acc.= current account; Tr. Bce.= trade balance; Gov. Sav.= government savings

Table G8.2

SCER: Nominal devaluations and complementary policies: export taxes, producer subsidies and monetary policy. Annual Av. growth 2004-2007and percentage change to base run a/

		Alternative Base Run 10% Nom. devaluation (1)	(1) & 50% inc. export tax (2)	(1) & 25% inc. in subsidies PP & MR (3)	(1) & 100% inc. nom. interest rate (4)
			% Change to Alternative Base Run		
	Macroeconomic Data				
1	Real GDP	8.32	3,55	0,83	-0,16
2	Tot. Consumption	8.43	-1,96	-3,56	-0,18
3	Tot. Investment	17.63	-0,64	2,04	-0,42
4	Tot. Exports	11.04	8,98	6,28	0,04
5	Tot. Imports	20.22	-3,50	-0,57	-0,27
6	Tot. Employment	5.49	-2,55	-0,88	-0,26
7	Current Account (surplus) / GDP	-20,3	-89,73	-64,48	-4,42
8	Trade Balance (surplus) / GDP	-21,3	-28,14	-18,04	-1,09
9	Gov. Savings (deficit) / GDP	37,3	16,81	18,49	-0,32
10	Consumer Price Index	13.14	-9,21	-2,39	0,11
11	Dom. Price CPP	13.37	-14,19	-0,25	0,02
12	Dom. Price CMR	12.15	-15,58	-1,07	0,06
13	Dom. Price COS	13.87	-6,11	-4,01	0,25
	Sectoral Competitiveness, Output and Exports				
14	Real Exchange Rate CMO	-0.4	-207,67	-39,44	-1,39
15	Real Exchange Rate CPS	-1.5	-74,89	-17,50	-0,90
16	Output APP	8.30	-1,55	-0,01	-0,21
17	Output AMR	7.51	-3,25	-0,13	-0,22
18	Output Mark-up sectors (MO + PS)	8.05	15,61	4,12	0,09
19	Output AOS	8.38	-3,91	-1,85	-0,35
20	Exports CPP	9.32	-5,98	1,48	-0,28
21	Exports CMR	12.10	-22,51	4,65	-0,41

Table G8.2 (Continuation)

		Alternative Base Run 10% Nom. devaluation	(1) & 50% inc. export tax	(1) & 25% inc. in subsidies PP & MR	(1) & 100% inc. nom. interest rate
		(1)	(2)	(3)	(4)
			% Change to Alternative Base Run		
	Sectoral Competitiveness, Output and Exports (cont.)				
22	Exports CMO	11.80	47,23	10,74	0,62
23	Exports CPS	11.36	49,10	12,13	0,87
24	ULC AMO	14.95	-9,73	-3,22	0,00
25	ULC APS	14.95	-10,02	-2,98	0,00
	Sectoral Competitiveness, Output and Exports (cont.)				
22	Exports CMO	11.80	47,23	10,74	0,62
23	Exports CPS	11.36	49,10	12,13	0,87
24	ULC AMO	14.95	-9,73	-3,22	0,00
25	ULC APS	14.95	-10,02	-2,98	0,00
	Socio-economic indicators				
26	Total Employment unskilled	5.40	-3,07	-1,00	-0,27
27	Total Employment skilled	5.55	-2,23	-0,81	-0,26
28	WL Employment Informal	5.61	-5,17	-1,44	-0,30
29	WL Employment Formal	5.67	-3,73	-1,22	-0,28
30	WL Employment unskilled	5.41	-2,93	-0,94	-0,27
31	WL Employment skilled	5.62	-1,98	-0,78	-0,25
32	Av. Real Wage	4.5	2,15	-0,15	-0,94
33	WL Real Wage unskilled	3.94	1,96	-0,19	-1,04
34	WL Real Wage skilled	4.95	3,02	0,01	-0,87
35	WL Real Wage informal	3.80	-4,46	-1,94	-1,27
36	WL Real Wage formal	4.68	3,72	0,23	-0,88
37	Wage labour share	0.27	66,36	-33,27	0,00
	Sectoral Competitiveness, Output and Exports (cont.)				
38	Income (YHQ1) / Income YHQ5	-0.25	39,37	8,10	0,03
39	Consumption (YHQ1) / Consumption YHQ5	0.45	54,29	154,24	1,45

Source: model computations;

a/ All simulations run using the benchmark closure rule: quantity adjustment the labour market; fixed exchange rate regime; exogenous government expenditure and Keynesian closure rule for the saving-investment balance;

Nom.=nominal; inc. = increase PP= primary products; MR= resource intensive manufacturing; MO=other manufacturing products; PS= producer and exportable services; OS= other (consumer) services ULC = Unitary labour costs; WL = wage labour; YHQ1(5) household quintile 1 poorest (5 richest)

Table G8.3
SCER: Nominal devaluations and complementary policies II: household income tax and government expenditure (producer subsidies, consumption and investment). Annual Av. growth 2004-2007 and percentage change to base run a/

		Alternative Base Run 10% Nom. devaluation	(1) & 25 %(15%) inc. TAX YHQ5 (YHQ4)	(1) & 25% red. subsidies PP & MR	(1) & 25% red GOV cons.	(1) & 12% red PUB inv.
		(1)	(2)	(3)	(4)	(5)
			% change to Alternative Base Run			
	Macroeconomic Data					
1	Real GDP	8.32	0,83	-1,35	-0,39	-2,58
2	Tot. Consumption	8.43	-3,56	-3,62	-3,48	-2,58
3	Tot. Investment	17.63	2,04	-2,90	-0,33	-6,71
4	Tot. Exports	11.04	6,28	4,34	4,66	2,01
5	Tot. Imports	20.22	-0,57	-2,10	-1,28	-3,11
6	Tot. Employment	5.49	-0,88	-1,30	-1,02	-2,18
7	Current Account (surplus)	-20,3	-64,48	-69,40	-59,15	-61,49
8	Trade Balance (surplus)	-21,3	-18,04	-20,62	-17,22	-17,72
9	Gov. Savings (deficit)	37,3	18,49	9,97	11,02	-1,45
10	Consumer Price Index	13.14	-2,39	-2,98	-4,08	-1,94
11	Dom. Price CPP	13.37	-0,25	-0,60	-0,36	-0,43
12	Dom. Price CMR	12.15	-1,07	-1,24	-1,12	-0,68
13	Dom. Price COS	13.87	-4,01	-5,07	-7,56	-3,04
	Sectoral Competitiveness, Output and Exports					
14	Real Exchange Rate CMO	-0.4	-39,44	-50,95	-58,19	-44,31
15	Real Exchange Rate CPS	-1.5	-17,50	-20,13	-24,22	-19,49
16	Output APP	8.30	-0,01	-0,60	-0,34	-1,04
17	Output AMR	7.51	-0,13	-1,29	-0,39	-1,13
18	Output sectors (MO + PS)	8.05	4,12	-1,83	0,25	-4,38
19	Output AOS	8.38	-1,85	-1,26	-1,20	-1,39
20	Exports CPP	9.32	1,48	2,32	1,51	0,79
21	Exports CMR	12.10	4,65	4,58	4,67	2,31
22	Exports CMO	11.80	10,74	4,85	6,26	2,69

Table G8.3 (Continuation)

		Alternative Base Run 10% Nom. devaluation (1)	(1) & 25 %(15%) inc. TAX YHQ5 (YHQ4) (2)	(1) & 25% inc. red. subsidies PP & MR (3)	(1) & 25% inc. in red GOV cons. (4)	(1) & 12% red PUB inv. (5)
			% change to Alternative Base Run			
Sectoral Competitiveness, Output and Exports (cont.)						
23	Exports CPS	11.36	12,13	6,64	7,84	2,42
24	ULC AMO	14.95	-3,22	-3,22	-3,22	-3,22
25	ULC APS	14.95	-2,98	-2,98	-3,48	-2,98
	Socio-economic indicators					
26	Total Employment unskilled	5.40	-1,00	-1,25	-0,99	-1,95
27	Total Employment skilled	5.55	-0,81	-1,33	-1,03	-2,33
28	WL Employment Informal	5.61	-1,44	-1,10	-1,11	-1,80
29	WL Employment Formal	5.67	-1,22	-1,28	-1,16	-2,23
30	WL Employment unskilled	5.41	-0,94	-1,24	-0,98	-1,97
31	WL Employment skilled	5.62	-0,78	-1,37	-1,07	-2,49
32	Av. Real Wage	4.49	-0,15	-1,94	0,38	-6,16
33	WL Real Wage unskilled	3.94	-0,19	-1,71	0,82	-5,80
34	WL Real Wage skilled	4.95	0,01	-2,20	0,03	-6,86
35	WL Real Wage informal	3.80	-1,94	-1,38	0,48	-6,05
36	WL Real Wage formal	4.68	0,23	-2,13	0,29	-6,55
37	Wage labour share	0.27	-33,27	66,36	33,21	-33,27
38	Income (YHQ1) / Income YHQ5	-0.25	8,10	-2,84	-0,53	-15,16
39	Consumption (YHQ1) / Consumption YHQ5	0.45	154,24	-6,96	-28,39	4,95

Source: model computations;

a/ All simulations run using the benchmark closure rule: quantity adjustment the labour market; fixed exchange rate regime; exogenous government expenditure and Keynesian closure rule for the saving-investment balance;

Nom.=nominal; inc. = increase; red = reduction; GOV = government; PUB = public; cons.= consumption; inv.=investment; PP= primary products; MR= resource intensive manufacturing; MO=other manufacturing products; PS= producer and exportable services; OS= other (consumer) services ULC = Unitary labour costs; YHQ5(4) household quintile 5(4) richest; WL = wage labour;

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DECLARATION:

This thesis has not been submitted to any university for a degree or any other award.