



**Working Paper**  
No. 441

**COMPETITIVE DIVERSIFICATION  
IN RESOURCE ABUNDANT COUNTRIES**  
*Argentina after the Collapse of the Convertibility Regime*

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May 2007

ISSN 0921-0210

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## ABSTRACT

The strong recovery of aggregate macroeconomic variables reopened the debate about the long-term development strategy of Argentina. As a contribution to this debate we develop a Scandinavian version of the dependent economy model and discuss the complex task of economic diversification in resource abundant countries. After showing the constraining role of resource abundance for tradable diversification, we discuss the effects of macroeconomic diversification policies, especially nominal devaluations.

The analysis shows that: (i) the promotion of structural change through devaluations is more costly in Argentina than in other countries with different structural characteristics; (ii) to effectively promote tradable diversification and avoid falling real wages devaluations must be implemented together with export taxes; (iii) taking into account Kaldor-Verdoorn effects links macroeconomic policies to productivity growth, which now contribute to increase the competitiveness of the non-traditional tradable sector through a new channel and limit the reduction and even open the possibility for rises in real wages. However, because the reduction in sectoral productivity differences is a fundamental condition for competitive and sustainable diversification additional policies with a direct impact on productivity growth, like investment in infrastructure, are also necessary.

## Keywords

Natural resource abundance, economic diversification, nominal devaluations, productivity dynamics, Kaldor-Verdoorn effects

**JEL classification:** F41, O11, O54

# COMPETITIVE DIVERSIFICATION IN RESOURCE ABUNDANT COUNTRIES: ARGENTINA AFTER THE COLLAPSE OF THE CONVERTIBILITY REGIME<sup>1</sup>

## 1 INTRODUCTION

Economically speaking, Argentina is a special and paradoxical case. It occupies a central place in long-term economic history accounts as well as in 21<sup>st</sup> century headlines. More often than not, it is on negative terms. Yet, since the collapse of the convertibility regime in December 2001 the country has been experiencing Chinese rates of economic growth, and these are good news.

The recovery from the crisis reopened the debate about the long-term development strategy of Argentina. In this debate it is emphasized the necessity to develop new competitive tradable sectors to finally overcome Argentina's recurrent internal and external disequilibria (Gerchunoff and Ramos, 2005; Kacef, 2004; Porta, 2005).<sup>2</sup>

As a contribution to this discussion we develop a simple analytical model to assess the complex task of competitive economic diversification, considering one of Argentina's most salient structural features: its abundant natural resources. In this respect, the analysis is inspired in the works of classical authors like Diamand (1972), Kaldor (1967, 1989) and Schydowsky (1993). The model is a Scandinavian version of the dependent economy model which shows how the presence of a natural resource sector of high productivity, like the agricultural sector in Argentina, constrains the development of other tradable sectors and thus competitive diversification.

An important characteristic of the model is that the relationship among the productivity of the tradable sectors and relevant prices is explicitly considered. It is thus possible to discuss competitiveness matters in a macroeconomic framework, linking changes in employment and the trade balance to resource shocks and economic policies. Furthermore, this characteristic of the model not only illustrates the effects but also the limitations of price or macroeconomic diversification policies, like nominal exchange rate devaluations.

Our analysis of economic policies primarily focus on the nominal exchange rate. Two reasons justify our close attention in this variable. First, a nominal devaluation, which started as a response to the balance of payments crisis in 2002, is an explicit policy in post-default Argentina. Second, we want to discuss the particular effects of nominal devaluations when, like Argentina, a country exports many of the less substitutable

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<sup>1</sup>I received helpful comments on an earlier version of this paper from professors R. Frenkel, M. Murshed, R. Vos, I. van Staveren, Juan Santarcangelo and an anonymous referee. I also received comments from various colleagues and participants at the 2nd Annual Conference on Development and Change and the 5th Conference on Labor Market and Equity in Argentina. The usual disclaimer applies.

<sup>2</sup>The former is associated to the declining but still two digits unemployment rates and an unequal income distribution, and the latter to the nowadays distant though frequently present external constraint. (Porta, 2005)

commodities of its consumption basket: food products. It is important to note that because we focus on real-side issues we omit the monetary considerations associated to the application of this policy.

Two innovative aspects of the analytical framework are: considering reductions in sectoral productivity differences as a fundamental requirement for sustainable economic diversification and the inclusion of a productivity equation with a Kaldor-Verdoorn effect. These broaden the role of macroeconomic policies for competitive diversification and emphasize the need of alternative and complementary policies.

## 2 THE SCANDINAVIAN MODEL

To understand the structural limitations for competitive diversification associated to resource abundance and discuss alternative policies contributing to structural change we develop a simple analytical model along the lines of the Scandinavian model. Our model is an unemployment version of this variety of the dependent economy model (see Dornbusch 1980, and Murshed 1997)<sup>3</sup>, and allows us to address the discussion about the competitiveness of the tradable sector(s) in Latin American countries, as elaborated by classical authors like Diamand, Kaldor and Schydrowsky, in a macroeconomic framework.

According to these authors, the relatively high productivity of Latin America's agricultural or mineral sector imposes a handicap to 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" (Schydrowsky, 1993, p.28, parenthesis ours). Though largely discussed, macroeconomic issues, like the achievement of full-employment and external balance, are never formally considered in the classical approach.

To work within a macroeconomic framework, we consider the nominal exchange rate as a policy variable and assume that factor prices reflect the productivity of the tradable sector(s).<sup>4</sup> In line with the argument of classical authors, prices which reflect the (high)

<sup>3</sup>The traditional version of the dependent economy model is the Australian one.

<sup>4</sup>In this respect we differ from classical authors who consider that it is the exchange rate the variable that reflects productivity of the tradable sector. Formally, their argument can be stated as follows. Let there be two tradable economic sectors, the traditional natural resource sector  $R$  and the industrial sector  $I$ , with sector  $R$ 's factors productivity ( $A_R$ ) being larger than that of sector  $I$  ( $A_I$ ). For given factor prices  $\bar{W}$ , production costs ( $1/A_i \cdot \bar{W}$ , with  $i=R$  and  $I$ ) in sector  $R$  will be consequently lower than in sector  $I$ . Besides the comparison between economic sectors, the core of the argument concerns the comparison of domestic production prices  $P_i^h$  (which we are equal to domestic production costs), with international prices expressed in domestic currency ( $E \cdot P_i^{int}$ , where  $E$  denotes the exchange rate and  $P_i^{int}$  prices prevailing in the international market). In a country with large differences in sectoral productivities, the nominal exchange rate can only guarantee the equality between  $P_i^h$  and  $E \cdot P_i^{int}$  and thus the law of one price in one of the two sectors. If, as stated by classical authors, the exchange rate reflects the productivity of the most competitive and largest tradable sector  $R$ , this value of  $E$  will make  $P_R^h = E \cdot P_R^{int}$  and  $P_I^h > E \cdot P_I^{int}$ . The non-tradable sector  $I$  will therefore not exist or its competitiveness will be seriously reduced.

productivity of the (natural resource) economic sectors will not necessarily clear the factors market.<sup>5</sup>

It is also worth noting that, by contrast to many open macroeconomic models that fail to take into account competitiveness matters<sup>6</sup>, in our model competitiveness issues are explicitly presented in terms of the relation among the productivity of the tradable sector(s) and prices, whether wages or the nominal exchange rate.

We are aware that this competitive measure is a highly simplified one and that, as recognized in the literature, the competitiveness of a sector 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.<sup>7</sup> This creates a trade-off facing analytical simplicity and tractability with analytical completeness, in which we opted for simplicity. The reason is that we want to give the competitiveness discussion within a macro context, what becomes extremely difficult, if not impossible, if many non-price competitiveness determinants are taken into account. As a consequence, the price and productivity variables are considered in a broad sense, to imperfectly represent other price and non-price competitiveness determinants.<sup>8</sup>

## 2.1 The model

The Scandinavian model is a three goods-sectors model that distinguishes between tradables and non-tradables. In the model there is only one factor of production, labelled  $L$ . We refer to it as labor, though we must bear in mind that this is for simplicity only. Similarly, we do not consider factors' accumulation and therefore neither investment. Economic sectors differ in terms of their factor's productivity, which is equivalent to their total factor productivity ( $TFP$ ).

Of the three sectors in the economy two of the them are tradables: the natural resource sector, that we call  $R$ , and the non-resource or manufacturing one, which we call  $I$ . The remaining sector is the non-tradable sector, labelled  $N$ .

We make the following simplifying assumptions, some of which will be removed as we advance on the discussion. First, we assume that, due to competition,  $TFP$  is higher in the tradable sectors than in the non-tradable one. Second, we assume that all the production of sector  $R$  is exported. This is a useful assumption to study the effects of structural factors for competitive diversification. For this analysis, it is irrelevant what

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<sup>5</sup>Other reasons for this to happen are efficiency wages or other labor market institutional arrangements.

<sup>6</sup>This is because models start from the assumption of full-employment and do not consider productivity issues. An example of this is the Australian version of the dependent economy model, where the only price that matters is the price which clears the non-tradable market.

<sup>7</sup>This point becomes clear in the review of the different approaches to the competitiveness problem elaborated by Chudnovsky and Porta (1990).

<sup>8</sup>In this respect, it is possible to think of an adjusted productivity variable, which increases (decreases) in relation to the presence (absence) of the other non-price competitiveness determinants like for example innovation capacity and logistics and publicity services.

the sector produces and  $R$  can be alternatively considered as a rent. In the discussion of economic policies, however, we will remove this assumption and consider the case of countries specialized in the production of food products.

Third, we assume that natural resource commodity prices are determined in the international market and that at such prices the country can sell all its production abroad. Fourth, we assume that manufacturing goods produced at home and abroad are imperfectly substitutes. Therefore, it is the external terms of trade of the goods produced in sector  $I$ , and not the law of one price, that counts in this sector. Finally, we assume that imports compete with production from sector  $I$  and, to simplify matters, we assume that intermediate inputs are of a non-tradable character. This implies that there are no imported intermediate inputs, a relevant issue which nevertheless does not add to our analysis.

Supply in the natural resource sector depends on labor and  $TFP$ , as indicated in equation (1) by  $L_R$  and  $A_R$ , correspondingly

$$R = R(A_R; L_R) \quad (1)$$

To the extent that output is demand-driven in the other two sectors we can define the price of these domestically produced goods in terms of their unitary factor costs.

$$P_i^h = \frac{1}{A_i} \cdot W + \bar{H} \quad (2)$$

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

Because we normalize to one the international price of tradables goods ( $P_i^{int}$ ), this price in domestic currency units equals the nominal exchange rate  $E$

$$P_i^f = E \quad (3)$$

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  $I$ . Our previous assumption regarding the natural resource sector implies that the law of one price prevails and that, for the moment, this is the only price that counts in sector  $R$ .<sup>9</sup> By contrast, for goods produced in sector

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<sup>9</sup>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, as can be approximated, for instance, by its unitary production costs. This is a relevant issue for the economic policy discussion, which will approach in the following section.



$I, P_I^f$  denotes the price of 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

$$W = \omega \cdot Q^\tau \quad (4)$$

In equation (4)  $\omega$  relates wages to factor's productivity, as approximated by  $A_i$ , and defined by

$$\omega = A_R^{\gamma_R} \cdot A_I^{\gamma_I} \cdot A_N^{1-\gamma_R-\gamma_I} \quad (5)$$

Where exponents  $\gamma_i$  weight sectoral productivity according to the relative size of the sector (with  $\sum_i \gamma_i = 1$ ). Variable  $Q$  in equation (4) indexes wages to the evolution of the consumer price index (*CPI*), which equals

$$Q = \left(P_I^f\right)^{\alpha_{If}} \left(P_I^h\right)^{\alpha_{Ih}} \left(P_N^h\right)^{1-\alpha_{If}-\alpha_{Ih}} \quad (6)$$

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 do not enter the index. This is one of the assumptions that will be removed in the following sections.

The degree of wage indexation depends on the value of  $\tau$ , which varies between 0 and 1. If  $\tau$  equals 0 there is no indexation and nominal wage rigidity, whereas a value of  $\tau$  equal to 1 means full-indexation of price changes and thus real wage rigidity. Intermediate values then represent imperfect indexation. The value of the indexation parameter can be negatively associated to the level of unemployment, a point which we do not model explicitly but that we consider as a likely behavior during the analysis.

The economy has three particular features. First, as one would expect to occur in the medium to long-term, factor prices follow factor's productivity. Second, and in line with the argument of classical authors, these prices will not necessarily clear the factor market, allowing for the possibility of structural unemployment or excess capacity. Third and finally, the economy has an indexation mechanism through which, *ceteris paribus*, nominal wages vary in accordance to the consumer price index, affecting the costs of exchange rate devaluations or other price changes.

Real income is defined as nominal wages times total employment deflated by the consumer price index

$$Y = \frac{W \cdot L}{Q} \quad (7)$$

By contrast to the traditional dependent economy model, in our model not only the internal but also the external terms of trade matter. This is because the external terms of trade affect demand for the tradable commodity  $I$  in the domestic and international market. 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 imperfectly substitute goods

$$p_I^* = \frac{P_I^f}{P_I^h} \quad (8)$$

The internal terms of trade ( $p_D$ ) are shown below and are defined as the ratio between the price of tradables and non-tradable goods.

$$p_D = \frac{P_T}{P_N^h} \quad (9)$$

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  $p_D^h = \frac{P_I^h}{P_N^h}$ , correspondingly. The assumption that the productivity of the tradable sectors is larger than that of the non-tradable one implies that the latter is the most  $L$ -intensive sector<sup>10</sup>, and that an increase in wages will rise the price of non-tradable goods ( $P_N^h$ ) relative to the price of manufacturing goods produced domestically ( $P_I^h$ ).

From the demand side output is defined in the following way

$$Y = C_I(Y; p_D^h; p_I^*) + C_N(Y; p_D^h; p_D^f) + T \quad (10)$$

In equation (10)  $C_I$  denotes demand for manufacturing goods produced domestically,  $C_N$  stands for 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 the goods produced in sector  $I$  is negatively linked to the internal and positively associated to the external terms of trade of the sector,  $p_D^h$  and  $p_I^*$  correspondingly. 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 imports and export performance.

$$T = P_R^f \cdot X_R(R; Y^f) + P_I^h \cdot X_I(Y^f; p_I^*) - P_I^f \cdot M_I(Y; p_I^*) \quad (11)$$

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<sup>10</sup>This is a realistic and common assumption for the analysis of resource abundant countries.

We assume 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.<sup>11</sup>

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

The internal balance is analyzed in terms of the factor's market equilibrium. As defined in equation (12), employment ( $L$ ) equals labor demand from the tradables ( $R$ ,  $I$ ) and non-tradable sectors ( $N$ ), and  $a_i$  equals  $\frac{1}{A_i}$  and represents sectoral factor intensities.

$$(12) \quad L = a_R \cdot X_R \left( R; Y^f \right) + a_N \cdot C_N \left( Y; p_D^b; p_D^f \right) + a_I \cdot \left[ C_I \left( Y; p_D^b; p_I^* \right) + X_I \left( Y^f; p_I^* \right) \right] \quad (12)$$

This quantity adjustment in the internal balance is compatible with unemployment rates prevailing in Argentina since 1990s.

### 3 CONSTRAINTS TO ECONOMIC DIVERSIFICATION

The central question of this section is the problem of diversification in resource abundant countries like Argentina. The analysis is expected to show the structural limitations to diversification and why economic diversification can be a matter of concern in resource abundant countries. In order to discuss these issues, we analyze the behavior of the economy when, as it is usually the case in Latin American countries, the tradable natural resource sector is more productive than the manufacturing one. Since we maintain the assumption that tradable sectors are more productive than the non-tradable one, we have the following sectoral productivity ordering  $A_R > A_I > A_N$ .

To analyze the consequences of resource abundance for tradable diversification we look at the effects of an increase in the productivity of the natural resource sector ( $A_R$ ).

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<sup>11</sup>We consider that the discussion about the sustainability of the current account can be omitted because we are concerned with the question of tradable diversification, which is expected to release the external constrain of the economy. Regarding the monetary aspects of the fixed exchange rate regime we consider that, in a context of capital inflows (for instance associated to the expansion of exports in response to a devaluation), the monetary authority is able to avoid the revaluation of the exchange rate. This requires the accumulation of reserves and sterilization of the money supply using the various methods discussed in Frenkel (2005).

Assuming no indexation of prices into wages ( $\tau = 0$ )<sup>12</sup>, the increase in  $A_R$  affects real and nominal wages, and via them the internal and external equilibrium of the economy. From equations (4) and (5) we have that

$$\frac{\partial W}{\partial A_R} = \gamma_R \left( \frac{A_I A_N}{A_R} \right)^{1-\gamma_R} \quad (13)$$

Equation (13) is positive 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  $\gamma_R$ .** This result is in line with the argument of classical authors, is equivalent to the Balassa-Samuelson effect<sup>13</sup> and is also consistent with the predictions of Dutch disease type models.

### 3.1 A positive resource shock and the internal balance

We consider first the effects that an increase in  $A_R$  has in the internal balance or labor market equilibrium. This requires that we totally differentiate equation (12). It is also necessary to totally differentiate real income, as expressed in (7), in order to disentangle the changes associated to variations in real wages and labor demand. This second point is left for the appendix (see equations (A.1) to (A.4)). After some manipulations we arrive at the expression presented in equation (14) below, which shows that the expansion of the resource sector has ambiguous effects in the labor market. Below each term we indicate the sign of partial derivatives which represent the different effects of the change in the exogenous variable  $A_R$ .

$$\begin{aligned} \frac{dL}{dA_R} = & \frac{1}{1-\phi} \left[ \frac{\partial a_R}{\partial A_R} \underset{(-)}{\quad} + a_R \cdot \frac{\partial X_R}{\partial R} \frac{\partial R}{\partial A_R} \underset{(+) \quad (+)}{\quad} + \frac{\partial p_D^h}{\partial A_R} \underset{(-)}{\quad} \left( a_N \frac{\partial C_N}{\partial p_D^h} \underset{(-)}{\quad} + a_I \frac{\partial C_I}{\partial p_D^h} \underset{(+) \quad (+)}{\quad} \right) \right] + \\ & \frac{1}{1-\phi} \left[ a_N \frac{\partial C_N}{\partial p_D^f} \underset{(+) \quad (+)}{\quad} \frac{\partial p_D^f}{\partial A_R} \underset{(-)}{\quad} + a_I \frac{\partial p_I^*}{\partial A_R} \underset{(-)}{\quad} \left( \frac{\partial C_I}{\partial p_I^*} \underset{(+) \quad (+)}{\quad} + \frac{\partial X_I}{\partial p_I^*} \underset{(+)}{\quad} \right) + \phi \frac{\partial Y \left( \frac{W}{Q} \right)}{\partial A_R} \underset{(+) \quad (+)}{\quad} \right] \geq 0 \quad (14) \end{aligned}$$

<sup>12</sup>Allowing for wage indexation will only reinforce, through circular effects, the adjustment we want to emphasize. The same is the case if price adjustments prevail in the non-tradable sector and we allow for changes in non-tradable inputs costs.

<sup>13</sup>This effect predicts that increases in the productivity of the tradable sector leads to higher non-tradable prices or a real exchange rate appreciation, with  $W$  as the non-tradable price in our model.

In equation (14)  $\phi = \left( a_N \frac{\partial C_N}{\partial Y} + a_I \frac{\partial C_I}{\partial Y} \right)$ ,  $\frac{\partial Y \left( \frac{W}{Q} \right)}{\partial A_R} = \frac{[1 - \alpha_{If}(a_I - a_N) - a_N(1 - \alpha_{If})]}{1 - A} \frac{\partial W}{\partial A_R}$ , and  $1 - A = 1 - \tau \alpha_{Ih}(a_I - a_N) - \tau a_N(1 - \alpha_{If})$ . The second expression represents changes in real income associated to variations in wages. Equation (13) and the assumption that sector  $N$  is more labor-intensive than sector  $I$  ( $a_I < a_N$ ) guarantees that real wages rise with the productivity shock.

Positive effects on employment result from: (i) the expansion of output and exports from sector  $R$ , and (ii) the increase in real wages (the second and last term within the square brackets in equation (14)).

The increase in the productivity of sector  $R$  has negative consequences for employment as well. These are associated to: (i) the reduction in sector  $R$ 's labour requirements, (ii) the substitution of non-tradable goods for manufacturing goods, both produced 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 market correspondingly.<sup>14</sup> The last two substitution effects arise because the wages increase which follows the productivity shock in sector  $R$  reduces the external terms of trade of sector  $I$   $\left( \frac{\partial p_I^*}{\partial A_R} < 0 \right)$ .

Since the natural resource sector is the less factor-intensive one and substitution between tradable and non-tradable goods are expected to be small, it is possible to consider that *employment will expand (contract) if the positive income effect of the shock is larger (smaller) than the crowding-out of sector  $I$* . Table 1 at the end of this section summarizes the conditions favoring one or another outcome.

As suggested by equation (13) and by the last term in equation (14), the expansion of employment is positively associated to the size of sector  $R$  ( $\gamma_R$ ), and we can take for granted that it will take place if the natural resource sector has the size it has in oil-exporting countries. However, if sector  $R$  is not sufficiently large, it is possible to observe the 'paradoxical' situation of a positive resource shock leading to a disequilibrium situation.

Besides size effects, the main conditions that can favor unemployment in the context of a resource shock are: (a) large productivity differences between the tradable sectors; (b) (accompanied by) low productivity in the manufacturing tradable sector ( $I$ ). There are two reasons for this. The first one is that the larger productivity differences the larger will be the mismatch between wages and productivity in sector  $I$ . This will imply that, for given non-tradable input costs  $\bar{H}$ , wages will represent a larger amount of total production costs, that will reduce the external terms of trade of the sector  $p_I^*$ , making it harder, if not impossible, for the manufacturing sector to compete internationally or get started in an open domestic market.

The second reason concerns the price elasticity of the goods produced in sector  $I$  and thus its sensibility to the resource shock. As explained by Chudnovsky and Porta

<sup>14</sup>These effects are captured by the first, third, fourth and fifth terms within the square brackets in equation (14).

(1990), the price elasticity and dependence on price competitiveness advantages is larger the lower is the productivity of the sector. Therefore, the negative substitution effects of a resource shock are expected to be larger in countries with a manufacturing sector of low productivity. By contrast, in resource abundant countries that manage to produce sophisticated manufacturing products, as it is for instance the case of Canada or the Scandinavian countries, the damaging effects of a positive resource shock will be more limited.

### 3.2 A positive resource shock and the external balance

We now consider the adjustment in the external balance, what requires totally differentiating equation (11). As shown in equation (15) below, an increase in the productivity of the natural resource sector is accompanied by higher exports; yet, its final effect for the trade balance is ambiguous.

$$\frac{dT}{dA_R} = p_R^f \underbrace{\frac{\partial X_R}{\partial R}}_{(+)} \underbrace{\frac{\partial R}{\partial A_R}}_{(+)} + \underbrace{\frac{\partial p_I^h}{\partial A_R}}_{(+)} X_I + \underbrace{\frac{\partial p_I^*}{\partial A_R}}_{(-)} \left( \underbrace{p_I^h \frac{\partial X_I}{\partial p_I^*}}_{(+)} - \underbrace{p_I^f \frac{\partial M_I}{\partial p_I^*}}_{(-)} \right) - \underbrace{p_I^f \frac{\partial M_I}{\partial Y}}_{(+)} \underbrace{\frac{\partial Y}{\partial A_R}}_{(\geq 0)} \geq 0 \quad (15)$$

The first term in equation (15) represents the positive impact for the overall trade balance of 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, we must note that the wage increase reduces the competitiveness of the sector and export demand for the goods its produces and this has negative effects for the trade balance.<sup>15</sup>

The last two terms in the equation above refer to the dynamics of imports. These will increase, worsening the trade balance, on two accounts: (i) because lower external terms of trade ( $p_I^*$ ) make imported goods cheaper than its domestic substitutes, and (ii) when the productivity shock increases real income.<sup>16</sup>

Although one expects that high(er) productivity in the natural resource sector leads to an improvement in the trade balance or to a new equilibrium with higher imports, this can fail to happen under certain circumstances. The factors that can lead to a ‘paradoxical’ external imbalance following a positive resource shock are : (a) high marginal propensities to import, and (b) large productivity differences between sector  $R$  and sector  $I$ , accompanied by low productivity in sector  $I$ . As discussed before, the second condition implies more unfavorable terms of trade (and terms of trade changes) and a larger sensibility to price changes of the goods produced in sector  $I$ .

<sup>15</sup>This is the first effect captured in the third term of equation (15).

<sup>16</sup>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 decrease and counteract the effect of higher real wages on imports demand.

Before moving to the policy analysis, it is convenient to summarize what we have so far:

(1) The model shows that resource abundance hinders competitive diversification through its effects on the external terms of trade of sector *I*.

(2) The model also shows why countries intend to diversify and modify what is a priori a favorable structural condition. They attempt to do so because, under certain conditions, resource abundance and a positive shock can favor internal and external disequilibria.

(3) Disequilibria are more likely to occur when: (i) the resource sector has not the size to ensure that the positive income effect of the shock dominates substitution effects; (ii) countries have a high marginal propensity to import; (iii) there are significant differences in the productivity of their tradable sectors, the traditional natural resource one vis-à-vis the manufacturing one, and (iv) the industrial sector has low productivity and is thus more dependent on price competitiveness advantages and vulnerable to a resource shock.

Remarkably, these conditions match some of Latin America's characteristics that gave place to its structuralist tradition. (Bielschowsky, 1998)

**Table 1**  
The effects of a positive resource shock

	Conditions
$dL/dA_R + (-)$	Large (small) positive real wage effect [encouraged by a large (small) sector R] Small (large) negative substitution effects [promoted by large sectoral productivity differences and low productivity in sector I]
$dT/dA_R + (-)$	small (large) substitution of manufacturing products in the domestic and external market [promoted by large sectoral productivity differences and low productivity in sector I] and small (large) marginal propensity to import

## 4 MACROECONOMIC DIVERSIFICATION POLICIES

In this section we analyze the effects of macroeconomic policies to improve the competitiveness of the non-resource tradable sector *I*. Our analysis plays special attention to the effects of nominal devaluations, a policy which, as emphasized by Frenkel and Taylor (2006), is a fundamental development policy which "enhances overall competitiveness", increasing employment and improving the external balance.<sup>17</sup>

<sup>17</sup>Williamson (2000) is another author which makes a case in favor of a policy of exchange rate devaluation in developing countries, and Hausmann, Pritchett and Rodrik (2004) provide some empirical support for this argument.

Two main reasons that justify our emphasis in this policy. First, a nominal devaluation, which started as a response to the balance of payments crisis in 2002, is actually a deliberate policy in post-default Argentina. Second, we want to discuss the particular effects of nominal devaluations when a country already has an internationally competitive sector and when, like Argentina, it exports many of the less substitutable commodities of its consumption basket: food products.

Before moving to the comparative statics exercise it is worth noting that: (i) we do not address the monetary aspects of the devaluation; (ii) for simplicity purposes we restrict the analysis of the effects of macroeconomic policies in the labor market; (iii) we will remove the assumption that products from sector  $R$  are only exported, and (iv) we no longer assume  $\tau = 0$ , allowing for wage indexation. The most relevant points are summarized in table 2 at the end of the section.

#### 4.1 Nominal exchange rate devaluations

We start the analysis of the effects of nominal devaluations maintaining for the moment the assumption that all production from sector  $R$  is exported. Totally differentiating equation (12) with respect to  $E$  we arrive at

$$\begin{aligned} \frac{dL}{dE} = & \frac{1}{1-\phi} \left[ \frac{\partial p_D^h}{\partial E} \left( a_N \frac{\partial C_N}{\partial p_D^h} + a_I \frac{\partial C_I}{\partial p_D^h} \right) + a_N \frac{\partial C_N}{\partial p_D^f} \frac{\partial p_D^f}{\partial E} \right] + \\ & \frac{1}{1-\phi} \left[ a_I \frac{\partial p_I^*}{\partial E} \left( \frac{\partial C_I}{\partial p_I^*} + \frac{\partial X_I}{\partial p_I^*} \right) + \phi \frac{\partial Y \left( \frac{W}{Q} \right)}{\partial E} \right] \geq 0 \end{aligned} \quad (16)$$

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

The impact of the devaluation in the internal balance is ambiguous, as it has two positive and two negative effects on employment. The expansion of employment results from substitution effects, which occur because the devaluation modifies the corresponding terms of trade.

Therefore, employment rises due to: (i) substitution of imported for non-tradable goods, and (ii) from substitution that favors production in tradable sector  $I$  and thus

<sup>18</sup>As in the previous section, the derivation of changes in real wages is left for the appendix (see equations (A.3) and (A.5)). The assumption regarding factor intensities ( $a_N > a_I$ ) guarantees that the denominator is positive.



tradable diversification. As shown by the third term within the large brackets, the devaluation promotes substitution of imported for domestically produced goods and encourages non-traditional exports.

The ambiguity of the final result means that the devaluation has negative effects on employment as well. Negative effects result from: (i) substitution of non-tradables with the goods produced in sector  $I$ , because the former are more labor intensive than the latter<sup>19</sup>, and (ii) the reduction in real wages caused by the devaluation, an effect captured by the last term in equation (16). The fall in real wages and domestic demand are positively associated to the share of imported goods in the consumption basket ( $\alpha_{If}$ ), which are the only tradable good fully increasing in price, and negatively related to the degree of wage indexation  $\tau$ .

A clear result which emerges from the static analysis is that the *promotion of tradable diversification with devaluations requires falling real wages*. With the reasonable assumption of low substitution between non-tradable and tradable goods, it follows from equation (16) that *export competitiveness and the export component of aggregate demand expand at the expense of domestic demand*.

## 4.2 Nominal devaluations when natural resource products are exported and consumed domestically.

It is interesting to extend the analysis removing one of our introductory assumptions: that natural resources are only exported. This assumption was useful to make clear the link between resource abundance and the competitiveness of sector  $I$ . It is a valid assumption for certain countries exporting mineral products that may not find any use at home, like precious stones in African countries. It is worth removing it, however, to analyze some particular effects of the devaluation in countries which, like Argentina, specialize in the production of food products, which are both exported and consumed domestically.

Before considering the analytical results, it is worth mentioning why this structural characteristic must be taken into account. First, because as we know from Engels law food products are among the less, if not the least, substitutable products. Second, because food products tend to represent a significant part of the basket which measures the evolution of the CPI<sup>20</sup>, and because, by contrast to other Latin America countries, Argentina exports many of the food products which are part of its consumption basket.<sup>21</sup> The final point to note is that in countries with different endowments and comparative advantages, like for instance East Asian countries, it is expected that food products

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<sup>19</sup>This effect requires some wage indexation and is captured by the first term within the square brackets in equation (16)

<sup>20</sup>In Argentina food products are the group of commodities that has the highest weight (30%) in the basket of the consumer price index.

<sup>21</sup>As explained by Gerchunoff and Llach (2003), in this respect Argentina is different from its Latin American neighbors, like for instance Colombia and Brazil, where the increase in the price of coffee after a devaluation will not have a significant impact on real wages.

are more easily substitutable or rather have a non-tradable character and are thus not affected by variations in the exchange rate.

The link we want to emphasize is straightforward. As recently mentioned, food products represent a sensible part of households consumption basket, which is 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  $Q^R = (P_R^f)^{\alpha_{Rf}} (P_I^f)^{\alpha_{If}} (P_I^h)^{\alpha_{Ih}} (P_N^h)^{1-\alpha_{Rf}-\alpha_{If}-\alpha_{Ih}}$ , where we are using supraindex  $R$  to indicate new variables and terms affected by this extension of the model.

Domestic consumption of natural resource products adds a new term to the internal balance, the one representing demand for such products in the domestic economy. This term will reflect domestic demand for tradable 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  $\left(p_D^{fR} = \frac{P_R^f}{P_N^h}; p_I^{*R} = \frac{P_R^f}{P_I^h}\right)$ . The effects of the devaluation when the products of sector  $R$  are consumed domestically are now given by equation (17) below.

$$\begin{aligned} \frac{dL^R}{dE} = & \frac{1}{1-\phi^R} \left[ \frac{\partial p_D^h}{\partial E} \left( a_N \frac{\partial C_N}{\partial p_D^h} + a_I \frac{\partial C_I}{\partial p_D^h} \right) + a_N \frac{\partial C_N}{\partial p_D^f} \frac{\partial p_D^f}{\partial E} + \frac{\partial p_D^{fR}}{\partial E} \left( a_R \frac{\partial C_R}{\partial p_D^{f'}} + a_N \frac{\partial C_N}{\partial p_D^{f'}} \right) \right] + \\ & \frac{1}{1-\phi^R} \left[ \frac{\partial p_I^{*R}}{\partial E} \left( a_R \frac{\partial C_R}{\partial p_I^{*'}} + a_I \frac{\partial C_I}{\partial p_I^{*'}} \right) + a_I \frac{\partial p_I^*}{\partial E} \left( \frac{\partial C_I}{\partial p_I^*} + \frac{\partial X_I}{\partial p_I^*} \right) + \phi^R \frac{\partial Y}{\partial E} \left( \frac{W}{Q^R} \right) \right] \geq 0 \quad (17) \end{aligned}$$

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 changes in real wages equal  $\frac{\partial Y \left( \frac{W}{Q^R} \right)}{\partial E} = \frac{(\tau-1)(\alpha_{If} + \alpha_{Rf})}{1-C}$ .<sup>22</sup>

The internal balance equation includes two new terms that can be recognized by the supraindex  $R$ , which have positive effects on labor demand. The reason is that the 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 factor-intensive sectors.

Yet, despite these new positive terms, which we can assume to be rather small to the extent that they refer to substitution between food and other products, our intention is to call the attention on the negative income effects of the devaluation.

As shown by  $\frac{\partial Y \left( \frac{W}{Q^R} \right)}{\partial E}$  above, which reflects changes in real wages associated to the devaluation, with natural resource commodity prices determined in the international

<sup>22</sup>Where  $1-C = 1 - \tau \alpha_{Ih}(a_I - a_N) - \tau a_N(1 - \alpha_{If} - \alpha_{Rf})$ , which is positive and larger than  $1-A$ .

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 number of exported products which are also consumed domestically, as expressed by the new term  $\alpha_{Rf}$  and is negatively associated to  $\tau$ , the wage indexation parameter.

This particular effect has been emphasized in traditional and recent Argentine macro-economic literature. On the one hand, because it implies that the domestic consumption of exported commodities enlarges the possibility of contractionary devaluations, that will take place if the negative wage effect dominates positive substitution effects (Porto, 1975). On the other, because as emphasized in a recent paper by Keifman (2005), allowing for some appreciation of the ‘devalued’ Argentine peso will increase real wages and the expansion of domestic demand will promote employment.

An important point to note 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 with different structural characteristics.*

In addition to this, we must stress that, unless there is a compensatory expansion in employment, the devaluation reduces real income. In this context, employment growth depends principally on substitution effects taking place in sector  $I$  and these need favorable changes in the external terms of trade of the sector ( $p_I^*$ ). Making this change happen and therefore securing the effectiveness of the devaluation to promote an export-led regime requires a low or null indexation parameter. As suggested (but not explicitly modelled) in section 2, this is likely to occur in a context of high unemployment rates, as it is the case in Argentina since the 1990s, but has not always been the case. As noted by Gerchunoff and Llach (2003), due to its high costs in real wage terms, devaluations in Argentina historically engendered political-economy conflicts which restored real wages and reduce the competitiveness of the economy.

### 4.3 Nominal devaluations and devaluation rents

It is instructive to consider a consequence of the devaluation usually omitted in the literature: the creation of a devaluation rent favoring the most productive sector  $R$ . The rent will arise because the devaluation makes international commodity prices higher than domestic production costs. Considering equation (2) as a valid approximation of unitary production costs in sector  $R$ , and assuming that before the devaluation such costs were equal to international prices as defined by equation (3), the rent will equal the difference between these two equations, as defined in the identity below

$$\Gamma = E - W \cdot \frac{1}{A_R} - \bar{H} \quad (18)$$

With commodity prices in domestic currency units larger than production costs, ‘average’ nominal wages will now equal  $W = a_R(\omega Q^\tau + \Gamma) + (1 - a_R)\omega Q^\tau$ . The new wage

expression denotes factor payments as determined in equation (4) plus the devaluation rent, making wages higher than the previous average wage.

Although this extension does not add any new term to the balance equation, it modifies the relevant terms of trade and real wage expressions. In this respect, we have that due to the presence of a devaluation rent: (i) there is a lower reduction (and the possibility of an increase) in real wages (see equations (A.7))<sup>23</sup>, and therefore (ii) 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 (A.10) and (A.11) in the appendix).

It is worth noting that, although the presence of a devaluation rent reduces the possibilities of having a contractionary devaluation, it will worsen the distribution of income if the rent accrues exclusively to factors of production in the most productive sector  $R$ . This non-trivial effect is hidden in our analysis because, as we work with average wages to avoid sectoral differences in this price, we are implicitly assuming that the rent is somehow distributed to all economic sectors.

#### 4.4 A compensated devaluation regime

Our detailed discussion so far exemplified the various (and ambiguous) effects of nominal devaluations. They have a clear positive side, as they promote employment through tradable diversification, reducing a common disequilibrium of Argentina in the last two decades and a clear feature of other (resource rich) Latin American countries. However, the promotion of structural change is at the cost of lower real wages, and adjustment which is expected to be larger in countries like Argentina. Moreover, the creation of a devaluation rent can seriously worsen the distribution of income putting at risk the competitiveness gain the devaluation seeks to promote.

Partially as a consequence of these conflicting effects, structural change is promoted using alternative and complementary policies, like import tariffs (and quotas) and production, wages and export subsidies.<sup>24</sup> Because these policies are nowadays banned by international trade agreements, we use the model to analyze the effects of another policy: taxes to natural resource exports<sup>25</sup>, which commonly accompany nominal devaluations in resource abundant countries. According to Schydrowsky (1993), the combination of these two policies creates a ‘compensated devaluation regime’, which is the one actually

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<sup>23</sup>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.

<sup>24</sup>In our model, 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 have no or positive effects on real wages, subsidy policies are superior to the exchange rate and tariff diversification policies. Yet, they require available finance.

<sup>25</sup>Direct property taxes and redistribution, could be an alternative but this requires a well developed tax system.

in place in Argentina and is considered to promote the non-traditional sector without major income distribution effects.

The combination of nominal devaluations with export taxes has four main effects. First, it separates the domestic 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 (A.8)). The export tax not only limits the fall in real wages but also reduces the impact of any wage indexation in the external terms of trade of sector  $I$  ( $p_I^*$ ) (see equations (A.10) and (A.11) in the appendix). As a consequence, *the compensated devaluation regime can guarantee that the devaluation effectively creates a price competitive advantage favoring sector  $I$ , while limiting its negative consequences on real wages.*

In the second place, 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 real competitiveness. In this way, the export tax avoids providing the most productive sector  $R$  an unnecessary price advantage, limiting income transfers among different agents in the economy and deteriorations in the distribution of income.

A third effect of the regime is that it contributes to the equalization of factor prices. Without this effect, which we do not formally consider in the model, the devaluation would have not suffice to promote sector  $I$ , its original purpose. Finally, the export tax transfers the rent created by the devaluation to the government. This income transfer, which prevents a worsening in the distribution of income, has important fiscal effects and constitutes a source of income to finance alternative diversification policies, the topic to which we turn next.

Table 2  
The effects of nominal exchange rate devaluations

Result	Conditions
<b>(1) The general case of a nominal exchange rate devaluation</b>	
$dL/dE$ (+)	Substitution of imported with non-tradable goods (expected to be small)
	Substitution of imported with domestically produced manufacturing goods
	Increase in manufacturing export demand
$dL/dE$ (-)	Substitution of non-tradables with domestically produced manufacturing goods (expected to be small and only with wage indexation)
	Reduction in domestic demand due to fall in real wages
	(positively associated to the share of imported goods in the CPI and negatively to indexation parameter)
<b>(2) Nominal devaluations when food products are exported and consumed domestically</b>	
$dL/dE$ (+)	Effects in (1)
	Plus substitution of food products for other more factor intensive goods (expected to be small)
$dL/dE$ (-)	Effects in (1)
	Further reductions in domestic demand from fall in real wages larger than in (1) (positively associated to the share of food products in CPI)
<b>(3) Nominal devaluations with devaluation rent</b>	
$dL/dE$ (+)	Effects in (2)
	With smaller increases in $(pI^*)$ than in (2) and smaller substitution effects promoting tradable diversification
$dL/dE$ (-)	Effects in (2)
	With smaller reductions in real wages than in (2) and likely worsening of income distribution
<b>(4) A Compensated devaluation regime</b>	
$dL/dE$ (+)	Substitution effects as in (1)
$dL/dE$ (-)	Effects in (3)
	With smaller negative effects in real wages than in (3) and income redistribution to the government

## 5 DO MACROECONOMIC POLICIES SUFFICE?

In the previous section we discussed the contribution of macro policies to the complex task of competitive diversification in resource abundant economies. In this respect, some fundamental questions arise: do macroeconomic policies suffice? Do they tackle the central constrain for competitive diversification in countries like Argentina?

Our answer to this questions is yes and no. Yes, macro policies can make the non-resource sector competitive, and they do so tackling the price-side of the competitiveness problem. The other side of the competitiveness problem: the productivity one, however, remains unaddressed. Looking at the problem dynamically, the answer to our questions is still yes and no. Macroeconomic policies can contribute to increase the productivity

of the industrial sector, but these policies may not suffice to solve the competitiveness handicap of the sector.

To discuss this point in more detail we find extend the analytical framework in two ways. In the first place, stating a *condition for competitive and sustainable diversification in resource abundant countries: reductions in sectoral productivity differences and decreases in non-wage production costs*.<sup>26</sup>

In the second place, adding to the model an equation that captures the dynamics of productivity in sector  $I$ .<sup>27</sup> Total factor productivity is modelled as in Thirlwall (2002) and Rada and Taylor (2004) and presented in the equation (19) below.

$$A_I = \Lambda + \delta Y(X_I) \quad (19)$$

Equation (19) states that productivity depends on exogenous and autonomous factors, which are captured by the term  $\Lambda$ . Human capital accumulation or access to foreign technology are a clear example of these factors. The equation also includes a Kaldor-Verdoorn component linking productivity growth to output or demand growth.<sup>28</sup>

Productivity is expected to increase with demand because, as it is enlarged, it 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 the actual days the importance of complementarities and economies of scale, both static and dynamic, tend to be larger in firms and sectors operating at a global scale, we associate the Kaldor-Verdoorn component to the evolution of exports in the non-resource tradable sector ( $X_I$ ).<sup>29</sup>

It is evident that the exchange rate, tariffs or subsidy policies have no direct incidence on productivity. Yet, because they can contribute to productivity growth indirectly by increasing demand, it is possible to reassess the contribution of macro policies to competitive diversification and the internal equilibrium of the economy. Following our previous analysis, we do so focusing on the effects of nominal devaluations, and we

<sup>26</sup>Diversification neither due to the presence of a stagnant agricultural sector, nor due to the presence of structural unemployment and low wages, should be considered as sustainable diversification.

<sup>27</sup>We only look at the productivity of sector  $I$ , not only because it is our variable of interest but also because, as it is commonly stressed in the literature, the manufacturing sector is the one with the largest endogenous productivity growth. See the papers by Torvik (2001) and Rattsø and Torvik (2003) for an extensive discussion of this issue. An interesting aspect of these papers is that they analyze the evolution of relative productivities between the manufacturing and other economic sectors, allowing for productivity spillovers.

<sup>28</sup>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 linkages.

<sup>29</sup>A study by Martin (2002), which finds that exporting sectors and firms are the ones experiencing the largest productivity growth, provides support for this argument.

present the results only for the last case of a compensated devaluation regime. The employment response to devaluation when productivity is endogenous is given by

$$\begin{aligned} \frac{dL^R}{dE} = & \frac{1}{1 - \phi^R} \left[ \frac{\partial p_D^h}{\partial E} \left( a_N \frac{\partial C_N}{\partial p_D^h} + a_I \frac{\partial C_I}{\partial p_D^h} \right) + a_N \frac{\partial C_N}{\partial p_D^f} \frac{\partial p_D^f}{\partial E} \right] + \\ & \frac{1}{1 - \phi^R} \left[ \frac{\partial p_D^{fR}}{\partial E} \left( a_R \frac{\partial C_R}{\partial p_D^{fR}} + a_N \frac{\partial C_N}{\partial p_D^{fR}} \right) + \frac{\partial p_I^{*R}}{\partial E} \left( a_R \frac{\partial C_R}{\partial p_I^{*R}} + a_I \frac{\partial C_I}{\partial p_I^{*R}} \right) \right] + \\ & \frac{1}{1 - \phi^R} \left[ + a_I \frac{\partial p_I^*}{\partial E} \left( \frac{\partial C_I}{\partial p_I^*} + \frac{\partial X_I}{\partial p_I^*} \right) + \phi^R \frac{\partial Y}{\partial E} \left( \frac{W}{Q^R} \right) + \frac{\partial a_I}{\partial A_I} \frac{\partial A_I(X_I)}{\partial E} \right] \geq 0 \quad (20) \end{aligned}$$

Where  $\phi^R$  is as in equation (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 adds a new term to the internal balance, which is the last term in the equation (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).<sup>30</sup> The impact of the devaluation on average wages will depend positively on  $\gamma_I$ , which denotes the size of sector  $I$ , and on the Kaldor-Verdoorn coefficient  $\delta$ , which is commonly assumed to be 0.5.<sup>31</sup> In turn, these effects modify real income and the different terms of trade of equation (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. Negative effects on employment result from: (i) substitution between non-tradable and food products<sup>32</sup>, and (ii) the reduction in the factor intensity of sector  $I$ , as indicated by the third and last and new terms within the square brackets, respectively. On the other hand, positive effects on employment are associated to: (i) substitution of imported goods for non-tradables, and (ii) increases in the competitiveness of sector  $I$  and associated import substitution and

<sup>30</sup>The derivative of equation (4) with respect to  $E$  equals  $\frac{\partial \omega}{\partial E} = \gamma_I \left( \frac{A_R A_N}{A_I} \right)^{1-\gamma_I} \delta \frac{\partial A_I(X_I)}{\partial E}$

<sup>31</sup>The devaluation also has a negative impact on nominal wages arisen because the productivity increase also implies lower domestic prices of the goods produced in sector  $I$ , and which through the indexation mechanism are also translated into wage changes.

<sup>32</sup>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 the opposite.



export growth. *Because we are taking into account that the devaluation promotes learning and productivity growth, the increase in the competitiveness of sector I has one price and one non-price component and is larger than what we have been considering so far.* Indeed, this adjustment can be seen as the counterpart of the negative and permanent losses associated to exchange rate appreciations emphasized in the literature.<sup>33</sup> Notably, the positive adjustment we are emphasizing in this paper is rarely taken into account.

As shown in equation (20) some effects can be positive or negative depending on the value of the parameters. The first one concerns the response of  $p_D^h$ , which will be negative like 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 one is related to the change in relative prices and substitution between food and domestically produced industrial goods, an effect which, due to Engels law, is expected to be low. The third and final effect is the one associated to the response of real wages, which can now be positive or negative and equal

$$\frac{\partial Y\left(\frac{W}{Q^R}\right)}{\partial E} = \frac{1}{1-F} \{a_R(1-\Omega) + [\tau(1-a_R^2)]\alpha_{If}\} + \frac{1}{1-F} \left\{ \delta \frac{\partial A_I(X_I)}{\partial E} \left[ \gamma_I \left( \frac{A_R A_N}{A_I} \right)^{1-\gamma_I} (1-a_R^2)(1-\Omega) - [\tau(1-a_R^2) - 1] \alpha_{Ih} \right] \right\}, \text{ where}$$

$\Omega = [\alpha_{Rh}(a_R - a_N) + \alpha_{Ih}(1 - a_N) + (1 - \alpha_{If})a_N]$  and  $1 - F = 1 - (1 - a_R^2)\tau\Omega$ , and are both positives.

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 follows from the rise in  $A_I$ .<sup>34</sup> Therefore, *the Kaldor-Verdoorn effect reduces the negative consequences that devaluations have on real wages and even can make real wages rise.* Indeed, increases in real wages are possible for plausible parameter values like a Kaldor-Verdoorn effect of 0,3, a manufacturing sector representing the 20% of total output, food products being 30% of the consumption basket and an indexation parameter of 0,2. Yet, we must note that the rise in real wages also results from the presence of a devaluation rent and taxes to sector's  $R$  exports.<sup>35</sup>

Although the devaluation affects productivity and is more likely to have positive effects on employment, a word of attention is however pertinent. To effectively contribute to competitive diversification we consider that the exchange rate, as well as other tariff and subsidy policies, have to be implemented as *temporary* and *selective* policies. The reason for this is that the productivity of sector  $I$  depend on other factors like innovation and the development of competitive linkages, in which producers will have no incentives nor be compelled to invest if the government guarantees them a permanent price competitive advantage.

<sup>33</sup>See Matsuyama (1992) and Sachs (1999) for models with this dynamic Dutch disease adjustment.

<sup>34</sup>These are denoted by the first and second term within the second large curly brackets, respectively.

<sup>35</sup>The share of imported and domestically produced manufacturing goods in the CPI is considered to be 0,2, respectively. With similar parameter values but no devaluation rent neither export taxes the devaluation reduces real wages.

Among the various productivity and competitiveness determinants, authors familiar with competitiveness studies emphasize the role of non-tradable productive linkages such as physical, technological and commercial infrastructure (Ocampo, 2005; Porta, 2005). The presence and expansion of adequate infrastructure is considered to be especially important to be competitive in sectors of monopolistic competition, where innovation, product quality, publicity and follow-up services play a critical role; a relevance which increases given that, as stressed in a recent paper by de Pavia Abreu (2005), technological and science-based policies are among the few policies which are not banned by WTO agreements.

Two points are worth noting regarding this productivity determinants. In the first place, that they open the room for the possibility of positive spillovers between the tradable sector, as discussed in Serino (2006). In the second place, that are determinants with public good characteristics, and therefore it may not suffice with the promotion and design of infrastructure investment policies. Since this kind of investment will probably need to be financed as well, we can establish a link with the compensated devaluation regime and indicate what needs to be financed with export taxes to promote sustainable and competitive diversification.<sup>36</sup>

## 6 FINAL THOUGHTS

As a contribution to the ongoing debate about the long-term development strategy of Argentina, in these notes we addressed the problem of competitive economic diversification in countries which, like Argentina, are endowed with abundant natural resources.

The analysis of section 3 not only illustrated the presence of a ‘price’ constraint for the emergence of a competitive manufacturing sector but also that, under certain circumstances, a positive resource shock can lead to a situation of internal and external disequilibria. The main conditions leading to this outcome are: large differences in sectoral productivities between the tradable sectors, and a non-resource tradable sector with low productivity and thus sensible to terms of trade changes.

In section 4, we studied the contribution to tradable diversification of the policy of deliberate exchange rate devaluation actually in place in Argentina. The analysis showed that the devaluation promotes substitution effects that fuel the expansion of the manufacturing sector and therefore competitive diversification. Yet, the analysis also illustrated that the promotion of structural change with nominal devaluations requires falling real wages. Since the fall in real wages is larger in countries which are exporter of food products, we concluded that this diversification policy is more costly in Argentina than in countries with other structural characteristics. To avoid large falls in real wages

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<sup>36</sup>A relevant extension to the analytical model will be to add a new term to equation (19) relating productivity growth to investment in infrastructure. The latter, in turn, can be considered to depend positively on available government finance and thus on the exchange rate and taxation of the devaluation rent.

and secure that the devaluation effectively provides a price competitive advantage to the manufacturing sector, our model showed that this policy has to be implemented in combination with export taxes to natural resource exports.

We concluded extending the analytical framework to take into account the productivity side of the competitiveness problem. We stated that the reduction in sectoral productivity differences is a fundamental condition for competitive and sustainable diversification and added a productivity equation, broadening the economic policy debate.

On the one hand, the extension implies that the contribution of macroeconomic policies to diversification also has to be assessed in terms of their impulses to productivity growth. Nominal devaluations, tariffs or subsidies have no direct incidence on productivity but they can improve indirectly by increasing demand. As exemplified with the analytical model, taking into account the generally omitted Kaldor-Verdoorn effects has two implications for the effects of the devaluation: it further increases the competitiveness of the less productive industrial sector and limits the reduction and can even lead to a rise in real wages.

On the other hand, it forces us to consider other economic policies, especially the development of adequate physical, commercial and technological infrastructure. This indicates what needs to be financed with export taxes to promote a sustainable development process, guaranteeing that *if the country taxes it is only to adequately invest*.

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## 8 APPENDIX

### 8.1 Changes in real income and real wages

To know the response of real income to changes in exogenous variables we use of equation (7). In logarithm form the equation equals

$$\ln Y = \ln \omega + (\tau - 1) \ln Q + \ln L \quad (\text{A.1})$$

Using equation (6), substituting into it the price expressions as defined in equations (2) and (3) and nominal wages as defined in equation (4), we obtain the following expression of the CPI in logarithm form:

$$\ln Q = \frac{\alpha_{If} \ln E + [\alpha_{Ih}(a_I - a_N) + a_N(1 - \alpha_{If})] \ln \omega + (1 - \alpha_{If}) \ln \bar{H}}{1 - A} \quad (\text{A.2})$$

where  $1 - A = 1 - \tau \alpha_{Ih}(a_I - a_N) - \tau a_N(1 - \alpha_{If})$ , which is positive due to our assumption about factor intensities ( $a_I < a_N$ ).

Plugging (A.2) into (A.1) we thus obtain

$$\ln Y = \frac{[1 - \alpha_{Ih}(a_I - a_N) + a_N(1 - \alpha_{If})] \ln \omega}{1 - A} + \frac{(\tau - 1) [\alpha_{If} \ln E + (1 - \alpha_{If}) \ln \bar{H}]}{1 - A} + \ln L \quad (\text{A.3})$$

The first two terms in equation (A.3) represent changes in real wages and the third one income changes due to variations in labor demand.

Differentiating (A.3) with respect to  $A_R$  we know how increases in the productivity of sector  $R$  affects real wages (equation (A.4) below shows the result for  $\tau = 0$ ).

$$\frac{\partial Y \left( \frac{W}{Q} \right)}{\partial A_R} = \frac{[1 - \alpha_{If}(a_I - a_N) - a_N(1 - \alpha_{If})]}{1 - A} \frac{\partial W}{\partial A_R} > 0 \quad (\text{A.4})$$

with  $\frac{\partial W}{\partial A_R} = \gamma_R \left( \frac{A_I A_N}{A_R} \right)^{1 - \gamma_R}$ , as defined in equation (13).

Differentiating equation (A.3) with respect to  $E$  we obtain the effects of nominal devaluations on real wages, when all products from sector  $R$  are exported (equation (A.5) shows the result for  $\tau < 1$ ).

$$\frac{\partial Y \left( \frac{W}{Q} \right)}{\partial E} = \frac{(\tau - 1)\alpha_{If}}{1 - A} < 0 \quad (\text{A.5})$$

To know the impact of nominal devaluations when products from sector R are exported and consumed domestically we use

$Q^R = \left( P_R^f \right)^{\alpha_{Rf}} \left( P_I^f \right)^{\alpha_{If}} \left( P_I^h \right)^{\alpha_{Ih}} \left( P_N^h \right)^{1 - \alpha_{Rf} - \alpha_{If} - \alpha_{Ih}}$  to obtain a new expression of real income. Differentiating it with respect to  $E$  gives

$$\frac{\partial Y \left( \frac{W}{Q} \right)}{\partial E} = \frac{(\tau - 1)(\alpha_{If} + \alpha_{Rf})}{1 - C} < 0 \quad (\text{A.6})$$

where  $1 - C = 1 - \tau\alpha_{Ih}(a_I - a_N) - \tau a_N(1 - \alpha_{If} - \alpha_{Rf})$ , 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

$$\frac{\partial Y \left( \frac{W}{Q} \right)}{\partial E} = \frac{1}{1 - D} \left[ a_R \cdot [1 - \alpha_{Ih}(a_I - a_N) + a_N(1 - \alpha_{If} - \alpha_{Rf})] + [\tau(1 - a_R^2) - 1] (\alpha_{If} + \alpha_{Rf}) \right] \quad (\text{A.7})$$

where  $1 - D = 1 - (1 - a_R^2)\tau [\alpha_{Ih}(a_I - a_N) + a_N(1 - \alpha_{If} - \alpha_{Rf})]$ . Equation (A.9) 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  $\alpha_{If}$  and  $\alpha_{Rf}$ .

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 (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

$$\frac{\partial Y \left( \frac{W}{Q} \right)}{\partial E} = \frac{1}{1 - E} \left[ a_R \cdot 1 - \alpha_{Rh}(a_R - a_N) - \alpha_{Ih}(a_I - a_N) - a_N(1 - \alpha_{If}) \right] + [\tau(1 - a_R^2) - 1](\alpha_{If}) \quad (\text{A.8})$$

where  $1 - E = 1 - (1 - a_R^2)\tau [\alpha_{Rh}(a_R - a_N) + \alpha_{Ih}(a_I - a_N) + a_N(1 - \alpha_{If})]$ . Real wages decrease less or increase more than when there are no export taxes (as showed in equation (A.9)).

## 8.2 Changes in the external terms of trade of sector I

To know the effects of exogenous changes in the external terms of trade we use equation (8) and its components as given by equations (2) and (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.

$$\frac{\partial p_I^*}{\partial E} = \left[ 1 - \frac{a_I \cdot \tau \cdot (\alpha_{If} + \alpha_{Rf})}{1 - C} \right] > 0 \quad (\text{A.9})$$

When there is a devaluation rent and natural resource commodities are consumed domestically the effects of the devaluation equal

$$\frac{\partial p_I^*}{\partial E} = \left[ 1 - \frac{a_I [a_R + \tau(1 - a_R^2)(\alpha_{If} + \alpha_{Rf})]}{1 - D} \right] \quad (\text{A.10})$$

Due to the presence of the new terms  $a_R$  and  $(1 - a_R^2)$  the competitiveness gain is smaller than in (A.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

$$\frac{\partial p_I^*}{\partial E} = \left[ 1 - \frac{a_I [a_R + \tau(1 - a_R^2)(\alpha_{If})]}{1 - E} \right] \quad (\text{A.11})$$

where  $1-E$  as defined in equation (A.8). Because the domestic price of natural resource products is not affected by the devaluation equation (A.11) is larger than (A.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

$$\frac{\partial p_I^*}{\partial E} = \frac{1}{1 - F} [a_R + \tau(1 - a_R^2)(\alpha_{If})] + \delta \frac{\partial A_I(X_I)}{\partial E} \left[ 1 - \frac{(1 - a_R^2)}{1 - F} \left( \gamma_I \left( \frac{A_R A_N}{A_I} \right)^{1 - \gamma_I} - \tau \alpha_{Ih} \right) \right] \quad (\text{A.11})$$

Due to the presence of a new positive term, associated to the Kaldor-Verdoorn effect, the devaluation further increases the competitiveness of sector  $I$ .