

INSTITUTE OF SOCIAL STUDIES

Working Paper Series No. 184

MODERN INDUSTRIALIZATION AND STRUCTURAL CHANGE

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January 1995

WORKING PAPERS

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1. Introduction.

The creation and expansion of a modern industrial sector is often seen as essential to ensure sustained rises in per capita income. In fact, in much of the early development economics literature development is synonymous with industrialization, as the implicit transition is from an agrarian, pre- (or non) capitalist society to a capitalist, industrial one.¹ One aspect of the impact of growth on economic structure is thus the shifting predominance of the three economic sectors agriculture, industry and services, in total output and employment shares, that occurs as higher levels of per capita GDP are reached. Identification of empirical regularities in these shifts links the impact of growth in low income economies to the evolution economic structures in developed market economies by a common pattern of development.

The paper proceeds by outlining the patterns of development that have been identified. The patterns are normative, consisting of changes in the sectoral composition of output and employment that should occur given rising per capita income. Positivist tools are used to identify the patterns and here there exists a difference in methodologies employed and the degree of emphasis given to individual causal factors that underlie the process by which patterns are created. Two theoretical approaches are identified. The first identifies the income effect, as the independent variable that determines the evolution of sectoral output and employment shares according to differential sectoral income elasticities of demand. The second focuses on the substitution effect that occurs due to changing sectoral price relatives. The substitution effect is attributed, in the main, to supply side factors. The difference between the two models is of emphasis rather than degree, as both models would accept that

¹ Two sector models, for example; Lewis, W.A. (1954) 'Economic Development with Unlimited Supplies of Labour'; Fei, J and G.Ranis (1964) 'Development of a Labour Surplus Economy: Theory and Practice' and Jorgenson, D.W (1967). 'Surplus Agricultural Labour and the Development of the Dual Economy' that focus on the transfer of resources from agriculture to industry reflect this interpretation of transition. The Feld'man Mahalanobis model focuses on the structural changes within the industrial sector and the considers the implication of intrasectoral investment allocation for future rates of economic growth in a planned economy.

both demand and supply side changes cause structural change.

The first approach is derived from Kuznets'² studies of the historical development of industrial countries, which is extended to developing countries by the World Bank economist Hollis Chenery and his various associates over the years. This model draws on an earlier economic tradition exemplified by Clark³ and Fischer⁴ and is thus called the Classical Industrialization (CI) model.

The second approach is based on the identification of differential rates of sectoral productivity growth as causal factors in the evolution as sectoral price relatives, and is called the Sectoral Productivity Difference (SPD) model. The model has been used to explore de-industrialization phenomenon in developed market economies where the service sector's share dominates output and employment at high levels of per capita income⁵. More recently the analysis has been extended developing countries by Kravis, Heston and Summers.⁶ A final section briefly discusses the relevance of the patterns of development for analysis of structural change in a single country over time and considers how evidence of growth convergence between economies of similar structure is interpreted.

It is concluded that the SPD model is limited by its exclusive focus on supply side factors and its concentration on the service industry dichotomy. The service industry sectoral division is conceptually translated into a division between sectors that produce tradeables and those that produce non tradeables. In developing countries such a division crosses the industry agriculture division as both sectors produce some tradeable and some non tradeable commodities. Nevertheless the model's focus on sectoral price relatives provides insights into determinants of structural change which need to be incorporated into Chenery et al's estimation of the CI model and

² Kuznets, S. (1966) Modern Economic Growth, London: Yale University Press.

³ Clark, C. (1957) The Conditions of Economic Progress, London: Macmillan

⁴ Fischer, A.G.B. (1935) The Clash of Progress and Security, London: Macmillan.

⁵ Baumol, W.J. (1967) 'Macroeconomics of Unbalanced Growth : The Anatomy of Urban Crisis', American Economic Review, Vol 57, 415-26.

⁶ Kravis, I.B., N. Heston and R. Summers (1982) 'The Share of Services in Economic Growth'. In Adams, F.G. and Hickman B.G (eds) Global Econometrics: Essays in Honor of Lawrence H. Klein. London: MIT Press.

interpretation of their results. Finally it is noted that institutional factors are ignored by both models and some examples of their relevance are discussed.

2. The Classical Industrialization Model.

Kuznets⁷ pioneered empirical work on the relationship between structural change and economic growth. In his studies of the historical development of the present day industrial nations Kuznets identified three shifts in the structure of production associated with modern economic growth.

First he noted a decline in the share of agricultural output in GDP, second structural changes within the industrial sector and third shifts in the structure of services. The decline in the share of agricultural output in GDP was accompanied by a rise in the share of industry in GDP in all the countries he examined⁸ that started to industrialize between the mid-nineteenth and early twentieth century. Changes in the share of service sector output were neither marked nor consistent across countries or over time.

Kuznets attributed these structural changes to the interaction of demand and supply side factors. The relatively low rate of growth of agricultural output per capita, compared to the rates of growth of industrial and service output per capita, can be explained by long term elasticities of demand. Engel's Law states that with given tastes, the proportion of food expenditure in household expenditure is inversely related to household income, implying an income elasticity for food expenditure of less than one. So when per capita income rises the decline in the proportion of food in aggregate consumption will result in a declining proportion of agricultural output in total output.

On the supply side, differences in the relative increase of prices of goods and services and social and institutional changes could influence sectoral shares. Differences in the rates of technical change and innovation between sectors can result in changing price relatives and thus effect the allocation of expenditure between sectors. In an international context this will result

⁷ Kuznets, S. (1966) op.cit.

⁸ Except Australia.

in changing patterns of comparative advantage, which will alter international patterns of demand. Institutional and social changes will accompany the growth of industry, thus demand for new goods and services will be associated with the transition to an industrial economy.

As changes in the sectoral distribution of GDP occur so too must changes in the sectoral distribution of the labour force. Changes in employment shares may not however be directly correlated with changes in output shares as productivity differences may exist between sectors. Observations of sectoral employment shares led to the conclusion that agricultural productivity must be approximately equal to the rate of growth of overall productivity, industrial productivity must be growing faster than the economy average and service productivity slower. Tables 1 and 2 show sectoral employment shares and productivity levels per worker compared between time periods for various countries compiled by Kuznets.

Table 1 shows proportions of the labour force employed in the three economic sectors between the late nineteenth (early twentieth) century and 1950 in some of the countries Kuznets studied. By 1950 employment in industry and services as a proportion of total employment had increased in all countries.

Table 1. Sectoral Employment Shares (%).

Country	Year	Agriculture	Industry	Services
U.K	1891	11	40	37
	1951	5	47	48
Japan	1897	73	12	15
	1950	29	30	41
U.S.	1900	37	30	33
	1950	11	35	54
France	1896	49	28	33
	1950	37	29	35
Germany	1890	34	44	22
	1950	12	48	40
Netherlands	1909	28	35	37
	1950	14	36	50

Source: Kuznets (1957), Appendix Tables 3 and 4 pp 75-95.

Table 2 shows total output per worker and changes in total output per worker. The sectoral output per worker data are expressed as ratios of national product per worker. So, in the UK the level of agricultural output per worker in 1891 was 63% of the economy wide product or average per worker, manufacturing output per worker was 69% of average productivity and the service sector's productivity level 171% of the economy wide average. Over time manufacturing's relative productivity is expected to increase at a faster rate than that of the other two sectors (US, France Germany and the Netherlands in Table 2.). Some of increase in output per worker may be due to increased efficiency of capital and technical change rather than just labour productivity increases. Nevertheless Kuznets argues that these

Table 2. Sectoral output per worker, expressed as relatives of National Product per worker.

Country	Year	Agriculture	Manufacturing	Services
U.K.	1891	0.63	0.69	1.71
	1951	1.08	0.98	1.02
	Change	+0.44	+0.29	-0.69
Japan	1897	0.69	1.60	1.84
	1950	0.50	1.47	1.46
	Change	-0.19	-0.13	-0.38
U.S.	1900	0.46	0.86	1.73
	1950	0.59	1.09	1.04
	Change	+0.13	+0.23	-0.69
France	1896	0.76	1.19	1.28
	1950	0.70	1.34	0.95
	Change	-0.06	+0.15	-0.33
Germany	1890	0.47	0.72	2.22
	1933	0.48	1.08	1.38
	Change	+0.01	+0.36	-0.84
Netherlands	1909	0.57	0.76	1.57
	1947	0.66	1.23	0.98
	Change	+0.09	+0.47	-0.59

Source: Kuznets (1957) Table 22, p 48.

data are good indicators of sectoral differences in labour productivity.⁹ Not all countries (see the UK and Japan above) show the expected pattern of the manufacturing sector's productivity relative increasing faster than those of the other two sectors. Kuznets however concludes (using data from a total of twelve countries) that with industrialization labour productivity increase more in the agricultural and industry sectors than in the service sector.

Kuznets points to the key role of agricultural productivity growth in the process of industrialization. He argues that agricultural productivity must grow in order to release labour and capital for use in other sectors and to

⁹ Kuznets (1957).

meet the increased demand for agricultural goods (raw materials and food) from the industrial sector.

As some of the components of the service sector can easily benefit from mechanization low overall productivity growth for the sector can conceal divergent intra-sectoral trends. The rising share of service employment can thus be explained either by lower rates of productivity growth of the sector or by high income elasticity of demand for the services that are labour intensive in production and therefore will have low absolute levels of productivity.

The changes in economic structure observed by Kuznets also necessitated changes in political and social institutions in the industrialized countries. Kuznets argues many of these changes occurred prior to industrialization and do not necessarily evolve smoothly. In many cases the emergence of social and political structures that could create the environment for economic growth involved conflict between classes and considerable periods of political instability; Kuznets cites the American Civil War and the Russian Revolution as examples. Structural change in an economy therefore implies changes in the class composition of society as well as changes in its social institutions. The manner in which such changes occur will however differ considerably from country to country.

2.1. Chenery and the Classical Industrialization Model.

Chenery's work¹⁰ on the CI model extends over thirty years, initially identifying patterns of structural change and making static comparisons between actual and predicted patterns of change and ultimately analysing long run transformations using simulations derived from economy models based on input: output matrices and computable general equilibrium models.

¹⁰ Chenery, H.B.(1960)'Patterns of Industrial Growth' American Economic Review, 50, pp 624-54. September.
 Chenery, H.B.(1979) Structural Change and Development Policy. Oxford: Oxford University Press.
 Chenery, H.B.(1982) 'Industrialization and Growth: The Experience of Large Countries'. World Bank Staff Working Paper No.539. Washington: World Bank.
 Chenery, H.B and M. Syrquin (1975) Patterns of Development 1950-70. London:OUP.
 Syrquin, M and H.B. Chenery. (1989)'Patterns of Development 1950-83' World Bank Discussion Paper, No 41.
 Chenery, H.B., S. Robinson and M.Syrquin (1986) Industrialization and Growth. New York; OUP.
 Chenery, H.B and L.J.Taylor (1968). 'Development Patterns Among Countries and Over Time'. Review of Economics and Statistics, 50, pp 391-45. November; 1968.

The theme of the interaction of growth and structural change runs through the work. The question asked is whether changes in the sectoral composition of output and employment, together with accompanying shifts in resource allocation and demand, restrict or enhance growth. A recurrent aim is to identify the structural changes necessary to achieve sustained rises in GDP so stressing the impact of structure on performance. Thus the approach departs from neoclassical growth theory which locates the growth dynamic solely in supply side factors; factor accumulation and technical change.

Chenery argues that despite factors such as differences in resource endowment, size, government policy and social objectives that will produce diversity in patterns of structural change accompanying growth, there are a number of factors that will produce uniform patterns of structural change for all countries. These are similar changes in consumer demand, the necessity to accumulate human and physical capital to raise per capita output and access to common sources of technology and international trade. The focus is the identification of 'universal factors of development', abstracting from historical specificity and the development of social and political institutions.

Changes in economic structure in any given country many take place over a number of decades. So Chenery pools cross series and time series data to analyze the economic structure associated with a particular level of per capita income in developing countries. He fits the following quadratic equation to his data which is drawn initially from 101 countries between 1950 and 1970¹¹, later the work is extended to 1983¹².

$$X = a + b_1 \ln y + b_2 (\ln y)^2 + l_1 \ln N + l_2 (\ln N)^2 + d_1 T_i + eF$$

X = dependent variable (percentage of GDP of structural components of demand, production, trade and employment).

y = per capita GNP (constant \$).

N = population (millions).

¹¹ Chenery and Syrquin (1975) and Chenery (1979). Earlier work, Chenery (1960) and Chenery and Taylor (1968), used data from fewer countries, 38 and 54 countries and a smaller number of observations, 1950-56 and 1950-63 respectively.

¹² Syrquin and Chenery (1989.)

T_i = time period. In the 1989 study this variable takes non-zero values as follows -:

$T_1 = 1$ if $t > 1960$

$T_2 = 1$ if $t > 1967$

$T_3 = 1$ if $t > 1973$ and

$T_4 = 1$ if $t > 1979$.

F = net foreign inflows as a percentage of GDP.

Data are converted into constant US dollars. The equation is estimated for changes in the structure of commodity demand, production and trade¹³. The structural elements of demand are defined as food consumption, all other private consumption, investment and government consumption. Those of production are defined as primary production, industrial production, utilities and services. All are expressed as shares of GDP. Export and import shares of GDP are also identified as dependent variables, with the export share decomposed to reflect the structural elements of production. Population is included as an indicator of country, and hence market size.

Structural change that occurs due to the interaction of demand and supply side factors is thus captured by a single income effect in this regression, so the equations are reduced forms¹⁴ of the general model. As more than one structure can generate similar reduced forms significance of regression results does not automatically imply structural similarity.

The aim of the studies remains however to identify common patterns of structural change that signify transition from a traditional, predominantly agricultural, economy to a developed industrial, economy. This transition is defined as " the set of changes in the economic structure required to sustain a continued increase in income and social welfare."¹⁵ If common patterns exist, this transition can be identified as occurring at a given level of real per capita GNP once exogenous differences, such as country size and resource

¹³ Earlier work also included analysis of the change in urbanization, income distribution and the demographic transition associated with the level of development.

¹⁴ Chenery and Syrquin (1975) Technical Appendix.

¹⁵ Chenery (1979) p. 6.

endowment, have been taken into account.¹⁶

A fundamental concern with the identification of patterns of change from cross section data is the extent to which they represent expected or actual temporal change. It is not known whether parameter estimates from the 1950-70 are only accurate for that time period due specific conditions in the post war world economic environment, or whether they can be used to extrapolated likely future trend. Time series analysis¹⁷ is used to support cross section conclusions, nevertheless, due to the restricted number of observations for individual countries, the assertion that time series results support the cross section ones has been questioned.¹⁸ Jameson (1982) shows, using time series data specifying the primary share and the industrial share as dependent variables, homogeneity of the income coefficients between countries is rejected, even when the intercept term is unrestricted. It therefore cannot be concluded that an individual country will industrialize according to the pattern derived from Chenery et al's cross section studies.

For Chenery et al, extension of the analysis to include the period from 1973 to 1983 serves the purpose of testing the robustness of their conclusions. The non homogeneity of the income coefficients could be attributable to the differential impact of exogenous factors on countries which is captured by the time shift variables in the 1989 study.

When compared to the results of the 1950-70 study cross section results for 1970-83 the standard errors of estimate for each regression equation are similar implying, according to the authors, that the results cited above are equally valid for the extended time period. The patterns that emerge from the 1989 study are therefore very similar to those generated by the 1950-70 study. Discussion of the results cited below points out major differences. Tests for homogeneity of coefficients generated by data for 1950-73 and 1973-83, also

¹⁶ In 1975 the transition range was \$100-\$1000 (\$1964) in 1983 \$300-\$4,000 (\$1980) the extended range in 1983 takes into account the trends in real exchange rates as depreciation has been greatest in lower income countries.

¹⁷ Chenery and Taylor (1968) Chenery and Syrquin (1975).

¹⁸ Kirpatrick, Lee and Nixon (1983) cite Jameson (1982) to argue 'that it should not be assumed that cross country data will necessarily indicate a pattern an individual country will follow over time.' p. 38. Jameson shows, using time series data specifying the primary share and the industrial share as dependent variables, homogeneity of the income coefficients between countries is rejected, even when the intercept term is unrestricted. This result could be attributable to the differential impact of exogenous factors on countries which is captured by the time shift variables in the 1989 study.

reveal that including the uniform additive time shift variables accounts for most of the displacement over time.

It is concluded that despite the instability of the post 1973 period the long term patterns of structural change are essentially stable.

The Structure of Demand.

Figure 1 in Appendix I summarizes the changes in the structure of demand derived from cross section country data. Regression results confirm that the proportion of food in domestic demand falls slowly, by about twenty percentage points, as per capita income rises and that the rising non-food component of demand is equally divided between consumption and investment. Overall total private consumption falls as a percentage of GDP. This is offset by rises in shares of government consumption and investment which occurs at early stages in the transition.

The other interesting result is that at low income levels (\$300 per capita in the 1985 World Bank Report) the shares of food and private consumption in GDP shifts upwards after 1973 in contrast to their decrease in higher income economies.

The Structure of Production and Employment.

Production and employment are analyzed in terms of the three main sectors; primary production which consists of agriculture and mining, the industrial sector and services. Chenery finds a falling share of primary output and employment accompanied by a rising share of industrial output and employment. The level of per capita GDP at which industry overtakes the primary share is the same in the two studies at \$1500 (1980 US\$). The changes in sectoral employment that accompany industrialization are shown in Figure 2, Appendix I.

The service share of output rises although not as rapidly as industry's share. Both sectors' employment shares, however rise at about the same rate. The 1989 data show a slower rise in manufacturing output accompanied by a more rapid rise in the service sector's share. The pattern of structural change of output support by Chenery's data is shown in Figure 2, Appendix 1.

Chenery finds that the shift of labour out of primary sector lags behind the transformation of output. This he attributes to lagging productivity in the agricultural sector arising from rapid population growth and lack of alternative employment opportunities - the surplus labour phenomenon in poor countries.

The Structure of Trade.

The transformation of the pattern of trade accompanying the transition from an agricultural to an industrialized economy is identified by a rising proportion of imports and exports in GDP. Typically imports both primary commodity and manufactures exceed exports at the early stages of development.

The composition of exports of was found to change in the course of development. Primary commodity exports fall as a percentage of total exports and manufactures account for the major share of exports at high levels of per capita GDP. In contrast there is little change in the composition of imports. Only large countries exhibit decreases in the share of manufactured imports in the total import share. Service exports remain approximately constant.

Chenery's 1950-70 data revealed that the rate of growth of exports was greater than that of imports implying that higher levels of per capita GDP are attained current account deficits will be gradually eliminated, illustrating how changing world economic conditions can mean that extrapolation from cross section analysis will produce totally unrealistic results. It is therefore not surprising that the principle difference that emerges between the 1950-70 and 1950-83 cross section data analysis is in the accuracy of the trade related variables. Inclusion of the more recent data shows that changes in the structure of imports and exports associated with increasing levels of per capita GDP are more variable than in the past, the share of manufactured exports in GDP showing the greatest increase in variability¹⁹. An excess of imports over exports remains negatively correlated with income²⁰ with weaker support for the gradual elimination of current account deficits.

2.2 Development Patterns.

¹⁹ Syrquin and Chenery (1989) Table 13 p. 64.

²⁰ Syrquin and Chenery (1989), table 15, p. 69.

Interpretation of the results lead Chenery and Syrquin to conclude that development can be conceptualized as,

"a multidimensional transition from one relatively constant structure to another."²¹

Figure 3 (Appendix I) captures the essence of the transformation of output structure that occurs as per capita income rises that Chenery and Syrquin have in mind. Figure 4 (Appendix I) shows the alternative transition path proposed by the sectoral productivity difference model.

As the first results were published in 1975, the conclusion cited above must be interpreted as a direct rebuttal to dependency theory. Dependency stressed the differences in economic and social structures between developed and developing countries. The conclusion that,

" Continuous structural change related to the growth of income is better supported than the alternative hypothesis that different structural relationships characterize developed and developing countries,"²²

must be read in the context of a development literature that encompassed the conviction that for low income economies, whose political and economic links with developed industrial countries were predominantly structured by present and past colonial relationships, the character of 'modern economic growth' in these countries had been fundamentally altered. For example, drawing on the work of the dependency school, Amin (1976)²³ concluded that the growth of capitalist industry in developing countries would be blocked. The argument goes that, due to their inability to compete with the high productivity levels achieved in industrialized economies (the centre), developing countries (the periphery) are forced to specialize in the production of primary commodities. Low wage levels in the export sectors of peripheral countries limit the growth of domestic demand for mass consumption goods. This results in the persistence

²¹ Chenery and Syrquin (1975).

²² Ibid (1975).

²³ Amin, S (1976) Unequal Development

of a large pre-capitalist agricultural sector and at a later stage the development of an overexpanded service sector. Large numbers of underemployed workers force wages down and the political and social dynamics that this system creates keep political power in the hands of an agrarian rather than a industrial class.²⁴

The common belief of dependency writers that a long run deterioration of the net barter terms of trade between primary commodities and manufactures meant that international trade would have little benefit to developing countries is also challenged by Chenery and Syrquins' empirical findings which point to similarities in the impact of growth on structure in developing countries and the historical experience of developed market economies.

Chenery and Syrquin (1975) place special emphasis on the role of international trade in resource allocation during industrialization. Unlike all the other structural features of the economy trade is considered particularly sensitive to government policy.

Natural resource endowment and country (hence market) size are exogenous factors they identify that influence the timing of industrialization. Once these differences in initial conditions have been allowed for it is government policy that determines the evolution of exports. Failure on the part of government adopt policies which encourage trade and thus offset the limitations of domestic market size,

'is the commonest reason why countries fail to complete the transition without serious disruptions in other development policies and in the overall rate of growth.'²⁵

The pre-eminent importance of government trade policy for ensuring that resource allocation occurs in a manner that re-enforces transition is a theme that is given increasing weight in as the work develops. Typologies of development patterns identified²⁶ by the timing of transition which is shown

²⁴ Brewer, A.(1980) Marxist Theories of Imperialism.

²⁵ Chenery and Syrquin (1975), p. 42.

²⁶ First in Chenery and Taylor (1968).

to vary consistently with a country's natural resource endowment (shown by trade orientation),²⁷ country size (defined by population) and the only policy variable, the degree of openness to trade.

Analysis of more homogeneous country groups,²⁸(see Figure 4, Appendix 1) defined by the factors above show that large countries have higher shares of manufacturing in commodity GDP at all income levels. At higher levels of per capita GDP the share of manufacturing in industrially orientated small countries catches up with that of larger countries as a result of growing domestic demand and exports. For small primary commodity orientated countries manufacturing's GDP share remains smaller at all levels of per capita income.

2.3. Relative prices.

A fundamental criticism of Chenery's work is its exclusively structuralist approach fails to incorporate any systematic analysis of the effect of changing price relatives on the composition of final demand. There is no formal consideration of the impact of sectoral differences in the rate of growth of prices and the impact this will have on the composition of final demand and thus the sectoral shares of GDP.

Throughout the work there is an awareness that the evolution of sectoral price relatives will affect patterns of structural change. It is recognised that conversion of country data into constant US dollars cannot remove price effects as purchasing power parity will not hold for non traded goods.²⁹ Lower shares of non traded goods, shown primarily by the service sector's share, in low income countries can therefore be a result of the fact that service are much cheaper in the price structure of a poor country than a richer one. This systematic variation in the internal price structure of countries means "that estimates of cross country patterns incorporate both real and price effects".³⁰

²⁷ Given by the bias towards primary as opposed to manufactured exports.

²⁸ UNIDO (1979) World Industry Since 1960: Progress and Prospects, Chenery and Syrquin (1986).

²⁹ Chenery and Syrquin (1975) note part of the enormous differential in per capita incomes is due to the relative underestimation of low income countries exchange rate converted data which will lead to an underestimation of income and growth elasticities. Technical Appendix, p. 145.

³⁰ Syrquin and Chenery (1989), p 76.

Price effects on sectoral output shares are discussed mainly with reference to the estimation of the service sector's share in the industrialization and structural change literature. It is argued as development proceeds initially the income elasticity of demand for services is highest and then, once a certain level of per capita GDP is reached, services become highly income elastic.³¹ The alternative view is that increases in the service sector's share is entirely explained by their high price relative to other goods. The theoretical assumptions behind "the relative price effect" are discussed in greater detail below.

Chenery and Syrquin fluctuate between these two views. Analysis of the 1950-70 data show an increased service sector share associated with rising per capita. This result is supported by time series analysis of the same regression equation.³² They conclude that as time series data are relatively free of the distortions associated with cross section analysis drawn from countries of extremely divergent levels of per capita GDP, increased service consumption cannot be due to relative price effects alone. In later work³³ however it is completely accepted that price effects alone explain increases in the services sector's share.

The 1989 study examines changing price relatives more systematically. Setting the relative price of each of the structural elements of demand equal to 100 in 1970, using time series data the following equation,

$$\ln p = a + bt$$

where p = current price share (of GDP) of the structural elements of demand and output divided by their constant price share and

t = time,

was estimated for between 85 and 105 countries. The coefficient, b , is therefore an estimate of the annual rate of change of developing countries' prices.³⁴

³¹ Fuchs (1968), Gemmell (1982).

³² Regressions are stacked allowing a different intercept term for each country and dummies used for small and large countries.

³³ Chenery, Robinson and Syrquin (1986).

³⁴ No results of tests for the functional form of this model are presented. Recent econometric work points to the importance of testing for unit roots to determine the appropriate specification.

Internal price structures are shown to be highly variable by the large the standard deviation from the unweighted mean of the time coefficient for all elements of demand and production.

Estimation of the impact of changing relative prices within individual countries over time on development patterns was assessed through comparisons of coefficients generated by constant and current prices time series data.³⁵

Government consumption and the service sector's share of value added in GDP are shown to be predominantly a price effect. The importance of manufacturing's output share is enhanced by constant prices showing the importance of rising income and falling relative price of manufactures for generating increased demand for manufactures.

These results seem to strongly support the argument that the demand for services is income inelastic and that changing sectoral price relatives influence patterns of development.

3. Relative Sectoral Productivity Difference Model.

Rowthorn and Wells³⁶ and Kravis, Heston and Summers³⁷ argue that differential rates of growth of sectoral productivity are the key to the evolution of output shares. For them, sectoral productivity determines output shares through its effect on relative prices. Their main concern is with the observed increase in the nominal value of services as per capita income rises. Higher rates of productivity growth in industry than in services mean that the price of goods rises less rapidly than the price of services. So, over time goods become cheaper in real terms. Kravis, Heston and Summers³⁸ examine the implications of this divergence using the data from the UN International Comparisons Project. They find that if purchasing power parity (PPP)

³⁵ Regression equations, estimating structural components as a function of per capita income, were pooled allowing individual country intercepts.

³⁶ Rowthorn and Wells (1987) 'Industrialization and Foreign Trade.'

³⁷ Kravis, I.B., A.Heston and R.Summers (1982) World Product and Income: International Comparisons of Real Gross Product.

³⁸ Op. cit. .

conversions of per capita incomes are used the range of per capita income between rich and poor countries is less than when incomes are converted according to exchange rates. This is due to the differences in relative price structures between countries. Low income countries have lower price levels for non tradeable goods than high income countries.

To explain the difference in service: commodity price relatives Kravis Heston and Summers adopt a sectoral productivity difference model. They assume,

1) That an economy produces manufactured goods that are traded and other non traded goods. (Non traded goods approximate to services.) There is no discussion of agriculture's role in economic development but as most agricultural output is, in principal tradeable it can only be assumed that it comes under the auspices of manufactured output in this model.

2) Purchasing power parity holds for the traded goods sector between all countries.

3) In rich countries there is a large gap between the level of productivity in the manufacturing sector and that in the service sector, manufacturing productivity being the highest.

4) The same productivity gap exists in poor countries but as manufacturing productivity is lower than in rich countries while service productivity is similar, the gap is narrower in poor countries than in richer ones. [So productivity levels are compared using international prices (purchasing power parities)].

Such a manufacturing-services productivity gap in developing countries is a strong assumption. A more realistic assumption would be that the productivity gap is most pronounced between formal and non formal sector activities where both sectors encompass the production of services and commodities.

5) Wages are determined for the economy as a whole by productivity in the traded goods sector and a competitive labour market is assumed to exist

throughout the period of transition from low levels of per capita GDP to high levels of per capita GDP.

Again these are a strong assumptions. Wages economy wide may be influenced predominantly by a minimum wage policy, with wages in some industries or sectors being a differential mark up above it. Alternatively wages in the government sector may constitute a reference point for other sectors. It may not be accurate, even as an approximation of reality, to assume that one wage rate is applicable to the economy. Labour markets are likely to be highly segmented in countries where production conditions are extremely heterogeneous.

6) In rich countries the (traded) manufactured goods sector always has lower prices and higher marginal productivities relative to the service (non traded) sector. This assumption is justified through a claim that the cost reducing aspects of technical change are more applicable to manufacturing than to services.

A specific growth dynamic follows from the assumptions of Kravis Heston and Summers. In real terms, over time, technical change increases the sectoral income of the commodity production and allows higher wages to be paid to its workers and lower prices to be charged for its products. Wages established in this sector push up service wages and, as cost reducing technical change is less far reaching in this sector, the prices of services rise relative to commodity prices.

Empirical support for this model is based on evidence from descriptive data. Rowthorn and Wells cite evidence from time series sectoral share data for developed industrial economies, and Kravis, Heston and Summers use the ICP data to support their case. Table 3 shows a the nominal (country data converted to US dollars by the exchange rate) and real (country data converted to US dollars by purchasing power parities) shares of services for countries at various levels of per capita income in 1975. Category I is the lowest and Category VI consists of one country the USA. Data are drawn from thirty five countries.

Table 3. Nominal and real service sector shares of GDP, by real per capita GDP (1975) country groups.

Country Groups	Poor	-----	-----	-----	-----	----> Rich
	I	II	III	IV	V	VI (US)
Exchange Rate converted GDP						
Services (% of GDP)	22.0	28.4	27.4	25.6	36.8	43.9
PPP converted GDP						
Service (% of GDP)	33.0	31.7	31.8	30.3	31.2	32.3

Source: Kravis, I., W. Heston and R. Summers (1983) Table 2.

Table 3 shows that once data are converted to real values (using purchasing power parities) the amount of service output per capita as a percentage of GDP varies little between rich and poor countries. These data show the richest country's service sector share (the USA's) is 32.3% compared to the poorest countries where the share of services is 33.8%. The conclusion is therefore that services are not income elastic in real terms, low income countries consume services in the same proportions as high income countries. The typical pattern of development that purchasing power parity data produces is shown in Figure 3, Appendix 1.

Kravis, Heston and Summers (1982) also find that although there is considerable variation in commodity prices between countries this variation is much less than the variation between service prices in rich and poor countries. Furthermore time series sectoral productivity (sectoral output divided by sectoral employment) ratios show that the productivity gap between services and commodity increases with rising income. However as there are great difficulties in measuring productivity growth in some service sector activities³⁹ too much weight cannot be attached to this.

The transformation of the structure of output that occurs over time (given growth of per capita gnp) can therefore be represented by the Figure 3 (see Appendix 1) when data are converted to real values.

³⁹ Some service output, e.g. many government services, is measured by the value of the wage bill.

Analytical testing of the model reveals that some, but not all of the evolution of sectoral price relatives can be explained by difference in sectoral productivity.⁴⁰ These results revealed that intersectoral productivity differences between agriculture and industry are also partially explained by intersectoral productivity differences. The agricultural share may decline therefore as agricultural products are relatively cheap in the price structure of a poor economy.

It can also be expected that different productivity growth rates in agriculture and industry have an analogous effects on the change in the output shares of these two sectors during the course of growth. In the early stages of economic development agricultural productivity growth may be greater than industrial productivity growth causing the intersectoral terms of trade to move against agriculture. Price and income effects will therefore combine to produce a greater decrease in agriculture's GDP share at constant than current prices.

4. Interpretation of Cross Section Patterns of Growth.

Interpretations of Chenery and associates patterns of development is that they represent long run adjustment paths that reflect the accumulated historical experience of development. This hypothesis is extended by constructing simulation models of the transition. The simulation is described as a 'prototype developing country' that typifies the post-war experience to which the actual experience of a specific country or country group can be compared.

In a study of semi-industrial economies⁴¹ an input:output model with fixed coefficients of production is used to simulate the structural changes that occur with a given rate of per capita income growth. Using data from the 1950-70 cross section study the static input:output model is solved for exogenous changes in per capita income. This model is thus essentially demand driven as

⁴⁰ Hanmer, 1991 Industry and Economic Development, Ph.D Thesis, University of Cambridge.

⁴¹ Chenery, Robinson and Syrquin, 1986.

input:output coefficients are specified a function of per capita income. Structural changes are therefore caused by differing income elasticities of demand for commodities, changes in input:output coefficients and export demand and import proportions, where parameter estimates are derived from the 1975 study. The changes that occur in the simulation are compared to the time series data from periods that cover a transition to semi industrial status in nine countries⁴² to check to what extent it captures typical aspects of industrialization. Overall it is concluded that time series trends confirm the simulation.

Next sectoral output is decomposed into final demand (both for investment and consumption goods), intermediate demand and net trade demand. The model is then used to estimate the relative importance of different sources of demand for structural transformation. There are two limitations to this approach. First is the accuracy of input:output coefficients and the extent to which they can be thought of as representative for a group of countries. Second is the fact that neither demand nor production functions depend on relative prices. If rapidly rising rates of productivity growth lead to the substitution of labour for capital input:output analysis will underestimate the extent of structural change in employment and output as technological change and capital labour substitution is lumped together under one input coefficient. In this study input coefficients are defined as a function of per capita income and derived from the cross country data and so therefore is intermediate demand.

Results from an earlier analysis of this model based on data from different countries, have shown that changes in domestic demand whilst the most important factor in explaining industrialization accounted for only half the total increase. Changes in trade patterns export expansion and import substitution accounted for 20-30% and technological changes reflected in increased use of intermediate inputs per unit of output the remainder.⁴³ The extent of the contribution of trade to industrialization is analyzed by breaking countries into more homogeneous groups, small primary orientated

⁴² Colombia, Taiwan, Turkey, Korea, Mexico, Israel, Japan, Yugoslavia and Norway.

⁴³ Chenery 1980 in R.C.O Matthews Economic Growth and Resources New York: Macmillan. Chenery (1980) 'Interactions between industrialization and exports' Proceedings American Economic Association World Bank Reprint Series No 150, Washington: World Bank.

(SP), small manufacturing orientated (SM) and large (L) countries. At a given level of per capita income the primary share of GDP is more important in small primary than small manufacturing or large countries. Further analysis of large countries controlling for policy orientation⁴⁴ shows that after a certain level of import substitution changes in economic structure are manifested in rising capital output coefficients rather than smaller primary output shares of GDP as opportunities for import substitution become exhausted.

For the semi industrial economies it was concluded that the changing composition of trade was of greater importance than income elasticities in determining the primary sector's decline associated with industrialization. The importance of intermediate demand for manufacturing's output share could however easily be attributable to the assumptions made about input coefficients. Making them a function of per capita income allows no possibility for countries benefiting from technological backwardness. Whether intermediate demand remains a large explanatory factor in industrialization in later time periods and in other countries will depend on whether the current technologies used in industrializing countries generate as large a demand for intermediate goods as previous ones did and whether countries have domestic capability to manufacture these intermediates.

Some attempt has been made to introduce some form of market behaviour into the system by estimating a Computable General Equilibrium (CGE) model.⁴⁵ The CGE model is based on S. Korea's experience and, apart from specification of a dual labour market, is neoclassical in its assumptions. One (Cobb Douglas) production function is specified for the whole economy and prices clear factor and goods markets. Using the model to estimate the effect of shifting from an import substituting to a neutral trade regime it is found that this policy change can result in growth increases of up to one percent when capital inflows and other indirect effects are held constant. The model also shows that capital inflows add significantly to the effects of export growth and are important explanatory factors in South Korean and Taiwanese growth. This result is consistent with economic literature on these countries, as although there was little direct foreign investment in these countries, other capital

⁴⁴ Based on experience of India, Brazil, Turkey, Mexico, Argentina, in 1950's and '60's

⁴⁵ Chenery, Robinson and Syrquin (1986).

inflows were high in comparison to many developing countries. Amsden⁴⁶ argues that South Korea borrowed its way out of balance of payments crises in the 1970s, a policy that was successful as high levels of borrowing were accompanied by large productivity gains.

Recent economic literature on South Korea⁴⁷ emphasises the role of government information in determining both key price relatives in factor and product markets and firms' ability to respond to incentives to export. The results of this model must therefore be seen as entirely hypothetical, as its specification allows price relatives to change only in response to changes in the domestic:world price ratio and the switch between producing for exports and imports is determined solely by this changing price relative. It is therefore not surprising that the shift from inward to outward trade policies captured by the model explains only half the actual acceleration of industrialization achieved in South Korea.

Policy implications, apart from attempts to assess alternative trade policies outlined above, are not the primary focus of Chenery's analysis. Its central aim is to establish the stylized facts of the transition to industrialization. For individual countries relevance is limited to indicators of feasible development paths given their initial level of per capita income.⁴⁸ However for policy makers in many developing countries in the 1990s, replication of the transition to industrialization described by the 1950-70 data must seem an over optimistic hope.

Data in Figures 1 and 2 in Appendix II show growth rates of real per capita GNP for regional country groupings. Between 1950 and the mid 1970s all developing countries experienced sustained rises in growth rates. After the mid 1970s the experience is more diverse. While countries in East Asia and the Pacific continued to grow, countries in sub-Saharan Africa and Latin America experienced a secular decline. In the decade of the 1980s sub-Saharan African growth rates first declined and then remained at around zero in the latter

⁴⁶ Amsden, A. (1989) Asia's Next Giant - South Korea and Late Industrialization.

⁴⁷ Westphal, L 1990 'Industrial Policy in an Export Propelled Economy: Lessons from South Korea's Experience', Journal of Economic Perspectives, Vol. 4., No 3., Summer pp. 41-59 and Amsden, A. 1989 op.cit. for example.

⁴⁸ For example in a World Bank study of China. World Bank (1985).

half of the decade. In Latin American countries per capita continued to decline reaching negative rates (approximately -2% per annum) between 1985 and 1990.

Figure 2 shows regional growth rates relative to East Asia and the Pacific, the region that attained the sustained increases in per capita GNP assumed by the CI and SPD models. South Asian growth has been consistently two or three percent less than East Asia's since 1970. For other regions, particularly sub Saharan Africa and Latin America GNP per capita growth has consistently diverged from that of the high growth region.

The concept of a relatively smooth transition has to substantially revised in light of this evidence. Structural changes achieved between 1950 and 1970 have allowed some countries to industrialize much more quickly than others. East Asia and the Pacific and South Asia recovered quickly from the world recession of the early 1970s and regained early growth rates. In contrast per capita GNP growth in sub- Saharan Africa and Latin America is still nowhere near its 1970 level. Sustained positive growth of per capita income from the 1950s to the 1980s and the structural changes accompanying this growth has not allowed countries in these two regions to quickly regain earlier growth rates. Per capita income levels in countries in sub- Saharan Africa and Latin America range from low income to middle and upper middle income countries thus the inability to regain previous rates of growth cannot be attributed to countries' having reached a particular point in the transition to industrialization. This is recognised by the 1989 study as it is concluded that the time shift variables cannot be solely interpreted as exogenous changes in processes, such as technology but,

'...has to be broadened to admit divergences between the short run transformation and the one implied by the long run accumulated experience in a variety of distinct economies.'⁴⁹

Although as noted earlier these studies results are essentially normative, describing a pattern of change that should occur given growth in per capita income, Chenery et al have always stressed that structural changes have

⁴⁹ Syrquin and Chenery 1989, p.78.

positivist implications for growth. Treating structural change as exogenous they define a disequilibrium model of growth.⁵⁰ The disequilibrium is due to the movement of capital and labour between sectors which, when moved from one sector to another more productive one, accelerates the growth process. Different rates of return to capital and labour in the different economic sectors result from the effects of learning by doing, scale economies and the reduction of bottlenecks that arise from segmented market structures and lags in adjustment. Sources of growth for developing countries thus include factor reallocation as well as additions to the stock of capital (human and physical) and labour and total factor productivity growth. It is argued that disequilibrium in developing countries is most often manifested by different rates of return to labour and capital in different sectors than surpluses and shortages arising from market clearing failures. The proposition is thus that changes in the structure of an economy that occur with economic growth shape and react in turn with the growth process. A question that arises from the regional growth rates presented in Appendix II is therefore how to explain the difference between the Latin American and the East Asian and Pacific data. By the mid 1970s most of the Latin American countries had achieved substantial industrialization but the impact of this structural change on their performance was very different to that in East Asia.

Table 4. Sectoral output shares of GDP expressed in constant prices.

Country	Agriculture		Industry.		Services	
	1970	1980	1970	1980	1970	1980
Argentina	13	16	38	35	49	50
Brazil	12	9	35	36	53	54
Mexico	12	9	32	34	56	57
S.Korea	28	14	30	56	42	31
Taiwan	15	5	44	55	43	40
Malaysia	30	21	28	31	42	48

Source: Hanmer (1991) Tables 4.2 and 4.4.

⁵⁰ Chenery, Robinson and Syrquin (1986).

Table 4 shows the sectoral output shares of GDP of some Latin American and East Asian countries. It can be seen that Latin American countries had, by 1970, industrialized substantially. The impact of Latin America's economic structure on performance during the 1980s and 1990s was obviously very different to the impact of the East Asian economic structure, as shown by Graphs 1 and 2 in Appendix 2.

5. Conclusions.

Contrasting the SPD model with the Classical Industrialization model illustrated the problems associated with identifying a theory of structural changes associated with industrialization.

Chenery's work over the years has been far reaching in its influence on the perceptions of the stylized facts of development. Nevertheless the assumptions underlying the model are sometimes lost in the mass of empirical evidence provided by the work. The effect of relative prices on structural change is not discernible from their work as estimates from the cross section model conflate both real and price effects. As the work progresses increasing attention is devoted to this problem. However parameter estimates for the simulation results are derived from the cross section model so limited weight can be given to these results.

The SPD model provides a useful insight into how relative prices formation can be modelled. It has limits in its applications to developing countries however as due to the labour market assumptions it adopts and because its focus on the tradeable non tradeable divide ignores the relationship between agriculture and industry. There are several reasons to explicitly consider the relative price of these two sector's output in an analysis of industrialization. First there exists a large volume of literature on the economic impact of turning the intersectoral terms of trade against agriculture. The extent to which government policy is able to achieve this will be reflected by decreases in agriculture's output share. In a study of large countries, this is recognised by Chenery as China's industrial share is considered incomparable with that of other countries due to the high relative

price of its products.⁵¹China may be an extreme case but the agriculture-industry terms of trade are relevant considerations in other countries.

Secondly industry's output share can be effected by the monopoly power of the sector and government policy towards it. In countries where industrial structure is fairly uncompetitive mark up pricing can maintain a constant margin between industrial and agricultural commodities. This scenario is particularly likely to occur when domestic food price increases determine the industrial wage rate. Relatively high industrial prices due to institutional factors can thus exaggerate the industrial output share.

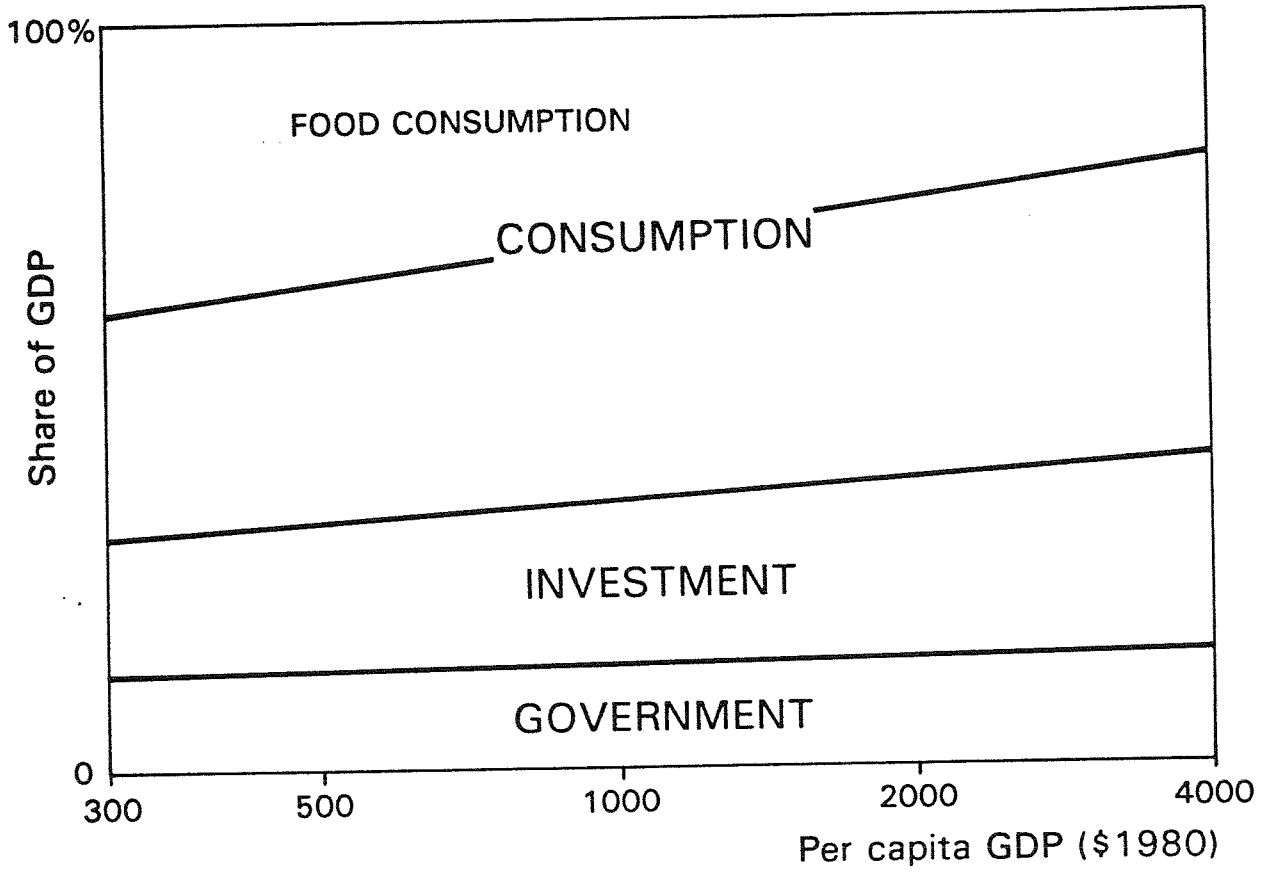
The only policy variable that enters Chenery's work is trade policy. The examples above show that it is important to consider other government policies especially agriculture policy. Institutional characteristics of the agricultural sector, such as the system of land holding and concentration of land ownership, the nature of rural credit and finance and the potential for the diffusion of new technologies have been shown to be key determinant of agricultural productivity growth and are thus relevant to the model.

Causes of variation in price structure between developing countries and industrialized countries and sectoral price formation itself is, as yet little understood although they are central to advancing understanding of the impact of structure on performance.

⁵¹ Chenery (1982).

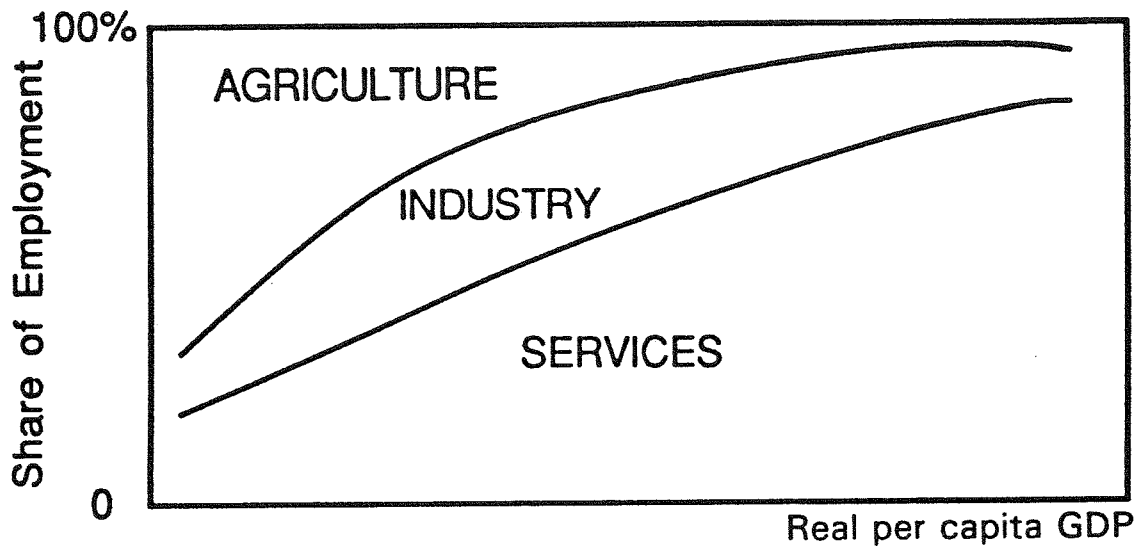
APPENDIX I.

Figure 1. Industrialization and Changes in the Structure of Domestic Demand.



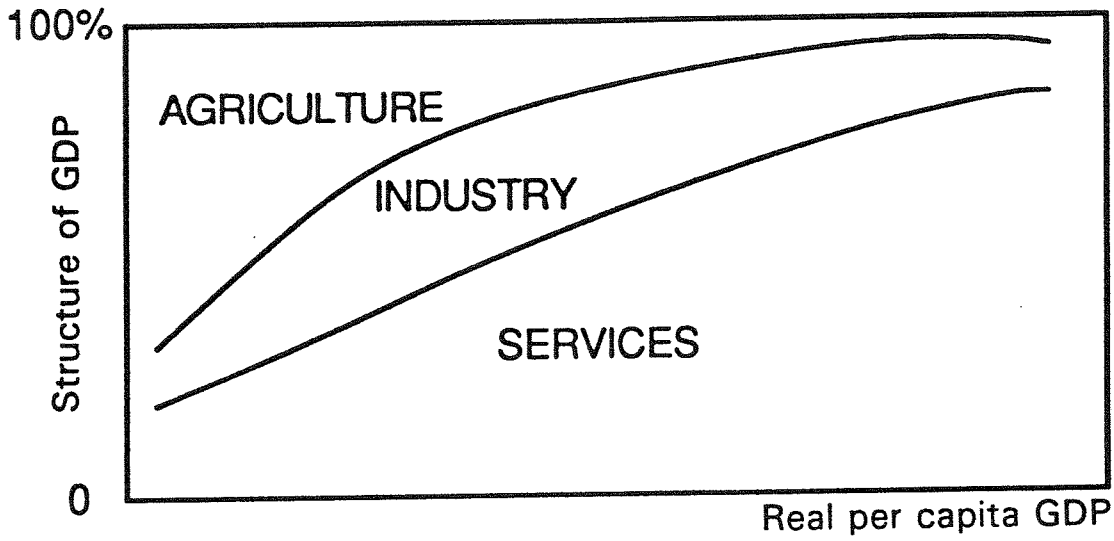
Source: Adapted from Figure 1, Syrquin and Chenery (1989; 22).

Figure 2. Industrialization and Changes in the Structure of Employment.



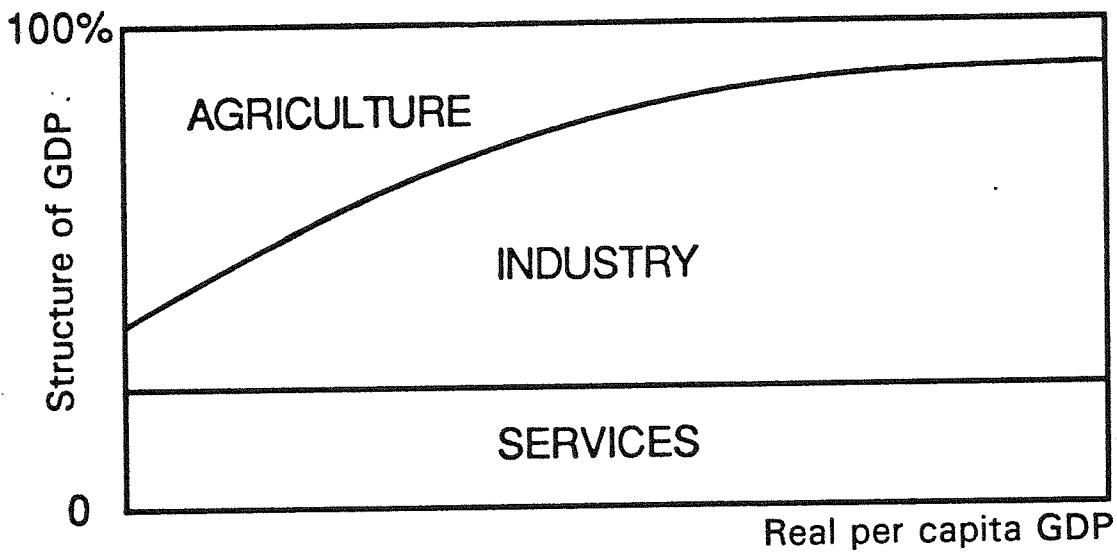
Source: Rowthorn and Wells (1987; 327).

Figure 3. The Classical Model of Industrialization.
Changes in the Structure of GDP at Constant Prices.



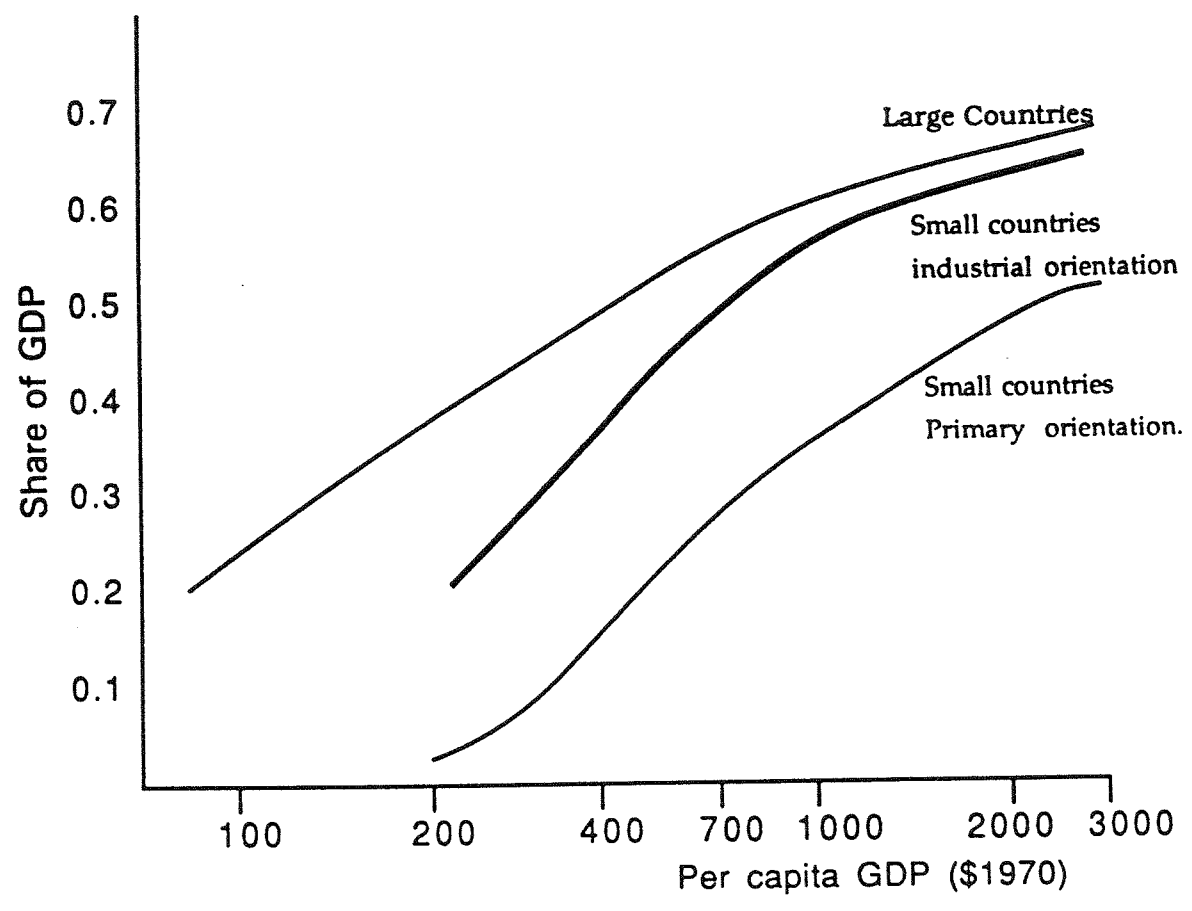
Source: Adapted from Rowthorn and Wells (1987; 18).

Figure 4. Sectoral Productivity Difference Model of Industrialization.
Changes in the Structure of GDP at Constant Prices.



Source: Rowthorn and Wells (1987; 18).

Figure 5. Chenery's Initial Conditions and Patterns of Development.



Source: Adapted from UNIDO (1983; 47).

APPENDIX II

Figure 1

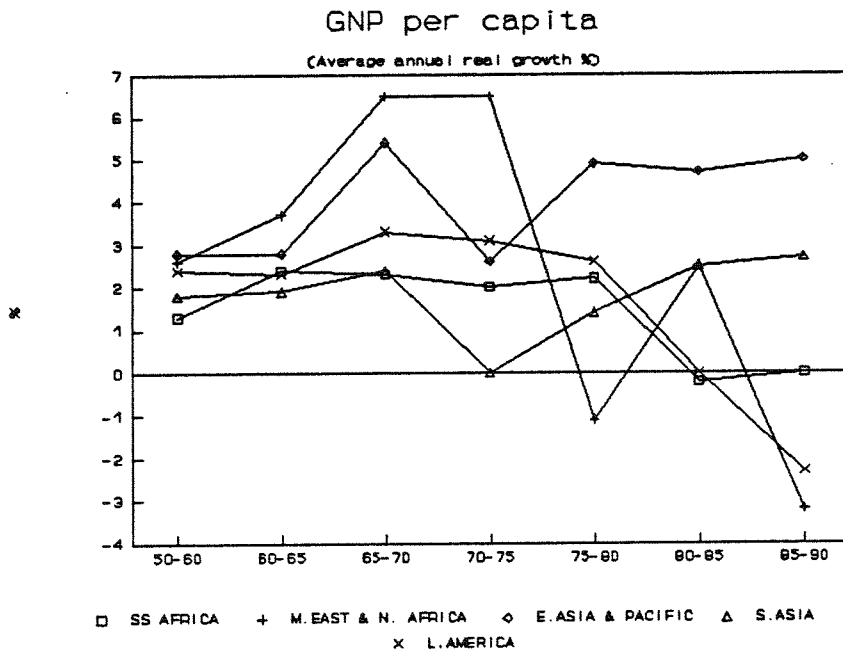
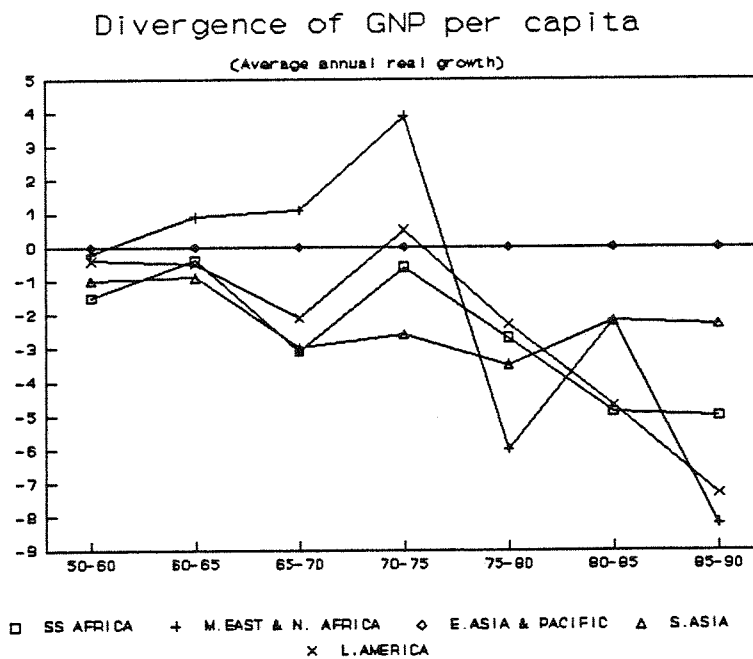


Figure 2



Source: IMF World Economic Outlook, various years.

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