THE SECTORAL COMPOSITION OF GLOBAL TRADE

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ABSTRACT

This thesis is an extension of recent research into the relationships between non-homothetic preferences and patterns of trade. The analysis focuses on the observed shift in consumption towards income-elastic services and, relative to agricultural goods, income-elastic manufactures associated with rising per capita incomes. In turn, the conjecture that we should witness a shift in global production and consequently a shift in trade away from primaries towards manufactured goods as the global economy develops is explored. This hypothesized change in the sectoral composition of global trade implies a change in individual country trade patterns. Specifically, the notion that a country's exports must respond to a changing global market may help to clarify one of the principle causes of the shift towards manufacturing production among most small, trading economies.

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Christopher M. Hajzler

To my mother

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1. INTRODUCTION

A key preoccupation of studies in development and growth is to identify the specific structural characteristics of growing economies as they move away from particularly low per capita incomes. Such research is commonly dedicated to examining changes in the structure of production in developing countries, their price structure, income distribution, and the relative importance of foreign trade, among other important issues, at various stages of development. A monumental product of such efforts is Kuznets' (1973) finding that economic growth is typically accompanied by structural shift away from agricultural production towards manufacturing and, eventually, away from industry towards services. This stylized *fact* of development has in turn motivated many important studies related to the processes of urbanization and industrialization, income inequality, and government subsidization and trade policies.

Much less familiar in the development and trade literature are inquiries into how this uneven, or alternatively 'unbalanced,' common development path has affected the composition of global trade in general and country trade patterns in particular. In the long view, the dominant pattern of global consumption, production and trade has undergone a quite noticeable change. The extensive studies conducted by Chenery and Syrquin (1975) and Chenery, Robinson, and Syrquin (1986) have previously examined the varying conditions that have brought about this transformation, noting in particular a gradual shift in the composition of both production and exports in many developing countries that closely parallels Kuznets' fact. First, with regard to production, the traditional closed economy view posits the relative change in the contribution of each sector to total output as an account of Engel's law, where aggregate consumption of agriculture rises less that proportionally with growth in per capita income. For the small open economy, the share of agriculture in total exports is also observed to decline on average relative to trade in manufactured goods as per capita incomes grow. However, since this shift in the supply of goods to the rest of the world must in turn influence the

structure of production, the opportunity to trade potentially invalidates the first view. A decomposition of the sources of sectoral growth in output in Chenery and Syrquin (1986, Chapter 3) shows that when allowing for the influence of trade in production decisions domestic demand tends to account for less than half of the rise in the industrial share, a finding they concede "requires a substantial revision in the common view that industrialization is largely explained by Engel effects."

The basis for their argument is that a shift away from specialization in primary products is determined entirely on the supply side by factors relating to accumulation of physical and human capital, economies of scale, and government policy. As we shall see in an overview of theories of trade in Chapter 2, this emphasis on supply conditions is the standard approach taken in explaining the volume of trade in each sector. Nevertheless, even outside of a country's borders, a change in the supply of a commodity must be met with commensurate changes in demand. To the extent that most countries have experienced a similar shift in their pattern of trade, therefore, it is still necessary to account for the apparent transformation of global demand.

Drawing upon the views of Echevarria (1997; 2000) and Kongsamut, Rebelo and Xie (2001), the thrust of this change appears to be rising incomes, and in particular rising world incomes, shifting emphasis back again towards the role of Engel effects in changing consumption patterns. At the international level, what this suggests is that changing global demand should be incorporated into models of dynamic comparative advantage when examining a country's intertemporal trade pattern. And since a country's own pattern of production and growth can be attributed in part to changes in the opportunities for trade presented to it by the changing structure of international production and demand, an approach such as this promises a fuller understanding of observed paths of development.

Trade has for some time been viewed as critical to the pace of development. Whereas production in a completely closed economy at the earliest stages of development is necessarily tied to supplying the nation's subsistence food requirements, trade allows a country to produce a completely different mix of goods than is actually consumed. Opportunities for exchange offer the possibility for further division of labour and the emergence of different crafts and skills (Bauer, 1998). Developing countries can

therefore diversify their economies and rapidly "industrialize," moving from agrarian production and small enterprise to highly specialized production and trade. In often many, however, such specialization and trade requires that the new industries can operate at a scale at which efficient production is possible. Bos and Kuyvenhoven (1969) note that the existence of such economies of scale places additional emphasis on demand in neighbouring countries so that sufficient capacity utilization can be expected through voluminous exports. The reliance of some countries upon traditional primary exports to their impoverished neighbours may in part account for the low levels of industrialization in certain regions.

At the same time, however, there exists a large number of developing economies moving away from agricultural production and trade toward the export of manufactured goods. The most prominent examples are in Asia, and some in Latin America and in the Middle East. In terms of the increasing number of industries in East Asia competing with traditionally "Western" exports, there has been considerable debate on the role of changing comparative advantage. Explanations for the rapid industrialization of these countries and competitiveness in technology intensive sectors emphasize the role of technology transfer (Edwards 1991), innovation (Romer 1986, 1990), and accumulation of human capital (Lucas 1988). On the other hand, the increasing numbers of developing countries competing in labour-intensive manufactured goods, or the so-called low-wage producers, have lent support to the notion of a product cycle, where due to the standardization of production processes it becomes more profitable to transfer these operations to developing countries where the initially higher costs of initially smaller scale production (or transfer of skills) are offset by the lower wages (Carolan, 1998). In the tradition of the "new trade theory" and economies of scale, the transfer of production to the south may take a long time for some commodity groups, and in other industries there may not be a shift in comparative advantage at all. As Gomery and Baumol (2000) point out, in many of today's industries economies of scale and large entry costs emphasize the decisive role of acquired advantages rather than natural ones in determining trade patterns. Any position of production and trade once arrived at, "whether deliberately or by the purist accident of historical events, does not break down

overnight. Market forces will preserve it because of the difficulty of new entry for new competitors in such an industry."

While these perspectives together bring a more coherent understanding of various influences on the volume and composition of trade in any particular country, they ignore relative demand conditions that vary between countries at different levels of per capita income. Markusen (1986) and Hunter and Markusen (1988) have demonstrated in a static framework that a relative consumption bias toward different bundles of goods, when tied to differences in per capita incomes, has significant potential to account for the direction of trade between developed and developing countries. These models are explored in detail in Chapter 2 following a discussion of the standard trade theory and a review of the literature covering unbalanced growth. Over time, the evolution of a country's trade pattern is fundamentally a product of catering to domestic and international demands given its own production possibilities. Thus a proper characterization of the trajectory of the composition of global consumption and production is equally vital in interpreting patterns of trade and development.

This study is an extension of recent research into the relationships between non-homothetic preferences and trade. Drawing upon previous work in economic growth and sectoral composition by Echevarria (1997) and Kongsamut et al. (2001), the model adopted in Chapter 3 to explain the dynamic pattern global production is simple, but general and straightforward. In contrast to some earlier studies, identical non-homothetic preferences are assumed in this analysis rather than tested, focusing the analysis instead on the implications of the implied global consumption and production dynamics on world trade patterns. The model highlights the observed shift in consumption towards income-elastic services and, relative to agricultural goods, income-elastic manufactures. This thesis, in turn, explores the conjecture that, as the global economy develops, we should witness a shift in global production and consequently a shift in global trade away from primaries towards manufactured goods. This hypothesized change in the sectoral composition of global trade implies a change in individual country trade patterns. Thus this thesis also explores whether countries are moving, some more rapidly than others, in the direction of an eventual decline in the overall share of primary commodity trade as a general rule.

Chapter 4 describes the main results of this research and discusses some of the proposed explanations for the observed trade patterns from the standpoint of the theories covered. The available statistical series pertaining to global trade covers the 1970-1992 period for approximately 140 countries, excluding petroleum exporters and the particularly 'small' countries. The ensuing cross-country comparisons extend in various ways the Chenery and Syrquin's (1975) analysis of world development and trade patterns for the 1950-1970 period, although the present study benefits from more extensive country coverage and more detailed data on resource endowments.

By shifting the focus from domestic supply conditions to the composition of exports, however, this study explores whether the observed patterns of change can be traced to shifts in international production and demand. Specifically, the notion that a country's exports must respond to a changing global market may help to clarify one of the principle causes of the shift towards manufacturing production among most small, trading economies. Since an open-economy view of development necessarily relates patterns of production to a country's comparative advantage, the analysis focuses on the role of differences in relative resource endowments in altering the predicted timing of the shift. This approach to explaining observed patterns is offered as an alternative to the view that untimely transitions towards industrialization are an indication of disequilibrium in the domestic market, a disequilibrium attributed to the failure of government development policy to promote the right industries or to achieve scale economies. However, arriving at a satisfactory explanation of *how* production and trade in each country evolves with changing comparative advantage is an arduous task; in the model estimated in Chapter 4, the average correspondence between changing global demand patterns, levels of development and the composition of trade provides only weak support for the development paths each country will follow. The potential for diverging equilibrium development patterns is briefly considered in the closing remarks of the final chapter.

2. OVERVIEW OF THEORIES IN GROWTH AND TRADE

Much of trade theory and empirical analysis, particularly in the tradition of the Heckscher-Ohlin model, have generally assumed that the respective shares of income devoted to the consumption of each commodity are not only the same across countries but also invariant to differences in per capita income. That is, it has been a conventional assumption in most trade literature that preferences are identical and homothetic. Given that the prices of traded goods are everywhere the same when abstracting from transport costs and barriers to trade, the assumption of identical homothetic tastes suggests that every household can be expected to purchase the same relative quantities of each good, the precise amount of these purchases rising proportionally with household or per capita income.

This approach to standard theoretical investigations into the determinants of trade is legitimate for emphasizing the relationship between differences in the structure of production, which are evidenced to be quite prominent between countries at different stages of development, and cost-driven patterns of specialization, without any special attention to the demand side of the equation. The resounding emphasis on relative supply conditions in much of the trade literature is rooted in Ricardo's theory of comparative advantage, where it is stressed that persistent differences in labour productivity across industries or commodity groups allow one nation to produce certain goods cheaper, thereby selling these goods to the rest of the world at a higher price than would be earned without trade. The modern Heckscher-Ohlin theory extends this approach by attempting to account for the sources of unequal labour productivity across countries, attributing comparative cost advantages to measurable differences in the country's endowment of one or another internationally immobile factor of production, often defined as either physical or human capital, land, or other natural resources. In the course of theoretical refinement and empirical tests of this model, however, many of the additional variables that Heckscher and Ohlin regarded as significant, such as demand conditions and

economies of scale, were dropped completely from the discussion (Blaug, 1992, pp. 186). One drawback of this one-sided approach is that there has typically been only weak empirical support for many of the theory's predictions.

This is not to suggest that the assumption of identical homothetic tastes is entirely responsible for the model's poor performance. There are indeed many insurmountable difficulties, both theoretical and practical, encountered when working with the Heckscher-Ohlin model. As an example of the first type, the model itself involves a variety of outcomes depending on one's assumptions concerning the number of factors of production, the degree of factor mobility, identical production functions across countries, etc., and therefore it is not unreasonable to expect that so much attention has been devoted to finding support for even these basic tenets before considering alterations to the traditional demand assumptions. Formidable challenges emerge in practice when aggregating trade data into a manageable number of commodity groups. Nevertheless, a familiar conclusion in many empirical studies is that the volume of inter-industry trade predicted by the Heckscher-Ohlin theory is far greater than the trade actually observed.[1] Recently, however, Trefler (2000) discusses different approaches to salvaging the model with the inclusion of an "error term" that allows for differences in aggregate consumption, leading not only to a remarkable improvement in the performance of the model but in some cases dramatic reductions in 'missing trade.' The results are improved further once a component dealing with the consumption of non-tradable ouput is included. Chul Chung (2000) explicitly links this consumption bias to non-homothetic preferences in a general equilibrium trade model and demonstrates that this modification to the standard assumption accounts for a large portion of the missing trade.

The above evidence in support of nonhomothetic demands, along with the observation that countries with similar per capita incomes exhibit similar demand patterns, is surely of importance to anyone interested in decomposing the determinants of trade implied by the Heckcher-Ohlin theory. Beyond altered expectations concerning the factor content of trade at any given moment, however, there is the question of how the composition of trade should be affected in the long-run as world income grows. To

[1] See Trefler (1995) for empirical estimates of the 'missing trade' predicted by the standard Heckscher-Ohlin-Vanek model.

explore this subject fully, the following sections tie together some of the prominent theories of economic growth and international trade.

2.1 THEORETICAL EXPLANATIONS FOR UNBALANCED GROWTH

In a study of industry productivity and growth in 14 OECD countries, Bernard and Jones (1996) note that the share of manufacturing in overall production is either constant or declining over the period 1970-90 for almost every country. Agricultural output displays similar patterns, although the diminishing share of total production is somewhat more pronounced when compared to manufactures in those countries where the manufacturing share is in fact declining. Services represent the only sector where a steady upward trend in value of total production is evident for most countries in the sample. These trends are resoundingly similar to those discovered by Kuznets (1973), Chenery, Robinson and Syrquin (1986), and Chenery and Taylor (1968), the third of these studies involving a sample of 54 countries both over time (1950-63) and at different stages of development (although the manufactures share displays an upward trend for sufficiently low levels of income). That is, there is evidence of similarities between production patterns in not only time-series data but in cross-sectional data ranking countries by levels of per capita income, establishing a link between development and the sectoral composition of output.

A wide range of economic literature has been devoted to providing a theoretical basis for understanding the empirical regularities in the structure of production that are observed as an economy develops. This section attempts to synthesize some of the more general theories in order to present a simple dynamic view of the sectoral composition of economic activity, expressed in terms of the three broad sector aggregates just outlined. In a closed-economy framework, the analysis focuses on the main features that describe, independent of country specific factors such as government policy or natural resource endowments, the changing structure of production in a growing economy. Drawing upon some conventional models of trade, we proceed to examine various complications when extending the analysis to the context of the open economy.

Baumol's (1967) analysis lends itself to a partial explanation for this observed connection between development and the composition of output, addressing the perceived rise in the service sector relative to industry. One reason that services are of consequence

in this analysis is that the share of traded commodities in national production may slacken off at higher incomes where services are characterized by a higher income elasticity of demand (Bhagwati, 1985). Baumol's model is one of unbalanced growth in which the economy is divided between a technologically "progressive" and a "non-progressive" sector, each characterized by relatively high or low productivity growth. Baumol affirms that the distinction is not entirely arbitrary; the source of differentiation resides in the role of labour in the two activities, and hence the classification is based on the technological structure of production. In the progressive sector, innovation and economies of scale contribute to a cumulative rise in output, while labour is simply an instrument in this process. In the non-progressive sector, by contrast, labour is itself the end product, and while innovations certainly give rise to increases in the productivity of these services, the quality of output is intrinsically tied to the amount of labour embodied in it (pp. 415-17).

In the single factor model, where labour is the only input in production, the progressive sector experiences a constant rate of growth in output in every period while output in the second non-progressive sector is constant over time. Wages are assumed to be equal in every period for both sectors, and thus grow in accord with productivity growth in the progressive sector. From these basic assumptions, he derives several properties of the growing economy. We emphasize the third proposition, which states: *In the unbalanced productivity model, if the ratio of outputs of the two sectors is held constant, more and more of the total labour force must be transferred to the non-progressive sector and the amount of labour in the other sector will tend to approach zero*. With rising productivity in the progressive sector, a consumption bias towards the services of the non-progressive sector implies an increasing proportion of total labour is absorbed by this sector. This result is explained by the fact that the progressive sector requires progressively less labour per unit of output, and therefore a non-decreasing, non-productive sector must make up an increasing proportion of the labour force. It follows that, given similar wages in both sectors, the relative cost of services must rise with per output.

Drawing upon previous work of Kravis, Heston, and Summers (1982), Panagariya (1988) reports the finding that as per capita incomes rise in any country, so does the price of services in it. The additional evidence that labour productivity in services relative to

that in commodities is lower in rich countries than in poor countries strongly supports the main argument suggested by Baumol, that in the case of sufficiently price inelastic or income elastic demand for services (the non-progressive sector) more and more of the total labour force must be transferred to the non-progressive sector, and the relative cost share of the non-progressive industry will rise without bound. Further examination reveals that the quantitative share of services in national production remains more or less constant across countries regardless of per capita income. Kravis, Heston, and Summers (1982) confirm this result, demonstrating that as incomes rise services tend to constitute an increasing proportion of the value of national output, but when measured in international prices, the positive correlation vanishes and the quantity of services produced appears to be relatively constant. A similar examination of both cross-country and time series data in Echevarria (1997) and Baumol (2001) also suggests that share of services, in real terms, in total output has remained more or less constant with rising per capita income.

While this perspective provides a theoretical framework in which to interpret the rising share of non-tradable output as aggregate income grows, what remains is a notable shift in the relative importance of traded goods in total output throughout the development process. In particular, broadly classifying traded goods as either primary production or manufacturing, the relative share that primaries represent declines at higher levels of income. In much of the development literature, the production of primaries is identified as another sector characterized by lower relative productivity growth. In contrast to the case of non-trade output, however, international competition implies that the long run price of primaries in terms of manufactures is determined by average *international* differences in productivity growth, so that changes in domestic production and demand conditions alter only the relative volume of goods produced and traded. In examining how relative resource endowments and changing preferences together influence determine the relative volumes of goods produced and traded, it is necessary to begin with a formal theory of trade. We will consider suitable models of trade in section 2.2. For now we shall briefly discuss the relationship between wealth-varying preferences and allocation decisions in production that would hold in the absence of trade.

Linder (1961) first observed that the declining share of primaries in aggregate production and consumption can be attributed to its large "necessary" or "subsistence" component at low levels of income, leading countries with similar per capita incomes to produce and trade similar goods. The existence of minimum consumption requirements for different goods implies that income elasticities of demand for each good will differ depending on the magnitude of their respective subsistence minimums. Such wealth varying elasticities have been empirically estimated; Atkeson and Ogaki (1996) find economically significant differences in the intertemporal elasticity of substitution between rich and poor countries, and estimate substantially higher subsistence levels for food compared to non-food requirements (pp. 518-19). Deviations from homothetic demand are also found to be significant in Hunter and Markusen (1988), and a particularly low income elasticity is estimated for the demand for food.[2] The estimated wealth-varying expenditures reveal an average income-elasticity for food of considerably less than 0.45, while elasticities for other goods and services were generally greater than 1 (with the exception of furniture, fuel, and education). Leisure, transportation and communication, and medical expenditures are among the categories with the highest elasticities, with estimates of 1.4, 1.7, and 1.9 respectively.

The relatively high income elasticities for these last commodity groups, which have a large service component relative to the other commodities, supports the conclusion that the expenditure share on services generally rises with income. The fact that the marginal propensity to consume is substantially lower for food compared to all other commodities is also significant; by separating commodity production into separate groups representing primaries and manufactures, one should expect considerable variation in patterns of consumption between the two groups as the economy develops. As per capita incomes rise, an income-elasticity below 1 suggests that the share of primaries in GDP declines.[3] In turn, the share of manufacturing in the value of total output may either rise or fall depending on the relative magnitude of the consumption bias towards services.

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[2] These results are derived from estimation of an aggregate linear expenditure system (LES) on 11 commodity groups for a sample of 34 countries, each country's expenditures measured in terms of its purchasing power parity estimates.

[3] Assuming similar rates of productivity growth in both traded goods sectors, and in turn a constant relative price, a declining relative share in the value of total production (GDP) is synonymous with slower growth in actual output. In the case of lower productivity growth in the agricultural sector, the relative price of

In summarizing these perspectives we arrive at a complete (closed-economy) description of the commonly observed development pattern. As per capita income grows, the share of services in the value of total output rises while the share of primaries falls. A higher average income elasticity of demand for the former raises the expenditure share, although much of this increase can be attributed to rising relative prices with little variation in the relative quantities consumed. Finally, the manufacturing share tends to rise at early stages of development and then to decline gradually as the value of services begins to dominate in the later stages.

When expanding the model to allow for trade, it is necessary to consider how each dimension of the unbalanced growth path is altered, including the growth, levels, and structure of production throughout the development of the small open economy. So far we have examined how, in the absence of trade and international capital movements, shifts in the structure of production can be attributed to relative domestic demand for each commodity group at varying levels of per capita income. Since international trade represents a highly significant proportion of economic activity in many countries, changes in relative global demand are equally important in an examination of production decisions. If, for instance, there is a shift domestic demand without a proportional shift in world demand, the resulting excess demand could initiate a change in the composition of both exports and imports without any change in the structure of output. Conversely, shifts in global demand may alter domestic production decisions irrespective of any change in the level of development at home. The direction of such changes in the composition of production or trade clearly depends on a country's particular levels of production and desired consumption at any given moment in time. The following sections draw upon the familiar notion of comparative advantage to examine the static determinants of trade. The concepts developed here will be instrumental in analyzing the dynamics associated with country development and changing global demand that are considered in Chapter 3.

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primaries in terms of manufactures is expected to rise over time and the negative association between per capita income and the relative quantity of primaries produced is even more pronounced.

2.2 TRADE AND SOURCES OF COMPARATIVE ADVANTAGE

A country may have a relative cost advantage in the production of some goods which forms a basis for trade with countries whose relative advantage lies in the production of a different set of goods. In the broadest sense, comparative advantage in the production of a particular good implies that the country can "transform" resources into this good more easily than other countries. In other words, if for a particular country the ratio of additional production of a particular good to the amounts of other goods forgone resulting from the reallocation of the factor(s) of production between industries exceeds that of other countries, then this country is said to have a comparative advantage in that industry.

There are two standard approaches to defining the source of comparative advantage, one emphasizing differences in technical efficiency in production and the other focusing on the relative abundance or scarcity of productive factors between nations. Diverging technologies in production form the basis for trade in the standard *Ricardian* model. The important feature of the model is that, given the homogenous input into production, there exists a constant rate of transformation between industrial output. That is, each country is characterized by a linear production possibilities curve. In the familiar two-country, two-good scenario a higher relative output to labour ratio in a particular industry will usually result in complete specialization of both countries in producing the good in which they are relatively most efficient.

The Ricardian model offers a highly simplified view of patterns of international trade in that it does not rely upon knowledge of the source(s) of a country's technological advantage in production. Often these differences in "technology" stem from differences in the organization of production or disparities in the types and quality of factors employed. They represent a gap in technical knowledge which, once embodied in a blueprint, a scientist or technician, machinery or some other tangible object, is perhaps more adequately described by a relative abundance (or scarcity) of one or more intermediate inputs. This view is consistent with the Heckscher-Ohlin formulation of comparative advantage, where differences in a country's internationally immobile factors or production determine the direction of trade.

Owing to the theory's somewhat more specific treatment of comparative advantage, we limit our attention to the Heckscher-Ohlin model of trade. Indeed, one of

the model's main drawbacks involves the extreme difficulty in measuring the virtually infinite number of distinct intermediate inputs into each production process. Nevertheless if we consolidate the numerous factors into a few tractable groups – in other words, if we can permit a relaxation of the criteria that are used to define a homogenous input – then a number of desirable features of this model stand out when compared to the Ricardian approach. The first is that a relative factor abundance view of comparative advantage is amenable to describing changing patterns of trade resulting from dynamic processes such as capital accumulation and resource depletion. Somewhat related to this, the model is explicitly based on diminishing returns to each input, and is therefore compatible with a Solow-type model of growth previously discussed.

2.2.1 The Heckscher-Ohlin-Samuelson Model

The precise model discussed here is derived from the familiar formulation of Paul Samuelson, in what has come to be known as the Hecksher-Ohlin-Samuelson (HOS) model of trade. Each country is assumed to share identical technologies in the production of various goods and, in the simple model, identical preferences in the consumption of these goods. Yet the production of each commodity involves varying factor intensities; aircraft manufacturing, for instance, may require more capital per unit of labour than can be presumed to be the case in, say, the textile industry. Drawing upon the price definition of capital abundance, it follows that, in a situation without trade, in order for two countries with asymmetrical endowments of capital and labour to produce and thus to consume identical quantities of aircraft and textiles, the wage-rental ratio must be higher in the capital-abundant country compared to the labour-abundant country.[4] This reflects the general property of the production functions for each of the two goods, which are characterized by constant returns to scale and diminishing returns to each individual

[4] See Bhagwati (1997, chapter 2) for logical proofs of the Hecksher-Ohlin theorem using both the *physical* and *price* definitions of factor abundance. Where the physical definition is used, the proof proceeds by showing that at a common commodity price ratio, a higher (X/Y) ratio is produced in the capital-abundant country (call it Country I) if X is the capital intensive commodity compared to labour-abundant Country II and, given common preferences (the ratio X/Y in consumption is the same in both countries), it is deduced that $(P_X/P_Y)_I<(P_X/P_Y)_{II}$, which is the basis for the argument that the capital-abundant industry exports the capital intensive commodity. With the price definition, which is used here, $(P_X/P_Y)_I<(P_X/P_Y)_{II}$ follows directly from $(r/w)_I<(r/w)_{II}$, where r/w is the price of capital in terms of the price of labour, which derives from a strictly quaziconcave production function (or declining marginal productivity in each factor) and hence a lower relative price for the abundant factor.

input.[5] Because factors of production are assumed to be immobile across national borders but are freely allocated between industries, this factor price differential exactly offsets the relative physical abundance of each factor. Thus the relative per unit costs of producing textiles in the capital abundant country, due to the relatively high labour requirement, is expected to be higher than in the labour abundant country. That is, in the single-factor Ricardian model the pre-trade commodity price ratio is shown to be equal to the inverse of the labour productivity ratio whereas, in the Hecksher-Ohlin model, it can be demonstrated that the pre-trade price of the commodity using the country's abundant factor intensively will be lower than in the other country (Bhagwati 1997, p.40).

This result is summarized in Figure 2.2. For a given capital to labour ratio in each country, the production possibilities frontier is represented by A_kT_k in the capital abundant country and A_lT_l in the labour abundant country. Since the production of aircraft requires more capital relative to labour, output is relatively higher in the capital intensive country when all of its resources are devoted to aircraft production ($A_k > A_l$). A community of indifference curves, reflecting identical and homothetic preferences, determines the autarky price ratios in each country. Here, the relative price of aircraft in

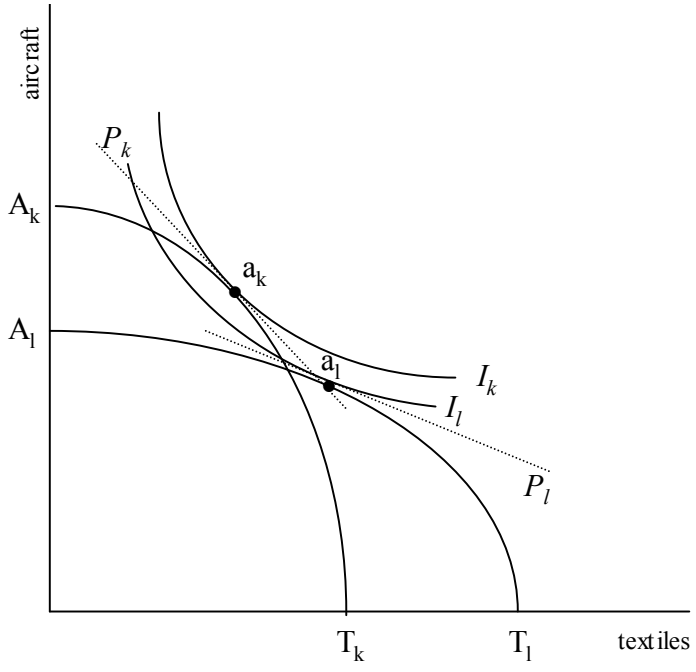

Figure 2.1
Relative Prices in Autarky

[5] Strictly speaking, the production possibilities frontier is mathematically convex.

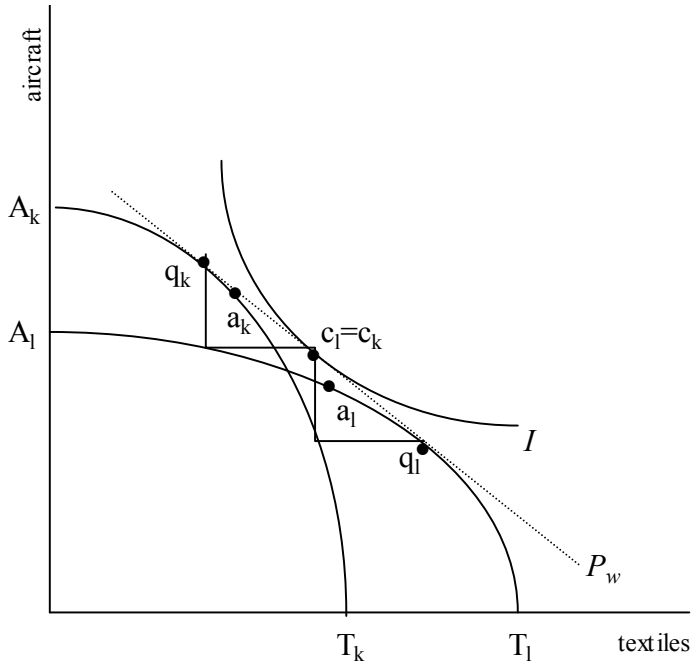

Figure 2.2
Free Trade Equilibrium

terms of textiles is lower in the capital-abundant country in comparison to the relative price in the labour-abundant country, where a scarcity of capital makes aircraft relatively costly to produce.

The implications of opening up the model to allow for international trade is that a country will tend to export commodities that are intensive in those factors in which the country is relatively abundant. This proposition constitutes the Hecksher-Ohlin theorem. Also implicit in this proposition is that if the pre-trade prices are identical between countries then no trade will occur (Bhagwati 1997, p.41). Because both identical preferences and technologies are assumed in both countries, at integrated world prices each country will want to consume (in terms of both their final and intermediate uses) equal shares of both commodities.

Figure 2.2 depicts the new free trade equilibrium. Given that it is relatively expensive to produce labour-intensive goods in the capital abundant country (and likewise capital-intensive goods are relatively expensive to produce in the capital scarce country), the capital-abundant country gains by importing the labour-intensive good at a lower world price while at the same time selling the capital-intensive good abroad at a price higher than in autarky. This change in demand that results also implies a shift in production. At the world relative price of aircraft P_w, the capital-abundant country now

produces at point q_k instead of at a_k along it's production possibilities curve, while the labour-abundant country moves from point a_l to point q_l. In this diagram both countries consumed $c_l = c_k$ units of each commodity. This is only a special case owing to the particular levels of production in each country and the resulting terms of trade. The aspects of the free trade equilibrium worth noting, however, are that consumption now lies on a higher indifference curve in each country and that the relative quantities of each commodity consumed is the same in each country. Another significant result is that the possibility for trade causes each country to become more highly specialized in the good that employs the abundant factor more intensively. It follows that the more two countries differ in their relative factor endowments, the more highly specialized each country becomes in that commodity which is relatively inexpensive to produce and the higher the volume of trade between them.

A number of other important properties of this model can also be derived. For a detailed discussion on these, including the Stopler-Samuelson and Rybczynski theorems, the reader is referred to chapter 5 of Bhagwati and Srinivasan (1983). As noted above, there is a direct relationship between factor-price and the autarky goods-price ratios. Specifically, a lowering of the relative price of a factor is associated with a lowering of the relative autarky price of the good that uses the factor intensively. This result is intuitively obvious since the relative costs in the industry which uses intensively this factor is bound to rise. This relationship also runs in the reverse direction. If the relative price of a good in the economy rises, which in free-trade equilibrium implies that the relative world price has also risen, then the competitive rewards in terms of final output of the factor used intensively in this sector must also increase relative to the other factors.

This raises the question as to how the relative prices of the productive factors differ according to the difference between the autarky and free-trade goods-price ratio. Here we appeal to the well-known *factor-price-equalization theorem*, which states that under constant returns to scale, free trade in commodities equalizes the relative factor prices in both countries as long as each country produces a positive quantity of each good. A concise interpretation of economic logic behind this effect goes as follows. Each country observes a relative increase in the price of the commodity in which it has a comparative advantage since an opening to trade is analogous to a relative rise in demand

for this commodity. The capital-abundant country therefore moves to produce relatively more aircraft and fewer textiles while the labour-abundant economy moves in the opposite direction. Because a reduction in textiles production releases more labour relative to capital whereas the increase in aircraft production requires relatively more capital to labour, an excess demand for capital emerges in the capital-abundant country, causing a rise in the relative price of capital sufficient to establish a new equilibrium. Similarly the relative price of labour rises in the labour-abundant country. Since the relative price of capital in autarky is higher in the capital-abundant country than in the labour-abundant country, the free-trade adjustment implies that relative factor prices in each country approach each other. In fact, it can be shown that there is a unique factor-price ratio for each commodity-price ratio, establishing the theorem (see Markusen et al. 1995, Chapter 8, for a complete discussion on the uniqueness property of relative factor prices). Moreover, a stronger result is that given identical factor-price ratios (and identical constant-returns technologies in each industry), the relative volume of each factor employed by each industry is also the same in both countries, yielding identical marginal products and equal real factor prices in both countries.

The one snag in the above relationship is that each industry must be active in both countries. However, if relative factor endowments are sufficiently disparate between countries, a situation where a country does not produce one or more goods might arise.[6] That is, if the country is sufficiently scarce in a particular factor, it may be cheaper to not produce the good that uses this factor intensively and to allocate all resources to the other sectors, importing the full quantity of desired consumption of the said commodity. In such circumstances factor-price equalization may fail. Although factor prices are uniquely determined by the value of their marginal products in the operating industries, the prices of the resulting goods, and hence the value of the marginal products themselves, are not since a rising price of the good will be compatible with continued specialization in its production (Bhagwati and Dehejia 1994). A decline in the relative world price of the most capital-intensive commodity, for instance, will not result in a reduction in the returns to capital in the labour-abundant country if no resources are devoted to its production. Naturally if the industry is inactive, no shift in relative production occurs and

[6] For a full account of specialization under the HOS framework see Jagdish Bhagwati (1983, pp. 61-64).

relative factor prices remain unchanged. However, the real returns to both factors decline in the economy that produces the capital-intensive commodity and rise in the economy specialized in the labour-intensive commodity. In the case that two or more goods are still produced, the expected distributional effects among these remaining industries allows for only incomplete adjustment in relative factor prices. In each instance the resulting real price of each factor will differ between countries.

Understanding the circumstances in which factor-price equalization does not hold is desirable since one does not typically observe equal real wages across countries, particularly when examining differences between developed and developing countries. However, observed differences in factor prices need not be a result of specialized production alone. Differences in the quality or productivity of the inputs, if not accounted for, may produce differences in the average compensation received. Scale effects and non-identical preferences can also lead to different factor prices (Bhagwati and Dehajia 1994).

Following the argument in the reverse direction, another important issue is how specialization in one or more commodities alters predictions concerning the pattern of trade. The potential for some countries to specialize in certain sectors may influence the relationship between relative factor abundance and the volume of trade predicted by equal factor prices in each country. As Schott (2000) points out, world production and trade is more adequately described by specialization in segregated commodity groups, and ignoring such specialization undermines the potential of the theory to explain the direction of trade.

Within a two-factor, multi-commodity model of a two-country world, Brecher and Choudhri (1982) show that the factor-content version of the Hecksher-Ohlin theorem remains valid in the absence of factor-price equalization, and also holds when the model is generalized to include trade-impediments, intermediate goods, or additional countries (except when the first of these extensions is combined with either of the other two). Their paper extends Deardorff's (1979) theoretical discussion of the chain proposition in the presence of unequal factor prices, tariffs, and intermediate goods.[7] In Vanek's (1968)

[7] The chain proposition is the idea that, having ranked each commodity in order of relative factor intensities, all of a country's exports must lie higher on this list than all of its imports. Deardorff finds that

article on the factor composition of trade with n factors and $m > n$ commodities, identical factor-income shares in each country means that the net factor flows through international trade will be uniquely ranked according to each country's relative factor endowments. Even without factor-price equalisation, however, it is shown that a dollar's worth of any commodity exported by the capital-abundant country uses absolutely (as well as relatively) more capital and less labour than a dollar's worth of any commodity exported by the labour-abundant country. Therefore in the multiple-country, many-commodity case, it is possible to identify a weaker form of the Hecksher-Ohlin theorem, or what is commonly known as the *Heckscher-Ohlin-Vanek* (HOV) theorem, namely that the value of exports from each country will on average be composed of relatively more of the abundant factor and relatively less of the scarce factor.

2.2.2 Dissimilar Preferences as a Basis for Trade

Continuing from the above example, trade need not occur between the two countries if either consumption in the labour abundant country is sufficiently biased towards textiles (the labour-intensive good) or if preferences in the capital-intensive country favour aircraft. In both instances consumption demand bids up the price of the commodity which is relatively inexpensive to produce domestically, eroding the relative price differential and hence the motivation for trade.

One prevalent source of variation in consumer preferences between countries is the level of per capita incomes. Even where underlying tastes can be assumed to be fundamentally the same, we have already considered circumstances in which differences in per capita incomes induce discrepancies in the distribution of expenditures between commodities. Insofar as some expenditures can be distinguished as necessary for subsistence while others can be classified as luxury items, one can naturally expect consumption in low-income countries to be biased towards subsistence goods, while only in the relatively rich countries would there exist a notable demand for luxury goods.

Depending in which type of commodity each country (rich/poor) has a comparative advantage, wealth-varying preferences can raise or dampen the volume of

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this propostion holds in the absence of factor price equalization, whether the inequality is the result of complete specialization or barriers to trade. The additional assumption of traded intermediate goods invalidates the proposition only when in conjunction with trade impediments.

trade. Whether one proceeds on the basis of technological differences (as in the Ricardian model) or differences in relative factor abundance in evaluating the direction of trade, a convincing case can be made for why the volume of trade is actually less than what is anticipated under homothetic preferences. In the Ricardian model, a positive relationship between a country's wealth or level of development and the technological advancement implies lower trade when the technologically "sophisticated" commodity is also characterized by income-elastic demand. Similarly, income-elastic demand for the capital intensive good implies lower trade given a positive relationship between per capita income and aggregate capital stock per worker.

This is in fact what some recent studies have found. Deviations from homothetic demand are found to be significant in explaining country trade patterns in Hunter (1991) and Hunter and Markusen (1988), where particularly low income elasticity is estimated for the demand for food. To gain a sense of the degree to which preferences might affect the pattern of trade, Hunter and Markusen (1988) estimate the volume of trade *potentially* explained by varying income elasticities in a static context by measuring the difference between actual consumption of each commodity group and a homothetic consumption share of each good based on the world average.[8] They estimate that due to differences in per capita income alone, 13.4% of all consumption expenditures are traded.

Hunter (1991) extends this analysis to conduct a counterfactual exercise aimed at measuring the (potential) volume of trade owed to non-homothetic preferences. To accomplish this, she draws upon earlier work (Hunter and Markusen, 1988) in estimating a world linear expenditure system (LES), which provides estimates of the share of each commodity in a country's aggregate consumption based on per capita incomes.[9] The fitted values of consumption for each country are then used to estimate net trade flows.

[8] This estimate abstracts from trade due to differences in factor endowments and price differences by assuming that each country produces each commodity in equal proportions. The fact that this is only the *potential* volume of trade explained by non-homothetic preferences is emphasized; Linder's (1961) hypothesis that production responds disproportionately to domestic demand, and the negative relationship between economic growth and the share of production that agriculture represents both suggest that actual trade due to income differences is less than this measure.

[9] A sample of 34 countries and 11 commodity groups is used to regress of the value of consumption on commodity prices and income, measured in real (purchasing power parity) 1975 exchange rates derived by Kravis, Heston, and Summers (1982). The 11 commodity groups considered are Food, Beverage and Tobacco, Clothing and Footwear, Gross Rent, Fuel and Power, House Furniture, Medical, Transportation and Communication, Recreation, Education, and Other.

Next, trade flows are estimated using a "neutralized" or homothetic consumption estimate, where each country's consumption is determined entirely by its share in world income, thereby equalizing the consumption share of each commodity in all countries. The trade vectors corresponding to homothetic and non-homothetic consumption are then used to find total trade in each case, and the ratio is calculated as measure of the contribution of nonhomothetic preferences to trade.[10] The estimated value of 1.29 suggests that under the assumption of homotheticity trade should be expected to be 29 percent higher in volume when compared to trade with nonhomothetic preferences. In other words, consumer tastes may account for as much as one-quarter of inter-industry trade.

Markusen (1986) devises a model that attempts to account for the low volume of inter-industry compared to intra-industry trade, focusing on the distinct roles of economies of scale and non-homothetic preferences. Specifically, intra-industry trade involves trade in non-homogenous, capital-intensive, manufactured goods while inter-industry trade occurs between manufactures exporters and exporters of a homogenous, labour-intensive commodity (possibly primaries). Dividing the world between the capital-abundant 'North' and labour abundant 'South', it follows that intra-industry trade occurs between the northern economies, while inter-industry trade describes North-South trade. The interesting feature of the model is that if low income-elasticity of demand for the labour-intensive good is assumed, disparity in incomes between North and South lead to reductions in North-South trade while increasing intra-industry trade in the North.

A special note is made, however, that the connection between factor-intensity and income elasticities, namely that the commodity that is largely the subsistence good should necessarily be the 'labour-intensive' commodity, has not yet been established. Where this hypothesis fails, it can no longer be said that nonhomothetic preferences cause North-South trade to lag behind North-North trade, even though this might be the pattern observed.[11] Nevertheless, the model formalizes one aspect in which trade is influenced by preference structure, and also incorporates taste for variety. A heightened preference

[10] "Total trade" refers to inter-industry trade only since by summing over the absolute values of estimated *net* trade flows intra-industry trade is, by definition, excluded.

[11] Markusen notes that trade between industrialized countries is very large in comparison to the volume of trade between the industrialized and developing world. Schott (2000) also makes this observation, citing that out of the 25 percent of total US imports in 1994 originating from either wealthy or poor countries exclusively, 24 percent is imported from rich countries and the remaining 1 percent from poor countries.

for variety as incomes rise might explain why industrialized countries with similar endowments (or technologies) trade substantially among themselves in similar categories of goods, assuming that each country specializes in a unique variety or brand of the good concerned.

2.3 TOWARDS AN INTEGRATED VIEW OF UNBALANCED GROWTH AND TRADE

Having formally summarized the dominant theories of comparative advantage and trade, an important question is whether these perspectives of the open-economy can be reconciled with observed patterns of development. In Chenery's (1961, pp. 27-28) discussion of the various models in a general equilibrium framework, his chief criticism is that the notion of comparative advantage has principally been treated as a static concept. In addressing existing conflicts between trade theory and growth theory, for instance, he emphasizes the importance of a dynamic concept of comparative advantage, whereby efficiency levels in production and quality of factors change over time, external economies may arise, and variable income and price elasticities affect an economy's long-run terms of trade. Since his critique of classical and neo-classical trade theory, the numerous developments in the field have offered new avenues for dealing with these shortcomings of the traditional model. In the context of the unbalanced growth path previously discussed, however, the present study is concerned with the last of these criticisms. Examining the effects of growth and wealth-varying elasticities of demand on international trade is a preoccupation of the following chapters. However, it will be useful to touch upon a few related points here before proceeding to the next section.

First, in elevating the standard models of trade to a dynamic context, time-dependent concepts such as capital accumulation and technological progress need to be taken into consideration. An excellent theoretical discussion of how accumulation affects patterns of trade is provided by Leamer (1987), extending the standard general equilibrium Heckscher-Ohlin model to include three factors of production and multiple goods, offering a diagrammatical analysis of the expansion paths of the production and trade equilibrium as capital is accumulated. By introducing a third factor, land, a number of different possibilities describing the development process can be offered. Specifically, his analysis demonstrates that countries varying in relative endowments of land will

become involved in manufacturing production at a rate disproportional to respective changes in the amount of capital per worker, assuming industry is relatively capital intensive. In a three-country example with four goods (two of which are particularly land intensive, and two others which require no land at all) and capital accumulation, the structure of production and trade in each country evolves along a unique path, with the relatively land-abundant country specializing completely in one of the land-intensive commodities. Oniki and Uzawa (1965), Kenen (1965), Findlay (1970), and Baxter (1992) provide other interesting examples of the effect of capital accumulation on international equilibrium over time. The important point is that with capital accumulation, investment and hence a country's relative endowments become endogenous.

Mussa (1979) examines the effects of asymmetric technological change on resource-allocation between two sectors and on factor prices, demonstrating that the effect of Hicks neutral technological change is analogous to the effect of a rising relative price of output in the rapidly expanding sector since, owing to a higher level of technical efficiency, the firm can afford to pay more for its factor inputs and still maintain zero profits. As previously noted in the section dealing with unbalanced growth, low average productivity growth in a given sector translates into a gradual rise in the relative costs of producing the commodity concerned, while its relative share of production and consumption over time in the closed economy depends on relative price and income elasticities of demand. With international trade in both physical capital and consumer goods, however, this axiomatic correspondence between domestic production and consumption no longer holds. However, higher relative productivity growth in a particular sector will result, assuming international prices do not change, in an increasing portion of productive resources employed in this sector. In the language of the Ricardian theory, differences in technology and hence a country's relative cost advantage may be a result of the production process itself, such as the concept of learning-by-doing eloquently formulated by Arrow (1961) and discussed at length by Lucas (1993), whereby labour becomes more efficient with the extent of past experience in production. Should opportunities for learned skills be higher in manufacturing compared to agriculture, this might account for much of the correlation between levels of development and the observed pattern of comparative advantage.

3. TRANSITIONAL DYNAMICS, TRADE AND UNBALANCED GROWTH

The objective of this chapter is to explore the long-run relationship between development, changing demand patterns, and the composition of trade. Much attention has been paid to the importance of international trade in economic development and yet, as noted above, the interrelations between trade and growth on the demand side tend to be neglected. As Chenery (1980) observes:

> Sustained economic growth requires a transformation of the structure of production that is compatible with both the evolution of domestic demand and the opportunity for international trade. This transformation normally involves a substantial rise in the share of industry and – except for a few specialized mineral producers – a shift away from dependence on primary exports toward manufactured goods as a source of foreign exchange. (p.281)

This perspective emphasizes the simultaneous importance of domestic demand conditions and demand in the rest of the world in determining resource allocation and patterns of trade.

From a general equilibrium standpoint, an analysis of the effect of changing demand patterns on production and trade should necessarily take into account both the intermediate and final goods sectors. In light of the above discussion, it would seem that low income elasticities for primary consumption goods such as food provide a substantive basis for the general decline in the share of primary production. However, to the extent that raw materials are used in the production of manufactured commodities, changes in the structure of production both at home and internationally can also increase opportunities for primaries trade.

Keeping in view the effect of a general interaction between domestic and international demands on the pattern and volume of production, this section aims to tie together the concepts of unbalanced growth and comparative advantage discussed in the previous chapter as a basis for studying a typology of development. Drawing upon a

simple neoclassical growth model to describe a hypothetical development path for the world as a whole, the potential for both diverging and converging trade patterns to arise is then considered for the case of the small open economy.

3.1 Effects of Growth on the Composition of Trade: A Historical Perspective on Declining Global Demand for Primaries

In Nurkse's (1959) analysis of patterns of industrialization and trade during the first half of the 20th century, primary exports, which constitute the bulk of all trade in the pre-World War I period, considerably lag behind exports of manufactured goods by mid-century. In addition to falling behind the rapidly expanding manufactured goods sector, the volume of primary exports originating from developing countries begins to fall below industrial countries' manufacturing exports for the 1955-57 period (Nurkse, 1959, p.20).[12]

The main finding in his study, and the focal point of the analysis, is that demand for primaries has not kept pace with the vigorous rise in per capita incomes for the period under consideration. Nurkse divides the sources of this asymmetric growth pattern into six 'well-known' characteristics of development. For the present discussion, these six propositions can be summarized into three dominant factors relating to final consumption demand (or Engel's law), intermediate demand, and government policy. The first of these is addressed in the previous section. The systematic decline in demand for primary commodities as intermediate inputs into production is explained by both the structural shift of industrialized country production from light to heavy industry, that is from industries where the content of raw materials in the finished product is high to those where it is low, and from a change in technologies, namely use of synthetic or man-made

[12] This comparison in total primary exports excludes petroleum. The exclusion is made on the grounds that oil deposits are "unevenly distributed gifts of nature, that they are exploited for export in only a limited group of countries, and that the great majority of underdeveloped countries have no means of benefiting from the present petroleum boom." Inasmuch as this lag in developing country primary exports is a consequence of wealth-varying preferences, a factor in which this analysis is particularly concerned, there is justifiable reason for excluding petroleum production from the primary goods sector from the demand side; namely, low elasticity of demand for food, a necessity/interior good will affect agricultural consumption and trade as incomes rise but will not ultimately affect consumption of petroleum or minerals. The latter primary commodities are more suitably classified as intermediate inputs rather than goods for final consumption. Minerals also comply with Nurkse's supply side considerations, but it is noted that mineral exports do not exhibit any significant trends, and hence their exclusion from the primary export measure would not alter the perceived dynamics. See page 21.

substitutes for raw materials. Finally, it is noted that agricultural protectionism has risen among many industrial nations. Since the levels of protection in most manufacturing industries have been reduced with the removal of tariffs and non-tariff barriers in many industrialized countries over the past few decades, rising *relative* protectionism in the primaries sector may be a prominent concern even today.

The separate effects of declining share of primaries in both consumption and production as the economy develops is empirically tested in Chapter 3 of Chenery and Syrquin (1986) for the 1950-70 period. In a comparative study of roughly 90 countries, the differences in the composition of production and trade are examined as a country develops from a level of per capita income below $280 (constant 1970 US dollars) to levels above $2,100. For the entire sample, gross aggregate industry output rose from 151 to 182 percent of value added. This increase represents the rising importance of the intermediate goods sectors in overall production, almost all of which is attributed to a rise in intermediate use of manufactured goods. Intermediate demand for raw materials remains constant in relation to GDP. There is also a marked shift in consumption away from primary goods towards manufacturing and services. Thus at a global level the relative importance of primary production has diminished as world incomes rise, explaining in part the relatively modest growth in developing country exports.

These results correspond more or less to Nurkse's observations concerning industrial growth in the American economy. He notes that despite the United States' increased dependence on foreign raw material resources, the rise in demand has been rather modest in comparison to overall economic growth:

> - Over nearly half a century the raw material consumption of the United States has increased by 98 percent while its own production of raw materials rose only by 70 percent. As a result, from a net exporter of raw materials at the beginning of the present century the United States has turned into a net importer. … the gross national product of the United States has, in turn, increased about 150 percent faster than its raw-material consumption. Most striking of all is the fact that the United States manufacturing production has increased more than three times as fast as the American economy's intake of raw materials (pp.24-25).

This view stresses not only the decline in the relative importance of primaries in overall consumption but points out the gradual shift in the structure of production as the economy develops.

As the share of raw materials in aggregate world consumption and intermediate production declines, one would expect the consequent lag in expansion of primary exports to affect patterns of domestic production over time. Steadily declining world demand, coupled with the eventual shift in domestic demand towards manufactures and services, translates into fewer profitable opportunities in primary industries, causing available resources to be funnelled into other sectors. Given constant long-run relative costs in each industry, this shift in patterns of resource allocation is reflected in a tendency for accumulated or newly invested capital to be disproportionately allocated in manufactured commodity production. Thus in a dynamic interpretation of the classic development model there are two rates of change to consider: the rate of expansion of demand (both domestic and global) and the rate of increase of productive resources relating to a country's comparative advantage.

Previous studies by Chenery and Taylor (1968) and Chenery and Syrquin (1975) highlight a number of interesting observations that lend support to the hypothesized relationship between development and trade. First, a comparison of small, primaries-oriented and manufactures-oriented economies reveals a gradual rise in the share of manufactures in total exports associated with rising per capita incomes among both groups, although this rise is generally more pronounced for manufactures-oriented countries.[13] A second and related observation made by Chenery, Robinson, and Syrquin (1980) is that the relative contribution of primary exports to overall growth declines with per capita income while that of manufactures exports rises among all country groups.[14] Moreover, there is an even more pronounced decline in the relative importance of domestic demand for primaries in economic growth as per capita incomes rise. Finally, notable differences exist between country groups. While total trade gains in relative economic significance at each stage of development in the case of the manufactures-

[13] In Chenery and Syrquin (1975) and Chenery, Robinson, and Syrquin (1986), multisector comparative analysis generally distinguishes between 'large' and 'small' countries based on total GDP, and between small 'manufactures-oriented' (SM) and 'primaries-oriented' (SP) countries accoriding to a tabulated trade-orientation index. The index, which classifies countries according to whether the relative contribution of primaries to total exports is lower or higher than the predicted average export bias, is described in detail in the Technical Appendix in Chenery and Syrquin (1975). In Chenery and Taylor (1968), classification of manufactures-oriented and primaries-oriented countries is based on relative scarcity or abundance of natural resources.

[14] The percent contribution of each factor to overall growth, measured as the incremental change in the variable as a percent of the total change in output, is provided in Table 6.3.

oriented group, its contribution to growth declines on average for the primaries-oriented countries. In both cases this shift is offset by a change in the relative significance of domestic demand.

These findings are along the lines of what we would expect. Declining global demand for primaries results in a relative reduction in primary commodity trade, while the somewhat more rapid shift in demand at home consolidates the negative relationship between growth and the share of primaries in total output. The observation that average percent contribution of exports to economic growth in the manufactures-oriented countries is rising while the importance of domestic demand declines – a pattern contrasted by the primaries oriented countries – can also be explained by non-homothetic preferences. At low income levels agriculture typically represents the largest sector as well as the largest share of domestic expenditure. The primaries-oriented country will begin by exporting agriculture and importing manufactures, the relative demand for imports rising with income. However, declining relative global demand for primaries results in an excess supply of agricultural exports, leading to the observed shift in production. Because the additional manufacturing output is largely absorbed by rising domestic demand, imports are replaced by domestic production and trade is reduced. The opposite is true for the manufacturing-oriented country, however, since the shift in global demand reinforces its initial trade orientation. A more detailed examination of dynamic country trade patterns implied by non-homothetic preferences is the preoccupation of the final section of this chapter.

3.2 Effects of Trade on Economic Growth

While the above discussion emphasizes the importance of growth in per capita incomes in explaining observed trade patterns, trade orientation is also an influential factor in a country's rate of growth. Specifically, different rates of total factor productivity growth in each sector will lead to varying rates of growth for the economy as a whole depending in which sector it is relatively specialized. Since manufactures are generally characterized by relatively high productivity growth, an open economy that begins as a net exporter of manufactures in the early stages of development will tend to experience higher average growth rates in comparison to the primaries-oriented country.

This commonly noted observation has raised important questions concerning the role of trade policy in promoting long-run development objectives. Echevarria's (2000) analysis, for instance, offers some insight into the implications of long-run specialization for economic growth. In a hypothetical economy where the world price for agricultural commodities is consistently higher than the autarky price, relatively more capital and labour are devoted to the primaries sector at each stage of development. Lower productivity growth in this sector means that the manufacturing-oriented country will converge to a higher steady-state growth rate when compared to the primaries exporter. Bernard and Jones (1996) reach similar conclusions. The key issue addressed in their paper is the role of trade in precipitating aggregate convergence in growth rates among OECD countries, noting that the transfer of knowledge that is embodied in traded goods from industry leaders to its followers tends to increase productivity in the lagging country. However, trade also causes countries to specialize, and therefore aggregate convergence is unlikely given that each country's output will not be equally distributed across the spectrum of high and low productivity sectors. This suggests that trade has the potential effect of thwarting the "natural" or autarky development path of the economy since higher per capita income and the consumption of manufactures can be achieved even without increased production in the manufacturing sector. While it is generally recognized that specialization in primary production is often necessary (and indeed beneficial) at early stages of development, the higher growth potential of many manufacturing industries has led some authors to call for the promotion of industrialization and manufactured goods trade.[15]

Lower average 'productivity' growth should not, however, be taken to mean lower overall welfare in the primaries exporting country. A consequence of trade is a rise in incomes in the form of additional export revenues. This in turn implies a rise in overall welfare and, through the feedback savings mechanism, a rise in investment and productive capacity in future periods. This point is stressed since evidence of low income elasticity of demand for primary commodities has been used to predict a systematic decline in the terms of trade for countries that are heavily reliant upon raw material exports, as predicted in the well-known Linder model. This justification for an

[15] See Chapter 8 in Chenery, Robinson, and Syrquin (1986) for an overview.

import substitution strategy of industrialization is incorrect since the volume of imports supplanted by relatively inefficient domestic production involves a severe long-run welfare loss in comparison to the free trade outcome. See Echevarria (2000) for a discussion of gains from trade when a country specializes in the low growth sector.

Moreover, these predictions concerning the dismal long-run growth patterns of primaries-oriented countries are based on the notion that patterns of specialization will not change significantly over time. Nonhomothetic preferences imply, however, that the share of primaries in global production must decline as the world incomes rise. As Echevarria (2000) points out, this would suggest that over time a lower proportion of global resources would be devoted to producing primaries. In the sections that follow, we describe how this shift in average global production can be linked to patterns of development observed at the country level. It is useful to begin with the demand side with a model describing the average path of production and consumption for the world as a whole.

3.3 A Simple Model of Global Production

The model chosen to investigate the average world pattern of production over time closely resembles the closed-economy models of Echevarria (1997) and Kongsamut, Rebelo and Xie (2001). It should be noted that both papers differ widely in their assumptions, the latter being considerably more restrictive, and therefore lend themselves to different predictions concerning the behaviour of production over time. Echevarria's analysis devotes attention to the effect of different production structures and differential rates of technological change in each sector on growth of the economy over time. The Kongsamut-Rebelo-Xie (KRX) model, by contast, abstract from such differences altogether, arriving at a hypothetical growth path featuring constant relative commodity prices and constant returns to capital. The primary focus of their work is to provide a simplified dynamic perspective of development that is consistent with both the Kaldor and Kuznets facts rather than to consider the transitional dynamics associated with a reallocation of resources between sectors and their effect on overall economic growth.[16]

[16] Kaldor's facts stem from the observation that the growth rate of output, the capital output ratio, the real interest rate, and the share of labour in aggregate income are all roughly constant over time. Kuznets, as

As a result, Echevarria's simulations generate much richer dynamics which, given the close symmetry of her results with observed cross-country patterns of growth and sectoral trends in the value of output, will form an integral part of the theoretical discussion. However, many simplifying assumptions render the KRX model easy to solve, and have the added benefit of emphasizing the role of preferences in determining production outcomes. Therefore even though this analysis begins by developing a rather unrealistic view of the representative economy by emphasizing the KRX development, more elaborate considerations and complications are introduced along the way.

Both papers make use of a neoclassical growth model defined in terms of three sectors representing primaries or agriculture, manufactured goods, and services. Each sector employs capital and labour, and exhibits constant returns to scale in both inputs. In addition, the common assumption is made that physical capital is produced in the manufacturing sector and subsequently invested in each of the three sectors. Intermediate product demand, therefore, is strictly in manufactured goods, ignoring the potential importance of intermediate use of raw materials in aggregate demand discussed above. Nonetheless, because most raw material inputs are used up entirely in the production process (in other words, they have a 100 percent depreciation rate), the effect of including the additional input in the analysis is of less interest than capital accumulation from a dynamic point of view. Moreover, Kongsamut et al. dismiss the practical significance of including additional intermediate goods based on an examination of U.S. input-output tables, whereby manufacturing and construction account for between 90% and 93% of all investment for the 1958-87 period. Finally, it is assumed that the representative economy has a fixed supply of labour which is continuously employed and normalized to 1 in order to isolate the effects of increasing productivity. The production structure can thus be expressed by the following system of equations:

$$A_t = \Gamma_{At} F(\phi_t^A K_t, L_t^A), \tag{3.1}$$

$$M_t + \Delta K_t = \Gamma_{Mt} G(\phi_t^M K_t, L_t^M), \tag{3.2}$$

$$S_t = \Gamma_{St} H(\phi_t^S K_t, L_t^S), \tag{3.3}$$

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previously mentioned, notes that growth in per capita income is typically accompanied by a shift in the structure of production out of agriculture and into manufacturing and services.

$$\phi_t^A + \phi_t^M + \phi_t^S = 1 \tag{3.4}$$

$$L_t^A + L_t^M + L_t^S = 1 \tag{3.5}$$

$$\Delta K_t = K_{t+1} - K_t \tag{3.6}$$

$$K_0 > 0 \tag{3.7}$$

The variable ϕ^i denotes the fraction of total capital K_t devoted to sector i, L^i is the share of labour, and Γ_{it} represents the rate of technological change. Labour and capital are completely mobile between sectors. Primaries A_t and services S_t are produced for final consumption, while manufacturing output can be consumed (M_t) or invested (ΔK_t). Assuming that each production function is homogenous of degree one, this is essentially the same model employed in Echevarria's (1997) analysis expressed in a slightly more general way.

Assuming for simplicity a constant interest rate r, it is possible to consider relative price movements of the three sectors in response to differential rates of productivity growth in each sector.[17] The present discounted value of profits in each sector, measured in units of manufactured goods, are given by:

$$\sum_{t=0}^{T}\left(\frac{1}{1+r}\right)^t \left[p_{At}\Gamma_{At}F(\phi_t^A K_t, L_t^A) - w_t L_t^A - \Delta\phi_t^A K_t\right] \tag{3.8}$$

$$\sum_{t=0}^{T}\left(\frac{1}{1+r}\right)^t \left[\Gamma_{Mt}G(\phi_t^M K_t, L_t^M) - w_t L_t^M - \Delta\phi_t^M K_t\right] \tag{3.9}$$

$$\sum_{t=0}^{T}\left(\frac{1}{1+r}\right)^t \left[p_{St}\Gamma_{St}H(\phi_t^S K_t, L_t^S) - w_t L_t^S - \Delta\phi_t^S K_t\right] \tag{3.10}$$

where p_i denotes the relative price of good i in terms of manufactures. The firms' first order conditions for profit maximization equate the marginal value products of labour and capital to the real wage and real interest rate, respectively (there is no depreciation of capital). The resulting zero profit conditions in each sector are given by:

$$p_{At}\Gamma_{At}F(\phi_t^A K_t, L_t^A) = w_t L_t^A + r\phi_t^A K, \tag{3.11}$$

[17] In a closed economy model, the assumption of a constant real interest rate is unrealistic, especially at early stages of development where the capital stock is particularly low (see King and Rebelo, 1993). However, Kongsamut et al. (2001) consider a specific transitional path featuring a constant interest which they refer to as the *Generalized Balanced Growth Path*. The assumption is therefore adopted for both ease of exposition and to highlight other important differences between their model and the one employed here.

$$\Gamma_{Mt} G(\phi_t^M K_t, L_t^M) = w_t L_t^M + r\phi_t^M K, \tag{3.12}$$

$$p_{St}\Gamma_{St} H(\phi_t^S K_t, L_t^S) = w_t L_t^S + r\phi_t^S K_t, \tag{3.13}$$

Making use of the profit-maximizing condition that the marginal product of capital is equal to the real interest rate, taking the natural logs for the primary goods sector and differentiating yields

$$\hat{p}_{At} + \hat{\Gamma}_{At} + \frac{r\cdot(\phi_t^A K_t)}{\Gamma_{At} F(\phi_t^A K_t, L_t^A)} \cdot \frac{d(\phi_t^A K_t)}{(\phi_t^A K_t)} = \frac{r\cdot(\phi_t^A K_t)}{\Gamma_{At} F(\phi_t^A K_t, L_t^A)} \cdot \frac{d(\phi_t^A K_t)}{(\phi_t^A K_t)} + \frac{w_t L_t^A}{\Gamma_{At} F(\phi_t^A K_t, L_t^A)} \cdot \hat{w}_t$$

where $\hat{x} = d\ln x = dx/x$. Recognizing that $w_t L_t^A / \Gamma_{At} F(\phi_t^A K_t, L_t^A)$ is labour's share of output in the primaries sector, and denoting this share by μ_{LA}, the above equation reduces to

$$\hat{p}_A + \hat{\Gamma}_{At} = \mu_{LA}\hat{w}_t .$$

Similarly, log-differentiation of the remaining two zero-profit conditions yields

$$\hat{\Gamma}_{Mt} = \mu_{LM}\hat{w}_t, \qquad \text{and} \qquad \hat{p}_S + \hat{\Gamma}_{St} = \mu_{LS}\hat{w}_t .$$

These equations can be used to solve for relative price movements $\hat{p}_A$ and $\hat{p}_S$ in terms of differences in productivity growth between sectors:

$$\hat{p}_A = \frac{\mu_{LA}}{\mu_{LM}} \cdot \hat{\Gamma}_{Mt} - \hat{\Gamma}_{At} \tag{3.14}$$

$$\hat{p}_S = \frac{\mu_{LS}}{\mu_{LM}} \cdot \hat{\Gamma}_{Mt} - \hat{\Gamma}_{St} . \tag{3.15}$$

These last two equations show the negative relationship between the price level in each sector and its own relative productivity growth. In the case of services, we obtain the familiar result discussed in section 2.1, namely, that should labour be used more intensively in this sector compared to manufacturing ($\mu_{LS} \geq \mu_{LM}$), higher total factor productivity growth in manufacturing implies that the relative price of services should rise over time. Insofar as services are not highly traded commodities, the fact that the sector has been included in the model is strictly a formality that provides balance to production and consumption decisions. Since the objective of this section is to examine

the relations between growth and trade, however, attention will be confined to the primaries and manufacturing sectors for the remainder of the analysis.

In the case of the long-run tendency for the relative price of primaries in terms of manufactures described by (3.14) (remember that we are considering prices in autarky to simulate the world economy), the predictions are much less certain. The KRX model predicts constant prices where two essential conditions are satisfied. First, all technological progress must be labour augmenting, characterizing economic growth as an increase in the 'effective' units of labour employed in each sector rather than a neutral rise in the Solow residuals in each sector. Second, all industries are defined by a common production function, each sector employing proportional quantities of capital and labour. This assumption equalizes the rate of productivity growth across sectors, and as a result any relative change in the quantities of each good produced is brought about entirely by a reallocation of productive resources. One is able to verify that under these assumptions equation (3.14) implies:

$$\hat{p}_A = \frac{\mu_{LA}}{\mu_{LM}} \cdot \hat{\Gamma}_{Mt} - \hat{\Gamma}_{At} = (1)\hat{\Gamma}_{Mt} - \hat{\Gamma}_{At} = 0 . \tag{3.16}$$

These conditions provide a rather distorted view of sectoral production patterns. Large difference in average productivity growth between the two sectors are estimated in Echevarria (1997), and with the relatively high average labour share in agriculture estimated in Echevarria (1998) constant relative prices becomes a tenuous assumption.[18] An estimated average labour share of 0.41 for the primaries sector yields a μ_{LA} / μ_{LM} ratio of 1.025. We can use this ratio, along with Echevarria's (1997) productivity growth estimates for the 13 OECD countries considered, to form loose predictions regarding the trend in the relative price of primaries. Given productivity growth in each sector of $\hat{\Gamma}_{Mt} = 1.4\%$, and $\hat{\Gamma}_{At} = 0\%$, it is clear from (3.14) that with no growth in the primaries

[18] The updated estimates for average labour compensation in agriculture, based on Canadian data, provided in Echevarria (1998) are argued to be more accurate than those based on OECD averages presented in Echevarria (1997). The reason for this is that a large portion of proprietor income, which in the absence of more detailed data is conventionally imputed as compensation to capital, is comprised of payments to other factors. Canadian proprietor income statistics are categorized according to property taxes, cash rents, cash wages, room-and-board, building and machinery repairs, livestock purchases and interest, which are returns more appropriately divided between land, labour and capital in Echevarria (1998).

sector the estimated growth in p_A will be positive. That is, the expected rise in the relative price of primaries is an annual 1.435 %.

We attempt to verify this prediction using United Nations producer price index statistics for 24 countries, the trend in the relative price of primaries in terms of manufactures presented in Figure 3.1. It is worthwhile to note that the predicted and actual global price movements, apart from being based on a different sample of countries, correspond to different time periods. Averages in Echevarria (1997) are based on the 1976-85 period, while the UN price indices are available for 1980-1992 only. To attempt to correct for the discrepancy in cross-sectional data, averages are calculated again restricting the sample to nine OECD countries, which do not include Denmark, Finland, France, and Norway. The resulting relative price trend is presented in Figure 3.2.

These figures indicate that the relative rise in the producer price is more pronounced for OECD countries. A comparison of the estimated average annual growth rates for the two sample groups, 1.2% for all 24 countries and 2.0% for the OECD sample, reveals that our predicted growth rate in the relative price of primaries lies perfectly within the estimated rates of increase. However, due to the small number of countries for which sector-specific producer price and labour stock data are available, and given that 'world' averages are not weighted by total output figures, the estimated price movements present

Figure 3.1: Relative Price of Primaries (1990=100)

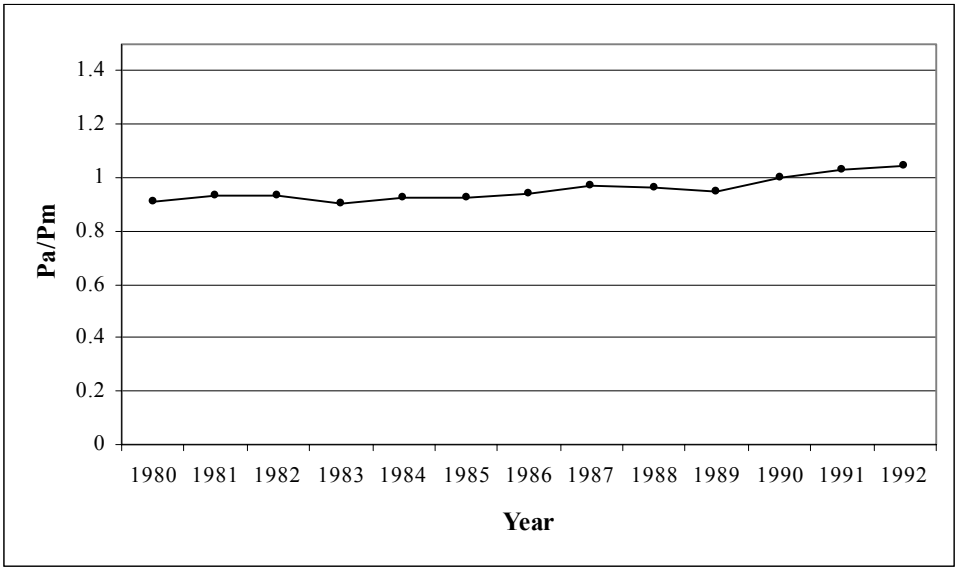
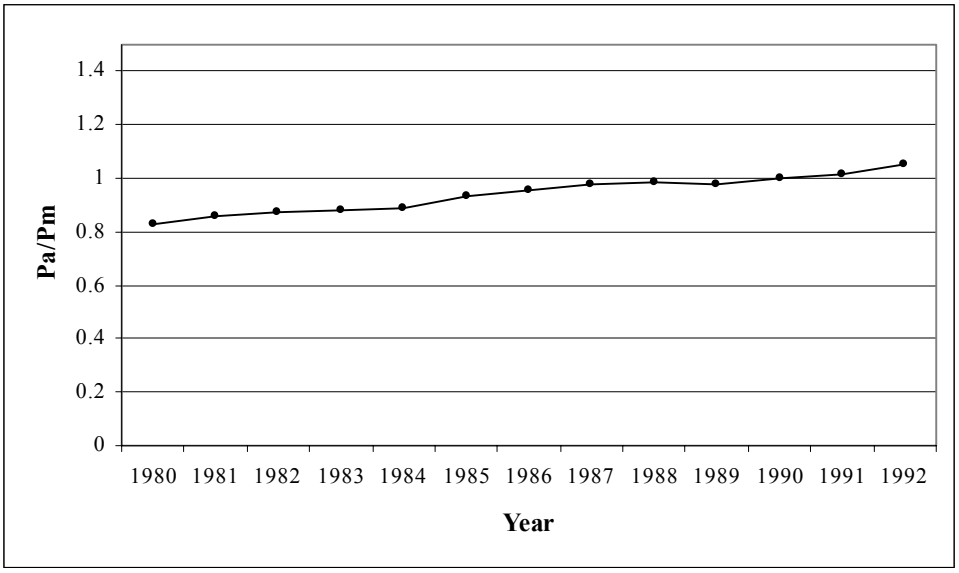


Figure 3.2: Relative Price of Primaries (OECD)



a contentious view of world trends. Nonetheless, the fact that these estimates conform to our expectations given observed productivity growth in each sector, the conclusion that the relative price of primaries is rising with time is not unreasonable from a theoretical standpoint.

These findings highlight some of the limitations of the KRX model, where relative prices are assumed to be constant over time, in forming predictions about global production and trade patterns. And while the more general model initially employed by Echevarria (1997) provides a more accurate description the dynamics we are attempting to explain, the KRX model enables us to consider a simple analytical, closed-form solution to the system without becoming heavily involved in specifying additional equilibrium conditions. In turn, very similar processes are arrived at with considerably less computational effort.

The crucial point in both papers is that conceding to the notion of general non-homotheticity of preferences is necessary to explain the observed downward trend in the relative *share* of primaries in the value of output over time, including the upward trend in services, regardless of how relative prices behave. The theoretical discussion in the previous chapter, however, emphasizes the important role of relative prices in determining trade patterns. We address this issue by considering relative price changes

diagrammatically rather than formally in the following section. For the moment we shall return to the transformation of production hypothesized by the KRX framework.

Given the economy's production structure, allocation of factors between sectors, and hence relative output, requires specific demand assumptions. As is well known, the Cobb-Douglas specification which features homothetic demand and elasticity of substitution equal to unity is not capable of explaining movements in the relative shares of each commodity consumed. A discrete analog of the preference structure proposed in their model can be expressed as:

$$U = \sum_{t=0}^{T} e^{-\rho t} \frac{[(A_t - \overline{A})^{\beta} M_t^{\gamma} (S_t + \overline{S})^{\theta}]^{1-\sigma} - 1}{1-\sigma} \tag{3.18}$$

where $\beta + \gamma + \theta = 1$ and $\sigma, \rho > 0$. These preferences imply that the income elasticity of demand for primaries is less than one while that for services is greater than 1. The variable $\overline{A}$ is interpreted as the subsistence level of food consumption while $\overline{S}$ represents the amount of home production of services, which are substituted for hired services as income rises.

The optimal consumption path is found by maximizing (3.18) subject to the budget constraint:

$$M_t + \Delta K_t + p_A A_t + p_S S_t = \Gamma_{Mt} G(\phi_t^M K_t, L_t^M) + p_A \Gamma_{At} F(\phi_t^A K_t, L_t^A) + p_S \Gamma_{St} H(\phi_t^S K_t, L_t^S),$$

where L_t^i represents the *effective* units of labour employed in sector *i*. Since production in each sector is 'proportional' (*F,G,* and *H* are the same), constant relative prices $p_A = \Gamma_{Mt}/\Gamma_{At}$ and $p_S = \Gamma_{Mt}/\Gamma_{St}$ permit simplification of the budget constraint to:

$$M_t + \Delta K_t + p_A A_t + p_S S_t = \Gamma_{Mt} F(K_t, L_t).$$

Again it is stressed that the assumptions of constant prices and equal factor intensities in each sector, while they seem tenuous given the above discussion, greatly simplify the analysis. The model enables a clear view of how non-homothetic preferences determine the equilibrium outcome, and from this point it is easier to consider cases where these properties do not hold.

Solving the first order conditions for the consumption shares of primaries in terms of manufactures yields

$$p_A A_t = \frac{\beta}{\gamma} M_t + p_A \overline{A} \tag{3.19}$$

Rearranging terms and log-differentiation (remembering to hold prices constant) implies the following growth relation between the manufacturing and primaries sectors:

$$\frac{\hat{A}_t}{A_t} = \hat{M}_t \cdot \frac{A_t - \overline{A}}{A_t}, \tag{3.20}$$

What their model serves to show is that at low levels of per capita income (or equivalently at low A, and M_t), output in each sector does not expand at the same rate. Growth in manufacturing production is constrained by the rate of technological progress (denoted in their model by g), while for A_t close to subsistence the primaries sector grows at a rate less than g. As income rises, however, the subsistence minimum loses importance, yielding asymptotic growth rate g in each sector. Since relative prices are assumed constant, the differential growth rates at lower income levels suggest a decline in the primary shares of both output and employment.

Figure 3.3 depicts the implied expansion path of production and consumption of primaries and manufactures implied by the model. Narrowing our attention to the tradable goods establishes the basis for examining potential country trade patterns below. Before considering the implications for trade, however, it is perhaps useful to relate the

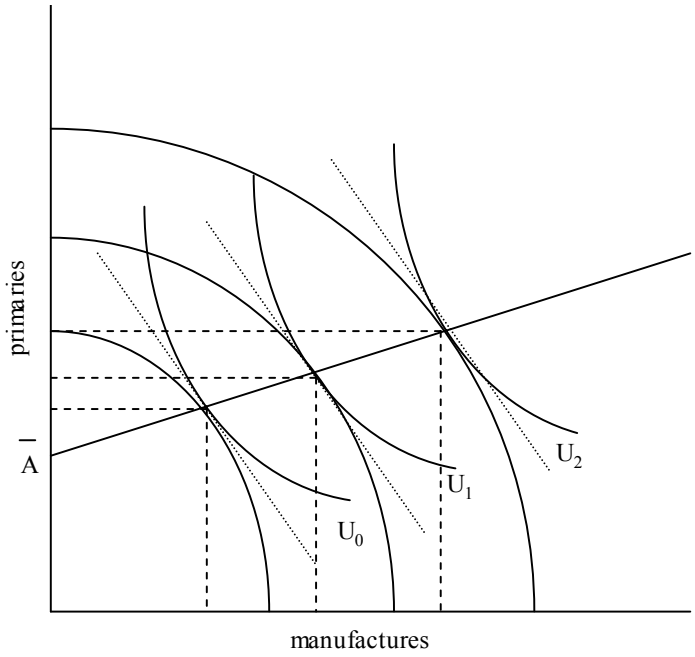


Figure 3.3
Non-homothetic Preferences and Patterns of Global Production

diagram to the properties of the model. The production possibility frontier (PPF) expands at a rate less that *g* since expansion of services is not represented in the diagram. However, manufactures grow at this constant rate while the primaries sector, initially expanding at a lower rate, demonstrates a gradual rise in its relative rate of growth. The expansion path is such that the relative price of primaries in terms of manufactures is constant throughout (represented by the dashed line tangent to both the PPF and indifference curves). At sufficiently high levels of income, then, both sectors expand at the same rate, and preferences do not differ significantly from homothetic ones. Therefore the consumption bias and production bias exactly offset each other at every stage.

While this simple model *could* be used to describe the path taken by the global economy, the predictions do not fit well with observed trends. To the extent that the relative price of primaries rises over time, it is instrumental to consider the marked difference in TFP growth between the two sectors documented in Echevarria (1997). Introducing the possibility of a higher average Solow residual in manufacturing leads to higher relative productivity growth in manufactures at every stage, independent of demand conditions. As can be seen in Figure 3.4, this implies a gradual rise in the relative price of primaries. The quantitative share of primary commodities produced and

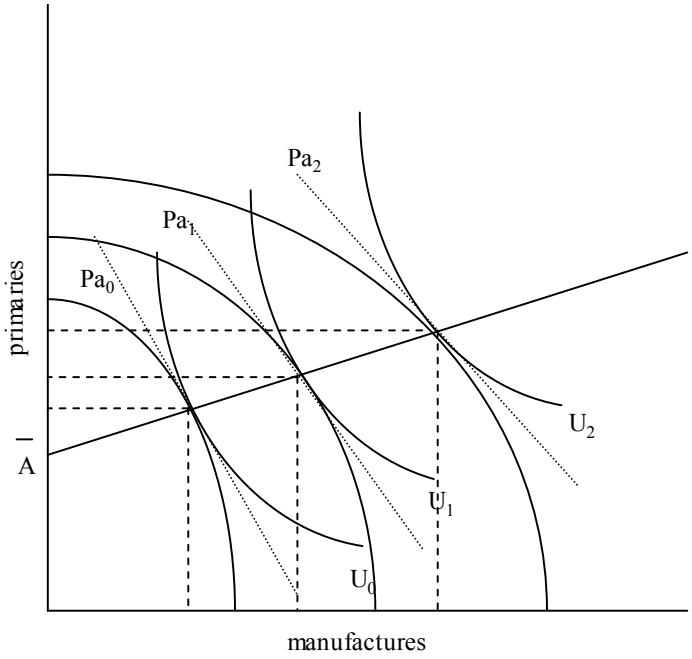


Figure 3.4
Sector Growth and Changes in the Relative Price

consumed also expands at a slower rate relative to manufactures (taking into account the price effect on relative demand). In terms of the relative share of each sector in aggregate expenditure, however, the expansion path represented in both figures are identical.

3.4 DYNAMICS OF TRADE CONSIDERED

Based on these hypothesized global production and consumption patterns, we are able to form certain expectations concerning the evolution of the sectoral composition of world trade between primaries and manufactures. The first is tied directly to the relative shares of each composite good in production and consumption at each stage of development. As the world PPF expands outward, the representative share of manufactures graduates from a percentage of primary production and consumption to accounting for the greater part of overall economic activity. Since the commodities exchanged in world markets are a natural reflection of what is both produced and consumed, this result implies that over time, or as world incomes rise, the share of primaries in global trade should decline. Specifically, non-homothetic preferences imply:

$$\hat{E}_A^W < \hat{E}_M^W \tag{3.21}$$

where $\hat{E}_i^W$ represents growth in world exports (or equivalently imports) of commodity *i*, and where there is no change in the relative price of the two goods. When the gradual rise in the relative price of primaries is accounted for, the implied divergence in the relative shares of each commodity in global trade is amplified:

$$\hat{p}_A + \hat{E}_A^W < \hat{E}_M^W \Rightarrow \hat{E}_A^W < \hat{E}_M^W - \hat{p}_A \tag{3.22}$$

Equations (2.21) and (2.22) are not properties of the model (even if possibilities for trade were introduced). Rather they describe a conjecture that the volume of world exports emanating from each broad commodity group grow in tandem with actual world production in each sector.

The second proposition is somewhat stronger than the first in that, apart from countries moving away on average from primary commodity production and trade, the number of countries that export predominantly primary commodities is anticipated to fall while the number of manufactures-oriented countries is anticipated to rise.

Keeping in view that there exists considerable trade *within* each sector, it is possible to contrast individual country patterns of production and trade by allowing for initial differences in relative endowments of factors of production. There are indeed other important determinants of trade, including domestic trade policies such as import-substitution which has been popular in many developing countries. Country size also has a tendency to affect the volume of trade, since in producing a large variety of products there is generally a reduced reliance upon foreign imports.[19] For these reasons the actual mix of goods traded may not be adequately reflected in the goods domestically produced. For the present purpose, however, it is assumed that each country is similar in openness, size, and preferences, and as a consequence that the availability of productive resources is the only source of differences in patterns of production. Given these assumption, the trajectory of average world demands and relative prices derived in the previous section can be used to examine different possible trade patterns throughout the development process. This method of analysis parallels the two-country framework that typically characterizes HOS models of trade, where the small country trades with the *rest of the world* and, owing to its relative smallness, cannot influence relative prices.

To simplify the analysis further, land is assumed to be the only input which is sector specific in the production of primaries, and which in addition is assumed to be fixed in supply. The reason for considering this particular factor is that endowments of land appear to have a clear connection with the volume of primaries exported in many of the empirical studies concerned with testing various versions of the HOV theorem. Its influence in individual country trade patterns will be considered in the following chapter.

A relatively high endowment of land is reflected entirely in a higher intercept in the PPF on the vertical axis and, assuming land is relatively fixed in supply, its inclusion affects relative growth in each sector through its influence on allocation of the other

[19] Bhagwati 1985, Chapter 10, conducts several cross-country regressions to estimate the influence of each of population, GDP, geographical area, per capita incomes, and percent share of manufacturing value-added on the share of total exports in output. The two size variables, GDP and area, have a significant negative effect on the volume of trade in both the linear and log-linear estimates, although area is only significant for some years. Interestingly, Bhagwati's regression of the share of manufacturing in total exports on the relative share in domestic production were the least satisfactory, yielding significant results only in the case of the log-linear specification and for 2 out of the 4 periods considered. This suggests that, among other difficulties involving data aggregation, that comparative advantage has a relatively minor role in determining overall trade flows.

factors. The conventional assumption of identical preferences across countries is adopted, and thus opportunities for trade arise from an interaction of the country's own endowments and those of the rest of the world.

Figure 3.5 depicts the production of primaries and manufactures over time in a primaries-oriented country, where a larger quantity or quality of the specific factor gives the country an initial comparative advantage in production of primaries. Initially there is higher than average growth in the primary sector since, with a relative abundance of the fixed factor, more labor and capital are devoted to primary production. Over time, however, the comparative advantage in primaries 'wears off' with the accumulation of capital. Since we are assuming there are no fixed factors in manufacturing production, this sector attracts a disproportional amount of accumulated capital (and perhaps skilled workers), absorbing also a larger proportion of available labour over time. Capital accumulation also implies that the relatively fixed factor becomes less important in the production process. For the manufactures-oriented country, the pattern of trade is associated with a more rapidly expanding manufacturing sector and relatively slow growth in primaries (Figure 3.8). The overall growth rates in the primaries-oriented country and manufactures-oriented country will also differ due to differences in productivity growth in each sector.

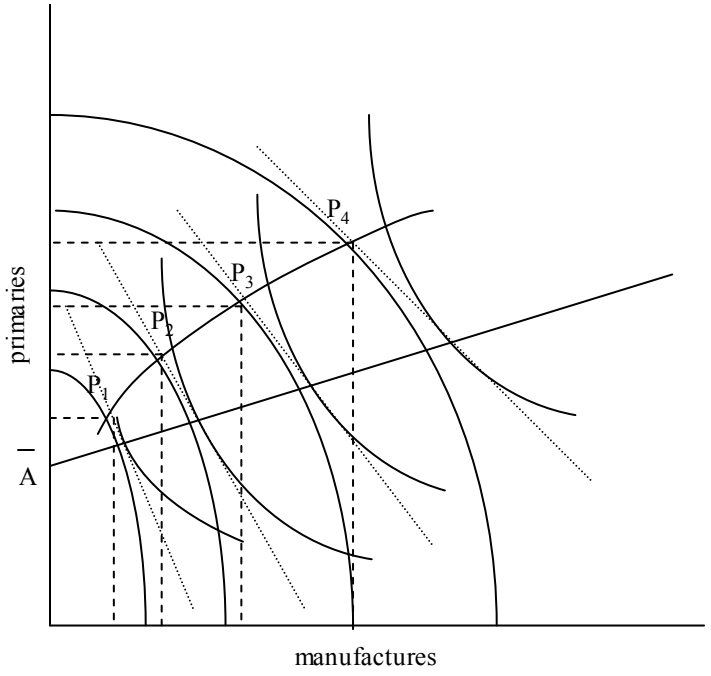


Figure 3.5
Production and Exports in the Primaries-Oriented Country

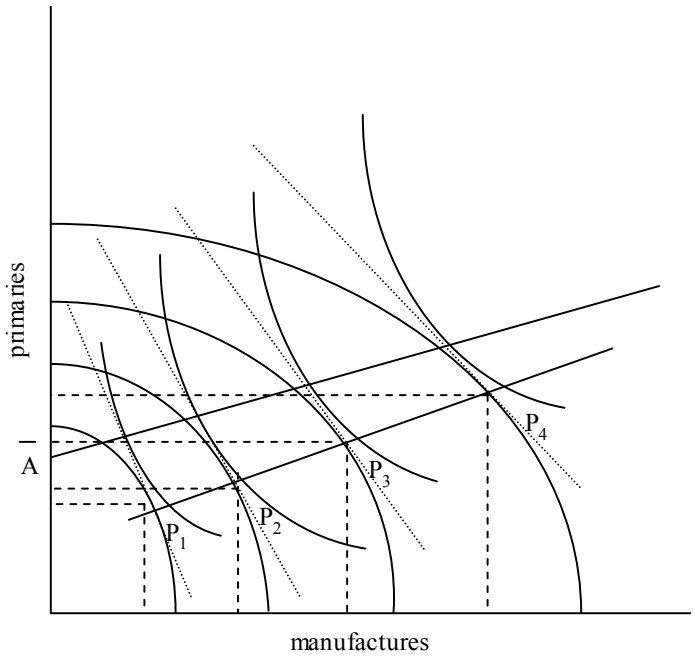


Figure 3.6
Trade in the Manufactures-Oriented Country

Relatively higher growth in the primary sector does not imply that the structure of production in the primaries-oriented economy will not eventually follow a process of transformation similar to Kuznets' fact. It is clear from this example, however, that the speed of transformation is dampened, the time required to reach commensurate levels of manufacturing production depending on the relative endowment of land and on how far behind the country is compared to levels of development in the rest of the world. Given that this model predicts that primaries become more expensive with growth, high average world incomes translates into a wider discrepancy between autarky and world prices, amplifying the country's comparative advantage in primary production. Still, when taking into account the disproportionately high savings in relatively poor countries, a standard feature of the neoclassical growth model, it is possible for growth in capital and output to exceed the rate of increase in the relative price of primaries, leading to an eventual dampening of the comparative cost advantage in primary production.

4. INTERPRETING THE SECTORAL COMPOSITION OF GLOBAL TRADE

In the theoretical discussion of the previous chapter, the relationship between economic growth and the pattern of global production implied by non-homothetic preferences lends itself to an explanation for the receding importance of primary commodities in global trade. As the global economy becomes richer, shifts in overall consumption are weighted more heavily towards manufactured goods, marked by a corresponding fall in the relative importance of agriculture and raw materials in both final and intermediate demand. To the extent that a large portion of manufacturing output entails production of differentiated technologies and consumer goods, one can also expect a gradual rise in the relative share of manufactures in international trade. This chapter is an empirical investigation of this relationship, exploring the degree to which observed trade patterns are consistent with a country's trade orientation and level of development.

A few words must be added in linking the results presented to the theoretical discussion of country trade patterns. As noted in Chapter 2, both the Ricardian model and the standard Hecksher-Ohlin framework with two *homogenous* tradable goods imply that the country exports only that good which is comparatively advantageous to produce. In the discussion so far, therefore, a simple view of the primaries-oriented country referred to a country exporting exclusively non-manufactured goods, when indeed no such country can be found. No explanation for the large amount of trade in differentiated products within these extremely broad categories is needed. However, insofar as the two aggregates make sense in terms of more or less dissimilar production and consumption characteristics, the hypothesized volume of trade in the above analysis is meant to reflect the relative importance of each sector in actual trade. In the following sections, therefore, the relative shares of that the two aggregates represent in total exports is basis for evaluating a country's trade orientation.

4.1 THE DATA

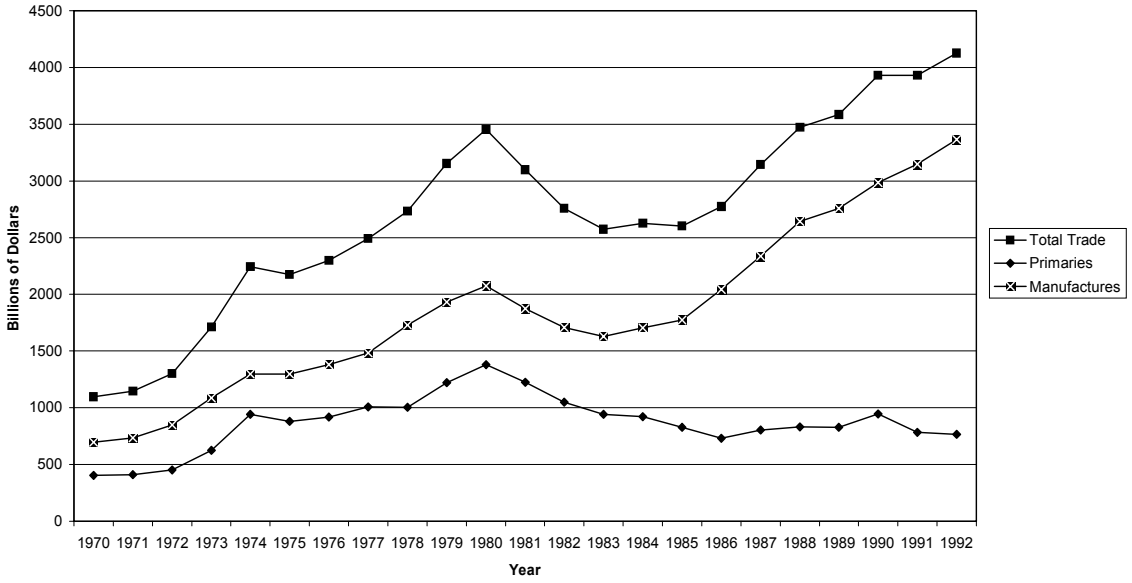
The following examination of global trade patters draws upon data taken from Statistics Canada, which have been converted from the original SITC classification to an industry-based classification system making use of the categories created by the Bureau of Economic Analysis (BEA) of the US Department of Commerce. The dataset spans over 22 years, and consists of bilateral trade data for 165 countries. The WBEA trade statistics are organized according to 34 manufacturing sectors and a 35th "non-manufacturing" group, which more or less corresponds to primary exports, but not entirely so. Details on commodity groups are provided in the discussion on aggregation procedures below.

4.2 GLOBAL TRENDS IN THE SECTORAL COMPOSITION OF TRADE

Trends in the total value of trade (measured in constant 1995 US dollars) for manufactures and primary commodities are presented in Figure 4.1, 'Value of Trade.' As might be expected, the value of total world trade has risen rather dramatically over the 1970-92 period. Save for a short period of decline during the 1982-85 period, the steady climb in world trade has meant a near fourfold increase in its total value, from $1.1 Trillion to $4.1 Trillion. This is compared to a more modest rise in world production (measured in terms of aggregate GDP – World Development Indicators [WDI], 2001), rising from $13.2 Trillion to $27.1 Trillion. Thus exports account for an increasing proportion of overall production and income, rising from approximately 8% of global income in 1970 to 14% in 1992.

This increase in the proportion of trade in overall income, however, can be attributed almost entirely to rising production and trade of manufactures. World primary commodity exports have more than doubled in absolute terms ($336 Billion - $695 Billion), while its relative share in total exports has declined. Similarly, aggregate value-added in agriculture as a share of total world GDP has declined in similar proportions over this period. What one finds is that manufactures make up a rising proportion of overall production and trade. The precise shares of manufacturing in total trade over the past few decades will vary depending on how the category is defined (i.e. whether processed agricultural goods are included), but the observed trend is unaffected.

Figure 4.1: Patterns of World Trade – value of exports (constant 1995 US dollars)



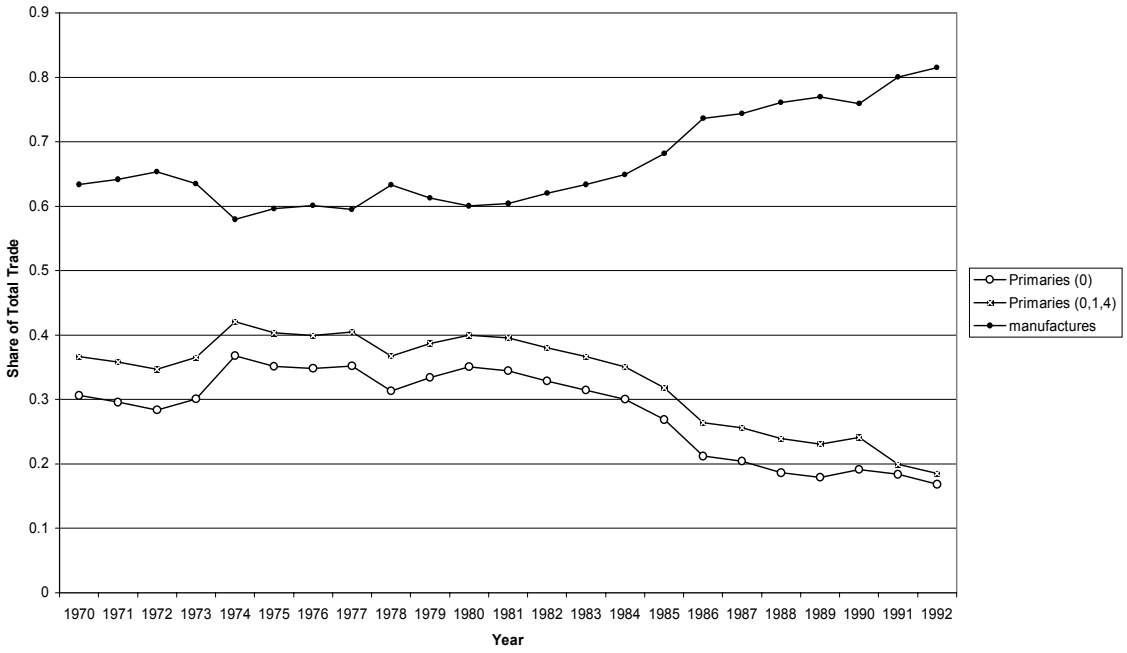
Individual country 'primary' commodity export statistics have been aggregated according to two criteria in order determine whether or not excluding processed materials should make any difference in the analysis of trade patterns. The reason for this initial investigation is that many primary product exporters worldwide could potentially shift between raw and processed commodity trade in response to changing technology, transport costs, or shifts in world preferences, and therefore could cause substantial variation in both aggregate share measures from period to period. Because this analysis is concerned with comparatively long-run trends in the composition of the two aggregates in global trade, the objective is here is to first explore whether any independent dynamics exists in processed food trade, and then to appropriately lump this group into either category. If, for instance, increases in processed food trade are offset by a fall in raw material exports, this counter-cyclical interdependence between the two sectors would suggests that they should be included together under the category of primary exports. If another trend is observed, then it is perhaps preferable to keep to the initial WBEA classification of non-manufactured exports for the remaining analysis.

As mentioned above, WBEA trade statistics are organized according to 34 manufacturing sectors and a 35th "non-manufacturing" group, which more or less

corresponds to primary exports, but not entirely so. Upon examining the list of 34 BEA manufacturing industries and their concordance with SITC codes, it is clear that those SITC categories pertaining strictly to primary products (commodities produced and sold/traded before any processing, packaging, freezing has been incurred) are predominantly excluded from the list. Exceptions include refined petroleum products and gases, metal ores and minerals (mining), wooden boxes and cut stone. Industry categories '1' and '4' consist mostly of oils, extracts, flours, preserves, and other derivatives of the strictly raw materials and produce. Since these two classifications comprise predominantly of what can be properly considered processed agricultural goods, values corresponding to these groups were added to the primary exports category to gain a sense of the magnitude to which lumping processed foods into one category or the other should affect the overall analysis.

Figure 4.2 indicates virtually no unique global trend in processed primary trade, its share in global trade measured by the difference in the two aggregates 'prim(0)' and 'prim(0,1,4)'. Its overall share in trade has remained more or less constant over the 1970-92 period, accounting for approximately 10-12 percent of total world exports. In the

Figure 4.2: Sector Shares in World Exports



absence of any significant dynamics, there is no indication as to which category the processed foods sector belongs. Upon examining country-level statistics, on the other hand, I opt to include processing with raw materials as a single category since, to the extent that the share of this sector in total trade displays some movement over time, it appears it evolves with raw primary trade in a counter-cyclical way. A few examples are shown in Figure A1 of the appendix for Morocco, Mauritius, Madagascar, and Somalia. There exists a small number of countries that exhibit a significant upward or downward trend in the share of processed food exports, but in general the countries in the sample conform to the world average described by Figure 4.2.

4.3 Country Trends According to Trade Orientation

This section extends the search for uniformity in the composition of global trade by subdividing countries into what appears at the outset to be more homogenous groups based on trade patterns. A survey of world trade data indicates that there exists a number of countries whose exports comprise almost exclusively primary products throughout the sample period. Based on the preceding analysis of the rising share of manufactured goods in global trade, it is evident that such countries are few in number and combined size in comparison to the overwhelming number of countries gradually shifting away from primary production and trade. There is also evidence, however, of a handful of countries moving away from manufactures exports into more specialized primary commodity trade. Such trends are interesting from the point of view of the contrasting global patterns of development and trade discussed above. Finally, there are also those countries that can be classified as predominantly manufactured commodity exporters at the beginning of the 1970-92 period and whose composition of exports has not significantly changed, presumably because they are particularly resource scarce countries or because a certain 'steady-state' level of development had been reached at the beginning of the period.

The objective of this section is to conduct a detailed examination of export trends in each group of countries and to explore some of the underlying characteristics of production and development that may help to explain the observed differences in trade orientation. The analysis also explores individual departures from the average

relationships observed within each group; this extension will serve to highlight various links between the nonconforming countries, and in many instances the observed similarities suggest that countries could be classified according to more detailed typologies, such as per capita incomes, resource endowments, and country size. The analysis also shows that a country's dominant pattern of trade is met with varying degrees of success among all groups considered.

4.3.1 Classification of Trade Patterns

Most of the empirical work on the patterns of global trade has focused on isolating and testing the theoretical predictions of existing trade models. A host of exogenous variables hypothesized to influence a country's domestic production and demand for a number of commodity groups relative to a world average, and the predicted excess demand or supply is tested against the observed international flow of goods and services. The present analysis proceeds in the reverse direction. The strategy taken in subdividing the sample begins by identifying dominant trade patterns and, based on inter-group differences in other indicators, an attempt is made to explain the underlying causes of the observed patterns in terms of the theoretical discussions of previous chapters.

In sorting the sample of countries according to observed trade patterns, it is desirable to not only distinguish between manufacturing and non-manufacturing oriented countries but between those that are characterized by increasing or decreasing relative importance of manufactures in total trade. This initial strategy adopted in identifying countries according to observed trade patterns examines country trade shares according to a "Markov chain" sequence over the entire sample period. Countries are separated according to a) whether they have "switched" from being predominantly primary commodity exporters (the share of primaries in the total value of exports exceeds 50 percent) in 1970 to exporting mostly manufactured goods in 1992, b) whether they have moved in the opposite direction, c) whether they export predominantly primaries at the beginning and end of the period, and d) whether they remain relatively specialized in manufactured commodity trade. The four country groups are henceforth referred to as the "Primaries-Manufactures' (P-M), 'Manufactures-Primaries' (M-P), 'Primaries-Primaries' (P-P), and 'Manufactures-Manufactures' (M-M) countries, indicating the

direction of specialization over time. The corresponding list of countries according to trade classification, corresponding to the 162 countries for which WBEA trade data is available, is given in table A1 of the appendix.

This method is a rather crude generalization of actual trade patterns since countries with relative trade shares exclusively above or below the 50 percent threshold are lumped into the P-P or M-M categories even when the actual trend is economically significant. Therefore, an alternative approach is also tried in classifying country trade orientations. For each of the countries in the sample, a linear trend in the share of primary commodities in total exports is fitted and tested for statistical significance. Those countries with a statistically significant positive trend are labeled as M-P countries and those with a negative trend identified by the P-M category.[20] The remaining countries without any observed trend are divided as before into two groups corresponding to trade orientation at the beginning of the period; countries whose share of primaries in total exports exceeds 50 percent in 1970 and those characterized by less that 50 percent are classified as P-P and M-M countries. The alternative country grouping is given in Table A2 of the appendix, and the corresponding regression estimates are provided in Table A3.

The new classification identifies the overwhelming number of countries that conform to the observed global pattern of increased manufactured commodity production and trade. Among the much smaller group of countries characterized by diverging trends in the composition of exports, the most marked rise in the share of primary commodity exports has occurred in Bolivia, Chile, Norway, and perhaps Angola and Algeria (see Figure A2 in the appendix). The remaining countries in this group have displayed a much more modest increase in the primary share, and in some cases the large variation in annual sectoral shares casts some doubt on whether they share the same long-run trends. For countries that display gradual movement toward manufacturing production and trade, however, the trend is generally much more pronounced, and significant inter-period fluctuations are only a concern in a few cases such as Gambia and Nepal. While the procedure taken to allocate each country into the appropriate group was intended to isolate statistically significant trends in the composition of trade, a cautious examination

[20] To measure statistical significance the 5 percent criteria is used.

of individual country data has the positive effect of identifying large disturbances in these trends. This identification suggests perhaps the quality of measurement and reporting is less than satisfactory.

Another potential explanation for the erratic behavior in the evolution of a few specific country trade patterns may be that the country is particularly small in size, and as a result may represent an insignificant amount of global trade. In such circumstances small movements in world prices for traded goods could conceivably generate large fluctuations in the relative shares of total exports that each commodity group represents. Following Chenery and Syrquin (1975), we avoid the potential bias in aggregate estimates caused by such variation by simply omitting small "splinter countries" from the analysis. The criterion used to identify this group of countries is those countries with a labour force of less than one million workers in 1990, as reported by the World Development Indicators (2001).

We omit a second group of countries on the basis of the relative importance of petroleum products in total exports. The WBEA database includes petroleum in the non-manufacturing commodity category, and as a result long-run dependence on oil production and trade will be reflected in a large share of primaries in total exports. The reason for excluding this group from the analysis is twofold: i) production and exports of Oil and Petroleum Exporting Countries (OPEC) members is largely controlled by coordinated government decision making, while exports of other major producers are likely to be influenced in the opposite direction, and ii) unlike most agricultural products, where petroleum is produced is entirely determined by geographical circumstances, and therefore changes in global demand for oil will be reflected almost entirely in the exports of the relatively small groups of countries where production is most highly concentrated. Because this study is not directly concerned with the isolated patterns of petroleum trade, countries excluded include OPEC members and other net petroleum exporters.[21]

Each country omitted from the initial sample ('splinter countries' and net oil exporters) is identified by category in Tables A2. Note that this omission leaves 143 countries in the sample.

[21] OPEC and net petroleum exporters are derived as listed in the Energy Information Administration, "Non-opec fact Sheet," June 2001 (http://www.eia.doe.gov/emeu/cabs/nonopec.html)

4.3.2 Sectoral Composition of Trade and Output

In examining differences in the structure of production and other indicators between country groups, the second (trend) classification method is used. Since the hypothesized effects of a country's level of development and relative resource endowments on trading patterns are complex, cross country patterns of development and trade should be examined according to the broadest definition of "trend." The 'Markov' classification has merit in that it accounts for the relative magnitude of a country's orientation towards each of the commodity groups. Thus in many instances identifying a country according to trade orientation based on whether the composition of exports has crossed the 50 percent threshold is arguably a stronger criterion than merely attributing to each group a statistically significant change in export shares, however small this change may be. However, we must also concede that the 50 percent threshold has no *a priori* economic significance (apart from saying that exports in one sector exceed that of the other). In identifying countries according to average trend, therefore, we allow for the possibility that two countries – one moving from, say, a 65 percent primary export share in 1970 to a 55 percent share in 1992 and the other moving from a 55 percent to a 47 percent share – are following similar development paths.

The average shares of primary commodities in total exports for each country group and five sub-periods are presented in Table 4.1. The upper portion of the table is based on averages for the entire sample, which varies in size depending on availability of data in each period.[22] The lower segment, listing averages derived from only those countries for which data is available over the entire 1970-92 period, is included since these averages provide a more accurate description of inter-period differences.

The table shows the expected result of relatively higher composition of primaries in total exports for the P-P group in each sub-period when compared to the other groups, while the opposite is true of the manufactures oriented countries. The P-M group is characterized by a rapid decline in the share of primaries, falling to less than 60 percent of its initial 1970-74 level by the end of the sample period. Beginning with a roughly

[22] The sample size listed for each sub-period refers to the number of countries reported at the beginning of the period.

Table 4.1

Share of Primaries in Total Exports: Entire Sample					
Period	1970-74	1975-79	1980-84	1985-89	1990-92
Sample	[119]	[119]	[130]	[130]	[130]
Primaries-Primaries	0.829	0.833	0.849	0.828	0.794
Primaries-Manufactures	0.618	0.603	0.551	0.464	0.360
Manufactures-Primaries	0.603	0.640	0.697	0.719	0.705
Manufactures-Manufactures	0.424	0.387	0.436	0.418	0.280

Share of Primaries in Total Exports: Compatible Sample					
Period	1970-74	1975-79	1980-84	1985-89	1990-92
Sample	[119]	[119]	[119]	[119]	[119]
Primaries-Primaries	0.829	0.843	0.860	0.837	0.805
Primaries-Manufactures	0.618	0.590	0.523	0.436	0.342
Manufactures-Primaries	0.603	0.640	0.697	0.719	0.705
Manufactures-Manufactures	0.424	0.384	0.422	0.404	0.273

equal share of primaries in total exports, the M-P group is characterized by a much more gradual increase in this share, and indicates a slight drop in the share of primaries in the final sub-period. This drop in the relative share of primary exports for the 1990-92 period is noted in the first country category as well, and reflected in the relatively sharp decline in the primary export share among the manufactures oriented countries.

Tables 4.2 and 4.3 link the observed export patterns to differences in the sectoral composition of domestic production. Table 4.2 summarizes average domestic production in agriculture, manufacturing, and services as a percentage of GDP and as averages for the relative shares of industry, gross capital formation, and foreign capital inflows for each group. These data are taken from the from the World Bank *2001 World Development Indicators*. The unweighted averages display, with few exceptions, a gradual decline in the representative share of agriculture in production for all groups. Perhaps unsurprising is the observation that the sharpest decline is experienced by the P-M group.

While the relative importance of agriculture in GDP has fallen on average for all countries, this has not translated into a parallel rise in manufacturing production in each group. For the first three groups, manufacturing production has roughly remained constant over the entire 1970-92 period, while the relative share of the sector in GDP

Table 4.2

Value Added by Sector (% GDP): World Bank					
Agriculture	1970-74	1975-79	1980-84	1985-89	1990-92
Primaries-Primaries	31.8	29.1	25.4	26.4	25.7
Primaries-Manufactures	26.1	22.8	21.2	19.8	18.4
Manufactures-Primaries	28.1	28.4	24.4	24.3	24.6
Manufactures-Manufactures	19.7	20.1	18.0	19.7	19.3
Manufacturing					
Primaries-Primaries	13.1	12.3	11.5	12.8	12.9
Primaries-Manufactures	15.8	16.9	16.4	16.6	16.0
Manufactures-Primaries	13.3	13.1	13.3	13.1	14.2
Manufactures-Manufactures	17.7	16.1	15.6	15.8	14.4
Services					
Primaries-Primaries	44.7	46.4	48.0	48.9	49.1
Primaries-Manufactures	46.5	46.4	48.0	50.1	52.5
Manufactures-Primaries	40.8	44.2	47.7	46.4	45.9
Manufactures-Manufactures	47.8	48.1	53.4	52.2	53.3
Industry	1970-74	1975-79	1980-84	1985-89	1990-92
Primaries-Primaries	23.4	24.5	26.6	25.6	25.7
Primaries-Manufactures	27.6	30.9	30.8	30.1	29.1
Manufactures-Primaries	31.0	27.5	27.9	29.3	29.5
Manufactures-Manufactures	32.5	31.8	28.6	28.1	27.4
Gross capital formation					
Primaries-Primaries	19.2	25.4	25.4	22.7	20.8
Primaries-Manufactures	21.1	23.8	23.7	22.0	22.2
Manufactures-Primaries	21.5	25.0	20.3	18.5	17.5
Manufactures-Manufactures	24.8	22.6	23.1	21.7	22.3
Financing from abroad					
Primaries-Primaries	22.5	28.4	27.9	28.5	24.6
Primaries-Manufactures	16.5	20.1	18.1	15.9	15.7
Manufactures-Primaries	19.1	19.9	16.0	13.0	13.2
Manufactures-Manufactures	13.7	13.5	12.9	12.5	10.5

among M-M countries has declined. This is explained in part by the rising relative importance of services in aggregate income for all countries. The rising share of services provides only a 'partial' account for the dual decline in both primaries and manufactures since, unlike the sector production data in Table 4.3, the World Bank aggregates do not provide a complete breakdown of economic activity. That is, the respective shares of value-added in agriculture, manufacturing, and services do not represent 100 percent of economic activity, while the categories listed in the United Nations dataset offer a full

Table 4.3

Value Added by Sector (% GDP): United Nations					
Agriculture, Fishery, and Forest	1970-74	1975-79	1980-84	1985-89	1990-92
Primaries-Primaries	…	…	34.2	32.6	31.3
Primaries-Manufactures	…	…	24.6	21.9	20.0
Manufactures-Primaries	…	…	28.9	33.8	30.0
Manufactures-Manufactures	…	…	17.3	15.9	13.0
Manufacturing					
Primaries-Primaries	…	…	11.6	12.7	13.7
Primaries-Manufactures	…	…	16.8	17.6	17.7
Manufactures-Primaries	…	…	13.6	14.3	15.5
Manufactures-Manufactures	…	…	17.3	16.2	18.1
Services					
Primaries-Primaries	…	…	22.2	24.7	25.3
Primaries-Manufactures	…	…	21.8	22.1	22.8
Manufactures-Primaries	…	…	23.0	21.3	23.1
Manufactures-Manufactures	…	…	24.8	26.0	25.6
Energy					
Primaries-Primaries	…	…	1.2	1.4	1.8
Primaries-Manufactures	…	…	1.8	2.4	2.4
Manufactures-Primaries	…	…	2.5	1.8	2.2
Manufactures-Manufactures	…	…	2.7	2.8	2.5
Other					
Primaries-Primaries	…	…	30.9	29.5	28.9
Primaries-Manufactures	…	…	35.6	36.4	38.1
Manufactures-Primaries	…	…	32.5	28.4	29.2
Manufactures-Manufactures	…	…	40.3	40.8	42.5

* Services includes wholesale and retail trade, restaurants and hotels, transport, storage, and communication. Remaining services are listed under 'Other'.

account of domestic production. The disadvantages of the latter breakdown of GDP are the relatively short period covered as well as the significant share that the unclassified or 'other' activities represent. Nevertheless, both tables offer insight into inherent differences in domestic production patterns for the groups considered.

Both tables convey the tendency for the share of agriculture in GDP to fall over time, with perhaps the exception of the M-P group, which has maintained a relatively stable share of agricultural production over the last three sub-periods. The World Bank table shows a compensating rise in the share of services for each group, whereas no trend in the services sector is evident from the United Nations data. Again, the relatively modest estimates for these shares suggests that many services are hidden in the 'other'

category, and therefore the narrow interpretation given to this definition of services may give an inaccurate depiction of actual country trends.

To the extent that the relative fall in primary production and the rise in services is uniform across countries, these results only reproduce the previously cited evidence on the unbalanced growth path. There is also some evidence of the tendency for the manufacturing share to rise, up to a certain point, and to then taper off or decline at higher incomes, a pattern also implied by higher income elasticities of demand for services. In terms of tradable goods production, it is evident that the closed-economy interpretation of unbalanced growth cannot suffice in explaining the observed patterns. In distinguishing country groups according to trade orientation, it becomes clear that the average rate of transformation in the structure of production is not uniform between groups, contrasting the predictions of the closed economy model. We should carefully note that it is not differences in the distribution of production for any given period that warrant our attention since each country group does not necessarily represent, on average, similar levels of development.[23] Rather the observed divergence in average sector shares over time, particularly where these shares were similar in one or more sub-periods, suggests that trade is significant in explaining the evolution of a country's industrial structure.

As discussed in previous chapters, trade allows for alternative patterns of development since the structure of production need not be tied to domestic consumption. Cross-sectional comparisons reveal the non-trivial bias of production towards that sector which represents a relatively large share of total exports. These tables also suggest that for both primaries-oriented groups the share of primaries in domestic production may remain at levels significantly above those of the manufactured-oriented groups. Given sufficient abundance of natural resources some countries may continue to specialize in the production and trade of primaries for a much longer period insofar as relatively high international commodity prices continue to favor terms of trade in this sector.

A final observation is that average gross capital formation, which is presented in table 4.2, has declined considerably for countries moving towards increased specialization in primary products when compared to other groups. Chenery and Syrquin

[23] The following sections reveal, in fact, that average per capita income between groups differs quite dramatically.

(1975, Chapter 4) note that development based on the initial exploitation of primary exports often requires a substantial inflow of capital which, being used as a source of foreign exchange as primary exports rise, is subsequently used to reduce the balance of trade deficit. As a result, there is typically a period of capital outflow for much of the transition towards becoming a developed economy. This explanation is supported by the relatively sharp decline in foreign financing in later periods.

4.3.3 Resource Endowments and Trade Orientation

Availability of resources can be an important determinant of a country's comparative advantage. Differences in factor endowments are briefly considered for the sample of countries, and although factor inputs are classified into extremely broad aggregates, the data lend themselves to surprisingly straightforward comparisons. The data set used was provided by Mohan Penubarti (the data is similar to that used in Maskus and Penubarti (1995)) and contains factor endowment data for all the countries in the Penn World Tables from 1970 to 1990. Tables 4.4 and 4.5 report factor endowment ratios for each country and sub-period, including the period averages for each group.

Included is a measure for capital stock, defined as the real net capital stock in millions of US dollars. This is the accumulated, depreciated, and deflated series (15 years, 13.33% depreciation rate) of gross fixed capital formation in each country, measured in 1000's of 1985 dollars at international prices. Arable land and the area of forests and woodland measured in thousands of hectares are taken from the FAO Production Yearbook. Values for skilled labour, defined as number of technical or professional workers, are also available for some countries. The remaining labour force is counted as the number of unskilled workers. It is recognized that the classification of different skill groups by distinguishing workers based on whether they are considered to be either a technical or professional employee can be misleading in the sense that large cross-sectional productivity differences are likely to exist within each occupational category. However, data on labour productivity differences by occupation or industry is difficult to find for less-developed countries. Nevertheless, the number of technicians and professionals in the labour force still provides some insight into differences in the labour market structure.

Table 4.4

Factor Endowments: Entire Sample						
Capital/Worker	Period	1970-74	1975-79	1980-84	1985-89	1990
	Sample	[51]	[59]	[60]	[61]	[60]
Primaries-Primaries		2.85	3.59	5.72	7.40	8.91
Primaries-Manufactures		5.92	9.08	13.93	20.55	26.75
Manufactures-Primaries		2.47	2.82	3.45	3.82	4.77
Manufactures-Manufactures		10.60	14.78	20.09	26.89	34.23
Arable Land/Worker	Period	1970-74	1975-79	1980-84	1985-89	1990.00
	Sample	[51]	[61]	[60]	[62]	[63]
Primaries-Primaries		1.07	0.97	0.86	0.78	0.69
Primaries-Manufactures		1.22	1.13	1.05	0.96	0.87
Manufactures-Primaries		0.87	0.89	0.86	0.81	0.67
Manufactures-Manufactures		0.67	0.64	0.60	0.57	0.46
Forest Area/Worker	Period	1970-74	1975-79	1980-84	1985-89	1990.00
	Sample	[59]	[61]	[62]	[62]	[63]
Primaries-Primaries		3.47	2.70	2.24	1.86	1.63
Primaries-Manufactures		4.25	3.52	3.09	2.57	2.49
Manufactures-Primaries		10.81	8.80	7.60	6.45	5.45
Manufactures-Manufactures		1.54	1.46	1.39	1.34	1.30
Skilled/Worker	Period	1970-74	1975-79	1980-84	1985-89	1990.00
	Sample	[0]	[14]	[21]	[30]	[34]
Primaries-Primaries		…	0.05	0.10	0.14	0.12
Primaries-Manufactures		…	0.12	0.13	0.16	0.17
Manufactures-Primaries		…	0.08	0.06	0.06	0.07
Manufactures-Manufactures		…	…	0.16	0.18	0.20

*excluding 1989

The standard approach to comparing relative endowments is to consider factor ratios, although there is no preferred combination of factors in forming these ratios. Because individual observations are occasionally lacking in each of the endowment series, and in particular measures for skilled and unskilled labour are available for only a small number of countries, each of the available measures of endowments are presented here as ratios over the total number of workers reported by the *World Development Indicators*. Since unskilled labour typically makes up the largest category of factor inputs (for instance the ratio of skilled labour to unskilled labour is, on average, 0.16 for all observations, with a maximum value of 0.49 and minimum of 0.03), the calculated

Table 4.5

Factor Endowments: Compatible Sample						
Capital/Worker	Period	1970-74	1975-79	1980-84	1985-89	1990
	Sample	[43]	[43]	[43]	[43]	[43]
Primaries-Primaries		3.31	5.36	8.12	10.38	13.25
Primaries-Manufactures		6.17	9.58	14.64	20.75	26.66
Manufactures-Primaries		2.47	2.82	3.45	3.82	4.77
Manufactures-Manufactures		10.60	14.78	20.09	26.89	34.23
Arable Land/Worker	Period	1970-74	1975-79	1980-84	1985-89	1990
	Sample*	[52]	[52]	[52]	[52]	[52]
Primaries-Primaries		1.06	0.95	0.85	0.77	0.72
Primaries-Manufactures		1.22	1.11	1.02	0.95	0.86
Manufactures-Primaries		0.87	0.89	0.86	0.81	0.67
Manufactures-Manufactures		0.67	0.64	0.60	0.57	0.46
Forest Area/Worker	Period	1970-74	1975-79	1980-84	1985-89	1990
	Sample*	[57]	[57]	[57]	[57]	[57]
Primaries-Primaries		3.53	2.80	2.33	1.94	1.68
Primaries-Manufactures		4.25	3.57	3.12	2.64	2.58
Manufactures-Primaries		10.46	8.80	7.60	6.45	5.45
Manufactures-Manufactures		1.54	1.46	1.39	1.34	1.30
Skilled/Worker	Period		1987	1988	1989	1990
	Sample		[31]	[31]	[31]	[31]
Primaries-Primaries			0.12	0.12	0.14	0.14
Primaries-Manufactures			0.16	0.16	0.17	0.17
Manufactures-Primaries			0.06	0.07	0.07	0.07
Manufactures-Manufactures			0.18	0.19	0.20	0.20

*excluding 1989

endowment ratios can be interpreted as an approximation of the endowment to unskilled labour ratio.

Comparing calculated averages for capital per worker, large initial differences between groups are apparent. Two things should be noted, however, when making cross-sectional comparisons. The first is that given the availability of endowment data the sample size has been substantially reduced, where the number of countries included in these averages makes up less than half of the initial sample. For the M-P group, a particularly small group to begin with, the missing observations pose the most severe problem, since the number making up this group falls from 12 to only 6 countries. Thus the estimated averages cannot be comfortably taken to representative of the entire group. The second important consideration is the substantial variation in this measure among the

small number of observations for which data was available. Bolivia, Chile, and Uganda each have very high capital per worker ratios in comparison to the average of this group, with that of Uganda ($7.84) eclipsing capital per worker even in Japan ($7.52)! For the remaining countries, Paraguay, Malawi, and Zambia, capital per worker estimates are more in line with most developing countries.

The general finding is that capital per worker is highest according to a country's orientation towards trade in manufactured goods in every period. That is, countries moving towards a larger share of primaries in total exports are relatively scarce in capital when compared to countries moving in the opposite direction, while those countries that have tended to exhibit the highest degree of specialization in manufactures are more abundantly endowed with capital when compared to all groups. This finding is also revealed in comparing the average annual growth rates of capital-labour ratios for each group, where increased tendency towards manufactured exports is accompanied by more rapid accumulation of capital.

To gain a more accurate picture of relative movements in capital per worker over time, one should refer to Table 4.7 since only the compatible series are used in calculating group averages. The table reveals relatively high growth capital per worker in the P-M category, with slower growth for the P-P group, and followed by the M-M and M-P categories in declining order. While this suggests a strong relationship between endowments of capital and a comparative advantage in manufactured goods production, it is not clear that relative abundance of capital is the cause of comparative advantage in the static sense. This is due to the fact that the net stock of capital per capita is expected to be a function of the level of development, and if for reasons already explained the relative share of manufactured commodity production is positively tied to development, then both ratios are endogenously determined.[24] That is, since savings and investment are predicted to rise with income, a country's net capital stock is tied to growth (the relation between trade patterns and levels of development is explored more fully in the following section), while in general production and consumption decisions are equally affected by rising

[24] In much of the trade litterature it is commonly assumed that primary production is labour-intensive when compared to manufacturing. While this "popular belief" has its roots in the empirical regularity of developed counties, abundant in capital per worker, exporting manufactures and importing primaries, Echevarria's (1997, 1998) decomposition of average returns to land, labour, and capital in each sector shows that agriculture is more capital intensive than manufactures.

incomes. Therefore it is useful to consider other factors of production which may have a more permanent role in explaining differences in a country's patterns of production and trade.

Hectares or arable land and forests and woodland per worker are also reported in the above tables. Comparing group averages provides weak evidence that trade in primaries is driven by a country's stock of arable land, while the evidence is somewhat stronger for forest and woodland resources. However if capital is also largely significant in agricultural production, as it seems to be, then the land-labour ratios alone will tell us little about patterns of comparative advantage. In this case relatively high land per unit of capital is another useful measure of comparative advantage in agriculture. It is interesting to note the particularly rapid decline in forest area per worker, representing the relatively non-renewable resource, among the primaries oriented group. This suggests that a large volume of trade in primaries is achieved through the intensive use of resources that are relatively fixed in supply. Based on the relatively large measures of forest area per worker, it is expected that lumber and wood products are prominent in exports from Bolivia, Cameroon, and Paraguay. Nevertheless, direct aggregation of primary exports in each country according to the different categories should take precedence over such speculative inferences.

The last endowment aggregate for which data is available, skilled labour, is presented for each group in the last four rows of these tables. The number of countries in this sample for which the measure could be imputed is small, rendering it difficult to draw meaningful inferences from a comparison of group averages. While these averages *could* suggest a positive correlation between skilled labour and the share of manufactures in overall production and trade, this interpretation suffers from a few major weaknesses. First, insofar as our measure of skill is associated with the average level of training received by the workforce (which is implied in the measure of the number of professional workers), it is also a measure of human capital investment, and like physical capital, can be expected to be correlated with per capita incomes. Second, this particular measure of skill cannot be interpreted as learning by doing or rising labour productivity in manufactures since, by classifying abundance of "skilled" labour as the relative number of technical and managerial positions, this trend is more properly tied to differences in

industry structure. In other words, as a country specializes in manufactures production, one would expect a rising number of employment positions to inherit the titles of "managers," "technicians," or "professionals." Therefore such measures of skill are only appropriate when assessing the direction of trade for a rather specific set of industries.

4.4 Economic Growth and the Composition of Trade

An important consideration is how the composition of trade is affected by levels of development and alternatively how trade orientation affects growth in incomes. Measures of annual GDP growth and average per capita GDP in each group are presented in Tables 4.6 and 4.7 based on entire sample and compatible sample estimates respectively. At the outset, one notes highest average annual growth for the P-P group in the first period, while falling below that of the P-M category in later periods. Annual per capita GDP growth for the M-M group follows close behind the P-P countries in the earlier periods. However, the higher average growth in the primaries-oriented group is not sustained over the entire period. These findings, together with the fact that lowest average growth is experienced by the M-P countries in almost every sub-period, suggest a positive correlation between average growth and the share of the economy's resource devoted to manufactured commodity production. Evidence and explanations for this connection were addressed in previous chapters and do not need to be reiterated here. But while a country's overall growth performance is inexorably linked to productivity growth in many manufacturing industries, periodic differences in overall growth rates between the groups should not be overemphasized without properly considering average levels of development.

In the language of neo-classical growth theory, there is the issue of whether countries are still moving towards their steady-state growth path or if steady-state levels have already been achieved. Certain countries may be experiencing unusually high growth rates where per capita incomes are particularly low, or rapid growth could also be due to higher savings rates or an increasing quantity or resources being dedicated to overall production. A comparison of levels of per capita income in Table 4.9 lends considerable evidence to this hypothesis.

Table 4.6: Per Capita GDP According to Country Group

Average Annual Growth in Real GDP per Capita (1995 US dollars)					
Period	1970-74	1975-79	1980-84	1985-89	1990-92
Sample	[111]	[111]	[132]	[132]	[132]
Primaries-Primaries	3.268	2.149	0.387	0.598	0.247
Primaries-Manufactures	2.507	2.895	0.894	1.919	0.633
Manufactures-Primaries	2.007	1.811	-2.104	-0.375	1.479
Manufactures-Manufactures	3.094	1.282	0.645	1.767	-0.962
Average - All Groups	2.708	2.446	0.484	1.400	0.427

Average Annual Per Capita GDP (1995 US dollars)					
Period	1970-74	1975-79	1980-84	1985-89	1990-92
Sample	[111]	[111]	[132]	[132]	[132]
Primaries-Primaries	1797	2145	2373	2297	2371
Primaries-Manufactures	6316	7145	7053	7288	7904
Manufactures-Primaries	915	981	929	918	1055
Manufactures-Manufactures	9462	10409	11449	11547	10863
Average - All Groups	5315	6006	6019	6172	6455

Table 47 : Per Capita GDP – Compatible Sample

Average Annual Growth in Real GDP per Capita (1995 US dollars)					
Period	1970-74	1975-79	1980-84	1985-89	1990-92
Sample	[89]	[89]	[89]	[89]	[89]
Primaries-Primaries	3.507	2.308	0.434	0.589	0.511
Primaries-Manufactures	2.500	2.378	0.798	2.132	1.094
Manufactures-Primaries	2.041	1.584	-2.133	0.373	-0.427
Manufactures-Manufactures	3.094	1.282	0.645	1.712	-1.334
Average - All Groups	2.769	2.145	0.458	1.589	0.506

Average Annual Per Capita GDP (1995 US dollars)					
Period	1970-74	1975-79	1980-84	1985-89	1990-92
Sample	[89]	[89]	[89]	[89]	[89]
Primaries-Primaries	1880	2247	2271	2370	2561
Primaries-Manufactures	6182	6849	7466	8311	9037
Manufactures-Primaries	968	1026	1065	1052	1141
Manufactures-Manufactures	10090	11098	12448	13777	13743
Average - All Groups	5398	6001	6550	7234	7675

Interestingly, each group of countries can also be roughly categorized, *on average*, according to different stages of development on the basis of per capita income differences. Doing this conveys the perhaps significant result that the countries are specialized or moving toward increased specialization in primaries represent the lowest income groups, while countries moving towards increased manufactured commodity production and trade are those with relatively high per capita incomes. This positive relationship between the manufacturing share and per capita incomes is certainly suggestive of, at the global level, an affinity between Kuznets' fact and observed trade patterns.

Consistent with the theories of growth already examined, however, we would also expect growth rates to be low initially and higher than average during the transition towards a mature economy. Moving from the low income groups to those with higher average incomes, this is not the pattern that is observed. Instead, the prolonged specialization in primary commodity exports exhibited by the lower income M-P and P-P countries is associated with a more rapid decline average growth when compared to the higher income P-M category. Needless to say, this approach to linking the composition of trade with average levels of development fails unless it is known that the structure of production in each economy evolves along a common path. With comparative advantage in trade and changing global consumption and production patterns, however, the existence of such uniformity in development is unlikely.

To examine the relationship between development and the composition of trade more closely, the relative share of primaries in total exports is plotted against per capita incomes for each group in the cases where per capita GDP estimates could be found for the entire 1970-92 period. The share of primaries in total trade at different levels of income is illustrated in Figure 4.3 for M-P countries, the relatively low income group. Figure 4.4 illustrates this relationship for the P-P group. Because the P-M group corresponds to a relatively wide range of income levels, ranging from less that $200 to over $10,000 per capita, this group is divided at $2000 per person to better illustrate movements at incomes below this level, where the sample of countries appears to be most concentrated. This group is represented by Figure 4.5. Finally, trade patterns across incomes are illustrated for the 'Manufactures-Manufactures' group in Figure 4.6. The

Figure 4.3: 'Manufactures-Primaries' Countries

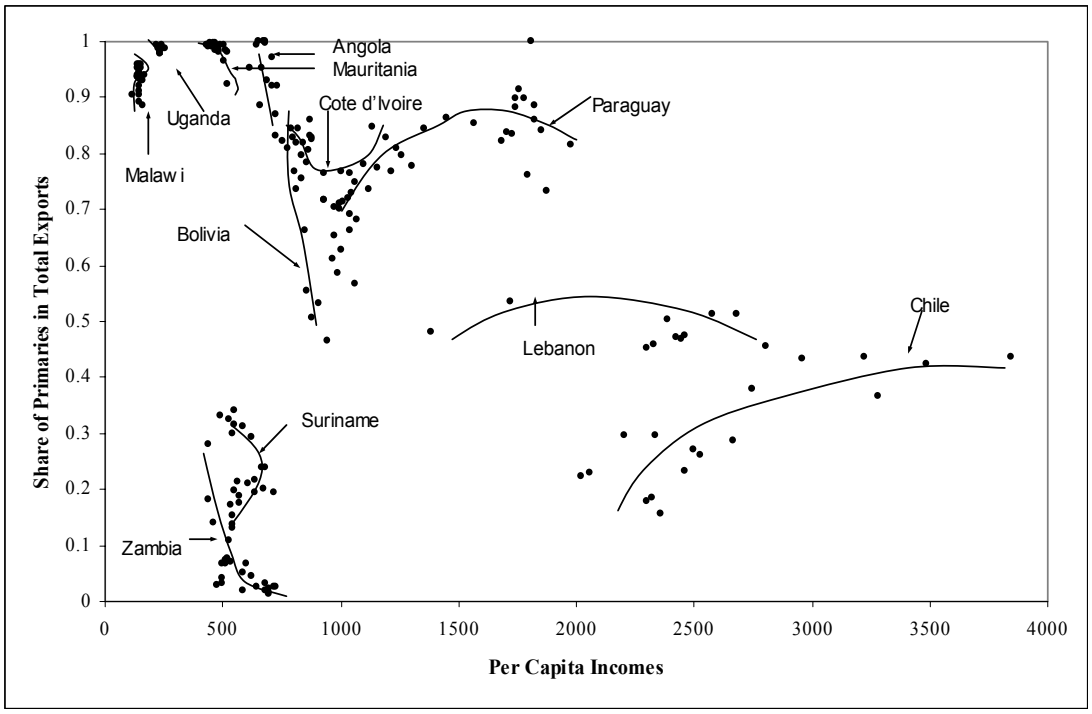


Figure 4.4: 'Primaries-Primaries' Countries

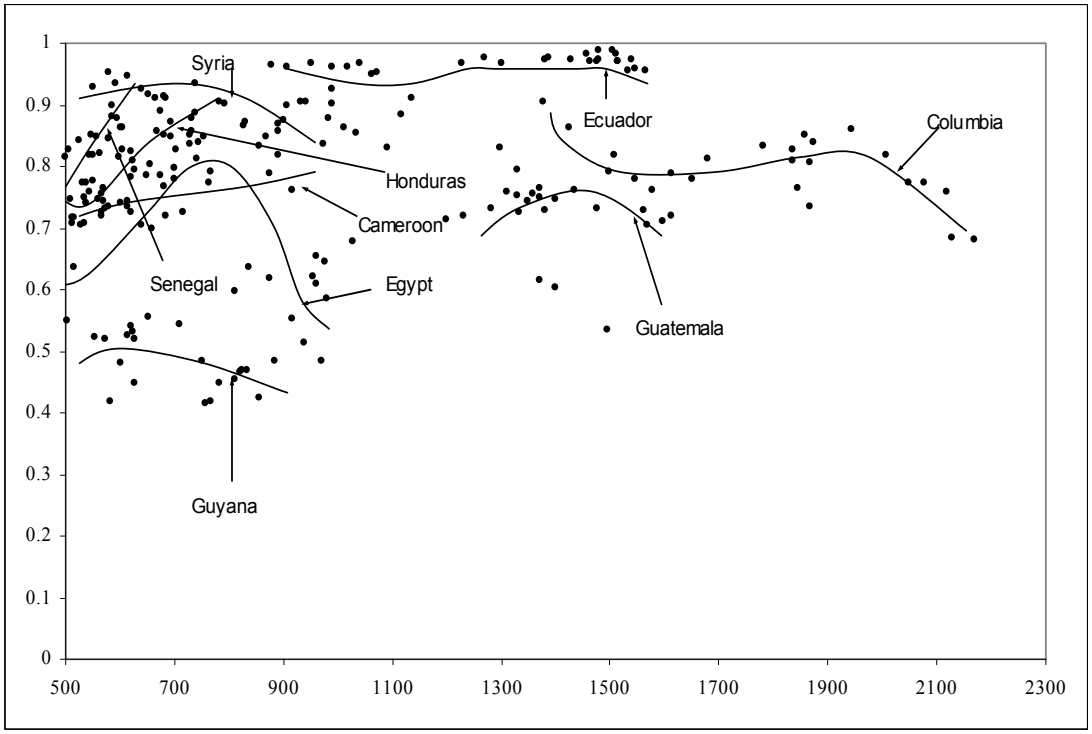
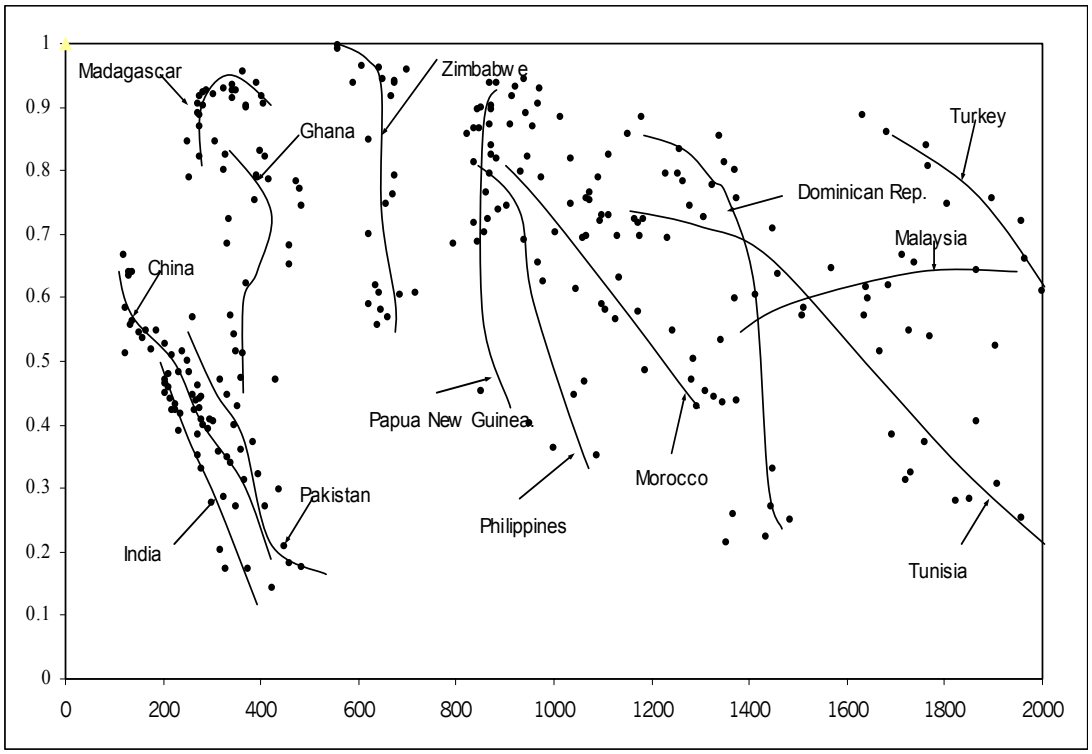


Figure 4.5: 'Primaries-Manufactures' Countries



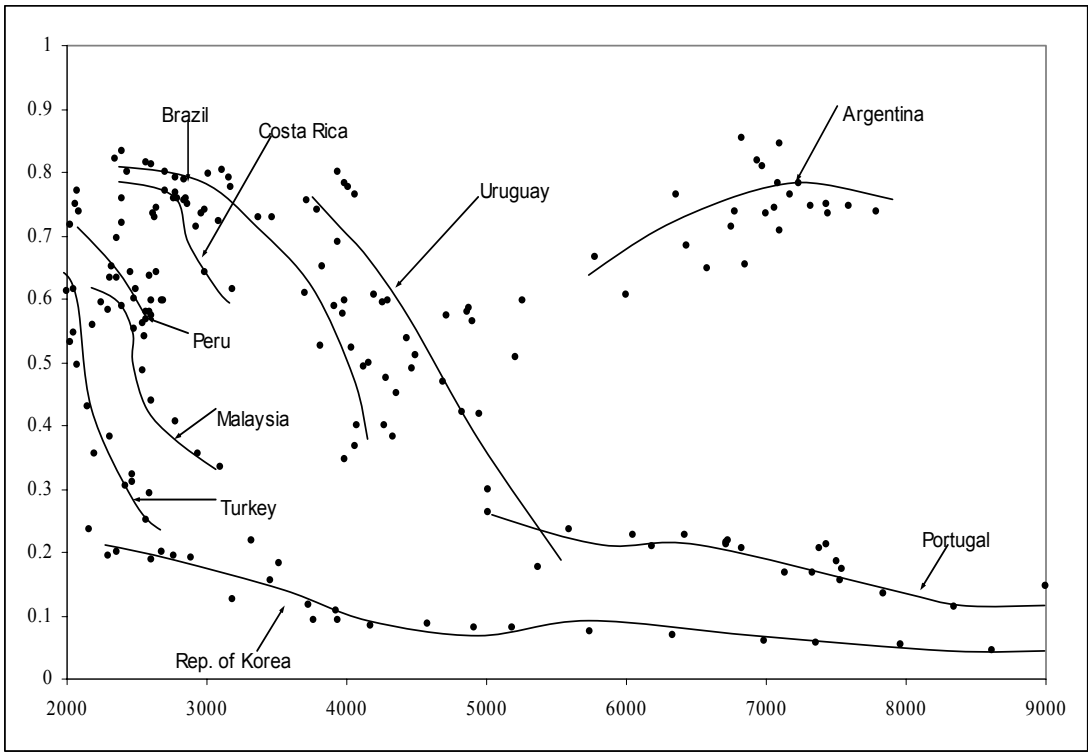
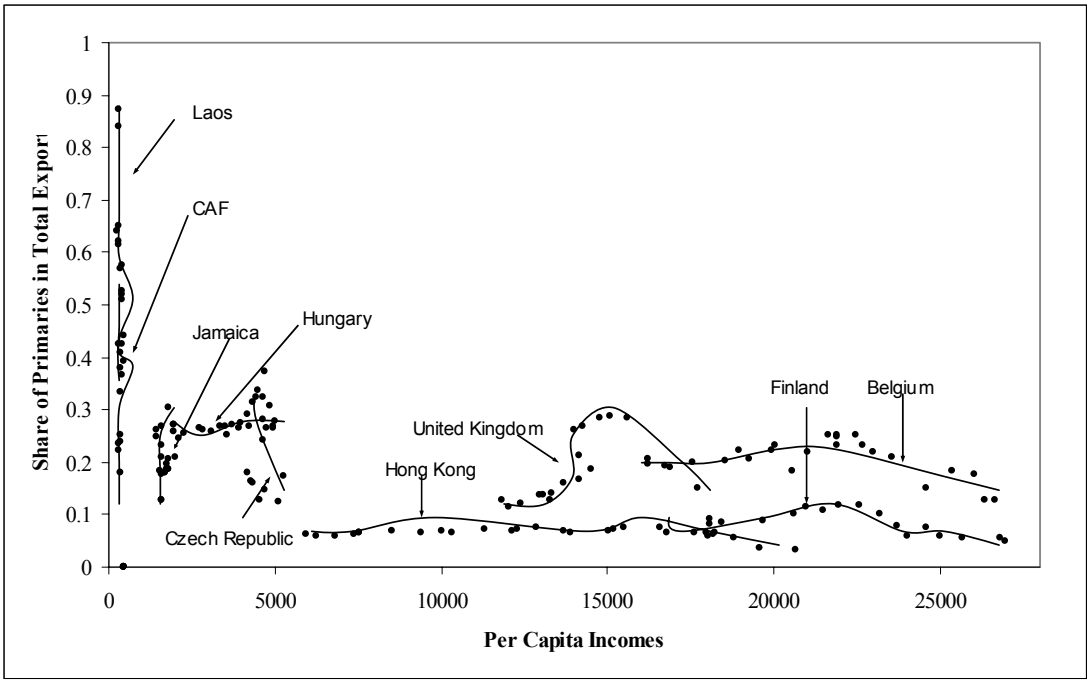


Figure 4.6: 'Manufactures-Manufactures' Countries



share of primaries in total exports is also plotted on per capita incomes of all countries taken together for the years 1970, 1980, and 1990, and graphical representations are provided in Figure A.3 of the appendix. In these figures lines are extended at the mean values of income and primary share in trade in order to illustrate both the cross-sectional relationship and average changes between years.

In examining each of the figures, the hypothesized inverse relationship between the share of primaries and per capita incomes is explored for each group, as well as the extent to which this trend can be uniformly ascribed to all groups. While this trend appears to describe the pattern of trade of many individual economies throughout the transition from low to medium incomes, a closer analysis reveals that there is a great deal of variation in the timing of the shift in the composition of exports.

Within the P-M category, the rate at which exports shift towards manufactured commodities exceeds, on average, countries in the other groups for a given level of per capita income. At approximately $5,000 per capita, this decline in the primary share begins to level off at between 5 and 25 percent of total exports, Argentina representing the glaring exception. Notice that the pattern of specialization and trade begins to resemble the M-M countries which, at per capita incomes in excess of $5,000 per capita,

show a relatively stable share of primary exports within these same bounds. This appears to be rather strong evidence in support of the hypothesized steady-state in the primary export share at high levels of development, where it is presumed that preferences resemble homothetic ones and the relative share of total expenditures that manufactures and primaries represent does not change.

In comparing average income levels between country groups in tables 4.8 and 4.9, it was noted that each group corresponds on average to different income categories for the period under consideration. However, when the Netherlands is excluded from the P-P category (having a per capita income in excess of $25,000 in 1992), the range of incomes covered by this group is similar to the M-P group. Indeed, now both the M-P or P-P countries represent per capita income levels often well below $5,000, explaining in part the absence of a negative trend in the primary export share when the initial classification of country groups was made. Other discrepancies stand out that tend to undermine the significance of average rising or constant primary shares estimated for these two groups.

First, a large number of countries in the two groups with per capita incomes below $500 do not exhibit any significant growth over the period examined, and therefore long-run development trends for these countries are ambiguous. Indeed, these cases account for a majority of the countries in this group for which both income and trade data are available. There also exists a fair number of examples in the 'Primaries-Primaries' category of negligible growth where per capita incomes fall below $500. While it initially appeared that a fair number of countries were either remaining or becoming increasingly specialized in primary exports, it is now evident that only for a few countries can these trends be properly classified as a growth or development path. But even for the remaining countries in these groups, specialization in primary commodity exports is only a temporary phenomenon. While the evidence is perhaps less than striking, a number of countries appear to exhibit rising primary shares at lower incomes and falling shares after a certain level of per capita income is reached.

In the 'Manufactures-Primaries' group, only Lebanon, Paraguay, and perhaps Chile accurately fit this description, with declining primary export shares after approximately $1500 in per capita income is reached. In the case of Chile, the primaries

share rises in tandem with income until $3,000 - $3,500, and it appears there may be a tendency for this share to decline at later stages in the country's development.

For the P-P countries, there is again considerable variation in the timing of this shift; both Egypt and Syria have experienced declining shares at a per capita income of $700, while this transition takes place at much higher incomes for both Guatemala and Columbia. Since countries in this group were selected on the basis of having no *linear* trend in the composition of exports over the 1970-92 period, it might have been anticipated that most of the 'Primaries-Primaries' countries exhibiting the inverted U pattern are near the 'peak' of the transition into manufactured commodity trade. This also assumes, however, that positive growth is realized throughout this entire period.

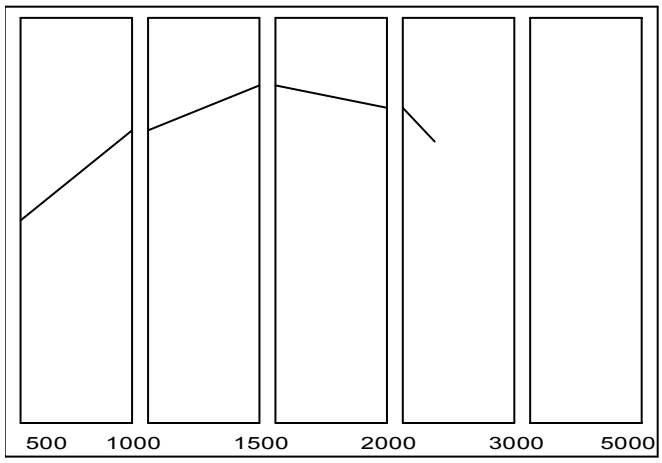
In addition, it is not certain that other countries in this group would necessarily exhibit trends that diverge from the average path taken by the M-P and P-P countries had a larger time-series been available. Because a large number of countries in the P-M group have higher per capita incomes than most of the M-P and P-P countries, the potential for many of these countries to follow the same transition path cannot be ignored. A larger dataset covering earlier stages of development would be useful in verifying this proposition. Countries such as Turkey, Tunisia, and Brazil are characterized by a gradual yet accelerating decline in the primary export share, and are easily compared to transition economies in the M-P and P-P groups. However, they are also sharply contrasted by a more dramatic fall in the primaries share consistent with the cases of India, China, Pakistan, Malaysia, and the Philippines. For these countries, the share of primaries in total exports declines rapidly at the lowest recorded per capita incomes. Finally, there are those countries which at sufficiently high levels of development have not displayed any significant trend in the composition of exports, yet may have nevertheless subscribed to any of the observed low-income patterns in their earlier stages. These countries are described by Korea, Portugal, and most high-income countries.[25]

To summarize both the differences and the potential uniformity in the average transition paths taken by each country group, Figure 4.7 compares the approximated linear trends displayed by all countries during various intervals of per capita income.

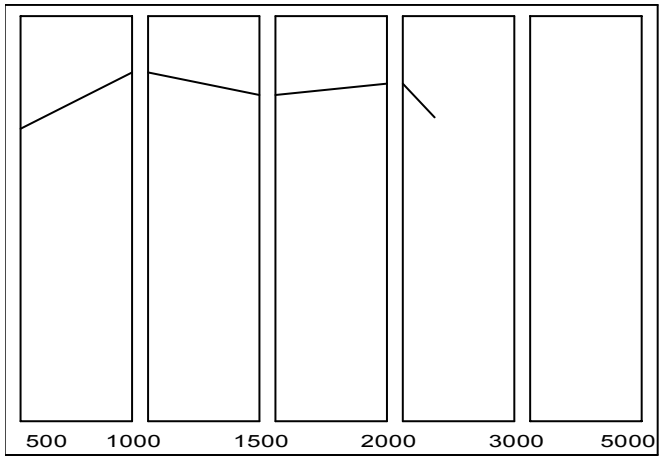
[25] High-income countries include countries with per-capita incomes that exceed $9,000 for the period under consideration, and are not shown here.

Figure 4.7: Primary Share and Per Capita Income –
Comparison of Country Group Trends

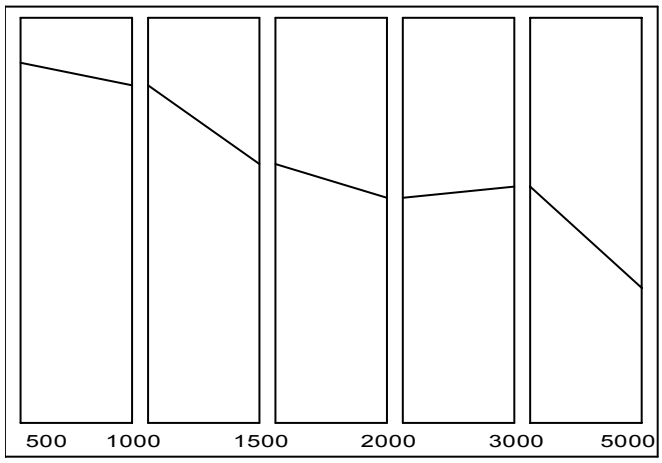
Manufactures-Primaries



Primaries-Primaries



Primaries-Manufactures



These diagrams summarize at least two observations made above. The first is that the primary export share in all countries, regardless of their initial pattern of specialization, shows a marked downward trend at higher incomes. The second observation is that the timing of this shift toward manufactured commodity trade, while similar for both primaries-oriented groups, occurs at a much earlier stage on average in the manufactured-oriented countries.

While primary orientation can be surmised by a perceived lag in the average rate at which primary commodities are supplanted for manufactured goods in total exports, the heterogeneity that exists among countries within each group tends to blur the contribution of additional factors to diverging patterns of trade. For this reason a more accurate depiction of global trade patterns is gained from a series of regression equations, each aimed at tying together the various relationships just described. To capture hypothesized relationship between the relative share of primaries in exports and levels of development, each regression considers the effect of growing per capita incomes, denoted by *ln(y)*, on the composition of trade. These regression equations can be thought of as reduced forms of a more detailed general equilibrium system, where in the simplest case the observed trade patterns are determined entirely by changing domestic demand with rising income, demand in the rest of the world, and capital accumulation. Specifically, we consider the relationship:

$$S_p(y) = f\left(\mathrm{Z}(y), \xi_p^d(y), \xi_p^w\right) \tag{4.1}$$

where Z(y) corresponds to the country's level of development (in the neo-classical growth model, a relevant measure would be the difference in per capita capital stock and the constant steady-state level of capital), and $\xi_p^d(y)$ is the share of primaries in domestic expenditures. Both of these variables are assumed functions of per capita incomes. ξ_p^w represents international intermediate and consumption demand, which is dependent on average world income and technological change.

We estimate this relationship using panel data in order to capture both the cross sectional relation and the correlation of variables over time. In previous studies on unbalanced growth (Chenery and Taylor 1968; Chenery and Syrquin 1975) cross-country

comparisons of production structures at different levels of development have been used to make inferences about the growth path taken by a single country over time. Since time series extending more than a few decades are rarely available, large cross sections consisting of countries at various stages of development could better approximate long run relationships. In estimating changing patterns of global trade, however, we would like to account for time-varying responses to factors such as rising world income and technological progress. Chenery and Syrquin (1975, Chapter 5) indeed find that exogenous factors responsible for significant time shifts (such as technological change) are associated over long periods of time with such factors as rising income, resulting in substantially different estimates between time series and cross-sectional data. In combining cross-sectional and time series data, we aim to distill both the average relationship between development and trade for all countries and how this relationship evolves over time.

In previous chapters we have argued that the observed decline in the average share of primaries in total exports can be largely explained by relatively higher total factor productivity growth in manufacturing sectors combined with income inelastic demand for many primary products. For sufficiently low levels of income, we have considered the possibility that the export share that primaries represent may be sustained for extended periods where a relatively large endowment of natural resources results in a comparative advantage in primary commodity production. In subsequent stages of development, capital and skills are accumulated and manufactured commodities begin to be produced domestically, resulting in a more pronounced decline in the primary export share. For manufacturing oriented countries, the expected pattern of development is characterized a more rapid decline in the primary exports share in the beginning followed by more modest changes at later stages. Thus even though the net effect of rising per capita incomes on the primaries share is expected to be negative, it is hypothesized that natural resource endowments will account, in part, for the observed differences in the timing of this transition. To allow for such influences we might estimate a simple log-linear regression equation:

$$S_{pit} = \alpha + \beta_1 \ln y_{it} + \beta_2 (\ln y_{it})^2 + \psi_1 \ln(land_1 / L)_{it} + \psi_2 \ln(land_2 / L)_{it} \qquad (4.2)$$

where i = 1,2,…,N refers to the number of countries in the sample, and t = 1,2,…T is a given year between 1970 and 1992. The variables S_p, y, $land_1/L$ and $land_2/L$ represent the primaries share in total exports, per capita income, arable land per worker and forest area per worker respectively. Due to the perceived nonlinearity of the primary share over varying income levels for a large number of countries examined, the proposed parameterization incorporates a first-order quadratic approximation of the income variable.

While relative endowments of the other productive factors also have a large role in determining trade patterns, they are not included in these regressions because they are either endogenous to the system (and hence captured by the income term) or data are not readily available for many countries. Capital per worker, as described in (4.1), is accumulated as incomes rise and thus falls into the first category. The relative endowment of skilled workers is also omitted since, in addition to the irregular and uneven availability of data, skills are also accumulated as the economy develops and are therefore assumed to be correlated with per capita incomes.

Unfortunately the model presented in (4.2), otherwise known as a *common coefficient* or *pooled regression* model, does not tell us anything about the separate effects of time on the estimated relationship. The common coefficients averaged across all t and i implicitly assume that the association implied with the dependent variable is stable over time and between cross-sectional units. If, as has been suggested, global consumption and intermediate demand for primaries is declining relative to manufactures and in turn affecting the structure of trade, one would expect the average share of primaries in trade to be lower in later periods *for any given level of development*. Cross-sectional stability in the average relationship, therefore, would be a reasonable assumption only for a subset of countries characterized by similar per capita incomes in every period. In our analysis, however, we consider countries spanning all levels of development in any given time period. To compensate for maintained disparities in the composition of exports that arise due to differences in the timing of industrialization, cross-sectional dummy variables are added to the model. Also concentrated in the dummy variables are the effects of omitted variables that have little or no change over time. In the new regression equation, then, different intercepts eliminate variation

between countries while providing richer estimates of the average response of the dependent variable over time.

The time-related pressures of changing global demand and technological change on country trade patterns raise another important concern. When these omitted variables are related to per capita income and other explanatory variables through a deterministic trend component, the estimates of the regression will be biased. Since both domestic income and world income – the latter being the source of declining relative consumption demand for primary commodities – typically trend upward together, the per capita income variable in our model exerts, in addition to its direct effect, an indirect effect through its association with world development. By adding a time trend, a country's own level of development no longer acts as a proxy for the effects of omitted variables. In principle a time variable will capture temporal changes in the primaries share that are independent of changes in the explanatory variables. The resulting estimated association between the primary export share and per capita income, then, is representative the net effect of two opposing influences – declining domestic relative demand for primaries which tends to raise primary exports, and the allocation of resources in manufacturing as capital and skills are accumulated. Thus while the time trend captures the 'universal' effect of changing global demand on the composition of exports, the income coefficients should be interpreted as the average response to this shift in demand, net of changes in domestic demand, made possible by successive increases in physical and human capital investment.

Because cross-sectional dummy variables also eliminate country-specific effects, the time trend can better approximate exogenous shifts in global demand that arise out of a combination of rising world income and changes in production technology and which are largely independent of individual country levels of development. One might endeavor to distinguish between the two separate causes of changing demand by adding world income as an explanatory variable, yet due to the close association between rising world income and technological progress it would be difficult to interpret their individual effect. The modified regression equation becomes:

$$S_{pit} = \alpha_i + \beta_1 \ln y_{it} + \beta_2 (\ln y_{it})^2 + \psi_1 \ln(land_1 / L)_{it} + \psi_2 \ln(land_2 / L)_{it} + \phi\, t \qquad (4.3)$$

By allowing each country to have a separate intercept (denoted by a_i) this model estimates the average relationship between a country's export shares and the explanatory variables over the two decades considered. Although we must again assume that the estimated relationship is stable across countries, the revised model imposes no restrictions on each country's initial export bias. In other words, a country with a lower per capita income is not constrained to having the same predicted primary export share as the high income country once the same per capita income is reached (holding differences in the other explanatory variables constant). Unlike the standard cross-section regression, therefore, these estimates admit differences in the predicted composition of trade depending on differences in the time period or other exogenous circumstances in which development takes place. In turn, we are essentially measuring the *changes* in the primary share associated with *changes* in income and relative resource endowments without regard to the timing of the transition.

The results of regression (4.3) are reported in Table 4.8. For the purpose of comparison, we have included the results obtained when restricting the model to contain a common intercept term and when regressed without the time trend (the first and second columns respectively). As expected, the common coefficient model does not perform especially well when compared to the dummy variable regressions, suggesting that while countries will on average move towards more intensive production and trade in manufactured goods, the timing of this movement will indeed differ across countries.

The estimated coefficients corresponding to relative resource endowments provide mixed results. For the pooled regression, inclusion of the second land ratio (forest area per worker) helps to explain the composition of trade while *Land 1* (arable land per worker) comes up as insignificant. However, when the fixed effect model (without trend) is estimated, both resource variables influence positively and quite significantly the primaries export share. The fact that arable land has no significant effect in the common coefficient specification highlights the large cross-sectional variation in endowments when compared to changes in the variable over time. When the time trend is added, however, it is forest area rather than arable land per worker that has no apparent effect on trade orientation. This result is not unusual in light of our previous observation that forest area, despite its positive effect on primaries trade, is being diminished on

Table 4.8: Share of Primaries in Total Exports – Panel Estimates

	Common Coefficient	*Fixed Effects without trend*	*Fixed Effects with trend*
constant	**0.4093***	--	--
ln(y)	**0.1614****	**-0.3540****	**-0.3307****
$\ln(y)^2$	**-0.0165****	**0.0159***	**0.0184****
ln(land 1)	-0.0095	**0.1376****	**0.0910****
ln(land 2)	**0.0178****	**0.0305****	0.0013
time(t)	**-0.0042****	--	**-0.0044****
Adjusted R^2	0.338	0.917	0.919
Cross-sectional Observations	53	53	53

* indicates significance at the 0.05 level
** indicates significance at the 0.01 level

average with time (see Tables 4.4 and 4.6). Since a declining average endowment of forest area implies a relative fall in primary exports over time, the negative time trend coefficient is now capturing much of this correlation, with the level or static effects of higher resource endowments rapped up in the cross-sectional dummies.[26]

We note that in both the pooled sample and fixed-effects regressions the time trend is highly significant and has the expected sign, albeit the estimated relationship becomes slightly inflated in the fixed-effects model for the reasons just mentioned. Another important implication of including the time trend is the change in the significance and magnitude of the income coefficients. In both fixed-effects regressions, the estimated coefficients indicate an average decline in the primary export share at low levels of income, with the positive effect of the squared term capturing the tendency of the primary share to taper off as income rises (based on the figures already presented it is reasonably safe to presume that the average primary share does not begin to rise at high

[26] In the common-coefficient model, the *Land 2* is significant despite the inclusion of the time trend since the variable still accounts for much of the cross-sectional difference in primary export shares. In the dummy-variable model, only average responses over time are estimated.

levels of income). Since the explanatory variables are expressed in log form, the primary share of exports already exhibits an asymptotic limit at zero percent even without the inclusion of the squared income variable. Thus the results indicate a tendency of the relative share curve to become flat at a level higher than this. With the inclusion of the time trend the income estimates are even more highly significant, yet the estimated negative relationship is dampened as a result of the anticipated correlation between per capital income and the exogenous shifts in relative demand for primaries. The final column (equation 4.3) therefore allows us to distinguish between the two effects. The time trend coefficient estimates the relative decline in the share of primary exports over time independent of a country's level of development, a decline that appears to be driven by primaries diminishing importance in both consumption and intermediate use. The income effect captures the country's average response to these patterns of global demand, net of changes in domestic relative demand for primaries, given the stock of accumulated capital and skilled workers. The negative relationship described by our model is consistent with the results implied by diminishing returns to the fixed factors and dynamic comparative advantage.

An important question is whether these estimates useful in describing the development path taken by a country in particular. Indeed, we are able to conclude that, on average, the relative share of primaries in a country's exports is reduced over time and at higher levels of development. However, extending these predictions to the behavior of individual countries may be misleading if, due to a misspecification in the hypothesized relationship or the omission of important variables, all country trade shares differ not only in their 'starting-point' as suggested above but in their average responsiveness to exogenous changes as well.

Because each slope coefficient has been restricted to be equal across countries, cross-sectional peculiarities are captured entirely in the differential intercept terms. The usual practice in pooling cross-section and time-series data, however, is to test for cross-sectional stability in the estimated relationship over time. If the null hypothesis of common slope coefficients for all countries can be rejected, then pooling the data as we have done may not be appropriate. In turn, the estimated association between the

different series may perhaps offer an overly generalized depiction of actual country development patterns.

To test the appropriateness of pooling country data, equation (4.3) should be jointly estimated for each country allowing for independent slope coefficients (in addition to the country-specific intercepts already assumed) and its statistical significance compared with that of the common-slope model. The adjusted R^2 value for the new regression is 0.967, a notable rise from 0.919, the value obtained from the restricted regression. This suggests that some countries, if not all, display development patterns significantly different from the one estimated. Since there is a potential for this difference to be entirely due to cross-sectional variation in the influence of a single explanatory variable, such as per capita incomes or natural resources, one may be interested in distinguish which coefficients are in fact similar across countries and which relationships significantly differ. To test which variable(s) are responsible for the cross-sectional variation in the hypothesized relationship, we constrain each coefficient individually to be equal for all countries, allowing all others to differ according to an estimated slope dummy.

Since the restricted-slope model itself suffers from heteroskedastic variance, however, it is essential to correct for this for a legitimate comparison of efficient alternate parameterizations. In conducting our tests of slope-homogeneity, therefore, we employ the standard F-test from the weighted-least-squares regressions. Specifically, we test the hypothesis that the estimated parameters are jointly zero, we then try to discern whether restricting one or another variable does not result in a model which passes the test equally well (in essence we can determine whether the slope dummies are jointly zero for each variable at a time). The F-statistic corresponding to each regression is reported in Table 4.9, including those derived from our heteroscedasticity-corrected initial (all coefficients are constrained) and unrestricted regressions. Note that both income terms are treated as part of a single relationship.

The first statistic corresponds to the regression where “none” of the coefficients are restricted to be equal across countries. We observe that restricting the coefficients leads to a particularly low F-statistic in comparison to the unrestricted model. In fact, using the appropriate degrees of freedom, conducting a standard F-test on each

Table 4.9: Comparison of Constant and Variable Slope Models

constrained coefficient	*F-statistic*	*degrees of freedom*
none	543.62	683
all	20.14	933
ln(y), $ln(y)^2$	3.94	833
ln(land 1)	2.14	883
ln(land 2)	2.90	883
time(t)	3.48	883

individually restricted coefficient reveals that none of these relationships display cross-sectional stability (in each case the null-hypothesis that the cross-sectional slope dummies are jointly zero is rejected at the 0.01 level of significance). That is, the variable-slope model is more robust than each of the partially restricted regressions, emphasizing the inappropriateness of the assumption that each of the countries considered subscribe to a pattern representing the world average.

The clear implication of this test is that our estimate of 4.3 would provide inaccurate forecasts of development patterns in some countries. For such predictions individual time-series estimates should be preferred. The one drawback to this is that given the relatively short time series when compared to the wide dispersion in levels of development across countries, limiting our attention to individual patterns over time cannot provide a satisfactory view of long-run relationships. In addition, combining time-series and cross-sectional data allows us to consider the direction of change in these average relationships over time for all countries taken together, which has been a key focal point in this study. It is important to note, however, that rejection of cross-section slope homogeneity also means that the slopes and their statistical significance reported in Table 4.8 are not likely to be reliable.

Therefore even though our analysis of average global development patterns has been useful in uncovering several important relationships that would be have been hidden

in multiple time-series regressions, we have determined that the estimated averages do not represent uniform tendencies, suggesting that there exists considerable room for improvement in terms of the model employed. It is almost certain that expanding the analysis to encompass other country-specific influences on trade, such as country size, government subsidies and degrees of openness, would be beneficial in this regard. Yet it is also necessary to critically evaluate the alternate ways in which each of the variables considered might alter trade patterns. As previously noted, the model used here may be incorrectly specified. It implicitly assumes, for instance, that trade patterns are tied to development in the same way for all countries, while differences in resource endowments and time of development affect only the pace in which this transition occurs. Going back to Figure 4.7, however, there is considerable evidence that the effect of differences in relative resource endowments on the development path is more complex than this. Although most countries appear to be moving in the same direction in terms of the rising relative importance of manufacturing in production and trade, a marked increase in the manufacturing share at earlier stages of development implies a smaller increase at a later stage in the resource scarce country. Hence the different paths taken by resource-rich and resource-scarce countries are not accurately represented by the additive inclusion of these variables.

As a final matter to consider, regressions involving time series potentially yield spurious results where the series concerned follow a stochastic trend. Although the present model accounts for the deterministic trend implied by changing consumption and production patterns, we cannot be sure that the resulting process is stationary. That is, fluctuations in the share of primaries may be characterized by a directional response to changes in the independent variables, while the resulting magnitude of the share itself is entirely dependent on its previous level. If, in turn, the observed levels in the primary share are determined by factors not considered in the model (the series follows a random walk), then simply removing the time trend will not necessarily correct for all spurious correlation with the dependent variables. Only if the independent variables follow the same random walk can changes in each of the variables be attributed to a causal relationship. Otherwise the situation must be corrected by taking the first differences for each variable and estimating the causal relation between such changes.

In our model the assumed stationarity in each series becomes suspect. The imminent trend in the average log of per capita GDP, for instance, is a deterministic one only to the extent that growth is constant over time. In both our theoretical discussions of previous chapters, however, growth in per capita income is explained by varying savings and investment rates, and consequently the series is not expected to be stationary. Yet varying rates of investment are also a source of changing comparative advantage, and thus influence the share of primaries in exports. As a result, the estimating 4.3 in terms of the respective levels of each variable may still be appropriate. This hypothesis should naturally be tested, rather than assumed. A potential difficulty arises, however, in that having conducted a unit root test for over 50 countries we can expect to find series that evolve according to entirely different processes than the one just described. Where an identical series must be differenced according to different orders of integration, it is no longer a simple matter of correcting for stationarity in the above regressions. We will therefore leave exploration of this matter to further research.

5. CONCLUDING REMARKS

The main purpose of this study has been to explore the interrelations between economic growth and the changing composition of global trade. By studying patterns of development for over 140 countries, the analysis has attempted to explain observed patterns in the respective shares of manufactured and non-manufactured commodity trade in the context of a dynamic perspective of comparative advantage, linking together the various influences of resource allocation, factor accumulation, technical progress and, most significantly, global shifts in relative demand for the two categories of goods. The results of the previous chapter indicate that while the traditional determinants of trade hypothesized in the static HOV model have important and interesting implications in a dynamic context, the extent to which resource endowments 'explain' the composition and direction of trade over elongated periods is limited. In a general equilibrium framework resources can be re-allocated according to changing international demand, and our results suggest that rising world incomes and a corresponding bias in manufactured commodity use has had the most pronounced influence on a country's average pattern of allocation and trade.

In general, growth in agricultural and raw-material exports has not kept pace with the massive rise in manufactured commodity trade over the 22 year period examined. At the global level, the relative share of primaries in world exports has decline from near 40 percent in 1970 to a mere 20 percent of total trade, with exports from the manufacturing sectors accounting for the remaining volume of global trade. Underlying this shift in the composition of world trade is an overwhelming number of individual countries moving towards increased exports of manufacturing goods; this trend is observed almost universally across countries, irrespective of the initial trade orientation, as the economy develops. In fact, our attempt to interpret the peculiar tendency of some countries to either move in a direction opposite to the world average or to sustain relatively high shares of primary exports in the time-series data was rearticulated in terms of low or

negative growth in many countries as well as a conspicuous non-linearity in the hypothesized relationship between exports and levels of development, although a few countries prevailed in showing an upward trend. Nevertheless, a detailed examination of development and trade patterns in even the primary oriented countries revealed notable downward pressure on the primary export share.

Other observations replicate some of the important findings in Chenery and Syrquin (1975). In their analysis a cross-sectional examination of developing country trade patterns at various per capita income levels reveals that while large differences in the importance of primary exports in total income do exist between primary oriented and industry oriented countries, distinguished largely on the basis of relative natural resource endowments, the differences are significantly dampened at higher income levels with the upward movement manufactured exports as a percent of GDP. Similarly, our analysis describes the tendency for most countries to move towards greater manufactured commodity trade.

Tied to this is their observation that a persistent bias towards primary commodity trade at higher income levels causes a country to lag significantly behind in export growth and, more importantly, to experience slower growth in output. The present study again reports a similar finding – while a primary export bias contributes to high growth rates during the initial stages of development, often with rates that exceed growth in manufactures oriented countries, at later stages of development continued specialization is typically associated slower growth in per capita incomes.

This gradual transformation in the composition of global trade, and the observed positive relationship between growth and manufactured goods trade, is explained in part by the fact that as incomes rise internationally, *world* consumption demand for manufactured goods increases relative to that of primary products. A growing international bias in demand for manufacturing is also occurring in the intermediate goods sector where innovation and new technologies become superior substitutes for raw materials. These shifts imply a perpetual emergence in manufacturing production and trade opportunities on the one hand, while on the other which countries have a momentary cost advantage in seizing these opportunities is also dependent on the particular level of development and on the relative abundance of natural resources.

While this study certainly shifts the focus of attention from individual country experiences in development and trade to the broad structural transformation taking place at the global level, significant to our findings is the substantial variation in the time taken for a country to become relatively specialized in manufacturing production and trade. This is evident not only from a comparison of country groups according to trade orientation but also in the dramatic improvement in the variation 'explained' by country-specific dummy variables in our regression analysis of Chapter 4. However, we also observe that individual development patterns are more complexly tied to development patterns than our simple model describes. As a result, these static comparisons do not readily lend themselves to a dynamic interpretation of individual development patterns. Nevertheless, it is quite incorrect to concede that the perceived differences between countries are wholly attributed to variables that have not so far been considered. Rather re-specifying the model to correctly account for the dynamic influence of differences in resource endowments may indeed provide a strong basis for evaluating trade patterns at the country level.

Despite these shortcomings, many important insights have been derived from our examination of average global trends. For many small open economies, we have noted that the relative importance of natural resources in determining allocation and production patterns is higher at particularly low levels of income. This also suggests that the initial stages of development are characterized by an increasing volume of raw material exports, a trend that is reinforced by non-homothetic preferences. At higher levels of income, the decisive importance of natural resources in determining allocation and production decisions is expected to dissipate. Whereas the closed economy model predicts that countries at similar levels of development will reallocate productive factors towards the manufacturing sector at similar rates, with trade the above dynamics are determined not only by the country's own level of development but also other countries' stage of development. That is, while earlier perspectives in development offered by Kuznets and others have emphasized the expected uniformity of world development patterns, and in particular that countries whose income per capita today is similar to that of today's developed countries in the 1950s should witness similar transformations to those observed over 50 years ago, a country's pattern of production and trade must be

alternatively viewed in relation to the level of *world* development, which has not remained the same 50 years later. Therefore, the standard theory used to explain a common trajectory for country trade patterns is not inconsistent with a perceived divergence in both the magnitude and the rate at which this transformation is brought about in each country. To the extent that a country's own growth path is influenced by development conditions in the rest of the world, such cross-sectional disparity is expected.

These conclusions are nevertheless taken to be a refinement rather than a departure from the ideas espoused in Chenery and Syrquin (1975), Chenery and Taylor (1968) and Kuznets (1971), among others. Their search for uniformity in country growth patterns continues to be instrumental in our exploration of the important underlying processes of development. In particular, the idea of the unbalanced growth path has in many respects supplanted the notion of an inherent dichotomy between developing and developed economies with the concept of a transition from one to the other. Although the corresponding transformation in the structure of production is usually attributed to shifts in domestic demand, it has conventionally been noted in empirical studies that the composition of trade is of equal or greater importance. From a general equilibrium standpoint, then, it is useful to link the concept of unbalanced growth to international changes in comparative advantage.

APPENDIX

Table A1: 'Markov Chain' Country Groups

Group 1 (total =67)

Primaries - Primaries

Afghanistan	Kenya
Albania	Lybia
Algeria	Madagascar
Angola	Malawi
Argentina	Mali
Australia	Mauritania
Bahrain	Mongolia
Benin	Mozambique
Bolivia	Netherland Antilles
Br. Ind. Oc. Tr.	Nicaragua
Brunei	Nigeria
Burkina Faso	Paraguay
Burundi	Qatar
Cameroon	Reunion
Chad	Rwanda
Columbia	Saudi Arabia
Comoros	Senegal
Congo	Seychelles
Costa Rica	Somalia
Cote d'Ivoire	St. Helena
Cuba	St. Kitts Nevis
Ecuador	St. Pierre Miq
Egypt	Sudan
Ethiopia	Syrian Arab Rep
Gabon	Tanzania
Ghana	Togo
Greenland	Trinidad-Tobago
Guadeloupe	Uganda
Guatemala	United Arab Emirates
Guinea-Bissau	USSR (former)
Honduras	Vietnam
Iran	Western Sahara
Iraq	Yemen
	Zimbabwe

Group 2 (total = 60)

Primaries - Manufactures

Bahamas	Gibraltar	New Zealand
Bangladesh	Greece	Niger
Barbados	Haiti	Oman
Belize	Iceland	Panama
Bhutan	Indonesia	Papua New Guinea
Brazil	Ireland	Peru
Bulgaria	Jordan	Philippines'
Cambodia	Kiribati	Poland
Cayman Islands	Korea, DPR	Romania
Central African Rep	Kuwait	Sierra Leone
China	Laos	Singapore
Cyprus	Liberia	Solomon Islands
Czechoslovakia	Malaysia	South Africa
Dominican Republic	Maldives	Sri Lanka
El Salvador	Mauritius	Thailand
Eq. Guinea	Mexico	Tunisia
Falkland Isl	Morocco	Turkey
Fiji	Myanmar	Turks Caicos Isl
French Guiana	Nepal	Uruguay
Gambia	New Cledonia	Venezuela

Group 3 (total = 4)

Manufactures - Primaries

Djibouti	Guyana
Lebanon	Norway

Group 4 (total = 32)

Manufactures - Manufactures

Austria	Hong Kong	Portugal
Belgium-Luxembourg	Hungary	Spain
Bermuda	India	Suriname
Canada	Isreal	Sweden
Chile	Italy	Switzerland
Denmark	Jamaica	Taiwan
Finland	Japan	United Kingdom
France	Korea, Republic	United States
Germany	Malta	Yugoslavia (former)
Guinea	Netherlands	Zambia
	Pakistan	Zaire

Table A2: Country Groups by Trade Orientation

Group 1 (total =34) — Primaries - Primaries

Bahrain	Iran*
Benin	Kenya
Br. Ind. Oc. Tr.	Mali
Burkina Faso	Mongolia
Burundi	Netherland Antilles
Cameroon	Nicaragua
Chad	Nigeria*
Columbia	Senegal
Comoros	Seychelles
Congo	Somalia
Ecuador	St. Helena
Egypt	St. Pierre Miq
Gabon	Syrian Arab Rep
Greenland	Togo
Guatemala	Vietnam
Guinea-Bissau	Western Sahara
Guyana	Yemen
Honduras	

Group 2 (total = 88) — Primaries - Manufactures

Albania	Guinea	Poland
Argentina	Haiti	Portugal
Australia	India	Qatar*
Austria	Indonesia*	Reunion
Bahamas	Ireland	Romania
Bangladesh	Isreal	Rwanda
Barbados	Italy	Saudi Arabia*
Bermuda	Japan	Singapore
Bhutan	Jordan	Solomon Islands
Brazil	Korea, Republic of	Spain
Brunei	Liberia**	Sri Lanka
Bulgaria	Lybia*	St. Kitts Nevis
Canada	Madagascar	Sudan
China	Malaysia	Sweden
Costa Rica	Maldives	Taiwan
Cuba	Malta	Tanzania
Cyprus**	Mauritius**	Thailand
Denmark	Morocco	Trinidad-Tobago
Dominican Republic	Mozambique	Tunisia
Eq. Guinea	Myanmar	Turkey
Ethiopia	Nepal	Turks Caicos Isl
Falkland Isl	New Cledonia	United Arab Emirates*
Fiji	New Zealand	United States
France	Niger	Uruguay
Gambia**	Oman**	USSR (former)*
Germany	Pakistan	Venezuela*
Ghana	Panama**	Yugoslavia (former)
Gibraltar	Papua New Guinea	Zimbabwe
Greece	Peru	
Guadeloupe	Philippines	

Group 3 (total = 16) — Manufactures - Primaries

Afghanistan	Lebanon
Algeria*	Malawi
Angola	Mauritania
Bolivia	Norway*
Chile	Paraguay
Cote d'Ivoire	Suriname
Djibouti	Uganda
Iraq*	Zambia

Group 4 (total = 24) — Manufactures - Manufactures

Belgium-Luxembourg	French Guiana	Laos
Belize	Hong Kong	Mexico*
Cambodia	Hungary	Netherlands
Cayman Islands**	Iceland	Sierra Leone
Central African Rep	Jamaica	South Africa
Czechoslovakia	Kiribati	Switzerland
El Salvador	Korea, DPR	United Kingdom
Finland	Kuwait*	Zaire

* indicates OPEC members and net petroleum exporters

** indicates countries with fewer than 1 million workers in 1990

Table A3: Regression Results for Country Trends – Share of Primaries in Total Exports Over Time (1970-90)

Primaries - Primaries				Primaries - Manufactures			
Country	Coefficien	T-statistic	P-value	Country	Coefficient	T-statistic	P-value
Bahrain	-0.0031	-1.539	0.139	Albania	-0.0031	-2.822	0.010
Benin	0.0018	0.511	0.615	Argentina	-0.0064	-4.436	0.000
Br. Ind. Oc. Tr.	0.0244	1.684	0.116	Australia	-0.0051	-4.021	0.001
Burkina Faso	-0.0072	-1.370	0.194	Austria	-0.0031	-9.564	0.000
Burundi	-0.0101	-2.133	0.053	Bahamas	-0.0172	-2.202	0.040
Cameroon	0.0010	0.394	0.698	Bangladesh	-0.0215	-6.822	0.000
Chad	0.0006	0.291	0.776	Barbados	-0.0132	-3.873	0.001
Columbia	-0.0031	-1.783	0.089	Bermuda	-0.0141	-2.383	0.027
Comoros	0.0002	0.037	0.971	Bhutan	-0.0259	-2.216	0.047
Congo	-0.0096	-1.860	0.088	Brazil	-0.0228	-24.277	0.000
Ecuador	-0.0028	-0.958	0.349	Brunei	-0.0105	-4.544	0.001
Egypt	-0.0021	-0.572	0.574	Bulgaria	-0.0308	-6.179	0.000
Gabon	0.0069	2.061	0.052	Canada	-0.0045	-3.887	0.001
Greenland	-0.0003	-0.281	0.782	China	-0.0166	-7.311	0.000
Guatemala	-0.0015	-0.903	0.377	Costa Rica	-0.0053	-4.693	0.000
Guinea-Bissau	-0.0021	-1.274	0.217	Cuba	-0.0086	-6.560	0.000
Guyana	0.0016	0.884	0.387	Cyprus**	-0.0250	-9.591	0.000
Honduras	0.0019	1.110	0.280	Denmark	-0.0043	-2.687	0.014
Iran*	-0.0006	-0.886	0.386	Dominican Republic	-0.0350	-9.217	0.000
Kenya	-0.0025	-1.716	0.101	Eq. Guinea	-0.0314	-7.431	0.000
Mali	0.0044	1.586	0.128	Ethiopia	-0.0045	-3.157	0.005
Mongolia	-0.0086	-1.651	0.123	Falkland Isl	-0.0233	-4.537	0.000
Netherland Antilles	-0.0010	-1.747	0.095	Fiji	-0.0167	-7.946	0.000
Nicaragua	-0.0028	-1.018	0.320	France	-0.0041	-6.985	0.000
Nigeria*	0.0004	1.183	0.250	Gambia**	-0.0206	-6.805	0.000
Senegal	-0.0004	-0.204	0.841	Germany	-0.0016	-3.727	0.001
Seychelles	-0.0018	-0.855	0.402	Ghana	-0.0122	-3.856	0.001
Somalia	0.0004	0.898	0.380	Gibraltar	-0.0318	-4.988	0.000
St. Helena	0.0253	2.138	0.052	Greece	-0.0100	-8.859	0.000
St. Pierre Miq	0.0068	1.830	0.081	Guadeloupe	-0.0087	-7.956	0.000
Syrian Arab Rep	-0.0063	-1.803	0.086	Guinea	-0.0057	-3.941	0.001
Togo	0.0002	0.118	0.907	Haiti	-0.0258	-14.011	0.000
Vietnam	-0.0009	-0.340	0.737	India	-0.0089	-4.531	0.000
Western Sahara	0.0021	0.110	0.914	Indonesia*	-0.0140	-4.725	0.000
Yemen	0.0023	0.651	0.528	Ireland	-0.0193	-16.139	0.000
				Isreal	-0.0084	-18.273	0.000
				Italy	-0.0038	-9.522	0.000
				Japan	-0.0042	-5.898	0.000
				Jordan	-0.0104	-5.360	0.000
				Korea, Republic of	-0.0085	-13.590	0.000
				Liberia**	-0.0349	-6.404	0.000

* indicates OPEC members and net petroleum exporters

** indicates countries with fewer than 1 million workers in 1990

Primaries - Manufactures Continued			
Country	Coefficien	T-statistic	P-value
Lybia*	-0.0024	-7.411	0.000
Madagascar	-0.0038	-4.128	0.000
Malaysia	-0.0143	-5.877	0.000
Maldives	-0.0327	-2.524	0.027
Malta	-0.0067	-9.101	0.000
Mauritius**	-0.0335	-23.641	0.000
Morocco	-0.0228	-18.529	0.000
Mozambique	-0.0181	-6.524	0.000
Myanmar	-0.0166	-5.643	0.000
Nepal	-0.0385	-12.085	0.000
New Cledonia	-0.0092	-2.578	0.018
New Zealand	-0.0150	-5.241	0.000
Niger	-0.0767	-5.325	0.000
Oman**	-0.0023	-3.081	0.006
Pakistan	-0.0086	-4.191	0.000
Panama**	-0.0165	-6.342	0.000
Papua New Guinea	-0.0107	-3.273	0.004
Peru	-0.0082	-3.263	0.004
Philippines	-0.0135	-4.552	0.000
Poland	-0.0292	-6.994	0.000
Portugal	-0.0062	-11.129	0.000
Qatar*	-0.0096	-3.937	0.001
Reunion	-0.0043	-3.969	0.002
Romania	-0.0173	-3.640	0.002
Rwanda	-0.0078	-3.665	0.003
Saudi Arabia*	-0.0096	-2.898	0.009
Singapore	-0.0195	-11.997	0.000
Solomon Islands	-0.0209	-2.662	0.021
Spain	-0.0073	-6.350	0.000
Sri Lanka	-0.0282	-16.818	0.000
St. Kitts Nevis	-0.0147	-5.444	0.000
Sudan	-0.0024	-4.530	0.000
Sweden	-0.0027	-7.273	0.000
Taiwan	-0.0086	-16.498	0.000
Tanzania	-0.0039	-2.830	0.010
Thailand	-0.0241	-10.863	0.000
Trinidad-Tobago	-0.0127	-6.529	0.000
Tunisia	-0.0245	-13.481	0.000
Turkey	-0.0327	-18.531	0.000
Turks Caicos Isl	-0.0398	-2.918	0.013
United Arab Emirates*	-0.0034	-6.065	0.000
United States	-0.0074	-11.077	0.000
Uruguay	-0.0136	-4.146	0.001
USSR (former)*	-0.0069	-5.127	0.000
Venezuela*	-0.0103	-7.827	0.000
Yugoslavia (former)	-0.0047	-9.725	0.000
Zimbabwe	-0.0224	-10.315	0.000

Manufactures - Primaries			
Country	Coefficient	T-statistic	P-value
Afghanistan	0.0038	3.632	0.002
Algeria*	0.0041	3.202	0.004
Angola	0.0067	4.149	0.000
Bolivia	0.0128	5.908	0.000
Chile	0.0151	7.000	0.000
Cote d'Ivoire	0.0080	6.518	0.000
Djibouti	0.0281	3.764	0.003
Iraq*	0.0061	2.652	0.015
Lebanon	0.0111	3.989	0.001
Malawi	0.0017	2.914	0.008
Mauritania	0.0012	2.888	0.009
Norway*	0.0177	6.320	0.000
Paraguay	0.0044	2.658	0.015
Suriname	0.0075	4.205	0.000
Uganda	0.0029	3.339	0.003
Zambia	0.0034	2.377	0.028

Manufactures - Manufactures			
Country	Coefficient	T-statistic	P-value
Belgium-Luxembourg	-0.0011	-1.049	0.306
Belize	-0.0048	-1.450	0.163
Cambodia	-0.0051	-1.016	0.322
Cayman Islands**	-0.0218	-1.463	0.169
Central African Rep	-0.0111	-1.661	0.123
Czechoslovakia	-0.0054	-0.767	0.452
El Salvador	-0.0035	-1.374	0.185
Finland	-0.0001	-0.180	0.859
French Guiana	-0.0093	-1.615	0.122
Hong Kong	-0.0003	-0.914	0.372
Hungary	0.0001	0.094	0.926
Iceland	-0.0109	-2.059	0.053
Jamaica	-0.0019	-1.345	0.194
Kiribati	0.0010	0.457	0.653
Korea, DPR	-0.0025	-0.807	0.429
Kuwait*	-0.0103	-1.663	0.112
Laos	0.0074	0.512	0.618
Mexico*	-0.0017	-0.398	0.695
Netherlands	-0.0026	-1.802	0.087
Sierra Leone	-0.0065	-1.244	0.228
South Africa	-0.0030	-0.912	0.373
Switzerland	-0.0001	-0.257	0.800
United Kingdom	0.0035	1.870	0.076
Zaire	-0.0017	-0.497	0.624

* indicates OPEC members and net petroleum exporters

** indicates countries with fewer than 1 million workers in 1990

Figure A.1 Comparison of Primary Export Classifications as a Share of Total Exports in Selected Countries

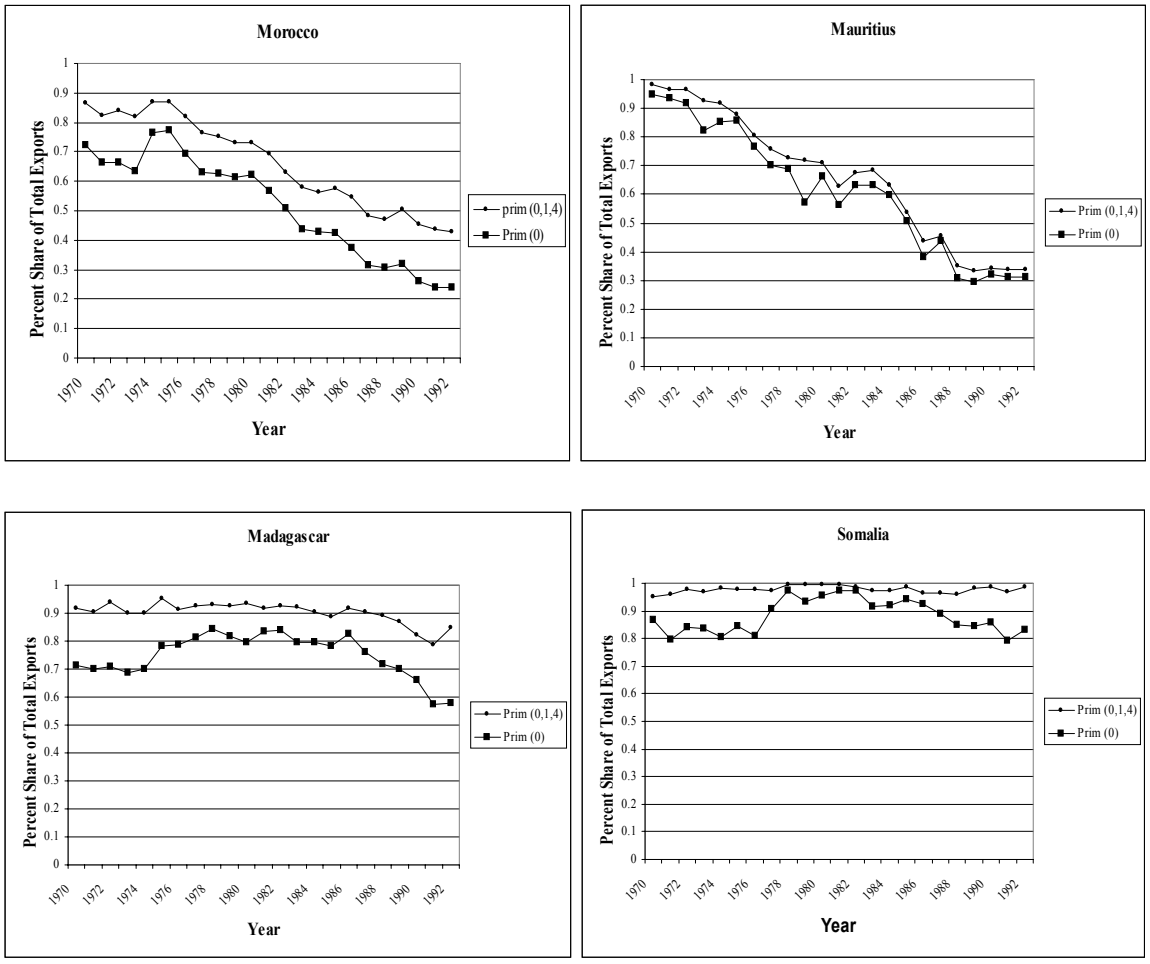
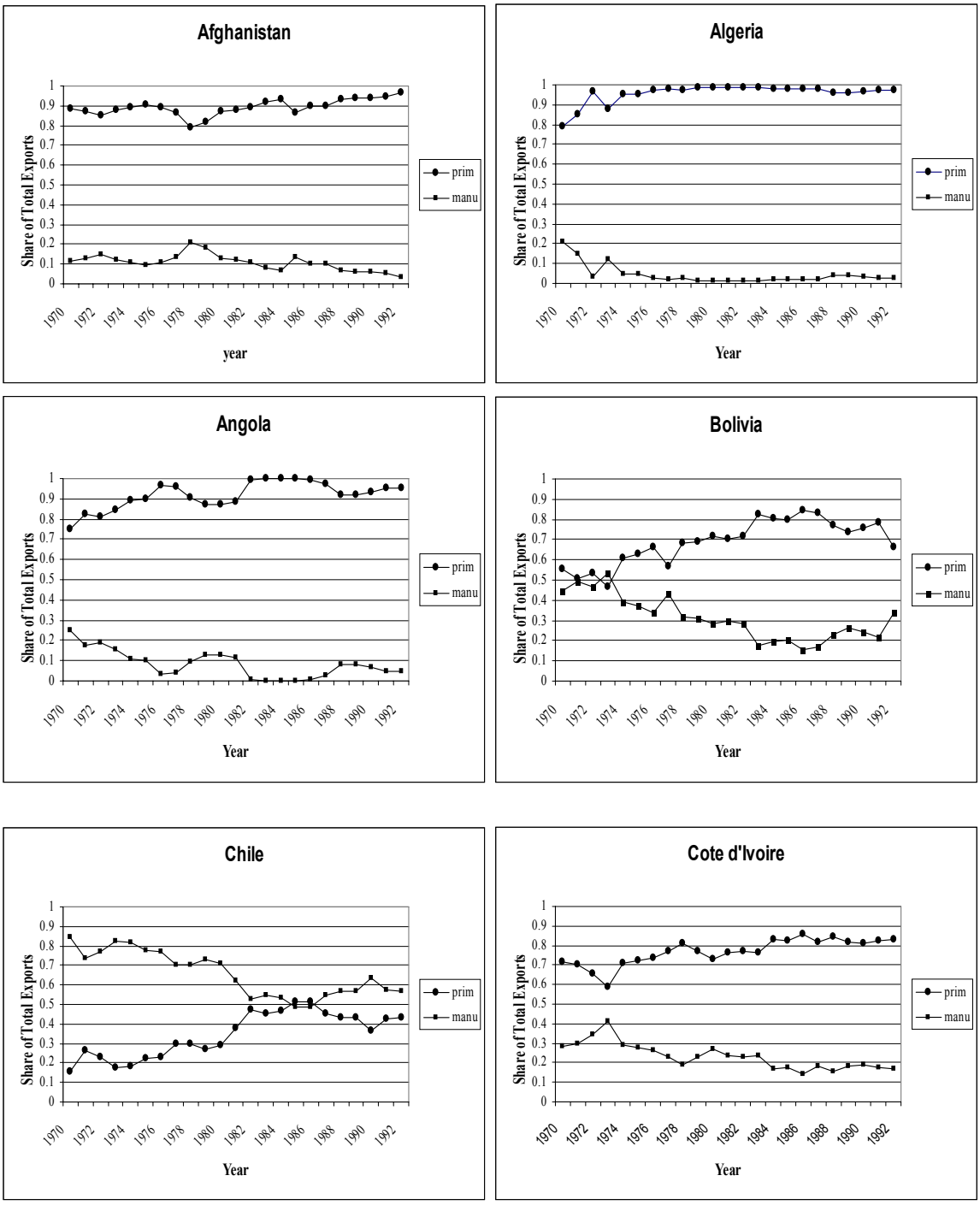
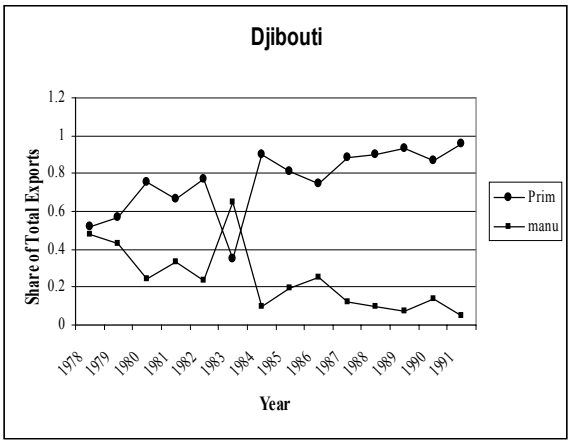
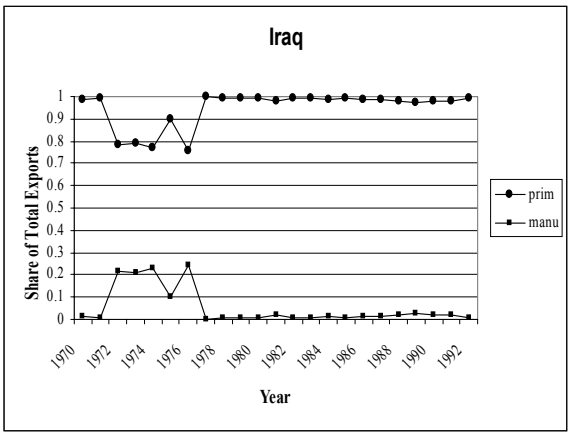
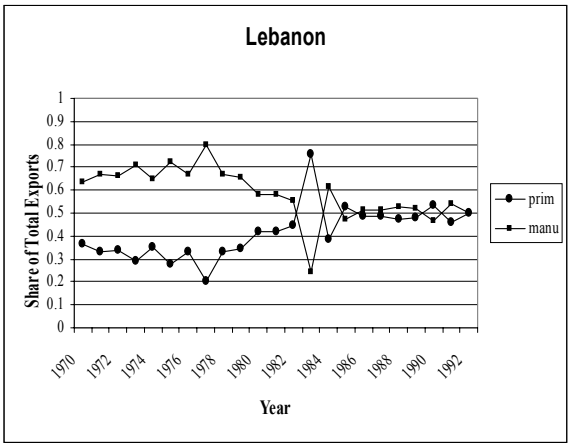


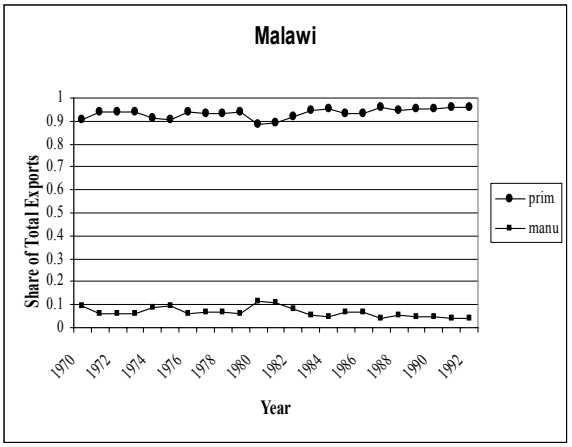
Figure A2: Sectoral Composition of Exports – Primaries-Oriented Countries

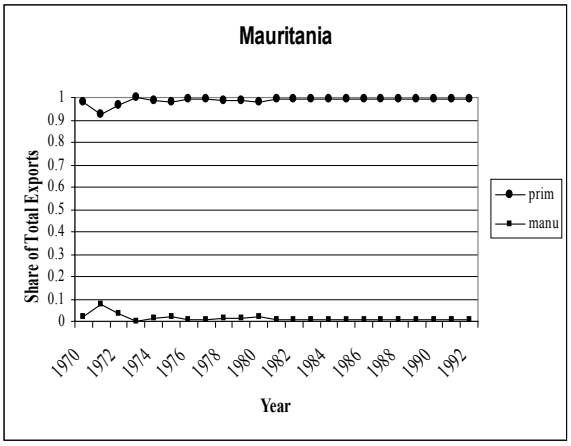


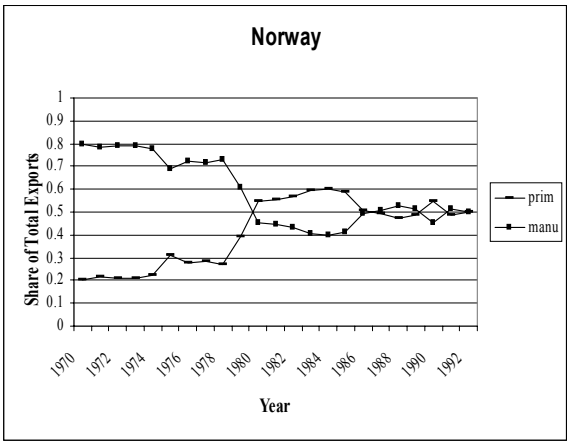

Djibouti
Share of Total Exports
Year
Prim
manu


Iraq
Share of Total Exports
Year
prim
manu


Lebanon
Share of Total Exports
Year
prim
manu


Malawi
Share of Total Exports
Year
prim
manu


Mauritania
Share of Total Exports
Year
prim
manu


Norway
Share of Total Exports
Year
prim
manu

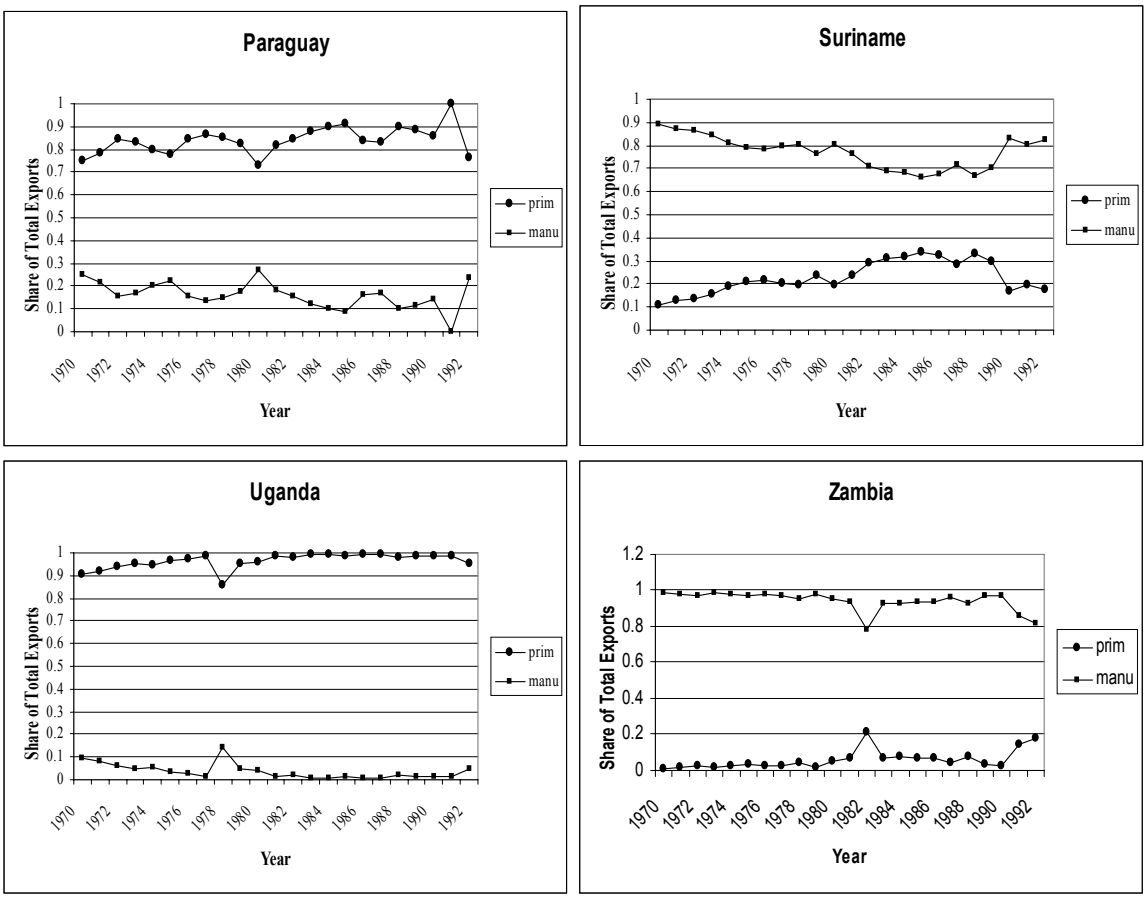
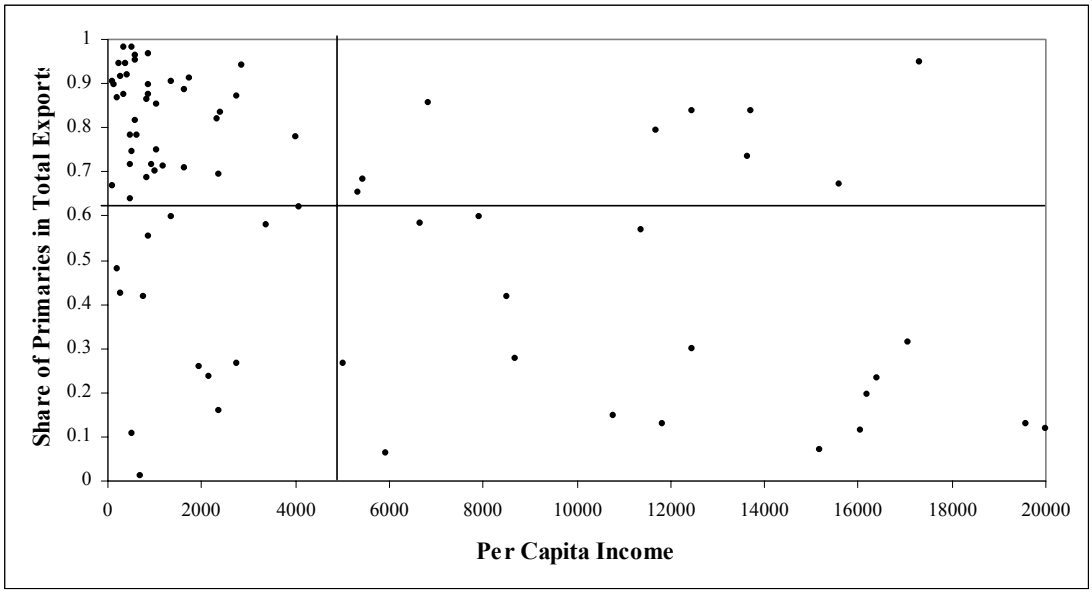
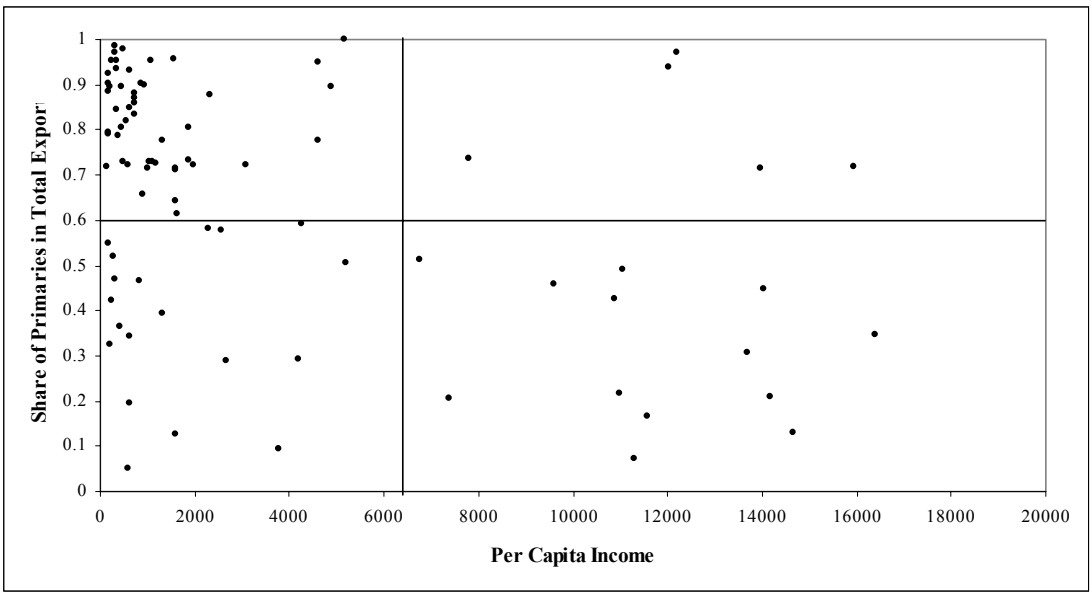

Paraguay
Share of Total Exports
Year
prim
manu
Suriname
Share of Total Exports
Year
prim
manu
Uganda
Share of Total Exports
Year
prim
manu
Zambia
Share of Total Exports
Year
prim
manu

Figure A3: Per Capita Incomes and the Share of Primaries in World Exports

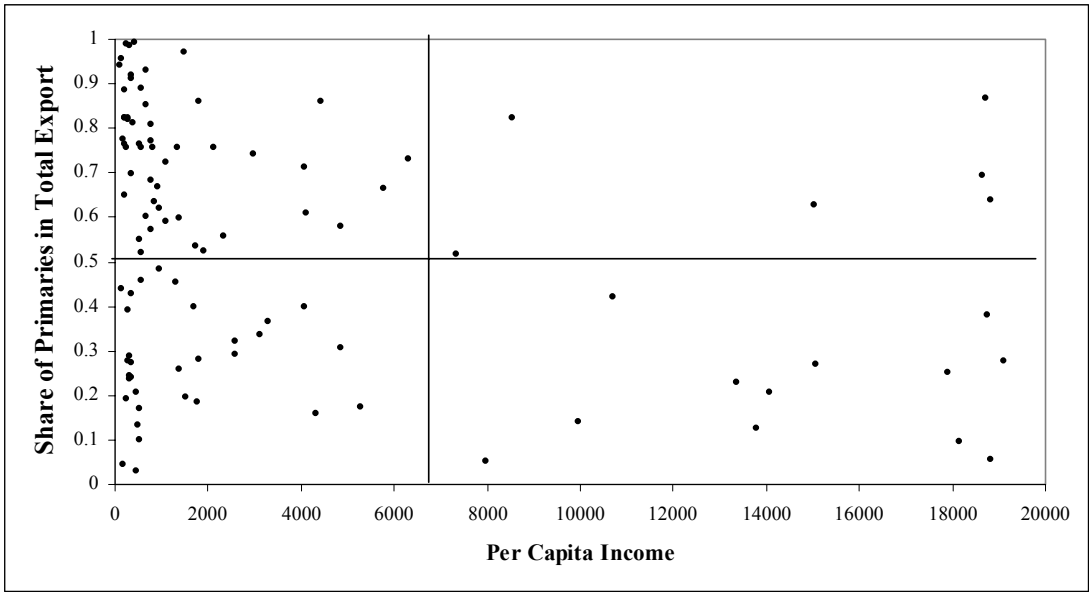
a. 1970



b. 1980



c. 1990


Share of Primaries in Total Export
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Per Capita Income

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