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Trade and Economic Development: Estimating Price and Income Elasticity on the World Market.

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Abstract

The balance-of-payments-constrained growth theory has emerged as perhaps the most interesting objection to the doctrine of unregulated free trade within the field of development economics. It stipulates that growth is constrained by demand, particularly demand for exports because exports are the only source for foreign currency (assuming balanced current account in the long run) and thus crucial to the acquisition of capital goods scarce in much of the developing world. Specifically, economic growth is thought to be dependent on the growth of world income as well as the price and income elasticity of demand for exports and imports. Implicit the argument is made that countries exporting refined goods benefit more from unregulated trade than do countries exporting unrefined goods, due to the different demand properties of refined and unrefined goods. This paper sets out to test the validity of this claim by measuring income and price elasticity of a collection of important export goods for a sample of developed and developing countries. Some evidence is found to support the theory. Nevertheless, statistically significant estimates for price and income elasticity can be found for only a minority of the goods analyzed. Given data coverage and methodology, price and income appear not to be important factors determining export growth rates.

Key words: balance of payments, income elasticity, price elasticity, export, development.

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1 Introduction

There is no doubt that trade liberalization has been an extremely successful development policy in the newly industrialized countries of South-East Asia and elsewhere. For others however, the experience has been more difficult. Much of Africa has enforced substantial trade deregulation since the late 1970s but growth still remains out of reach, as does consensus on the effects from trade liberalization on the least developed countries. However, it is quite apparent that, whatever the reasons, trade deregulation has not resulted in growth for some countries.

The divergent experiences of trade deregulation call into question if unregulated international trade is truly a generic instrument for growth. Two possible stylized hypotheses can be formulated: either free trade is growth enhancing independent of economic structures, or the growth inducing properties of free trade is dependent on one or more variables. Under the first hypothesis the poor performance of the least developed countries is explained by malignant factors that were too powerful to be countered by free trade; growth has been lacking *in spite* of free trade. Under the second hypothesis, in contrast, unregulated trade is a process that can have positive or negative impact on growth, depending on the economy's ability to survive in and take advantage of the possibilities given by the world market. This paper does not aim to validate nor reject these hypotheses but it is with the second hypothesis' skeptical view of international trade's universally beneficial growth effects that it looks to understand the challenges that developing countries face in the world economy.

1.1 Purpose and Question

Traditionally, trade theory assigned little importance to the composition of exports and imports when discussing gains generated by trade; free trade increases real income and consumption possibilities of the world's population equally. If anything, the difference in factor endowments across countries would make levels of income converge between rich and poor parts of the world. The obvious evidence to the contrary makes one look for a theory that reflects reality more closely.

Following Raúl Prebisch, a more nuanced view of the effects from trade took form. Prebisch argued that there were a number of characteristics associated with the production and world market for primary commodities that caused trade gains tilt to the advantage of countries producing refined goods. I will build on the work of Prebisch and others below.

The point of origin for this thesis is the question whether trade truly is a generic instrument for growth, or if it is rather dependent on domestic economic structures, the specialization of the economy, the branch of the economy that holds the comparative advantage on the world market, and the composition of trade. Such a broadly defined question would however be beyond a paper of this size and so I have elected to focus on determining price and income elasticities of demand for a series of goods in the world market. Even though this paper deals with the specific question of elasticities, the overall question to keep in mind while reading it is if the growth effect from international trade depends on what is exported and imported. The elasticities of exports and imports are theoretically linked to economic growth as will be explained in detail below.

This thesis will present an overview of the theoretical reasons put forward in the literature why the developing world's gains from trade might not be as large as the developed world's gains. However, this paper is not primarily an overview of current research, but an empirical work of econometric analysis. The question of the importance of trade composition will be answered using the perspective of the balance-of-payments-constrained (BOPC) growth theory as it has been laid out by Thirlwall and others. The

proponents of this theory typically hold the view that primary goods are different from manufactured goods. Specifically, price elasticity (to what degree consumers change their consumption quantity when prices change) and income elasticity (to what degree consumers change their consumption quantity when income changes) are thought to be major explanations of why certain countries seem to be so differently affected by international trade. The econometric analysis below is limited to determining price and income elasticity of demand for exports. Two groups of countries are formed: one is composed of 23 developed countries, the other of 88 developing countries. Econometric analyses are performed in an attempt to estimate price and income elasticities for the two samples' 50 most important export goods. The elasticity coefficients are regressed in a time series model of panel data using 22 years of data (1980-2001) for a sample of 111 countries and 100 goods[1]. Focus of the theoretical and empirical investigation will be on income elasticity due to the limited importance assigned to price elasticity by the balance-of-payments-constrained growth theory.

The remainder of this thesis is organized as follows: in chapter 2 the theoretical connections between trade composition and economic growth are laid out. Chapter 3 details the model. Chapter 4 contains a brief discussion about the policy implication of the theory of balance-of-payments-constrained growth. Chapter 5 deals with the methodology of the statistical and econometrical work. Chapter 6 presents and analyzes the results. Chapter 7 concludes.

[1] See chapter 5.2 for a detailed description of sample selection methodology.

2 Balance-of-Payments-Constrained Growth Theory

One of the most easily identifiable features of the current economic literature on the growth-trade nexus is the theoretical divide separating demand side (Keynesian or Post Keynesian) and supply side (neoclassical) economists. A quote from Krugman, in this context representing the latter, illustrates the disagreement:

> It just seems fundamentally implausible that over stretches of decades balance of payments problems could be preventing long run growth, especially for relatively closed economies like the US in the 1950s and 1960s. Furthermore, we all know that differences in growth rates among countries are primarily determined in the rate of growth of total factor productivity, not differences in the rate of growth of employment; it is hard to see what channel links balance of payments due to unfavourable income elasticities to total productivity growth. (Krugman quoted in McCombie & Thirlwall 1997).

For the neoclassic school of thought the accumulation of financial and human capital and technological innovation drive productivity, economic growth and income; demand does not influence growth, but the other way around. This paper takes opposition to this belief and the remainder of chapter 2 will make the case for why demand (for exports) is indeed central to economic growth in much of the developing word.

Starting in general terms, the skepticism towards unregulated trade has often been articulated by center-periphery academics. This includes Gunnar Myrdal who describes his view of neoclassical economic theory as follows: “The theory of international trade did not develop to explain the reality of underdevelopment and need for development. You could say that this impressive structure of abstract thinking had almost the opposite goal, namely to *make excuses for the problem of international equality*” (1970 p. 202,

original emphasis, this author's translation). Myrdal, being an important representative of the school of institutional economy, believed that unregulated trade would enhance – not erode – inequality between nations. The dynamic effects from trade (for example increasing economies of scale) would reinforce the differences in productivity between developed and developing countries: the increasing input requirements of profiting areas would subsequently drain the developing world of its resources. For Myrdal, the key to explaining the internationally uneven distribution of gains from trade was the dynamic effects from trade (including trade composition, economies of scale, income elasticity of demand, and internal and external positive effects), which would evolve more favorably for the developed world than for the developing world, thus making it hard for the latter to compete in the international market (Myrdal 1970 p. 208 f.). The market power of the developed world would make it hopelessly difficult for developing nations to sell their products and services on the world market. Export earnings would consequently be kept low and, under the very plausible assumption of significant import requirements, the balance of payments would deteriorate and become a real impediment to economic growth.

Economists Raúl Prebisch and Hans Wolfgang Singer were among the first to, in 1950, approach growth and development theory from a balance-of-payment-perspective.[2] Prebisch and Singer suggested that the gains from trade were distributed unevenly due to the international division of production, to the great misfortune of the 'periphery' who would continue to be exploited by the 'center' as long as their domestic production structure would favor the production of primary goods. Primary goods production often exhibit diminishing returns to scale because they are dependant on a fixed factor of production. Classical economic theory would suggest that this simple fact would help develop terms of trade in favor of the developing world: in accordance with the law of diminishing returns, the addition of certain variable factors (labor and capital) to a production with a fixed factor (land) will make the additional variable factors less and less productive, which in turn would raise prices (since marginal cost is to be equal to marginal product). Primary production also has relatively slow-paced technological

[2] See Toye & Toye (2003) for an in-depth look at the origin of the Prebisch-Singer thesis.

progress which tends to keep input capital goods costly. Given a production function that keeps prices high for primary commodities while prices for manufactured goods generally becomes cheaper over time, one would expect terms of trade to develop favorably for the developing world and prior to the Prebisch-Singer thesis economists since Robert Malthus had feared a declining terms of trade trend for the manufacturing industry (Toye & Toye 2003 p. 439; Thirlwall 2003 p. 659).

Based on a statistical study about the United Kingdom's foreign trade during the period of 1876-1947, Prebisch found that there was a secular deterioration in the relative world market prices of primary goods.[3] Singer stated further that even if the trend would become reversed it would only serve to create incentives against industrialization in the developing world. It is still an open question whether the short run positive effect on income from a terms-of-trade improvement is preferable to the potential long term gains of industrialization forced by deteriorating terms of trade for primary goods. The theoretical work of Prebisch and Singer was one rationale behind trade regulating reforms (later known as import substitution) undertaken by much of the developing world in the 1940s, 1950s and 1960s (Hadass & Williamson 2003). It also relates to the more recent discussions about resource curse and Dutch disease.

According to this Keynesian view, economic growth is driven by demand and exports is singled out as the most important component of aggregate demand since it alone can finance import requirements. The reasons for the unfavorable development of the relative prices of primary goods was largely found in the characteristics of demand – particularly in the income and price elasticity of demand for primary goods.

More specifically the theoretical point of origin for this paper will be Thirlwall's Law (also referred to as the 'dynamic Harrod foreign trade multiplier' or the '45 degree rule') which proposes that a country's economic growth is primarily constrained by its balance of payments because no open economy can maintain a growth rate inconsistent with balance of payments equilibrium unless it is able to finance its current account deficit (which can be thought of as impossible in the long run). In its original form, assuming

[3] See Hadass & Williamson (2003) for the Prebisch data.

fixed relative prices and capital immobility, Thirlwall's Law stipulates that the growth rate is to follow the rate of growth of the world economy multiplied by income elasticity of demand for the country's exports divided by income elasticity of the country's imports (Thirlwall 1979).[4] Building on the original model Thirlwall and Hussain (1982) relaxed the assumptions and allowed for capital flows and variable terms of trade.[5] As mentioned before, this paper will not analyze Thirlwall's Law, but focus on determining the export elasticities included in it.

Before turning to a discussion about demand elasticity it is important to point out that primary goods are produced all over the world and not only in developing countries. Also, plenty of services and manufactured goods are produced in developing countries. Even so, there is an apparent North-South dilemma present in the terms of trade debate, since primary goods are predominantly produced in the South and manufactured goods predominantly produced in the North. As a result, the North-South trade relation will be a central theme throughout this paper, but it will be useful to keep in mind that the group of countries producing primary goods is a diverse one. Some primary products (like cotton, coffee, diamonds, oil and gold) are export components important to several countries, but the mix of the export basket is quite varied and some resources are fairly unique to a few countries (like uranium, phosphates and iron ore) (Deaton 1999).

The following subsections go more in-depth into the theories of Prebisch, Singer and Thirlwall, starting with income and price elasticity of demand.

2.1 Income Elasticity of Demand

Singer argued that the unequal distribution of the gains from technological progress was one reason behind the downward sloping trend of relative primary goods prices. As the development of different technologies would continue, the world's income would grow and global consumption of all goods would increase (bar inferior goods). The exact

[4] The original version of Thirlwall's Law is formalized in equation 3.10 below.
[5] The extended version of Thirlwall's Law is formalized in equation 3.9 below.

relation between increasing income and increasing consumption of different goods will, however, depend on their relative income elasticity of demand. Primary goods typically exhibit low income elasticity compared to manufactured goods[6] and thus even large increases in world income risks having only limited effects on the demand for primary goods. As a result, and because generally speaking the developing world is relatively specialized in primary goods and the developed world is relatively specialized in manufactured goods, the increase in demand resulting from growing income will benefit developed countries more than it will developing countries. To add further to the demand side issues, advances in chemical and other production techniques, has offered synthetic alternatives to some of the primary goods previously only provided by developing countries. Other technological breakthroughs have decreased the amount of raw materials necessary for production.

As mentioned above, there is a fairly wide agreement that income elasticity for primary goods is generally lower than for manufactured goods. By implication, the wealthier the world gets, the smaller share of its wealth will be spent on primary goods imported from developing countries (assuming less than unity income elasticity, commonly referred to as Engel's Law). Respectively, the wealthier a developing country becomes, the larger the share of its wealth spent on imports of manufactured goods from developed countries. Through this mechanism, where the developing country's import to export ratio will continue to grow, there will be an automatic balance of payment differentiation caused by the nature of demand for these different types of goods. (Obviously, if the developed world grows at a faster pace than the developing world, then this effect can be offset, but it would certainly be strange to stick to a development strategy that presupposes lower growth rates than the rest of the world.)

It is important to note that there is no consensus on the causality between the income elasticity of demand and economic growth ("I am simply going to dismiss a priori the argument that income elasticities [of demand for exports] determine growth, rather than the other way round" (Krugman in McCombie & Thirlwall 1997)). This author sees no

[6] There appear to be a some agreement that income elasticity of refined goods on average are higher than that of unrefined goods (Thirlwall 2003 p. 661).

reason for why the causality could not go in both directions. Clearly, factor accumulation and economic growth will cause the domestic production to adjust, presumably as to contain less inelastic goods. Nevertheless, of the two factors behind economic growth according to the neoclassic school, factor accumulation and total factor productivity (TFP), only one appears to be important to the experience of the developing world. It appears that even for fast growing NICs like Hong Kong, Singapore, South Korea and Taiwan, growth has mainly been a result of factor accumulation, while TFP has not been rapidly growing (Young 1995). Given stable TFP, foreign currency shortage and the fact that one of the scarcest factors of production in the developing world is capital goods (that need to be imported), it is reasonable to think that substantial export earnings will be needed in order for meaningful factor accumulation to take place. Furthermore, since export earnings are determined by production capacity, prices and characteristics of demand (entailed in the concepts of income and price elasticity), it is clear that, on a theoretical level, income elasticity can influence economic growth. This paper will therefore make the assumption that for most developing countries the causality is likely to go from income elasticity to growth, and not the other way around.[7]

2.2 Price Elasticity of Demand

Low price elasticity in the export goods market will also add to the difficulties associated with global trade deregulation. In the short run, a trade liberalization process by itself can add to the terms of trade difficulties of a deregulating country, because the policy in itself will invariably have a negative impact on its terms of trade. If one makes the reasonable assumption that imports to and exports from the deregulating country will increase as the protective measures are scaled down, then world aggregated demand of the imported goods will go up, and so would world aggregated supply of the exported goods. Hence, the ratio of world market prices for exported goods to imported goods would decline. The magnitude of this effect will obviously be proportional to the size of the deregulating

[7] Perraton (2003 p. 4) and others come to the same conclusion.

economy, and so it is quite possible that the effect will be marginal for small countries. On a wider scale, a trend across primary goods producing countries to deregulate trade, can cause terms of trade to deteriorate further as supply increases, since the low price elasticity of demand will create high gear transmission between output and prices. Thus, the persisting policy recommendation of free trade reforms risks making worse the chances to retain enough earnings from the export industry.

In fact, price elasticity of demand is a central component of the explanation of the trend of developing countries' terms of trade, and is crucial for the assessing the potential of export promotion strategies. The presence of low price elasticity for primary goods weakens the rationale for export promotion strategies, since allocating production resources into those sectors would cause prices to drop. Whether or not the industry would survive would depend on the slope of the demand curve and the initial markup levels, but regardless, it is theoretically problematic to specialize domestic production in industries producing goods the demand for which has low price elasticity. In the worst of cases the production process could exhibit properties similar to diminishing returns, in the sense that as quantity goes up, profits go down.

The situation where increased output moves prices and terms of trade enough to offset increases in income has been referred to as immiserizing growth. Absolute immiserizing growth – the actual decrease in the rate of economic growth – is not a very likely scenario, but relative immiserizing growth can be an important explanation of the wide gap between the world's rich and poor countries (Maneschi 1983).

The price elasticity of demand would only be important if countries are unable to sell any amount of their export goods at the going world market price (without causing the world market price to decrease as export quantities increase). The validity of this small country hypothesis remains a topic of disagreement in the literature, but on the whole it appears that very few countries are pure price takers in the world market of very few goods (Thirlwall 2003 p. 690; Perraton 2003 p. 5).

2.3 Exchange Rate Consequences

Theoretically speaking the developing world's difficulties with generating export earnings (caused by relatively low demand for their products) will put depreciatory pressures on these countries' currencies, which might further worsen the balance of payments if demand is inelastic (Thirlwall 2003: 662). For much of the developing world the issue of capital shortage is often a serious one, and traditionally a major rationale behind foreign aid. Accordingly, assuming no sudden increase in foreign investments, the need for foreign aid will increase as a result of the balance of payments deficit, putting further pressure on the already stressed ODA situation.

Exchange rate consequences will be discussed further within the context of policy alternatives in chapter 4.1.

2.4 Commodity Price Variance

If the existences of trends in commodity prices are hard to prove, the same can not be said about variance. An example from Deaton (1999) is telling: the price of coffee in April 1977 was more than six times higher than in June 1975, and during an eight months period in 1994 it increased threefold. Put in relative terms, for every 1 percent change in industrial goods prices, the prices of primary goods change 2.4 percent (Thirlwall 2003). Demand side factors (notably interest rates) are thought to have some effect on the short run price shocks, but much of the answer appears to lie on the supply side (political unrest, epidemic, weather, violent conflict).

Short term revenue fluctuations[8] are usually seen as adding a burden of unpredictability to investors, but business opportunities can still constitute a sound investment as long as the expected payoff is large enough to make it worth the risk. But in the case of countries

[8] Cashin, Liang & McDermott (2000) (and others) find that primary goods prices are more long-lived than what is usually believed. Of 60 commodities looked at over the period 1957-98, 17 presented price shocks that lasted longer than 5 years.

with substantial primary goods production (in terms of percent of GDP or exports) and inadequate financial institutions (that otherwise could have helped consumers, producers and the government to make intertemporal adjustments), price volatility can be a very real problem as it can cause balance-of-payments and government budget instabilities and make long term development policies hard to plan (Cashin et al 2000). To make matters worse, the difficulties in predicting prices (and the arrogance of various policy advisors) have created a situation where developing countries have received poor and even misleading advice on whether to utilize export revenues for savings, investments or consumption (see figure 5 in Deaton (1999) for examples).

To stabilize the revenue situation for developing countries, five international commodity agreements have been set up in the recent past (for sugar, tin, rubber, coffee and cocoa), accounting for some 35 percent of the non-oil exports of developing countries (Thirlwall 2003 p. 675 ff). However, due to lack of funds and disagreement on the distribution of compensation, the rubber commodity arrangement is the only one still in operation.

Returning to the overall topic of balance of payments, it is apparent that the degree to which demand is income and price elastic will determine the importance of the objection raised by the balance-of-payments-constrained growth theory against the doctrine of free trade. The next subchapter will examine the empirical finding of these elasticities, but will begin by looking at the empirical work done to determine trends in terms of trade.

2.5 A Review of the Literature

Prebisch's findings on the downward sloping trend of the relative prices of primary goods has, in turn, been dismissed and confirmed by a number of studies. Typically the criticisms raised against Prebisch are that 1) the UK trade situation was not typical for the industrialized world, 2) the primary goods import to a substantial degree originated from developed countries, 3) export prices in the data set do not include transportation or insurance costs, while import prices do, 4) the price index does not fully reflect the

quality improvements of manufactured goods traded (Spraos 1980). Nevertheless, there appears to be some agreement that relative primary prices really have fallen, but there are still disputes concerning if these deteriorations are best described as secular trends or structural breaks. Newbold, Pfaffenzeller and Rayner (2005) in a study of 24 commodities during 1987-2002 find that "while it is true that real prices have fallen for a large number of commodities in the course of the twentieth century it does not necessarily follow that this development is best modeled as a continuous trend: in the majority of cases, no significant trends were inferred [and] if there is one stylised fact that tends to be applicable to commodity prices in general, it is that of general volatility rather than predictable trend movements." The price index of Enzo Grilli and Maw Cheng Yang for the period 1900-1986 demonstrate that the general fall in relative primary goods prices during the twentieth century largely happens in two short periods, specifically the years around 1920 and 1985 (Hadass & Williamson 2003). Hadass & Williamson (2003) find that terms of trade for all trading partners, grouped in four by production factor endowments and wealth, improve from 1870 to World War I due to the decrease in transportation costs, thus negating the findings of Prebisch. Even more interesting however, they find some evidence that the improved terms of trade caused unwanted effect on long term (or quasi-long term) growth figures for the developing world and offer two possible explanations for this: 1) improved terms of trade for primary goods punishes the industrial sector that is assumed to generate technological progress and long term growth, and 2) the change in relative prices cause rent seeking behavior and capital flight from the primary goods producing countries. They also found that this trend was broken after World War I when relative primary commodity prices deteriorated due to the developed world's tendency to restrict trade and because the drastic decline in transportation costs subsided. Deaton (1999) analyze nominal prices for a number of primary commodities and reaches the conclusion that "owners of a constant flow of primary commodities would not have seen much growth in their real income [during the twentieth century]" since the nominal prices lacked an upward sloping trend that would be able to offset inflation.

Terms of trade is one of the elements making up the Thirlwall's Law, which also includes elasticities and capital flows (see equation 3.9). Testing of Thirlwall's Law is typically

accomplished by estimating the growth rate consistent with Thirlwall's Law and comparing it to the actual rates of economic growth. In 1979, in his pioneering work, Thirlwall estimated balance-of-payments consistent growth rates (using the simplified model, see equation 3.10) for 18 developed countries over two separate time periods (1951-73 and 1953-76) and found that they closely match the actual growth rates.[9] Bairam (1988), sampling 19 European and North American countries over the period 1970-85 finds Thirlwall's Law to be valid and comes to the conclusion that income elasticity of exports and imports are important factors determining economic growth but that price elasticities often are not. Small and insignificant price elasticity estimates are not uncommon in the literature (McCombie & Thirlwall 1997).

Many studies come to similar conclusions analyzing developed countries[10], while studies of developing countries are fewer in number and generally more limited and less persuasive (Perraton 2003 p. 1). Bairam & Dempster (1991) analyze the experiences of 11 Asian countries during the time period 1961-85 and find that "overall economic growth is determined by the Harrod foreign trade multiplier". Nevertheless, only 7 of the 11 countries exhibit less than one percentage point difference between estimated and actual growth rates. In several papers, Bairam concludes that "the results imply that, in an open economy, relevant economic management is the factor that manipulates the income elasticities of exports and imports" (Bairam & Dempster 1991; Bairam 1988).

More recently Razmi (2005) uses the Johansen's cointegration technique to analyze India's growth experience during the time period 1950-1999. He comes to the conclusion that estimated levels of growth approximate actual growth rates in the long run, but that substantial deviations occur in the short run. Hussain (1999) finds that only 4 developing countries out of a sample of 40 exhibit estimated growth rates which do not match actual growth rates. Perraton calculates estimates for 59 developing countries over the period 1970-84, and finds that average actual and average predicted growth rates differ by only 0.16 percentage points (McCombie & Thirlwall 1997). Hussain (1995) finds the

[9] The estimated growth rates' average deviation from actual growth rates were 0.63 percentage points.
[10] See McCombie & Thrilwall (1997) for an excellent overview of the econometrical tests made of Thirlwall's Law.

corresponding figure for 29 African and 11 Asian countries to be 0.24 percentage points and 0.14, respectively.

Different studies do to some degree come to different conclusions, but overall it seems that Thirlwall's Law is more suitable for developed countries than for developing countries. Additionally, it is more accurate for the long run than the short run.

As is evident from the previous paragraphs, numerous studies focusing on the validity of Thirlwall's Law have been conducted since 1979. Although they all most probably include estimates of income and price elasticity for imports and exports, these are all calculated on a country level, i.e. the question has been: how well does the estimated growth of country A's economy match the income and price elasticity of country A's export and import, its terms of trade and capital flows. As explained above this study does not ask that question, rather it will focus on the elasticity of specific goods (not on the elasticity of baskets of goods), the aim being to determine whether or not the export of some goods is are more beneficial for economic growth than others. We have been unable to find any empirical work pursuing this objective.

3 The Model

We will now turn to a formal mathematical description of the importance of the balance of payments for economic growth.[11] The central hypothesis of Thirlwall's law – that growth is restrained by the demand for exports – is reached by the following algebraic exercise.

An economy's current account balance can be expressed as

$$P_d X + K = P_f ME \tag{3.1}$$

where P_d is average export price, X is export quantity, K is nominal capital flows measured in domestic currency, P_f is average foreign price of imports, M is quantity of imports and E is the nominal exchange rate. ($K > 0$ denotes net capital inflow.) Now let us turn to what restrictions this relationship imposes on the growth of the economy by first considering what variables determine import and export quantities. The demand for a country's export goods will depend on the rest of the world's income (the purchasing power of the consumer) and propensity to import, and also on the price of competing export goods from other countries. Formally, the demand for export goods can be written as:

$$X = \left(\frac{P_d}{P_f E} \right)^{\eta} Z^{\varepsilon} \tag{3.2}$$

[11] I follow the mathematical notation and structure of Thirlwall (2003 p. 689 ff) and Hussain (1999).

where η denotes the price elasticity of demand for exports, Z is the income of the rest of the world and ε is the income elasticity of demand for exports. Conversely, the demand for imports can be expressed as:

3.3

$$M = \left(\frac{P_f E}{P_d} \right)^{\psi} Y^{\pi}$$

where ψ is the price elasticity of demand for imports, Y is domestic income and π is the income elasticity of demand for imports. The above equations describe static relationships between income, prices, imports and exports, but for a discussion on the limitations the balance of payments impose on growth, we will now turn to derivatives of equations 3.1 to 3.3. First though, we will introduce Θ and τ which denotes the share of the import costs that is financed by export earnings and capital inflows, respectively.

3.4

$$\Theta = \frac{P_d X}{P_d X + K}$$

3.5

$$\tau = \frac{K}{P_d X + K}$$

For the balance of payments to hold the growth rate of domestic income generated by imports should equal the growth rate of expenses on exports, as:

$$\Theta(p_d + x) + \tau k = p_f + m + e \tag{3.6}$$

where the lower-case letters represent growth rates of their upper-case counterparts. Continuing, growth rates of import and export demand can be written as:

$$x = \eta(p_d - p_f - e) + \varepsilon \cdot z \tag{3.7}$$

$$m = \psi(p_f - p_d + e) + \pi \cdot y \tag{3.8}$$

We are now arriving at a mathematical expression for the argument that the balance of payments imposes restrictions on domestic growth rates. By substituting equations 3.7 and 3.8 into equation 3.6, we get the extended dynamic Harrod foreign trade multiplier:

$$y^* = \frac{(1 + \Theta\eta + \psi)(p_d - p_f - e) + \Theta\varepsilon z + \tau(k - p_d)}{\pi} \tag{3.9}$$

Assuming constant relative prices $(p_d = p_f + e)$, balanced current account and capital inflexibility, the original dynamic Harrod foreign trade multiplier can be written as:

$$y^{**} = \frac{\varepsilon z}{\pi} \tag{3.10}$$

Although conveniently straightforward, the unreasonable assumption underlying equation 3.10 will make us discuss the mathematics of balance-of-payments-constrained growth theory using the extended version of equation 3.9.

Perhaps the most obvious characteristic of equation 3.9 is the terms of trade effect; the rate at which the terms of trade changes, expressed in the equation as $(p_d - p_f - e)$, is derived from the more familiar $(P_d/(P_f E))$, which is the standard expression of terms of trade (the ratio of export to import prices measured in a common currency). As is apparent from the equation, and from the theoretical discussion above, the terms of trade will restrict the growth rate of the economy further if foreign prices of import goods increase more rapidly than domestic prices of export goods.

In this model, changes in the terms of trade do not translate directly into the balance of payments, as is sometimes seen in basic models. Rather, it will depend on the price elasticity of the demand for goods traded (η and ψ). The price elasticities, in turn, are composed by a number of good-specific characteristics and will determine the consequential shift in quantities imported and exported.

Likewise, the income level of the rest of the world (z) will be an important explanatory variable for export demand, but it will work through the income elasticity of demand for exported goods (ε).

Finally, the own country's propensity to import (π) will enter into the equation, since more imports expenditures require more export earnings. This is basically the domestic version of the mechanism of income elasticity for the rest of the world's consumption of export goods, mentioned in the previous paragraph.

This chapter (and particularly equation 3.9) highlights the importance of elasticity of the demand for the goods traded. It appears as though gains from trade are distributed unevenly between the developing and developed world simply because they produce goods with different demand patterns. Not all factors affecting the growth rate consistent with balance of payments equilibrium are vague properties of demand: following the logic of Bairam (1988) it is perfectly reasonable to think that the dynamic Harrod foreign trade multiplier can be modified by policy. We will now turn to a discussion about some of the available policy alternatives.

4 Policy Alternatives

A number of policy alternatives can be formulated by looking at economic development and pro-growth policies from the perspective of balance-of-payments-constrained growth theory within the framework of equation 3.9. This will be a fairly superficial walkthrough, intended only to offer some concreteness to the algebraic notations of chapter 3.

4.1 Exchange Rate Policy

The exchange rate – the amount of domestic currency needed to purchase one unit of foreign currency – under a flexible exchange rate system will be determined by the market forces of demand and supply; the demand for foreign currency (needed to purchase goods produced abroad) and the supply of foreign currency (determined by the world's interest in domestically produced goods as well as the country's ability to supply these goods). Consequently, a flexible exchange rate system will allow for the exchange rate to fluctuate freely in order to offset any imbalances in the balance of payments. Such an arrangement would, for developing countries that have difficulties financing their import needs, cause continuous currency depreciation and an ensuing deterioration of the terms of trade. In an attempt to counter this mechanism many developing nations maintain fixed exchange rates. Under a fixed exchange rate system, the price of the domestic currency is set politically (typically by the central bank) and in order to maintain the price the central bank buys and sells foreign currency. The currencies of Sub-Saharan African countries have traditionally been overvalued, meaning that the

economies have had fixed exchange rates that have been higher, and sometimes dramatically higher, than market prices equilibrium.[12] The unnaturally high purchasing power will lead to an unnaturally high demand of foreign currency. In order to maintain equilibrium and satisfy the demand, the central bank will have to continuously sell foreign currency until the own currency is no longer overvalued. However, since the overvaluation is politically motivated and not determined by market clearing factors, the need for the central bank to sell foreign currency might very well outlast its ability to do so as its foreign currency reserve is drained. The resulting shortage of foreign currency will limit imports of inputs thereby raising the costs of production and making the export sector less competitive. The de facto subsidy of the import sector will furthermore discourage the production of production inputs and other goods inside the country. On the other hand, if managed correctly a fixed exchange rate system with an overvalued exchange rate can work favorably on the current account balance by controlling the use of foreign currency. At least in theory, the government could direct import licenses to those importing capital input goods used in the export sectors and that cannot be produced domestically. Such a strategy would lower the costs of production for the export sector. Whether or not this effect would be larger or smaller than the fact that the overvalued exchange rate raises the costs for foreign consumers is hard to tell a priori.

Nonetheless, the nominal exchange rate is probably the easiest factor to influence of those included is the relationships between growth rate and balance of payment (equation 3.9). Accordingly, it has been a very popular policy, the belief being that devaluating the domestic currency will increase competitiveness by lowering the foreign price of exports, and increasing the domestic price of imports, thus inducing increased export earnings and decreased import expenditures. But, as Thirlwall (2003 p. 693) and others have pointed out, a devaluation policy that seeks to increase the room for growth by enhancing the balance of payments situation demands several qualifications. For a devaluation policy to be rational, the source of the balance of payments imbalance has to be lack of competitiveness, the sum of price elasticities has to be greater than unity, and the nominal

[12] Triple digit black market exchange rate premiums were not uncommon in SSA during the 1980s. For example, in Angola during the first half of the 1980s, the black market exchange rate was more than 2 300 percent higher than the official figure (Mshomba 2000 p. 27).

exchange rate has to change the real exchange rate (Thirlwall 2003). Because it is the *change* in nominal exchange rate the enters into equation 3.9, a long term growth policy would have to see continuous devaluations, and it does seem improbable that such a public policy would be able to influence the real exchange rate indefinitely.

As is widely acknowledged, currency devaluation comes with a number of potentially harmful side-effects: rising import prices could cause significant inflationary pressures, the change in relative prices between tradeables and non-tradeables could reallocate means of production into a possibly inefficient export sector, lower export goods prices will not translate into increased export earnings if demand is inelastic, and the uncertainty on the currency market could have unwanted effects on investments.

4.2 Interventionism, Protectionism and Structural Change

The remaining factors affecting the growth rate consistent with balance-of-payments-equilibrium are price and income elasticity of imports, price and income elasticity of export, and the growth rate of the rest of the world. We will dismiss the latter as impossible to influence by an individual country, and concentrate on the remaining four.

Price and income elasticity are important components of much of economic theory. Nonetheless, knowledge about how they are determined and affected is limited; often they are simply regarded as exogenous. Even though it is reasonable to assume that consumer decisions are affected by marketing, branding and other rent seeking measures taken by producers, it is not quite as reasonable to assume that for goods (largely primary goods) originating from the developing world, marketing has been a very important factor. Therefore this thesis will regard price and income elasticity to be fixed for every good (the demand elasticity for any given good is not changed depending on who is exporting or importing it). This is not to be seen as a belief that consumers can not influence, it is only to say that under free price settings there is no way to influence

quantities purchased. Obviously, taxation and other policies that affect prices and disposable income will still change demand.

Under these assumptions the only viable alternative to change price and/or income elasticity of exports and imports is to change what is being exported and imported, which turns us to the discussion about governmental interventionism and structural change.

Export is embraced as a pro-growth policy in several important economic schools of thought, beginning with Adam Smith – who saw free trade as a way of enlarging the market for domestically produced goods – and onwards. In the neoclassical export-led growth model, the export sector is assumed to be more productive than other sectors. By liberalizing trade the export sector grows and its external positive effects benefit the rest of the economy. Much research has been done providing support for the hypothesis that export and growth correlates but for low-income countries the empirical evidence is weak (Thirlwall 2003 p. 646f). As was discussed in length above, this is probably because the export sectors in these countries are less productive, has fewer connections to the rest of the economy, higher price elasticity which makes export promotion policies cause prices to decrease, and lower income elasticity which makes it hard to find buyers if production increases.

Raúl Prebisch suggested monopoly export pricing among developing countries (like OPEC) to make more favorable the terms of trade. Prebisch also argued that some protectionist trade policies for certain domestic production could alleviate the limitations put on growth by shortage of foreign capital by restricting the domestic consumption of high elasticity imports. As was discussed earlier the five international commodity agreements that have been reached have proven to be unsustainable.

5 Methodology

This thesis is an econometrical study that aims to determine the income elasticity of goods produced in and exported by the developing world. This is done by estimating equation 3.7 for a series of goods and countries. A number of limitations have been made mainly because data coverage has been imperfect.

5.1 Estimating Elasticities

It has been argued that estimates of elasticities of export demand tend to be invalid (of exaggerated statistical significance) due to trending in the data.[13] This should not influence the econometrical analysis below since my work will be preformed on a per-good basis (and not aggregated export data per country). Nevertheless, chapter 6.1 performs a number of statistical tests on the data to ensure that regressions are valid.

However, supply side objections to the importance of estimating elasticities will still be valid. Mody and Yilmaz (1997) contend that export volumes are determined by a number of non-price factors, of which the insider-outsider factor is singled out as the most important. According to Mody and Yilmaz, the relationship between world income and export volumes are characterized by country-specific effects, applying that countries are not treated the same on the world market (but that customers form relationships to some exporting businesses in some countries and thus creating insiders) and that elasticities therefore can not be calculated into one value for all countries.

[13] Perraton (2003 p. 5) quotes James Riedel as making this argument.

In addition, changes in the structure of global production can introduce trending in data. In a scenario where the production of a good is systematically increased in one country and decreased in another, it is completely possible that demand will change due to different consumer relationships (insider or outsider), geographic location etc. However, taking into account the stable patterns of export that has been verified in several studies, it is unlikely that the econometrical tests would be significantly compromised due to trending (Noland 1997).

It should also be noted that estimating the relationship between world income and export volume assumes that the domestic production can grow to serve an increased demand. Given failed or insufficient capital markets and foreign exchange shortage in much of the developing world it is not to be taken for granted that the export sector has the capacity to grow output. Supply side factors are exceedingly difficult to model and this paper will follow the practice of ignoring them (Riedel 1988).

Further, it should be noted that the export function (equation 3.7) really only includes two factors (price and income). This is obviously an extreme simplification. The countless factors determining the complex patterns of production and consumption of all goods can not realistically be summarized into price and income. As with any statistical analysis there is not much one can do about the bewildering complexity of the real world, except try to summon some humility when drawing conclusions based on simplified models.

5.2 Sample Selection

The 22 years from 1980 to 2001 are covered in this paper. Because of the generality of the hypothesis tested in this paper the aim has been to include as long a time period as possible. Thusly, the time span used is motivated by the scant data available from earlier time periods. It can also be argued that several chocks hit the world economy during the 1970s causing structural shifts that could interfere with the econometrical analysis (Perraton 2003 p. 7).

88 developing countries are included in this study.[14] The selection has been made by including all developing countries (as defined by the World Bank) with a minimum population of one million (2005 figures)[15]. Furthermore, Yemen, Botswana, Lesotho, Namibia, Swaziland and Taiwan were excluded; Yemen because of inconsistencies in the export data, Taiwan because insufficient inflation data and the remaining because their export data were inadequate. Eritrea was excluded for obvious reasons.

The sample of developed countries includes 23 economies.[16] The selection was made by including all developed countries (as defined by UNCTAD) with a minimum population of one million (2005 figures). Belgium was excluded due to inconsistent export data.

84 types of goods (using the SITC3 classification[17]) were included in this study, 50 goods for each of the two samples of countries, with 16 goods overlapping.[18] The selection was made by ranking all the 239 types of goods included in SITC3 by their average share of the sample countries' export value, and including the top 50.[19]

The study includes 244 200 annual observation of export growth rates.[20] However, countries that have one or more export data point missing or set to zero[21] (or have missing inflation data) have been excluded from the pools for which data is missing. The actual number of observations included in regressions is 62 546[22]. As mentioned before elasticity estimates are made on a per good basis and because the perfect time series are distributed unevenly between the different types of goods, some elasticity estimates will include fewer observations than others. As will be discussed in chapter 5.6, even some of the numerical observations display properties that make them unsuitable for

[14] Table 4 lists all developing countries included in the study.
[15] This practice has also been used by Perraton (2003).
[16] Table 3 lists all developed countries included in the study.
[17] The Standard International Trade Classification (SITC) is the standard for classifying traded goods. This paper uses revision 3 (SITC3) which divides the world market's flow of goods into 239 different types. More information is available at http://unstats.un.org/unsd.
[18] Table 5 and
table 6 list the sample of goods for the developed and the developing countries respectively.
[19] The selection of goods was based on export data from the arbitrarily chosen years 1980, 1985, 1990, 1995 and 2000.
[20] 244 200 observations = 22 years multiplied by 111 countries multiplied by 100 goods.
[21] Observations set to 0 is quite common and natural since not all countries produce all of the goods.
[22] 62 546 observations = 22 years multiplied by 2 843 complete time series (all including different countries and goods).

econometrical analysis and depending on what criteria are placed on the quality of the data the number of observations will vary. The number of observations for each good and econometrical technique is included in all regression tables of the appendix.

Considering the large amount of data, it is fitting to express a certain amount of humility about out limited capacity to handle complexity. Hundreds of pages of computer code have been written during the course of this study to collect, distill, manage, convert, analyze and present the statistical material. It would be arrogant to dismiss the risk of miscalculation in any of these steps. However, every stage of the data manipulation process has been verified to the greatest extent possible.

5.3 Statistical Operationalization

Five variables are included in equation 3.7: the growth rates of export, domestic prices, foreign prices, exchange rate and world income. In order to estimate the two coefficients (price and income elasticity), numerical values for these five variables had to be obtained from imperfect data coverage demanding a series of compromises.

The export data was originally denominated in USD which makes the exchange rate factor in the left hand side of equation 3.7 superfluous while at the same time adding defects to the econometric calculations by substituting (x) for $(x+\eta e)$ on the right hand side of same equation. In reality, the equation estimated will be $x+\eta e=\eta(p_d-p_f)+\varepsilon\cdot z$. How much of a distortion this adds is hard to assess, but we will work under the assumption that the distortion is less than critical.

Since the elasticities are estimated separately for each type of good the ideal value of p_d and p_f (in the right hand side of equation 3.7) would have been the actual border price of the goods included in each type. Such numbers are extremely difficult to obtain for a substantial number of goods and countries. It would also have added a number of conceptual issues (concerning transport and insurance cost, from what exchange or

country to get prices and so forth) that is far beyond the scope of this paper. An additional problem with using inflation as a proxy is trade barriers. Since the price that interests us is the price that the foreign (rather than domestic) consumer is paying, using inflation as a proxy will exclude any changes to price effects caused by tariffs, quotas, export promotion, import substitution and the like. Given the magnitude of trade reforms implemented in most of the developing world during the 1980s, it would be ridiculous to fail to differentiate between domestic rates of inflation and the price at which goods are sold to foreign markets. Estimating the impact of tariffs – or worse, quotas and administrative regulations – on prices is a monumental task and far beyond this study.[23] Compromising with the availability of statistics, p_d is given the value of domestic inflation, and p_f the value of average world inflation. On the relatively few instances where inflation data has been missing, estimates based on implicit price deflators[24] have been used. For remaining instances, inflation has been measured by consumer prices. It will be important to take these simplifications into account when interpreting the results.

z in equation (in the right hand side of equation 3.7) measures world annual GDP growth. For the same reason as the change in price of goods would have been preferable to inflation when measuring p_d, it would have been preferable to have z measure the purchasing power of the consumer of each good. While the data to make the necessary calculation to obtain consumer purchasing power is available, the time for it within present work is not. Nevertheless, not only does world growth actually measure the purchasing power of the potential buyer (albeit on a globally aggregated level), but it is also a fact that much of exports originating from developing countries are sold to developed countries whose appetite for consumption reasonably corresponds fairly well to world growth (through the workings of the global economic business cycle).

World inflation was calculated by making the average of the inflation of all countries, weighted by their share of world exports year 2003.

[23] Foreign exchange reserves have been used in some studies as proxies for trade protection but found not to be robust (Perraton 2003 p. 4).
[24] This practice has also been used by Perraton (2003).

5.4 Data Sources

Export data is gathered table 4.2 of UNCTAD's Handbook of Statistics on-line[25].

Domestic and foreign price rates are calculated from the World Bank's Global Development Network (GDN) Data Query[26]. Where this data was unavailable UNSTATS'[27] implicit price deflator were used to calculate approximate values for inflation.

World growth data is also taken from the World Bank's GDN Data Query.

5.5 Econometrical Setup

All econometrical analyses have been made using the computer software EViews, version 4.0 (the December 15 2000 build) manufactured by Quantitative Micro Software[28].

The data has been organized (pooled) by type of good. For example, the export of live animals for food (SITC3 code 001) contains perfect data (no missing values for years 1980 to 2002) for 31 of the 88 developing countries included in the study. Since the elasticities are thought to be of general nature – and not variable depending on where in the world the good is produced, sold or purchased – common elasticity coefficients are looked for by pooling the 31 countries and forcing the regression to set one income elasticity coefficient and one price elasticity coefficient for all countries.

Equation 3.7 has been regressed running 2 843 time series of export growth rates (100 time series of export goods with an average of approximately 28 countries per good) against 111 time series of inflation (the difference between domestic rates of inflation and world rate of inflation) and one series of world growth rate.

[25] Available online at http://unctad.org.
[26] Available online at http://devdata.worldbank.org/wbquery.
[27] Available online at http://unstats.un.org.
[28] More info at http://www.eviews.com.

Estimates are calculated using the ordinary least squares (OLS) model.

5.6 Data Manipulation

The export data (especially that of the developing countries') exhibit extreme variation. For some countries and some goods, annual export growth rates are in the millions. Export variations of that magnitude are obviously not the result of similar changes in world income levels but rather caused by supply side factors or structural breaks (as was discussed in chapter 5.1 above) or possibly bumpy exchange rates or domestic price. However, the majority of the time series are less volatile. Estimates based on unaltered time series will be referred to as NOCAP, indicating that all time series with numerical values are included in the sample. For the more extreme time series I have employed a filter to exclude all time series that include one or more observations equal to or greater than 500 percent (a quintuple of the value of export from one year to the next). The pools including only observations below 500 percent will be referred to as CAP500. For the developing world's export data is was required to add a third type of pool, CAP100, which includes all time series whose observations are below 100 percent. The limits of 500 and 100 percent were chosen after extensive trial and error to limit the standard error of the regressors while at the same time retaining a high number of observations. The specific value of the caps is the result of a couple factors: 1) a compromise between low standard error and many observations, but also on 2) a theoretical insight that annual variances of that magnitude cannot possibly result from income and price variances (except perhaps in countries with exceptional inflation and/or exchange rate crises). The econometrical results will be reported separately for the capped and uncapped data.

Other attempts to normalize the data were made, primary applying the Hodrick-Prescott filter and experimenting with different caps. The Hodrick-Prescott (HP) filter has been applied using a factor 100 which is standard for annual data. Even though pooled regressions based on the HP filtered time series were better at producing significant estimates for more types of goods, the regressions also exhibited grave autocorrelation. In

fact, the Durbin-Watson test applied to the HP regressions reported statistics ranging from 0.03 to 0.19, far below the acceptable range of 1.5 to 2.5. No method of countering the autocorrelation could be found and so the results were discarded.

6 Results

Examples of econometric testing of import and export demand functions which find statistical significant estimates abound in the literature.[29] However, these estimates have without exception been made on an aggregated per-country basis (i.e. the entire export value of any given country has been found to correlate with domestic prices and world income growth). This is the natural approach if one's aim is to test the validity of Thirlwall's Law. In contrast, this paper has estimated the export demand function on a per-good basis in an attempt to determine if there are some goods that are less elastic than others.

Before looking at the results from the econometric analysis we will examine the results from a series of statistical test ran on the time series data.

6.1 Statistical Tests

In order to determine if the econometrical analysis meets the assumptions made for least squares regressions some statistical tests was performed on the data. This subchapter lists the results from these tests.

The Jarque-Bera test was applied for the pooled regressions to determine if the residuals are normally distributed. The test measures the difference of the skewness and kurtosis of the series with those from the normal distribution. Under the null hypothesis of normal

[29] For example, Perraton (2003) finds that significant estimates can be found for 27 of the 34 countries included in his study.

distribution, the Jarque-Bera statistic is distributed with 2 degrees of freedom. A small probability value leads to the rejection of the null hypothesis of normal distribution. The test showed that all pooled regressions using the uncapped data exhibit normally distributed error terms. The capped data series were not tested in their entirety due to the complicated calculations it would involve. Random testing of a handful of the capped regressions suggests that the Jarque-Bera probability values were even higher than for the uncapped series. The complete list of results from the Jarque-Bera tests is given in table 7 and table 9 in the appendix.

The Durbin-Watson test was applied to control for the existence of autocorrelation. A value near 2.0 for the Durbin-Watson statistic indicates that there is no serial correlation and that the residuals are independent of each other, at least successively. Not all pooled estimates fall within the acceptable range of 1.5 to 2.5. For the sample of developed countries, indications of autocorrelation are found in the uncapped pooled regressions for 6 out of 50 goods (NOCAP). For the pools capped at 500 percent, 2 regressions fall short of 1.5 (CAP500). For the sample of developing countries autocorrelation can not be dismissed for 2 pooled regressions based on the unaltered data (NOCAP). The corresponding number of the capped data is 1 and 4, respectively for CAP500 and CAP100. The complete list of results from the Durbin-Watson tests is given in the estimation tables in the appendix.

For the sample of developed countries two of the autocorrelating pools generate statistically significant elasticity estimates: the income elasticity of demand for unmilled wheat (SITC3 041) based on the uncapped pools, and the price elasticity of demand for fresh and dried fruit and nuts (SITC3 057) based on the data capped at 500 percent.

For the sample of developing countries, only one of the pooled estimates displaying autocorrelation turns out to generate statistically significant estimates – namely the income elasticity of sugar and honey (SITC3 061) regressed using CAP100.

It would have been appropriate to test also for non-stationary time series. However, an automated method of determining the number of lagged differences that should be applied for the augmented Dickey-Fuller unit root test (for each time series) could not be

found and manual testing was not feasible due to the size of the data coverage. The same is true for cointegration tests.

Furthermore, given that it is not uncommon for statistical analysis based on time series to be heteroskedastic, testing whether or not the regression error terms have constant variance would have been warranted. However, the computer program used for econometric analysis does not allow White's heteroskedasticity test to be carried out on pooled regressions.

The absence of tests for unit root, cointegration and heteroskedasticity makes it impossible to determine if the econometrical analysis meets the assumptions needed for least squares regressions to be functional. In this instance the intention of estimating demand elasticities across countries, which required pooled regressions, was given higher priority.

6.2 Variance

The first impression from the data is the extreme variation found in the export from developing countries. The median of the 100 largest annual growth rates (mixing countries and goods) are an astonishing 1 500 000 percent. This is partially to be expected since the initiation of an industry easily can cause export values to increase say from a mere 100 000 USD to a business exporting billions, and so low initial export figures will cause growth rates to be inflated. Still, some of the huge growth figures do not have very low initial export values.

It is clear that this variance is not primarily the result of changes in price and income. Two possible explanations can be postulated. First, the variation is caused by supply side factors ranging from the normal Schumpeterian creation and destruction of business to trade reform, foreign aid explosion or post-war reconstruction. Second, given that export values are reported in denominations of USD any changes in foreign exchange rates will influence the value of what is being exported. Because many of the developing countries

included in this study have had a less than carefree relationship to the US dollar during the last two decades it is quite possible that export value variations at times are heavily influenced by exchange rate variations. Regrettably, the data does not allow us to distinguish between the first and second explanation.

6.3 Trade Composition

It is striking how the trade composition of the developed and the developing worlds differs. Two characteristics concerning trade composition are particularly interesting. First, the type of goods exported by the two areas is dissimilar. Of the two areas' 50 most important types of goods[30], only 16 overlap. Of the developing world's 50 goods, 18 can be considered refined[31]. The corresponding figure for the developed world is 39. It is clear that the assumption made above about the production of primary goods being located in the developing world is largely correct. It should be pointed out that the SITC3 classification of goods is fairly general, grouping together somewhat different goods, and it can therefore be argued that the actual difference in specialization is even larger than the figures would have us believe.

Secondly, the developing countries on average depend on fewer goods for their export earnings than do developed countries. Ranked in descending order by their average export share, the top four goods for the developing world add up to 32 percentage points, while the corresponding figure for the developed countries is 16. However, considering all the 50 goods the difference is smaller. The average share of the export value for these goods in the sample of developing countries is 1.79, only slightly higher that the sample of developed countries (1.64). This somewhat surprising find is possibly explained by the configuration of the samples (the sample of developing countries include China, Mexico and other major manufacturers). A complete list of trade composition can be found in table 5 and table 6 of the appendix.

[30] See chapter 5.2 for details on what calculations the selection of goods is based on.
[31] Degree of refinement was determined relatively casually by reading the SITC3 descriptions and making an educated guess about the production of the goods included.

6.4 Price Elasticity of Demand

The effect from price changes on demand depends on the sign and size of the price elasticity coefficient (η in equation 3.7). For normal goods, we expect the coefficient to be negative (or else consumption would increase as prices increase).[32] There is no theoretical reason for why price elasticity should be very different for refined and unrefined products and it can therefore be expected that both samples of goods show similar price elasticity of demand.

Depending on what manipulations are applied to the time series the price elasticities exhibit somewhat different properties. I will highlight the most interesting parts of the results from the unaltered and capped pool regressions. See the appendix for the full econometrical report.

6.4.1 Developed World

For the sample of developed countries significant estimates for price elasticities based on the uncapped time series can be found for 8 of the 50 types of goods in the sample[33]. 10 significant and meaningful estimates was found using CAP500.[34] The corresponding number for the CAP500 and CAP100 regressions is 11 and 16. The setup of equation 3.7 puts domestic price change in the right hand side to be positive, and so for the price to correspond negatively with export growth rates we expect the price elasticity coefficient to be negative. The surprising result is that none of the estimates are negative. However, the coefficients are low, on average 0.35 for NOCAP, 0.17 for CAP500 and 0.12 for CAP100. Nonetheless, it is difficult to in find an intuitive reason for why export would

[32] Demand for Giffen goods is expected to show positive price elasticity. Whether or not Giffen goods exist in the actual world is uncertain. Potatoes in Ireland during parts of the 18th century is sometimes given as an example of a Giffen good.

[33] The volatile nature of the export data has made it necessary to deviate from the standard practice of applying a confidence interval of 0.05. In order to find at least a few significant estimates in some of the calculations made a confidence interval of 0.10 has been used instead.

[34] 11 significant estimates were found but as mentioned above, one of these regressions (that of fresh and dried fruit and nuts) exhibits autocorrelation. The number of valid and significant estimates are therefore 10.

grow by on average 0.35 or 0.05 percent for every 1 percent increase in prices, and although it would be tempting to label them Giffen goods, that is extremely unlikely given the nature of the goods. It can therefore be assumed that there are important variables at play that are not included in the equation. This is also supported by the low average R^2 value of 0.02 reported by all three series.

It would appear that the price of exports has very little to do with the size of volumes exported. This would have been excepted if the countries included in the sample met the small-country condition[35] on the world market of the sampled goods. However, given that the sample includes many of the world's greatest exporters and the goods are selected to be those that account for the largest share of their average export values, it is very unlikely that they are complete price takers. Economic theory does not offer any reasonable explanation for the strange results and so the cause is likely to be found in the reliability and validity issues discussed in chapters 5.1 and 5.3 or omitted variables, like supply side factors.

6.4.2 Developing World

The extreme nature of the export data is made very clear by the price elasticity estimates found for the sample of developing countries. Using the uncapped time series of export growth rates, significant estimates for price elasticity can be found for only one good, refined petroleum products. However, the standard error is extremely high and the R^2 value very low (1394 and 0.005 respectively) – it is clear that the time series will have to be normalized. Excluding time series containing one or more observation equal or above 500 percent (CAP500) leaves 7 goods with significant price elasticity estimates. Displaying similar unexpected properties as the developed world's price elasticities, only 1 good has a coefficient below 0. On average price elasticity is 0.46 (average p-value and R^2 value is 0.03 and 0.02 respectively). Limiting the sample further by using the CAP100

[35] As was discussed in chapter 2.2 the small-country condition is true for countries that can export any amount of any given good to the world market at the going price without influencing prices.

lowers the average elasticity to 0.02 – with 3 elasticities below 0 – but does not cause any other significant alterations (average p-value and R^2 value is 0.03 and 0.06 respectively).

Clearly, the most striking property of the results is the counterintuitive sign of the price elasticity estimates (only 4 of 50 goods with significant estimates have coefficients below 0) and their very low R^2 values (averages ranging from 0.02 to 0.06). The weak explanatory power could possibly be due to the invalidity of the small country assumption although, as discussed above, this is unlikely given the sample of countries and goods. It is hard to see any theoretical reasons for why so few elasticity estimates exhibit probability values below 0.10, nevertheless it is a frequent feature of the literature of econometrical testing of Thirlwall's Law (Thirlwall & McCombie 1997).

6.5 Income Elasticity of Demand

The effect changes in world income will have on demand depends on the sign and size of the income elasticity coefficient (ε in equation 3.7). For normal goods, we expect the coefficient to be greater than 0 (or else increased income will cause decreased consumption). [36] For theoretical reasons made clear above we expect the sample goods from the developed countries to exhibit larger coefficients than the sample goods from the developing countries.

Only a selection of the results is reported on in this chapter; see the appendix for the econometrical results in its entirety.

6.5.1 Developed Countries

Using the uncapped export data, meaningful and statistically significant OLS estimates of income elasticity are found for 12 types of goods from the sample of developed

[36] Demand for inferior goods is expected to show negative income elasticity coefficients. Inferior goods can for example be goods of poor quality.

countries.[37] One of these estimates, namely that for wool and animal hair (SITC3 268), is negative and remains negative even in the CAP500 and CAP100 estimates (i.e. even after time series including one or more observation equal to or above 500 and 100 respectively have been removed from the sample). For NOCAP's 12 estimates average income elasticity is 2.36 (the number goes up to 3.23 if the negative elasticity of wool is excluded).[38] Limiting the sample to CAP500 estimates for 15 types of goods are significant, of which wool and manufactured natural gas (SITC3 341) show negative estimates. Average coefficient is 1.84 (if the two negative values are removed the average coefficient is 2.95).[39] CAP100 regressions report 17 significant goods with estimates averaging on 2.22.[40] If the two negative elasticities are removed average income elasticity increases to 3.05.

Table 1: Statistically significant income elasticity estimates (developed world, CAP500 time series).

Good	Income elasticity	Standard error	P value	R^2 value	Countries included
Aircraft, etc	5,204	2,843	0,068	0,013	18
Metal working machy, tools	4,163	1,154	0,000	0,026	23
Lorries, spec motor vehicl nes	3,494	1,940	0,072	0,008	19
Passengr motor vehicl, exc bus	3,433	2,062	0,097	0,008	19
Electricity distributing equip	3,204	1,114	0,004	0,022	23
Iron, steel tubes, pipes, etc	3,112	1,220	0,011	0,014	23
Oth machy for spec industries	2,812	0,795	0,000	0,041	21
Mechanical handling equipment	2,765	1,226	0,025	0,022	23
Heating, cooling equipment	2,710	0,808	0,001	0,026	23
Non-electr machy parts, acces	2,260	0,984	0,022	0,011	23
Paper and paperboard	2,162	0,993	0,030	0,015	23

[37] 14 types of goods exhibit significant estimates, although 2 of these (crude petroleum and unmilled wheat) show standard errors in the thousands due to some extreme observations in the time series. The income elasticity regression for unmilled wheat was also found to be autocorrelating.
[38] Average standard error 1.48, average p-value 0.02 and average R^2 value 0.02. (If negative wool is excluded the numbers change to 1.35, 0.02 and 0.02, respectively.)
[39] Average standard error 1.39, average p-value 0.03 and average R^2 value 0.02 (If negative wool and manufactured natural gas are excluded the numbers change to 1.28, 0.03 and 0.02, respectively).
[40] Average standard error 1.03, average p-value 0.02 and average R^2 value 0.04 (If negative wool, transistors and valves are excluded the numbers change to 1.00, 0.02 and 0.04, respectively).

Good	Income elasticity	Standard error	P value	R^2 value	Countries included
Switchgear etc, parts nes	1,627	0,770	0,035	0,027	23
Furniture and parts thereof	1,465	0,689	0,034	0,013	23
Gas, natural and manufactured	-4,867	2,841	0,088	0,011	12
Wool (exc tops), animal hair	-5,896	1,478	0,000	0,034	21

Table 1 lists the income elasticity estimates from the regression results based on the CAP500 time series. One can take note of how highly refined goods like aircrafts and motor vehicles are at the top of the list, while relatively unrefined goods like furniture, paper and paperboards are at the bottom with smaller coefficients.

Although the magnitude of the positive income elasticity estimates are in line with the balance-of-payments-constrained growth theory laid out above, there are two other properties that are more surprising. First, as mentioned above, elasticities for wool and natural gas are negative. This paper is not able to detail the industry-specific properties of the two goods; however, it does not seem unlikely that the production and export of wool from the developed countries included in the sample has diminished over the period 1980-2001 due to structural factors of specialization. It is possible that this is partially true also for the production of natural gas and that these circumstances are part of the explanation.

Secondly, just as with the results from the price elasticity analysis above, the explanatory power of the independent variable is very limited. In both selections of goods the average R^2 value is at 0.02. That so very little of the variance in export growth rates is explained by world income is counterintuitive, especially given the relatively long time series and large country sample. One is inclined to blame the methodological complications laid out in chapter 5 or supply side factors.

6.5.2 Developing Countries

The income elasticity estimates from the developing countries' unaltered export data (NOCAP) is more or less useless. Estimates for a number of goods are found to be significant, but their average standard error is 970 and the estimates themselves without exception completely ridiculous. In order to get the unstable export data under control the sample was limited to time series that did not contain observations equal to or above 500 percent (CAP500). Using this normalized data 6 types of goods display statistically significant income elasticity estimates, of which only 2 estimates are greater than 0, and average income elasticity is -2.46.[41] Limiting the sample further, regressions based on CAP100 are able to generate 9 valid and significant estimates for income elasticity, of which 5 are negative.[42] Average income elasticity estimate is -0.45.[43]

Table 2: Statistically significant income elasticity estimates (developing countries, CAP100 time series).

Good	Income elasticity	Standard error	P value	R^2	Countries included
Fish, fresh, chilled, frozen	5,286	1,852	0,005	0,056	7
Outer garments knit nonelastic	4,494	1,640	0,007	0,104	7
Base metals ores, conc nes	4,062	1,935	0,037	0,024	10
Men's outwear non-knit	2,982	1,599	0,064	0,019	9
Coffee and substitutes	-4,943	2,216	0,028	0,120	5
Spices	-4,954	1,804	0,007	0,034	10
Transistors, valves, etc	-5,039	2,006	0,014	0,073	4
Cocoa	-5,064	2,422	0,039	0,037	6
Natural rubber, gums	-5,382	2,187	0,015	0,065	6

[41] Average standard error 3.12, average p-value 0.02 and average R^2 value 0.02.
[42] 10 significant estimates were found. The regression of one of these (sugar and honey) does however exhibit autocorrelation.
[43] Average standard error 2.01, average p-value 0.03 and average R^2 value 0.06.

Table 2 lists the income elasticity estimates from the regression results based on CAP100 pools for the sample of developing countries. The relationship between degree of refinement and rank in table 2 is less obvious than in table 1, partly because few of the goods in table 2 can be thought of as refined, and all the goods, without knowing the details, presumably produced with fairly modest technology requirements.

The surprising finding evident from table 2 is that the assumption made above, about primary goods having lower income elasticity than manufactured goods, is not unambiguously supported. Even though the average income elasticity of the developing world's goods in table 2 is lower than that of the developed world's listed in table 1 (-0.45 and 1.84, respectively), it is clearly quite possible for primary goods to have large income elasticity of demand: the top 5 goods in table 2 averages on 4.17.

Similar to the previous tests, R^2 values are low, not reaching above 0.03, hinting at the low explanatory powers of the income variable. As stated earlier, this is surprising and without support from economic theory, and lead us to suspect omitted supply side variables, problematic data coverage or methodological mistakes.

7 Conclusion

From the perspective of balance-of-payments-constrained growth theory the export demand function tested in this paper is not the only factor influencing economic growth. As described above (equation 3.9), capital flows and appetite for imports as well as other factors combine to form the growth restriction. Limiting the scope to the export function makes this paper unable to test the validity of the general theory: rather, it has tried to estimate income and price elasticity for 50 of the developing and developed world's most important export goods.

The econometrical results are largely inconclusive and it is with caution one should make generalized statements based on them. Nevertheless, a few stylized findings can be put forward:

- For the sample of developing countries the export data exhibits extreme variation with numerous observations of annual growth rates ranging in the millions.

- Statistically significant price elasticity estimates can be found for relatively few goods. This finding could be suggestive of the invalidity of the small country hypothesis. This is implausible seeing how calculations are based on the exports of a wide range of countries, and not on a single country's export. Although common in the literature, these strange results may warrant skepticism against the data coverage or methodology applied.

- Statistically significant income elasticity estimates can be found for relatively few goods. In the case of the sample of developing countries it could arguably be caused by weak market mechanisms and a domestic inability to adjust to shifting

world demand. The uncertain business climate in much of the developing world opens up for a series of supply side factors unaccounted for in the model to determine size and growth of export volumes. This proposition is supported by the low explanatory power of price and income found in regressions for all types of goods. On the other hand, few statistically significant goods are found and poor explanatory power is also displayed in the sample of developed countries for which these problems with uncertainty do not apply.

- On average, price elasticity of demand for exports from the developing world does not differ significantly from their developed world's counterparts.

- Income elasticities of demand for unrefined goods can be higher than those for refined goods. On average though, income elasticity of demand for exports from the developing world is lower than for exports from the developed world. This is in line with the theoretical arguments made above that the accumulation of export earnings is an uphill battle for much of the developing world.

The mechanisms that connect balance of payments and economic growth are compelling on a theoretical level and there is overwhelming econometrical work to support its claims, as shown in chapter 2.5. Nonetheless, this thorough attempt at estimating demand elasticity per good (and not per country as previous studies have) is met largely by statistically insignificant estimates. The only thing hinting at validating the theory is that income elasticity estimates of demand are found to be greater for the exports of developed countries than for the exports of developing countries, although the number of statistically significant estimates are far too few to make any conclusive claims.

Furthermore, the very low R^2 values found throughout the results indicate that price and income elasticities of demand are more or less useless concepts when explaining export volumes classified by type of good. Three possible explanations for these finding can be formulated. First, omitted supply side factors, ranging from trade reforms to conflicts, can be influencing and introducing disturbance into the model. Second, even though it would be theoretically counterintuitive, it is possible that the elasticity for any given good varies depending on which country is exporting it, and that would make any attempt at finding a

common cross-continental estimate futile. Third, considering the volatile nature of the data, the manipulations made to it, and the fact that all the assumptions necessary for least squares regressions could not be performed, it cannot be dismissed that the largely strange findings are the result of methodological or statistical shortcomings.

Regardless of the results presented here, balance-of-payments-constrained growth theory remains an interesting framework for explaining different rates of economic growth and development. Because of the impressive track record of BOPC growth theory and the stress it puts on demand elasticities, further attempts at estimating elasticities on a per good basis must be encouraged. Such estimates could possibly produce policy recommendations for a more realistic export led growth strategy, centered on goods that will yield meaningful export revenues and economic development.

8 References

Bairam, Erkin (1988), "Balance of Payments, the Harrod Foreign Trade Multiplier and Economic Growth: The European and North American Experience: 1970-85", *Applied Economics*, Vol 20:12 p. 1635-1643.

Bairam, Erkin I.; Dempster, Georgina J. (1991), "The Harrod Foreign Trade Multiplier and Economic Growth in Asian Countries", *Applied Economics*, Vol 23:11 p. 1719-1725.

Cashin, Paul; Liang, Hong; McDermott, C. John (2000), "How Persistent are Shocks to World Commodity Prices?", *IMF Staff Paper*, Vol 47:2.

Deaton, Amgus (1999), "Commodity Prices and Growth in Africa", *The Journal of Economic Perspective*, Vol 13:3 p. 23-40.

Dos Santos, Theotonio (1998), 'The structure of dependence', in Seligson, Mitchell A. & Passé-Smith, John T, ed., *Development and underdevelopment*, second edition, Colorado: Lynne Rienner Publishers, Inc.

Hadass, Yael S; Williamson, Jeffrey G. (2003), "Terms-of-trade shocks and Economic Performance, 1870-1940: Prebisch and Singer revisited", *Economic Development and Cultural Change*, Vol 51:1.

Hussain, M. Nureldin (1995), "The Balance-of-Payments Constraint and Growth Rate Differences among African and East Asian Economies", *African Development Report*, African Development Bank.

Hussain, M. Nureldin (1999), "The Balance-of-Payments Constraint and Growth Rate Differences among African and East Asian Countries", African Development Bank.

Maneschi, Andrea (1983), “The Prebisch-Singer Thesis and the 'Widening Gap' between Developed and Developing Countries”, *The Canadian Journal of Economics*, Vol. 16:1 p. 104-108.

Mody, Ashoka; Yilmaz, Kamil (1997), “Is there Persistence in the Growth of Manufactured Exports? Evidence from Newly Industrializing Countries”, *Journal of Development Economics*, Vol 53 p. 447-470.

Myrdal, Gunnar (1970), ‘Politiskt manifest om världsfattigdomen’, Stockholm: Rabén & Sjögren.

Newbold, Paul; Pfaffenzeller, Stephan; Rayner, Anthony (2005), “How well are long-run commodity price series characterized by trend components”, *Journal of International Development*, Vol 17 p. 479-494.

Perraton, Jonathan (2003), “Balance of Payments Constrained Growth and Developing Countries: an Examination of Thirlwall’s Hypothesis”, *International Review of Applied Economics*, Vol 17:1.

Razmi, Arslan (2005), “Balance-of-payments-contrained growth model: the case of India”, *Journal of Post Keynesian Economics*, Vol 27:4 p. 655-687.

Riedel, James (1988), “The Demand for LDC Exports of Manufactures: Estimates from Hong Kong”, *The Economic Journal*, Vol 98 (March issue) p. 138-148.\

Spraos, John (1980), “The Statistical Debate on the Net Barter Terms of Trade Between Primary Commodities and Manufactures”, *The Economic Journal*, Vol. 90.

Syrquin, Moshe (1988), ‘Patterns of Structural Change’, in Chenery, Hollis & Srinivasan, T.N., ed, *Handbook of Development Economics*, Vol 1, Amsterdam: Elsevier Science Publishers.

Toye, John; Toye, Richard (2003), “The Origins and Interpretation of the Prebisch-Singer Thesis”, *History of Political Economy*, Vol 35:3.

Thirlwall, A. P. (2003), *Growth and Development*. 7th edition. New York: Palgrave Macmillan.

Young, Alwyn (1995), "The Tyranny of Numbers: Confronting the Statistical Realisties of East Asian Growth Experience", *The Quarterly Journal of Economics*, Vol 110:3 p. 641-680.

Appendix

Table 3: List of Countries (sample of developed countries)

Australia	Hungary	Poland
Austria	Ireland	Portugal
Canada	Israel	Spain
Denmark	Italy	Sweden
Finland	Japan	Switzerland
France	Netherlands	United Kingdom
Germany	New Zealand	United States
Greece	Norway	

Table 4: List of Countries (sample of developing countries)

Algeria	Haiti	Panama
Angola	Honduras	Papua New Guinea
Argentina	India	Paraguay
Bangladesh	Indonesia	Peru
Benin	Iran, Islamic Republic of	Philippines
Bolivia	Jamaica	Rwanda
Brazil	Jordan	Saudi Arabia
Burkina Faso	Kenya	Senegal
Burundi	Korea, Republic of	Sierra Leone
Cameroon	Kuwait	Singapore
Central African Republic	Lebanon	Somalia
Chad	Liberia	South Africa
Chile	Libyan Arab Jamahiriya	Sri Lanka
China	Madagascar	Sudan
Colombia	Malawi	Syrian Arab Republic
Congo	Malaysia	Thailand
Costa Rica	Mali	Togo
Côte d'Ivoire	Mauritania	Trinidad and Tobago
Cuba	Mauritius	Tunisia
Dominican Republic	Mexico	Turkey
Ecuador	Mongolia	Uganda
Egypt	Morocco	United Arab Emirates
El Salvador	Mozambique	United Republic of Tanzania
Ethiopia	Myanmar	Uruguay
Gabon	Nepal	Venezuela
Gambia	Nicaragua	Viet Nam
Ghana	Niger	Zambia
Guatemala	Nigeria	Zimbabwe
Guinea	Oman	
Guinea-Bissau	Pakistan	

Table 5: List of Goods (sample of developed countries)

Good (SITC)	Average share of exports	Median share of exports
Aircraft, etc (792)	1.39	0.76
Alcoholic beverages (112)	0.93	0.44
Aluminium (684)	1.47	0.73
Articles of plastic nes (893)	0.97	0.95
Automatic data processing equip (752)	2.34	0.92
Base metal manufactures nes (699)	0.98	0.67
Base metals ores, conc nes (287)	0.93	0.16
Coal, lignite and peat (322)	1.63	0.04
Crude petroleum (333)	4.04	0.28
Electrical machinery nes (778)	1.41	1.31
Electricity distributing equip (773)	0.81	0.45
Fertilizers, manufactured (562)	0.90	0.43
Footwear (851)	1.00	0.42
Fruit, nuts, fresh, dried (057)	1.05	0.21
Furniture and parts thereof (821)	1.33	0.79
Gas, natural and manufactured (341)	1.64	0.18
Heating, cooling equipment (741)	0.82	0.87
Intern combust piston engines (713)	1.47	0.83
Iron, steel shapes, etc (673)	1.22	0.72
Iron, steel tubes, pipes, etc (678)	0.89	0.53
Iron, steel univ, plate, sheet (674)	1.30	0.97
Lorries, spec motor vehicl nes (782)	1.19	0.87
Measuring, controlg instruments (874)	1.25	1.04
Meat, fresh, chilled, frozen (011)	3.10	0.63
Mechanical handling equipment (744)	0.81	0.72
Medicinal, pharmaceutical prdts (541)	2.74	2.05
Metal working machy, tools (736)	0.88	0.59
Miscel chemical prdts nes (598)	0.78	0.50
Motor vehicl parts, acces nes (784)	2.14	2.47
Non-electr machy parts, acces (749)	1.28	1.23
Office, adp machy parts, acces (759)	1.72	0.92
Organo-inorgan compounds, etc (515)	1.37	0.48
Oth machy for spec industries (728)	1.21	0.85
Outer garments knit nonelastic (845)	1.00	0.36
Paper and paperboard (641)	2.91	1.16
Passengr motor vehicl, exc bus (781)	4.58	2.71
Pearl, prec, semi-prec stones (667)	1.89	0.04
Petroleum products, refined (334)	4.00	3.19
Polymerization, etc, prdts (583)	1.44	1.24
Pulp and waste paper (251)	1.30	0.18
Ships, boats, etc (793)	1.38	0.41
Special transactions (931)	2.91	1.90
Switchgear etc, parts nes (772)	1.27	1.00
Telecom equip, parts, acces (764)	4.33	2.90
Textile yarn (651)	1.17	0.89
Transistors, valves, etc (776)	2.22	1.14
Wheat etc, unmilled (041)	1.08	0.13
Women's outwear non-knit (843)	0.92	0.54
Wood, shaped, rail sleepers (248)	1.34	0.25
Wool (exc tops), animal hair (268)	1.18	0.03

Table 6: List of Goods (sample of developing countries)

Good (SITC)	Average share of exports	Median share of exports
Aluminium (684)	0.61	0.03
Base metals ores, conc nes (287)	3.36	0.08
Cocoa (072)	2.04	0.00
Coffee and substitutes (071)	8.24	0.48
Copper (682)	1.70	0.00
Cotton (263)	5.43	0.11
Cotton fabrics, woven (652)	0.76	0.03
Crude petroleum (333)	13.12	0.00
Crude vegetb materials nes (292)	1.30	0.37
Feeding stuff for animals (081)	0.97	0.20
Fertilizers, crude (271)	1.32	0.00
Fertilizers, manufactured (562)	0.68	0.02
Fish, fresh, chilled, frozen (034)	1.07	0.13
Fixed vegetable oils, soft (423)	0.66	0.01
Floor coverings, etc (659)	0.64	0.01
Fruit, nuts, fresh, dried (057)	3.66	0.55
Gas, natural and manufactured (341)	1.50	0.00
Gold, non-monetary nes (971)	1.42	0.04
Hides skins, exc furs, raw (211)	1.49	0.12
Inorg chem elmnt, oxides, etc (522)	0.91	0.03
Iron ore and concentrates (281)	1.05	0.00
Leather (611)	0.81	0.03
Live animals for food (001)	1.41	0.01
Men's outwear non-knit (842)	1.29	0.11
Natural rubber, gums (232)	0.69	0.00
Other fixed vegetable oils (424)	0.81	0.00
Other wood rough, squared (247)	1.19	0.00
Outer garments knit nonelastic (845)	0.97	0.11
Pearl, prec, semi-prec stones (667)	2.43	0.00
Petroleum products, refined (334)	5.34	1.69
Rice (042)	0.67	0.00
Seeds for soft fixed oils (222)	1.64	0.01
Shell fish fresh, frozen (036)	2.77	0.16
Ships, boats, etc (793)	0.64	0.01
Special transactions (931)	1.31	0.30
Spices (075)	0.74	0.05
Sugar and honey (061)	1.78	0.15
Tea and mate (074)	1.73	0.01
Textile articles nes (658)	0.60	0.07
Textile yarn (651)	0.94	0.13
Tobacco, unmanufactd, refuse (121)	1.43	0.02
Transistors, valves, etc (776)	0.81	0.00
Under garments knitted (846)	1.02	0.08
Under garments non-knit (844)	0.93	0.10
Uranium, thorium ores, conc (286)	0.62	0.00
Vegtb etc fresh, simply prsrvd (054)	1.24	0.21
Women's outwear non-knit (843)	1.46	0.11
Wood, shaped, rail sleepers (248)	0.81	0.04
Wool (exc tops), animal hair (268)	0.79	0.00
Woven man-made fib fabric (653)	0.60	0.06

Table 7: Estimates of price and income elasticity for developed countries based on uncapped data

Good	Price elasticity (standard error)	Income elasticity (standard error)	P value	R^2	Durbin-Watson [44]	Jarque-Bera	Observations
Aircraft, etc	-0.3153 (0.2667)	-1.2104 (4.2266)	0.2377	0.0031	1,752	4216	484
Alcoholic beverages	0.0515 (0.0659)	-0.0273 (1.0435)	0.4344	0.0012	1,704	86031	506
Aluminium	0.1322 (0.1104)	0.8305 (1.7492)	0.2316	0.0033	2,161	42	506
Articles of plastic nes	0.0604 (0.0487)	1.1151 (0.7715)	0.2156	0.0071	1,992	115723	506
Automatic data processing equip	-0.6466 (1.4023)	10.8426 (22.2207)	0.6449	0.0009	2,069	38458	506
Base metal manufactures nes	0.0574 (0.1259)	-0.9337 (1.9943)	0.6487	0.0009	**1,086**	163	506
Base metals ores, conc nes	-0.2694 (0.6245)	11.8768 (9.8966)	0.6664	0.0035	2,099	61754	462
Coal, lignite and peat	-338.1886 (778.3112)	-1449.15 (12333.35)	0.6641	0.0004	2,097	880129	462
Crude petroleum	-6190.30 (14322.87)	-562273.0 (226964.4)	0.6661	0.0352	2,103	822696	176
Electrical machinery nes	0.0848 (0.0522)	-0.2472 (0.8268)	0.1046	0.0054	2,158	1897	506
Electricity distributing equip	0.1184 (0.0703)	3.2039 (1.1144)	0.0928	0.0215	2,033	1795	506
Fertilizers, manufactured	0.1956 (0.1818)	1.8600 (2.8813)	0.2825	0.0031	2,087	42715	506
Footwear	0.0877 (0.0504)	1.1135 (0.7988)	0.0825	0.0097	1,703	293	506
Fruit, nuts, fresh, dried	0.4262 (0.1269)	-1.5960 (2.0113)	0.0008	0.0232	2,000	9600	506
Furniture and parts thereof	0.0646 (0.0435)	1.4655 (0.6895)	0.1380	0.0131	1,536	561	506
Gas, natural and manufactured	1.5431 (0.7339)	-10.2163 (11.6303)	0.0361	0.0118	2,039	310104	440
Heating, cooling equipment	0.0800 (0.0510)	2.7096 (0.8075)	0.1173	0.0265	2,216	146	506
Intern combust piston engines	-0.4503 (0.6210)	0.6359 (9.8401)	0.4686	0.0011	2,027	203	506
Iron, steel shapes, etc	-0.0944 (0.3175)	-7.4290 (5.0309)	0.7664	0.0045	2,074	8241	506
Iron, steel tubes, pipes, etc	0.0583 (0.0770)	3.1117 (1.2197)	0.4489	0.0139	1,971	20392	506
Iron, steel univ, plate, sheet	0.1582 (0.0841)	0.2124 (1.3330)	0.0605	0.0070	2,175	13165	506
Lorries, spec motor vehicl nes	-0.2571 (0.2899)	8.9400 (4.5930)	0.3754	0.0090	2,274	221207	506
Measuring, controlg instruments	0.0211 (0.0652)	0.9724 (1.0333)	0.7460	0.0020	**1,412**	1534	506
Meat, fresh, chilled, frozen	-0.0779 (0.1335)	-0.9411 (2.1150)	0.5599	0.0011	**1,473**	27259	506
Mechanical handling equipment	0.1937 (0.0774)	2.7651 (1.2258)	0.0126	0.0220	2,306	792	506

[44] A Durbin-Watson statistic outside the range of 1.5 t o2.0 is considered indicative of autocorrelation. These Values are marked with bold text.

Good	Price elasticity (standard error)	Income elasticity (standard error)	P value	R^2	Durbin-Watson [44]	Jarque-Bera	Observations
Medicinal, pharmaceutical prdts	-0.0274 (0.0414)	-0.0262 (0.6568)	0.5082	0.0009	1,883	306	506
Metal working machy, tools	0.0492 (0.0728)	4.1630 (1.1540)	0.4999	0.0260	2,179	367	506
Miscel chemical prdts nes	-0.0363 (0.2759)	-4.7070 (4.3722)	0.8955	0.0023	**1,409**	801	506
Motor vehicl parts, acces nes	0.0408 (0.0557)	-1.0786 (0.8825)	0.4643	0.0040	1,637	595	506
Non-electr machy parts, acces	0.0449 (0.0621)	2.2597 (0.9836)	0.4699	0.0114	2,089	828	506
Office, adp machy parts, acces	-3.2361 (6.5296)	68.8523 (103.4697)	0.6204	0.0014	2,102	885424	506
Organo-inorgan compounds, etc	0.1050 (0.2780)	-0.4061 (4.4045)	0.7057	0.0003	2,107	70067	506
Oth machy for spec industries	0.0677 (0.0839)	3.1249 (1.3291)	0.4202	0.0127	2,165	1005	484
Outer garments knit nonelastic	0.0423 (0.0880)	1.3952 (1.3941)	0.6306	0.0024	1,959	230726	506
Paper and paperboard	0.1060 (0.0627)	2.1625 (0.9930)	0.0914	0.0148	2,349	20	506
Passengr motor vehicl, exc bus	-0.1465 (0.2054)	3.2331 (3.2549)	0.4760	0.0031	2,142	696691	484
Pearl, prec, semi-prec stones	-0.2439 (0.6296)	-12.6054 (9.9768)	0.6987	0.0040	2,139	512764	440
Petroleum products, refined	-1.4426 (2.7423)	27.6188 (43.4548)	0.5991	0.0014	2,112	864	506
Polymerization, etc, prdts	0.0010 (0.0541)	-0.4344 (0.8573)	0.9854	0.0005	1,902	1195	506
Pulp and waste paper	0.1075 (0.2356)	-5.9326 (3.7330)	0.6484	0.0059	1,512	118378	462
Ships, boats, etc	-0.5786 (0.6466)	-7.2321 (10.2468)	0.3713	0.0026	1,879	68599	506
Special transactions	32.6620 (31.5988)	-496.3636 (500.7240)	0.3025	0.0094	2,143	463485	220
Switchgear etc, parts nes	0.1511 (0.0486)	1.6269 (0.7695)	0.0020	0.0273	2,065	25767	506
Telecom equip, parts, acces	0.0782 (0.0889)	1.9105 (1.4087)	0.3793	0.0052	2,142	110	506
Textile yarn	0.0504 (0.0542)	-0.1430 (0.8586)	0.3532	0.0018	2,130	34406	506
Transistors, valves, etc	-0.0008 (0.2202)	-2.2515 (3.4887)	0.9972	0.0008	**1,319**	1246	506
Wheat etc, unmilled	-79.2097 (136.8691)	-3658.590 (2168.867)	0.5631	0.0085	**1,153**	817820	374
Women's outwear non-knit	0.1018 (0.0662)	1.5321 (1.0495)	0.1248	0.0088	1,789	1741	506
Wood, shaped, rail sleepers	-0.2509 (0.4514)	3.4855 (7.1537)	0.5786	0.0011	2,155	499063	506
Wool (exc tops), animal hair	-0.1116 (0.1831)	-7.2642 (2.9021)	0.5425	0.0136	2,169	487379	484

Table 8: Estimates of price and income elasticity for developed countries based data capped at 500%

Good	Price elasticity (standard error)	Income elasticity (standard error)	P value	R^2	Durbin-Watson[45]	Observations
Aircraft, etc	-0.2325 (0.1794)	5.2038 (2.8432)	0.1958	0.0127	1,578	396
Alcoholic beverages	0.0515 (0.0659)	-0.0273 (1.0435)	0.4344	0.0012	1,717	506
Aluminium	0.0230 (0.0599)	-0.0553 (0.9484)	0.7015	0.0003	1,606	484
Articles of plastic nes	0.0604 (0.0487)	1.1151 (0.7715)	0.2156	0.0071	1,631	506
Automatic data processing equip	0.0196 (0.1019)	-0.7525 (1.6153)	0.8478	0.0006	1,611	462
Base metal manufactures nes	0.1198 (0.0399)	0.9782 (0.6326)	0.0028	0.0231	1,880	484
Base metals ores, conc nes	0.0105 (0.1635)	1.6372 (2.5910)	0.9490	0.0010	2,335	396
Coal, lignite and peat	0.0134 (0.1015)	0.2634 (1.6090)	0.8954	0.0001	1,976	308
Crude petroleum	0.0118 (0.1934)	-2.7929 (3.0642)	0.9514	0.0131	2,067	66
Electrical machinery nes	0.0848 (0.0522)	-0.2472 (0.8268)	0.1046	0.0054	1,945	506
Electricity distributing equip	0.1184 (0.0703)	3.2039 (1.1144)	0.0928	0.0215	1,969	506
Fertilizers, manufactured	0.1105 (0.1026)	0.0297 (1.6263)	0.2823	0.0025	2,238	462
Footwear	0.0877 (0.0504)	1.1135 (0.7988)	0.0825	0.0097	1,758	506
Fruit, nuts, fresh, dried	0.2996 (0.1115)	-1.1361 (1.7675)	0.0075	0.0156	**2,521**	484
Furniture and parts thereof	0.0646 (0.0435)	1.4655 (0.6895)	0.1380	0.0131	1,536	506
Gas, natural and manufactured	-0.0392 (0.1793)	-4.8674 (2.8414)	0.8273	0.0113	1,898	264
Heating, cooling equipment	0.0800 (0.0510)	2.7096 (0.8075)	0.1173	0.0265	2,047	506
Intern combust piston engines	-0.0749 (0.0832)	-1.4103 (1.3190)	0.3690	0.0044	1,835	440
Iron, steel shapes, etc	0.0765 (0.0838)	1.1726 (1.3278)	0.3615	0.0035	2,102	462
Iron, steel tubes, pipes, etc	0.0583 (0.0770)	3.1117 (1.2197)	0.4489	0.0139	2,019	506
Iron, steel univ, plate, sheet	0.1582 (0.0841)	0.2124 (1.3330)	0.0605	0.0070	2,295	506
Lorries, spec motor vehicl nes	-0.0194 (0.1224)	3.4942 (1.9403)	0.8744	0.0078	1,947	418
Measuring, controlg instruments	0.0211 (0.0652)	0.9724 (1.0333)	0.7460	0.0020	2,083	506
Meat, fresh, chilled, frozen	0.0011 (0.1076)	0.2103 (1.7047)	0.9916	0.0000	1,561	484

[45] A Durbin-Watson statistic outside the range of 1.5 t o2.0 is considered indicative of autocorrelation. These Values are marked with bold text.

Good	Price elasticity (standard error)	Income elasticity (standard error)	P value	R^2	Durbin-Watson[45]	Observations
Mechanical handling equipment	0.1937 (0.0774)	2.7651 (1.2258)	0.0126	0.0220	1,866	506
Medicinal, pharmaceutical prdts	-0.0274 (0.0414)	-0.0262 (0.6568)	0.5082	0.0009	1,883	506
Metal working machy, tools	0.0492 (0.0728)	4.1630 (1.1540)	0.4999	0.0260	2,234	506
Miscel chemical prdts nes	0.1162 (0.0745)	-0.9896 (1.1799)	0.1192	0.0072	2,137	440
Motor vehicl parts, acces nes	0.0408 (0.0557)	-1.0786 (0.8825)	0.4643	0.0040	1,821	506
Non-electr machy parts, acces	0.0449 (0.0621)	2.2597 (0.9836)	0.4699	0.0114	2,265	506
Office, adp machy parts, acces	-0.1410 (0.0962)	1.0103 (1.5241)	0.1435	0.0062	1,708	418
Organo-inorgan compounds, etc	0.1969 (0.1065)	0.2734 (1.6883)	0.0652	0.0074	1,925	462
Oth machy for spec industries	0.1344 (0.0502)	2.8119 (0.7951)	0.0076	0.0410	2,202	462
Outer garments knit nonelastic	0.0595 (0.0556)	0.8705 (0.8817)	0.2858	0.0044	**1,300**	484
Paper and paperboard	0.1060 (0.0627)	2.1625 (0.9930)	0.0914	0.0148	1,828	506
Passengr motor vehicl, exc bus	-0.1097 (0.1301)	3.4329 (2.0619)	0.3997	0.0083	1,539	418
Pearl, prec, semi-prec stones	-0.1140 (0.1434)	0.5908 (2.2730)	0.4272	0.0021	2,045	330
Petroleum products, refined	-0.1471 (0.1106)	-0.5440 (1.7528)	0.1841	0.0039	2,042	484
Polymerization, etc, prdts	0.0010 (0.0541)	-0.4344 (0.8573)	0.9854	0.0005	1,842	506
Pulp and waste paper	0.2886 (0.1152)	-1.0441 (1.8255)	0.0126	0.0157	2,107	418
Ships, boats, etc	-0.1458 (0.1641)	3.1803 (2.5996)	0.3747	0.0055	2,070	418
Special transactions	-0.2500 (0.3511)	1.7433 (5.5632)	0.4780	0.0056	1,567	110
Switchgear etc, parts nes	0.1511 (0.0486)	1.6269 (0.7695)	0.0020	0.0273	1,892	506
Telecom equip, parts, acces	0.0782 (0.0889)	1.9105 (1.4087)	0.3793	0.0052	1,602	506
Textile yarn	0.0504 (0.0542)	-0.1430 (0.8586)	0.3532	0.0018	1,690	506
Transistors, valves, etc	0.1363 (0.1231)	0.0289 (1.9508)	0.2689	0.0025	1,990	484
Wheat etc, unmilled	-0.1392 (0.2321)	-1.2972 (3.6776)	0.5492	0.0018	2,341	264
Women's outwear non-knit	0.1018 (0.0662)	1.5321 (1.0495)	0.1248	0.0088	**1,417**	506
Wood, shaped, rail sleepers	0.0371 (0.0802)	-0.2507 (1.2715)	0.6440	0.0005	1,567	484
Wool (exc tops), animal hair	0.0238 (0.0933)	-5.8956 (1.4778)	0.7984	0.0337	2,007	462

Table 9: Estimates of price and income elasticity for developing countries based on uncapped data

Good	Price elasticity (standard error)	Income elasticity (standard error)	P value	R^2	Durbin-Watson [46]	Jarque-Bera	Observations
Aluminium	-2.5069 (3.6292)	-108.7052 (57.5097)	0.4899	0.0054	2,095	200,00	748
Base metals ores, conc nes	-65.5696 (84.2005)	462.76 (1334.26)	0.4364	0.0010	2,099	3,26	704
Cocoa	-0.9147 (0.8553)	-26.6866 (13.5527)	0.2852	0.0069	1,908	0,60	726
Coffee and substitutes	-0.9094 (1.5581)	-22.0674 (24.6896)	0.5596	0.0011	**1,387**	0,66	1078
Copper	-74.9238 (142.0931)	-5495.97 (2251.64)	0.5982	0.0104	2,098	23,79	594
Cotton	-1.2106 (3.4030)	-149.3379 (53.9257)	0.7221	0.0095	2,069	139,91	814
Cotton fabrics, woven	-30.7000 (33.3693)	635.7226 (528.780)	0.3578	0.0026	2,096	182,00	880
Crude petroleum	-0.6651 (0.8742)	-10.4892 (13.8521)	0.4471	0.0026	1,545	53,32	440
Crude vegetb materials nes	1.2549 (1.6869)	-38.2918 (26.7318)	0.4571	0.0019	1,966	69,19	1408
Feeding stuff for animals	-2.7011 (5.1516)	-29.1390 (81.6333)	0.6002	0.0004	2,087	0,45	1144
Fertilizers, crude	-0.0972 (1.7720)	6.8306 (28.0795)	0.9563	0.0002	2,101	0,94	352
Fertilizers, manufactured	-50.7734 (79.7325)	-875.6511 (1263.4650)	0.5245	0.0014	2,110	298,54	638
Fish, fresh, chilled, frozen	-15.7428 (17.2276)	-777.3561 (272.994)	0.3610	0.0081	2,108	72,72	1100
Fixed vegetable oils, soft	-4.9987 (4.8113)	34.4378 (76.2410)	0.2994	0.0028	2,128	51,25	462
Floor coverings, etc	-0.7313 (5.1816)	100.1709 (82.1094)	0.8878	0.0016	2,093	4,98	968
Fruit, nuts, fresh, dried	-0.5620 (0.8618)	-37.5285 (13.6568)	0.5145	0.0055	1,507	7,28	1452
Gas, natural and manufactured	-237.1722 (402.7477)	-15697.96 (6382.05)	0.5563	0.0180	2,106	336,24	352
Gold, non-monetary nes	-42.1856 (72.9474)	1040.1140 (1155.94)	0.5636	0.0048	2,122	177,22	242
Hides skins, exc furs, raw	-3.5355 (6.2682)	25.3359 (99.3275)	0.5729	0.0004	2,099	175,21	968
Inorg chem elmnt, oxides, etc	-0.4519 (1.3127)	3.3679 (20.8010)	0.7307	0.0002	1,934	7,79	792
Iron ore and concentrates	439.9196 (341.0113)	4472.1260 (5403.76)	0.1993	0.0178	2,148	49,45	132
Leather	-24.2924 (43.8369)	707.0462 (694.651)	0.5796	0.0016	2,104	24,68	836
Live animals for food	-623.0946 (762.9733)	12844.900 (12090.3)	0.4144	0.0026	2,093	133,03	682

[46] A Durbin-Watson statistic outside the range of 1.5 t o2.0 is considered indicative of autocorrelation. These Values are marked with bold text.

Good	Price elasticity (standard error)	Income elasticity (standard error)	P value	R^2	Durbin-Watson [46]	Jarque-Bera	Observations
Men's outwear non-knit	-12.1997 (10.1575)	173.5468 (160.959)	0.2300	0.0026	2,100	44,17	1012
Natural rubber, gums	-0.3118 (9.3672)	-335.8111 (148.434)	0.9735	0.0145	2,108	0,26	352
Other fixed vegetable oils	-28.2325 (64.7993)	-2528.165 (1026.82)	0.6632	0.0123	2,098	1,79	506
Other wood rough, squared	-2.2152 (4.3981)	6.8308 (69.6937)	0.6147	0.0005	2,116	3,17	528
Outer garments knit nonelastic	-18.2338 (24.6525)	-728.7881 (390.651)	0.4597	0.0048	2,104	121,08	836
Pearl, prec, semi-prec stones	-2.6682 (2.9682)	-72.0396 (47.0353)	0.3690	0.0051	**1,107**	1,15	616
Petroleum products, refined	3208.1570 (1394.5940)	1862.0640 (22099.1)	0.0216	0.0052	2,094	289,56	1012
Rice	-58.5209 (102.0332)	268.3373 (1616.84)	0.5666	0.0008	2,104	332,56	462
Seeds for soft fixed oils	-158.0142 (197.6521)	-1080.231 (3132.05)	0.4243	0.0009	1,682	291,01	814
Shell fish fresh, frozen	-16.6570 (19.0675)	99.7505 (302.149)	0.3825	0.0008	2,101	8,05	1100
Ships, boats, etc	0.1569 (11.6522)	155.8613 (184.643)	0.9893	0.0012	1,539	20,80	616
Special transactions	-1887.0500 (2874.0190)	-20863.23 (45542.5)	0.5118	0.0015	2,097	1,63	440
Spices	-3.5676 (83.6065)	-912.5799 (1324.85)	0.9660	0.0004	2,095	25,44	1166
Sugar and honey	-8.0743 (17.1958)	199.1715 (272.489)	0.6388	0.0007	2,099	5,44	1122
Tea and mate	-1.7813 (2.1080)	38.6223 (33.4040)	0.3984	0.0033	2,095	34,72	616
Textile articles nes	-3.3396 (74.4060)	1931.3830 (1179.05)	0.9642	0.0023	2,098	0,84	1188
Textile yarn	-21.8995 (31.8687)	374.8875 (505.00)	0.4922	0.0012	2,097	27,52	880
Tobacco, unmanufactd, refuse	-7.5990 (6.9604)	23.8023 (110.297)	0.2753	0.0015	2,082	170,99	814
Transistors, valves, etc	-44.6625 (61.0323)	1616.7870 (967.135)	0.4646	0.0058	2,073	45,88	572
Under garments knitted	-501.1722 (605.2560)	10316.300 (9591.06)	0.4079	0.0025	2,093	1,80	748
Under garments non-knit	-3026.3240 (3727.9600)	63122.640 (59074.3)	0.4171	0.0021	2,093	1,11	880
Vegtb etc fresh, simply prsrvd	-179.4152 (277.7303)	1946.5610 (4400.99)	0.5184	0.0005	2,097	18,70	1342
Women's outwear non-knit	-7.4420 (5.9720)	115.6153 (94.6344)	0.2130	0.0030	2,116	0,29	1012
Wood, shaped, rail sleepers	-1.0456 (1.0691)	-10.9920 (16.9419)	0.3283	0.0015	2,145	136,73	924
Wool (exc tops), animal hair	-3.2674 (4.0736)	-152.4720 (64.5515)	0.4229	0.0117	2,088	1,65	528
Woven man-made fib fabric	-0.5128 (0.9646)	-9.3266 (15.2853)	0.5952	0.0009	1,917	110,04	748

Table 10: Estimates of price and income elasticity for developing countries based on data capped at 500%

Good	Price elasticity (standard error)	Income elasticity (standard error)	P value	R^2	Durbin-Watson[47]	Observations
Aluminium	0.0221 (0.2170)	-0.5454 (3.4381)	0.9190	0.0001	2,129	440
Base metals ores, conc nes	0.3476 (0.1613)	3.8540 (2.5566)	0.0317	0.0124	2,065	550
Cocoa	-0.0821 (0.1714)	-2.5970 (2.7165)	0.6320	0.0021	2,274	550
Coffee and substitutes	0.7507 (0.1493)	-0.4535 (2.3659)	0.0000	0.0303	2,112	814
Copper	0.1941 (0.2489)	7.9988 (3.9444)	0.4362	0.0193	1,885	242
Cotton	0.6771 (0.2111)	-1.9743 (3.3459)	0.0014	0.0217	2,238	484
Cotton fabrics, woven	0.1256 (0.1396)	-0.9299 (2.2116)	0.3688	0.0020	1,986	506
Crude petroleum	-0.1277 (0.2045)	2.4092 (3.2404)	0.5328	0.0029	2,430	330
Crude vegetb materials nes	0.1008 (0.1085)	-2.1687 (1.7188)	0.3527	0.0024	2,206	1034
Feeding stuff for animals	0.0332 (0.1740)	-3.6666 (2.7578)	0.8488	0.0033	2,187	550
Fertilizers, crude	0.2040 (0.2411)	1.4989 (3.8211)	0.3984	0.0040	1,769	220
Fertilizers, manufactured	-0.0412 (0.2412)	-7.9811 (3.8216)	0.8646	0.0198	1,900	220
Fish, fresh, chilled, frozen	-0.1277 (0.1319)	0.6946 (2.0906)	0.3336	0.0014	2,077	726
Fixed vegetable oils, soft	0.5450 (0.3096)	-4.8988 (4.9061)	0.0801	0.0232	2,169	176
Floor coverings, etc	0.1599 (0.1573)	0.7186 (2.4927)	0.3099	0.0018	2,081	616
Fruit, nuts, fresh, dried	0.0554 (0.0974)	1.8334 (1.5435)	0.5700	0.0018	2,310	968
Gas, natural and manufactured	0.1486 (0.2763)	4.5799 (4.3777)	0.5913	0.0079	2,149	176
Gold, non-monetary nes	0.1097 (0.5862)	-1.9413 (9.2894)	0.8525	0.0019	2,405	44
Hides skins, exc furs, raw	0.2357 (0.2350)	-4.9080 (3.7240)	0.3164	0.0060	1,972	462
Inorg chem elmnt, oxides, etc	0.2537 (0.1575)	-0.4756 (2.4961)	0.1080	0.0054	2,252	484
Iron ore and concentrates	-0.1350 (0.1400)	0.2738 (2.2191)	0.3378	0.0110	2,430	88
Leather	0.0378 (0.1763)	3.1945 (2.7931)	0.8301	0.0029	1,956	462
Live animals for food	0.6042 (0.3289)	-7.1441 (5.2121)	0.0674	0.0198	1,928	264
Men's outwear non-knit	-0.1700 (0.1540)	2.7701 (2.4406)	0.2701	0.0044	2,071	572

[47] A Durbin-Watson statistic outside the range of 1.5 t o2.0 is considered indicative of autocorrelation. These Values are marked with bold text.

Good	Price elasticity (standard error)	Income elasticity (standard error)	P value	R^2	Durbin-Watson[47]	Observations
Natural rubber, gums	0.1396 (0.2567)	-1.3817 (4.0676)	0.5870	0.0017	2,057	242
Other fixed vegetable oils	0.2331 (0.2539)	1.8753 (4.0233)	0.3593	0.0037	2,179	286
Other wood rough, squared	-0.3521 (0.3152)	3.1802 (4.9954)	0.2653	0.0076	1,987	220
Outer garments knit nonelastic	-0.1731 (0.1652)	-0.1727 (2.6180)	0.2953	0.0026	1,815	418
Pearl, prec, semi-prec stones	-0.1451 (0.1594)	-0.6581 (2.5266)	0.3632	0.0019	2,190	462
Petroleum products, refined	-0.2708 (0.1723)	-1.6293 (2.7307)	0.1167	0.0053	1,829	528
Rice	0.2119 (0.3442)	6.1670 (5.4540)	0.5389	0.0095	2,474	176
Seeds for soft fixed oils	0.6802 (0.2630)	6.0410 (4.1678)	0.0101	0.0261	1,932	330
Shell fish fresh, frozen	0.0817 (0.1291)	-6.7407 (2.0464)	0.5270	0.0158	2,064	704
Ships, boats, etc	-0.1242 (0.4705)	0.2238 (7.4560)	0.7923	0.0007	**2,568**	110
Special transactions	0.2633 (0.2712)	1.6829 (4.2973)	0.3331	0.0072	2,127	154
Spices	0.0447 (0.1372)	0.8255 (2.1748)	0.7447	0.0004	2,089	682
Sugar and honey	-0.0535 (0.1604)	0.7711 (2.5410)	0.7388	0.0003	2,370	594
Tea and mate	-0.3599 (0.1421)	-3.0158 (2.2513)	0.0117	0.0204	1,862	396
Textile articles nes	-0.0636 (0.1516)	0.9488 (2.4019)	0.6750	0.0005	1,985	660
Textile yarn	0.2132 (0.1390)	-1.5355 (2.2031)	0.1257	0.0048	1,974	594
Tobacco, unmanufactd, refuse	0.2578 (0.1573)	1.3231 (2.4929)	0.1019	0.0064	2,338	462
Transistors, valves, etc	0.3074 (0.2528)	-8.6906 (4.0062)	0.2253	0.0253	2,113	242
Under garments knitted	0.0027 (0.1647)	3.2363 (2.6091)	0.9871	0.0037	1,739	418
Under garments non-knit	-0.1165 (0.1840)	4.4282 (2.9155)	0.5270	0.0054	2,021	506
Vegtb etc fresh, simply prsrvd	0.0120 (0.1393)	6.4800 (2.2072)	0.9311	0.0108	2,175	792
Women's outwear non-knit	-0.0287 (0.1550)	1.7782 (2.4565)	0.8533	0.0010	2,038	550
Wood, shaped, rail sleepers	0.0877 (0.2027)	2.3978 (3.2113)	0.6652	0.0013	2,188	572
Wool (exc tops), animal hair	-0.2419 (0.2975)	1.8148 (4.7144)	0.4167	0.0025	2,383	330
Woven man-made fib fabric	0.0366 (0.1703)	-5.8248 (2.6991)	0.8298	0.0102	1,845	462

Table 11: Estimates of price and income elasticity for developing countries based on data capped at 100%

Good	Income elasticity (standard error)	Price elasticity (standard error)	P value	R^2	Durbin-Watson[48]	Observations
Aluminium	-1,3436 (2,9920)	0,2996 (0,1888)	0,1156	0,0248	2,014	110
Base metals ores, conc nes	4,0622 (1,9345)	0,1248 (0,1221)	0,3080	0,0244	2,123	220
Cocoa	-5,0636 (2,4223)	-0,1156 (0,1529)	0,4508	0,0368	2,035	132
Coffee and substitutes	-4,9435 (2,2157)	0,4315 (0,1398)	0,0026	0,1197	1,980	110
Copper	2,9496 (3,3543)	-0,0253 (0,2117)	0,9063	0,0398	2,013	22
Cotton	5,8302 (7,0675)	0,5896 (0,4460)	0,2019	0,1130	1,987	22
Cotton fabrics, woven	1,5701 (1,1800)	0,0385 (0,0745)	0,6056	0,0093	1,826	220
Crude petroleum	1,8654 (2,0608)	-0,0526 (0,1300)	0,6867	0,0091	2,162	110
Crude vegetb materials nes	-0,8914 (1,0414)	0,0703 (0,0657)	0,2853	0,0045	2,131	418
Feeding stuff for animals	-2,5279 (1,7881)	-0,1307 (0,1128)	0,2486	0,0216	2,202	154
Fertilizers, crude	0,8754 (2,5348)	-0,1503 (0,1600)	0,3501	0,0117	2,498	88
Fertilizers, manufactured	-1,9032 (2,1259)	-0,1490 (0,1342)	0,2698	0,0233	2,042	88
Fish, fresh, chilled, frozen	5,2859 (1,8516)	-0,1072 (0,1169)	0,3605	0,0563	1,790	154
Floor coverings, etc	-0,2623 (1,4761)	-0,0473 (0,0931)	0,6119	0,0010	2,025	286
Fruit, nuts, fresh, dried	-0,3092 (1,0497)	0,0783 (0,0662)	0,2375	0,0031	2,230	484
Gas, natural and manufactured	0,5043 (2,7840)	0,2665 (0,1757)	0,1330	0,0267	2,000	88
Gold, non-monetary nes	-4,6747 (5,7934)	0,4694 (0,3656)	0,2146	0,1083	1,854	22
Hides skins, exc furs, raw	-2,2964 (7,6905)	-0,3837 (0,4853)	0,4390	0,0361	1,802	22
Inorg chem elmnt, oxides, etc	0,1619 (1,7359)	0,1427 (0,1095)	0,1944	0,0098	2,003	176
Iron ore and concentrates	0,2738 (2,2191)	-0,1350 (0,1400)	0,3378	0,0110	2,430	88
Leather	1,2845 (2,5763)	-0,4113 (0,1626)	0,0129	0,0586	1,891	110
Men's outwear non-knit	2,9816 (1,5992)	-0,0606 (0,1009)	0,5488	0,0193	1,607	198
Natural rubber, gums	-5,3824 (2,1874)	0,2341 (0,1380)	0,0923	0,0650	1,555	132
Other fixed vegetable oils	-3,7339 (4,0137)	-0,0308 (0,2533)	0,9037	0,0210	1,912	44

[48] A Durbin-Watson statistic outside the range of 1.5 t o2.0 is considered indicative of autocorrelation. These Values are marked with bold text.

Good	Income elasticity (standard error)	Price elasticity (standard error)	P value	R^2	Durbin-Watson[48]	Observations
Other wood rough, squared	3,7375 (3,6439)	-0,1252 (0,2300)	0,5881	0,0210	**2,563**	66
Outer garments knit nonelastic	4,4941 (1,6403)	-0,3264 (0,1035)	0,0019	0,1039	1,823	154
Pearl, prec, semi-prec stones	0,3240 (4,4898)	0,0994 (0,2833)	0,7276	0,0031	**1,100**	44
Petroleum products, refined	0,2856 (2,5353)	-0,0846 (0,1600)	0,5978	0,0027	1,999	110
Rice	-1,6359 (3,1944)	0,2391 (0,2016)	0,2423	0,0392	2,090	44
Seeds for soft fixed oils	-0,7782 (4,3766)	-0,0009 (0,2762)	0,9975	0,0005	2,379	66
Shell fish fresh, frozen	-1,2485 (1,2890)	-0,0501 (0,0813)	0,5383	0,0040	1,798	330
Ships, boats, etc	-6,6495 (8,2110)	-0,4843 (0,5182)	0,3617	0,0742	2,498	22
Special transactions	-1,2948 (8,7877)	0,1435 (0,5546)	0,7987	0,0047	1,926	22
Spices	-4,9542 (1,8045)	-0,0039 (0,1139)	0,9725	0,0336	2,019	220
Sugar and honey	4,0485 (2,3960)	0,1641 (0,1512)	0,2797	0,0302	**2,612**	132
Tea and mate	-2,7280 (1,7807)	-0,0687 (0,1124)	0,5418	0,0154	2,267	176
Textile articles nes	2,0841 (1,3309)	-0,0210 (0,0840)	0,8031	0,0104	1,910	242
Textile yarn	-1,7983 (1,3749)	0,1802 (0,0868)	0,0389	0,0247	1,723	242
Tobacco, unmanufactd, refuse	1,6082 (2,2478)	0,3064 (0,1419)	0,0321	0,0290	2,269	176
Transistors, valves, etc	-5,0386 (2,0061)	0,0820 (0,1266)	0,5190	0,0735	1,527	88
Under garments knitted	0,7003 (1,8241)	0,0132 (0,1151)	0,9091	0,0011	1,666	154
Under garments non-knit	0,9431 (1,4164)	0,0238 (0,0894)	0,7906	0,0024	1,733	220
Vegtb etc fresh, simply prsrvd	-0,2695 (1,4805)	0,0874 (0,0934)	0,3503	0,0030	2,282	308
Women's outwear non-knit	0,1906 (1,5191)	-0,1492 (0,0959)	0,1216	0,0139	**1,443**	176
Wood, shaped, rail sleepers	0,6249 (2,3791)	-0,2932 (0,1501)	0,0535	0,0351	1,798	110
Wool (exc tops), animal hair	1,9967 (4,1721)	0,0589 (0,2633)	0,8242	0,0067	1,793	44
Woven man-made fib fabric	-0,9564 (1,5710)	0,0920 (0,0991)	0,3552	0,0095	1,763	132