Explaining Trade Flows: Traditional and New Determinants of Trade Patterns

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EXPLAINING TRADE FLOWS: TRADITIONAL AND NEW DETEMINANTS OF TRADE PATTERNS

Abstract

An empirical tradition in international trade seeks to establish whether the predictions of factor abundance theory match with the data. The relation between factor endowments and trade in goods (commodity version of Hecksher-Ohlin) provide mildly encouraging empirical results. But in the analysis of factor service trade and factor endowments (factor content version of HO), the results show that it performs poorly and reject strict HOV models in favor of modifications that allow for technology differences, consumer's preferences differences, increasing returns to scale or cost of trade. In this paper we test if these "new" determinants help us to improve our estimation of trade patterns in commodities. Since the commodity version allows obtaining a large panel data we also compare two periods, pre and post 1980. We use a Heckman procedure to allow for non linearity in the relation between factors endowments and net exports and between trade intensity and net exports. The results show that adding the "new" determinants of factor content studies help us to improve the prediction of being specialized in the different manufactured products. However specialization according to factor endowments is stronger than ever, especially concerning the specialization according to human capital endowment. Trade patterns are also determined by trade intensity. Here differences in technology, trade policy, transport and transaction costs, explain the difference in trade intensity.

JEL Classification: F11, F14, F2
Keywords: International Trade; Hecksher-Ohlin Model

1. Introduction

In the neo classical general equilibrium model of international trade, countries trade with each other because of their differences. The Hecksher-Ohlin model holds on the idea that trade patterns depend on the relative differences in the factor endowment of countries. Empirical studies have often shown a weak link between factor endowment and trade flows, both within countries (between regions) and between countries. Those studies tested the two versions of the HO model[1]. In the commodity version, a capital abundant country will export a capital intensive goods and the generalization in a factor version (Vanek, 1968). In that version, a capital abundant country will export capital services. Many improvements have been tested concerning the factor content version[2], but their implications concerning net trade in commodities seems relatively weak. Predicting net trade in commodities in an nxn world is not straightforward, notably because input-output linkages preclude a linear relation between factor endowment and net exports. Furthermore, unlike in the Ricardian model, we cannot obtain a ladder of comparative advantage[3]. This paper is a contribution to the study of pattern of trade for developing countries.

So far, starting with Leamer (1984) has shown that trade specialization for primary goods is highly dependent on the differences in endowments of natural resources, whereas the result for manufactured goods is not clear (even though this does not appear in his book, he

[1] See Annex II

[2] There are also improvements concerning the literature about specialization in production: some authors (ex: Harrigan 1997) argue that's more important to look at the pattern of specialization rather than the pattern of trade since economists won't be able to understand trade until they understand specialization.

[3] Furthermore, because we will also studying the effect of trade on income distribution studied it is necessary.

developed the idea at a later date, notably in an article written in collaboration with Bowen and Sveikauskas (1987)). Subsequent attempts also encountered little success with regard to manufactured goods, the coefficients either being non-significant or carrying the wrong sign. Nevertheless, some studies (e.g. Minford (1989), Balassa and Bauwens (1988)), find that North-South trade can be explained by difference in skill endowments (but not in capital endowments).

The HOV theorem has frequently been rejected in favor of statistical hypotheses such as a zero correlation between factors' endowments and trade patterns. Facing those unclear results, the widespread view in the middle of 90's could be resumed by Leamer and Levinsohn appraisal (1995) of the empirical performance of factors endowment theories: "It is more convenient to estimate the speed of arbitrage rather than test if the arbitrage is perfect and instantaneous". Moreover, as Trefler said (1995), there is no general equilibrium model of factor service trade that is known to perform better than the HOV theorem.

Then in the middle of the 90's an expanding literature on the determinant of trade patterns used differences in consumers' preferences, in technology or in returns to scale to explain trade patterns. Differences in technology (suggested by Ricardo) have been frequently used (Trefler 1995, Davis and Weinstein 2001) and, not surprisingly, have considerably improved the prediction of trade in factor services. Difference in consumer's preferences could relate to home bias consumption (Trefler 1995) or non homothetic preferences due to differences in income per capita (Markusen 1986 or Jones and al. 1999). Finally increasing returns to scale in some sectors is also useful to explain some factor service trade flows (Antweiler and Trefler 2002, Head and Ries 2001).

All these "new" determinants have been used in factor content studies, which have been applied mostly to developed countries because only these countries have data allowing to compute the factor content of trade in each sector in an economy. In addition to factor endowments, these studies use "new" determinants to explain why a country is a net exporter of one factor and to explain the excess of factor content in exports relatively to factor supply. Some use also these "new" determinants to explain the specialization in production (Harrigan 1997, Schott 2003).

To learn more about the determinants of comparative advantage one needs to include many countries and, if possible over a long enough period of time, to see if this determinants have changed through time. In the absence of reliable input-output data needed to compute the net factor content of trade, one way to proceed is to study the determinants of net trade on commodities (i.e. to rely on the commodity version of the HOV theorem). Lederman and Xu (2001) include these "new" determinants in a commodity version for a panel of 57 countries over 25 years for 10 products groups clusters introduced by Leamer (1984). They used a probit estimation to test the impact of factors endowments on net exports which is a better way to control for non linearity than the way used in previous studies on commodities (Leamer 1984 and 1987).

This paper extends this commodity version analysis in the following ways. First we include differences in consumers' preferences and differences in returns to scale as a determinant of comparative advantage and not only as determinants for trade intensity. Second we use total factor productivity as a measure for differences in technology, rather than expenditure in research and development. Third, our sample of 71 countries over 40 years allows us to discern two periods: pre-1980 and post-1980, and to isolate any changes in the relative importance of conventional

and new factors during the period under review. Fourth we use International Trade Center (ITC) and National Asia Pacific Economic and Scientific (NAPES) commodities classification rather than Leamer's classification. This allows us to obtain better results on manufactured commodities[4]. Finally rather than use "unadjusted" factor endowments measures, we use a measure of relative factor endowment (relative to the world endowment) as in Spilimbergo and al. (1999) in order to be closer to the theory. Also we distinguish three sorts of skills.

To anticipate, our results show that HOV is "alive and well" and furthermore that the "new" determinants have not more explanatory power in the period 1980-2000 compared with the period 1960-1980. Nonetheless adding the new determinants of factor content studies help us to improve the prediction of being specialized in different manufactured products. This result was already found by previous studies. That factor endowment matter is especially robust concerning specialization according to human capital endowment. This result is probably attributable to our distinguishing among three sorts of skills. Trade patterns are also determined by trade intensity, here difference in technology, trade policy, transport and transaction costs explain the difference in trade intensity. More generally, the results in this chapter provide a further justification for our concentration in the next chapter on factor endowments as factors contributing to explain why trade have different effects on income inequality.

The paper is organized as follows. Section 2 reviews the presentation of the HO model and the amendments added in the factor content studies. Section 3 describes the empirical approach, the data used and their organization between explanatory variables for comparative

[4] The manufactured commodities' clusters are more detailed.

advantage and for trade intensity as well as the cluster's construction. Section 4 presents the econometric results and section 5 concludes.

2. Approaches to explain trade patterns

This section presents the framework and justifies the empirical approach. Consider the standard Hecksher-Ohlin theory, with a world of C countries $(c = 1,....,C)$, I industries $(i = 1,....,I)$ and F factors $(f = 1,....,F)$. Let Y^c $(I \times 1)$ the output in country c. The factor content of Y^c is AY^c, where A is a matrix $(F \times I)$ of factor content coefficient. Let V^c the factor endowment of country c, the full employment implies that $AY^c = V^c$. For the world we get: $AY^w = V^w$, assuming that factor intensity (technology) A is identical in each country for each good and the assumption that the technology is identical assumes that the factor price equalization holds in equilibrium.

If we assume that each country consumes the product in the same proportion (identical homothetic preferences) we have: $C^c = s^c Y^w$ where s^c is the country's consumption share: $s^c = pC^c / pC^w$ where p is the vector of internal prices. Under balanced trade, the vector of net exports T^c is the difference between production and consumption

$$T^c = Y^c - C^c = A^{-1}\left(V^c - s^c V^w\right) \qquad (1.1)$$

The link between factor prices and commodity prices is implied by the zero profit conditions, where w is the vector of factor returns: $Aw = p$. Here equation *1.1* says that trade in each industry is linearly related to factor endowments.

In higher dimensions it becomes impossible to state the HO theorem in a useful way analogous to its statement in the 2 –dimensional case. What

remains true in higher dimensions is that the inverse of a strictly positive matrix has at least one positive and at least one negative element in every row and column (Either 1974). So each factor has at least one friend and at least one enemy among goods. But we have to assume here that A is invertible (it is square with $I = F$). That is why Vanek rephrased the HO theorem in a correct way, which is called the factor content version (in contrast to the commodity version). A country with balanced trade will export the services of abundant factors and import the services of scarce factors. This equation does not depend on any assumptions about the dimension or invertibility of the matrix A .

$$F^c = AT^c = \left(V^c - s^c V^w\right) \qquad (1.2)$$

2.1 Empirical approach to "test" the theorem

The three main approaches used to assess the HO theorem are presented in table 1. Column 2 describes the basic approach, column 3 extensions to that approach, column 4 the estimation technique and column 5 the results.

The first (Table 1a), uses the factor content version (equation 1.2) and directly link net trade in factor services and factor endowments. In order to do that, authors use an input-output matrix by sector to measure the factor intensity in each sector[5] and then, knowing the net exports of each sector, they can calculate the net exports of factors.

$$F^c = AT^c = \left(V^c - s^c V^w\right) \qquad (1.2)$$

This approach is undeniably the most appropriate technique to test the HOV proposition, since all parameters are measured, none are estimated econometrically. However it requires data that are not available for a large

[5] except Antweiler and Trefler (2002)

number of countries and for many years (as input-output data). Therefore those analyses have only appeared relatively recently and are always imperfect. They often cover just one year (Bowen and al., 1987, Trefler, 1995, Davis and Weinstein, 2001, Schott, 2003), or do not use real input output matrix from all countries[6] (Bowen and al. 1987, Trefler 1995, Estervadeordal and Taylor 2002), or do not account for natural resources (Davis and Weinstein). These misspecifications (e.g. imposing the same input-output matrix for all countries) lead some authors like Estervadeordal and Taylor (2002) to "give HO a break"; that is, to argue that one should stop the test on factor content until reliable and sufficient data becomes available for a large panel of countries for a long time period. However those studies provide interesting improvements that are useful for other forms of the HO test. Notably, they have relaxed some central assumptions from the HO model (similarity in technology and consumer preferences, constant returns to scale and no trade impediments) to obtain "new" determinants. These so called "new" determinants improve the explanation of trade patterns. Not surprisingly, generally, they find that a strict HO model (just considering difference in factor endowments) performs poorly.

Table 1a: Studies of factor content in trade

Authors/Sample	Factors	Extensions	Empirical Technique	Results
Bowen, Leamer Sveikauskas 1987 27 countries in 1967	K, 3 sorts of land, 7 sorts of labor	Technological difference in using US I-O matrix Non proportional consumption	Proportion of factors for which the sign of net trade in factor matched the sign of the corresponding supply in factor	Sign test[7]: no supportive, the role of technological is not clear.
Trefler 1995 33 countries in 1983	K, 2 sorts of land, 7 sorts of labor	Technological difference in using US I-O matrix	Compare for nine factors the difference in endowment to the net trade (factor content test).	Sign test and variance ratio test[8]: supportive if we allow for neutral

[6] They use the US input –output matrix

[7] Sign test focuses on whether the sign of net trade in factor (left hand-side in equation 2) matches the sign of excess supply in factors (right hand-sign in equation 2).

[8] Variance ratio test ask whether the variance of net trade in factor is as large as variance of excess supply in factors.

		Home bias in consumption	Then add neutral technology difference and Armington home bias in consumption	technological difference and home bias in consumption
Davis and Weinstein 2001 10 countries and the ROW (20 countries aggregated) in 1985	K and Labor	Technological difference in using I-O matrix for all 10 countries Trade impediments Non homothetic preferences	Estimate with identical technology (US), then with Hicks neutral difference and no Hicks neutral difference. And finally with trade cost and non homothetic preferences	Sign test and variance ratio test: supportive if we allow for technological difference and costs of trade
Antweiler and Trefler 2002 71 countries on 1972, 1977, 1982, 1987, 1992	K, 3 sorts of land, 4 sorts of educational level, 3 sorts of energy stocks	Technological difference (by difference in wages) Increasing scale returns	Estimation of the scale economies in each sector then use to explain net trade in factors.	For sector with increasing returns to scale, scale economies contribute to understand the factor content of trade. It doesn't improve the sign test.
Estervardeorval and Taylor 2002 18 countries in 1913	K, Land, 2 sorts of educational levels		Compare the difference in factors endowment to the net trade in factor in using the same US I-O matrix for all countries	Sign test and variance ratio test: no reliable Some goods results for natural resources but not for K and L.

A second approach (Table 1b) consists in studying the patterns of industrial specialization. Some authors prefer to test comparative advantage by specialization in production reasoning that economists won't be able to understand trade until they understand specialization. These studies test if production by commodities' clusters conforms to comparative advantage in factors endowments.

$$Y^c = A^{-1}\left(V^c - V^w\right) \qquad (1.3)$$

With this approach they avoid all problems due to trade impediments or differences in consumer's preferences. Commodity clusters are constructed according to factor intensity in each product. The studies often relax the assumption of identical technology to obtain better results. Nevertheless when they use the strict HOV model, this approach yields results that are more in conformity with the prediction than the factor content studies. However this empirical method is far away enough from the Hecksher-Ohlin theorem which is based on international trade and data on

production by sector is less available than data on trade by sector, so the sample of countries is often small.

Table 1b: Studies of patterns of specialization

Authors Sample	Factors	Extensions	Empirical Technique	Results
Harrigan 1997 10 countries on 1970-1990	K, Land, 3 sorts of educational levels	Technological difference in using I-O matrix for all countries	Compare the share of production on GDP of each commodities cluster to the factors endowment and TFP in each sector.	Technological differences as well as factors endowment difference give comparative advantage.
Harrigan and Zarajsek 2002 28 countries on 1970-1992	K, Land, 2 sorts of educational levels		Compare the share of production on GDP of each commodities cluster to the factors endowment.	HO performs particularly in large industrial sectors that are not natural resource-based.
Schott 2003 45 countries in 1990	K, Land, 2 sorts of educational levels	Difference in capital intensity within industry (across countries)	Construct new goods aggregate for each country according to the factor intensity difference within industry across countries	Once we account for intra industry trade due to difference in capital intensity, the HO model performs.

Like the first approach, the third approach analyzes the patterns of trade that are linked to factor endowments. This third approach (Table 1c), which we choose in this paper, is to compare factor endowments and trade in commodities as in equation 1.1.

$$T^c = A^{-1}\left(V^c - s^c V^w\right) \qquad (1.1)$$

It was first developed by Leamer (1984) for two years, 1968 and 1975. One objective of such an estimation exercise is to infer implicitly the value of A^{-1} (that is not directly measured) and to study how it changes over time. As for the commodities specialization test, this approach demands us to construct commodity clusters, which regroup products sharing the same technology.

In this paper we construct clusters differently than those used in previous studies to be more precise. This approach presents advantages because we only need data on endowment and trade, and not on technology in each product. Less data requirements makes it easier to carry

out the analyses on a long time period (e.g. Lederman and Xu 2001). Because it does not make reference to factor intensity, it is a weakened form of the HOV model, what Feenstra (2004) calls the "partial" test. Curiously, this approach rarely relaxes assumptions of the HO model, except for Lederman and Xu (2001). Finally this type of approach allows us to obtain a large sample which is best to compare the role of endowment in factors and "new" determinants in explaining trade patterns.

Table 1c: Studies of net export patterns

Authors **Sample**	Factors	Improvements	Empirical Technique	Results
Leamer 1984 27 countries 1958 and 1975	K, 3 sorts of land, 7 sorts of labor		Net exports by commodities clusters on relative factor's endowments	Perform for natural resources intensive commodities
Eastevardeorval 1997 18 countries in 1913	K, 2 sorts of Land, 2 sorts of educational levels		Net exports by commodities clusters on relative factor's endowment	HO performs concerning the significance of relationship between factor endowment and net trade of goods.
Lederman and Xu 2001 57 countries on 1970-1995	K, 3 sorts of land, 2 sorts of educational levels	Difference in research and development Scale economics Consumers preferences Non linearity Trade impediments	Probability of being a net export for different commodities clusters on factors endowment, knowledge, ICT. And in a second step trade intensity for net importers and net exporters on scale effects or consumers preferences.	Land and capital play an important role on determining the status, but also other characteristics

2.2 Extensions to the strict HO theorem

As we have just seen, many assumptions on the HO theorem have been relaxed in previous studies. Let us look closely the theoretical implications of such relaxations. The HOV relation holds under the following: homogeneity in technology, constant scale returns, homothetic consumers' preferences, non trade impediments. Otherwise, the relation between factors endowments and net export is not linear since it depends on the hypotheses that are relaxed. Which assumptions are relaxed in our study are discussed below.

Differences in technology: Factor content studies have shown us that similarity in technology is an assumption of the HOV model that must be relaxed to have a convenient test (Trefler 1995, Harrigan 1997, Davis and Weinstein 2001). Input output analyses among sectors between countries (Davis and Wenstein 2001, Schott 2003) have shown that factor intensity in sector varies across countries. This difference in technology could influence trade patterns in two ways. Firstly, concerning a neutral technology difference, it captures efficiency in the use of inputs, hence two countries with similar factors endowments but different inputs' efficiency could have different patterns of trade[9]. Secondly, concerning a technology difference that changes factor proportion in sectors, it could provide a competitive advantage in the production of some specific goods[10]. Hence, let δ_c measure the difference in factor productivity of each country. Compared to the standard A^{-1} (equation 1.3a), we obtain a new equation for net trade in commodities (equation 1.3b).

$$Y^c = A^{-1}\delta^c V^c \qquad (1.3a)$$

$$T^c = A^{-1}\left(\delta^c V^c - s^c V^w\right) \quad (1.3b)$$

The impact of this difference in technology for specialization has been rarely tested empirically. Bowen and al. (1987) modify the HOV model by introducing differences in technology. And if they find that the original HOV model has a weak prediction, they reject as well differences in technology as a determinant. However, subsequently Trefler (1995) has shown that a model taking into account differences in technology between developed countries and developing countries improves substantially the empirical results of the original HOV model. On the other hand, in studies

[9] In Trefler (1995), his preferred model use neutral technology difference across industries or factors which does not influence comparative advantage, so differences in technology are pure scale effects.

[10] Neary (2003) using graphics shows that comparative advantage (determined by factors endowments) always explains trade structure. However, competitive advantage (in terms of productivity) has an impact on resource allocation, structure and volume of trade.

using the same test as we use in this paper (the weakness test), the difference in technology is never relaxed, except in the Lederman and Xu (2001), which controls for cross-country technological heterogeneity via unconvincing measures (research and development expenditures and stock of technical workers). Here we take into account differences in productivity via total factor productivity.

Homothetic preferences: Homothetic preferences in consumption also need to be relaxed. Hunter and Markusen (1988) provide convincing evidence that an assumption of quasi-homothetic preferences is superior to the traditional assumption of homotheticity. Bowen and al. (1987) find no evidence to relax such a restriction, but Markusen (1986) and Davis and Weinstein (2001) improve their factor content studies in considering non homothetic preferences. That is why in our study we include the mean income per capita[11] as we consider an expanded version of the HO model by allowing a portion of consumption to be dependent on income (equation 1.4a). Under this more general formulation, if the endowment among two countries do not differ by much but demand patterns differ by more, a capital intensive country may export its relatively labor intensive commodities if its tastes are biased towards those commodities produced with more capital intensive techniques (equation 1.4b).

$$C = C_{(Y/L)} \text{ so } s^c = s^c_{(Y_c/L_c)} \qquad (1.4a)$$

$$T^c = A^{-1}\left(\delta^c V^c - s^c_{(Y_c/L_c)} V^w\right) \qquad (1.4b)$$

Returns to scale: The assumption of constant returns to scale should also be relaxed. Returns to scale are not constant across sectors. Large

[11] Jones and al. (1998) explained clearly that in the case of intra-sectoral trade. A capital abundant country may import a more capital intensive good than this exported. Effectively whereas the traditional inter-sectoral factor intensity basis for trade relies primarily on supply-side differences between country in their endowments, the intra-sectoral pattern of trade reflect demand side differences

countries have low autarkic price in sectors where scale economies are important (with increasing returns). Therefore, these countries have a comparative advantage in the international market for specific sectors with increasing returns to scale. Markusen and Melvin (1981) develop a model where in equilibrium a large country exports the commodity with increasing returns to scale and the other countries export the commodities with constant returns to scale. Antweiler and Trefler (2002) in a factor content version find that allowing for the presence of increasing returns to scale in production significantly increases our ability to predict international factor services trade flows. They find that a third of all goods-producing industries are characterized by increasing returns to scale[12]. Since scale likely includes aspects of international technology differences[13], it is important to use a measure which is not directly related to factor productivity. Here we adopt the Lederman and Xu (2001) technique of adding as determinant of trade patterns a measure of scale in the economy (population) to see which sort of products are sensible to increasing returns to scale[14]. We use the formulation of Antweiler and Trefler (2002) where μ is the elasticity of scale in each sectors (equation 1.5a). Contrary to technological differences which are specific to each country, increasing scale returns are specific to sectors.

$$T^c(\mu) = A^{-1}\left(\delta^c V^c - s^c_{(Y_c/L_c)} V^w\right) \qquad (1.5a)$$

[12] These increasing returns to scale factors content prediction have rarely been explored empirically. Leamer (1984) admits that it is "a great disappointment" that his work does not deal seriously with economies of scale

[13] In Antweiler and Trefler (2002), the industries with the largest scale estimates are mostly those where technical change has been most rapid. New process technologies are often embodied in larger plants.

[14] Trefler (2002) remarked, it seems unusual that we do not distinguish between internal and external returns to scale, as their different in their implications for market structure and trade patterns. But Helpman and Krugman (1985) help us in showing that the form of scale has only very modest implications for the factor content of trade.

Trade impediments: Frictions (trade barriers[15], transaction and transport costs) should also be taken into account. As Leamer (1984) showed, these impediments are reflected in a deviation of domestic prices from international prices. Davis and Weinstein (2001) improve the HOV model in adding a measure of trade costs through a gravity equation. We control for landlockness and distance to the market[16], which could increase transport costs. We also control for the difference in infrastructure and ICT endowment, and we take into account the intensity of free trade by using a measure of deviation from predicted trade, to measure trade barriers. We introduce the price differences notion in our formulation: let θ, the price difference to the world price due to transport cost, tariffs and other trade impediments. We express trade and resources in value terms.

In matrix notation, let θ subscript indicate variables that depend on trade impediments, w the vector of factor prices and p the vector of commodity prices. Then, the zero profit condition $Aw = p$ becomes $A_\theta w_\theta = \theta p^w = p_\theta$. Hence, the production evaluated at the internal prices is $Y^c = A^{-1} w_\theta V^c$ and the consumption at internal prices is $C^c = s_\theta^c Y^w$. Let $w_\theta V^c$, be the vector of resources evaluated at the internal prices, and $w_w V^w$, the vector of world resources evaluated at the world prices. We may then write the trade vector in value terms as:

$$p_\theta T^c(\mu) = A_\theta^{-1}\left(w_\theta \delta^c V^c - s^c_{\theta(Y_c/L_c)} w_w V^w\right) \qquad (1.6)$$

[15] Travis (1964) argues that tariffs on labor intensive imports can explain the Leontief finding that US in 1947 was net exporter of labor services.
[16] Distance to the ten main partners in trade.

3. Empirical approach

This part presents econometric results about the determinants of trade structure and trade intensity across countries and over time. These estimates control for the simultaneous determination of the intensity of trade (that is, the level of net exports) together with a non-linear version of comparative advantage models. More specifically, we model export intensity as a Heckman selection model. That is, country-specific characteristics or factor endowments determine comparative advantage (proxied by the condition of having positive net exports), and then domestic and foreign market sizes, the macroeconomic environment, transaction costs, and institutions determine export intensity. Moreover, we allow the estimates of trade intensity for the net-importer and the net-exporter sub-samples to differ.

3.1 A selection model

To implement equation (1.6) one could regress the net exports of a country c for a product i in year t, NX_{ict}, on endowment in different factors j, E_{jct}, on k new determinants (difference in productivity, in consumers preferences and returns to scale) N_{kct}, on m variables determining trade intensity (or impediments) TI_{mct} and on regional dummies DR_{rt} and year dummies DY_t in the following way:

$$NX_{ict} = \beta_0 + \sum_{j=1,5} \beta_{1j} E_{jct} + \sum_{k=1,3} \beta_{2k} N_{kct} + \sum_{m=1,5} \beta_{3M} TI_{mct} + DR_{rt} + DY_t + \varepsilon_{ct} \qquad (2.1)$$

However trade impediments variables will not have the same impact on net trade for net importers and net exporters, since trade liberalization increases the net trade ratio for net importers and decreases

the net trade ratio for net exporters. So in a linear homogenous implementation, the effects of many variables are washed out by this heterogeneity. In other words, it is unlikely that the coefficients of the explanatory variables for trade intensity are the same for all countries, especially for importing and exporting countries of the same commodity. If we consider that the impact of trade intensity differs according to the status for a country (e.g. increase (decrease) net exports for net exporter (net importer), we have to add the trade intensity variables interacted with a dummy indicating the status S_{ct} of the country (where 1 indicate a net exporter and 0 a net importer). And the status of countries, net exporter or net importer, depends mainly on factors endowments but also on technology, consumers' preferences and scale effects.

However once we account for the status, factor endowments does not matter on the volume of trade NX_{ict}. Neary (2003) shows that comparative advantage in factors endowments continues to determine direction of trade (the specialization) however competitive and absolute advantage due to productivity or scale effects impact on trade patterns and trade volume. So factors endowments do not appear in our second step on net trade volume; they impact only on the status. An estimable model would have the following form:

$$NX_{ict} = \beta_0 + \sum_{k=1,3} \beta_{1k} N_{kct} + \sum_{m=1,5} \beta_{2M} (S_{ct} * TI_{mct}) + \sum_{m=1,5} \beta_{3M} TI_{mct} + \beta_{4M} S_{ct} + DY_t + \varepsilon_{ct} \quad (2.2)$$

$$\text{where } S_{ct} = \alpha_0 + \sum_{j=1,5} \alpha_{1j} E_{jct} + \sum_{k=1,3} \alpha_{2k} N_{kct} + DR_{rt} + DY_t + \mu_{ct} \quad (2.3)$$

$$\text{with } \beta_2 > 0 \text{ and } \beta_3 < 0$$

But in using a probit estimation for the status, this implies that the relationship between factor endowment and the net export is not linear. The initial presumed linear relationship between factor endowments and

the structure of net exports is questionable (Leamer 1984, Leamer et Levinsohn 1995). Effectively all countries do not produce all goods, particularly developing countries. An increase in capital endowment would not lead to an increase in capital-intensive good exports if the country is already specialized in a non capital intensive good or does not product a capital intensive.

As Leamer (1995), we present our data in Figure 1 below which plots net exports of a labor-intensive aggregate composed mostly of apparel and footwear divided by the country's workforce against the country's overall capital/ labor ratio. There is very clear evidence of nonlinearity here – countries which are very scarce in capital don't engage in much trade in these products. Exports start to emerge when the capital/ labor abundance ratio is around $10,000 per worker.

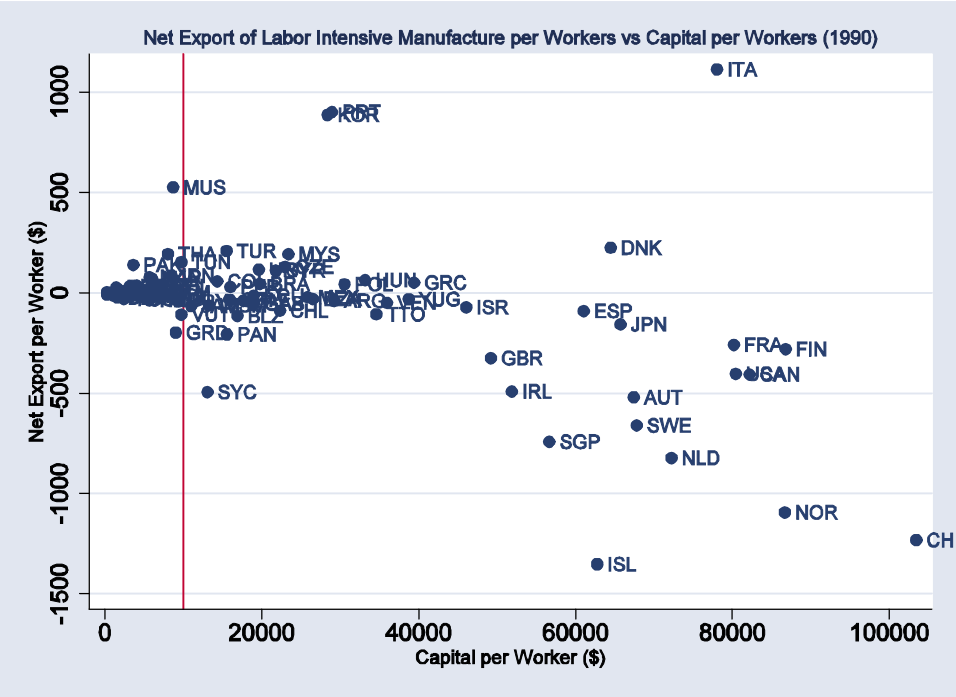

Figure 1

Exports rise to around $300 per worker when the country's abundance ratio is around $20,000 per worker. Thereafter, net exports

steadily decline, turning negative when the country's capital/ labor abundance ratio is around $40,000. Hence until a sufficient level of capital per worker, an increase in capital per worker has no effect on specialization.

With a probit estimation we have a non linear relationship, meaning that the marginal impact of an increase in factor endowment is greater when the factor endowment is sufficiently high to allow countries to be specialized in the good. So we are confident in our assumption concerning non linearity between factor endowment and trade structure.

With a linear estimation, we would have biased results in case of correlation between ε_{ct} and μ_{ct}. It is plausible that the unobservable variables for the status would be correlated with unobservable variables for the amount of net exports. Following Lederman and Xu (2001), we use a Heckman procedure to control for that. As shown in Figure 2, we initially test in equation *2.4* the probability of being a net exporter of a good (i.e. the status). We assume that the probability of having positive net exports S_{ct} is determined by the conventional explanatory variables, factor endowments E_{jct} (arrow 1), and by 'new" determinants N_{kct} (arrow 2). Contrary to Lederman and Xu (2001), we assume increasing returns to scale and differences in consumers' preferences as potentials determinants in this comparative advantage equation. Moreover some determinants of trade intensity TI_{mct} (e.g. infrastructure and ICT) could also determine comparative advantage (arrow 3), since products are differently sensitive to transport and transactions costs[17].

[17] In a Heckman procedure all determinants of the second step (here trade intensity variables) have to be included in the first step if they are significant in this first step. The same variables that determine how big a country's net exports of a particular good (or commodity group) also determine that probability that a country will export these goods at all.

$$S_{ct} = \alpha_0 + \sum_{j=1,5} \alpha_{1j} E_{jct} + \sum_{k=1,3} \alpha_{2k} N_{kct} + \sum_{m=1,2} \alpha_{3m} TI_{mct} + DR_{rt} + DY_t + \mu_{ct} \qquad (2.4)$$

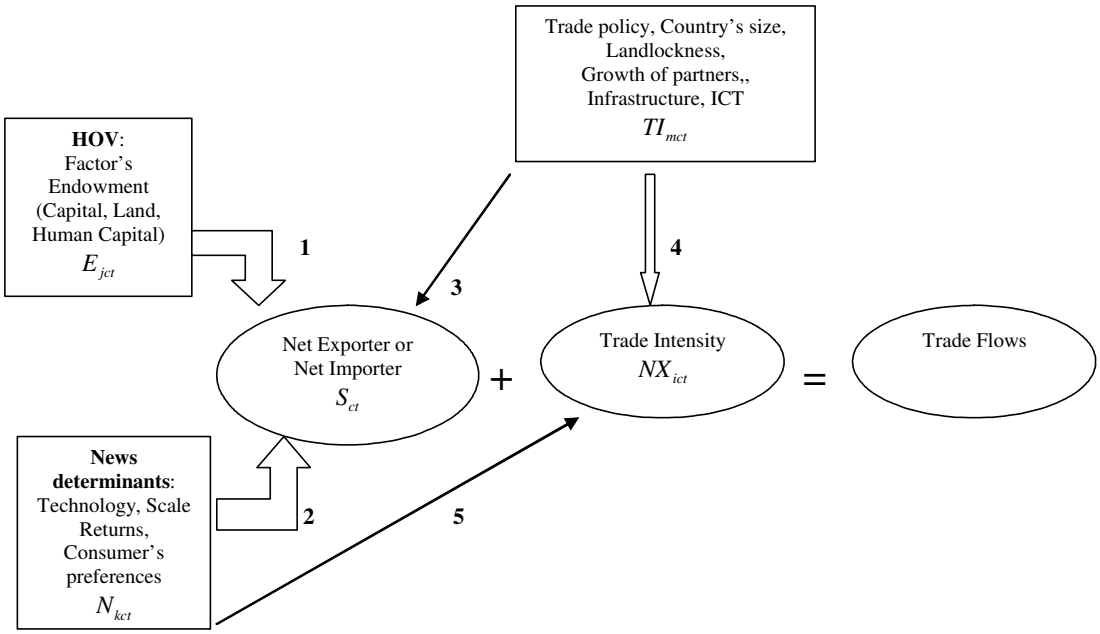

Figure 2

Then we continue by testing the explanatory variables on the samples of net exporters (equation *2.5*) and net importers (equation *2.6*) relative to trade intensity (Figure 2). To the usual determinant of trade intensity (arrow 4), we add new determinants that are as important as in comparative advantage (arrow 5). This procedure permits to uncover a trade intensity trend, since, without separating the sample into net importers and net exporters, it cannot appear. Effectively an increase in trade will raise net exports in the net exporters segment and the net imports in the net importers segment, therefore on a global sample the effect on net export would be null.

$$NX_{ict} = \beta_0 + \sum_{k=1,3} \beta_{1k} N_{kct} + \sum_{m=1,5} \beta_{2M} TI_{mct} + DY_t + \varepsilon_{ct} \text{ if S=1} \qquad (2.5)$$

$$NX_{ict} = \beta_0 + \sum_{k=1,3} \beta_{1k} N_{kct} + \sum_{m=1,5} \beta_{2M} TI_{mct} + DY_t + \varepsilon_{ct} \text{ if S=0} \qquad (2.6)$$

This specification is acceptable only if we add variables in the first step that do not appear in the second step to identify our model. Those variables are factor endowments and regional dummies. Our justification is both theoretical and statistical. Firstly as we said before, we do not expect a linear relation between relative factor endowment and net export intensity[18]. Secondly, from a statistical standpoint, we see in the Table A1 (in Annex) that the condition of being a net exporter has an even higher cross-country variance (column "between") relative to cross-time variance (column "within") than the value of net export for most sectors. The relative factor endowment variables (in bold) are also relatively more stable over time than among countries.

3.2 Construction and measure for commodities' clusters

In order to divide the products into different categories (Table 2), we drew our inspiration from Leamer (1984) whose classification is often used in other studies (Estervadeordal 1997, Lederman and Xu 2001) from the NAPES' classification and from the factor intensity classification of Marrewjik (2004) on the basis of UNCTAD/ WTO and ITC classification. Our classification (Table 3) is less detailed than Leamer's with regard to the categories of primary products for which the determinants of comparative advantage have often been estimated. We construct three clusters of primary products, agricultural products (AGR), processed food products (PFO) and Minerals products (MIN).

We increase the number of categories of manufactured goods by using a 3-digit classification, in order to distinguish human capital intensive products, which was not allowed in Leamer's classification. We obtain five clusters for manufactured products: intensive in natural resources and capital (NRK), intensive in unskilled labor (UNL), intensive in skilled labor

[18] When we add factor endowment ratios in the second equation we obtain non significant or non sensible results.

(SKL), intensive in capital (CAP) and intensive in technology (TEC). This level of detail is more precise compared to the existing literature; which should allow us to obtain better results than using only a two digit classification.

Table 2: Construction of clusters

NAPES	Sitc Rev.2	Leamer	Sitc Rev.2	Marrewjick	Sitc Rev.2	Our Clusters	Sitc Rev.2
Agriculture	00, 041-045, 051, 052, 054, , 2-27- 28	**Forest, Tropical, Cereals Animal Products**	0,1, 2-27- 28 63,64	**Primary**	0, 1, 2,,3 ,4	**Agriculture (AGR)**	00, 041-045, 051, 052, 054, 2-27-28
Processed Food	01, 02, 03, 046-048, 053, 055, 06,07, 08, 09, 1, 4					**Processed Food (PFO)**	01, 02, 03, 046-048, 053, 055, 06,07, 08, 09, 1, 4
Minerals Intensive	27, 28, 3,61,63, 661-663, 667, 671, 68	**Raw Materials**	27, 28, 3-33 68			**Minerals (MIN)**	27, 28, 3-33
				Natural resources	61, 63 661-663, 667, 671, 68	**Natural resources (NRK)**	61, 63, ,661-663, 667, 671, 68
Labour intensive	65, 664-666, 81-85, 894, 895, 899	**Labour intensive**	66, 82-85, 89	**Unskilled Labour**	65, 664-666, 793, 81-85, 894, 895	**Unskilled Labour (UNL)**	65, 664-666, 81-85, 894, 895
				Human capital intensive	53, 55, 62, 64, 67(-671), 69, 76(-764), 78, 791, 885, 892, 896, 897, 898	**Skilled Labour* (SKL)**	52,53, 55, 59, 896, 897, 899
Capital intensive	5, 62, 64, 67, 69, 7, 87, 88,, 892, 896, 897, 891, 893	**Capital intensive**	61, 62, 65, 67, 69, 81			**Capital intensive (CAP)**	62, 64,67, 69, 76(-764), 78, 791,891, 892, 893
		Chemicals	5	**Technology intensive**	51, 52, 54, 56-58,59, 71,72,73, 74, 75 , 764, 77, 792, 87, 881-884, 893	**Technology intensive (TEC)**	51, 54, 56-58, 71,72,73, 74, 75 , 764, 77, 792, 87, 88
		Machinery	7, 87, 88				

*We use Marrewijck(2004) and Estervadeordal (1997) approach for this cluster.

Because of the incertitude on the form of the relationship between factor endowments and trade structure (linear or not), I used several specifications to measure trade structure. Sometimes gross exports are used. Deardoff (1984) clearly prefers to use the net exports indicator, arguing that if there are differences with gross exports results, it will be due to intra industry trade about which H-O theorem does not reach a decision. We follow Leamer (1988) approach and for selected clusters, we use the share of net exports on GDP. This ratio being negative for net importers, we

added a constant to allow us to use a logarithm form. We finally obtain a sample of 71 countries on 1960-2000.

3.3 Construction and measure for factors endowments

The HO model framework considers relative factor endowment between many factors but also between many countries. Factor intensity in a country is often measured as factor intensity in a sector, i.e. by a ratio of the factor on labor as denominator for the most reliable studies; otherwise some only use the stock of the factor. It is more suitable to use a ratio of per capita endowment of a factor in the country to the world per capita endowment of this factor as we deal with relative advantage in factor endowment (Harrigan and Zakrajsek, 2002). We use the formula constructed by Spilimbergo and al. (1999)[19]. The ratios are weighted by the degree of openness to take into account that endowments of closed countries do not compete in the world markets with other factors.

The factor content studies mainly used occupational-based classification to measure human capital endowments. We prefer to use an educational-based classification for the reasons exposed by Harrigan (1997). The first is that educational levels are more likely to be exogenous with respect to net exports shares, since growth in some industries might induce workers to shift their occupations. The second is that education is probably more closely related to skill than occupation. However, rather than using a secondary school enrolment rate (lagged six years) as Balassa

[19] E_{if} is the endowment of country i in factor f and the measure of relative endowment is

$$RE_{if} = \ln \frac{\left(E_{if}\right)}{\left(E_f^*\right)} \text{ and } E_f^* = \frac{\sum_i \left(E_{if} \times pop_i \times \left(\frac{X+M}{GDP} \right)_i \right)}{\sum_i \left(pop_i \times \left(\frac{X+M}{GDP} \right)_i \right)}$$

and Bauwens (1986) did, we prefer to use as Harrigan and Zakrasejk (2000), stock measures of education of the current labor force calculated from the Barro and Lee database (2000). In contrast to Estervadeordal (1997) or Schott (2003) who used only the distinction between skilled and unskilled workers, we use, as Harrigan (1997) three sorts of skill: unskilled, primary skilled and highly skilled.

Physical capital is difficult to include because of its mobility. Wood (1994) argues that empirical tests of the H-O model were mispecified by considering physical capital as the land while it is more mobile across countries and should not affect the structure of net exports across countries. However, the well-known Ethier-Svensson-Gaisford (ESG) model with mobile (capital) and immobile (land and labor) factors shows that capital is a determinant of pattern of trade for a country, depending on capital intensity of the goods in which its immobile factors give it a comparative advantage. Thus if a country has a high labor-land ratio, making it an exporter of clothing, which happens to be also capital intensive, then it exports capital via goods and capital affects the pattern of trade. But if it has a low labor-land ratio, making it an exporter a less capital-intensive goods (e.g. food), then it exports capital directly (by Foreign Direct Investment). Following Leamer (1999), we adopt the Kraay and al. (1999) measure of capital stock per worker.

The measure for natural resources is arable land per habitant, so our measure does not include resources in mineral and fuel which are not available for a large sample in the period under review. The only measure available for our sample is the index from Isham and al. (2005) based on the net export ratio in mining and fuel products, so we could not use it in an estimation of net exports in mineral products due to endogeneity issues.

3.4 Construction and measure of "new" determinants of trade

Concerning differences in technology, we measure total factor productivity (TFP). This measure was used by Harrigan (1997) to explain how differences in technology associated to factor endowments could help to explain specialization in production. We use the TFP index of Bosworth and Collins (2003) who calculate the residual of a growth regression (assuming constant returns to scale). We use a proxy of scale economic effect that could lead the country to be specialized in some increasing returns to scale sectors, measured by the number of habitants. We control also for differences in consumer's preferences via income per habitant, since an increase of per capita income will lead the consumer to prefer capital and human intensive goods and hence to be a net importer of this commodity.

3.5 Construction and measure of trade intensity explanatory variables

Variables that determine trade intensity can be separated in two groups: structural variables and the political variables. The first ones are the distance to its main partners, and the size of the domestic market, which is measured by population and GDP per habitant. Domestic transport infrastructure and transaction costs determine the amount that a country exports or imports. For those variables, we use an index constructed as a principal component (roads networks, rails networks and paved road for infrastructure; personal computer, internet host, telephone lines and mobile phones for ICT). Finally openness depends on the degree of outwardness for the country. We measure this position by an indicator computed from the method proposed by Guillaumont (1994). We measure the part of trade that is not explained by domestic market size (population), landlockness, mean income in the country, to be an OCDE country and to

be an oil exporter[20]. Since we use generated variables (openness policy, mills ratio, principal component index) we have to recalculate all the standards errors of the variables, we use the bootstrap technique to estimate standard errors and to construct confidence intervals[21].

4 Results

The main objective of this study is to improve the prediction of patterns of trade. So we have to assess the reliability of the prediction of status for each country. This is done in section 3.1. We have also a large part of this paper on the importance of "new" determinants of comparative advantage. In section 3.2, using an Anova estimate, we compare their importance relative to the traditional factors and we analyze changes during two periods, 1960-1980 and 1980-2000. Then we comment on the results of the Heckman estimation. In section 3.3 we present results for the first step, the selection equation on comparative advantage, which is estimated for two periods. The last section, 3.4, deals with the second step, trade intensity. We jointly comment results on net exporter and on net importer of each cluster.

4.1 Goodness of fit

A way to assess model fit is to concentrate on its predictive power by looking at prediction statistics. In the first part of table 4 we present the goodness of fit for a model with only factor endowments. In the second part, we add new factors (productivity differences, scale returns and

[20] $$\ln\left(\frac{X+M}{PIB}\right) = 11.68 + 0.09^{**}\ln(PIB/t) - 0.25^{***}\ln(Pop) - 0.50^{***}\ln(Dist) - 0.05(encl) + 0.07^{***}\ln(Xpétrole) + \varepsilon$$

[21] For a generated variable, the confidence interval in the second step is not correct as it refers to the first step. So we built a sampling distribution based on the initial sample from which repeated sample are drawn to obtain a correct distribution and correct standards errors.

consumers preferences) and in the last part we add ICT and infrastructure. For each part, the first column gives us the predictive success rate calculated with the sensitivity, percentage of positive sign (net exporter) correctly identified, and the specificity, percentage of negative sign (net importer) correctly identified. We add in the second column a test which compares the predicted results to a random assignment. For the second and third parts, the third column presents the improvement in the goodness of fit (measured by the Fit test) compared to the previous part. For example, for the capital intensive cluster (CAP), accounting for new determinants improves the goodness of fit by 8%, and if we account for difference in ICT and Infrastructure we improve the goodness of fit by 3%.

Table 4: Quality of prediction for the comparative advantage model

	1: HOV		2: HOV + New determinants			3: HOV + New determ. + ICT-Infrastructure		
	Fit*	ROC**	Fit*	ROC**	Improv.	Fit*	ROC**	Improv.
Agricultural products (AGR)	70	76	70	76	0%	74	78	6%
Processed Food products (PFO)	70	72	70	74	0%	72	76	3%
Minerals products (MIN)	58	65	63	70	9%	64	72	2%
Natural resources intensive (NRK)	62	71	64	74	3%	65	75	2%
Unskilled Labor intensive (UNL)	56	61	76	85	36%	78	87	3%
Skilled Labor intensive (SKL)	72	79	78	88	8%	78	89	0%
Capital intensive (CAP)	71	85	77	90	8%	79	90	3%
Technological products (TEC))	85	93	86	93	1%	89	97	3%

* Proportion of correct sign prediction for net exporters and net importers (with the mean of predicted probability as cutoff). ** Receiver Operating Characteristics: Compared to a random prediction (50 means that the model doesn't do any better that random assignment would).

We conclude that adding "new" determinants for trade patterns helps us to improve the prediction to be a net exporter for manufactured products as well as for minerals products. Improvement due to the inclusion of ICT and infrastructure seems to concern all clusters, and especially primary commodity cluster.

As a comparison, in Bowen and al. (1987) the sign test[22] is around 0.6 (it depends on factors). Trefler (1995) with the sign test improves his model from 0.71 (conventional factors) to 0.93 (conventional and "new" determinants). Davis and Weinstein (2001) with the same test improve their model from 0.32 to 0.91. Antweiler and Trefler (2002) obtained a sign test of 0.67 with a strict HOV model and 0.66 with a modification taking into account returns to scale. Here the percentage of signs correctly identified depends on sectors; the"new" determinants do not improve the ROC test for primary and high technology products.

Because of the presence of a number of potentially collinear variables in this first step we implement the variance inflation factor test (VIF). The literature states that in order for an indication of multicolinearity to exist, the value that indicates the highest VIF should be greater than 5. Here we have 4.7 which suggest that multicolinearity is not a serious problem.

4.2 Conventional factors versus "new" factors: ANOVA estimates

As we see in the ANOVA exercises[23] on the predicted probability of being a net exporter of a product (in table 5), the role of conventional factors in accounting for patterns of comparative advantage is still important. However concerning some industrial products the new factors could be more important to explain structure of trade. In the conventional factors we add a distinction between capital and land on one hand, and human capital on the other hand, which is sometimes analyzed as a non conventional factor (Lederman and Xu 2001). We perform this test on two periods, 1960-1980 and 1980-2000.

[22] Proportion of observations for which excess in factor endowments and excess in factor content in net export have the same sign.
[23] We report the range of the variance of comparative advantage attributable to traditional factors and to "new" factors.

Table 5: Role of Conventional and New factors in explaining the predicted probability[a]

Share of variance explained by:	Period	Land and Capital	Human Capital	New	ICT-Infra	R squared
Agricultural products	**1960-2000**	**24%**	**32%**	**4%**	**41%**	**98**
AGR	1960-1980	15%	15%	3%	67%	
	1980-2000	41%	40%	13%	7%	
Processed Food	**1960-2000**	**48%**	**37%**	**11%**	**4%**	**96**
PFO	1960-1980	44%	41%	10%	5%	
	1980-2000	47%	41%	10%	3%	
Minerals (raw, without oil)	**1960-2000**	**39%**	**39%**	**8%**	**14%**	**99**
MIN	1960-1980	25%	56%	4%	16%	
	1980-2000	47%	17%	7%	30%	
Natural Resources Intensive	**1960-2000**	**54%**	**32%**	**6%**	**8%**	**91**
NRK	1960-1980	27%	37%	10%	25%	
	1980-2000	50%	33%	4%	13%	
Unskilled Labor intensive	**1960-2000**	**5%**	**17%**	**65%**	**13%**	**88**
UNL	1960-1980	5%	14%	70%	11%	
	1980-2000	8%	45%	41%	6%	
Skilled Labor intensive	**1960-2000**	**26%**	**5%**	**60%**	**9%**	**81**
SKL	1960-1980	30%	24%	43%	3%	
	1980-2000	13%	5%	65%	16%	
Capital intensive	**1960-2000**	**1%**	**49%**	**42%**	**8%**	**79**
CAP	1960-1980	2%	52%	43%	3%	
	1980-2000	4%	50%	41%	6%	
Technological products	**1960-2000**	**39%**	**25%**	**26%**	**10%**	**67**
TEC	1960-1980	21%	26%	46%	8%	
	1980-2000	50%	25%	15%	10%	

[a] The dependent variable in the ANOVA equations is the predicted probability of being a net exporter of the product.

As we could expect, physical capital endowments is not a main determinant to explain the choice of specialization across industrial clusters. Because of its mobility, a country which has more capital could prefer to transfer it in another country via FDI rather than invest it in a more capital intensive production. In the same way a country relatively less endowed in physical capital could produce more capital intensive goods via FDI from another country. Roughly for primary products the share of traditional factors is greater than the share of new determinants, and inversely for manufactured goods.

The main conclusion about the decomposition in two periods is that effectively conventional factors are not the only determinants of trade patterns but they are as determining as ever during the specialization that took place during the least twenty years. Land abundance is particularly more determining in the last period for primary products, because of the emergence of land abundant developing countries in international trade.

4.3 Comparative advantage

The role of Conventional factors

Concerning natural resources, results are encouraging because of the positive and significant sign for the probability of being a net exporter of AGR, PFO and NRK. The results in table 6 imply that a one percent increase in the relative endowment in arable land is associated with an increase in the probability of being a net exporter of PFO of 0.308% (column 2) and of 0.28% for NRK (column 4). Those results confirm earlier estimated found by Leamer (1984), Estervadeordal (1997), Lederman and Xu (2001). The non significance for MIN (column 3) is probably due to the misspecification of endowment in mineral resources (we just measure endowment in arable land). The negative coefficient for land abundance concerning TEC (column 8) conforms to Leamer's view (1999) that countries relatively abundant in land will export land intensive products and after extracting the capital used in agriculture their capital abundance ratio is less than that of countries not relatively abundant in land[24].

In the case of the capital stock, here again we have good results. The positive sign on MIN and NRK (columns 3 and 4) conforms to the characteristics of those sectors. These results contradict those from Leamer (1984) and Lederman and Xu (2001), but conform to Estervadeordal's

[24] Leamer explains in this why US in 1947 were a net importer of capital intensive goods from Japan whereas US were more capital intensive than Japan.

results (1997). Concerning manufactured commodities, no study found a significant impact of endowment in capital on labor intensive goods and capital intensive goods[25]. Here by discerning more clusters we find a negative impact on UNL (column 5) and SKL (column 6) and a positive (but weak) impact on CAP (column 7).

Previous studies did not obtain good results on the human capital component. Estervadeordal (1997) found that skilled labor was significantly positive as well as labor intensive goods as capital intensive goods; Lederman and Xu (2001) found that it was significantly negative for all manufactured goods. In discerning three sorts of skills we obtain relatively better results, and the results roughly conform to expectations. An increase in the share of non educated labor or primary educated labor increases the probability of being a net exporter of UNL intensive products. We observe the increase in this probability is greater for a 1% increase in the share of primary educated labor (+0.37%) than for a 1% increase in the share of non educated (+0.18%) meaning that UNL intensive sector needs more primary educated labor than non educated labor.

The coefficients appearing in the table are marginal effects calculated for the mean value of the variable. However we assumed a non linear relationship, that is an impact of an increase in capital per labor which differs according to the value of this variable. In the annex we show graphs (Graphs A) for the results of an increase in different factors on the probability of being a net exporter of different groups of products intensive in the factor. We can observe that the impact of increasing the endowment in a factor has no impact until a sufficient level of endowment, hence the

[25] In Estervadeordal and Leamer, the impact was positive in the two cases, in Lederman and Xu, the impact was negative on labor intensive goods but non significant on capital intensive goods.

impact if stringer until a point where additional endowment do not play anymore on the probability becoming net exporter.

Table 6: Determinants of Comparative Advantage: Heckman selection equation: Probit on the probability of being a net exporter of each commodity cluster on 1960-2000.

	1	2	3	4	5	6	7	8
Probability of being a net exporter	**Agr. AGR**	**Pr. Food PFO**	**Minerals MIN**	**Nat. Res. NRK**	**Uns. Lab. UNL**	**Sk. Lab. SKL**	**Capital CAP**	**Technol. TEC**
Capital	-0.145**	-0.207***	0.367***	0.299***	-0.343***	-0.101**	0.003*	0.000001
	(2.10)	(3.05)	(4.58)	(4.09)	(4.89)	(2.07)	(1.85)	(0.90)
Land	0.157***	0.308***	-0.048*	0.280***	0.068**	-0.052***	0.001	-0.000001***
	(4.74)	(7.57)	(1.68)	(7.39)	(2.46)	(3.71)	(1.59)	(3.88)
Unskilled	-0.054	0.107***	0.086**	0.164***	0.180***	-0.004	-0.002**	-0.000000
	(1.47)	(2.76)	(2.32)	(4.26)	(4.10)	(0.28)	(2.51)	(1.03)
Primary	-0.116**	0.158**	-0.170***	0.222***	0.371***	0.111***	0.005***	0.000001*
	(2.01)	(2.37)	(2.90)	(3.47)	(5.36)	(3.78)	(2.97)	(1.91)
High-Secondary	-0.035	-0.015	0.247***	0.262***	0.080	0.090***	0.001	0.000001
	(0.58)	(0.25)	(4.18)	(4.40)	(1.18)	(2.84)	(0.56)	(0.73)
Income p.c.	0.058	0.281***	-0.222*	-0.143	0.310***	0.061	-0.004*	-0.000002
	(0.50)	(2.59)	(1.80)	(1.26)	(2.77)	(0.82)	(1.66)	(1.43)
Population	-0.045**	-0.022	0.037*	-0.016	0.172***	0.061***	0.003***	0.000001***
	(2.15)	(0.97)	(1.73)	(0.72)	(7.65)	(5.86)	(5.74)	(5.54)
TFP	0.031	0.357***	-0.223*	0.045	0.466***	0.140**	0.009***	-0.000000
	(0.22)	(2.65)	(1.71)	(0.35)	(3.75)	(2.03)	(3.10)	(0.38)
ICT	0.006	-0.047**	-0.007	0.028	-0.075***	-0.002	-0.000	0.000000*
	(0.27)	(2.09)	(0.33)	(1.38)	(3.68)	(0.22)	(0.40)	(1.84)
Infrastructure	-0.002	0.132*	-0.206***	-0.120*	0.322***	0.051	0.004**	0.000002**
	(0.02)	(1.81)	(2.77)	(1.71)	(4.41)	(1.32)	(2.10)	(2.31)
Regional Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	461	461	443	465	461	462	456	454

The coefficients are the marginal coefficients.

We can conclude by the distinction between the two periods (Table 7 in Annex) that the impact of skill seems more conform to the theory in the second period than in the first one, especially concerning AGR, PFO, MIN and NRK sectors. Concerning these sectors, to be well endowed in unskilled labor is a comparative advantage mainly in the second period. We also observe that the impact of land abundance and capital abundance are more conform to the prediction in the second period. However in the second period, USL sectors seem more sensitive to skilled labor than in the previous period. As expected the endowment in skilled labor is more important in the second period for SKL and TEC sectors.

Regarding capital per labor, its impact is more important and conforms to expectations in the second period for all manufactured products (NRK, UNL, CAP and TEC) as well as for MIN sectors. But it has no more impact on primary sectors (AGR and PFO). Finally results concerning arable land per labor show an increasing and expected impact in the second period for AGR, PFO and NRK sectors. However the results on manufactured products are very mixed and do not really conform to expectations except for the TEC sector.

The role of "new" determinants

We saw that "new" determinants are determining, especially concerning manufactured products. Among these factors we assume that because of the presence of "population" which captures scale effects, the log of income per capita captures demand effects. The sign for demand effects should be negative especially for superior goods. Effectively the income per capita rise tends to increase the probability of being a net exporter in inferior goods PFO and UNL (column 2 and 5) and a net importer in superior goods CAP or MIN (column 3 and 7). The scale effects should be positive for products with increasing returns to scale, in industry and especially high technology industry. The results tend to confirm that prediction, since

the size of the population is significantly positive for all industrial products (UNL, SKL, CAP and TEC). The measure of factor productivity seems to be more important in the second period (Table 7 in annex), and leads countries to be net exporters of manufactured goods or PFO (column 2). Lederman and Xu (2001) did not account for scale effects and consumers preferences in the comparative advantage equation, so we can not compare our results to their results.

Infrastructure and ICT

Roughly, an improvement in those variables leads countries to be net exporters of manufactured products and net importers of primary products. They are not very important in our model so we could assume that they mainly play a role in trade intensity but are not very determining in trade structure. However the distinction in two periods (Table 7 in Annex) shows us that ICT and infrastructure improvements tend to increase the chance for a country to develop a comparative advantage in manufacture industry. An interesting result is that a one percent increase in the infrastructure index increases the probability of being net exporter of UNL of 0.32 as important as a one percent increase in primary educated labor.

4.4 Intensity of Trade

Among the structural variables, the size of the country, measured by population, presents robust results in reducing net exports for net exporters (table 8) and reducing the net imports for importer (table 9) in most goods. Here population does not capture scale effects but only the country's size. We disagree with Lederman and Xu (2001) who find the same results as ours but interpret this variable as a scale effect. In fact, having a large domestic market size reduces trade flows. The result concerning income

per capita does not show clear results on the impact of consumer's preferences, whereby they would prefer to consume superior goods when their income increases. It seems that income per capita, as population, captures a market size effect which decreases the net exports for net exporters and decreases net imports for net importers. We showed that difference in technology could explain trade specialization we see here that differences in productivity might affect trade patterns in affecting trade intensity, since an improvement in the productivity lead countries, net exporters as net importers, to increase its nets exports in manufactured products. The trade flows are significantly determined by transport costs (infrastructure) and seem less sensitive to transaction cost (ICT).

Concerning the policy trade measure we obtain an interesting and robust result. The policy trade variable has increased net exports for net exporters and net imports for net importers. The results are quite different among clusters. It seems that for net importers (Table 9) protection tends to favor capital intensive and technological intensive products. This means that this measure of trade policy is robust and captures a sort of specialization. It is a test of validity for this sort of measure (e.g. adjusted trade ratio by residuals), sometimes criticized. Graphs in annex (Graphs B), show this non linearity concerning the impact of openness on net exports between next exporter and net importer. Our cluster classification allows us to obtain better results on the policy openness impact than Lederman and Xu (2001) who used Leamer's classification. We observe also in the coefficients in table 8 and 9 that if trade liberalization stimulated export growth it raised import growth by more as in Santos Paulino and Thirwall (2004).

Table 8: Trade intensity: Heckman's second equation: OLS on net exports for net exporters

	1	2	3	4	5	6	7	8
$Ln\left(c+\frac{X-M}{PIB}\right)$	**Agr. AGR**	**Pr. Food PFO**	**Minerals MIN**	**Nat. Res. NRK**	**Uns. Lab. UNL**	**Sk. Labor SKL**	**Capital CAP**	**Technol. TEC**
Income p.c.	-0.031	-0.048*	0.053**	-0.161**	-0.126***	0.004	-0.143***	-0.154
	(0.82)	(1.66)	(2.17)	(2.02)	(3.72)	(0.31)	(3.58)	(1.46)
Population	-0.055***	-0.041***	-0.013***	-0.051***	-0.018**	0.002	-0.048***	-0.007
	(7.18)	(5.05)	(2.99)	(3.69)	(2.04)	(0.37)	(5.39)	(0.21)
TFP	-0.029	0.025	-0.001	-0.099	0.137***	0.048**	0.119*	0.183*
	(0.63)	(0.62)	(0.03)	(1.48)	(3.10)	(2.09)	(1.70)	(1.91)
Partner Growth	-0.034	0.205**	-0.271**	0.268	0.005	0.062*	-0.145	0.383
	(0.29)	(2.35)	(2.59)	(1.32)	(0.06)	(1.70)	(1.39)	(1.37)
Landlockness	-0.169***	0.036	0.167**	0.177**	-0.148***	0.012	-0.226***	0.255***
	(3.94)	(0.80)	(2.49)	(2.51)	(5.31)	(0.92)	(7.87)	(3.03)
Infrastructure	-0.082***	0.042**	-0.053***	0.067	0.066**	-0.008	0.122***	0.185*
	(2.75)	(2.17)	(3.69)	(1.33)	(2.59)	(0.45)	(3.60)	(1.74)
ICT	-0.011	-0.014**	-0.001	-0.002	0.016*	0.005	0.004	0.015
	(1.61)	(2.46)	(0.23)	(0.29)	(1.70)	(0.88)	(0.65)	(1.29)
Pol. Open	0.093***	0.055***	0.033***	0.028	0.067***	0.041***	-0.039	0.067
	(3.61)	(3.85)	(3.09)	(1.04)	(3.92)	(3.91)	(1.19)	(0.63)
Mills Ratio	-0.044	-0.020	-0.044*	-0.211**	-0.021	0.013	0.075***	0.149**
	(1.62)	(0.90)	(1.86)	(2.45)	(1.22)	(0.58)	(2.92)	(2.08)
Constant	8.687***	7.684***	7.555***	8.742***	8.338***	6.743***	9.373***	7.249***
	(21.03)	(23.59)	(21.91)	(11.69)	(20.24)	(27.88)	(17.05)	(5.51)
Observations	264	240	199	180	157	89	78	62
R-squared	0.42	0.27	0.31	0.35	0.33	0.32	0.52	0.43

The Mills' inverse ratio, which estimates the correlation between the error from comparative advantage equation and the error from trade intensity equations, is sometimes significant. This suggests that part of trade intensity not explained by the explanatory variables are significantly correlated with unexplained comparative advantage, and that explanatory variables in the second step (trade intensity) are correlated with unobserved variables in the first step (comparative advantage). So, in

correcting for that correlation, we have avoided a bias in the estimation of parameters in the second step.

Table 9: Trade intensity: Heckman's second equation: OLS on net exports for net importers

	1	2	3	4	5	6	7	8
$Ln\left(c+\frac{X-M}{PIB}\right)$	**Agr. AGR**	**Pr. Food PFO**	**Minerals MIN**	**Nat. Res. NRK**	**Uns. Lab. UNL**	**Sk. Lab. SKL**	**Capital CAP**	**Technol. TEC**
Income p.c.	0.039**	-0.008	-0.000	-0.005	0.010	0.017***	0.019	0.043**
	(2.39)	(0.62)	(0.03)	(1.36)	(1.07)	(4.17)	(1.34)	(2.52)
Population	0.011***	0.008***	-0.002**	0.004***	0.017***	0.014***	0.044***	0.038***
	(3.68)	(2.71)	(2.21)	(4.38)	(6.15)	(10.38)	(13.67)	(10.30)
TFP	0.014	0.046**	-0.017***	-0.002	0.029**	0.026***	0.058**	0.072*
	(0.67)	(2.45)	(2.98)	(0.43)	(2.32)	(2.94)	(1.98)	(1.92)
Partner Growth	0.008	0.026	-0.004	0.003	-0.144***	0.007	-0.030	0.073
	(0.12)	(0.67)	(0.31)	(0.20)	(3.98)	(0.52)	(0.56)	(1.40)
Landlockness	0.034**	0.007	-0.006*	-0.005	0.023***	0.009	0.018	0.031
	(2.31)	(0.73)	(1.91)	(1.26)	(3.37)	(1.42)	(1.25)	(1.57)
Infrastructure	-0.018	0.009	-0.010***	0.002	-0.016*	-0.008**	-0.011	-0.026**
	(1.45)	(1.03)	(2.95)	(0.80)	(1.80)	(2.48)	(1.11)	(2.01)
ICT	0.008**	0.005**	0.003***	0.001	0.002	-0.006***	-0.000	-0.005
	(2.53)	(2.00)	(2.85)	(0.87)	(1.02)	(4.45)	(0.12)	(0.76)
Pol. Open	-0.023	-0.052***	-0.013***	-0.018***	-0.035***	-0.031***	-0.136***	-0.151***
	(1.65)	(3.81)	(3.29)	(5.85)	(4.17)	(8.95)	(10.97)	(8.77)
Mills Ratio	0.028**	0.056***	-0.005	0.009***	0.039***	0.013	0.039*	0.130***
	(2.38)	(5.06)	(0.99)	(3.74)	(4.02)	(1.33)	(1.77)	(6.08)
Constant	6.307***	6.688***	6.978***	6.881***	6.893***	6.497***	5.974***	5.558***
	(27.86)	(47.75)	(146.26)	(159.54)	(73.25)	(142.80)	(38.39)	(27.36)
Observations	197	221	244	285	304	373	378	392
R-squared	0.27	0.42	0.24	0.30	0.44	0.57	0.59	0.52

5 Conclusions

We have tried to improve the commodity version of the HO model by adding the "new" determinants (trade impediments, differences in technology, in consumers' preferences and in returns to scale) developed in the factor content literature as well as determinants in trade structure and in trade intensity, in using a non linear estimation. This lead us to implement a Heckman procedure where in the first step we estimate the probability of being a net exporter for each eight cluster of products (what we call the comparative advantage equation). We include in this step as explanatory variables factor endowments and the new determinants which may affect specialization. In the second step, we estimate the trade intensity of net exports for each cluster depending on new determinants as well as on trade policy. This procedure helps us to control for the correlation between the unobserved variables which explain trade specialization and the explanatory variables of trade intensity. We also used a more detailed cluster classification allowing leading to more clusters for manufactured products. The eight clusters are: agriculture, processed food, minerals, natural resources based- manufactures (NRB), unskilled labor intensive (USK), skilled labor intensive (SK), capital intensive (K) and technology intensive (T). And we distinguish three sorts of skills to better assess the specialization according to human capital. All our factor endowments measures are weighted relative to world factor endowments.

Our principal results are as follows. First we find that conventional factors are still important in determining trade structure, arguably because we have a better measure of factor endowment (e.g the endowment of a country is weighted by the mean endowment in the world) and a better cluster classification. Second we find that new determinants (e.g. difference in productivity, consumers' preferences and scale returns) need to be

included to determine comparative advantage, especially for the manufactured products. Controlling for factor endowments, a better technology or scale economies enhance comparative advantage for manufactured products. Moreover, an increase in mean income leads consumers to prefer superior goods (capital intensive products or minerals intensives products) relative to inferior goods (low skilled labor intensive products and processed food) which change net exports structure. An improvement in information and communication technology or infrastructure also helps a country to reduce dependence on primary products.

Next, turn to change across periods. The results indicate that differences in factor endowments have not diminished through time: we observe an increase in the specialization according to skill endowment. So difference in productivity, in returns to scale or in consumers preferences are not new forces that drive trade flows, they were also important before 1980. It is an important conclusion since no study has been investigating this aspect before.

Estimation of trade intensity also yields plausible results. First country size matters as expected, as trade intensity decreases with population. Second a reduction in our proxy for trade barriers, increases trade intensity for both net exporter and for net importers clusters. However its effects are not uniform among sectors. Third a reduction in barriers to trade increase trade intensity, with a stronger effect for infrastructure-related costs than for transaction-related costs. Finally for manufactured clusters, increases in TFP raises net exports and reduces net imports for manufactured products. As to the overall two-step procedure, the statistical test (Mills ratio) accepts the two-step procedure.

In sum, the specialization according to factor endowments is always relevant, although "new" determinants of trade patterns are necessary to explain specialization and trade intensity.

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APPENDICES

A.1: *List of countries included in the sample 1960-2000*

	Countries	observations		Countries	observations
Latin America	Argentina	8	Africa and Middle East	Algeria	6
	Bolivia	8		Egypt, Arab Rep.	5
	Brazil	8		Ghana	7
	Chile	8		Iran, Islamic Rep.	3
	Colombia	8		Israel	8
	Costa Rica	7		Jordan	7
	Dominican Republic	5		Kenya	5
	Ecuador	8		Mali	7
	El Salvador	8		Mauritius	6
	Guatemala	7		Rwanda	1
	Honduras	8		Senegal	8
	Jamaica	7		Sierra Leone	4
	Mexico	8		South Africa	4
	Nicaragua	7		Tanzania	2
	Panama	8		Tunisia	8
	Paraguay	8		Turkey	7
	Peru	8		Uganda	2
	Trinidad and Tobago	6		Zambia	4
	Uruguay	6		Zimbabwe	4
	Venezuela, RB	8	**Total**	**19**	**98**
Total	**20**	**149**	Asia	Bangladesh	5
Developed Countries	Australia	7		China	4
	Austria	7		India	8
	Belgium	1		Indonesia	7
	Canada	7		Korea, Rep.	8
	Cyprus	5		Malaysia	7
	Denmark	6		Pakistan	6
	Finland	7		Philippines	8
	France	8		Singapore	8
	Greece	8		Sri Lanka	8
	Ireland	8		Thailand	8
	Italy	8	**Total**	**11**	**77**
	Japan	8			
	Netherlands	7			
	New Zealand	5			
	Norway	7			
	Portugal	8			
	Spain	8			
	Sweden	8			
	Switzerland	8			
	United Kingdom	8			
	United States	8			
Total	**21**	**147**			

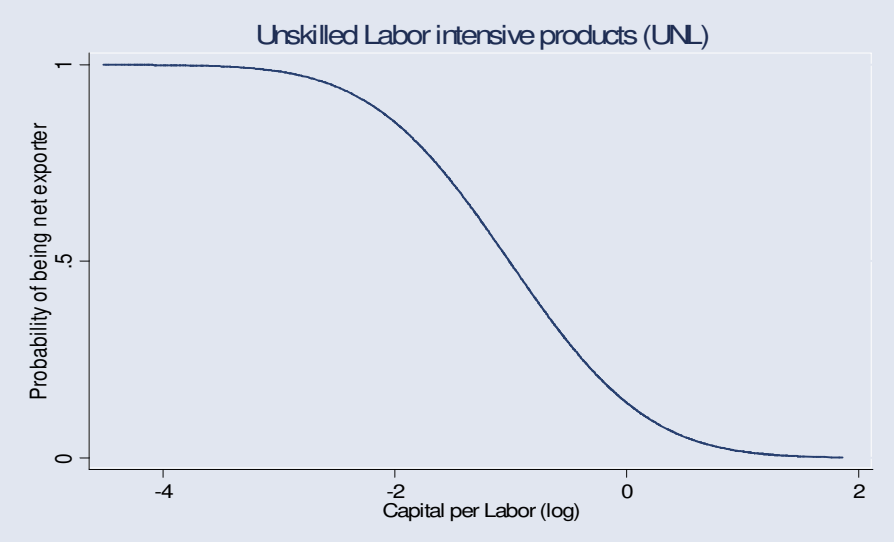
A.2: *List of variables and data sources*

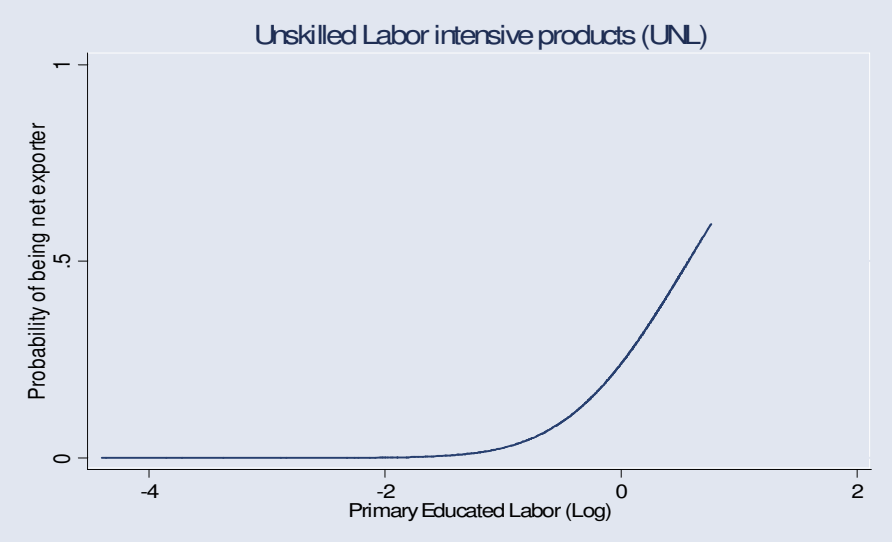
Label	**Content**	**Sources**
Net Exports per GDP on Ten Commodity Aggregates		Own calculations. Original data from UN COMTRADE, accessed with World Integrated Trade Solution – WITS.
Capital	Capital per Worker	Easterly and Levine (1999) & Kraay and al. (2000)
Arable Land	Land arable per labor force (Cereal-land; Crop-land; Forest-land)	WDI (2004)
No Educated	Proportion of the population over 15 years (non educated (or primary not completed)	Barro and Lee (2000)
Primary (Based) Educated	Proportion of the population over 15 years primary educated (completed) (or secondary not completed)	Barro and Lee (2000)
High (Skilled) Educated	Proportion of the population over 15 years High educated	Barro and Lee (2000)
TFP index	residual of a growth regression (assuming constant returns to scale)	Bosworth and Collins (2003)
GDPpc (consummers' preferences)	GDP per capita in power parity purchase (PPP)	Pen WorldTables (2005)
Population (scale economics)	Number of habitants	WDI (2004)
Partner Growth	Growth of the 10 mains partners in Trade	UN COMTRADE and WDI
Landlockness	Distance to the 10 mains partners in Trade	UN COMTRADE and CEPII
Information and Communication Technology (ICT)	a principal component personal computer, internet host, telephone lines and mobile phones for ICT	Calderon and Serven (2004)
Infrastructure	a principal component on roads networks, rails networks and paved road	Calderon and Serven (2004)
Adjusted Openness	Adjusted Trade ratio: residual once we account for size, distance and difference in factor endowment	Spilimbergo and al. (1999)

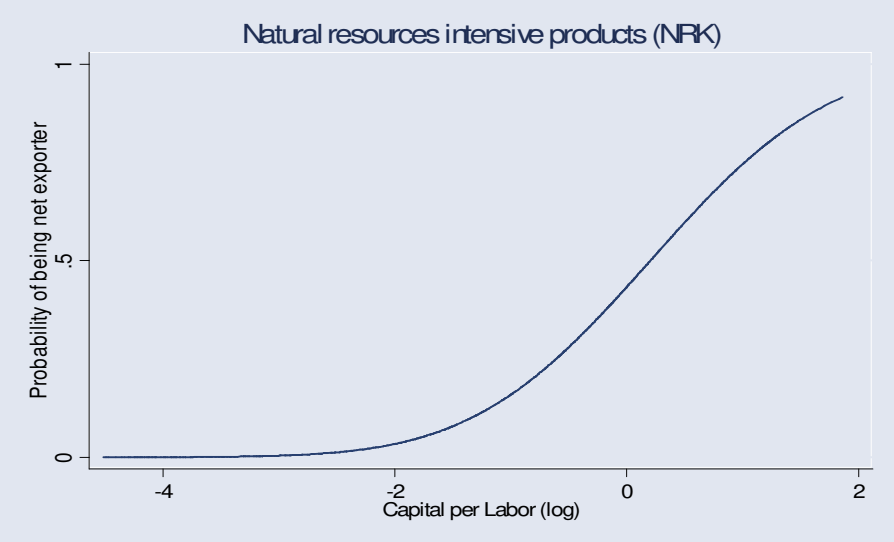
***A.3**: Variance of variables*

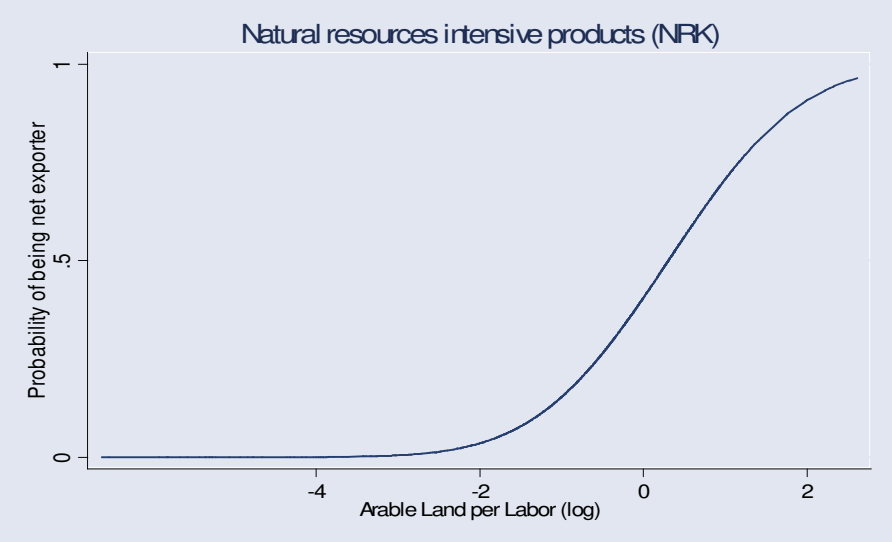
		Between	Within	Between/ Within
Net Exports				
	Agriculture (AGR)	0,21	0,06	3,48
	Pr. Food (PFO)	0,15	0,04	3,43
	Minerals (MIN)	0,10	0,03	3,91
	Nat. Resources (NRK)	0,14	0,02	5,53
	Unskilled Labor (UNL)	0,11	0,04	2,64
	Skilled Labor (SKL)	0,05	0,02	2,41
	Capital (CAP)	0,17	0,05	3,38
	Technology (TEC)	0,21	0,08	2,55
Predicted Probability				
	Agriculture (AGR)	0,27	0,04	6,81
	Pr. Food (PFO)	0,27	0,06	4,23
	Minerals (MIN)	0,25	0,09	2,82
	Nat. Resources (NRK)	0,31	0,07	4,46
	Unskilled Labor (UNL)	0,31	0,10	3,13
	Skilled Labor (SKL)	0,26	0,05	5,18
	Capital (CAP)	0,26	0,05	4,98
	Technology (TEC)	0,29	0,04	7,39
Explanatory variables				
	Income p.c.	0,94	0,18	5,08
New determinants	Population	1,47	0,15	10,06
	TFP	0,26	0,15	1,72
	Growth Partners	0,05	0,08	0,56
	Infrastructure	1,31	0,22	5,89
	ICT	0,88	0,72	1,23
	Openness	0,33	0,16	2,05
	Land	**1,14**	**0,11**	**10,67**
	Capital	**1,32**	**0,21**	**6,37**
Factor's endowments	**Unskilled**	**1,38**	**0,24**	**5,76**
	Primary	**0,52**	**0,18**	**2,88**
	Highly & Secondary	**0,78**	**0,23**	**3,34**

A.4: *Graphs Non linearity between factor endowments and probability of being net exporter*

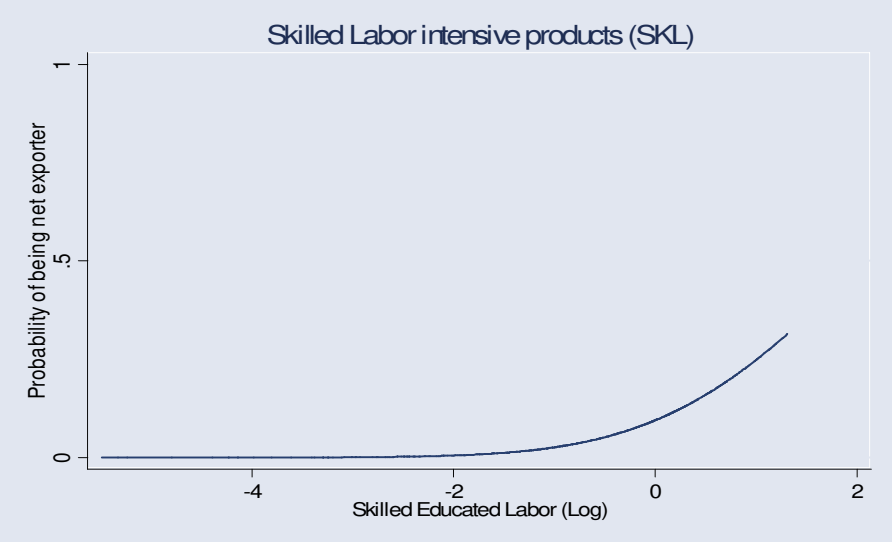


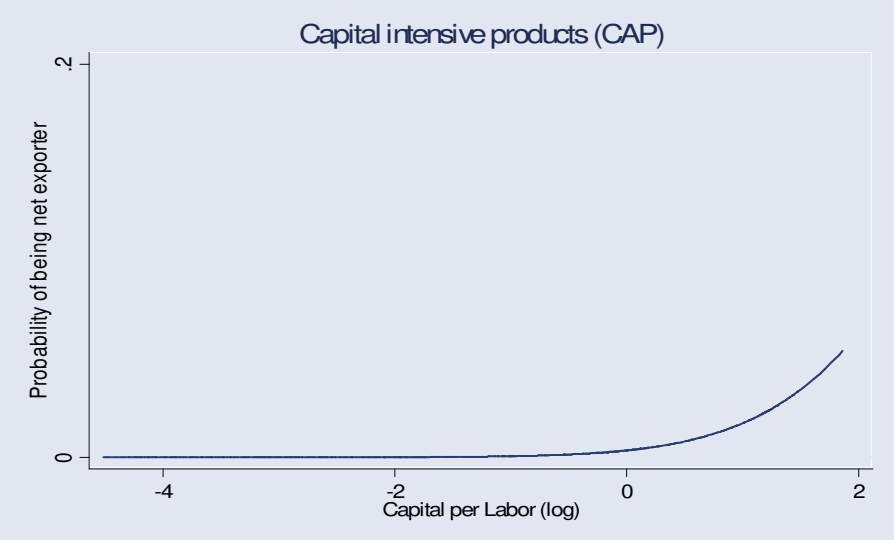


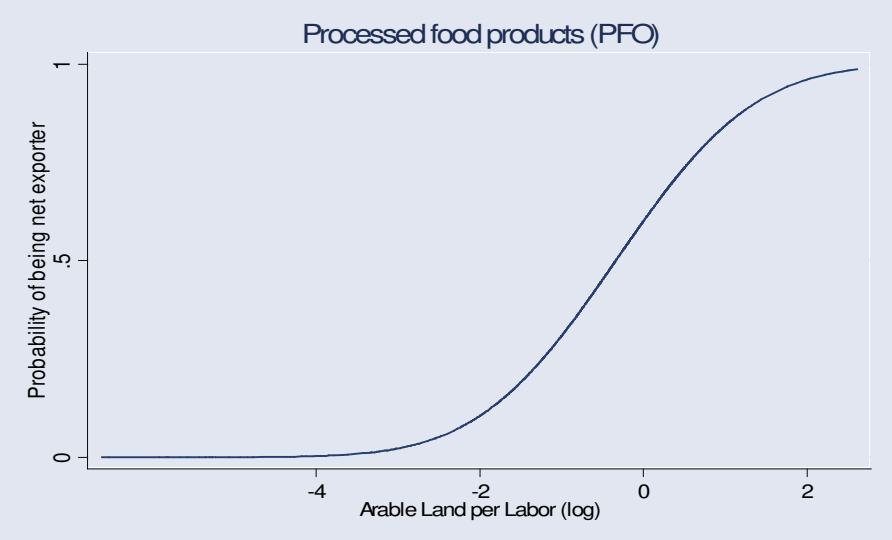





Skilled Labor intensive products (SKL)
Probability of being net exporter
0
.5
1
-4
-2
0
2
Capital per Labor (log)


Skilled Labor intensive products (SKL)
Probability of being net exporter
0
.5
1
-4
-2
0
2
Skilled Educated Labor (Log)


Capital intensive products (CAP)
Probability of being net exporter
0
.2
-4
-2
0
2
Capital per Labor (log)

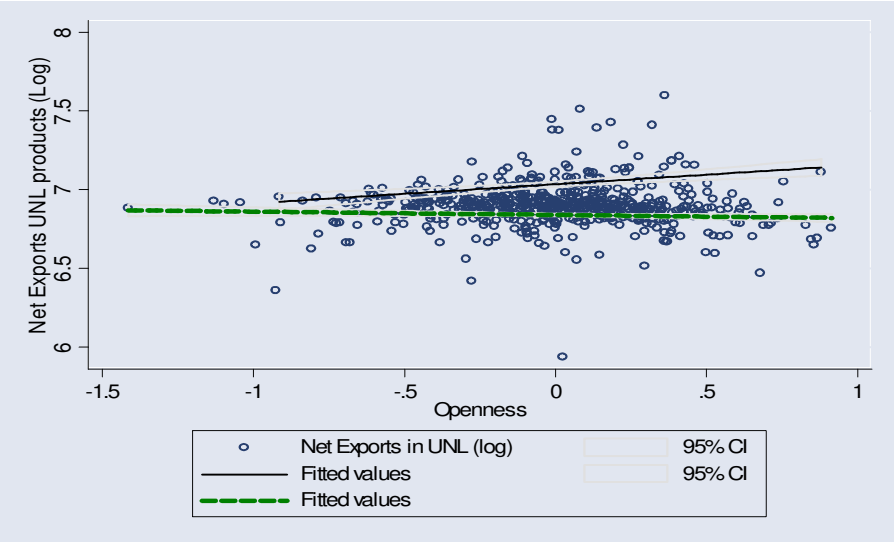

Processed food products (PFO)
Probability of being net exporter
0
.5
1
-4
-2
0
2
Arable Land per Labor (log)

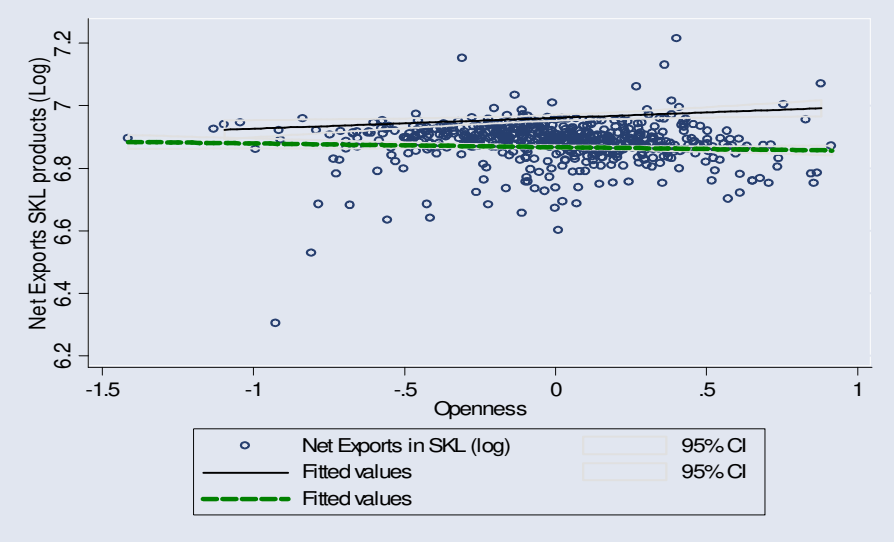
A.5: *Determinants of Comparative Advantage: Probit on the probability of being a net exporter of each commodity cluster for 1960-1980 and 1980-2000.*

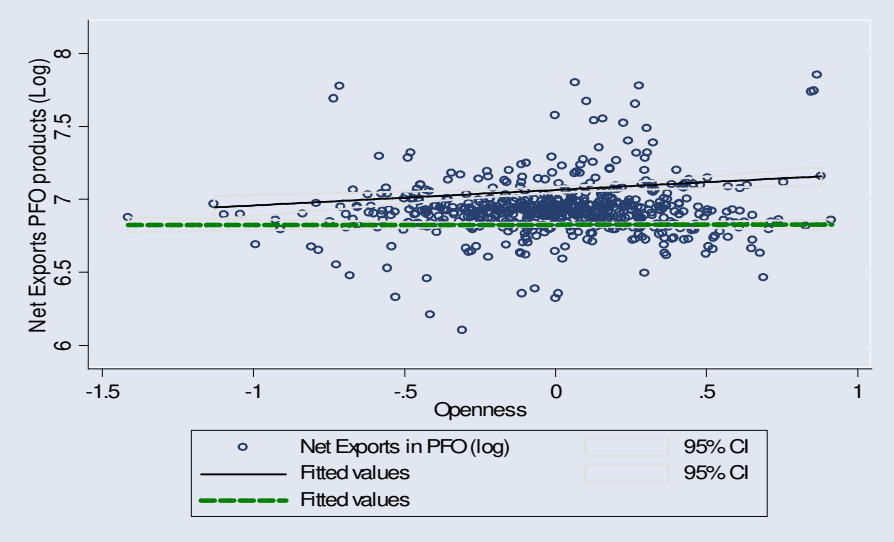
Probability of being a net exporter	**Agr. AGR**	**Agr. AGR**	**Pr. Food PFO**	**Pr. Food PFO**	**Minerals MIN**	**Minerals MIN**	**Nat. Res. NRK**	**Nat. Res. NRK**
Period	**1960-1980**	**1980-2000**	**1960-1980**	**1980-2000**	**1960-1980**	**1980-2000**	**1960-1980**	**1980-2000**
Capital	-0.275***	0.074	-0.436***	-0.042	0.326***	0.766***	0.186**	0.697***
	(2.93)	(0.80)	(4.11)	(0.36)	(2.98)	(5.27)	(2.12)	(4.93)
Land	0.078	0.222***	0.429***	0.354***	0.037	-0.127***	0.211***	0.446***
	(1.60)	(3.76)	(5.35)	(5.87)	(0.79)	(3.29)	(4.52)	(6.62)
Unskilled	-0.190***	-0.078	0.147	0.112*	-0.038	0.165**	0.207**	0.237***
	(3.30)	(1.50)	(1.50)	(1.85)	(0.51)	(2.13)	(2.20)	(3.59)
Primary	-0.065	-0.152	0.538***	0.186	-0.266*	-0.095	0.056	0.236*
	(0.71)	(1.57)	(3.24)	(1.55)	(1.74)	(0.63)	(0.32)	(1.78)
High-Secondary	-0.098	-0.240**	0.295*	0.168	0.488***	0.191	0.303**	0.186
	(1.11)	(2.32)	(1.81)	(1.57)	(3.77)	(1.33)	(2.33)	(1.38)
Income p.c.	0.054	-0.193	0.385**	0.076	-0.144	-0.518**	0.003	-0.278
	(0.33)	(1.19)	(2.30)	(0.41)	(0.88)	(2.56)	(0.02)	(1.38)
Population	-0.007	-0.032	0.012	-0.059*	-0.010	0.065**	0.014	0.001
	(0.21)	(1.06)	(0.32)	(1.79)	(0.30)	(2.17)	(0.44)	(0.04)
TFP	-0.240	-0.037	-0.147	0.521***	-0.390	-0.268*	0.150	0.056
	(0.74)	(0.25)	(0.47)	(3.11)	(1.27)	(1.70)	(0.50)	(0.32)
ICT	1.127**	-0.011	-1.289**	-0.038	-2.172***	0.001	-0.145	0.012
	(2.32)	(0.40)	(2.34)	(1.24)	(3.88)	(0.04)	(0.32)	(0.42)
Infrastructure	-0.187	0.150	0.490***	0.165	0.226*	-0.353***	-0.122	-0.318***
	(1.49)	(1.28)	(3.61)	(1.49)	(1.84)	(2.85)	(1.02)	(2.89)
Regional Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	213	248	212	249	202	241	214	251

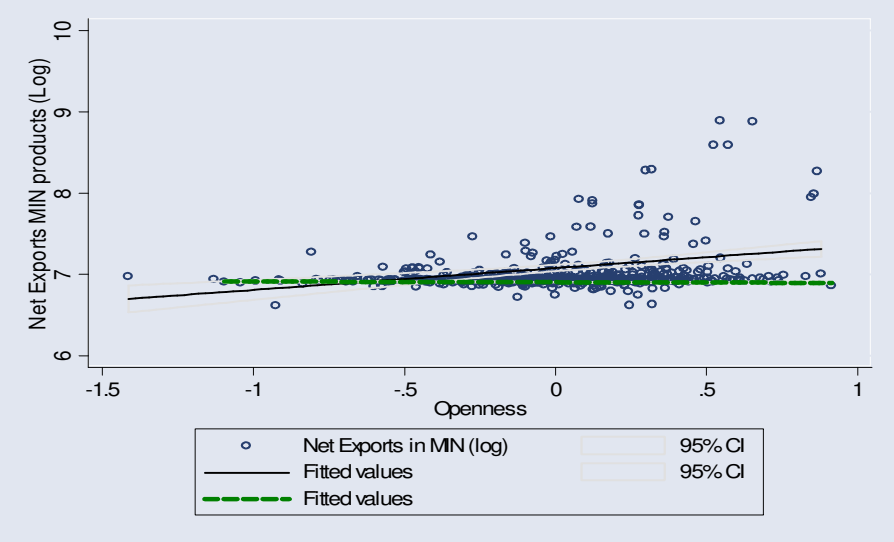
Probability of being a net exporter	**Uns. Lab. UNL**	**Uns. Lab. UNL**	**Sk. Lab. SKL**	**Sk. Lab. SKL**	**Capital CAP**	**Capital CAP**	**Technol. TEC**	**Technol. TEC**
Period	**1960-1980**	**1980-2000**	**1960-1980**	**1980-2000**	**1960-1980**	**1980-2000**	**1960-1980**	**1980-2000**
Capital	-0.240***	-0.797***	-0.109***	-0.006	-0.000**	0.084***	0.000000	0.000077
	(4.51)	(4.86)	(3.62)	(0.16)	(2.48)	(2.74)	(0.22)	(0.76)
Land	-0.048*	0.126***	-0.044***	-0.005	0.000**	0.017*	-0.000000**	-0.000059**
	(1.85)	(2.82)	(4.01)	(0.51)	(2.11)	(1.69)	(2.04)	(2.10)
Unskilled	-0.015	0.440***	-0.022**	-0.034**	-0.000***	-0.023**	-0.000000	0.000001
	(0.59)	(4.49)	(2.25)	(2.43)	(2.75)	(2.28)	(1.39)	(0.03)
Primary	0.134**	0.648***	0.106***	0.019	0.000**	0.017	0.000000	0.000056
	(2.52)	(5.32)	(3.24)	(0.76)	(2.04)	(0.61)	(0.89)	(0.94)
High-Secondary	-0.182***	0.910***	0.049**	0.106**	0.000**	-0.055*	0.000000	0.000213**
	(3.60)	(4.50)	(2.10)	(2.38)	(2.50)	(1.81)	(0.62)	(2.14)
Income p.c.	0.072	0.723***	0.015	-0.067	-0.000	-0.034	-0.000000*	-0.000221
	(0.84)	(3.59)	(0.41)	(1.24)	(1.10)	(0.83)	(1.88)	(1.49)
Population	0.141***	0.186***	0.044***	0.039***	0.000***	0.031***	0.000000***	0.000046***
	(6.80)	(4.34)	(5.64)	(5.70)	(3.62)	(4.54)	(5.31)	(2.93)
TFP	0.263*	0.667***	-0.035	0.122**	0.000***	0.100***	0.000000	-0.000039
	(1.68)	(3.82)	(0.64)	(2.37)	(3.40)	(2.69)	(0.89)	(0.47)
ICT	1.458***	-0.103***	0.147	-0.002	0.000***	-0.002	0.000000	0.000020*
	(5.42)	(3.23)	(1.35)	(0.39)	(2.88)	(0.26)	(1.45)	(1.95)
Infrastructure	-0.025	0.229	0.026	0.084***	-0.000**	0.036	0.000000***	0.000143*
	(0.35)	(1.54)	(0.87)	(2.93)	(2.38)	(1.17)	(4.07)	(1.65)
Regional Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	213	248	213	249	214	242	213	241

A.6: *Graphs Non linearity between Openness and Net Exports for status S=1 and S=0*






Net Exports PFO products (Log)
6
6.5
7
7.5
8
-1.5
-1
-.5
0
.5
1
Openness
Net Exports in PFO (log)
95% CI
Fitted values
95% CI
Fitted values


Net Exports MIN products (Log)
6
7
8
9
10
-1.5
-1
-.5
0
.5
1
Openness
Net Exports in MIN (log)
95% CI
Fitted values
95% CI
Fitted values