Trade Diversification and Economic Development

Pushan Dutt, Ilian Mihov and Timothy Van Zandt

INSEAD

(Very preliminary; please do not quote.)

October 28, 2008

Abstract: In this paper, we document patterns of export diversification, its evolution over time, the drivers of export diversification, and its consequences for economic development. First, we show that trade costs—measured in terms of distance to trading centers and market access through a host of trading arrangement (multilateral, bilateral and unilateral)—are key drivers of diversification. Second, we provide evidence for a causal link from export diversification to development and show that an increase in the extensive margin of exports is much more effective in raising per capita income than increasing the intensive margin of exports. Third, we show that what is most effective for economic development is broadly mimicking the production structure of the US, especially in those industries where the US is the most productive.

JEL Classification: F12; F13; F15; O11.

Keywords: Export diversification, Economic Development, Trade structure, Trade costs

Email addresses: pushan.dutt@insead.edu, ilian.mihov@insead.edu, timothy.van-zandt@insead.edu.

1 Introduction

In 1978, South Korea was a net importer of non-electrical machinery, with imports in this sector exceeding 15% of total manufacturing imports while exports being less than 2% of total exports. In the same year, the US was a net exporter of machines in this category. By 1999, South Korea had become a leading exporter of machinery while the US became a net importer in this category. Over the same period of time, the industrial structure as well as the trade structure of South Korea changed rapidly. There was significant relocation of capital and labor across sectors and, more importantly, a parallel process of diversification of output and exports. Over the past 20 years, this process of diversification was accompanied by a five-fold increase in South Korea's income per capita.

In this paper we analyze the links between economic development and diversification, as we attempt to understand how countries diversify their export base, and how they gain and sustain comparative advantage in different industries over time. We also examine the drivers of export diversification and how it is influenced by changes in market access and trade costs. We combine two detailed data sets from UNIDO and COMTRADE in order to document the joint evolution of trade, industrial structure, and economic development.

Although the literature has already emphasized the importance of diversification in the process of development (Acemoglu and Zilibotti, 1997; Imbs and Wacziarg, 2003), we emphasize some new facts: (1) Only a particular type of diversification is associated with economic development: We document that countries that have diversified their production and export structures to resemble the diversification of the US industrial structure are the countries that have successfully developed to become rich relative to the rest of the world. (2) While Imbs and Wacziarg (2003) analyze the relationship between production concentration and economic development, we focus on exports and show that export diversification is a significant determinant of economic development. As compared to Imbs and Wacziarg (2003) who

simply document patterns of diversification, we look for causality and extend our analyses to measures of diversification with better microtheoretic foundations (the extensive and intensive margin of exports). (3) We also document the drivers of export diversification and show differential impact of trade costs and market access on production and trade diversification.[1]

Figure 1 presents a striking picture of the relationship between export diversification and economic development. It plots the Herfindahl index of exports at the 4-digit (SITC) level over time for four sets of countries: Rich countries with low growth rates, rich countries with high growth rates, poor countries with high growth rates, and poor countries with low growth rates. We classify a country as rich, rather than poor, if its per-capita GDP exceeds \$4,000 n the year 1962 (in constant PPP dollars, according to Penn World Tables 6.2). We classify a country as high-growth, rather than low-growth, if its average growth rate between 1960 and 1999 exceeds 3%.[2] Low-growth poor countries did not experience a significant change in their export diversification: they started off less diversified and remained so for the entire time period. However, countries that started poor but exhibited high growth rates (primarily the growth miracles of East Asia) experienced a substantial rise in their diversification of exports. Countries initially classified as rich countries were substantially more diversified than poor countries in their exports in 1962 and remained so until about 1990. From 1990 onwards, the growth-miracle countries had largely caught up in terms of their export diversification index.

[**Figure 1 here**]

The paper is structured as follows: In Section 2, we present alternate measures of diversification and list our methodology and data sources for constructing the diversification measures. Sections 3 and 4 draw on recent theoretical developments in international trade

[1]This also helps us in identifying instruments for export diversification and establishing causal links from diversification to development.

[2]The Herfindahl index is an inverse measure of diversification.

to examine the drivers of diversification. Section 5 finds correlation between diversification and development and attempts to establish a causal relationship: diversification leads to development. Section 6 examines alternate forms of diversification and asks whether growth is associated mainly with any specific forms of diversification. Section 7 concludes with various policy implications of our findings.

2 Diversification Measures and Data Sources

Herfindal index of export diversification

In this paper we focus upon export diversification, meaning a broadening of the range of products that a country exports. As a starting point, we measure diversification using the Herfindahl index for exports at the 4-digit SITC level. The value of this index for county i at time t is the squared sum of export shares, where the summation is across all goods in the set J^{it} of categories in which the country exports:

$$HFI_{it} = \sum_{j \in J^{it}} \left(\frac{p^i_{jt} q^i_{jt}}{\sum_{k \in J^{it}} p^i_{kt} q^i_{kt}} \right)^2, \tag{1}$$

where $p^i_{jt} q^i_{jt}$ is the value of exports in country i of good j at time t. It is an inverse measure of diversification that ranges from maximum value of 1 (no diversification: all exports are in a single category) down to 0 (full diversification: each category contains a negligible fraction of the country's exports).

We use trade data from the World Trade Flows Database (Feenstra et al., 2005), which contains information on bilateral exports for more than 150 countries over the period 1962–1999. The authors give primacy to the trade flows reported by the importing country, whenever they are available, assuming that these are more accurate than reports by the exporters. They use exporter reports only when the corresponding importer report is not

available for a country pair. We aggregate bilateral flows across countries to obtain total exports in each country and industry, for each year.

The data on the value of exports are at the 4-digit Standard International Trade Classification, revision 2. Although recent time series are available with a finer degree of disaggregation, which are therefore favored by research on cross-sectional or short time-frame trade patterns, we require a long time series with a consistent definition of product categories over time and across space. There are 790 4-digit categories and these data account for 98 percent of all world trade.[3]

Production diversification

Some of our regressions examines the relationship between export diversification and production diversification. However, production data are available only for the manufacturing sector. We use the UNIDO database which provides annual data on production, value-added, employment, and number of firms for 28 manufacturing sectors (3 digit ISIC codes are reported) for 183 countries over the time period 1976-2001. We complement this with data for the manufacturing sector from Mayer and Paillacar (2008). Mayer and Paillacar (2008) update the UNIDO database to the year 2004. They also use the COMTRADE database from the United Nations Statistical Department, to provide data on exports and imports.

We construct the Herfindahl indices of manufacturing production, exports, and imports as in equation (1). To measure production diversification, we use data on production rather than value added because such data are more comprehensive and reliable, both across countries and over time. In both datasets, the original data are in nominal dollars at current exchange rates. We convert these to constant PPP dollars using PPP exchange rates from Penn World Tables and the US Consumer Price Index from the Bureau of Labor Statistics.

[3]Some trade gets classified at the 3-digit level but cannot be classified at the 4-digit level. We drop such trade, but assigning it to fictitious sub-categories would not qualitatively affect our results.

Extensive and intensive export margins

As alternative measures of export diversification, we construct measures of the extensive and intensive margin of exports following Hummels and Klenow (2005) (and the working-paper version, Hummels and Klenow (2002)). These authors build on the methodology of Feenstra (1994) to investigate the extent to a country with a higher volume of exports does so because it exports a wider variety of goods (extensive margin) or because it exports larger quantities of each variety (intensive margin).[4]

Following Hummels and Klenow (2002), we construct the extensive margin of exports for county i at time t as

$$XM_{it} = \frac{\sum_{j \in J^{it}} p_{jt}^W q_{jt}^W}{\sum_{j \in J^W} p_{jt}^W q_{jt}^W} \tag{2}$$

where W denotes World and J^W is the set of varieties exported by the World as a whole. Thus, this is a measure of the fraction of categories in which country i exports, but it weights the categories by their importance in world trade.

The intensive margin of exports for county i at time t is

$$IM_{it} = \frac{\sum_{j \in J^{it}} p_{jt}^i q_{jt}^i}{\sum_{j \in J^{it}} p_{jt}^W q_{jt}^W} \tag{3}$$

Thus, it measures the overall market share the country has within the set of categories in which it exports.

Although the interesting question is "by how much", one would expect that the highest-volume exporter would export in the most categories and also have the largest market shares

[4]Freenstra (1994) and Feenstra and Kee (2004) provide microfoundations for the construction of these indices. These papers develop a methodology for measuring the impact of new varieties on productivity. It uses a constant elasticity of substitution (CES) specification that identifies the gains from variety by keeping track of only two factors: the elasticity of substitution among different varieties of a good and shifts in expenditure shares among new, remaining, and disappearing goods. The main intuition is that increasing the number of varieties does not increase productivity much if new varieties are close substitutes to existing varieties or if the share of new varieties is small relative to existing ones. Broda and Weinstein (2003) use this methodology as well and apply it to all U.S. imports. They find that increased import variety contributes to a 1.2% per year fall in the "true" import price index.

in the categories in which it exports. In fact, the US has the largest extensive and intensive margins. Chad has the lowest extensive margin and Djibouti has the lowest intensive margin.

Summary statistics

Appendix Table A1 presents the summary statistics for measures of diversification as well as for other variables used in this paper. Details on these variables, along with their data source are covered in the subsequent sections of the paper.

3 What Drives Diversification?

3.1 Theory

We start by investigating the determinants of export diversification. We draw on a variety of new trade models (Melitz, 2003; Eaton and Kortum, 2003; Bernard, Eaton, Jensen and Kortum, 2003) to identify the variables that are potential drivers of diversification.

The neoclassical Ricardian and the Hecksher-Ohlin models provide no clear role for export diversification. Underlying both models is the idea of specialization according to comparative advantage, rather than diversification. The Ricardian approach emphasizes technological or productivity differences between countries and shows that countries can gain by specializing in and exporting goods in which they have a relative cost advantage. The Hecksher-Ohlin model focuses on the relative proportion between productive factors (i.e., physical capital, labor, land, skills or human capital). Hence, poor countries specialize in export of goods intensive in unskilled labor and land, whereas richer countries specialize in export of goods intensive in human and physical capital.

In both these models, the export Herfindahl would depend entirely on whether the underlying technological or resource comparative advantage provides a comparative advantage across a small or large number of product categories. For example, in a two-country two-

factor many-good H-O model, if there are many product categories that are labor intensive and a few product categories that are capital intensive, then the labor-abundant country will have a smaller Herfindahl index (large diversification). However, one would see no link between the volume of exports or growth of the economy and the value of the index.

The "new" trade models, which we turn to next, emphasize the extensive margin of trade and are better suited for understanding the determinants of export diversification. Krugman (1979) presents the workhorse model of trade with a monopolistic competitive market structure. The model was originally designed to address the high incidence of trade between countries that have similar technologies and factor endowments—an empirical fact that was in stark contrast with the traditional Ricardian and Hecksher-Ohlin predictions that the bulk of trade would be between dissimilar countries. In the Krugman (1979) model, the emphasis is on the extensive margin of trade, with countries in equilibrium producing an endogenous number of varieties. The number of varieties produced in a country is proportional to the size of the economy, with each country (conditional on exporting a particular variety) exporting that variety to all other countries.

Consider a richer specification of the Krugman (1979) model—that of Melitz (2003), which allows for firms who are heterogeneous in terms of productivity. When firms vary by productivity, only the more productive firms find it profitable to export. Melitz (2003) allows for stochastic draws of technology for each firm, and only those firms with productivity above a certain cutoff level operate. A subset of these firms—the most productive —also become exporters. Melitz shows that this cutoff productivity level depends on trade barriers faced by the exporters and other features of the world market; profitability is higher and the corresponding cutoff productivity level for exporting is lower when exporting to countries with higher demand levels, and when firms in the focal country face lower costs of exporting.

Transport costs that depend on geographic distance, as well as are artificial barriers such as tariffs and quotas, are trade costs that vary across country pairs and affect the composition

of trade. The role of such costs is incorporated by Eaton and Kortum (2002) into a Ricardian model of trade (one based on differences in technology).[5] Each country imports any product variety from at most one other country (in fact, from a single firm within that country), but several countries or firms (in different countries) can be exporters of a product variety due to heterogeneous trade costs. This model thus emphasizes the resulting competition between firms to be this exclusive supplier. Transport costs and market access play a key role in determining the extensive margin of trade.

3.2 Independent variables

Size of economy

Our first variable is the logarithm of population of the country, a proxy for the size of an economy. We do not use GDP because we want an exogenous measure of the resources of the country.

Geographic distance

To capture geographic barriers to trade, we use a remoteness index from Rose (2005). This is not a measure of distance for a country pair, but rather it is a multilateral analogue that measures the overall distance of one country from the remaining potential trading partners. We use this measure because our analysis is also at the level of the country rather than the country pair. It is defined as the average of log distances from each country to all other countries, weighted by reciprocal of GDP. According to this measure, Luxembourg has the lowest value of the index and therefore the easiest market access, while New Zealand is the most remote.

[5]See also Bernard, Eaton, Jensen, and Kortum (2003).

Market access

To capture market access and the ability to circumvent artificial trade barriers, we use three measures of preferential access:

1. membership in the GATT/WTO;
2. membership in preferential trade arrangements (PTA);
3. the Generalized System of Preferences (GSP).

We motivate each of these in order.

Trade liberalization under GATT/WTO is on a Most Favored Nation basis, whereby trade concessions granted to one member should be available to all members. Such mrket access is one of the key reasons for WTO accession. Therefore, we use a GATT/WTO dummy which takes the value one in all the years that a country was a member of the GATT/WTO.

However, since the early days of GATT, there have been two major ways in which the non-discriminatory aspect has been violated. GATT permits exemptions to the MFN principle for regional preferential trade arrangements that reduce local barriers to trade. Members in free trade areas and customs unions obtain privileged access to each others markets that do not have to be granted to non-members. We capture this aspect of market access by constructing, for each country i, a weighted sum of all the PTAs it participates in, with the weight being the market size (as measured by GDP):

$$PTA_{i,t} = \sum_j pta_{ijt} GDP_{jt},$$

where $pta_{ij,t} = 1$ if i and j are members of the same preferential trade agreement.

Finally, Rose (2004) finds that accession to the GATT/WTO did not affect the volume of bilateral trade and he attributes it to the fact that the GATT historically made few

demands on most countries in terms of trade liberalization, since most entrants were developing countries eligible for "special and differential treatment". However, he finds that the Generalized System of Preferences (GSP) extended from the rich countries to developing countries approximately doubles trade. The Generalized System of Preferences (GSP) are schemes of trade preferences granted on a non-reciprocal basis by developed countries to developing countries. Those schemes are unilateral tariff preferences which facilitate LDCs access to markets of rich countries. So our third variable is a count measure of the number of countries that grant GSP access to each country.[6]

Data for all these measures, apart from population, are from Andrew Rose's website. Population data are from Penn World Tables.

4 Determinants of Diversification

4.1 Herfindahl Index

Our baseline regression is

$$HFI_{it} = \alpha_i + \beta_1 GATT_{it} + +\beta_2 PTA_{it} + \beta_3 GSP_{it} + \beta_4 Remote_{it} + \beta_5 Pop_{,t} + \gamma' Z + \epsilon_{it}, \quad (4)$$

where we include in the vector Z additional variables that might affect diversification.[7]

[Table 1 here]

The results from estimating (4) are reported in Table 1. Since all of the regressors are reasonably exogenous, we estimate the regressions by OLS. Column (1) reports pooled OLS results with time fixed effects, while columns (2) and (3) also include country fixed effects.

[6] GSP resulted in a substantial increase in developing country exports (for empirical evidence, see Baldwin and Murray (1977), Rose (2003) and Romalis (2003)). Our data are from Rose (2003).

[7] Table A1 in the Appendix describes the data in terms of means, ranges and standard deviation.

For both the pooled and within estimates, the signs are as expected – entering GATT leads to a statistically significant increase in export diversification.[8] To understand the magnitude of the effect consider the estimated coefficient on the GATT/WTO dummy in column (2). If a country exports evenly in several industries and has a value of the Herfindahl index equal to the overall mean of 0.18, then a coefficient of -0.044 implies that this country will start exports in slightly fewer than two new industries following accession to GATT/WTO. The first row of the table indicates that while the magnitude is sensitive to the specification of the regression, but it is always highly significant. At the low estimate in column (3), a country with an equal distribution across export industries will add just one new industry to its nomenclature of exports. However, these calculations underestimate the impact of GATT because they assume that exports are evenly distributed. If this is not the case and if new exports do not jump in value right away to the values in the old exporting sectors, then an entry to GATT may result in a bigger expansion on the extensive margin.

Countries with greater market access as measured by the sum of market size of countries with whom they have preferential trade agreements also tend to be more diversified, and the result holds for both the pooled estimates in column (1) and the within estimates in columns (2) and (3). With GSP access, the estimate for the pooled OLS specification in column (1) has the opposite sign from the specification with country fixed-effects in column (2). While across countries, GSP access is associated with higher levels of export concentration, within countries over time GSP access leads to export diversification. This is not surprising given that preferential agreements are generally granted to the least developed countries for specific products or groups of product (mainly agriculture). The least-developed countries tend to have a much less diversified export base and tend to specialize in primary and unskill-intensive products. However, granting preferential access to a country leads it to diversify

[8]Since column (2) includes both time and country fixed-effects, the estimated coefficient is equivalent to a difference-in-difference estimator.

exports over time as the negative coefficient in columns (2) and (3) signify.[9]

Next, the remoteness index also has significant explanatory power for export diversification: The further away a country is, the lower is the degree of diversification. This suggests that productive firms are clustered in certain industries and if the threshold for exporting is higher for countries due to higher transportation costs, then these countries tend to be less diversified in their exports. The decline in the significance of the coefficient on *Remote* in column (2) is not surprising, given the lack of time variation in this variable. Finally, estimates in column (1) suggest that larger countries in terms of population are more diversified in their exports.

In addition to the standard variables used to explain trade patterns, we include additional controls in column (3) to examine the robustness of our results. These are the Herfindahl index capturing production concentration in neighboring countries, the volume of trade defined as $(X + M)/GDP$, and a measure of institutions, constraints on the executive from the Polity IV database. Addition of these variables, results in a decline in the magnitude of our estimates. However, all variables, save population, remain significant. In terms of these additional controls, we find that the Herfindahl index of exports of the focal country is negatively related to the Herfindahl index of production of its neighbors. The coefficient on this variable implies that if neighboring countries have a well-diversified industrial structure (i.e. low level of the production Herfindahl index) then the exports of the home country are quite concentrated. The volume of trade does not seem to matter, while an improvement in institutions increases export diversification.[10]

[9]Collier and Venables (2007) show that various Sub-Saharan African countries have had large manufacturing export supply response to trade preferences following the African Growth and Opportunities Act which gives trade preferences to African countries in the US market.

[10]This finding is similar to Klinger and Lederman (2004, 2005) who built on Hausmann and Rodrik (2003) and show a causal link from market failures to insufficient diversification. They find that the inability of export entrepreneurs to completely appropriate benefits of their exporting activity is an instance of market failure that leads to lower levels of diversification.

From a theoretical point of view, the results in Table 1 may be somewhat puzzling. In standard neoclassical trade models of Ricardo and Hecksher-Ohlin, a fall in trade costs/barriers should lead to concentration of exports in the sectors where the country has a comparative advantage. And yet, one of the most robust findings in cross-country or panel regressions is that entry into GATT, or participation in PTAs leads to a sizable increase in exports diversification. This finding is not easily reconciled within a monopolistic competitive model of trade either. In such a model, all varieties are exported and the f.o.b. prices are identical for all destinations, regardless of trade barriers.[11] However, this evidence is consistent with the Melitz (2003) model with heterogenous marginal costs of firms and fixed costs of exporting. The fixed costs explain why not all varieties are sold in all markets while the heterogeneous marginal costs explain why some firms (the productive ones with low marginal costs) in a country manage to export while others focus purely on the domestic market.[12] This in turn raises the question, whether lower trade barriers lead to an increase in specialization or in diversification on the production side for the economy?

To answer this question, we rerun regression (4) by comparing the Herfindahl indices of exports, imports and production. Column (1) shows the Herfindahl index of manufacturing production (at the 3-digit ISIC level), constructed using UNIDO data. Columns (2) and (3) present the Herfindahl indices of exports and imports for all commodity trade, while columns (5) and (6) show Herfindahl indices of exports and imports for the manufacturing sector alone. All columns include both time and country fixed effects. We report these results in Table 2.

[**Table 2 here**]

The first interesting comparison is in terms of how remoteness affects the various Herfindahl indices. We see in column (1) that countries who are remote from major trading centers

[11] The c.i.f. import price absorbs all trade costs.

[12] See Baldwin and Harrigan (2007) for a discussion of various streams in this literature.

tend to have a more diversified production base. At the same time, columns (2) and (3) show that remote countries have a less diversified export and import structures. This is in line with Melitz (2003) if we think of the remoteness index (the multilateral analogue to distance) as capturing variable trading costs. Our results suggest that only the most productive firms export in remote countries and only the most productive foreign firms can sell in these remote countries. However, if consumption patterns are similar across countries, one would expect a diversified base of firms who produce exclusively for the domestic market, which leads to production diversification in remote countries, as seen in column (1). This comparison of production vs. export Herfindahls continues to hold when we restrict export diversification to the manufacturing sector alone (compare column (1) to column (4)).

The second interesting comparison is the effect of GATT/WTO accession — once trade barriers fall on a multilateral basis, production becomes more concentrated, while exports and imports become more diversified. This is again true, regardless of whether we look at overall commodity export and imports, or whether we confine our attention to manufacturing exports and imports. It is important to remember that liberalization under the auspices of GATT/WTO are conducted on a reciprocal basis. So it results in not just a reduction in trade barriers for exporting firms, membership in the GATT or in a PTA also lead to greater competition from imports. Therefore, some domestic firms are unable to compete and this effect dominates so that we see a decline in production diversification. At the same time, conditional on exporting, the dismantling of trade barriers leads to more diversified exports.

PTAs seem to affect overall export and import diversification but not that of the manufacturing sector exports and imports. Similar to GATT, bilateral liberalization also reduces the diversification of manufacturing sector production, but surprisingly has no significant impact on manufacturing sector export and import diversification. GSP access has a negative sign in column (1), but does not have a significant impact on manufacturing Herfindahl index of production, or on the manufacturing export Herfindahl. Since GSP access is targeted

mainly to the agricultural sector, this finding is not surprising.

4.2 Extensive and Intensive Margin of Exports

As argued before, although the Herfindahl measure of exports is a convenient measure of diversification and often used in policy circles (see UNCTAD, 2006) and in previous empirical research (see Carrère, Strauss-Kahn and Cadot, 2007; Imbs and Wacziarg, 2003; Amin Gutierrez de Pineres & Ferrantino, 1997), it lacks a solid theoretical foundation. Therefore, we also examine the determinants of diversification in this section using the measures of the extensive and the intensive margin of exports. The correlation of the Herfindahl index with the extensive margin equals 0.6 while with the intensive margin equals only 0.25. In fact, if we regress the Herfindahl index on both margins, the extensive margin has the right sign (negative) and is highly significant (t-statistic=52) while the intensive margin has the wrong sign (positive and significant.) Therefore, the Herfindahl index of exports captures more of the extensive margin rather than the intensive margin of exports.

[Table 3 here]

Table 3 examines how GATT, PTAs, GSP, remoteness and population affect each of the two margins. Columns (1) and (2) present results with the extensive margin while columns (3) and (4) use the intensive margin as the dependent variable. Columns (1) and (3) show pooled OLS estimates with time fixed effects, while (2) and (4) use country-fixed effects as well. The results with the extensive margin are similar to that with the Herfindahl index of exports for the within-estimates (compare column (2) in Table 1 with column (2) in Table 2). In column (2), GATT membership and access through PTAs and GSP all increase the extensive margin of exports, while remote countries exhibit a lower extensive margin of exports.[13] Bigger countries, in terms of population, have a larger extensive margin

[13]The estimated coefficient on GSP in column (1) is negative which again reflects that GSP is granted to poor countries who are less diversified. However, over time GSP access is instrumental in raising the

(see column 1) but increases in population over time (see column 2) actually results in a decline in the extensive margin. For the intensive margin, the pooled OLS estimates in column (3) show that countries who are members of GATT and who have access to markets through PTAs exhibit higher intensive margin of exports. Countries with GSP have lower intensive margins. However, when we add country fixed-effects, neither GATT membership nor access via PTAs matters (a result similar to that of Rose, 2004). Only GSP access increases the intensive margin over time. Remoteness does not matter for the intensive margin for either the pooled OLS or the within estimates. Finally, with country size, the results mimic those with the extensive margin. Across countries larger countries exhibit a higher intensive margin. However, over time, as population size increases we observe a decline in the intensive measure.

Overall, our results indicate that market access matter—that GATT membership, access through PTAs and GSP, and geographic proximity to major markets all lead to an increase in export diversification. Further, these results are stronger in the within-estimates over time and much of the effect is on the extensive margin.

5 Diversification of Exports and Economic Development

When examining the links between trade and economic development, researchers have tended to focus on whether higher ratios of trade volumes to GDP (or lower levels of protectionist policies) are positively correlated with growth, even after controlling for a variety of other growth determinants. Such a positive link is suggested by Sachs and Warner (1995), Frankel and Romer (1999), and Wacziarg and Welch (2008) amongst others. However, in a critical survey of this literature, Rodríguez and Rodrik (2000) question the robustness of these

extensive margin of exports (see positive coefficient on GSP in Column (3)).

findings, due to problems in measuring openness, the collinearity of protectionist policies with other bad policies, and other econometric difficulties. More recently, a consensus seems to be emerging that the deeper determinants of economic development are not policies (trade policies as well as macroeconomic policies) but the underlying institutions in a country. Institutional indicators such as the constraints on executive decision-making, the rule-of-law, and bureaucratic corruption have been shown to have a much more significant impact on economic growth and level of development (Mauro, 1995; Hall and Jones, 1999; Rodrik et al, 2004; Easterly, 2005). The prevailing consensus is that institutional quality trumps both the role of geography and economic integration with the rest of the world in accounting for cross-country differences in income levels (see Acemoglu, Johnson and Robinson 2001; Rodrik, Subramaniam, and Trebbi, 2002). This verdict of the primacy of institutions over policies, while illuminating, may be of little comfort to policymakers who have much less flexibility when it comes to institutional reform.

Meanwhile, recent developments in the trade literature document studies these aspects of the composition of trade:

1. How trade expands along the extensive and intensive margins (Hummels and Klenow, 2005).

2. The role of firms in international trade (Bernard et al 2007).

3. Only the most productive firms export (Bernard and Jensen, 1995, 1999)

4. How trade liberalization leads to a reallocation of economic activity towards high-productivity firms (Bernard, Jensen and Schott, 2006).

5. That richer countries export not just more goods, but a broader variety of goods (Hummels and Klenow, 2005).

6. That exporting firms are more capital- and skill-intensive than non-exporting ones (Bernard, Jensen, Redding and Schott, 2006).

7. That a fall in trade costs leads more-productive firms to not just increase exports, but also upgrade quality (Verhoogen, 2008).

8. That there exists endowment-driven specialization within products rather than across products (Schott, 2004).[14]

What this research shows is that an understanding of trade and its expansion requires digging deeper than simply analyzing export and import volumes and establishing a link between trade volumes (or trade policies) and development. Exceptions to this include Broda, Greenfield, and Weinstein (2006), and Hausman, Hwang and Rodrik (2007).[15] Broda et al show that, across a wide sample of countries, the growth in the extensive margin of imports can also account for an important component of that country's productivity growth. Hausman et al (2007) show that the type of goods countries export matters—exporting goods associated with higher productivity levels leads to rapid economic growth grow more rapidly, after controlling for standard growth regressors such as initial income per head, human capital levels, etc.

Imbs and Wacziarg (2003) were the first to document the relationship between production and employment diversification and per capita income. They showed, that as countries develop, they tend to diversify their production structure but after a threshold level of per capita income, we observe a reversal and a tendency towards re-concentration. Klinger and Lederman (2004, 2005) and Carrère, Strauss-Kahn and Cadot (2007) show a similar result using export data. However, these papers simply present a pattern between development and diversification, leaving aside questions of causality.

[14]See Bernard et al., 2007 for a very informative summary.
[15]Theoretical exceptions include Ventura (1997) and Acemoglu and Zilibotti (1997).

We analyze the link between diversification of exports and economic development and examine if there is a causal relationship from export diversification to per capita GDP.[16] Figure 2 plots the Herfindahl index of exports at the 4-digit level against per capita GDP. The clear negative relationship between the two indicates a clear positive relationship between diversification and the degree of development. Figure 3 plots the evolution of the extensive margin of exports and per capita GDP against time for South Korea. Over time, we see a clear positive correlation between the two - the rise in the extensive margin of exports is accompanied by a rise in per capita GDP.

[**Figures 2 and 3 here**]

5.1 Herfindahl Index

We start with a simple pooled OLS regression where we regress per capita GDP on export Herfindahl at the 4-digit level, controlling for trade volumes (termed integration and defined as $(X + M)/(GDP)$ from Penn World Tables,) an institutional variable, measured as constraints on the executive, and distance to the equator.[17] Our specification follows that of Rodrik et al, 2002 who use a similar specification to examine the relative importance of institutions over geography and integration.

[**Table 4 here**]

Column (1) in Table 4 shows that export diversification is associated with significantly higher levels of per capita GDP. Meanwhile, the signs and significance on the other variables

[16] Per capita GDP is from the Penn World Tables. As before, we will use three measures of diversification: the Herfindahl index, the extensive and the intensive margin of exports.

[17] Constraints on the Executive that has been used in a number of influential papers (e.g., Acemoglu et al, 2003; Acemoglu, Johnson, and Robinson, 2001). 'It takes values between 1 and 7 and measures the extent of institutionalized constraints on the decision-making of chief executives. The data are from the Polity IV database. Distance to the equator is measured from the capital city of a country as abs(Latitude)/90. The data are from Dollar and Kraay (2002).

are in line with Rodrik et al, 2002 - countries that are more open, with better institutions and that are distant from the equator are more developed. Since this in no way establishes causality, the second column of Table 4 uses the Herfindahl index of exports lagged by 5 years, while column 4 uses the initial Herfindahl index from the year 1962. Here with reverse causality less of a concern, we again find that a country with a diversified export base tends to be richer. The estimates in column (1) imply that a one standard deviation decline in the export Herfindahl (which is roughly equivalent to a country that produces equally in two industries to adding an extra industry) raises the log of per capita GDP by 0.21.[18] The magnitude of effect is largest for distance and institutions—a one standard deviation increase raises per capita by 0.41 and 0.34 respectively.

Column (4) adds country fixed effects to column (1). Using fixed effects in this manner also dramatically reduces the scope for omitted variables and mis-measurement that may plague our estimates, as the intercepts take out all variation that is country-specific but time-invariant. Despite the fall in the absolute magnitude of the coefficient on export diversification, it remains significant. In fact, these estimates indicate that the magnitude of the effect is largest for export diversification, as compared to institutions and integration. Since these are within-estimates, it implies that there are significant returns for a country if it manages to diversify its export base over time.

There are two potential problems with the results reported in table 4: omitted variables and endogeneity of trade policies. While the country-fixed effects remove all time invariant omitted variables, it may be argued that a move towards diversification may be accompanied by other policy changes (e.g., industrial policies) which also affects per capita GDP. To address these concerns we use instrumental variables. Incidentally, instrumental variables will help us also deal with measurement error problems, which might be present in the Herfindahl measure. The presence of measurement error creates an attenuation bias, i.e., it works

[18]In our sample, the standard deviation of log of per capita GDP is 1.04.

against finding a significant relationship between per capita GDP and export diversification. If the instruments help us deal with the measurement error we should see an increase in the absolute value of the coefficient. If, on the other hand, endogeneity has an important impact on our OLS estimates, then we should see a decrease in the absolute value of the coefficient.

In column (5) we instrument the Herfindahl index of exports with a Herfindahl index of agricultural exports (calculated as the Herfindahl index of exports for SITC 1-digit code 0), the GATT dummy, and the PTA access variable. We believe the Herfindahl index of agricultural exports to be a valid instrument, since logically it is related to contemporaneous overall export diversification and but unlikely to be directly related to per capita GDP (other than through its effect on overall export diversification.) This seems plausible since natural endowments of land, fertility, and weather mainly affect this variable.[19] Similarly, accession to the GATT is not conditional on changing any other policy stance prior to membership. And finally, PTAs tend to be geographically localized with neighboring countries entering into such preferential trading arrangements. However, it may be argued that both GATT membership and PTA access affects trade volumes and through it per capita GDP, we instrument openness using these instruments as well.[20] Our first stage regressions support these conjectures across all measures and yield very high F-statistics for the test of excluded instruments (see last three row of Table 3).

As an aside, we do not use the remoteness index, the GSP variable or population since it may be plausibly argued that the remoteness index captures the role of geography which we see in columns (1) has an effect on per capita GDP even after controlling for export diversification. Similarly, since GSP is granted to only poor countries and population (or

[19]Note that we are implicitly assuming that consumption patterns of food are more or less similar across countries.

[20]The instrument recommended for institutions is the logarithm of settler mortality in British colonies, as constructed by Acemoglu, Johnson and Robinson (2001). We cannot use this, since it is time-invariant. However, by instrumenting openness and export diversification we are in fact giving a better chance to institutions.

size of labor force) may independently influence per capita GDP, we exclude these from the instrument set. In fact, if we include any of these three variables as an independent regressor, it shows up with a significant coefficient. Moreover, a Hansen J-test of overidentification strongly rejects the orthogonality of these variables with the error term.

Upon instrumenting export diversification and openness in column (5), we observe a coefficient on export diversification which is similar to that in column (1) and significantly higher than that in column (4) which includes fixed effects. The increase in coefficient's absolute magnitude suggests the presence of attenuation bias in the estimates in column (4).[21] Finally, a Hansen test (the $p-$value of this is reported on the last row of Table 4) fails to reject the null hypothesis of overidentifying restrictions confirming the validity of our instruments.

The specification in Rodrik et al 2002 uses a cross-section of per capita GDP for a single year while the results in Table 4 use a panel of countries over time. To facilitate comparison, table 5 presents a pure cross-sectional regression of diversification, institutions, integration and geography on per capita GDP. All variables pertain to the year 1996.

[**Table 5 here**]

Column 1 uses the Herfindahl index from the year 1996, column (2) uses the initial Herfindahl index of exports from the year 1962; column (3) instruments the Herfindahl index and Openness with the same set of instruments as in Table 3; column (4) instruments constraints on the executive with the colonial settler mortality variable from Acemoglu, Johnson and Robinson (2001) and adds the Frankel-Romer instrument for openness.[22] This

[21] It may be argued that the while the overidentification (OID) test validates our choice of instrument, if only one of the instruments is correlated with the instrumented variable, then effectively we do not have overidentification. We address this issue by removing one instrument at a time from the list of instruments and including it as an additional explanatory variable. For every regression, the coefficient on export diversification barely changes, and the coefficient on the additional exogenous variable fails to be significant.

[22] Frankel and Romer (1999) regress bilateral trade flows (as a share of a country's GDP) on measures of country mass, distance between the trade partners, and a few other geographical variables, and then

specification exactly mimics that of Rodrik, et al 2002. Across all specifications, we find that countries with a diversified export base tend to be richer. The use of initial Herfindahl index in column (2) and the instrumenting techniques in columns (3) and (4), suggest that the causal influence is from diversification to per capita GDP.

5.2 Extensive and Intensive Margin of Exports

Next, we substitute the Herfindahl index of exports with the extensive and intensive margin of exports. We use the two measures concurrently since it allows us to examine the relative importance of each for economic development. Table 6 shows these results.

[**Table 6 here**]

In column (1) which shows pooled OLS estimates with year effects, we find that both the countries with larger extensive and the intensive margin of exports are significantly richer. Column (2) uses the extensive and intensive margins from the year 1962 and shows that countries who were initially more diversified along both margins tend to be richer in terms of per capita GDP. The estimates in column (3) with country and year fixed effects and contemporaneous values of extensive and intensive margins imply that those who succeeded in raising both the extensive and intensive margin of exports over time, succeeded in becoming richer. The estimates in column (3) imply that a one standard deviation increase in the extensive margin of exports, raises log of per capita GDP by 0.27, while a similar increase in the intensive margin raises per capita GDP by 0.24—both effects far outweighing the effect of a one standard deviation increase in either institutions or integration. The magnitudes are even more stark for the estimates in column (1)—here a one standard deviation increase along the export margin results in an increase in per capita GDP by 0.41 while for the intensive margin, the estimated magnitude is only 0.12.

constructing a predicted aggregate trade share for each country on the basis of the coefficients estimated. This constructed trade share is then used as an instrument for actual trade shares.

Column (4) instruments the extensive and intensive margin with the same set of instruments as that in Table 4. Upon instrumenting, we find that extensive margin of exports continues to be significant, while the intensive margin of exports is no longer significant. However, some caution is required in interpreting this result—the first-stage $F-$test of the significant for excluded instruments yields much higher test statistics for the extensive margin as compared to the intensive margin.[23] Finally, column (5) replicates column (4) from Table 5 along the lines of Rodrik et al 2002. Here, we instrument the institutional variable with the settler mortality and openness with the Frankel-Romer gravity based instruments. Again, only the extensive margin of exports significantly affects per capita GDP. Integration and institutions are significant as well. The magnitude of effects are roughly the same for institution, integration and extensive margin of exports, equal to 0.5. For both set of IV estimates, the panel one in column(4) and the cross-section in column (5), the first-stage results and the OID tests support the validity of instruments.[24]

Overall, our results indicate that there is a tight link between export diversification and development, that export diversification in all likelihood has a causal effect on per capita GDP (if we believe that the instrumenting strategy is valid), and that expansion of exports along the extensive margin delivers bigger benefits in terms of facilitating economic development. Whatever is the driving force of economic development, it cannot be the forces of comparative advantage as conventionally understood. The trick seems to be to acquire mastery over a broader range of activities, instead of concentrating on what one does best.

[23]While the $F-$statistic is significantly different from zero, Stock, Wright and Yogo (2002) recommend an$F-$statistic of at least 10. Otherwise, we have a problem of weak instruments.

[24]We conducted two further robustness checks. First, we regressed per capita GDP in 1996 on initial intensive and extensive margins. Coefficients on both variables are positive and significant. Second, we regressed per capita GDP in the panel setting on the intensive and extensive export margins lagged by 5 years—again both turned out to be positive and significant.

6 Is Every Diversification Linked to Economic Development?

So far, we have demonstrated that diversification of exports matters for development. However, a natural question that arises is whether any diversification works or whether there is some form of diversification which is more effective than others. In this section, we examine if a diversification pattern that is isomorphic to the US—which by all measures is the most productive country and is commonly used to define the world technology frontier—is the one which is key to economic development. To examine this, we analyze how per capita GDP is affected by its Herfindahl index of production (HFI_{it}), the difference in its production structure relative to the US ($DIFF_{it}$) and a US-productivity weighted difference in the structure of production. We use the manufacturing sector data, since this is the only data for which we have data on all three—exports, production, and productivity (defined as value-added per worker).

The Herfindahl index of production is constructed in the same way as before. The variable $DIFF_{it}$ is calculated as follows: for each country-year, we first calculate the proportion of production in each of the 28 3-digit manufacturing sectors. Next we sum the squared differences in production shares between country-pair i and the US at time t, with the summation carried out over the 28 manufacturing sectors.

$$DIFF_{it} = \sum_{j=1}^{28} \left(\left[(Sh)_{jt}^{i} - (Sh)_{jt}^{US} \right]^2 \right) \tag{3}$$

$(Sh)_{jt}^{i}$ is the share of good $j's$ production in total production at time t in country i and $(Sh)_{jt}^{US}$ is the share of good j in the US at time t. Note that this variable may be written as

$$DIFF_{it} = HFI_{it} + HFI_{USt} - 2\sum_{j=1}^{28} \left[(Sh)_{ijt} (Sh)_{USjt} \right]$$

The variable $Prod\_DIFF_{it}$ is calculated in a similar fashion except that the squared differences are weighted by a function of US productivity. We would like the productivity weighted difference in production structure to take smaller values not just when country i has shares in production similar to the US, but also when these shares are similar in sectors that the US is the most productive. Therefore we weigh the difference in production shares by

$$\left(1 - \frac{Productivity_{jt}^{US}}{\max_j[Productivity_{jt}^{US}]}\right),$$

where $Productivity_{jt}^{US}$ is the value-added per worker in industry j at time t in the US. The variable $Prod\_DIFF_{it}$ is defined as

$$Prod\_DIFF_{it} = \sum_{j=1}^{28}\left[\left(1 - \frac{Productivity_{jt}^{US}}{\max_j[Productivity_{jt}^{US}]}\right)\left((Sh)_{jt}^{i} - (Sh)_{jt}^{US}\right)\right]^2 \tag{4}$$

We use variants of the following regression in Table (7)‘;

$$GDPpc_{it} = \alpha_i + \beta_1 HFI_{it} + \beta_2 DIFF_{it} + +\beta_3 Prod\_DIFF_{it} + \gamma' X + \nu_{i,t} \tag{5}$$

where we include the same measures of institutions and integration as before in X. All columns include country and year fixed effects.

[**Table 7 here**]

The first column in Table 7 simply replictaes our earlier results and shows that countries who succeed in diversifying their production base, become richer over time. Column (2) adds the difference in production structure ($DIFF_{it}$) to the Herfindahl index of production. This variable is now significant while the Herfindahl index is not. What this signifies is that countries whose production structures became more similar to the US over time, are the ones who succeeded in raising their per capita income. Column (3) adds the productivity weighted

difference in production structure. We obtain a negative and significant sign on this variable, which implies that its not simply that the similarity of production structure with respect to the US that matters, but that it is similarity in production shares in industries where the US is most productive. This is a striking result—that it is not just any diversification matters; instead, mimicking the production structure of the US, especially in its most productive industries, yields the best results for increasing per capita income over time.[25]

7 Conclusion

In this paper, we document patterns of export diversification, its evolution over time, the drivers of export diversification, and most importantly its consequences for economic development. First, we find that all countries who became rich, diversified their base of exports over time and that this diversification happened mainly along the extensive margin. We show that trade costs—measured in terms of distance to trading centers and market access through a host of trading arrangement (multilateral, bilateral and unilateral) are key drivers of diversification. However, there are various subtle differences in how these market access variables work—some increase diversification over both time and across countries, while the effect of others is realized only when we do a cross-country comparison. Similarly, they have varied effects on production vs. export diversification.

Second, we show that there is a tight link between economic development, as measured by per capita GDP, and export diversification, as measured by the Herfindahl index of exports and the extensive margin of exports. While intensive margin of exports matters, it does so only in the cross-sectional dimension. An increase in the extensive margin of exports is much more effective in raising per capita income than increasing the intensive margin of exports. We also provide evidence for a causal link from export diversification

[25]We get identical results if we define productivity in the US in terms of production per worker rather than value-added per worker.

to development. Third, we show that what is most effective for economic development, is broadly mimicking the production structure of the US, especially in those industries where the US is the most productive.

Once we recognize the link between export diversification and development, several policy implications emerge from our findings. First, our findings imply that development is fundamentally about structural change: it involves producing and exporting new goods with new technologies and transferring resources from traditional activities to these new ones. This insight is not new and was the central insight of the classical two-sector models of development (Lewis 1954). Second, our paper makes a case for trade liberalization on a multilateral basis, since this leads to a diversification of exports. While Rose (2004, 2005) shows that the volume or volatility of trade flows are unaffected by GATT/WTO accession, we show that his findings ignore the extensive margin of exports component. Similar to Rose (2004) we find that the intensive margin of exports does not respond to GATT accession. Second, since preferential trade arrangements are also instrumental in diversifying the export base, welfare implications of PTAs cannot simply be evaluated in terms of trade creation and trade diversion. Instead, one must take into account, the impact on the extensive margin of trade. Third, given that diversification into particular productive sectors delivers the maximum gains, our paper makes a case of targeted industrial policies as was adopted by the growth miracle countries like South Korea, Taiwan and Japan prior to that. We do recognize that there are two practical bottlenecks to adopting a successful industrial policy. First the informational requirements for governments to identify with any degree of precision and certainty the relevant sectors, or markets to target. Second is the objection that activist industrial policies is an invitation to corruption and rent-seeking (see Dutt, 2009). Recently Rodrik (2004; 2006; 2007) has made a strong case for reinstituting activist industrial policies that have been discarded or fallen into disuse. By showing that some forms of diversification matters more than others, our paper provides empirical support for such a pursuit.

Our findings raise a number questions: Why do patterns of diversification differ between industrial structures and exports? And more importantly, which trade theories can explain how countries identify and develop their comparative advantage, and diversify into these sectors. Note that even the new trade models are static in nature and are less equipped to explain how patterns of comparative advantage shift over time. Diversification can also be driven by portfolio diversification motifs as in Acemoglu and Zilliboti (1997) but what are there any other trade-offs involved in diversification. These are interesting avenues to pursue in future work.

References (incomplete)

Acemoglu, Daron and Zilibotti, Fabrizio. "Was Prometheus Unbound by Chance? Risk, Diversification, and Growth.' Journal of Political Economy, August 1997, 105(4), pp. 709–51.

Dornbusch, Rudiger; Fischer, Stanley and Samuelson, Paul A. "Comparative Advantage, Trade, and Payments in a Ricardian Model with a Continuum of Goods.' American Economic Review, December 1977, 67(5), pp. 823–39.

Ghironi and Melitz (2007), "Trade Flow Dynamics with Heterogeneous Firms," AER.

Harrigan, James. "Specialization and the Volume of Trade: Do the Data Obey the Laws?' in James Harrigan and Kwan Choi, eds., Handbook of international trade. Malden, MA: Basil Blackwell, 2003.

Hausmann, Hwang and Rodrik (2007), "What You Export Matters," JEG.

Hidalgo, Klinger, Barabasi and Hausmann (2007), "The Product Space Conditions the Development of Nations," Science.

Hummels, David. "Have International Transportation Costs Declined?' Mimeo, University of Chicago, 1999.

Hummels and Klenow (2005), "The Variety and Quality of Nation's Exports," AER.

Imbs and Wacziarg (2003), "Stages of Diversification," AER.

Lederman and Maloney (2002), "Trade Structure and Growth," mimeo.

Ventura, Jaume. "Growth and Interdependence.' Quarterly Journal of Economics, February 1997, 112(1), pp. 57–84.

Figure 1: Herfindahl Index for Various Groups of Countries 1962-1999
(countries are grouped by their initial income per capita and subsequent growth rate)

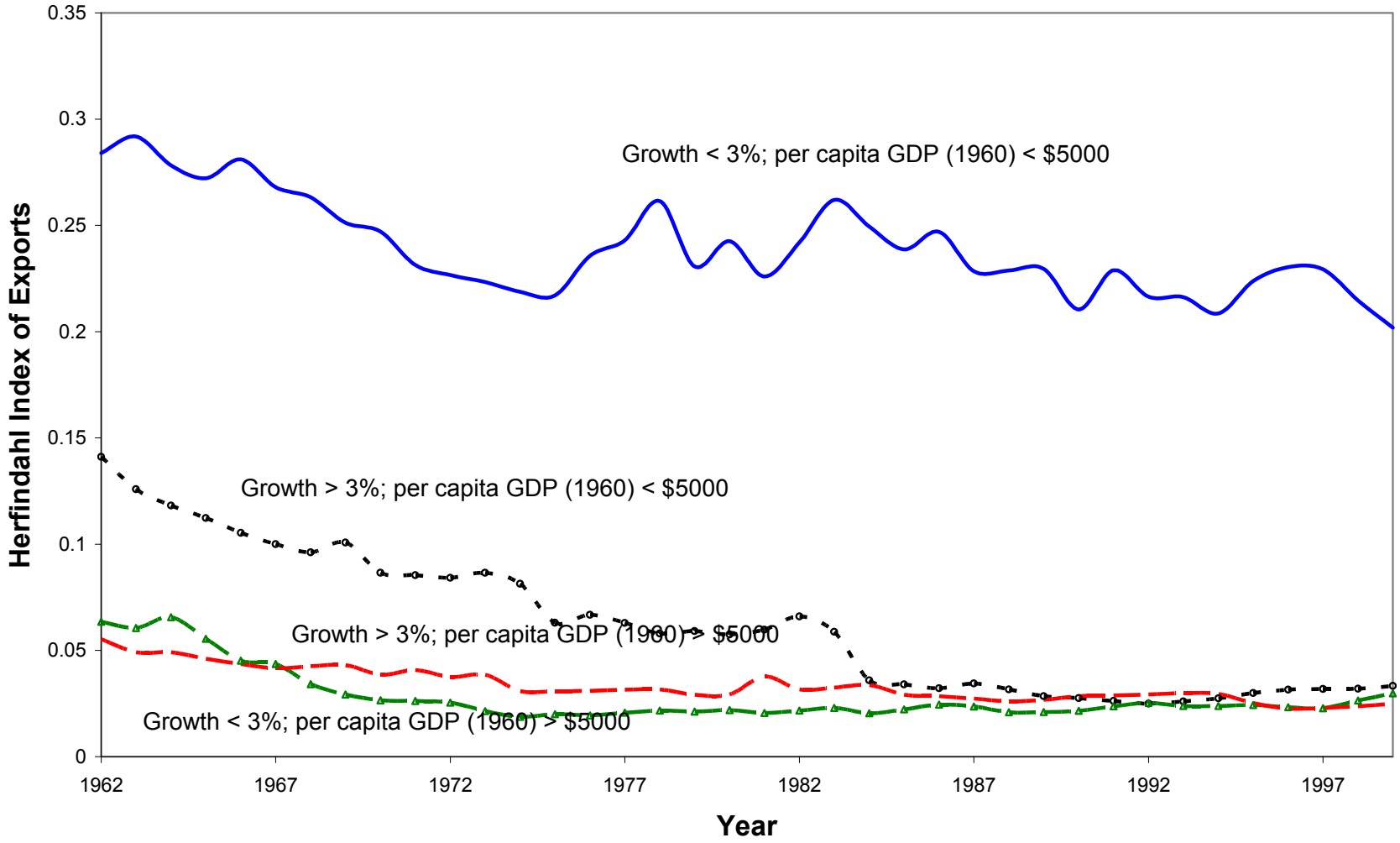

Figure 2: Herfindahl Index and log of per capita GDP in 1996

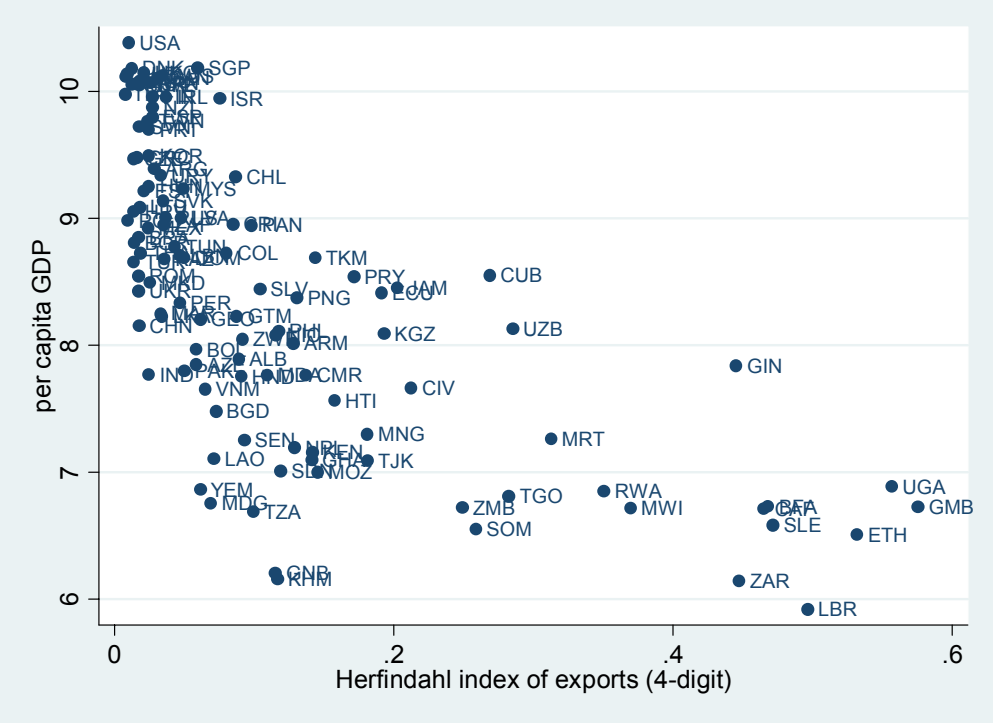

Figure 3: Per Capita GDP and Extensive Margin of Exports: South Korea (1962-1999)

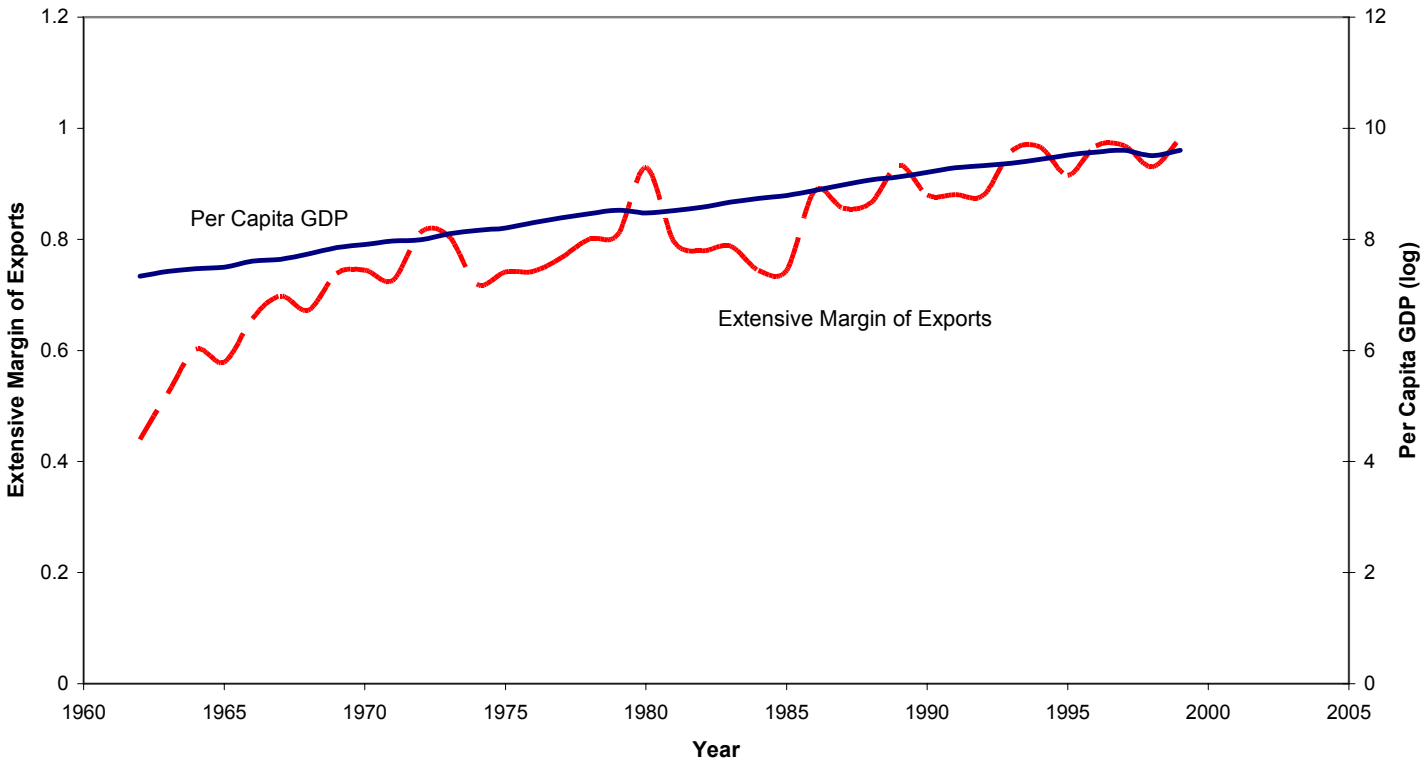

Table 1: Effect of Trade Costs and Market Access on Export Diversification

Dependent Variable: Export Herfindahl Index using 4 –digit SITC classification

	(1)	(2)	(3)
GATT dummy	-0.031***	-0.044***	-0.033***
	(0.006)	(0.007)	(0.010)
PTA access	-0.0002***	-0.0002***	-0.0001**
	(0.000)	(0.000)	(0.000)
GSP access	0.004***	-0.004***	-0.003*
	(0.000)	(0.001)	(0.002)
Remoteness index	3,966.744***	2,649.364***	2,498.592*
	(297.456)	(462.253)	(1,466.423)
Population (logged)	-0.026***	0.052***	-0.031
	(0.001)	(0.015)	(0.037)
Production Herfindahl of neighbors			-0.228***
			(0.058)
Constraints on the executive			0.010***
			(0.002)
Openness: (X+M)/GDP			0.000
			(0.000)
Observations	4428	4428	2217
Number of countries	143	143	122
R-squared	0.18	0.07	0.04
Time fixed effects	Yes	Yes	Yes
Country fixed effects	No	Yes	Yes
Joint significance test	44.58***	38.7***	28.73***

Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

Table 2: Effect of Trade Costs and Market Access on Diversification

Dependent Variables: Export, Import and Production diversification

	(1)	(2)	(3)	(4)	(5)
	Herfindahl index of manuf. production	Herfindahl index of exports	Herfindahl index of imports	Herfindahl index of manuf. exports	Herfindahl index of manuf. imports
GATT dummy	0.009**	-0.044***	-0.004**	-0.058***	-0.006***
	(0.004)	(0.007)	(0.002)	(0.014)	(0.002)
PTA access	0.0001***	-0.0002***	-0.0001***	0.00004	0.000
	(0.000)	(0.000)	(0.000)	(0.0001)	(0.000)
GSP access	-0.001	-0.004***	-0.000*	0.003	0.005***
	(0.001)	(0.001)	(0.000)	(0.002)	(0.001)
Remoteness index	-2,224.747***	2,649.364***	670.219***	3,472.016**	-252.305
	(809.291)	(462.253)	(122.419)	(1,527.833)	(455.537)
Population (logged)	0.050	0.052***	-0.006	-0.232***	-0.016
	(0.034)	(0.015)	(0.004)	(0.056)	(0.017)
Observations	1392	4428	4425	1392	1392
Number of countries	91	143	143	91	91
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes
R-squared	0.04	0.07	0.03	0.18	0.06
Joint significance test	2.21	7.48***	2.78***	7.68	2.93

Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

Table 3: Effect of Trade Costs and Market Access on Export Diversification

Dependent Variable: Extensive and Intensive Margin using 4 –digit SITC classification

	(1)	(2)	(3)	(4)
	Extensive Margin of Exports		**Intensive Margin of Exports**	
GATT dummy	0.063***	0.023***	0.003***	0.000
	(0.007)	(0.006)	(0.000)	(0.000)
PTA access	0.001***	0.000***	0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
GSP access	-0.010***	0.003***	-0.001***	0.000***
	(0.001)	(0.000)	(0.000)	(0.000)
Remoteness index	-4,308.378***	-1,531.349***	70.007	30.873
	(433.196)	(413.150)	(46.325)	(41.345)
Population (logged)	0.076***	-0.133***	0.004***	-0.003***
	(0.002)	(0.020)	(0.000)	(0.001)
Observations	4431	4431	4431	4431
Number of countries	143	143	143	143
R-squared	0.47	0.44	0.32	0.03
Time fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	No	Yes	No	Yes
Joint significance test	182.96***	80.71***	18.82***	2.65***

Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

Table 4: Effect of Export Diversification on Economic Development

Dependent variable: Per Capita GDP (PWT Panel)

	(1)	(2)	(3)	(4)	(5)
	Pooled OLS	Lagged Herfindahl	Initial Herfindahl	Fixed effects	IV-fixed effects
Herfindahl index of exports (4-digit)	-1.199***	-1.195***	-0.516***	-0.335***	-1.229***
	(0.064)	(0.066)	(0.077)	(0.040)	(0.172)
Constraints on the executive	0.150***	0.155***	0.161***	0.007**	0.009*
	(0.005)	(0.005)	(0.005)	(0.003)	(0.005)
Openness: (X+M)/GDP	0.003***	0.004***	0.003***	0.002***	0.012***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)
Distance to equator	0.025***	0.026***	0.028***		
	(0.001)	(0.001)	(0.001)		
Observations	3780	3419	3782	3780	3674
Number of countries	136	134	113	136	124
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Country fixed effects	No	No	No	Yes	Yes
R-squared	0.59	0.60	0.56	0.43	0.31
Joint significance test	172.87***	190.11***	153.30***	66.92***	46.83***
F-test of excluded instruments					
Export Herfindahl					91.14***
Openness: (X+M)/GDP					46.17***
OID test p-value					0.27

Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

Table 5: Effect of Export Diversification on Economic Development

Dependent variable: Per Capita GDP in 1996 (Cross-Section)

	(1)	(2)	(3)	(4)
	OLS	Initial Herfindahl	IV	IV
Herfindahl index of exports (4-digit)	-1.879***	-0.863**	-4.312**	-2.415**
	(0.367)	(0.425)	(2.010)	(1.071)
Constraints on the executive	0.101***	0.207***	-0.090	0.345**
	(0.038)	(0.033)	(0.143)	(0.147)
(X+M)/GDP	0.004**	0.006***	-0.027	0.005
	(0.002)	(0.002)	(0.023)	(0.004)
Distance to equator	0.023***	0.028***	0.021*	0.015
	(0.004)	(0.005)	(0.011)	(0.012)
Observations	135	98	130	59
R-squared	0.50	0.69		
Joint significance test	42.88***	50.68***	5.77***	13.63***
OID test p-value			0.27	0.98

Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

Table 6: Effect of Extensive and Intensive Margin of Exports on Economic Development

Dependent variable: Per Capita GDP (Panel and Cross-Section)

	(1)	(2)	(3)	(4)	(5)
	Pooled OLS	Initial export margins	Fixed effects	IV-fixed effects	IV-Cross-section
Extensive margin of exports (4-digit)	1.385***	1.676***	0.879***	1.507***	1.443***
	(0.044)	(0.044)	(0.038)	(0.203)	(0.448)
Intensive margin of exports (4-digit)	7.179***	5.498***	13.918***	-1.590	9.604
	(0.413)	(0.369)	(1.181)	(38.058)	(10.391)
Constraints on the executive	0.106***	0.161***	-0.000	-0.004	0.286**
	(0.005)	(0.005)	(0.003)	(0.004)	(0.118)
Openness: (X+M)/GDP	0.003***	0.002***	0.000*	0.002	0.008***
	(0.000)	(0.000)	(0.000)	(0.003)	(0.002)
Distance to equator	0.017***				0.015*
	(0.001)				(0.009)
Observations	3780	3782	3780	3674	58
Number of countries	136	113	136	124	58
Time fixed effects	Yes	Yes	Yes	Yes	No
Country fixed effects	No	No	Yes	Yes	No
R-squared	0.69	0.56	0.55		
Joint significance test	300.43***	174.09***	76.07***	73.84***	43.95***
F-test of excluded instruments					
Extensive margin				157.64***	26.69***
Intensive margin				3.91***	1.52***
OID test p-value				0.24	0.47

Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

Table 7: Effect of Different Forms of Diversification on Economic Development

Dependent variable: Per Capita GDP (Panel):

	(1)	(2)	(3)
	Fixed effects	Fixed effects	Fixed effects
Herfindahl index of manuf. production	-0.319***	0.165	0.053
	(0.066)	(0.227)	(0.233)
Difference in manuf. production structure wrt to US		-0.521**	-0.174
		(0.234)	(0.283)
Productivity-weighted difference in manufacturing production structure wrt to US			-0.444**
			(0.203)
Constraints on the executive	-0.004	-0.004	-0.004
	(0.003)	(0.003)	(0.003)
(X+M)/GDP	0.002***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)
Observations	1764	1764	1764
Number of countries	132	132	132
R-squared	0.42	0.42	0.42
Joint significance test	49.64***	47.89***	46.27***

Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

Appendix Table A1: Summary Statistics

Variable	N	Mean	Std. Dev.	Min	Max
Export Herfindahl (4-digit SITC)	5762	0.18	0.18	0.01	0.96
Export Herfindahl (3-digit SITC)	5762	0.20	0.19	0.01	0.99
Export Herfindahl (2-digit SITC)	5761	0.24	0.19	0.03	0.99
Export Herfindahl (1-digit SITC)	5760	0.39	0.18	0.13	0.99
Production Herfindahl (3-digit ISIC): Manufacturing Sector	2697	0.16	0.12	0.06	0.97
Export Herfindahl (3-digit ISIC) : Manufacturing Sector	2418	0.23	0.17	0.06	1
Import Herfindahl (3-digit ISIC) : Manufacturing Sector	2167	0.11	0.03	0.06	0.31
Extensive Margin of Exports (4-digit SITC)	5745	0.53	0.31	7.87E-09	0.99
Intensive Margin of Exports (4-digit SITC)	5745	0.01	0.02	1.03E-06	0.18
Difference in production structure (relative to US)	2669	0.10	0.11	0	0.97
Access through Preferential Trade Arrangements	10117	26.81	76014	0	465.79
Access through Generalized System of Preferences	6195	8.24	8.01	0	20
Remoteness Index	6888	2.64E-05	1.49E-05	3.86E-06	1.15E-04
GATT dummy	10665	0.50	0.50	0	1
Production Herfindahl of neighbors	3712	0.08	0.06	0.01	0.69
Per Capita GDP: Panel Regressions	5788	8.16	1.03	5.64	10.69
Per Capita GDP: Cross-Section Regressions (1996)	168	8.42	1.12	5.74	10.47
Constraints on the executive	5492	3.86	2.37	1	7
Openness: (X+M)/GDP	7309	72.62	54.39	2.00	986.45
Distance from Equator of Capital City	207	24.82	16.69	0	64
Settler Mortality (Acemoglu, Johnson and Robinson, 2001)	71	4.64	1.23	2.15	7.99
Frankel-Romer Instrument for Openness	195	-2.83	0.64	-4.41	-0.64