The Growth and Patterns of International Trade

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Abstract

Over the last 40 years, there has been an unprecedented growth in trade amongst countries, and the growth in trade shows no sign of slowing down. The increases in trade have put tremendous pressure on the maritime and port industries, and these industries have responded with innovations, investment, and greater productivity. International trade and maritime trade are synonyms, and an understanding of the determinants of international trade is central to understanding maritime trade. In this paper, we provide a review of the international trade literature with a focus on the determinants of trade and the evolution of trade modeling. We then present a broad overview of the extent and growth of trade in the context of primary determinants. The basic results are: 1. Trade is growing at a phenomenal rate; 2. Trade is dominated by relatively few countries who tend to remain dominant; 3. While trade of all products is growing, there are large differences in the growth rates, but yet, there is stability in the relative sizes of product markets; and 4. Over the last 40 years, trade has changed from major flows between the US and Europe to major flows between Asia and the US.

Keywords: Trade Growth, Patterns of Trade, Imports, Exports, Products

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1. INTRODUCTION

Maritime Policy and Management was first published in 1973. At that time, there was about $4.5 billion in world trade. Today, trade levels are in excess of $16 trillion, an increase in trade by a factor of about 35.[1] Trade levels continue to increase, and over the last decade trade has grown faster than in previous decades. The growth in trade has placed a tremendous amount of pressure on the transportation network consisting of hinterland (truck, rail, barge, air) transportation, port services, and maritime sectors of the logistics framework. To some extent, these sectors have responded in kind. That is, there have been tremendous innovations, investments, and policy changes to accommodate the growth in trade. Likewise, international trade theory innovated as well in response to the evolving patterns of international trade that were often not well explained by existing models. To commemorate the 40th anniversary of *Maritime Policy and Management*, it seems fitting that we provide a brief review of the evolution of international trade theory and analysis, as well as a broad description of the growth and evolving patterns of trade.

2. ECONOMIC MODELS OF INTERNATIONAL TRADE

While the origination of many economic concepts is attributed to Adam Smith's *Wealth of Nations* (Smith, 1776), his formalization of the theory of absolute advantage to explain how trade between countries can be mutually beneficial was a major focus of his treatise. It was a direct response to the mercantilist ideology that believes a country improves its wealth by encouraging exports and discouraging imports. In this sense, Smith's example of absolute advantage was revolutionary in suggesting that unfettered international trade would provide benefits to *both* the importing and exporting countries.

[1] These figures are drawn from the United Nation's COMTRADE files described in section 3.

2.1 Comparative advantage models

Ricardo's *Principles of Political Economy and Taxation* provided a generalization of Smith's views in the notion of comparative advantage, which remains a fundamental theory for why countries trade with each other. His two-country, two-good example shows that countries can engage in mutually beneficial trade with each other, even when one country has an absolute advantage in the production of both goods. The theory suggests not only that trade can be beneficial, but also predicts the pattern of production specialization and direction of trade. Namely, countries will specialize their production in the good for which their opportunity cost of production (relative to the other country) is lowest, and this will then be the good they export to the other country in exchange for the product for which they have a relatively higher opportunity cost to produce. The Ricardian theory of comparative advantage has been generalized from the two-good setting to a multi-product setting (Dornbusch, Fischer, Samuelson, 1977) and even into multi-product, multi-country general equilibrium contexts (e.g., Eaton and Kortum, 2002, and Bernard et al., 2003)

Ricardo's formulation of comparative advantage involved relative differences in productivity in the sectors of production. In reality, any differences between countries that lead to different relative autarky prices will create comparative advantage and potential gains from trade between countries. The most famous alternative model of comparative advantage to the Ricardian model is the Heckscher-Ohlin model, where relative autarky price differences (i.e. comparative advantages) stem from differing factor endowments in countries and differing intensities with which sectors use these production factors.[2] The model's prediction for trade flows comes from the Heckscher-Ohlin theorem that postulates that a country will export the good that uses relatively intensively the factor of production in which the country is relatively abundant.

[2] The model was developed by both Eli Heckscher and Bertil Ohlin, but formally published in English by Ohlin (1935).

A real appeal of the Heckscher-Ohlin model is that it allows one to examine the distributional consequences of trade and trade policy across different factors of production. For example, what happens to real wages if a country opens up to international trade? In this respect, the model has engendered the famous Stolper-Samuelson theorem, which states that trade will lead to a real increase in the factor price in which the country is abundant, and a decline in the real price of the other factor. Relatedly, the equally well-known Rybczynski theorem states that an increase in one of the country's endowment will lead to a production increase in the good that uses that factor relatively intensively, but a decline in the production of the other good. This latter effect is often known as "Dutch disease," because of the well-known example of the Dutch manufacturing sector suffering a decline when oil was discovered off the Dutch coast and its oil industry was rapidly developed. A general equilibrium formulation of the Heckscher-Ohlin model has been polished over many decades in the international trade literature, and literally thousands of published articles have used and extended the model in many ways.

2.2 Empirical evidence for comparative advantage forces in trade patterns

Despite its immense popularity, data analysis is hard pressed to find evidence to support that relative factor endowments are a significant determinant of world trade patterns. For example, Leontief (1954) pointed out that when one examined the factor content of trade, the U.S. (a presumably capital abundant country) was paradoxically a net importer of embodied capital services. While Leamer (1980) resolved this paradox by appropriately using a multi-sector version of the Heckscher-Ohlin model developed by Vanek (1968), researchers continued to find little robust support for a role of factor endowment differences in determining international trade patterns (e.g., Trefler, 1995).

At the same time, empirical researchers had found an empirical specification that explains international trade volumes between countries exceedingly well – the "gravity equation." The gravity

equation, often attributed to Tinbergen (1962), simply specifies the volume of trade between two countries as a direct function of the "mass" of the each country (typically proxied by GDP), and an inverse function of distance between the two countries. In other words, larger and closer countries trade more with each other. Yet, a real issue for scholars until well into the 1980s was that the gravity equation was not tied to any theoretical model. This is where the field of international economics found itself in the late 1970s. It had a beautiful theory that did not match actual data very well, and an *ad hoc* empirical specification that did. As is true with most intellectual crises, this one led to a number of major advances in the international trade literature.

2.3 New trade theory

Beginning in the late 1970s, researchers began to realize that most world trade was between developed countries, who are relatively similar to each other in factor endowments, and much of that trade is actually intra-industry; i.e., two-way trade of products within the same industry. This set the stage for Krugman (1979) and his development of a new trade theory. Krugman's model has two main elements. The first is a single production sector in each country characterized by monopolistic firms that are identical in every way, except that each produces a different variety of the good; e.g., different makes and models of automobiles. These firms also display economies of scale. The second key feature in the model is a CES utility function over the available varieties for the representative consumer in a country, which displays a "love for variety"; i.e., utility increases as more varieties of the product are available to be consumed. In these models, countries trade their (different) varieties with each other even though there is no source of comparative advantage in the model because consumers gain utility from importing additional varieties. And, countries both gain from trade due to increased availability of varieties and because the larger combined market allows the operating firms to realize greater economies of scale.

New trade theory easily explains empirical regularities that comparative advantage theories cannot, such as why similar developed countries would trade extensively with each other, and why a significant portion of this trade would be intra-industry trade. Thus, in rough terms, new trade theory is the obvious framework to explain trade between developed countries (which is the majority of world trade) and intra-industry trade, whereas comparative advantage models are best suited to explain trade between developed and less-developed countries.

One can also easily derive a gravity equation from new trade theory (see Bergstrand, 1989; 1990), and so initial thoughts were that the robustness of the gravity model provided confirmation of new trade theory forces driving trade patterns, not comparative advantage models. However, an important discovery by economists was that the gravity equation can be also be derived from comparative advantage models (Deardorff, 1998). In that sense, the gravity empirical specification is now seen as theoretically founded. And, in fact, the basic relationships appear to be general across essentially all types of trade models, and empirical analyses also confirm its robustness across various subsamples of countries (Hummels and Levinsohn, 1995).

2.4 Recent advances in trade theory

In the most recent decade of research in international trade, scholars have focused on understanding the agents that make the decisions to engage in international trade; i.e., the micro foundations of international trade. In a seminal paper, Melitz (2003) introduces a major extension of new trade theory within a general equilibrium framework that explicitly models the export decisions of firms that are heterogeneous in their productive efficiency. This allows researchers to examine how trade (and trade policy) affects industry dynamics, including exporting decisions, aggregate productivity, and wages.

While recent theory has focused on the micro foundations and effects of trade, these analyses have ramifications for understanding aggregate trade patterns. One fundamental example is various

ways in which trade determinants and frictions can be quite different by the type of product. A primary distinction is between differentiated and homogeneous goods. An early example in the literature is Rauch (1999), which examines the extent to which ethnic networks across countries leads to greater trade. He posits, and confirms, that this effect will primarily operate with respect to differentiated products. Of course, even more fundamentally, differentiated product trade should correspond to new trade theory forces since differentiated products have varieties (by definition), whereas homogeneous products are then thought to reflect trade following comparative advantage forces.

From almost the beginning of new trade theory established by Krugman (1979), researchers have used the framework to also explore issues connected with intermediate inputs. Modeling of an intermediate inputs sector explicitly recognizes that firms can and do vertically separate parts of their production process, which they can then "source" from different locations. When they source from a country besides their own, we call this "offshoring". There is clear evidence that there has been a large increase in offshoring the past couple decades (see, e.g., Hummels, Ishi, and Yi, 2001) and there is a growing literature on what this means for such important issues as wages (see, e.g., Harrison and McMillan, 2011, and Hummels et al., 2011) and productivity (see, e.g., Amiti and Konings, 2007, and Goldberg et al., 2009). The natural focus is on the offshoring that firms in developed countries are doing in less-developed countries to access low wages for lower-skilled tasks, particularly China (see, e.g., Bernard, Jensen, and Schott, 2006). This is where new trade theory models have come back full circle to considering traditional comparative advantage motives.

A final recent focus of the literature that we note here is the distinction between increases (or declines) in trade at the extensive margin (new trade connections) versus at the intensive margin (intensity of existing trade connections). Exploration along these dimensions allows one to naturally examine theories for why entering new markets can be difficult (such as high fixed costs) versus factors

that make it more difficult to increase an existing trade flow (high variable costs). Researchers are also finding that it is important for understanding the effect of quality and quality upgrading decisions by exporters. Hummels and Klenow (2005) take predictions from various trade models and find that the patterns of trade over time along the extensive and intensive margins of trade fits predictions from a new trade theory model with quality differentials across products better than alternative trade models. Other recent work shows that examination of the extensive and intensive margins of trade can provide substantial insights into various fixed costs of exporting and market access (e.g., Arkolakis, 2010), the effect of trade barriers on trade (e.g., Chaney, 2008), and the dynamics of trade growth (e.g., Besedes and Prusa, 2011)

In summary, the recent focus on the microeconomic foundations behind trading patterns of countries has highlighted a number of dimensions in the available data that can provide useful insights. This includes differentiated versus homogenous product trade, which should correlate with the extent to which trade is motivated by new trade theory or traditional comparative advantage forces. It also includes examination of intermediate inputs (rather than final goods), as intermediates indicate a vertical separation of the production process, and may be particularly important as a vehicle for developed country firms to offshore low-skilled tasks to low-wage less-developed countries. Finally, examining how trade expand or contracts along the extensive and intensive margins can be quite important for understanding how gains from trade occur and the dynamics by which new trade flows begin. After exploring general country-level trade patterns over time in the sections below, we also explore how trade flows have changed along some of these important dimensions.

3. DATA SOURCES

Our primary source of data is the COMTRADE (United Nations) database from 1973-2011. These data provide trade values between countries along with trade quantities for various commodity codes. The

data are for Standard International Trade Classification (SITC) version 1 codes, and, as is common practice, we use importer reported data.[3] We deflated the data to 2005 levels using the US gross domestic product price deflator. These data are used in conjunction with gross domestic product data taken from the World Development Indicators (WDI) developed by the World Bank.

4. TRADE GROWTH AND PATTERNS

This section provides a broad and brief overview of trends in international trade. The overview is factually based, but also attempts to tie in some of the points raised in section 2; e.g., growth in incomes, trade amongst developed and non-developed countries, as well as key features of interest to maritime trade. These include identification of, and changes in, major importers and exporters over time, major products traded over time, and major trading pairs. These latter factors highlight the trade patterns and trends that bear directly on maritime trade, while the former (i.e., trade among developed and non-developed countries) bears directly on the evolving trade literature.

4.1 World Trends

Trade models discussed in section 2 generally agree that rising incomes generate trade. In Figure 1, we present total world trade (values) and GDP over time. Both trade and GDP are measured in 2005 US dollars, and trade is the sum of all trade in the COMTRADE import files, while GDP is the sum of all GDP measured in the WDI files. The sheer magnitudes are of considerable interest. In these data, real total world GDP was over $60 trillion in 2011, and total world trade was nearly $15 trillion. It is also abundantly clear that the trend is positive, with increases in nearly every year since 1973, and considerable growth since the early 2000s. It is also very apparent that the relationship between trade

[3] Further, inspection of the data at various commodity levels, point to omissions for product classifications at the three digit level or higher, with egregious omissions for the five digit levels. Most of our analysis is, therefore, based on broad commodity aggregates.

and GDP is strong (the correlation is .9735), consistent with the notion that growing economies and trade are strongly correlated.

INSERT FIGURE 1

To underscore the growth, in Figure 2, we present real trade and GDP relative to 1973. In this form, the extent of growth is astounding. First, real GDP has nearly quadrupled, while trade has increased more than eight times. Second, the recessions of the early 1980s, the Asian financial crisis, and the recession of 2009 are immediately evident and map directly into trade, and, thus, the maritime sector. Third, while trade growth has generally increased over the entire sample, it has increased more dramatically since 2000, which suggests the need for greater investments and planning for maritime traffic.

INSERT FIGURE 2

4.2 Trade among Developed and Developing Countries

There are many features of trade that can be analyzed. One well-known feature is that trade tends to occur between the developed countries. But in recent years, there has been growing emphasis on offshoring, which involves trade primarily between developed and developing countries. To examine the offshoring phenomenon in greater detail, in this subsection we explore trade within and across developed and developing countries.

As is standard in the literature, we define developed countries as those belonging to the Organization for Economic Co-operation and Development (OECD), and developing countries as all non-OECD countries. The OECD is an international economic organization of 34 countries founded in 1961 to facilitate trade. There were twenty initial members of the OECD, with 14 countries added since the OECD's inception. In Table 1, we list the 34 member countries and the dates they joined the OECD. For

our purposes, the data run from 1973-2011 annually. We define membership in the data as the year after the date in which they joined. Thus, in 1962, there were 19 members in the data, and, with the addition in March of 1962 of Italy, membership in 1963 was twenty countries. Four countries (Japan, Finland, Australia, and New Zealand) joined from 1964 through 1973. Membership remained stable at 24 countries between 1973 and 1994. From 1994 through 2000, Mexico, the Czech Republic, Hungary, South Korea, Poland and Slovakia joined, raising the number to 30 countries. In 2010, Chile, Estonia, Israel, and Slovenia joined to form the current 34 members.

INSERT TABLE 1

A key feature of OECD membership is the facilitation of trade between countries. We first describe the level of trade in terms of imports by OECD members from OECD members (OECD-OECD), by OECD members from non-members (OECD-NonOECD), by non-members from OECD members (NonOECD-OECD) and between non-members (NonOECD-NonOECD). These are represented graphically in Figure 3 (level of imports) and Figure 4 (in percentage terms) for members of OECD in 1973.[4] It is readily apparent from these figures that trade among OECD members dominates world trade, and trade where at least one partner country is a member of the OECD countries represents the vast majority of trade. However, it is also noteworthy that trade levels between Non-OECD and OECD has grown and has grown significantly, but trade between Non-OECD and Non-OECD countries has grown faster especially since the early 2000s (Figure 3). The increases in trade between OECD and Non-OECD is likely due to the explosion of growth in trade with China and the growing trends in off-shoring. The increases in trade between Non-OECD trade is also likely the result of the increasing presence of China in world markets coupled with the growth of Non-OECD countries.

INSERT FIGURE 3

[4] Membership in OECD remained stable from 1973-1994. From 1994 through 2010, several countries joined, but the bulk of trade was dominated by 1973 members.

Figure 4 contains the shares of world trade between OECD countries, between OECD and NonOECD countries, and between NonOECD countries (where again, we fixed OECD to members between 1973-1993). Trade is and has been dominated by trade between OECD members. From 1973 through 1999, the range was about 44 to 58 percent of world trade. However, since the early 2000s there has been a steady decline in the share of world trade. While there are modest increases in OECD trade with NonOECD countries, which again maybe due to off-shoring, there is a decided increase in trade between NonOECD countries, which now accounts for more than 25 percent of world trade.

INSERT FIGURES 4

4.3 Major Importers and Exporters

The primary importers and exporters are represented in Tables 2 and 3 for 1973 and 2011. Two sets of countries are included; those in the top 10 in 1973, and those in the top 10 in 2011. It is notable that seven of the top 10 importing countries in 1973 remained so in 2011, and that seven of the top 10 exporting countries in 1973 remained so in 2011. In all years, the US is the primary importer and is either the primary exporter (until 2004) or among the top three exporters (since 2004). In general, the rank of a country appears to be strongly correlated over time. To examine this further, we calculated a rank correlation for both imports and exports for varying lengths of time.[5] Without exception, all of the correlations are quite high, in excess of 0.9 for both importers and exporters. This means that large importers and exporters tend to remain large *vis a vis* the others.

INSERT TABLES 2 AND 3

[5] We took the rank in a year t and the rank in another year $t+k$ and calculated the correlations for each k. For small k the rank correlations are exceedingly high e.g., in excess of .94 for k <10, and are in excess of .9 for both importers and exporters throughout the 38 years of consideration (1973-2011).

Table 2 contains the shares of total world trade by importers and exporters. The US, Germany, Japan, and the UK were the leading four importers in 1973 with market shares of 14, 13, 8, and 7 percent, totaling about 42 percent of all imports. The US, Germany, France and Japan were the leading four exporters in 1973 with market shares of 14, 12, 6, and 6 percent of the market, totally about 45 percent of all exports. In 2011, Canada, Norway, and Switzerland dropped out of the top 10, and were replaced by China, Korea, and Belgium.[6] For exports, the UK, Sweden, Saudi Arabia dropped out of the top 10 from 1973 in 2011 and replaced by China, Korea, and the Russian Federation. In 2011, the US was the top importer, and China the top exporter. Indeed throughout the data, the US is the top importer in every year. And, from 1973 to 2003, the US was the top exporter in all years except 1974 and 1987. But, since 2003, the US has been either the second or third largest importer, and since 2004, China has been the leading exporter. Figures 5 and 6 provide the Herfindhal-Hirschmann Indexes (HHIs) and four-country concentration ratios over time for the leading importers. For both imports and exports, the HHIs range between about 400 and 800. Imports tend to be more concentrated than exports, and import HHIs tend to be more volatile. In both cases, the international market place appears to be getting more competitive, in that the HHIs have been steadily falling since about 2000 and are now at their lowest point in the data. Concentration ratios yield the same general conclusions that imports are more concentrated than exports, but that concentration has been falling. Unlike the HHIs, the concentration ratios have been falling steadily since about 1985.

INSERT FIGURES 5 and 6

4.4 Major Products

Table 4 contains the level of and the percentage of total trade by one-digit SITC codes for 1973 and 2011. Machinery and Transport Equipment (SITC-7) is the largest product group in both years, and

[6] In 1973 Belgium and Luxemburg reported consolidated numbers.

commands the largest fraction of trade in both years with 18 percent of total trade in 1973 and about 13 percent in 2011. Manufactured Goods (SITC-6) and Mineral Fuels and Lubricants (SITC-3) are the second and third leading products in 1973, and the third and second in 2011. Together these three commodity groups account for 57 percent of trade in 1973, and 63 percent of trade in 2011. Figure 7 contains the levels for the top four commodities (SITC-7, SITC-3, SITC-6, and SITC-0) from 1973-2011. Note that the growth varies by commodities, but all have grown since 2000, and all reflect the 2009 recession.

INSERT TABLE 4 AND FIGURE 7

Table 4 also contains the growth rates by commodities between 1973 and 2011. This is important because, while levels are important in planning transport infrastructure, so are growth rates. In all cases, there is considerable growth where all product groups more than quadrupled between 1973 and 2011, and one product group increased more than 27 times. These are phenomenal growth rates, and transportation and logistics is obviously affected by a need for investment and efficiency. The major growth areas are for Commodity and Transactions (No Class) (SITC-0), which has increased over 27 times, while Machinery and Equipment has increased over 10 times, Mineral Fuels over 12 times, and Chemicals over 13 times. It is interesting to note that the leading commodity group in both years (Machinery and Transport Equipment) is also one of the strongest growing product groups.

Modern trade theory points to increases in the variety of trade over time. To examine this possibility, we calculate HHIs for each year based on the variable levels of product categories (SITC-1, SITC-2, SITC-3, SITC-4) and plot them through time in Figure 8. As is usual, the broader the aggregation, the larger is the HHI; i.e., HHI-1 (calculations based on one-digit sectors) is larger than HHI-2, HHiI3, and HHI-4. In all but the SITC-1 case, there are modest increases in the 1970s (less product variety), with declines in the early 1980s (more product variety), and relative stability since the mid-1980s. In the SITC-1 case, there appears to be growing concentration through the late 1990s (less product variety)

with modest declines since the late 1990s. Of course, new trade theory concerns trade between developed countries and an explanation of trade within relatively disaggregated product categories. Nevertheless, at the broad world level, the level of concentration amongst various products appears to be relatively stable at most levels of aggregation. New trade theory requires much more precise measures of product differences than are available in the COMTRADE data.

INSERT FIGURE 8

4.5 Major Flows

Transportation occurs between locations. Over time, locations and volumes can and do change dramatically. Such changes are very important to the maritime industry because new markets and evolving markets require investments in the industry. In this final section, we identify major trade flows, and consider the stability of trade flows by examining HHIs through time. The largest trade flows (the top ten) for 1973 and 2011 are in Table 5. As indicated, in both cases, the top two trading pairs involve the US. In 1973, the top trade flow (with about 4 percent of total world trade) was that between the US and Canada. In 2011, the top trade flow was from Canada to the US, and the second largest was from Mexico to the US. In terms of maritime trades, the trade flows between the US and Japan was the largest in the world in 1973, and the remainder of the top 10 was among OECD countries. In 2011, China emerged with major flows from Japan, Korea and the US. Indeed, none of the top 10 flows in 2011 involved OECD countries. They involved Asian-North American and Asian-Asian country pairs.

INSERT TABLE 5

In Table 5 and Figure 9, there is information on the level of concentration in flows. In 1973, the top ten flows accounted for about 21 percent of total trade, while in 2011, the top ten flows accounted for only 12 percent. While the US, Canada, and Japan remain in the top 10 each of the two years, the

OECD has disappeared from the top 10. Figure 9 points to the HHI over time. In general, there appears to be little concentration in the flows. Each of the market shares is relatively low, and the HHI is well below standards for the presence of market power. It is, however, interesting to note that as the market has been growing (earlier sections), the trade flows have become progressively more diffused; i.e., the share of the top 10 has fallen dramatically, and the HHI has been falling progressively since the early 1980s.

INSERT FIGURE 9

5. SUMMARY AND CONCLUSIONS

Transportation occurs between locations, and maritime transportation focuses on trade between the ocean ports of countries. In this paper, we first describe existing theoretical and empirical models of trade. Traditional theory rests on absolute or relative differences between trading partners, while more recent "new trade" model focus on economies of scale and product variety. It is clear that in all models, rising incomes in the importing country and lower transportation costs increase trade. In the descriptive data, world economies have grown substantially, and it is clear that growing economies are fueling at least part of the growth in trade. In addition, throughout the logistics chain there have been sizable investments, deregulation and innovation. These have occurred in the form of larger vessels, increased port capacity, and in consolidation infrastructure in the hinterlands i.e., railroad loading facilities. These investments and innovations have reinforced the growth in trade.[7]

We used the United Nations COMTRADE data from 1973-2011 to document the growth in trade and the patterns of trade. These data combined with the World Development indicators point to the relationship between world incomes and trade levels. The relationship is quite strong, and more notably

[7] As just one of many examples, railroads in the US were partially deregulated in 1980. The US is the leading market in the world. The railroad industry is a primary mode which provides transportation of marine traffic inland. Railroad rates are now about one-half of the level at the time of partial deregulation.

trade levels are increasing much faster than the growth in world GDP. The world has become much more global over the time period we study. Most trade, however, is between OECD countries. Trade between OECD countries has accounted for nearly 60 percent of world trade. An important trend, however, is that trade amongst the OECD countries, while growing in magnitudes, has been declining in relative terms since the early 1990s. The relative increases have been accounted for by trade between NonOECD countries and between OECD and NonOECD countries. This may be the result of and/or point to the need for investment in transportation infrastructure in developing countries.

The major importers and exporters in the world are OECD countries. Indeed, the US has been the primary import market throughout the data. However, China has grown dramatically over the time period, especially since 2000, and is now the second leading importer. As is well known, there has been dramatic investment in Chinese ports, and this has undoubtedly fueled growth in trade with China. The US has historically been the leading exporter. However, since 2000, China has overtaken the US in exports. China now has a 13 percent market share followed by the US which has about an 8.3 percent market share in exports. Despite these changes, however, the set of major importers and exporters appears to be quite stable with rank correlations in excess of 0.90 for almost all periods of time.

There has dramatic growth in all commodity markets, but machinery and transport equipment have been and remain the primary goods exported and have even increased in relative measures. There has been a sizable difference in growth rates over the time period. The largest growth has been in non-specified commodity and transactions, which is a very small market with only 2 percent of total trade in 2011. But, chemicals, machinery and transport equipment, mineral fuels, and miscellaneous manufactured materials have each grown by a factor 10 or more since 1973. This is important in that some of these commodities require specialized infrastructure investment (e.g., chemicals).

Finally, we examine major trade flows over time. In general, major trade flows are between OECD members, and remain quite stable over time. Trade flows tend to have little concentration, but it is notable that through time, the concentration levels measured by the share of trades by the top ten trade and the HHI have been falling. This points to a more competitive marketplace and, perhaps, more diffuse patterns of trade. Along with the growth of trade between NonOECD members, this may point to the importance of infrastructure investments in emerging markets.

This research points to several areas of future research. First, over the last 40 years there have been major innovations in trade modeling that help explain trade between developing countries (i.e., new trade theory), but also trade between developed and developing countries (i.e., offshoring and the more traditional models of absolute and comparative advantage). Generally, transportation is largely ignored in the economics trade literature, and this economics literature (short of what could be called gravity variables) is largely ignored in the transportation literature. There is considerable room to integrate these models more closely. Second, the costs of infrastructure and vessels are quite high in maritime economics, and new markets (flows) are quite important to the industry. While the rank correlations of leading importers and exporters are quite high, the concentration levels of importers and exporters appear to be falling. This points to greater diffusion and competition in world markets; complete with new trading partners and growth among previously small traders. This finding hits directly on growth in transportation markets, particularly among emerging economies. Finally, the recent development in trade following Melitz (2003) may prove quite useful in incorporating transportation decisions into new trade models. In particular, the decision to export along with the target (importer) is a promising area to area to examine the introduction and growth of specific trading lanes.

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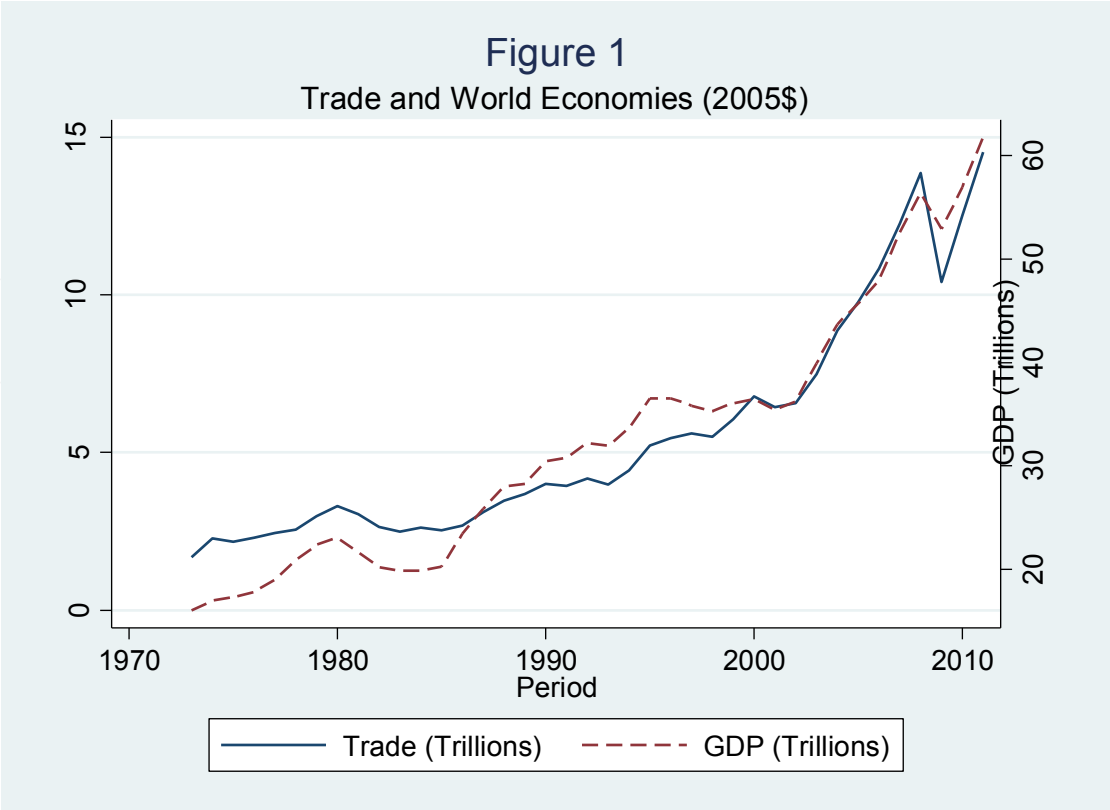


Figure 1
Trade and World Economies (2005$)
0
5
10
15
20
30
40
50
60
GDP (Trillions)
1970
1980
1990
2000
2010
Period
Trade (Trillions)
GDP (Trillions)

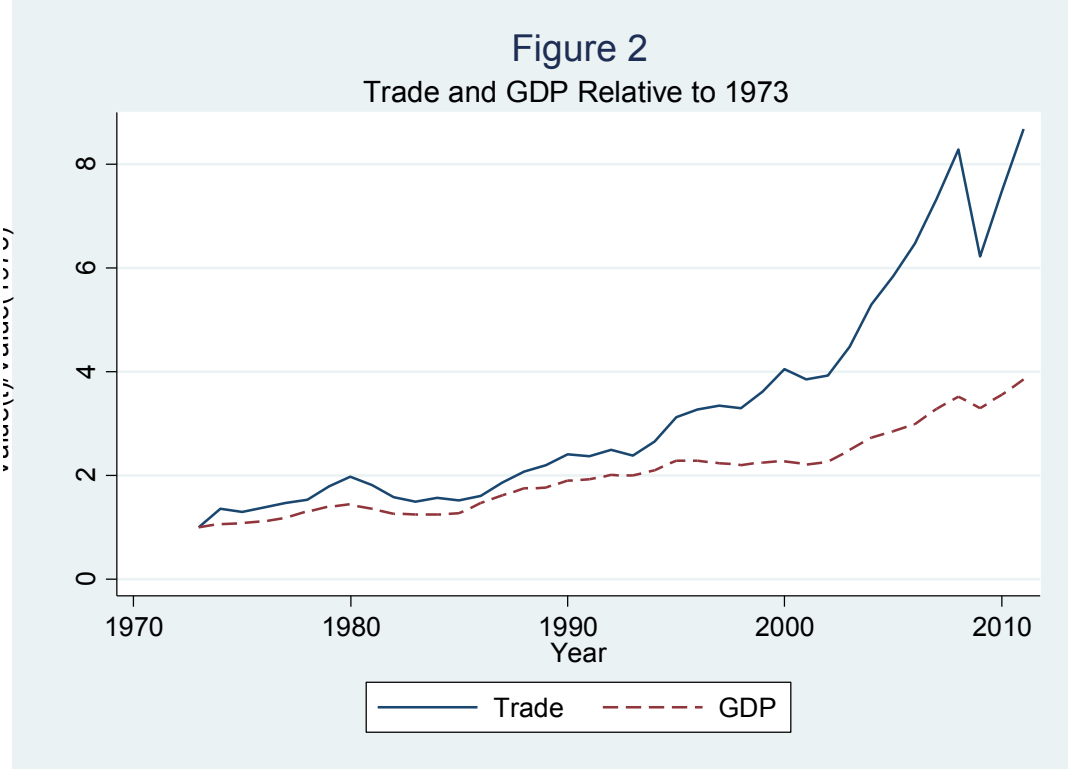


Figure 2
Trade and GDP Relative to 1973
0
2
4
6
8
1970
1980
1990
2000
2010
Year
Trade
GDP

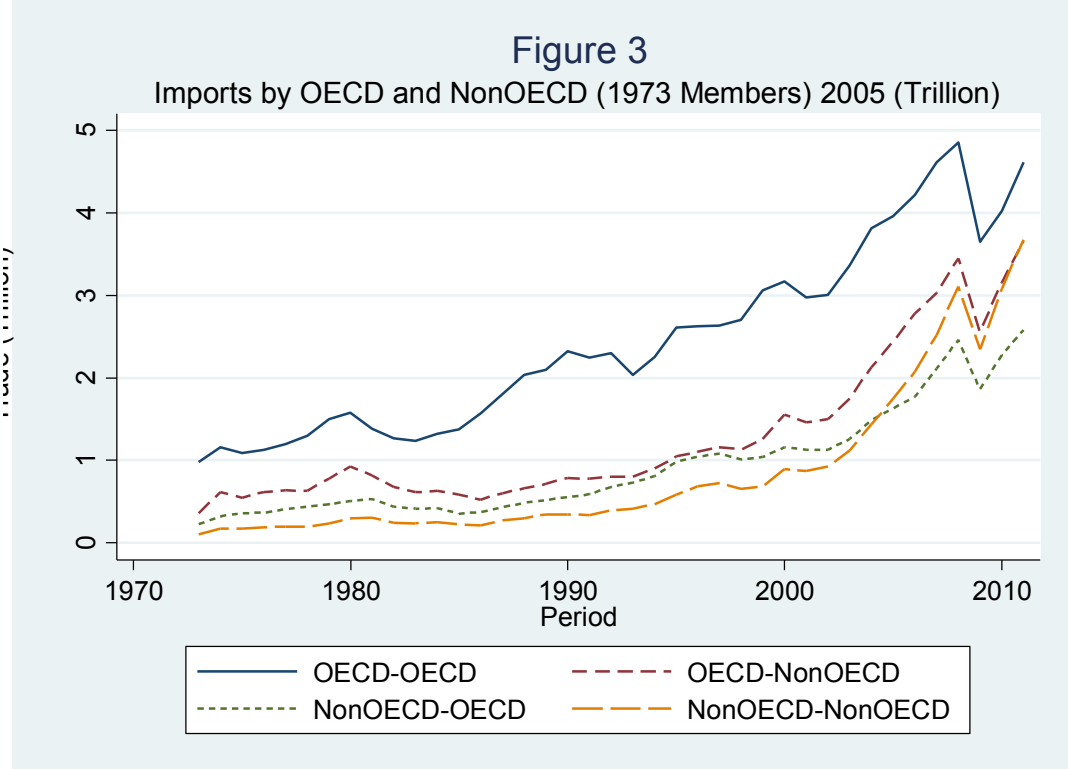


Figure 3
Imports by OECD and NonOECD (1973 Members) 2005 (Trillion)
0
1
2
3
4
5
1970
1980
1990
2000
2010
Period
OECD-OECD
OECD-NonOECD
NonOECD-OECD
NonOECD-NonOECD

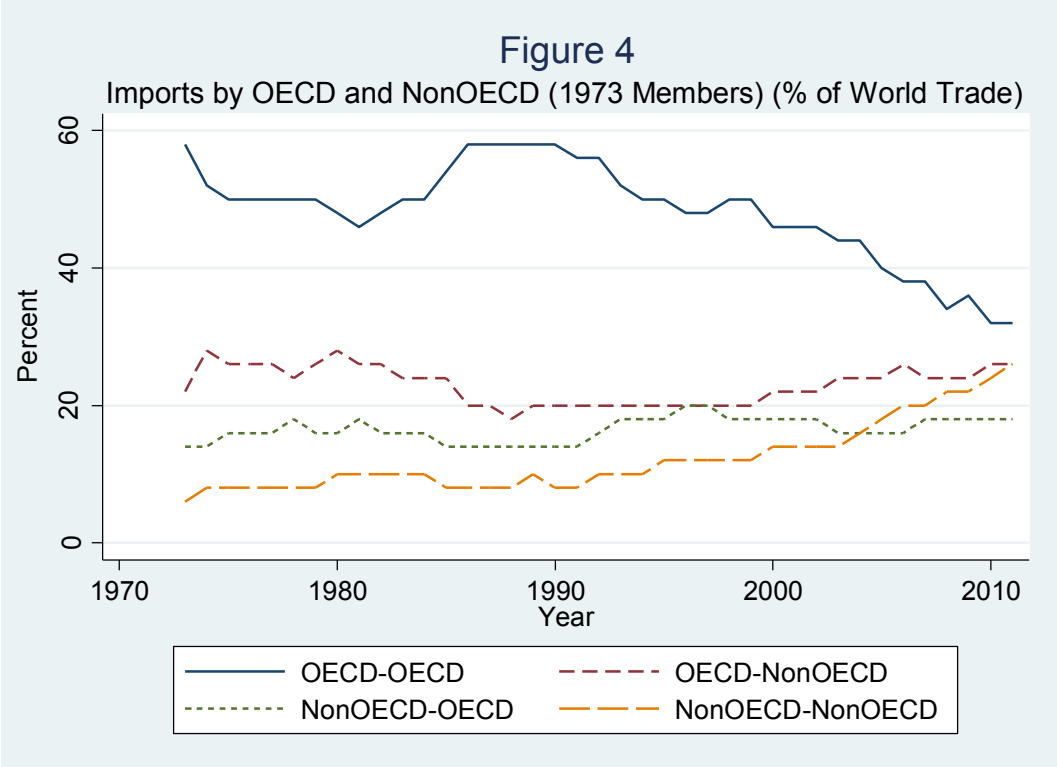


Figure 4
Imports by OECD and NonOECD (1973 Members) (% of World Trade)
Percent
0
20
40
60
1970
1980
1990
2000
2010
Year
OECD-OECD
OECD-NonOECD
NonOECD-OECD
NonOECD-NonOECD

Figure 5

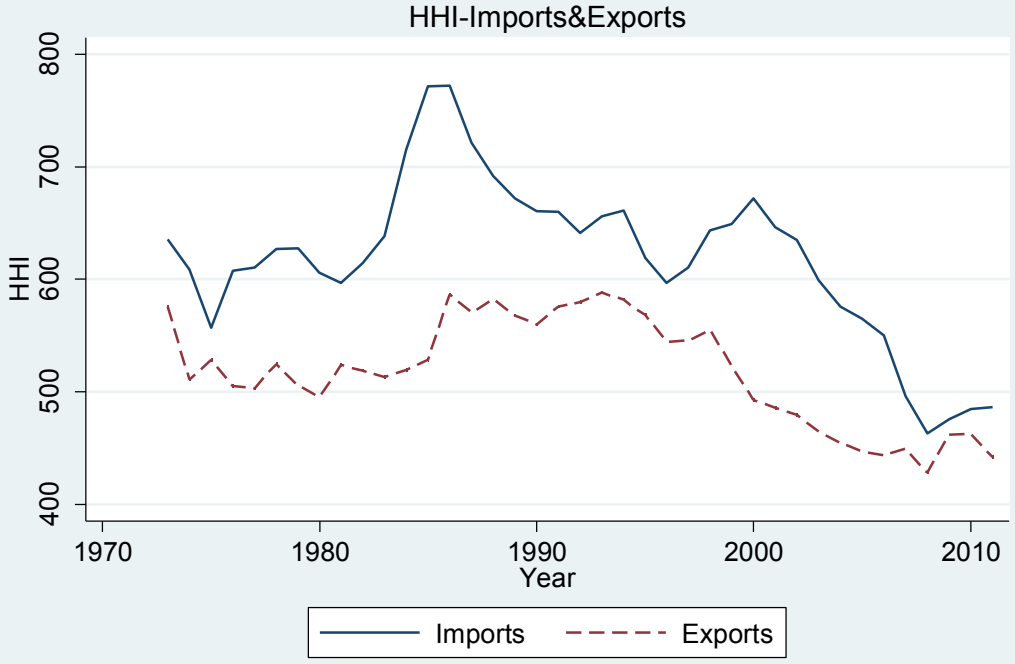


Figure 6

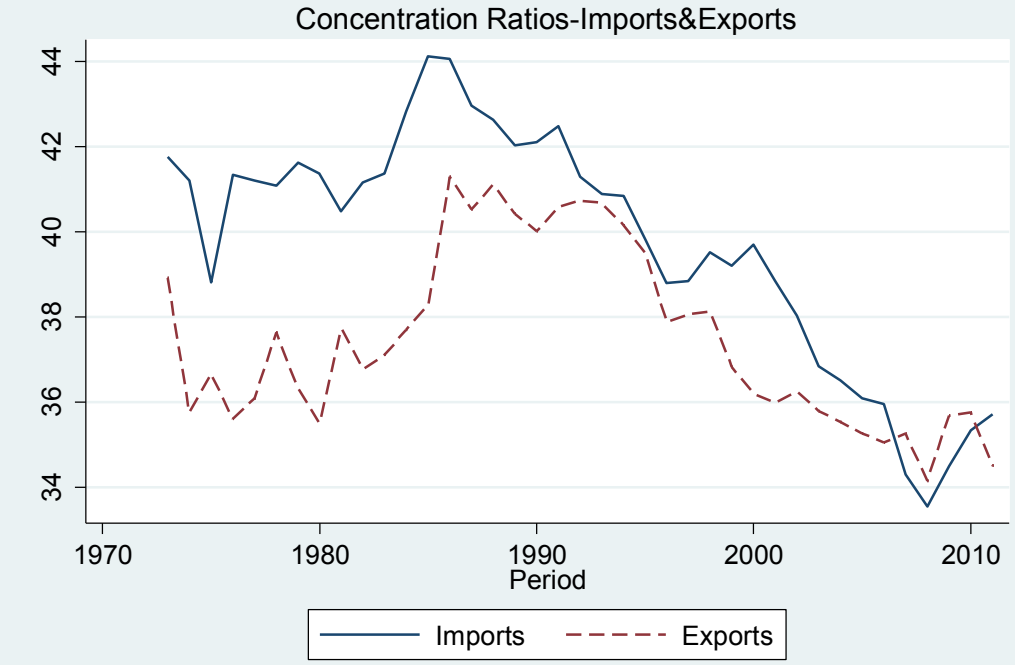


Figure 7

Major Products Over Time

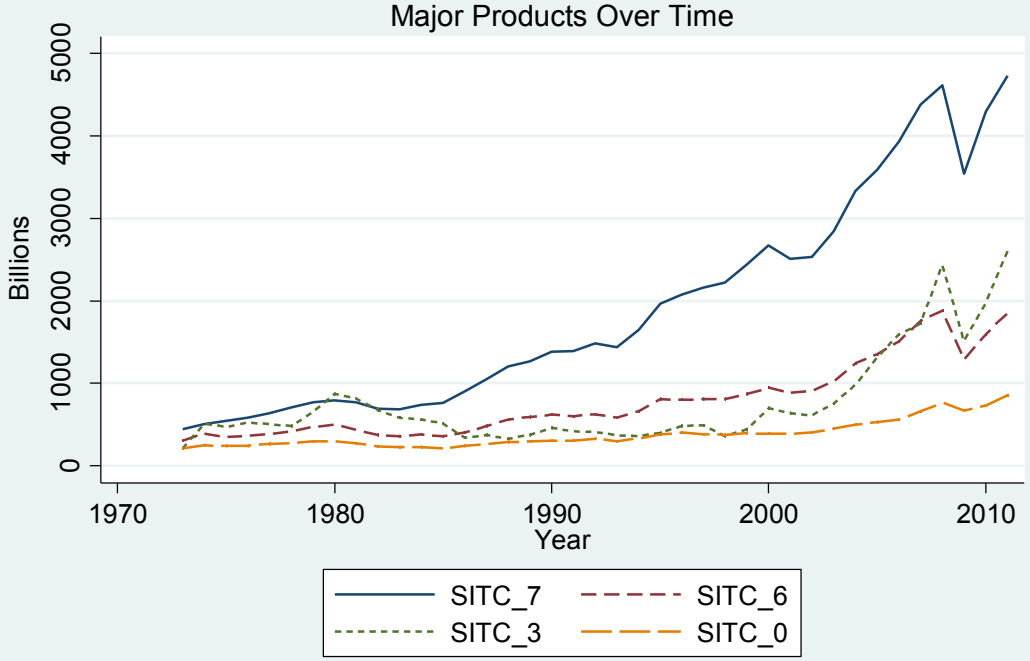


Figure 8

Product Level HHIs over Time

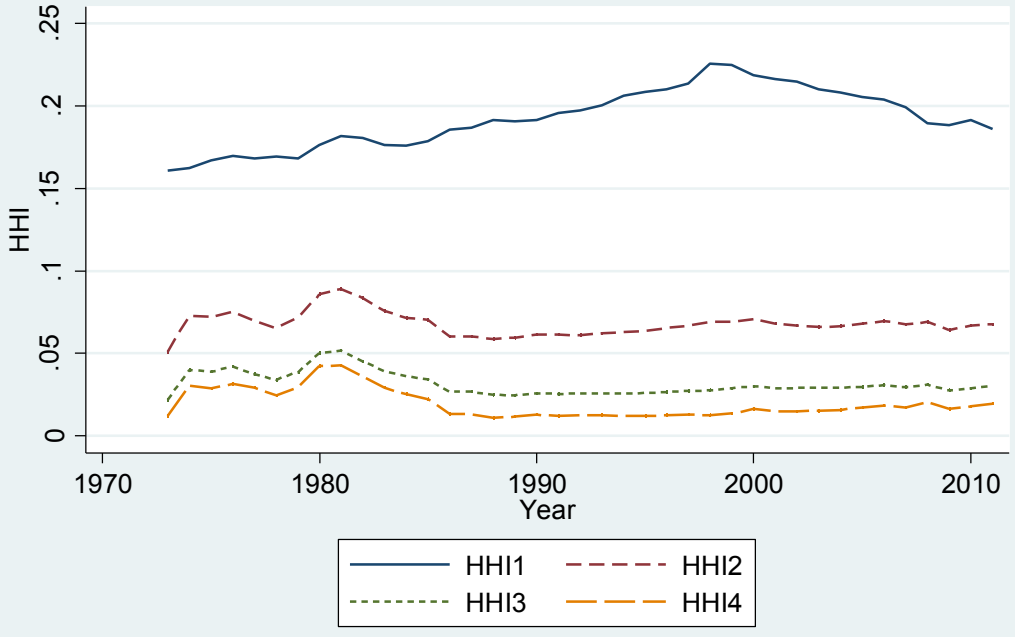
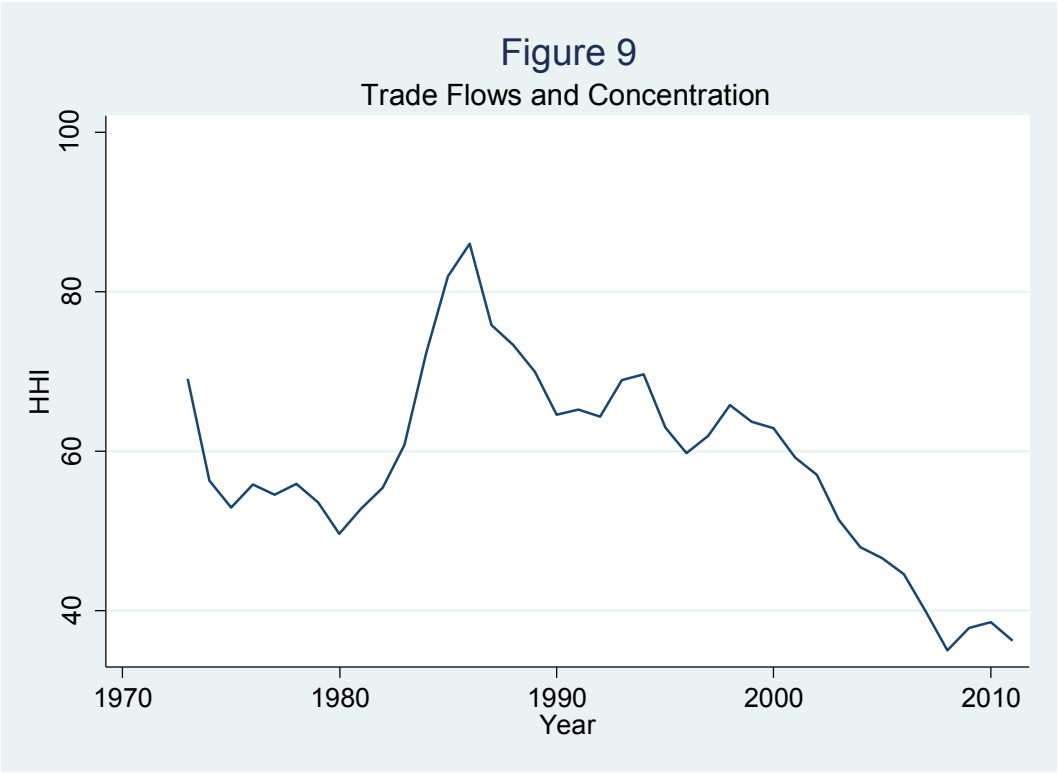


Figure 9


Trade Flows and Concentration
HHI
100
80
60
40
1970
1980
1990
2000
2010
Year