Evolution of Trade Costs

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First draft
January 26, 2012

Abstract

The variability of trade costs makes statements about the average height of trade barriers quite misleading. The aim of this paper is to provide a detailed investigation of trade barriers by examining a cross-country, cross-industry analysis of evolution of trade costs for a 44-year period positing the possible reasons behind the changes. Employing the methodology of Shikher (2010), which is a framework based on the Eaton-Kortum model at the industry level, I estimate trade costs using a gravity-like equation. The constructed final dataset is very large and unique, and covers international bilateral trade costs of 19 ISIC manufacturing sectors of 21 OECD and 52 non-OECD countries over the period 1963-2006. The paper answers the following questions: (i) How large are the trade barriers in the total manufacturing industry and at the sector level? (ii) In what direction and why did trade costs change over time? (iii) What is the difference between the trade costs of developed and developing countries at the sector level? What are the causes of the difference? (iv) Is there convergence between trade costs of developed and developing countries? (v) What is the effect of the trading partner on trade costs? The results show that trade costs are large and vary significantly across goods, but the trends are downward for the total manufacturing industry and for the majority of the individual industries. Trade costs of non-OECD countries for all sectors are larger than those of OECD countries, and there is divergence between the trade costs until the 1980s. After the 1980s, there is steady catching up in trade costs of capital goods industries, labor intensive industries and the total manufacturing industry. But differences in average trade barriers are still more than 40% for these sectors. The results according to country group of the trading partner show that, for the total manufacturing industry, if exports come from the OECDs, the barriers to trade are lower than in the case of non-OECD exporters. At the sector level, on the other hand, the trade costs among non-OECDs are lower than the barriers to trade from OECDs to non-OECDs. I also examine which determinant has the largest effect on trade costs, and encounter endogeneity bias issue, which I correct using the differenced panel data approach.

JEL codes: F1, F11, F17

Keywords: international trade, trade costs, trade barriers, computable models, trade policy.

1 Introduction

In today's globalized world, countries are open to trade more than ever before. Data shows that the ratio of the world merchandise trade relative to GDP more than tripled between 1960-2008 and

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hit 53% record level in 2008.[1] Since trade costs are shown to be one of the major determinants of trade, one plausible explanation for this rapid expansion of trade integration is changes in trade costs.[2]

International trade costs include any cost associated with the exchange of goods across international borders, such as transportation costs, insurance, tariff and non-tariff policy barriers, information costs, costs arising from use of different currencies or different languages, among others. Although economists agree that the trade costs are large and vary widely across countries and industries, little is known about the magnitude of variation and evolution of these impediments of international integration (Anderson and van Wincoop, 2004). Most of the literature measures trade costs in a specific year, and/or focuses on the aggregate level data for a limited number of countries. In this paper, however, I present a detailed analysis of trade costs for 19 ISIC manufacturing sectors for a 44-year period for 73 countries at different stages of economic development.[3] This paper, therefore, goes beyond the existing literature in terms of country coverage, industry coverage, and time period, and gives quantitative information on the evolution of trade costs from 1963 to 2006.

The economic importance of trade costs lies in their impact on economic welfare through their effect on trade flows and specialization. Trade costs differ across country pairs and across industries; hence they influence comparative advantage by affecting the relative cost of one country's goods in another country. Beyond that, trade costs determine comparative advantage even if they are equal across industries, since they affect the cost of intermediate goods. Therefore, if a country is close to a cheap source of some intermediate goods, industries using these intermediate goods have an advantage over industries using intermediate goods from far away sources.

Another effect of trade costs on comparative advantage is that they limit the geographical range of comparative advantage. In a hypothetical scenario with no trade costs, a country would export according to its comparative advantage which is determined relative to any trading partner in the world. With trade costs, however, the neighboring countries have a greater impact on determination of comparative advantage than do far away countries. Again, in the hypothetical scenario of zero trade costs, a country would export according to its comparative advantage and import according to its preferences. But in reality, most of the production is purchased by domestic customers in most countries and industries, since with non-zero trade barriers preferences are strongly linked to specialization rather than net export.

Because of all these effects of trade barriers on international trade, a better understanding of international economy necessitates the careful measurement of trade costs. In the empirical literature, Hummels (1999, 2007) estimates the evolution of freight costs over time.[4] But freight costs are not the only cost of trade, and direct measures of trade costs are remarkably sparse and inaccurate since it is very difficult to measure all the costs included in the exchange of goods (Anderson and van Wincoop, 2004). Therefore, in the trade literature bilateral trade costs are widely estimated from bilateral trade volumes by gravity-like equations.[5] Anderson and van Wincoop (2004), using

[1] World Development Indicators 2010, The World Bank.

[2] For a recent study see Shikher, 2010a.

[3] Manufacturing is by far the largest part of the merchandise trade. For example, share of manufactures in total world merchandise trade in 2009 was 68.6% (WTO).

[4] Hummels shows that ocean transport costs rose and air transport costs declined during 1955-2004. Baier and Bergstrand (2001), Limao and Venables (2001), Behar and Venables (2010), Martinez-Zarzoso and Suarez-Burguet (2005), Wilmsmeier, G. and Martínez-Zarzoso (2010) are related papers on transportation costs.

[5] Anderson and van Wincoop (2004) examine and evaluate different approaches to estimate trade costs.

a gravity based equation, estimate that the ad valorem tax equivalent of total trade costs is about 170% for OECD countries.

Studies examining the evolution of trade barriers usually look at the cross-country changes at the aggregate level. One of the most recent studies is Novy (2009). In that paper, the author derives a micro-founded measure of aggregate bilateral trade costs that indirectly infers trade frictions from observable trade data. Novy shows that U.S. trade costs declined by 40% during the period 1970-2000. Moreover, in studying the determinants of the trade costs, he confirms that geographical and historical factors, like tariffs and free trade agreements,.largely dominate the role of trade policy. Jacks, Meissner, and Novy (2008,2009) and Beltramo (2010) also use the same model to analyze the changes in bilateral trade costs

One of the few studies on sector level trade costs is Bernard et al. (2006), which looks at the changes in industry level trade costs at 20 manufacturing industries in the U.S. over the period 1982-1997. The results show that tariff rates declined by more than one quarter in 13 of 20 industries over the entire period. Moreover, the authors report that tariff rates are highest for the labor intensive sector Apparel, and lowest for the capital intensive sector Paper.

Olper and Raimondi (2009) focus only on the Food Manufacturing industry and document the patterns of international trade costs for 70 countries during 1976-2000. Their findings show that there is strong heterogeneity across trade costs of countries. For 2000, for example, they report the export-weighted average tariff equivalent of trade costs ranges from 73% for developed countries to 134% for developing countries. For the whole period of study, a 13% average decline in trade costs is reported. Considering the country groups, Northern countries have lower trade costs than Southern countries, which is explained by the geographical, cultural and development ties among these countries.

Considering the scarcity of research studying the evolution of trade costs from a broad perspective, this paper fills a major gap by answering the following questions:

(i) How large are the trade barriers in the total manufacturing industry and at the sector level?

(ii) In what direction and why did trade costs change over time?

(iii) What is the difference between the trade costs of developed and developing countries at the sector level? What are the causes of the difference?

(iv) Is there convergence between the sectoral trade costs of developed and developing countries?

(v) What is the effect of the trading partner on trade costs?

In order to answer these questions, I estimate trade costs using methodology of Shikher (2010), which is a framework based on the EK model (Eaton and Kortum, 2002) at the industry level. Instead of using the Armington assumption (1969) to explain intra-industry trade, the model imposes the producer heterogeneity assumption. Therefore, the goods are differentiated according to their features, rather than their country of origin. Moreover, in case of producer heterogeneity, countries do not have monopoly power, and home bias in consumption and price difference across countries are explained by trade costs rather than demand-side parameters. Another advantage of the model is that it captures trade in intermediate goods, which is important since trade in intermediate goods affects trade costs.

The main findings of the paper are as follows:

Trade costs are large and vary significantly across goods. The difference in trade barriers can be as high as 60% on average at the sector level. But the trend is declining for the total manufacturing industry and for the majority of the individual sectors. One important exception is the petroleum industry, which shows increasing trade barriers for both developed and developing countries throughout 1963-2006. Petroleum is the only industry trending upward in developed country trade costs.

The trade costs of non-OECD countries for all sectors are larger than those of OECD countries. But the rankings of the sectors' trade costs for OECDs and non-OECDs show similar results: for both country groups the lowest trade cost sector is Medical, Precision, and Optical Instruments and the highest trade cost is in Printing and Publishing. This makes economic sense considering trade costs are ad-valorem trade costs.

An interesting case occurs in Medical, Precision, and Optical Instruments industry. The trade costs of OECDs for this sector increase after 1990 while trade costs of non-OECDs keep decreasing. The possible reason might be the safety regulations on medical instruments, Medical Device Directives, that are imposed by EU and EFTA members after 1990.

By examining the convergence/divergence of trade barriers, I find that all the industries show divergence until the 1980s. For the total manufacturing industry, after the peak of the 1980s, there is gradual convergence. Although the industry breakdown results are mixed after the 1980s, there is steady catching up in trade costs of capital goods industries, and labor intensive industries. But still the differences in average trade barriers are more than 40% for these sectors.

In order to better understand the reasons for the gap between trade barriers of the developed and developing countries, I present the trade costs according to country group of the trading partner. For the total manufacturing industry, if the exports come from the OECDs, the barriers to trade are lower than in the case of non-OECD exporters. The results are different at the sector level; the trade costs among non-OECDs are lower than the barriers to trade from OECDs to non-OECDs.

I also examine which determinant has the largest effect on trade costs. The results point to the endogeneity bias issue of the traditional gravity literature. I correct the endogeneity bias using the differenced panel data approach suggested in recent literature

This paper is organized as follows. Section 2 describes the methodology used in the paper. Section 3 describes the scope and the sources of the data. Section 4 presents the empirical results of the study, and Section 5 concludes.

2 Methodology

The methodology comes from Shikher (2010). In the model, technology is assumed to exhibit constant returns to scale, and the market structure is perfectly competitive. Production requires two factors; labor and capital, which are mobile across industries, but fixed in a country. Countries differ in their fixed factor endowments, and the tastes they have. Each industry has a specific technology, demand function, and set of factor intensities.

There are N countries, indexed by i and n, and J industries, indexed by j and m.

Besides capital and labor inputs, intermediate inputs are also taken into account in the model. Cost function has Cobb-Douglas form,

$$c_{ij} = r_i^{\alpha_j} w_i^{\beta_j} \rho_{ij}^{1-\alpha_j-\beta_j}. \tag{1}$$

Here, r_i and w_i are returns to capital and labor, respectively, ρ_{ij} is the price of the intermediate goods, and the exponents are the shares of respective factors. Industries mix intermediate inputs in a Cobb-Douglas fashion, so the price of inputs ρ_{ij} is a Cobb-Douglas function of industry prices:

$$\rho_{ij} = \prod_{m=1}^{J} p_{im}^{\eta_{jm}}, \tag{2}$$

where η_{jm} is the share of industry m goods in the input of industry j, such that $\sum_{m=1}^{J} \eta_{jm} = 1$, $\forall j$.

Bernard et al. (2003), and Eaton et al. (2004) state the existence of productivity differences across producers. Following this theory, the model imposes the assumption that within each industry, there is a continuum of goods, with each good represented by a different productivity level. Indexing goods by $l \in [0, 1]$, the productivity level of good l of industry j at country n is denoted by $z_{nj}(l)$. The key assumption of the EK model is that productivities are random draws (independent of l) from a probabilistic distribution. Note that, in order to produce a good, every country uses the most up-to-date technique available to it. Therefore, it is reasonable to use an extreme value distribution to represent technology.[6] Assuming that an importer chooses the minimum price across countries, we need an extreme value distribution for the prices as well. Among the three extreme value distributions for technology, namely Weibull, Gumbell, and Fréchet, the Fréchet distribution is the one resulting with an extreme value distribution for the prices, which justifies the use of it in the model (Eaton and Kortum, 2002).

The mean of the Frechet distribution, $T_{ij} > 0$, represents the average productivity of producers in an industry; hence, it determines the comparative advantage across industries.[7] Variance, $\theta > 1$, on the other hand, captures the comparative advantage across goods in an industry. A smaller variance implies more variability of productivites across goods within an industry. Consumers have CES preferences over the continuum of goods within an industry with the elasticity of substitution $\sigma > 0$.

Now we turn our attention to the prices. Making Samuelson's well-known "iceberg" assumption, that delivering 1 unit good of industry j from country i to country n requires producing $d_{nij} > 1$ units in i (by definition $d_{ii} = 1$, $\forall i$), price is defined as the unit production cost times the trade cost. Hence, the price of each good l of industry j produced in country i and delivered to country n is $p_{nij}(l) = c_{ij} d_{nij} / z_{ij}(l)$. However, since the consumers (final consumers or the firms buying intermediate inputs) purchase from the lowest-price supplier, the actual price paid in a country for a specific good is the minimum of all the prices set by the partner countries. Solving the consumer's problem of maximizing the CES objective function, we derive the ideal consumer price index,

$$p_{nj} = \gamma \left[\sum_{i} T_{ij} \left(d_{nij} c_{ij} \right)^{-\theta} \right]^{-1/\theta}, \tag{3}$$

where c_{ij} is the cost of production in country i at sector j, and γ is a constant.

Given the price index, the cost function is obtained by combining (1), (2), and (3):

$$c_{ij} = r_i^{\alpha_j} w_i^{\beta_j} \prod_{m=1}^{J} \left[\gamma^{-\theta} \sum_{n=1}^{N} T_{nm} \left(d_{inm} c_{nm} \right)^{-\theta} \right]^{-\frac{\eta_{jm}\left(1-\alpha_j-\beta_j\right)}{\theta}}. \tag{4}$$

[6] Kortum, (1997), Eaton and Kortum, (1999) show how a process of innovation and diffusion can give rise to Frechet distribution.

[7] The productivity parameter, T, in the EK model is the mean of the Fréchet distribution, and is different from the total factor productivity (TFP). Although T, like TFP, is potentially affected by technology as well as social and political factors, it is exogenous while TFP is endogenous.

Note that, up to this point, trade flows are not present in the model. In order to connect the model discussed so far with the industry level bilateral trade flows, we introduce the probability that country i's price is the lowest price in country n for good l , which is denoted by Π_{nij}. Formally, Π_{nij} is also the fraction of goods of industry j that country n buys from country i, since there is a continuum of goods in the unit interval, i.e. $l \in [0,1]$. It is also the fraction of n's expenditure spent on industry j goods from i (Shikher, 2010b). So, the industry level bilateral trade can be written as

$$\pi_{nij} \equiv \frac{X_{nij}}{X_{nj}} = T_{ij} \left(\frac{\gamma d_{nij} c_{ij}}{p_{nj}} \right)^{-\theta}, \tag{5}$$

where X_{nij} is the spending of country n on industry j goods imported from country i, and X_{nj} is the total spending in country n on industry j goods.

The goods market clearing condition is written as $Q_{ij} = \sum_{n=1}^{N} X_{nij} = \sum_{n=1}^{N} \pi_{nij} X_{nj} = \sum_{n=1}^{N} \pi_{nij} (Z_{nj} + C_{nj})$, where Z_{nj} is the spending on intermediate goods and C_{nj} is the spending on final goods made by country n on industry j.

By separating the amounts spent on intermediate and consumption goods, and noting that the preferences are Cobb-Douglas across industries, and CES across goods within each industry, consumption can be written that $C_{nj} = \Psi_{nj} Y_n$, where Y_n is the GDP of country n, and Ψ_{nj} is the parameter of tastes. The spending on intermediate goods is $Z_{nj} = \left(\sum_{m=1}^{J} ((1-\alpha_j - \beta_j)\eta_{mj} w_n L_{nm})/\beta_m \right)$ where $L_{nm} = Q_{nm}\beta_m / w_n$ is the stock of labor employed in industry m of country n. (By the same manner, capital stock is $K_{nm} = Q_{nm}\alpha_m / r_n$) Plugging this into market clearing equation, we get the equation for industry output Q_{ij}:

$$Q_{ij} = w_i L_{ij}/\beta_j = \sum_{n=1}^{N} \pi_{nij} \left(\left(\sum_{m=1}^{J} \frac{(1-\alpha_j - \beta_j)\eta_{mj}}{\beta_m} w_n L_{nm} \right) + \Psi_{nj} Y_n \right). \tag{6}$$

In this paper, due to data limitations, only manufacturing sectors are modeled. The consumption of manufactures by the nonmanufacturing industry is treated as final rather than intermediate consumption and nonmanufacturing sector price index is normalized to 1.

The sum of manufacturing and nonmanufacturing sector incomes gives the country income equation, $Y_i = Y_i^M + Y_i^O = w_i L_i + r_i K_i + Y_i^O$, where K_i and L_i are specific to maufacturing (exponent M denotes the manufacturing sector, and O refers to non-manufacturing sector), and $Y_i^O = \xi_i Y_i$, where ξ_i is a parameter.

To sum up, the model parameters are $\alpha_j, \beta_j, \eta_{jm}, \theta, d_{nij}, T_{nj}, K_i, L_i, \Psi_{nj}$, and ξ_i. In order to calculate trade costs, labor shares, β_j, are obtained using the average labor shares of the countries in the sample, and θ is set to 8.28 following Eaton and Kortum (2002).[8] Wages, w_i, are taken directly from data. The data sources are described in Section 3.

2.1 Trade Costs

The ratio of country n's imports from country i to its domestic imports is

[8] They also obtain a second estimate of 3.6, but 8.28 is their preferred estimate since $\theta = 3.6$ results in unreasonably high trade costs. Shikher (2010) stated that the model results are robust to the choice of θ.

$$\frac{\Pi_{nij}}{\Pi_{nnj}} = \frac{X_{nij}}{X_{nnj}} = \frac{T_{ij}}{T_{nj}} \left(\frac{d_{nij} c_{ij}}{c_{nj}} \right)^{-\theta}. \quad (7)$$

Defining $B_{ij} = T_{ij} c_{ij}^{-\theta}$ as an "international competitiveness" measure for industry j of country i, we obtain the theoretically derived gravity-like equation:

$$\ln \frac{X_{nij}}{X_{nnj}} = -\theta \ln d_{nij} + \ln B_{ij} - \ln B_{nj}. \quad (8)$$

The left-hand side of (8) is log of the trade ratio of imports from country i to country n on industry j, X_{nij}, to imports from home on industry j, X_{nnj} (which is calculated as output minus exports). On the right-hand side of the equation, d_{nij} is the iceberg trade cost, and θ is a model parameter that determines the comperative advantage across goods within an industry, and is taken to be 8.28 from the literature.

The log iceberg trade costs are estimated using the trade cost function that relates unobservable trade costs to observable country characteristics:

$$\ln d_{nij} = d_{kj}^{phys} + b_j + l_j + f_j + m_{nj} + \delta_{nij}. \quad (9)$$

Here d_{kj}^{phys} is the physical distance effect in the kth interval ($k = 1, ..., 6$). Following Shikher (2010), the distance between i and n is divided into six intervals (in km): $[0, 375)$, $[375, 750)$, $[750, 1500)$, $[1500, 3000)$, $[3000, 6000)$, and $[6000, max)$.[9] b_j, l_j are the indicator variables for common border effect, and common language effect, respectively. f_j is the effect of belonging to the same free trade area (FTA), m_{nj} is the overall destination effect, and δ_{nij} is the sum of the trade costs arising from all other factors, or the error term.

Taking the logs of both sides and plugging the trade cost function, we get the estimating equation:

$$\ln \frac{X_{nij}}{X_{nnj}} = -\theta d_{kj}^{phys} - \theta b_j - \theta l_j - \theta f_j + D_{ij}^{\exp} + D_{nj}^{imp} - \theta \delta_{nij}, \quad (10)$$

which is independently estimated by generalized least squares for each year,[10] where $D_{ij}^{\exp} = \ln B_{ij} = \ln T_{ij} c_{ij}^{-\theta}$ is the exporter dummy and $D_{nj}^{imp} = -\theta m_{nj} - \ln B_{nj} = -\theta m_{nj} - \ln T_{nj} c_{nj}^{-\theta}$ is the importer dummy.[11] The destination-industry specific import barrier is calculated as $m_{nj} = -(1/\theta) \left(D_{nj}^{exp} + D_{nj}^{imp} \right)$.

3 Data

In order to estimate (10), data on output, bilateral trade, and gravity variables are necessary. Sectoral output data comes from the United Nation's Industrial Statistics (UNIDO) database (INDSTAT2-2010, Rev.3), which reports data for 23 manufacturing sectors of 162 countries at the 2-digit ISIC level for the period 1963-2008. Although the dataset covers a 46-year period, not all the data are available for all countries and all sectors in each year. Hence, some of the missing

[9] The distance is calculated based on bilateral distances between the biggest cities of the two countries, those inter-city distances being weighted by the share of the city's population in the overall country's population.

[10] By definition $d_{iij} = 1$, hence the estimation is necessary only for non-domestic transport costs.

[11] Importer and exporter dummies for the US are normalized to 0, i.e. $D_{us,j}^{exp} = D_{us,j}^{imp} = 0$.

output data is constructed using equation (6), $Q_{ij} = w_i L_{ij}/\beta_j$. Total manufacturing wage, w_i, sectoral labor, L_{ij}, and labor share in output data, β_j, are also from the UNIDO (INDSTAT2-2010, Rev.3). β_j is calculated as the average of the labor shares of the countries in the dataset.

The corresponding bilateral trade data comes from the COMTRADE database of the UN, and covers 4-digit SITC (Rev.1) data. Using the concordance I developed, I aggregate 4-digit SITC Revision 1 trade data into 2-digit ISIC data. For less than 1% of the county-year-sector combinations, data is discarded since either the trade value is zero or total output is below total exports.[12] After careful examination of the data due to missing values, the constructed final dataset is a very large and unique one, which covers 19 ISIC manufacturing sectors of 21 OECD and 52 non-OECD countries for the period 1963-2006.

The data on trade impediment variables (distance, common border, common language, regional trade agreements) come from the Gravity Database compiled by CEPII. The lists of countries is presented in Table 1.

Table 1 here.

4 Results

Bilateral international trade costs are estimated by equation (10) for (importer, exporter, industry) combinations for each year over 1963-2006 whenever the data is available. Trade costs reported in this paper are calculated based on the importer country i using the arithmetic average, $d_{nj} = \sum_i d_{nij}, \forall(n, i, j)$. This section summarizes the results with explanations for possible underlying causes of changes in trade costs.

4.1 Trade costs are large, but declining for most sectors.

First, let us look at the evolution of trade costs on average for the whole sample. Figure 1 shows the average total manufacturing trade costs of the sample.

Figure 1 here.

Average trade barriers for the total manufacturing industry show a declining trend over 1963-2006. In despite of the decline, trade barriers stay fairly high; even the minimum value of 2.26, in 2006, is more than double the domestic trade cost. However, this average value hides substantial cross-country differences. For example, for the same year, estimated international trade costs range from 1.27 for Netherlands, to 4.44 for Trinidad and Tobago.[13]

Trade costs vary widely across sectors, as well. For the whole period of study, the average trade costs by industry vary from 2.16 for Medical, Precision, and Optical Instruments to 3.43 for Printing and Publishing, which shows almost a 60% difference.

In terms of changes over time, considering trade-liberalizing policies of countries and technological developments in transportation and communication, we expect to see declining trade barriers. Although figures show declining trade costs for most of the sectors, it is of note that some sectors

[12] This model cannot replicate zero trade values because of the unbounded support of distribution of $z(j)$. While allowing unbounded supports limits the applicability of the model to large countries, it reduces the complexity of the model and makes it more tractable (Shikher, 2010b). For prediction of positive as well as zero trade flows between countries see Helpman et al.,2007.

[13] I prefer not to give the standard deviation values throughout the years since the sample is different for each year.

have increasing trade barriers.[14]

Figure 2 here.

Out of 19 industries, 4 sectors show increasing trends according to the slope values of the fitted lines. These are Coke, Refined Petroleum Products, Nuclear Fuel; Printing and Publishing; Leather and Leather Products, Footwear; and Food and Beverages.[15]

Among those declining, the most significant declines come from the labor intensive sectors Textiles; Wearing Apparel, Fur, and capital representative sectors Office, Accounting, Computing, and Other Machinery; Electrical Machinery, Communication Equipment; Transport Equipment, in addition to Furniture and Other Manufacturing.

At this point, two questions occur naturally: First, how well do these aggregate values reflect the trade costs of developed and developing countries? This question is especially important from the developing countries' perspective and their relations with industrialized countries. Sections 4.2-4.4 answer this question in detail. And second, what is the reason for the differences in trade barriers across countries, and across sectors? The rest of this section explores the answer by analyzing which determinant affects the trade barriers most.

4.1.1 The determinants of trade costs

Since the total manufacturing sector represents the weighted average of all the other sectors, it is appropriate to use total manufacturing data to explain this section.

By deriving the coefficients for the partner country characteristics from regression equation (10), and dividing each coefficient by $-\theta$ $(= -8.28)$, I derived d_{kj}^{phys}, b_j, l_j, f_j, and m_{nj} values for the total manufacturing industry. By using $d_j = e^{d_{kj}^{phys}}.e^{b_j}.e^{l_j}.e^{f_j}.e^{m_j}.e^{\delta_j}$ (from equation [9]), where d_j, m_j and δ_j are the averages over countries, I showed how much each characteristic affects trade barriers. Therefore, an exponential value of greater than 1 shows the increasing effect of that country characteristic on trade costs, while a value smaller than 1 shows decreasing effect. The results are summarized in Figure 3.

Figure 3 here.[16]

First, and not surprisingly, import barriers (destination effect) and distance have increasing effects on trade costs, and the farther the distance between the trading countries, the higher the trade cost. These two variables affect trade barriers the most.

Common language and common border normally display expected signs and decrease trade costs. FTA, on the other hand, shows an increasing effect on trade costs for most of the period. This result, of course, contradicts everything known about FTAs. Therefore, a deeper exploration is necessary.

[14] Note that the sectors are not all the same size. Some sectors are a large percentage of total manufacturing, and some are small. Therefore, one should not expect the arithmetic average of trade costs across sectors to be equal to the total manufacturing sector trade costs. The total manufacturing sector is an approximation for the weighted average of all the sectors.

[15] Food and Beverages sector trade costs are slightly increasing over time which finding conflicts with the findings of previous research by Olper and Raimondi (2007). In that paper, the authors find that the "Food Manufacturing" (ISIC rev2, 311) sector's iceberg trade costs show around a 7% reduction during the period 1978-2000. The reason for this difference in results may be attributable to differences in industry classification, and sample, etc.

[16] The destination effect values are relative to the US, except 1996. In 1996, necessary data is not available for the US, so the estimation is done relative to Germany.

Bearing in mind the data problems, Figure 4 shows the FTA coefficient estimates for developed and developing countries separately.

Figure 4 here.

The results appear interesting. Although for non-OECD case, years 1982, 1983 and 1991 show increasing effect of FTA on trade barriers, the values are not statistically significant. Therefore, the FTA coefficients for the subsamples show the expected signs. Then how can we explain the result of the pooled regression? Recent literature on the gravity equation of trade might shed light on this issue.

Traditional gravity literature assumes that the FTA is an exogeneous variable; that is, it is assumed that the countries are randomly selected for the FTAs. In reality, however, the FTA is an endogenous variable and depends on determinants that are unobservable to the econometrician, and possibly correlated with the level of trade (Baier and Bergstrand, 2007). Hence the estimates of effects of FTAs may be biased, inconsistent, and underestimated if FTA is taken to be exogeneous. Frankel (1997), for instance, finds significant negative effects of European Economic Community membership on trade using exogenous FTA. Baier and Bergstrand (2007) show that traditional estimates of the effect of FTAs on bilateral trade flows tend to be underestimated by as much as 75-85%. Recently, Egger et al. (2011) argue that the impact of endogeneous FTA on members' trade flows relative to nonmembers' trade flows is about 188% higher than that of an exogeneous FTA case. According to Baier and Bergstrand (2007), the solution to this problem is to estimate the effect of FTAs on bilateral trade flows by employing a theoretically motivated gravity equation using differenced panel data. Section 4.1.2 uses this methodology to correct for endogeneity bias.

4.1.2 Correcting for endogeneity bias

4.2 Non-OECD trade costs are higher than OECD trade costs.

The results of this section confirm previous findings from Anderson and van Wincoop (2004) by showing that the trade costs of developing countries are higher than those of developed countries. Table 2 compares the trade costs of country groups by industry.

Table 2 here.

Table 2 shows the mean, standard deviation, and rank of the importer's trade costs for OECD and non-OECD countries for the period 1963-2006. The first thing to note is that the average trade costs of non-OECD countries for all sectors are larger than those of OECD countries. This can be seen in the last column of Table 2 with ratios of mean values of non-OECD to OECD for all industries larger than 1. This is not a surprising result given that the majority of the OECD countries are EU countries; therefore, they are geographically (distance, common border) and economically (free trade agreements, currency union, etc.) tied together, which makes trade costs smaller. Moreover, developing countries have higher tariff levels and more restrictive trade policies as compared to developed countries (Kee, 2009).

Although trade costs for all individual industries and for total manufacturing are smaller for OECD countries than those of non-OECDs, rankings of the sectors' trade costs for OECD and non-OECD countries show similar results: for both country groups the sector with the lowest trade cost is Medical, Precision, and Optical Instrument, and the highest trade cost is in Printing and Publishing. This makes economic sense considering trade costs are ad-valorem trade costs. Since medical and optical instruments are highly valuable, their trade costs relative to their value are small, and the opposite is true for printing and publishing goods.

Although rankings make economic sense, considering that non-OECD countries import more capital intensive goods, and specialize in labor intensive goods, while OECDs specialize in capital intensive sectors (Eaton and Kortum, 2000), one might expect the sectoral trade cost rankings for OECDs and non-OECDs to be different. Because of protective trade policies, countries are expected to have higher tariffs, hence higher trade costs, for the industries they are specializing, and lower trade costs for the goods they import more. This is especially important for developing countries because by importing the so-called capital goods embodying new technology, these countries may increase their productivity and human capital. Eaton and Kortum (2000), for example, develop a model that links productivity and imports of capital goods, and show how impediments to trade in capital goods can affect productivity. They attribute 25% of cross-country productivity differences to variation in the relative price of equipment, about half of which is ascribed to the barriers to trade in capital goods. Since the trade cost is one of the biggest impediments to trade, by lowering the trade costs developing countries can achieve productivity growth. But if we look at the industries representing the capital goods, such as Office, Accounting, Computing Machinery; and Electrical Machinery, Communication Equipment, ratios of mean values for these sectors show more than 40% difference between trade costs of OECD and non-OECD countries.

Figure 5 shows the evolution of trade costs over the years for the total manufacturing industries of the country groups. Trade costs of developing countries are higher than those of developed countries in each year during 1963-2006, but both decrease over time. Regression equations show that it will take approximately 160 years for non-OECDs to catch up with OECDs.

Figure 5 here.

The industry level figures are similar to total manufacturing results in the sense that OECD trade costs are lower than non-OECD trade costs throughout the period, with the exception of the Petroleum Products industry during the 1960s.

Figure 6 here.

The Petroleum industry is exceptional also for being the only industry with a positive trade cost trend for both country groups over the period of study. Starting in 2000, this increasing trend is more obvious. This can be seen more clearly in Table 3 and Table 4, which show the percentage change in trade costs by decade for OECD and non-OECD, respectively.

Table 3 and Table 4 here.[17]

The last column of Table 3 shows that, for OECDs, all industries' trade costs, except Petroleum Products, are lower in the 2000s than in the 1960s. Considering the trade enhancing efforts made by countries, one would expect the trade costs to decrease over the 44-year period for each industry. But we see a 14% increase in OECD petroleum trade costs, mainly because of the 22% increment occurring in the 2000s compared to the previous decade. As shown in Table 4, in parallel with the

[17] Here the change is the percentage change in the averages of decades. So the last column of the tables, for example, compares values of the 1960s' average and the 2000s' average. The goal here is to show how much of the change is at the end of the period compared to the beginning.

OECDs, the trade costs of non-OECD petroleum industry also peaks in the last decade with a 18.5% change. Petroleum is the only industry with rising trade costs for each decade for non-OECDs.

This period, the 2000s, coincides with the rise in oil prices. Oil prices tripled in 2000 compared to 1999 levels and increased until peaking in 2008. The reason is a combination of many factors such as OPEC production cutbacks, low oil stock levels, weather, and strong growth in oil demand from developing countries.

Perhaps an even more interesting case is Medical, Precision, and Optical Instruments industry. Figure 6 shows that the trade costs of OECDs for this sector show a steady increase after 1990 while trade cost of non-OECD keeps decreasing.

Table 3 shows that trade costs of the Medical industry started to increase in the 1990s and increased by 8.9% in the 2000s compared to the 1990s. But the same figure for non-OECDs in Table 4 shows a 5.5% decrease. This is worth looking into, and different from what we observe in the petroleum industry, since the change occurs in the opposite direction, and shows a sudden rise in developed countries' trade costs after gradual decreases until 1990. Since the rise occured in developed countries' trade barriers, the usual suspects are non-tariff barriers such as technical regulations and safety standards. Indeed, after 1990, EU developed some safety regulations on medical instruments to ensure that the products are well designed and safe for the public health. These regulations, known as Medical Device Directives, are imposed by EU and EFTA members.[18] Country by country examination of the sector's trade costs exhibits increasing values for EFTA members and EU countries of the time, but not for the US, Canada or Japan, which justifies the possible link between the increasing trend in trade costs of OECDs and safety regulations of the sector for EU countries.

Since the focus of this section is to compare developed and developing country trade barriers, one especially important point to pay attention to is the capital goods. By looking at the graphs in Figure 6 and the values in Tables 3 and 4, we can say that non-OECDs' trade costs of the capital industries (Office, Accounting, Computing, and Other Machinery; and Electrical Machinery, Communication Equipment) show large declines compared to the 1960s. Especially in the last two decades, the reductions are far greater than the reductions in OECD values. Actually, not only for capital industries, but for most of the sectors, after the mostly positive changes of the 1970s and the 1980s, the last two decades have brought even higher trade cost declines for non-OECDs than OECDs, which points out a convergence, and the scope of the next section.

4.3 Is there convergence between trade costs?

In order to understand the convergence/divergence trend of trade costs between the two country groups, Table 5 demonstrates the ratios of average trade costs of non-OECD to OECD by decade.

Table 5 here.

The first thing to note is that all the industries show divergence for the first 3 decades. For the total manufacturing industry, after the peak of the 1980s, there is gradual convergence. But the industry breakdown results illustrate more mixed patterns after the 1980s.

[18] Three major directives for manufacturers of medical devices are the Active Implantable Medical Device Directive of 1990 (90/385/EEC), the Medical Device Directive of 1993 (93/42/EEC) and the In Vitro Diagnostic Directive of 1998 (98/79/EC).

After the 1980s, the developing countries have been catching up with the industrialized countries in trade costs of the capital goods industries. This is consistent with the trade theory since developing countries are the major importers of capital goods. But still the difference in average trade barriers is more than 40% for Office, Accounting, Computing Machinery, and as high as 55% for Electrical Machinery, Communication Equipment in the 2000s.

Trade costs of labor intensive industries such as Textiles, and Wearing Apparel, Fur also converge after the 1980s.

4.4 Partner country's effect on trade costs

In order to better understand the reasons for the gap between trade barriers of the developed and developing countries, this section shows the trade costs according to country group of the partner. As always, total manufacturing is the first industry to analyze.

Figure 7 here.[19]

Figure 7 shows the expected results; if the exports come from the OECDs, the barriers to trade are lower than in the case of non-OECD exporters.

Figure 8 here.[20]

Figure 8 shows the trade costs for country groups at sector level. The results are interesting since the trade costs among non-OECDs are lower than the barriers to trade from OECDs to non-OECDs.

The figure illustrates that OECD trade costs in Medical, Precision, and Optical Instruments sector increase after 1990 for imports from both OECD and non-OECD countries. For developing countries, on the other hand, trade barriers for imports from OECD decline while trade costs of imports from non-OECD remains almost stable. This result supports the idea of relating trade cost changes to the safety regulations of EU, which mentioned in Section 4.2.

5 Conclusion

The variability of trade costs makes statements about the average height of trade barriers misleading. This paper, therefore, attempts to explain the magnitude of variation and the evolution of trade costs across countries and across sectors. Using the methodology of Shikher (2010), I estimate trade costs using a gravity-like equation for a 44-year period, for 73 developed and developing countries, and 19 manufacturing industries. The main results are as follows:

Trade costs are large and vary significantly across goods. The difference in trade barriers can be as high as 60% on average at the sector level. But the trend is declining for the total manufacturing industry and for the majority of the individual sectors. One important exception is the petroleum industry, which shows increasing trade barriers for both developed and developing countries throughout 1963-2006. Petroleum is the only industry trending upward in developed country trade costs.

The trade costs of non-OECD countries for all sectors are larger than those of OECD countries. But the rankings of the sectors' trade costs for OECDs and non-OECDs show similar results: for

[19] d (importer, exporter).
[20] d (importer, exporter).

both country groups the lowest trade cost sector is Medical, Precision, and Optical Instruments and the highest trade cost is in Printing and Publishing. This makes economic sense considering trade costs are ad-valorem trade costs.

An interesting case occurs in Medical, Precision, and Optical Instruments industry. The trade costs of OECDs for this sector increase after 1990 while trade costs of non-OECDs keep decreasing. The possible reason might be the safety regulations on medical instruments, Medical Device Directives, that are imposed by EU and EFTA members after 1990.

By examining the convergence/divergence of trade barriers, I find that all the industries show divergence until the 1980s. For the total manufacturing industry, after the peak of the 1980s, there is gradual convergence. Although the industry breakdown results are mixed after the 1980s, there is steady catching up in trade costs of capital goods industries, and labor intensive industries. But still the differences in average trade barriers are more than 40% for these sectors.

In order to better understand the reasons for the gap between trade barriers of the developed and developing countries, I present the trade costs according to country group of the trading partner. For the total manufacturing industry, if the exports come from the OECDs, the barriers to trade are lower than in the case of non-OECD exporters. The results are different at the sector level; the trade costs among non-OECDs are lower than the barriers to trade from OECDs to non-OECDs.

I also examine which determinant has the largest effect on trade costs. The results point to the endogeneity bias issue of the traditional gravity literature. I correct the endogeneity bias using the differenced panel data approach suggested in recent literature

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Table 1: Country Coverage

OECD*	Non-OECD	
Australia	Argentina	Korea, Rep.
Austria	Bangladesh	Kuwait
Canada	Bolivia	Malaysia
Denmark	Brazil	Mauritius
Finland	Bulgaria	Mexico
France	Chile	Nigeria
Germany	China	Pakistan
Greece	Colombia	Peru
Iceland	Costa Rica	Philippines
Ireland	Czech Republic	Poland
Italy	Ecuador	Russian Federation
Japan	Egypt, Arab Rep.	Saudi Arabia
Netherlands	El Salvador	Senegal
New Zealand	Ethiopia	Slovak Republic
Norway	Fiji	Slovenia
Portugal	Ghana	South Africa
Spain	Guatemala	Sri Lanka
Sweden	Honduras	Taiwan Province of China
Switzerland	Hungary	Tanzania
United Kingdom	India	Thailand
United States	Indonesia	Trinidad and Tobago
	Iran, Islamic Rep.	Turkey
	Israel	Ukraine
	Jordan	Uruguay
	Kazakhstan	Venezuela, RB
	Kenya	Vietnam

* Included OECD countries are member countries of OECD in 1973, excluding Turkey. Turkey is excluded in order to have a homogeneous developed country group (For developed country classification see IMF World Economic Outlook, April 2011).

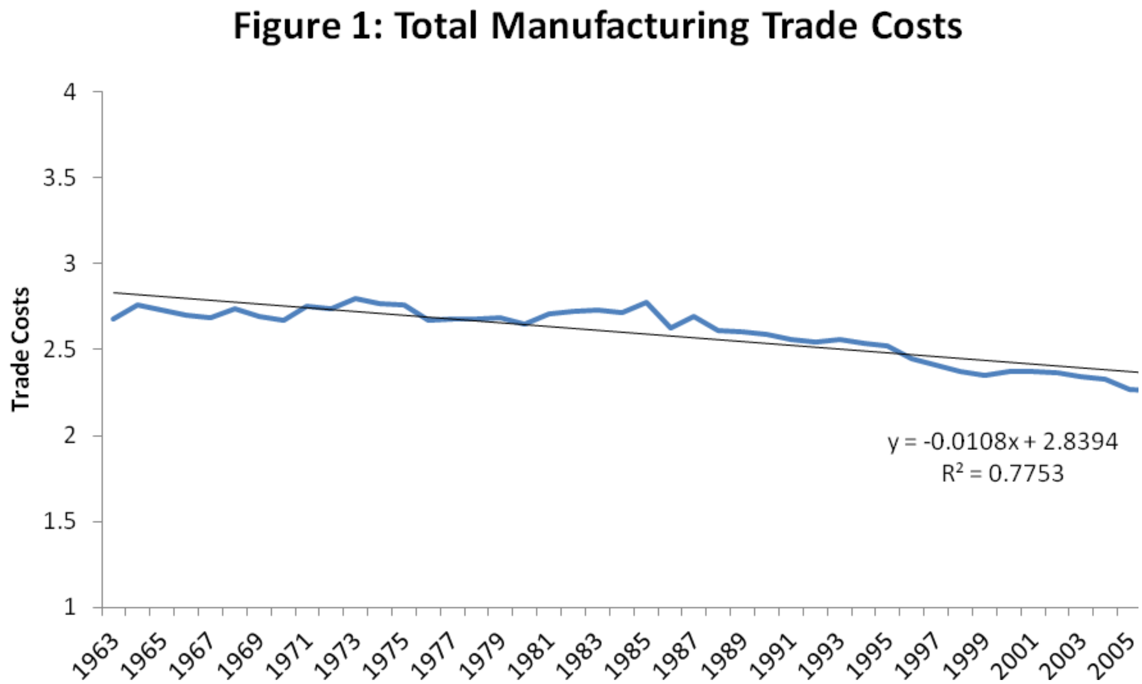
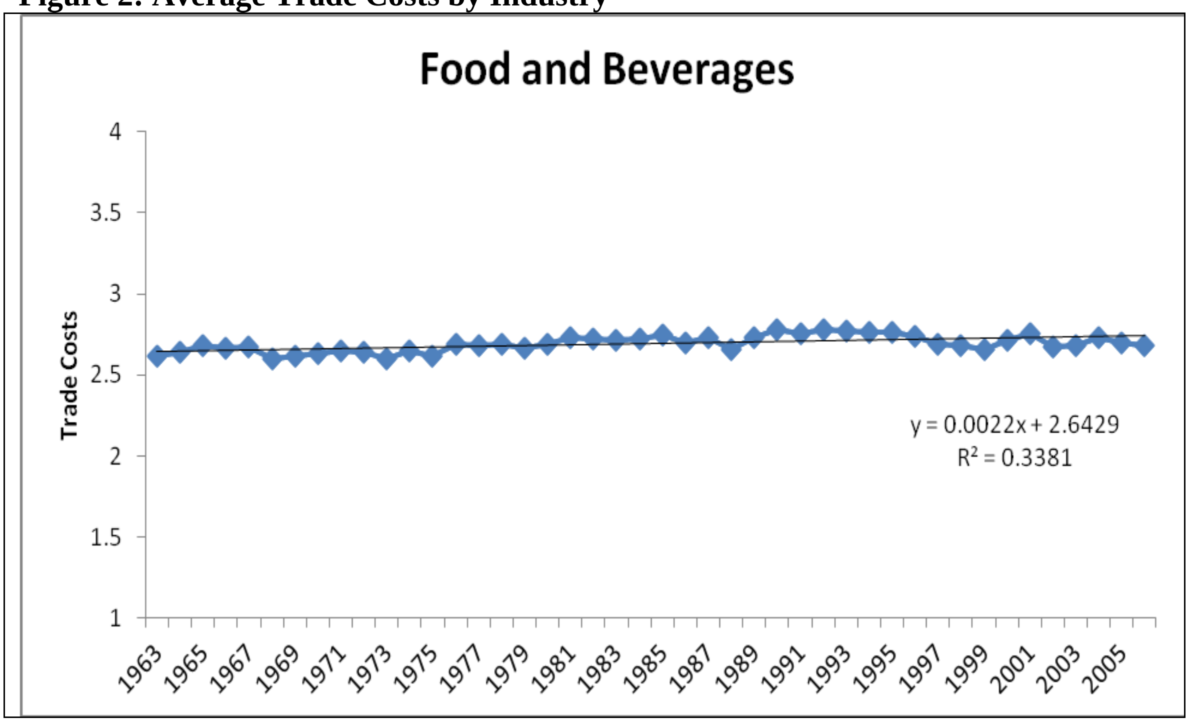
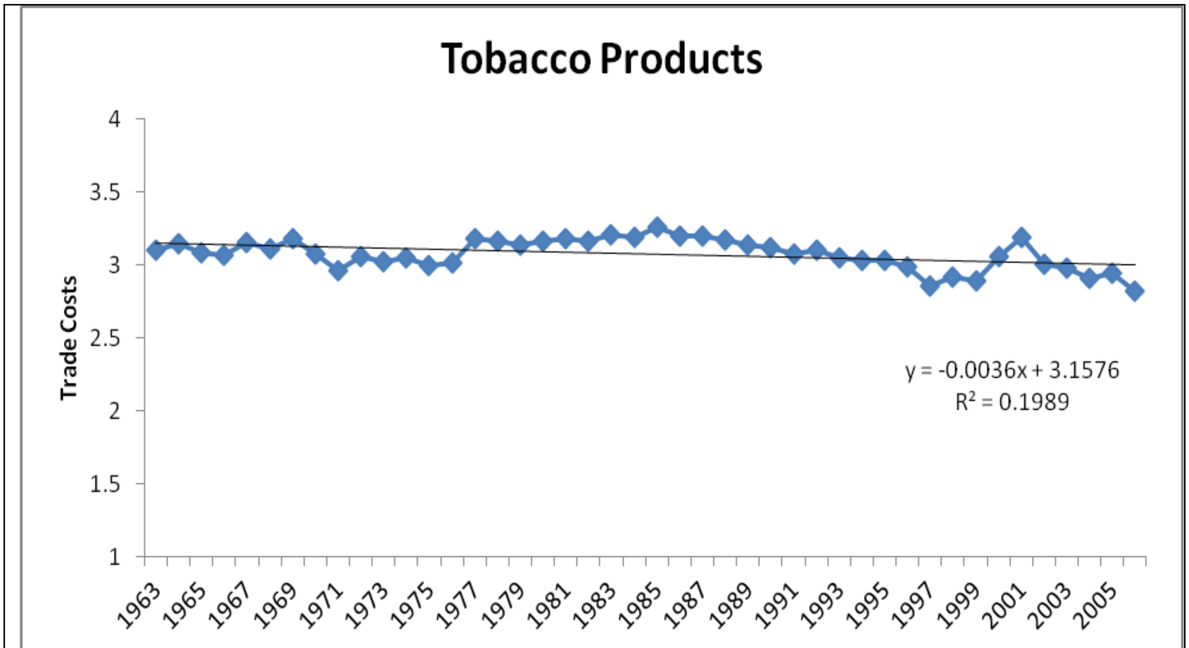
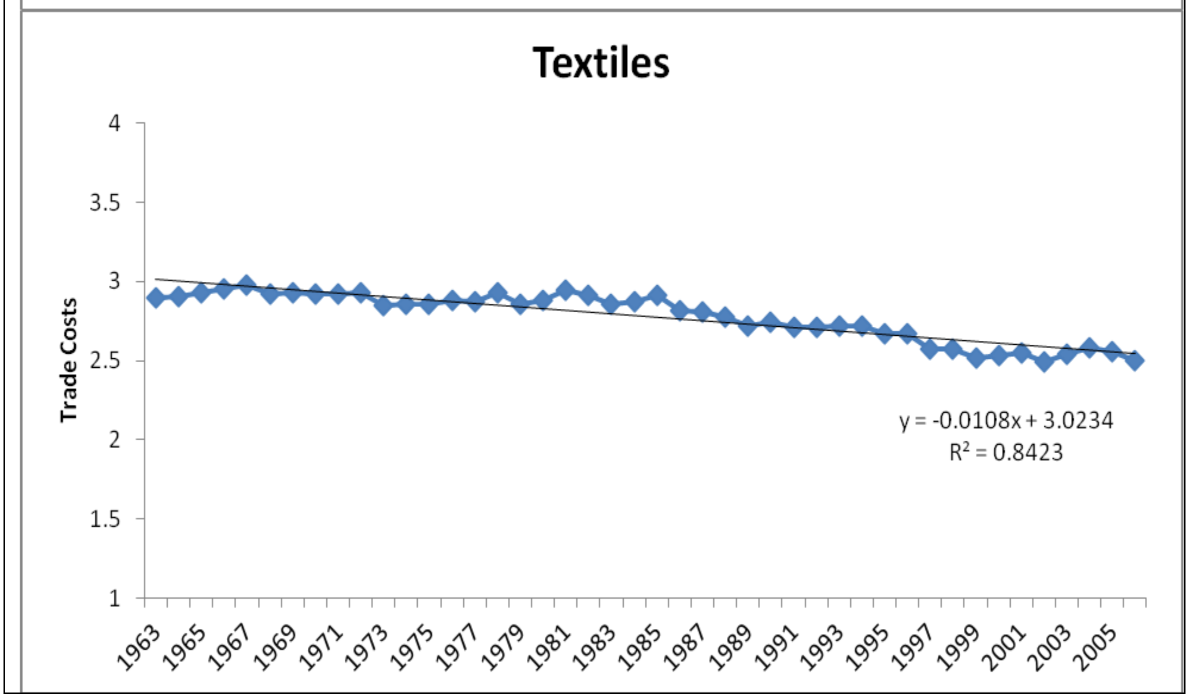
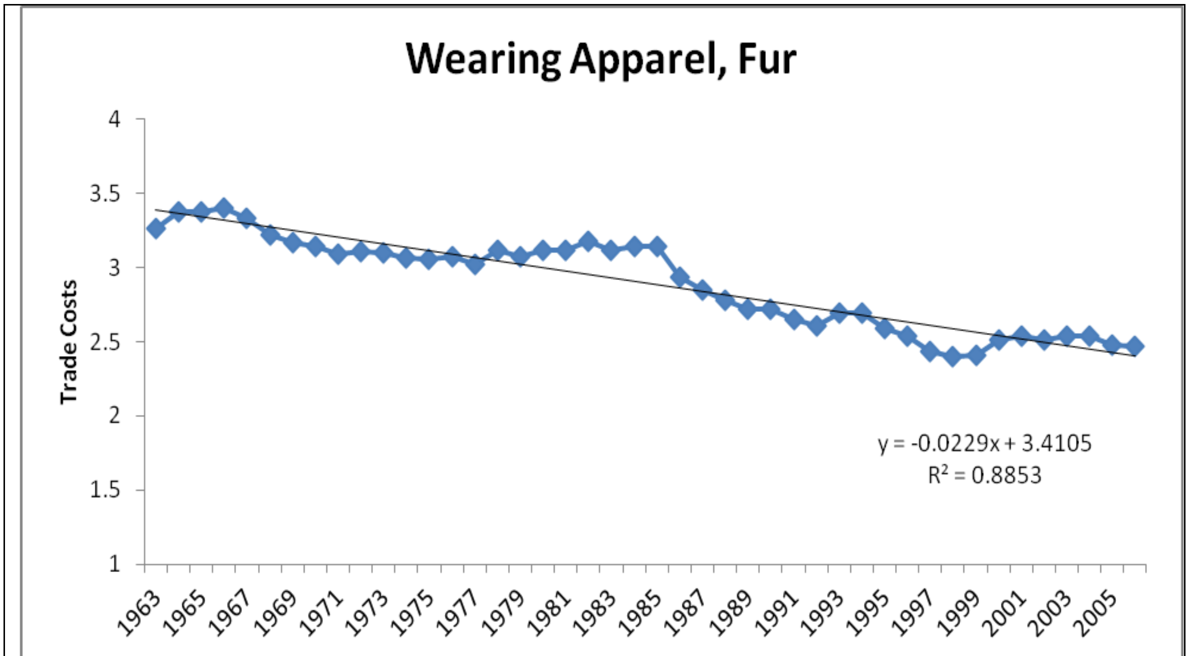


Figure 2: Average Trade Costs by Industry

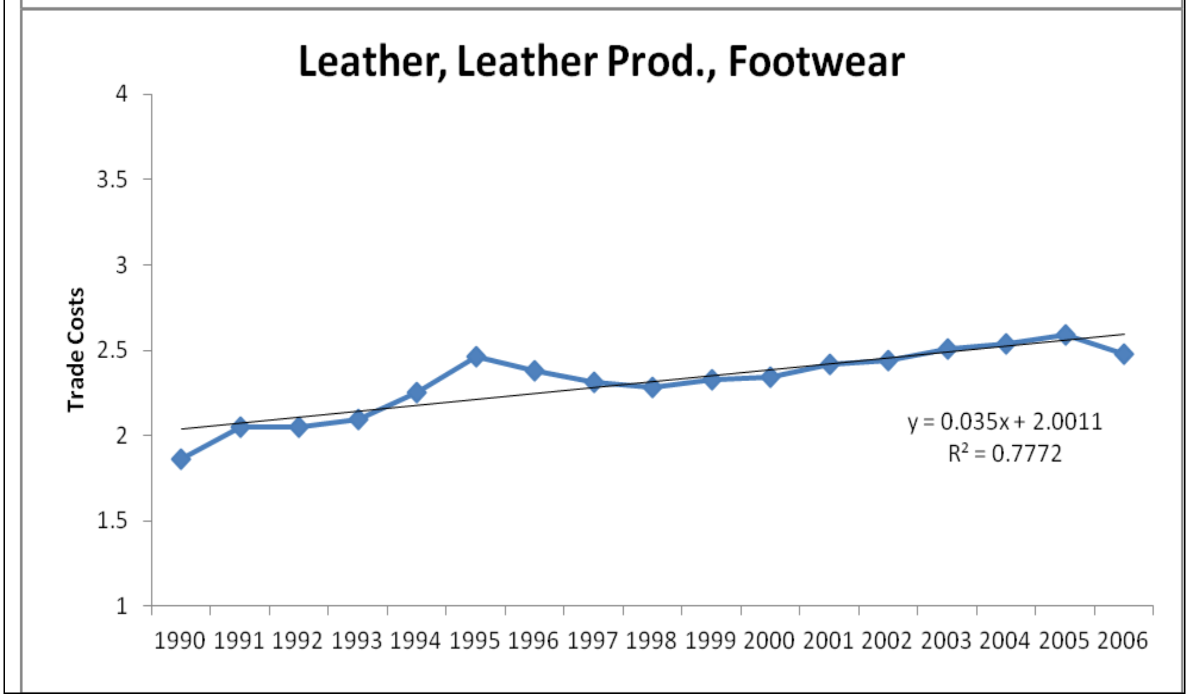



Tobacco Products
Trade Costs
y = -0.0036x + 3.1576
R² = 0.1989
4
3.5
3
2.5
2
1.5
1
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005


Textiles
Trade Costs
y = -0.0108x + 3.0234
R² = 0.8423
4
3.5
3
2.5
2
1.5
1
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005

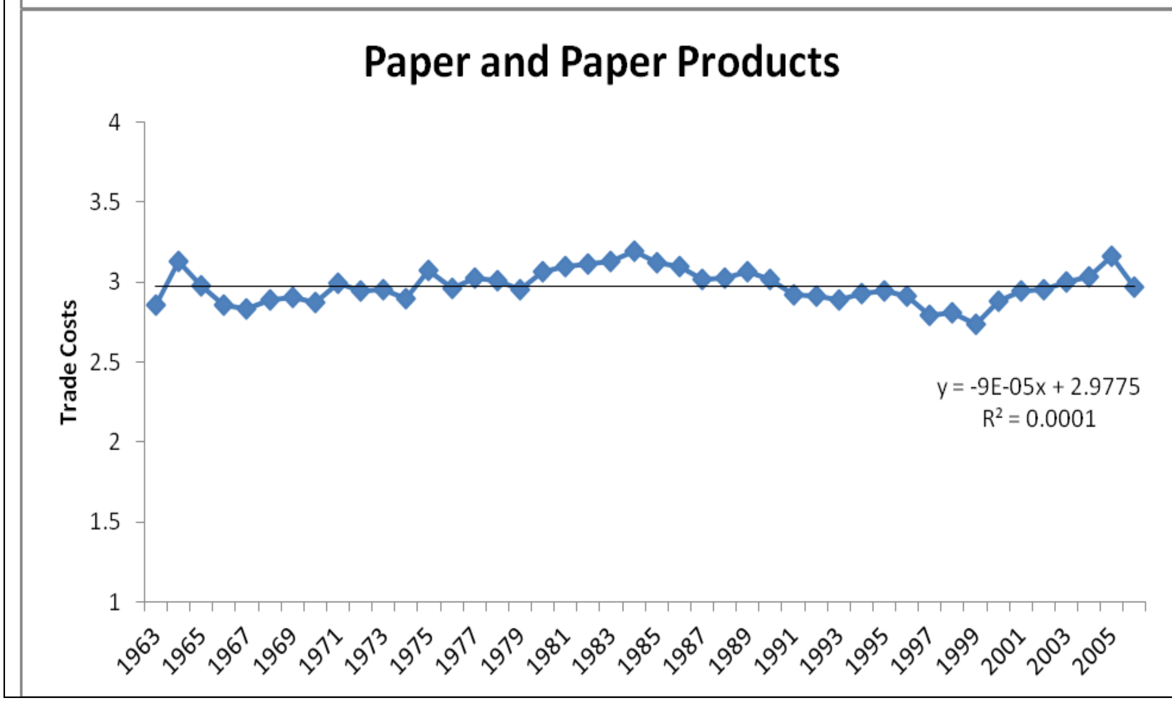


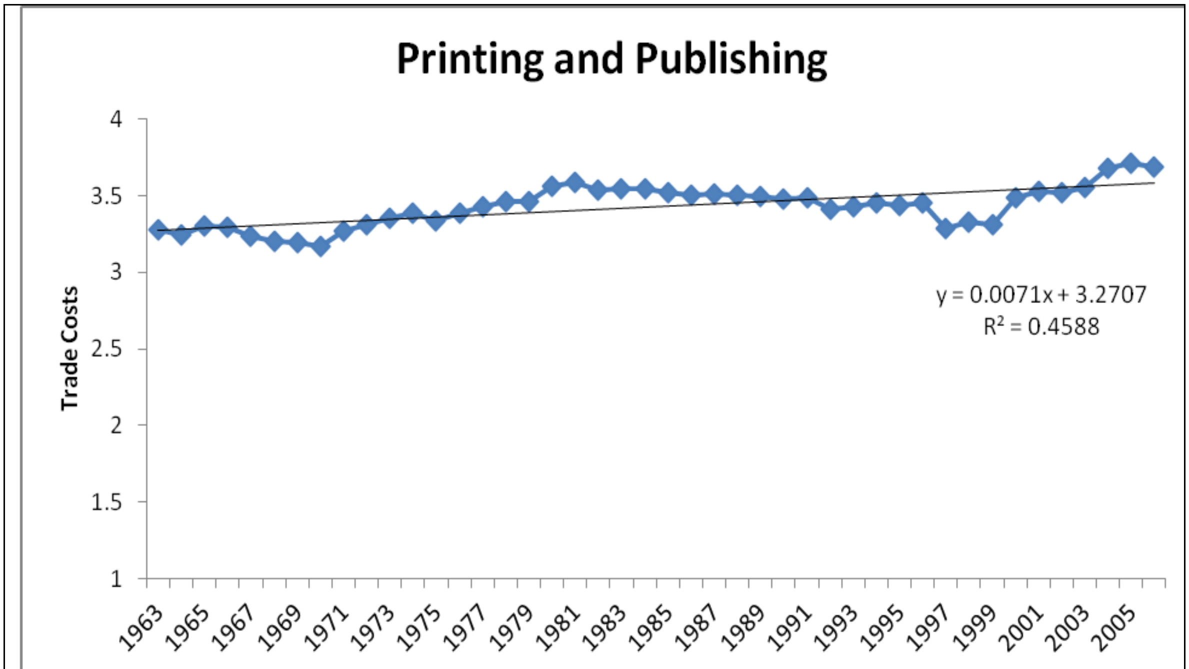
Wearing Apparel, Fur
Trade Costs
4
3.5
3
2.5
2
1.5
1
y = -0.0229x + 3.4105
R² = 0.8853
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005



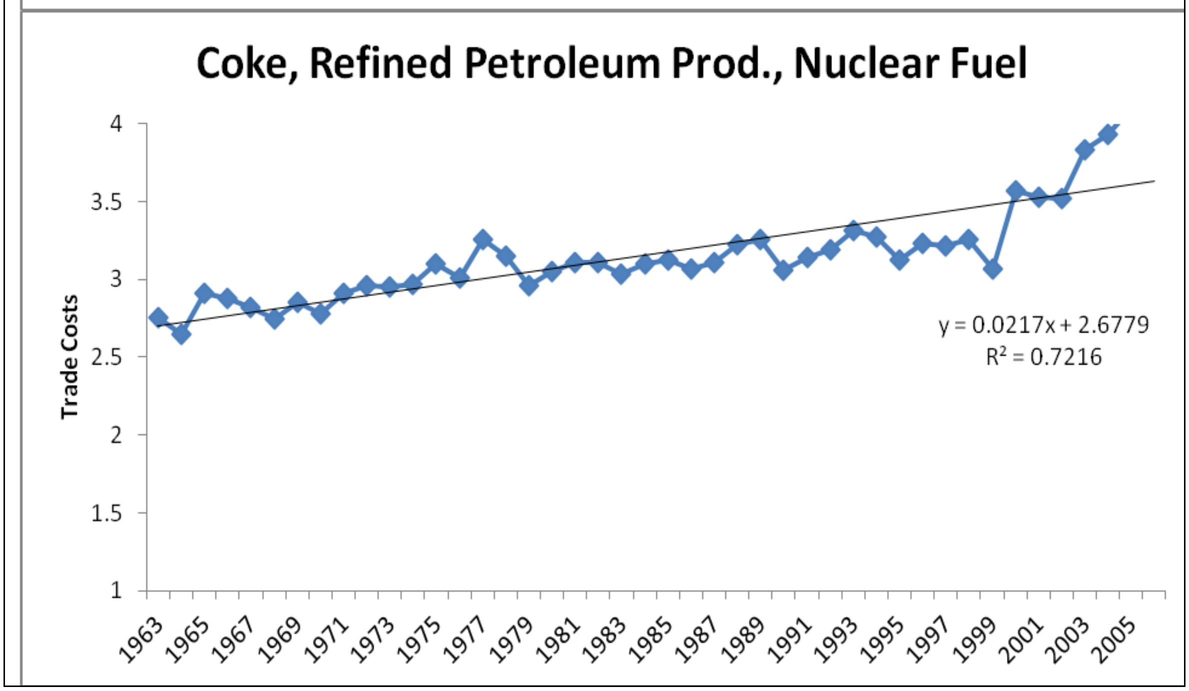
Leather, Leather Prod., Footwear
Trade Costs
4
3.5
3
2.5
2
1.5
1
y = 0.035x + 2.0011
R² = 0.7772
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006


Wood Products (Excl. Furniture)
Trade Costs
4
3.5
3
2.5
2
1.5
1
y = -0.001x + 3.0961
R² = 0.0253
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005

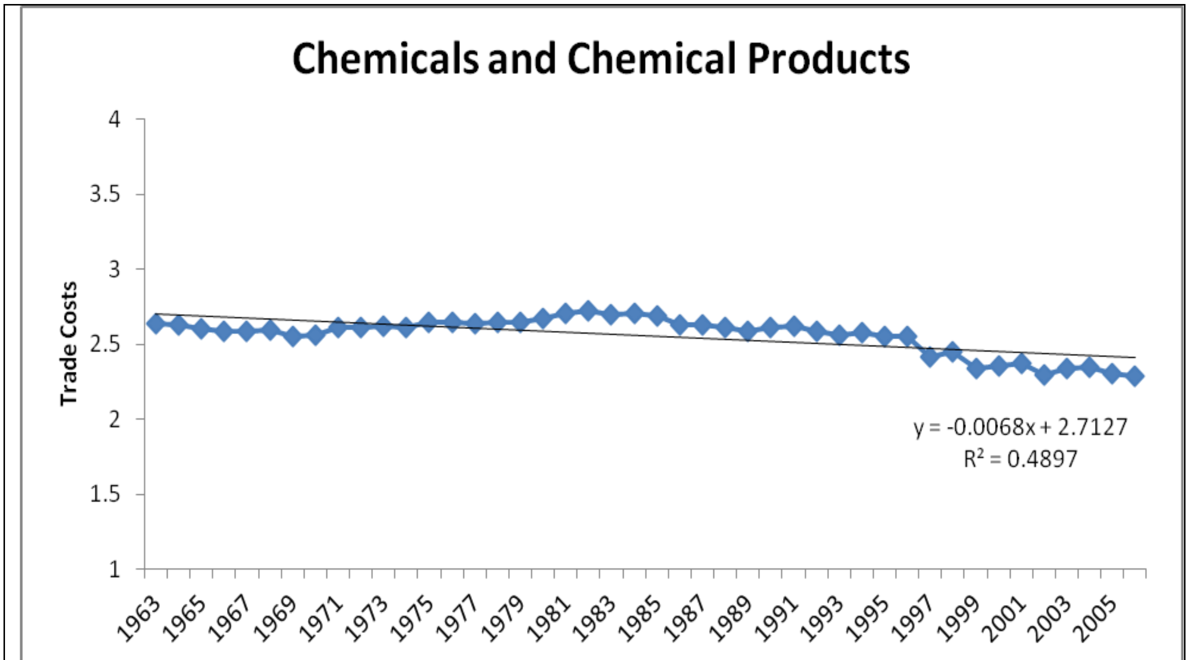

Paper and Paper Products
Trade Costs
4
3.5
3
2.5
2
1.5
1
y = -9E-05x + 2.9775
R² = 0.0001
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005

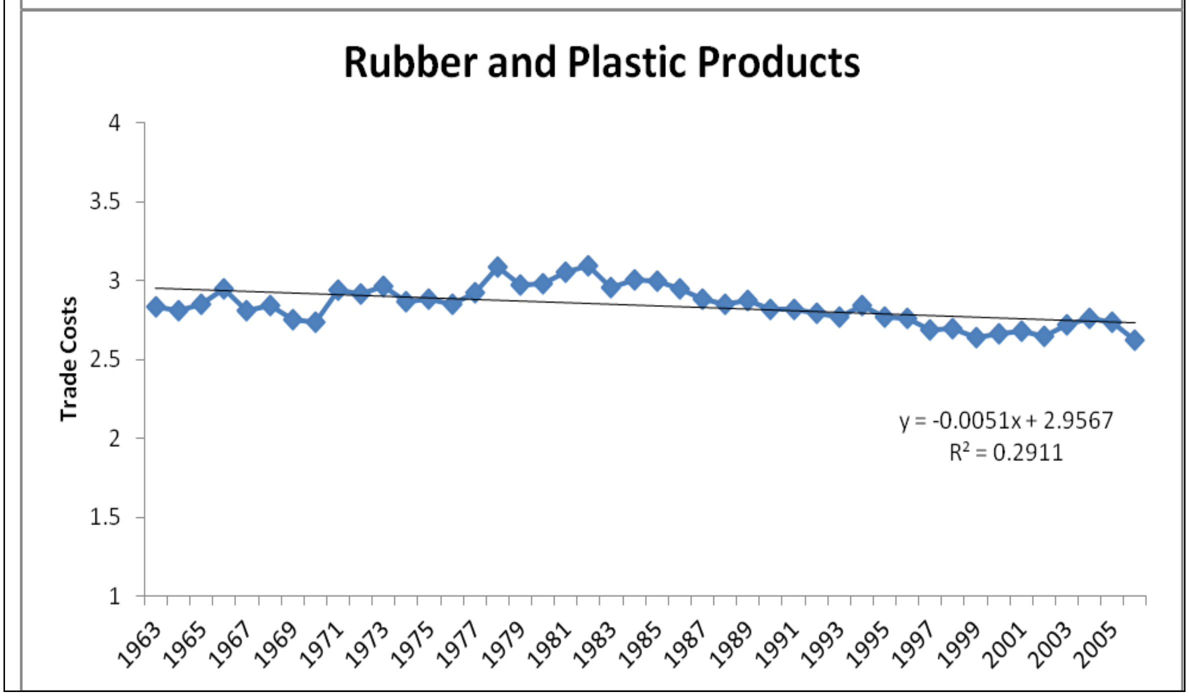


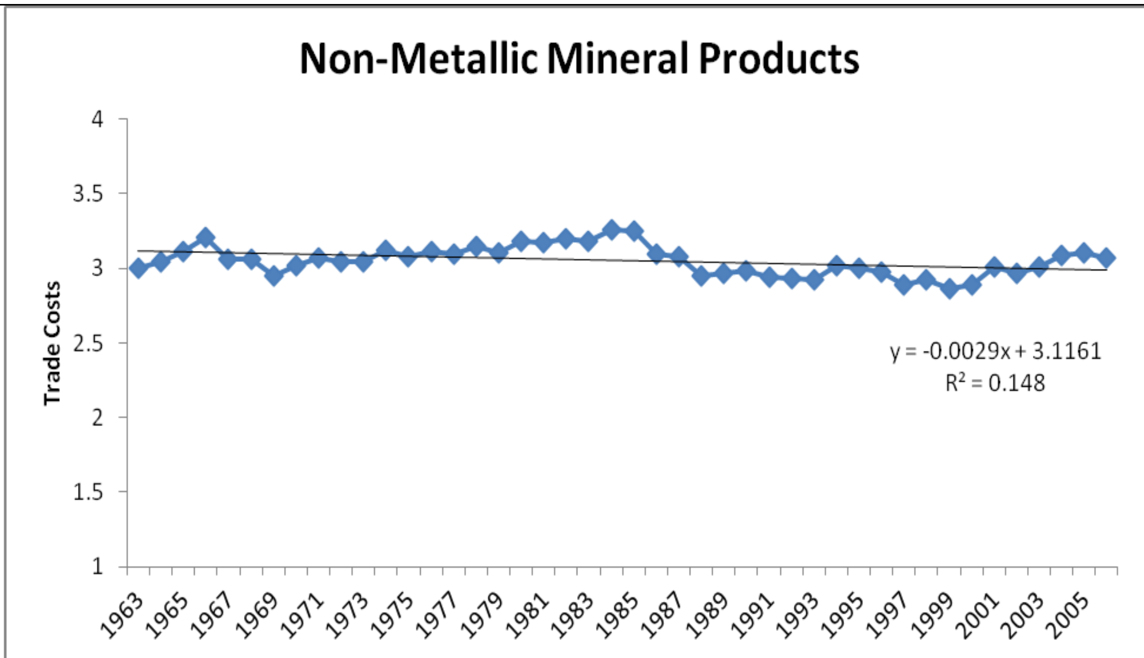
Printing and Publishing
Trade Costs
4
3.5
3
2.5
2
1.5
1
1963 1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005
y = 0.0071x + 3.2707
R² = 0.4588

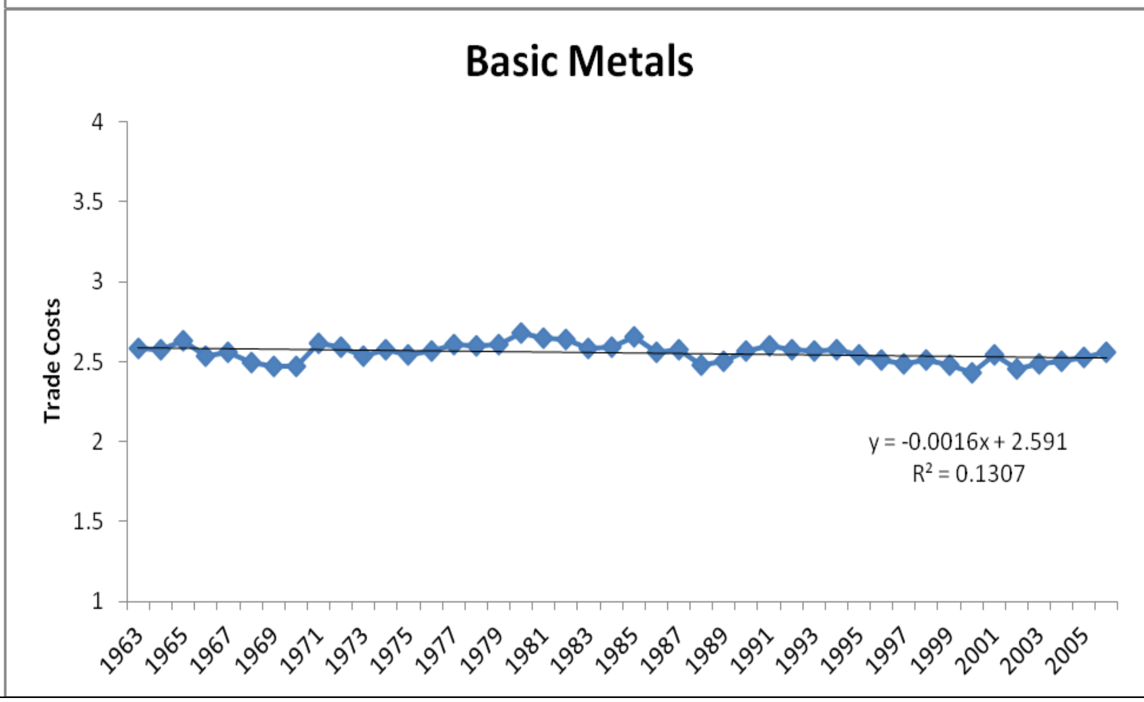


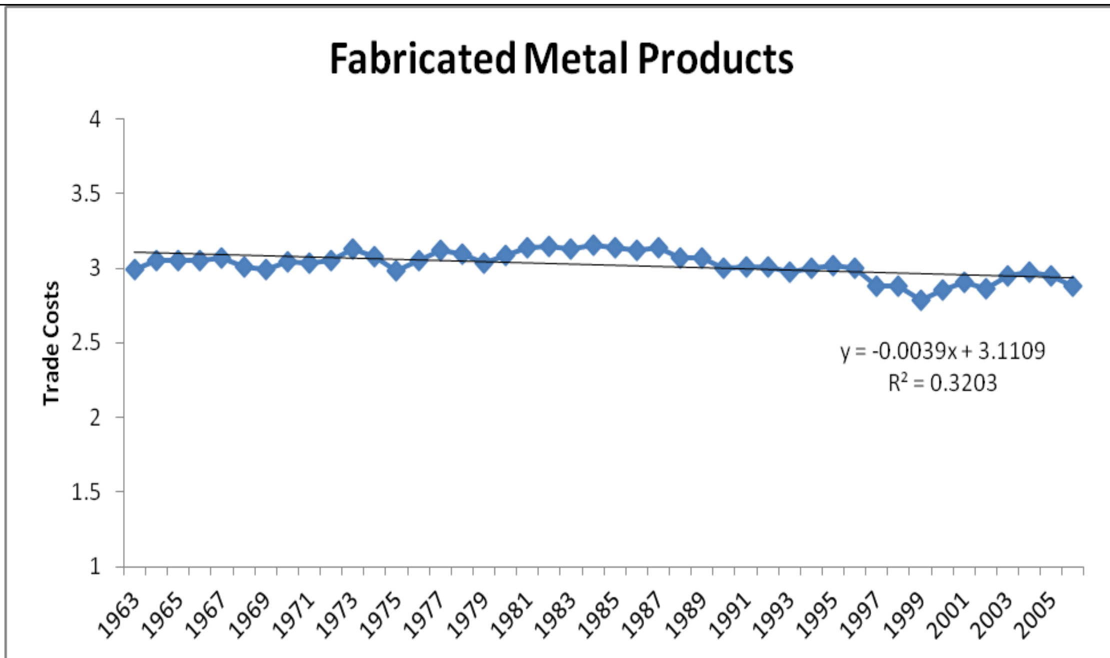
Coke, Refined Petroleum Prod., Nuclear Fuel
Trade Costs
4
3.5
3
2.5
2
1.5
1
1963 1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005
y = 0.0217x + 2.6779
R² = 0.7216

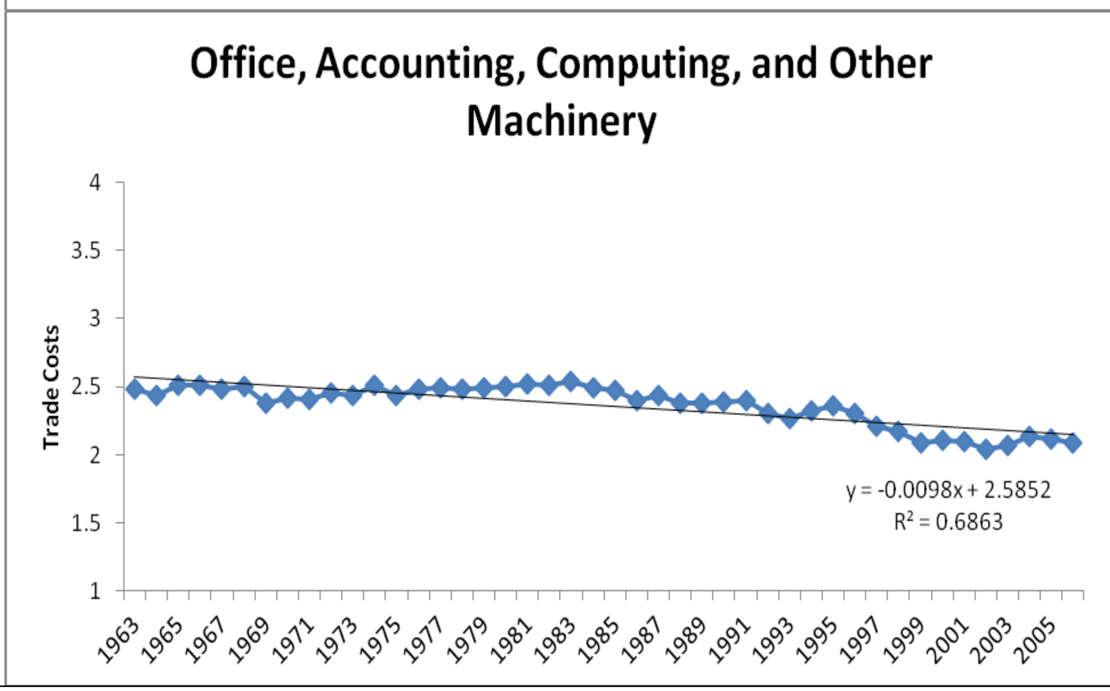

Chemicals and Chemical Products
Trade Costs
4
3.5
3
2.5
2
1.5
1
y = -0.0068x + 2.7127
R² = 0.4897
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005

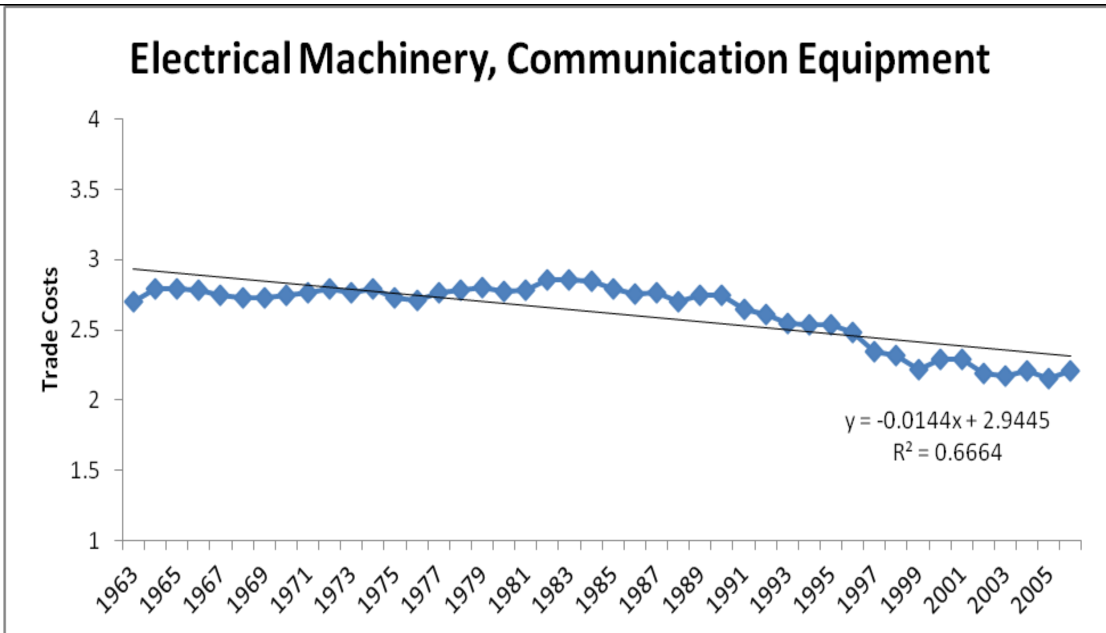

Rubber and Plastic Products
Trade Costs
4
3.5
3
2.5
2
1.5
1
y = -0.0051x + 2.9567
R² = 0.2911
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005


Non-Metallic Mineral Products
Trade Costs
y = -0.0029x + 3.1161
R² = 0.148

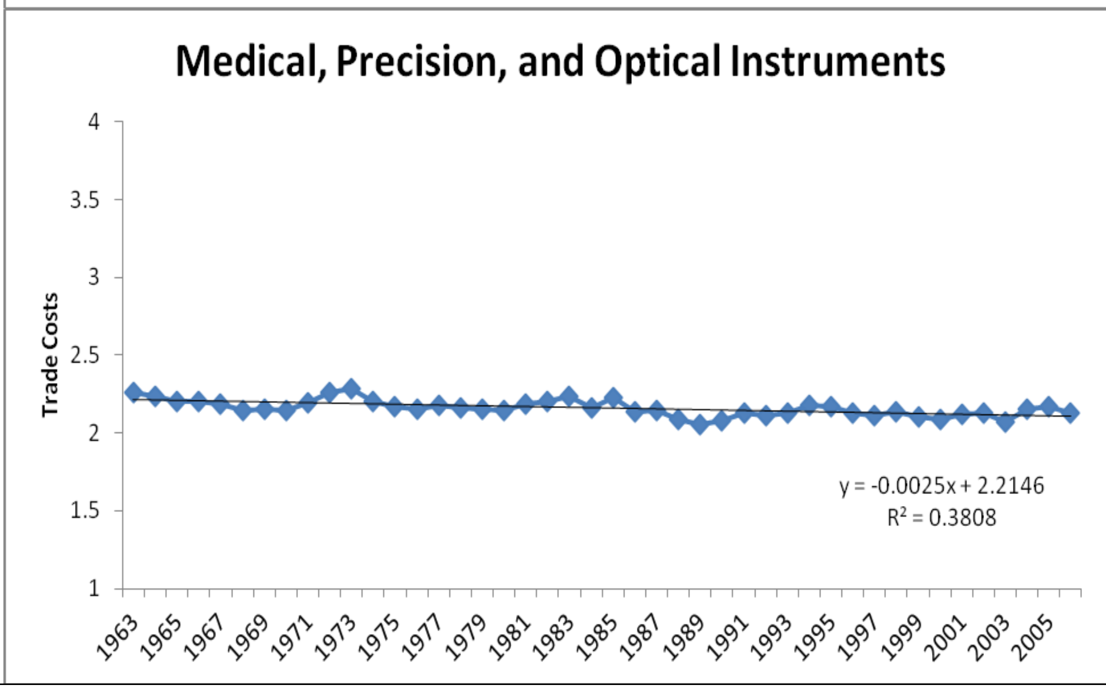

Basic Metals
Trade Costs
y = -0.0016x + 2.591
R² = 0.1307


Fabricated Metal Products
Trade Costs
4
3.5
3
2.5
2
1.5
1
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
y = -0.0039x + 3.1109
R² = 0.3203

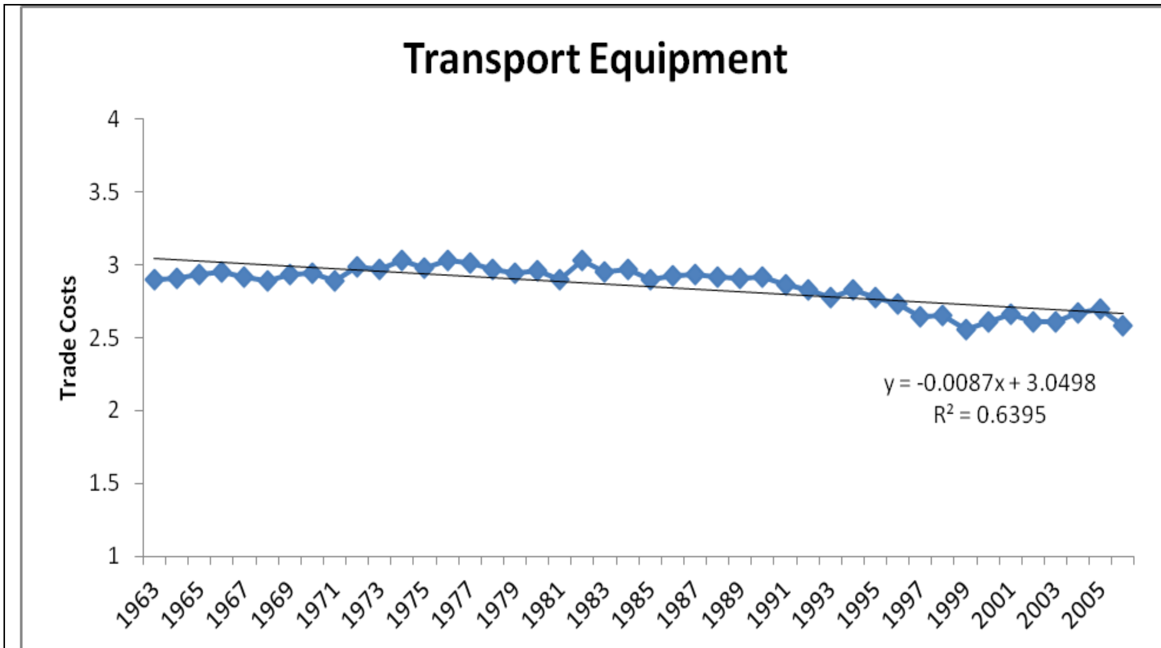

Office, Accounting, Computing, and Other Machinery
Trade Costs
4
3.5
3
2.5
2
1.5
1
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
y = -0.0098x + 2.5852
R² = 0.6863



Electrical Machinery, Communication Equipment
Trade Costs
y = -0.0144x + 2.9445
R² = 0.6664



Medical, Precision, and Optical Instruments
Trade Costs
y = -0.0025x + 2.2146
R² = 0.3808


Transport Equipment
Trade Costs
4
3.5
3
2.5
2
1.5
1
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
y = -0.0087x + 3.0498
R² = 0.6395

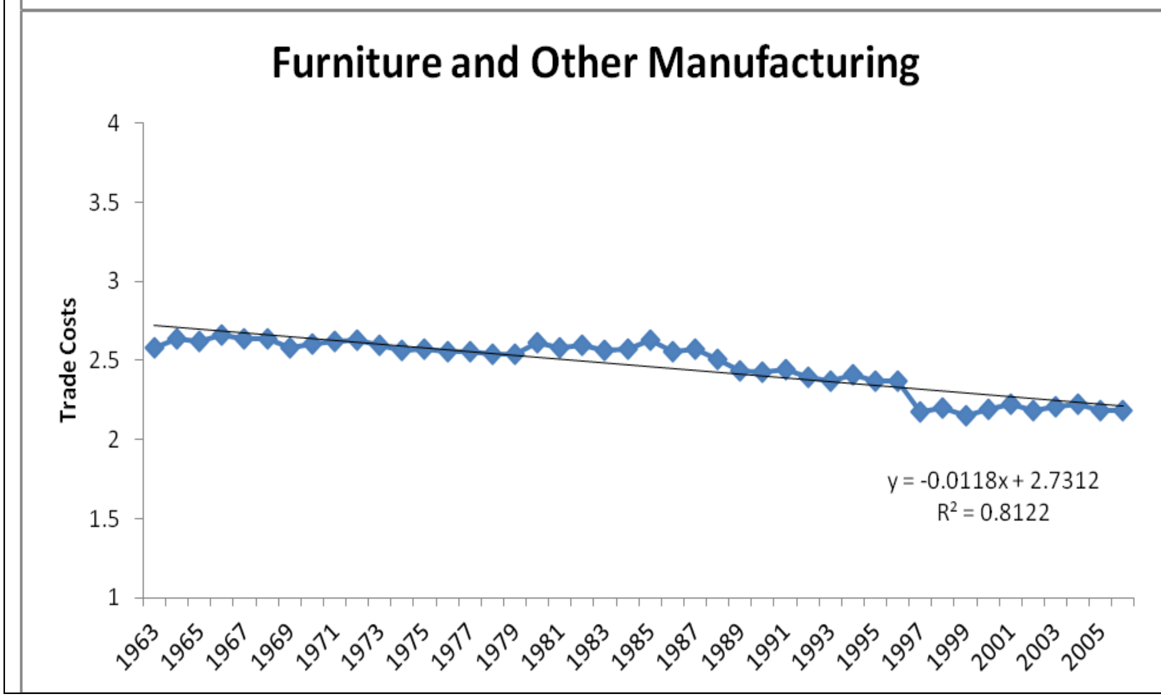

Furniture and Other Manufacturing
Trade Costs
4
3.5
3
2.5
2
1.5
1
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
y = -0.0118x + 2.7312
R² = 0.8122

Figure 3: Effect of Country Charactristics on Trade Barriers

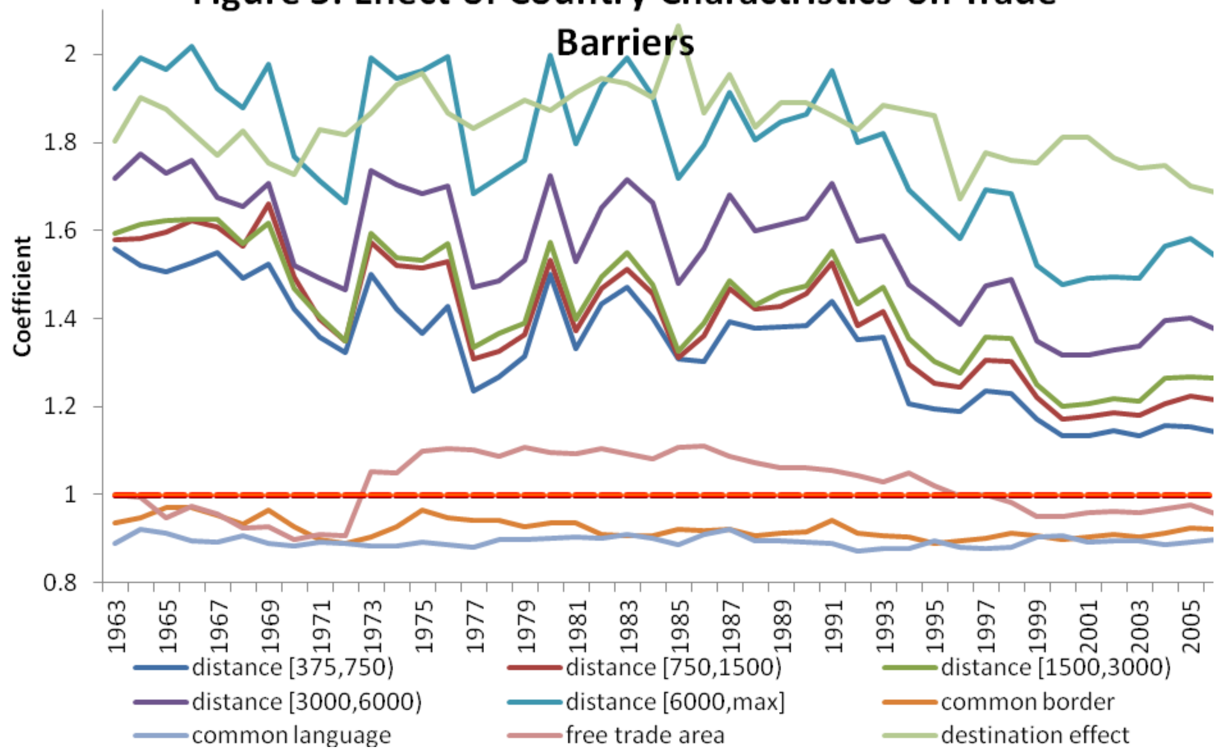


Figure 4: Effect of FTA for Subsamples

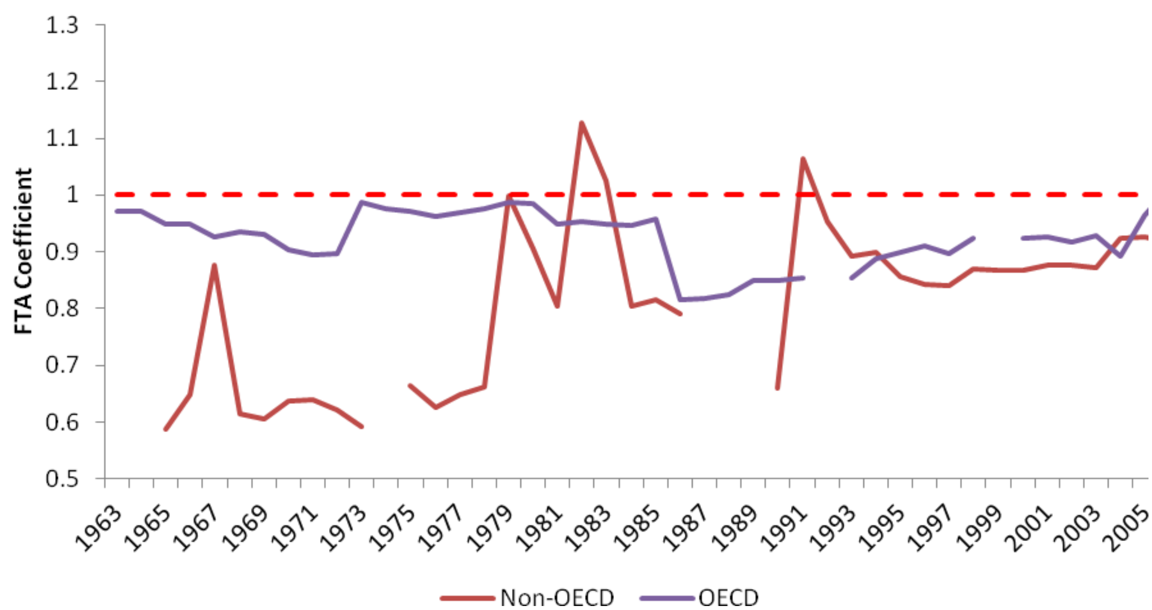


Table 2: Average Trade Costs for the Country Groups* (1963-2006)

	OECD			Non-OECD			
Industry	**Mean**	**St.Dev.**	**Rank**	**Mean**	**St.Dev.**	**Rank**	**Ratio of Mean****
Food and Beverages	2.31	0.51	7	3.04	0.58	6	1.31
Tobacco Products	2.91	0.69	15	3.44	1.01	12	1.18
Textiles	2.32	0.58	8	3.26	0.83	8	1.40
Wearing Apparel, Fur	2.36	0.71	9	3.60	1.20	17	1.53
Leather and Leather Products, Footwear***	1.92	0.38	-	3.04	1.03	-	1.58
Wood Products (Excl. Furniture)	2.81	0.54	14	3.50	0.77	14	1.24
Paper and Paper Products	2.58	0.54	12	3.37	0.76	11	1.31
Printing and Publishing	3.09	0.68	17	3.91	0.73	18	1.26
Coke, Refined Petroleum Products, Nuclear Fuel	2.94	0.84	16	3.56	1.28	15	1.21
Chemicals and Chemical Products	2.16	0.49	5	2.91	0.68	4	1.34
Rubber and Plastic Products	2.36	0.61	9	3.29	0.76	9	1.40
Non-Metallic Mineral Products	2.61	0.69	13	3.57	0.95	16	1.37
Basic Metals	2.26	0.50	6	2.88	0.72	3	1.27
Fabricated Metal Products	2.56	0.59	11	3.48	0.81	13	1.36
Office, Accounting, Computing, and Other Machinery	1.93	0.48	2	2.75	0.66	2	1.42
Electrical Machinery, Communication Equipment	2.12	0.56	4	3.08	0.77	7	1.46
Medical, Precision, and Optical Instruments	1.86	0.44	1	2.49	0.63	1	1.34
Transport Equipment	2.44	0.64	10	3.29	0.74	10	1.35
Furniture and Other Manufacturing	1.98	0.64	3	2.99	0.86	5	1.51
Total Manufacturing******	**2.03**	**0.53**	**-**	**2.91**	**0.69**	**-**	**1.43**

* Trade costs are calculated based on the importer country. That is, $d_{nj} = \sum\_\{i\} d_{nij}$ is calculated for each country, where d_{nij} is the iceberg trade cost from country i to country n in industry j. The averages for OECDs and non-OECDs are reported in the table.

** Ratio of the average trade costs of non-OECD s to those of OECDs.

*** Available data covers 1990-2006.

**** Total manufacturing includes all the ISIC manufacturing sectors except Recycling.

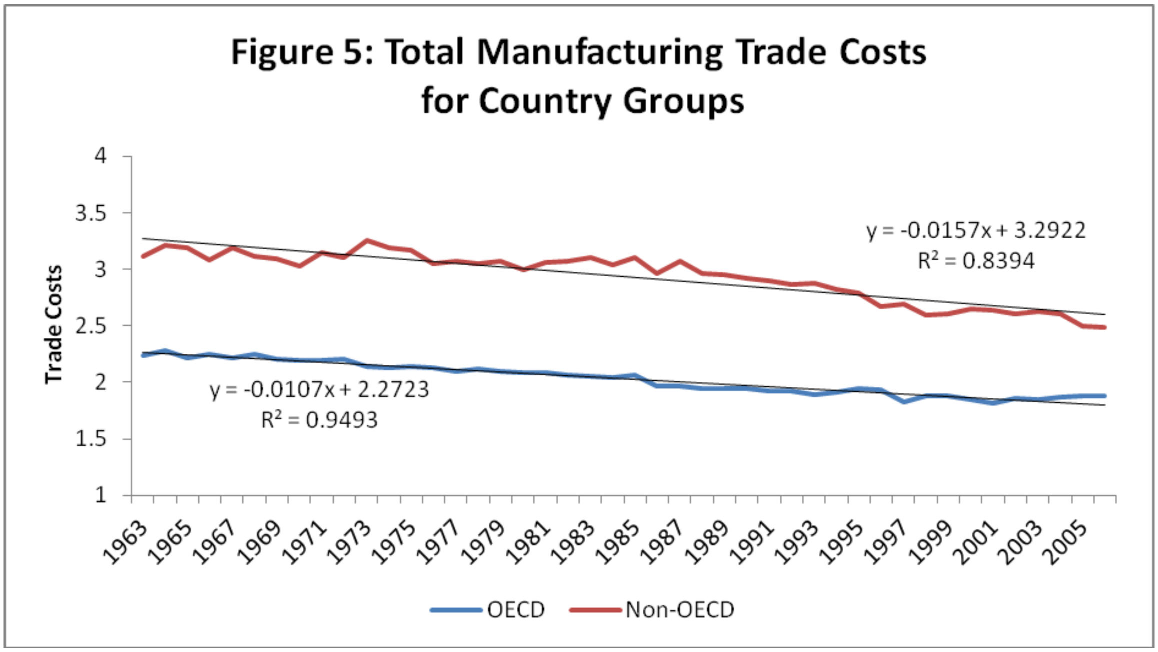
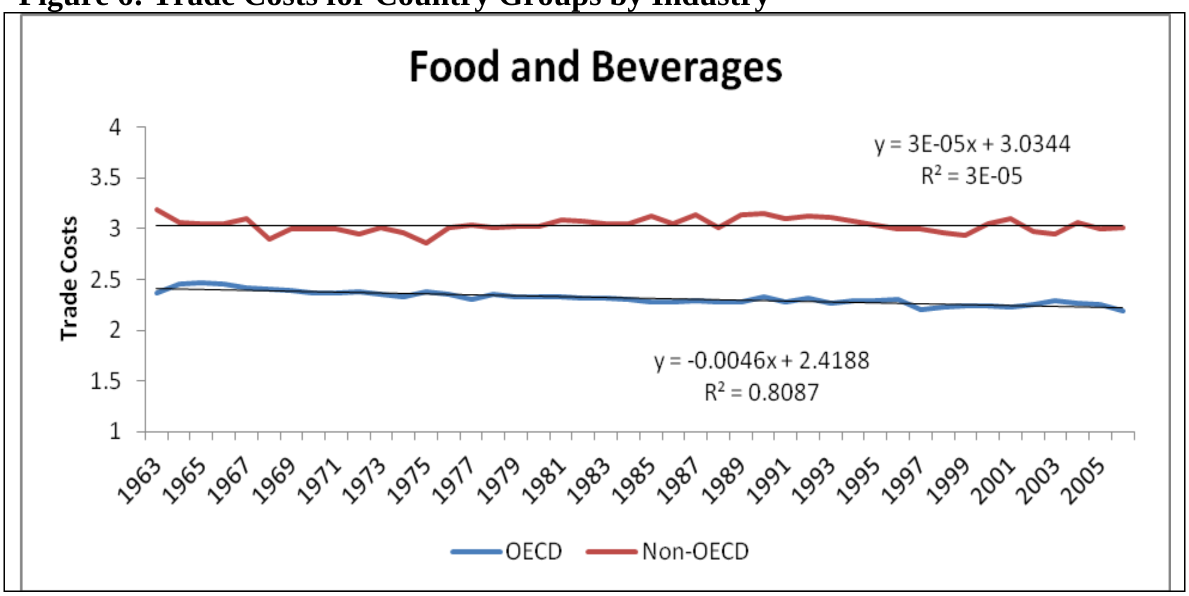
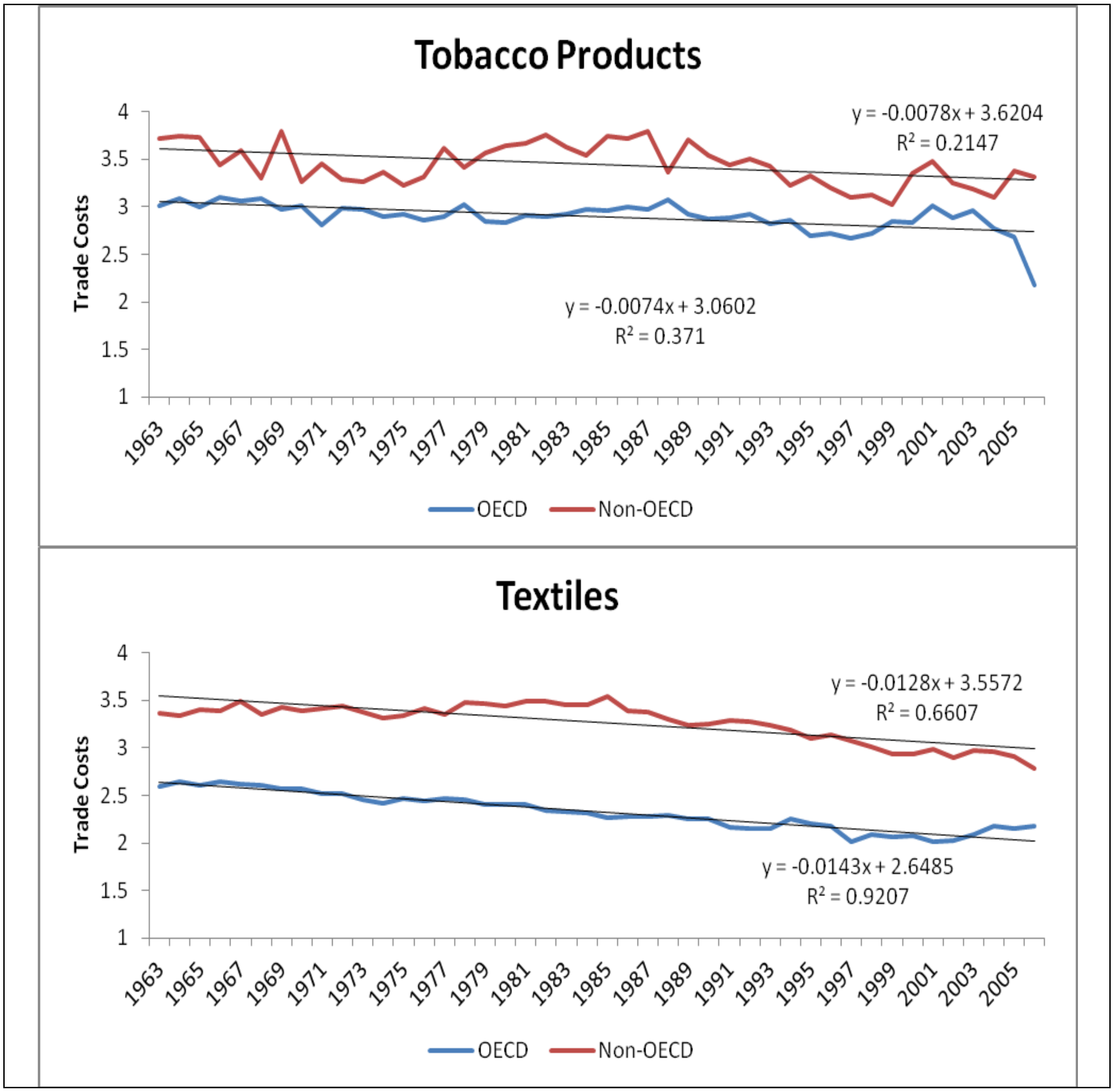
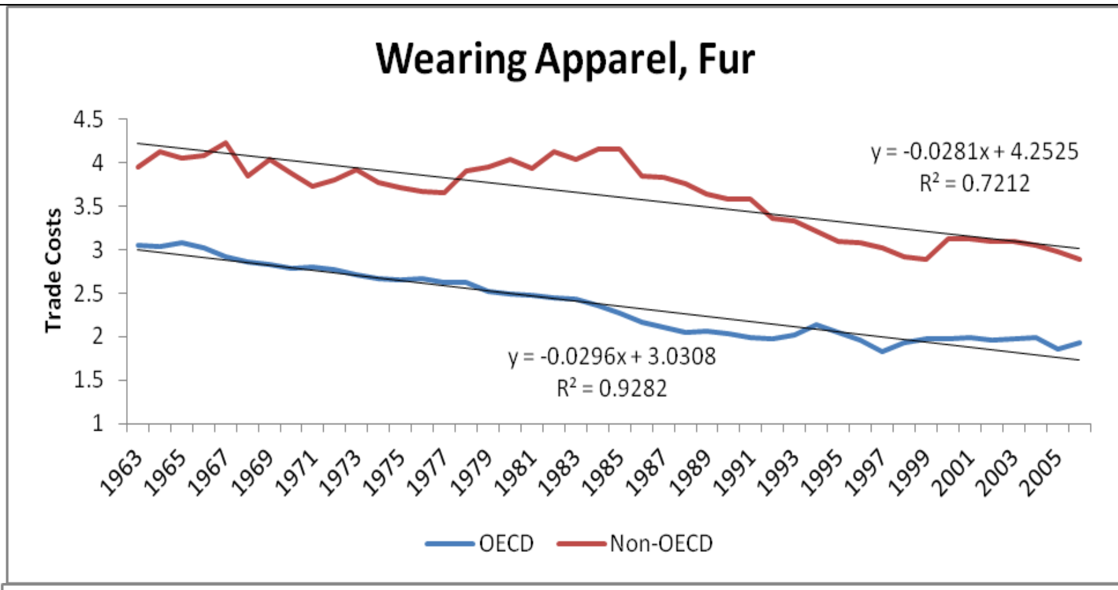
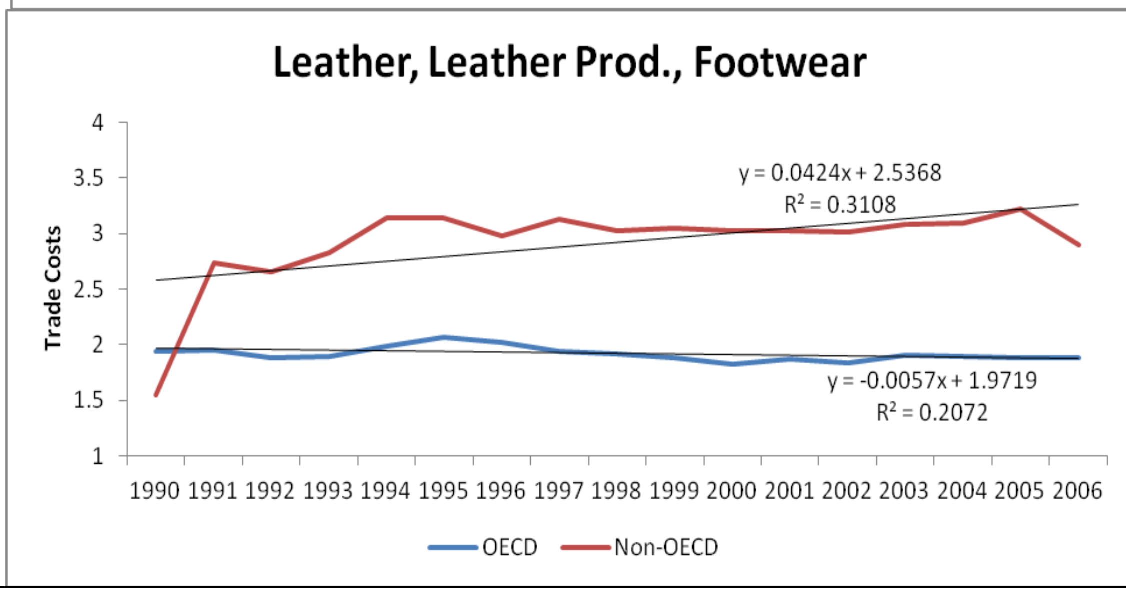


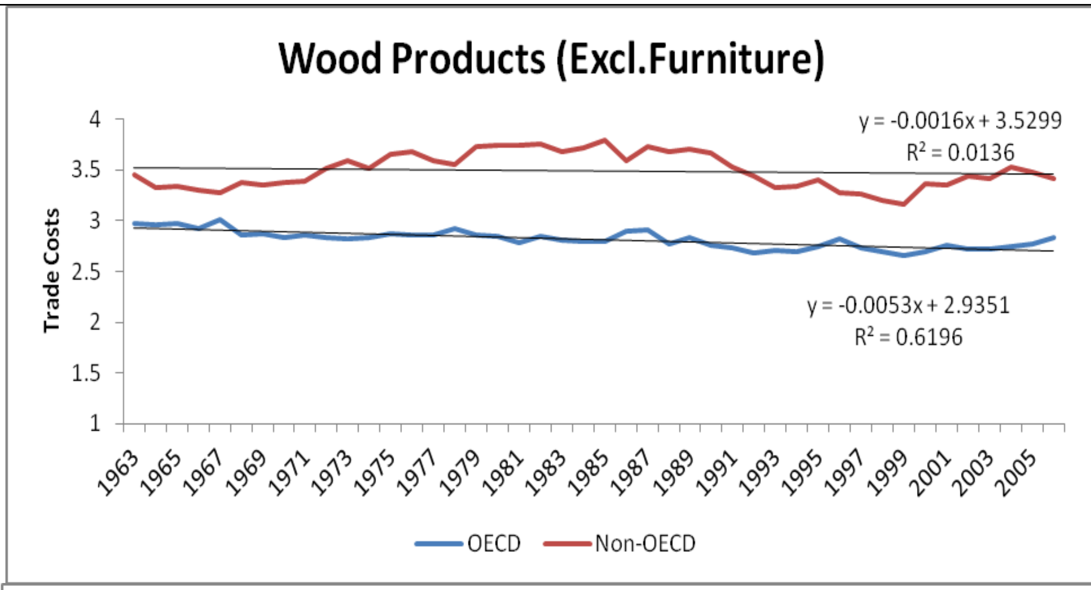
Figure 6: Trade Costs for Country Groups by Industry



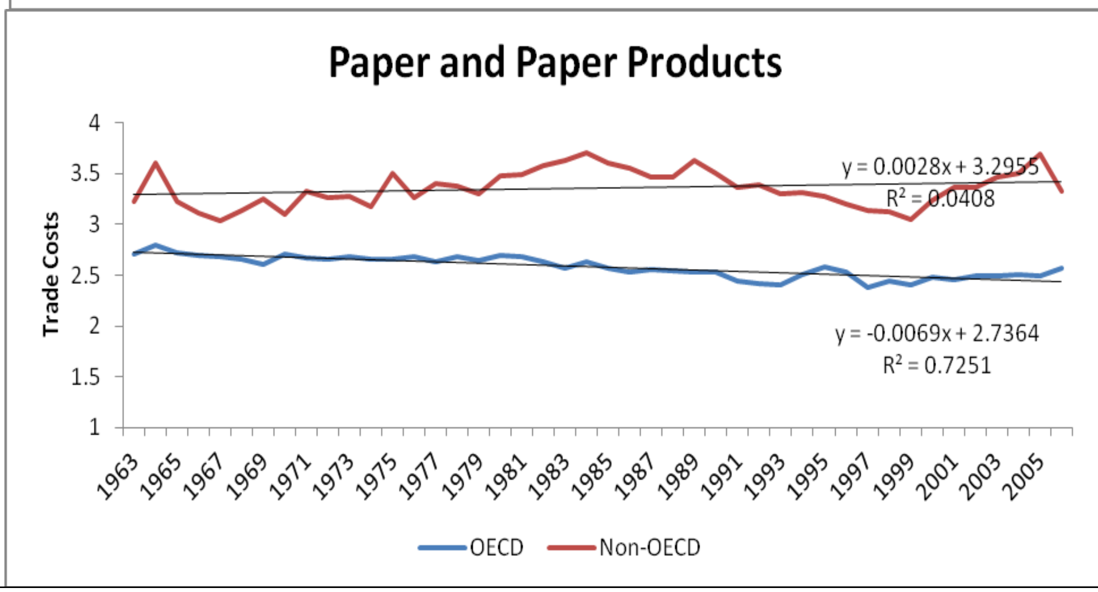

Tobacco Products
y = -0.0078x + 3.6204
R² = 0.2147
y = -0.0074x + 3.0602
R² = 0.371
Trade Costs
OECD
Non-OECD
Textiles
y = -0.0128x + 3.5572
R² = 0.6607
y = -0.0143x + 2.6485
R² = 0.9207
Trade Costs
OECD
Non-OECD


Wearing Apparel, Fur
Trade Costs
y = -0.0281x + 4.2525
R^2 = 0.7212
y = -0.0296x + 3.0308
R^2 = 0.9282
OECD
Non-OECD

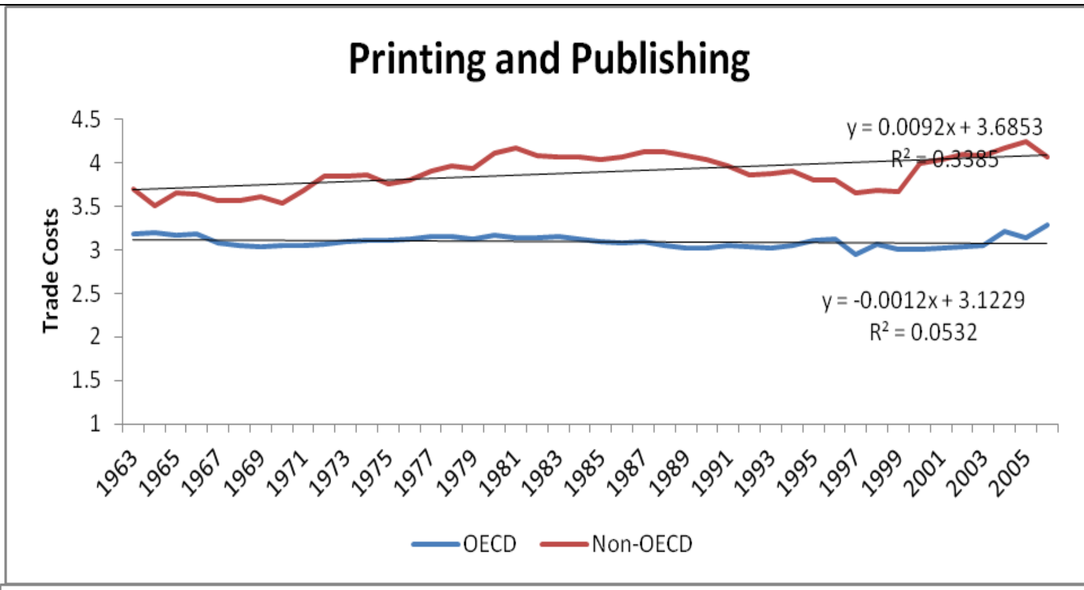

Leather, Leather Prod., Footwear
Trade Costs
y = 0.0424x + 2.5368
R^2 = 0.3108
y = -0.0057x + 1.9719
R^2 = 0.2072
OECD
Non-OECD

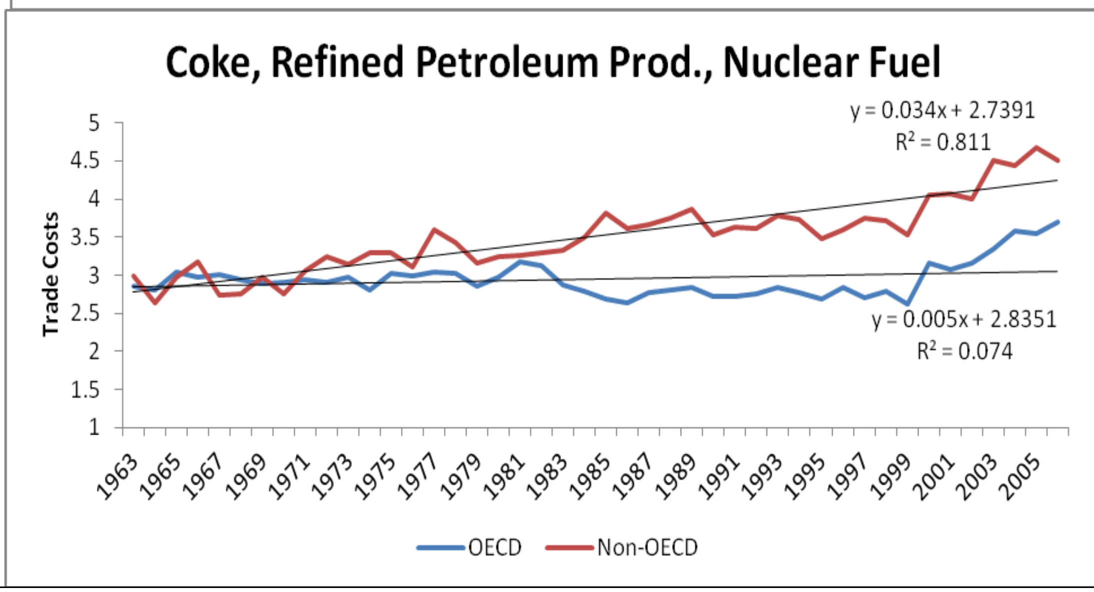


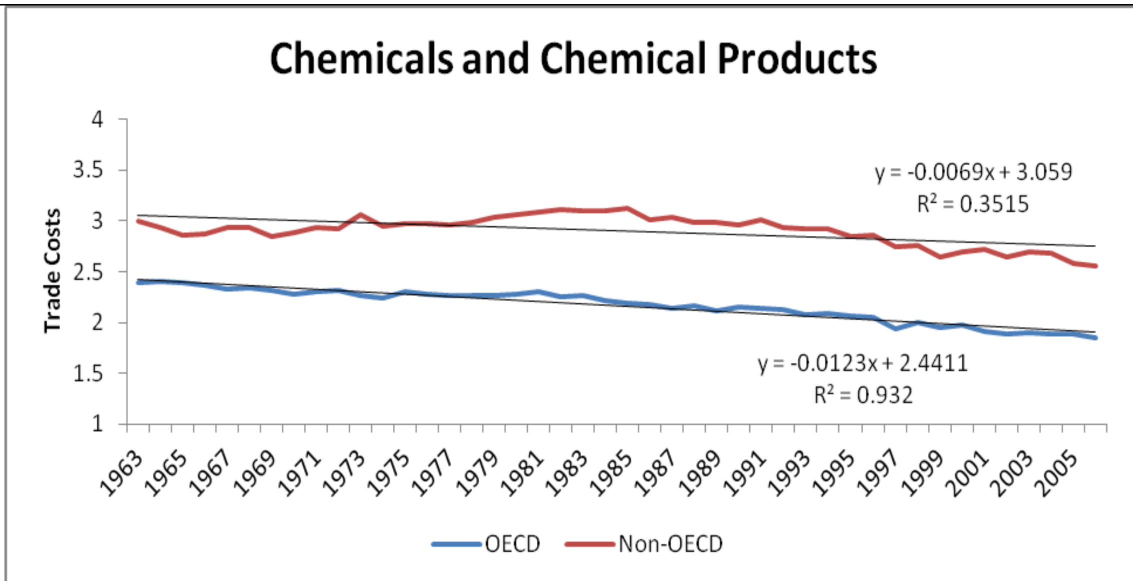
Wood Products (Excl.Furniture)
Trade Costs
y = -0.0016x + 3.5299
R² = 0.0136
y = -0.0053x + 2.9351
R² = 0.6196
OECD
Non-OECD

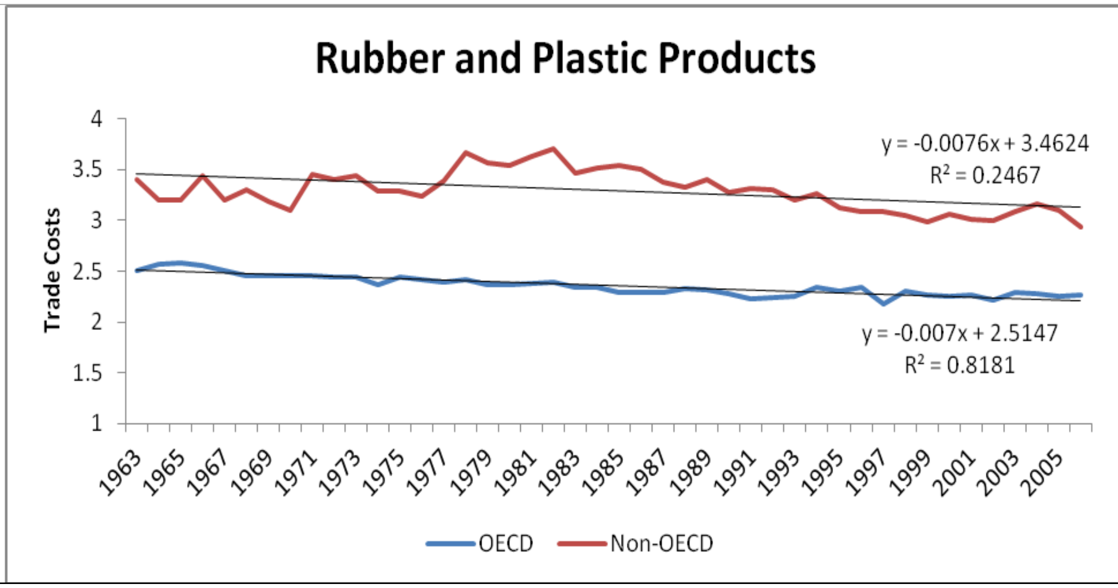


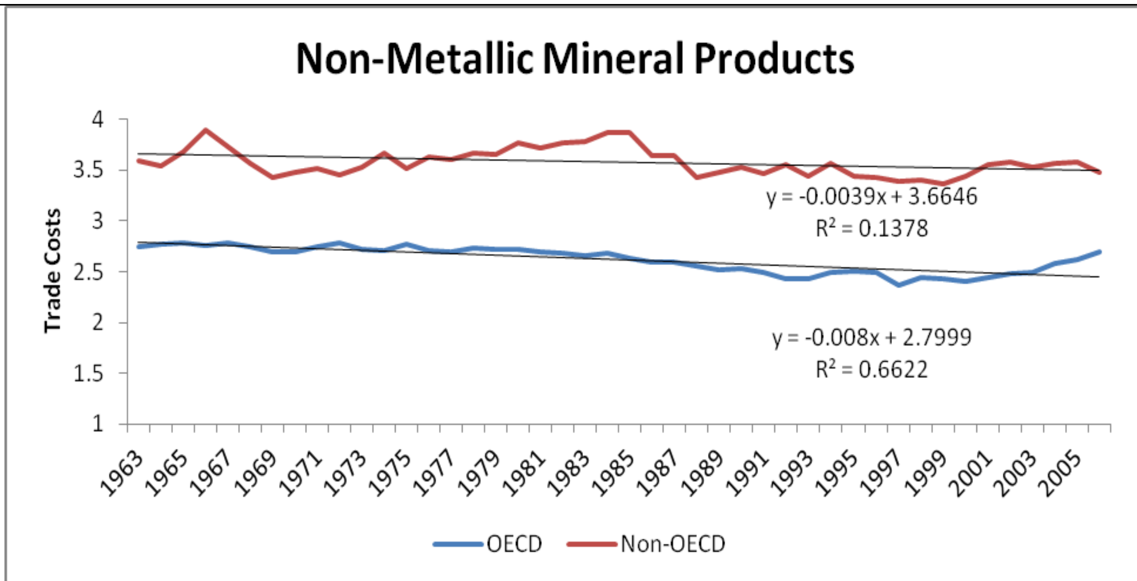
Paper and Paper Products
Trade Costs
y = 0.0028x + 3.2955
R² = 0.0408
y = -0.0069x + 2.7364
R² = 0.7251
OECD
Non-OECD

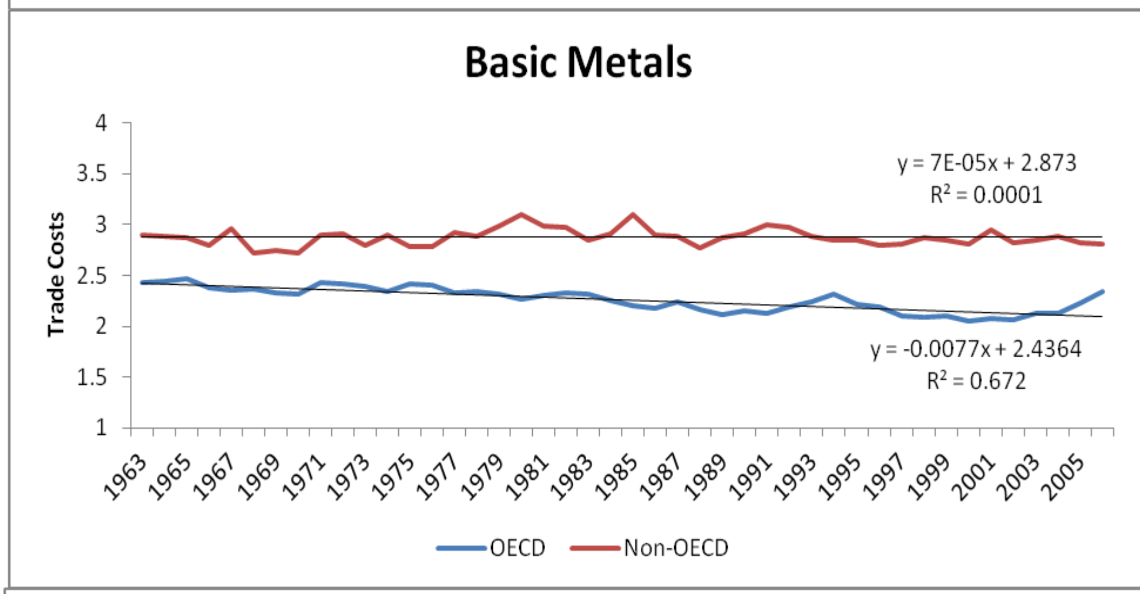

Printing and Publishing
Trade Costs
4.5
4
3.5
3
2.5
2
1.5
1
y = 0.0092x + 3.6853
R² = 0.3385
y = -0.0012x + 3.1229
R² = 0.0532
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
OECD
Non-OECD

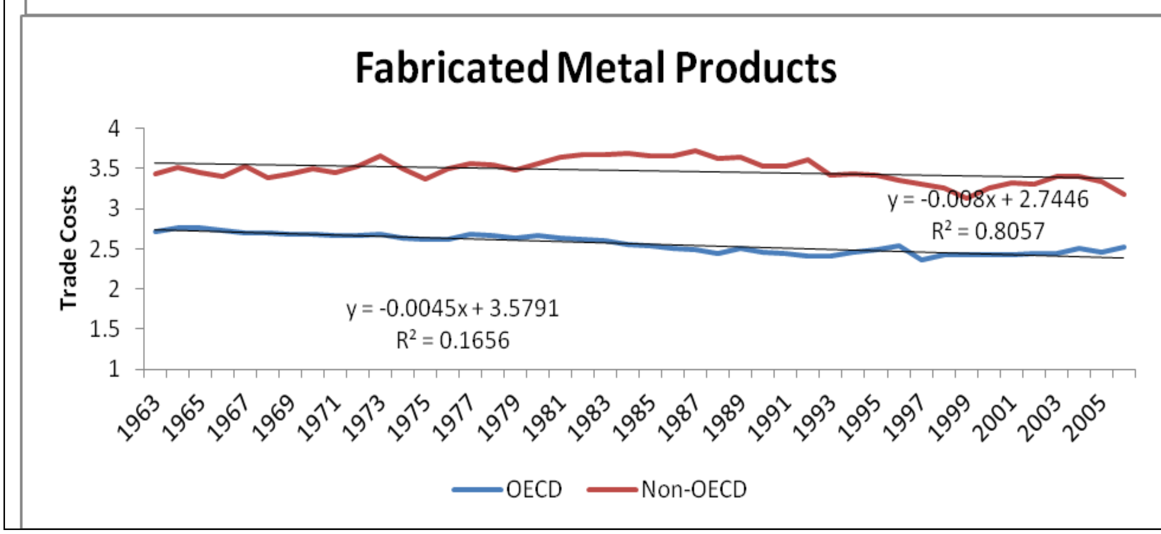

Coke, Refined Petroleum Prod., Nuclear Fuel
Trade Costs
5
4.5
4
3.5
3
2.5
2
1.5
1
y = 0.034x + 2.7391
R² = 0.811
y = 0.005x + 2.8351
R² = 0.074
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
OECD
Non-OECD


Chemicals and Chemical Products
Trade Costs
y = -0.0069x + 3.059
R² = 0.3515
y = -0.0123x + 2.4411
R² = 0.932
OECD
Non-OECD

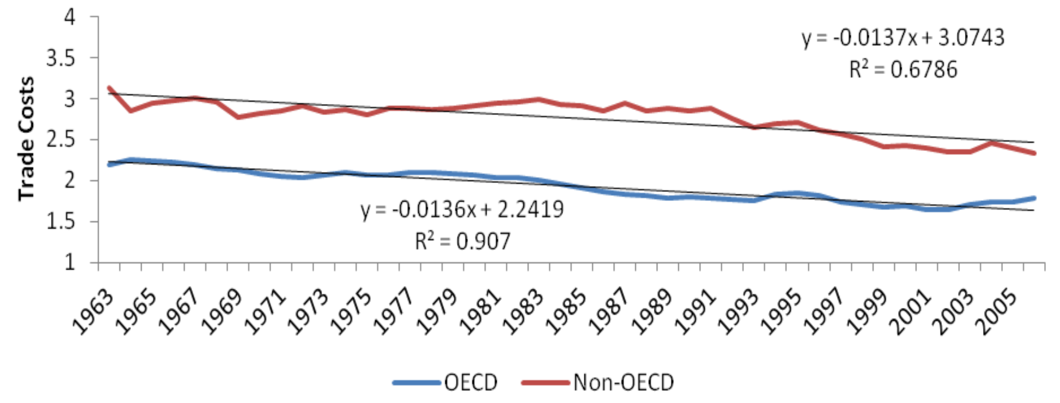

Rubber and Plastic Products
Trade Costs
y = -0.0076x + 3.4624
R² = 0.2467
y = -0.007x + 2.5147
R² = 0.8181
OECD
Non-OECD


Non-Metallic Mineral Products
Trade Costs
y = -0.0039x + 3.6646
R² = 0.1378
y = -0.008x + 2.7999
R² = 0.6622
OECD
Non-OECD

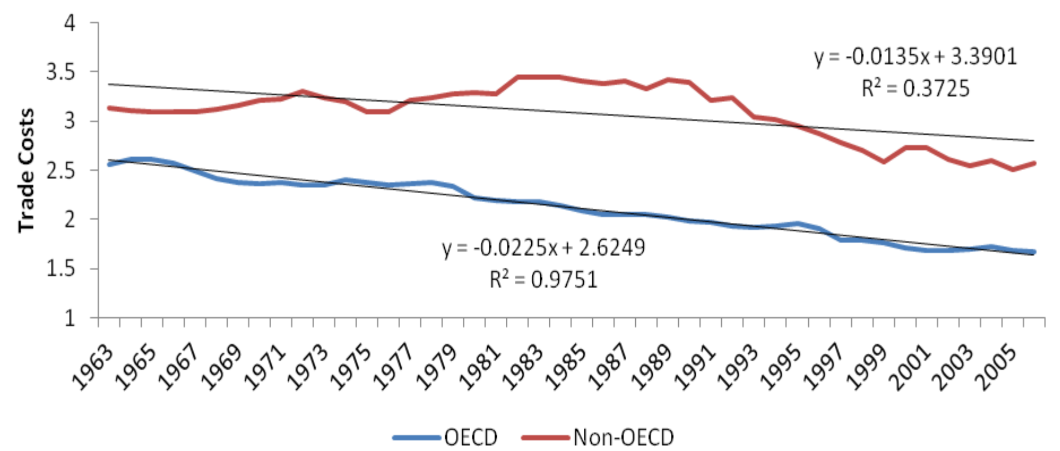

Basic Metals
Trade Costs
y = 7E-05x + 2.873
R² = 0.0001
y = -0.0077x + 2.4364
R² = 0.672
OECD
Non-OECD


Fabricated Metal Products
Trade Costs
y = -0.008x + 2.7446
R² = 0.8057
y = -0.0045x + 3.5791
R² = 0.1656
OECD
Non-OECD

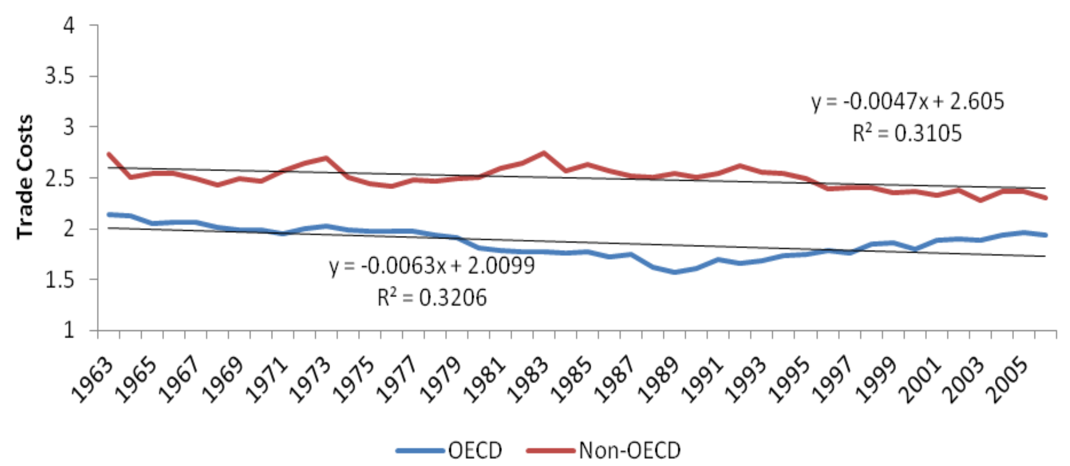
Office, Accounting, Computing, and Other Machinery

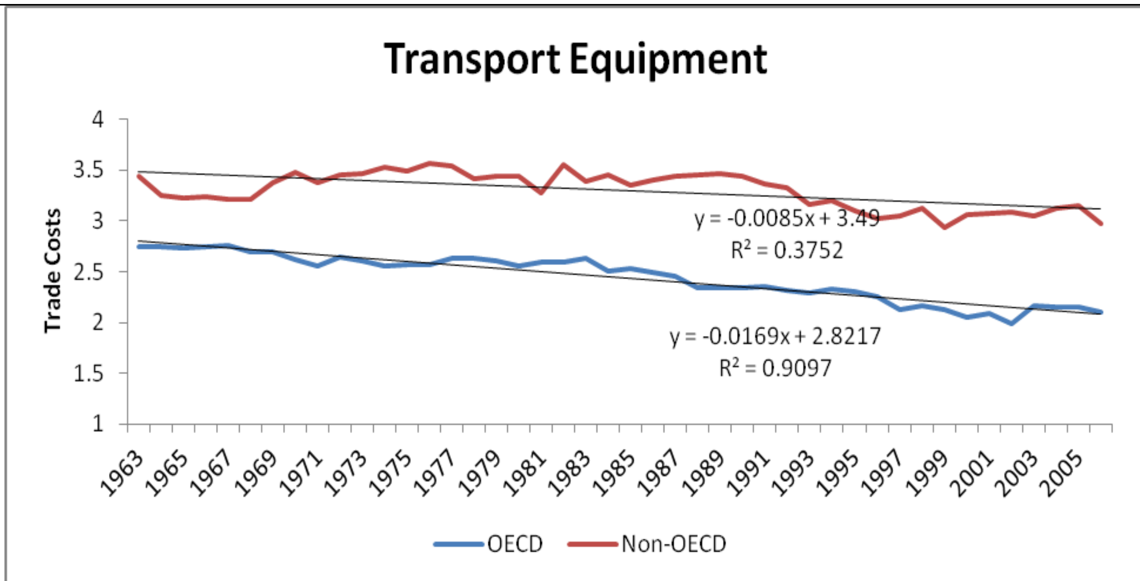


Electrical Machinery, Communication Equipment



Medical, Precision, and Optical Instruments




Transport Equipment
Trade Costs
y = -0.0085x + 3.49
R² = 0.3752
y = -0.0169x + 2.8217
R² = 0.9097
OECD
Non-OECD

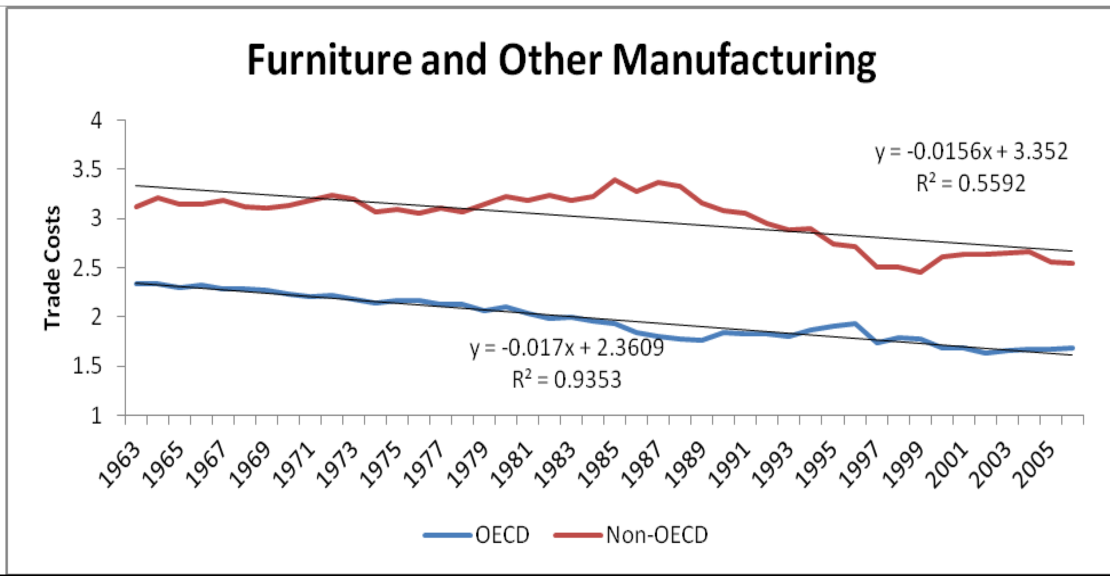

Furniture and Other Manufacturing
Trade Costs
y = -0.0156x + 3.352
R² = 0.5592
y = -0.017x + 2.3609
R² = 0.9353
OECD
Non-OECD

Table 3: % Change in Trade Costs of OECD Countries by decade[17]

Industry	60s-70s	70s-80s	80s-90s	90s-2000s	60-2000s
Food and Beverages	-2.92	-2.05	-1.22	-1.24	-7.24
Tobacco Products	-3.97	0.77	-4.71	-0.14	-7.91
Textiles	-5.23	-6.31	-7.09	-2.51	-19.58
Wearing Apparel, Fur	-9.49	-14.82	-13.02	-1.47	-33.93
Leather and Leather Products, Footwear				-4.06	
Wood Products (Excl. Furniture)	-2.76	-0.98	-3.70	0.86	-6.48
Paper and Paper Products	-0.99	-2.67	-5.14	1.35	-7.36
Printing and Publishing	-0.74	0.20	-2.10	1.98	-0.70
Coke, Refined Petroleum Products, Nuclear Fuel	0.68	-2.76	-4.15	21.73	14.22
Chemicals and Chemical Products	-3.40	-3.06	-6.99	-7.51	-19.45
Rubber and Plastic Products	-3.75	-3.57	-2.65	-0.55	-10.14
Non-Metallic Mineral Products	-0.98	-3.41	-6.58	2.70	-8.24
Basic Metals	-1.07	-5.58	-2.97	-1.44	-10.67
Fabricated Metal Products	-2.27	-3.74	-4.57	0.78	-9.53
Office, Accounting, Computing, and Other Machinery	-5.46	-6.99	-8.00	-4.00	-22.34
Electrical Machinery, Communication Equipment	-6.04	-10.43	-10.68	-10.45	-32.68
Medical, Precision, and Optical Instruments	-4.20	-12.19	0.51	8.90	-7.91
Transport Equipment	-4.77	-3.56	-9.83	-7.01	-22.99
Furniture and Other Manufacturing	-6.08	-11.25	-4.72	-8.77	-27.54
Total Manufacturing	**-4.09**	**-5.81**	**-5.61**	**-2.63**	**-16.98**

Table 4: % Change in Trade Costs of Non-OECD Countries by decade[17]

Industry	60s-70s	70s-80s	80s-90s	90s-2000s	60-2000s
Food and Beverages	-1.66	3.00	-0.83	-0.95	-0.51
Tobacco Products	-6.27	8.30	-9.88	0.06	-8.45
Textiles	0.10	0.63	-7.79	-7.27	-13.87
Wearing Apparel, Fur	-5.90	4.19	-18.79	-4.85	-24.24
Leather and Leather Products, Footwear				0.97	
Wood Products (Excl. Furniture)	6.54	4.18	-9.61	1.99	2.32
Paper and Paper Products	2.70	7.81	-8.36	4.74	6.27
Printing and Publishing	6.00	7.17	-6.48	6.99	13.67
Coke, Refined Petroleum Products, Nuclear Fuel	11.76	9.72	3.05	18.54	49.78
Chemicals and Chemical Products	2.07	2.96	-6.43	-7.21	-8.75
Rubber and Plastic Products	3.48	3.48	-9.57	-3.72	-6.77
Non-Metallic Mineral Products	-1.21	3.45	-6.55	2.10	-2.49
Basic Metals	1.30	2.41	-1.95	-0.79	0.91
Fabricated Metal Products	1.84	4.16	-7.06	-2.36	-3.74
Office, Accounting, Computing, and Other Machinery	-2.87	2.02	-8.62	-10.34	-18.81
Electrical Machinery, Communication Equipment	2.83	5.65	-12.19	-11.97	-16.02
Medical, Precision, and Optical Instruments	-0.14	2.61	-4.04	-5.49	-7.08
Transport Equipment	6.10	-1.52	-7.39	-2.94	-6.08
Furniture and Other Manufacturing	-0.53	4.14	-14.75	-5.73	-16.76
Total Manufacturing	**-0.68**	**-2.70**	**-8.52**	**-6.61**	**-17.43**

Table 5: Ratio of Average Trade Costs of Non-OECD to OECD by decade

Industry	1960s	1970s	1980s	1990s	2000s
Food and Beverages	1.25	1.27	1.34	1.34	1.35
Tobacco Products	1.18	1.16	1.24	1.18	1.18
Textiles	1.30	1.37	1.48	1.46	1.39
Wearing Apparel, Fur	1.36	1.42	1.73	1.62	1.56
Leather and Leather Products, Footwear				1.55	1.63
Wood Products (Excl. Furniture)	1.14	1.25	1.31	1.23	1.25
Paper and Paper Products	1.19	1.24	1.37	1.33	1.37
Printing and Publishing	1.15	1.23	1.32	1.26	1.32
Coke, Refined Petroleum Products, Nuclear Fuel	0.98	1.09	1.23	1.32	1.29
Chemicals and Chemical Products	1.23	1.30	1.38	1.39	1.40
Rubber and Plastic Products	1.30	1.40	1.50	1.39	1.35
Non-Metallic Mineral Products	1.31	1.31	1.40	1.40	1.40
Basic Metals	1.18	1.21	1.31	1.32	1.33
Fabricated Metal Products	1.27	1.32	1.43	1.39	1.35
Office, Accounting, Computing, and Other Machinery	1.34	1.38	1.51	1.50	1.40
Electrical Machinery, Communication Equipment	1.24	1.36	1.60	1.57	1.55
Medical, Precision, and Optical Instruments	1.22	1.28	1.49	1.42	1.24
Transport Equipment	1.20	1.34	1.37	1.40	1.46
Furniture and Other Manufacturing	1.36	1.44	1.69	1.52	1.57
Total Manufacturing	**1.40**	**1.45**	**1.50**	**1.45**	**1.39**

Figure 7: Total Manufacturing Trade Costs according to the Country Group of the Partner

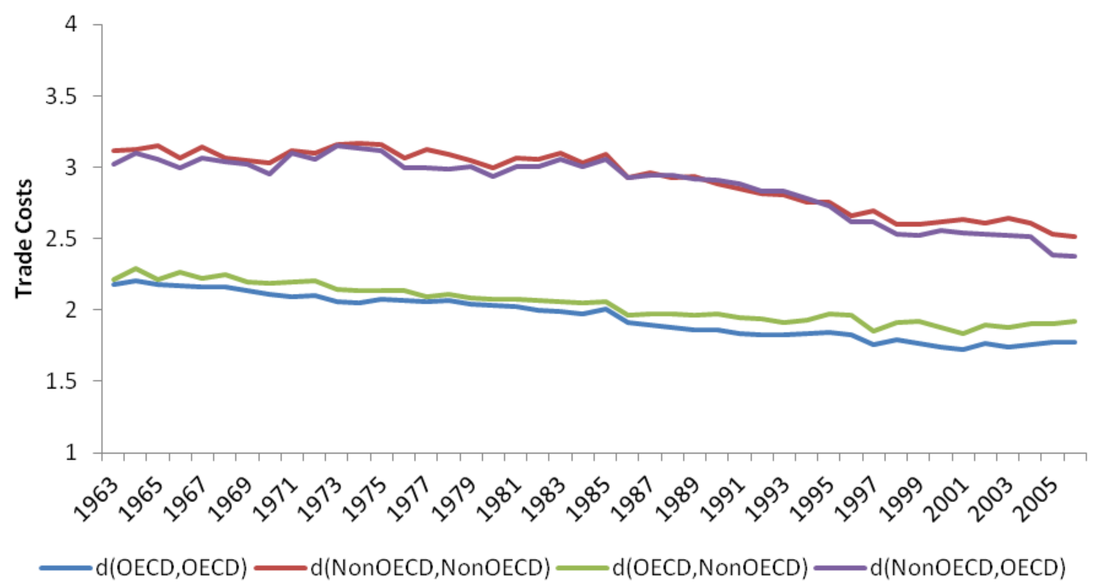
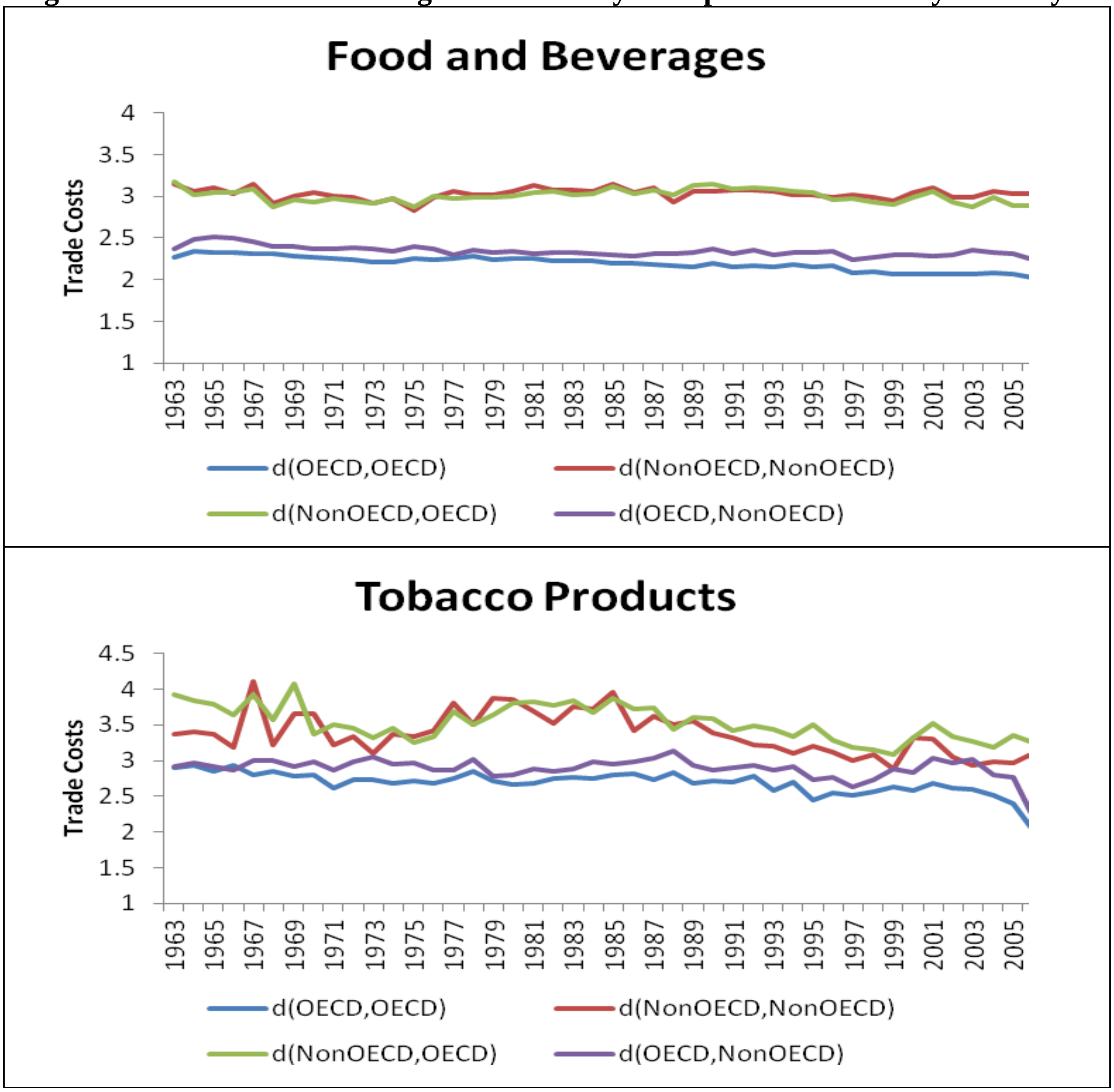
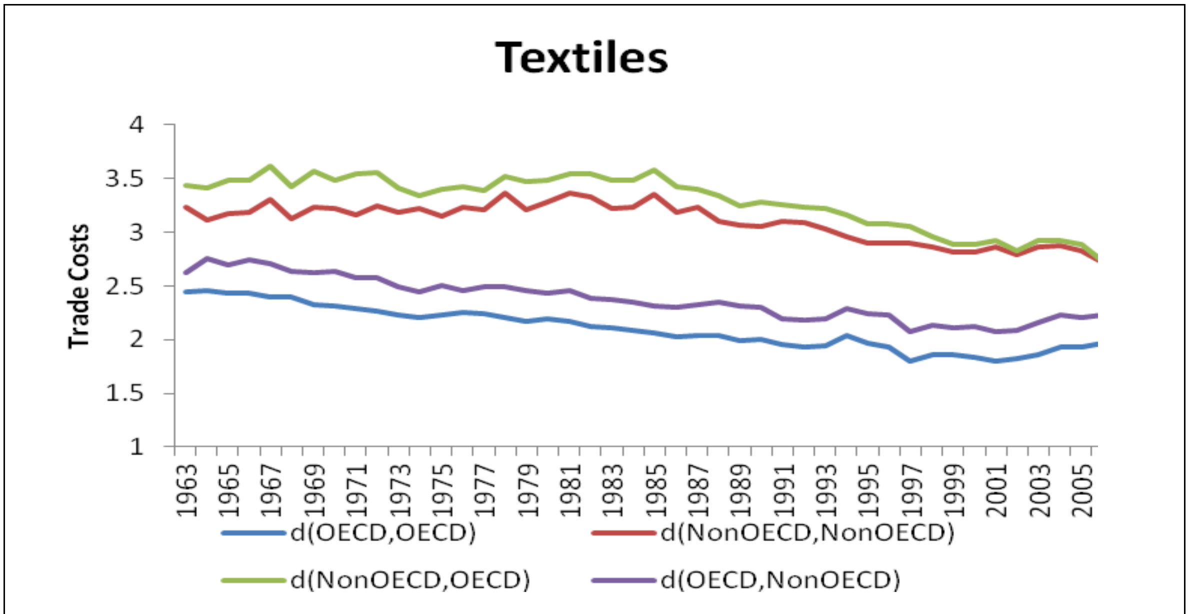
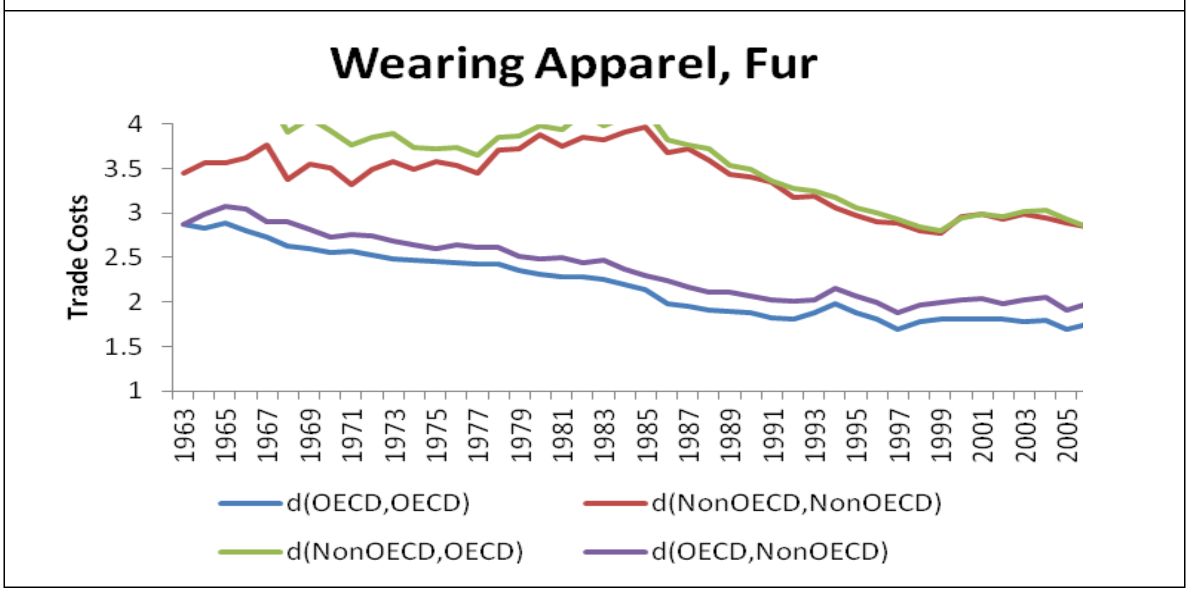
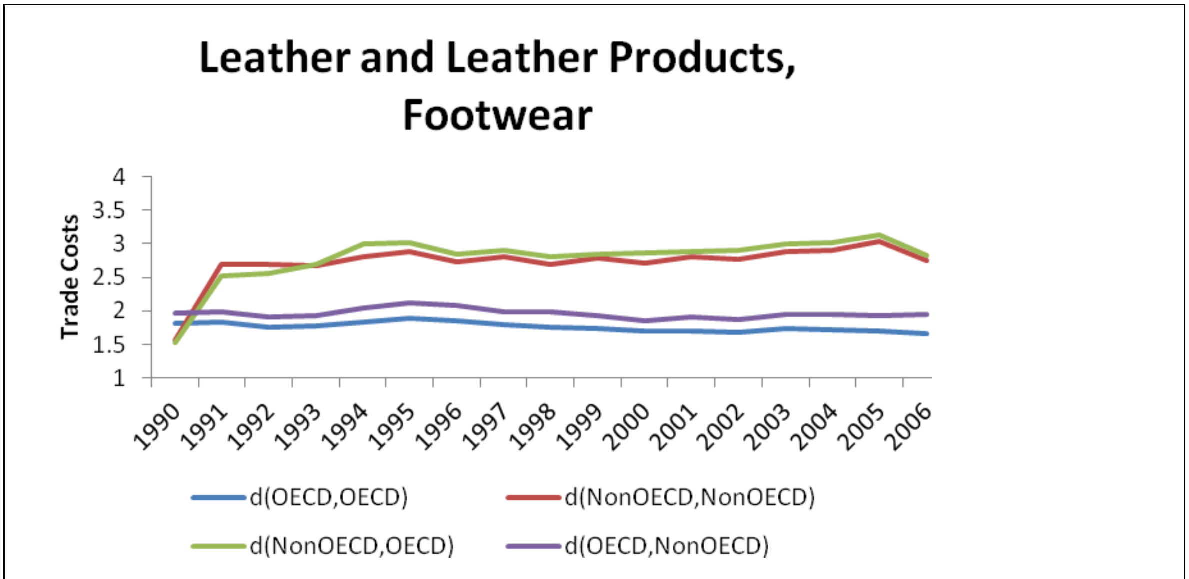


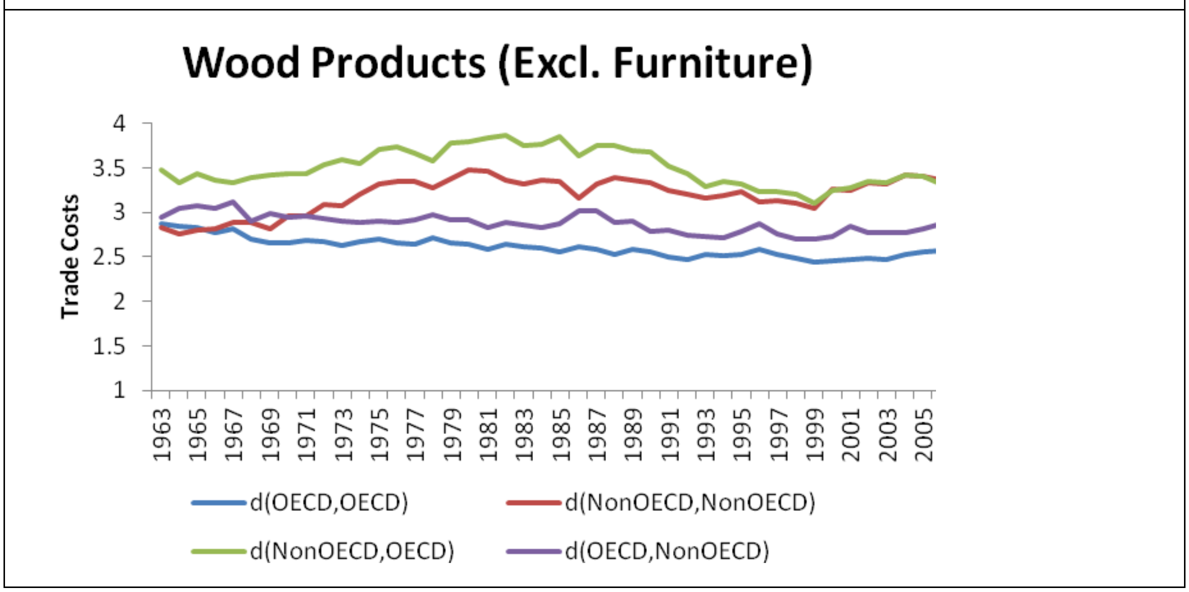
Figure 8: Trade Costs according to the Country Group of the Partner by Industry

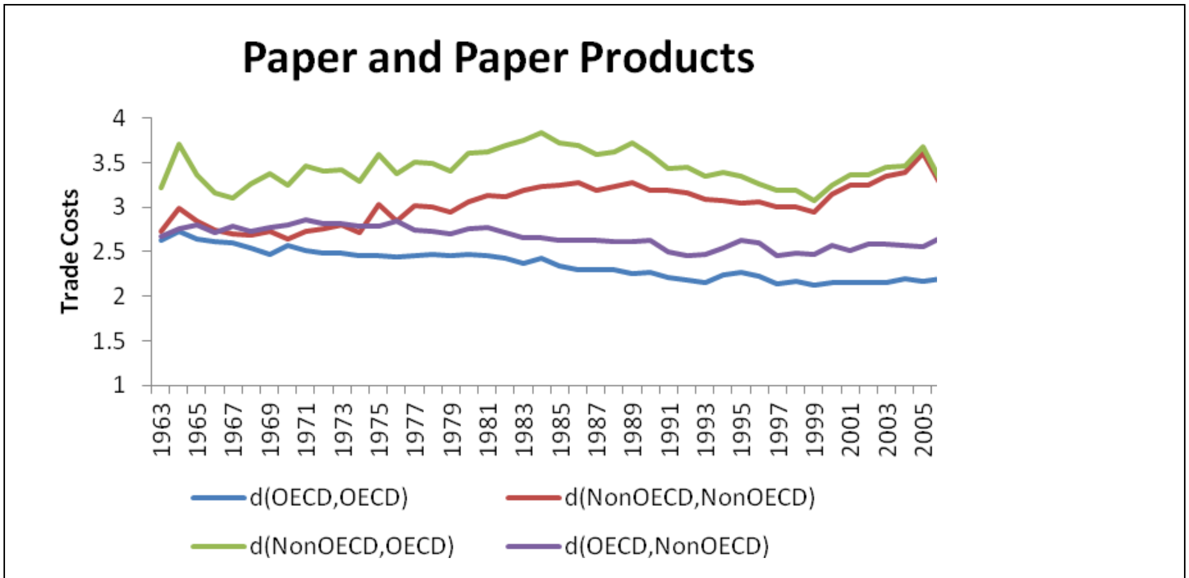


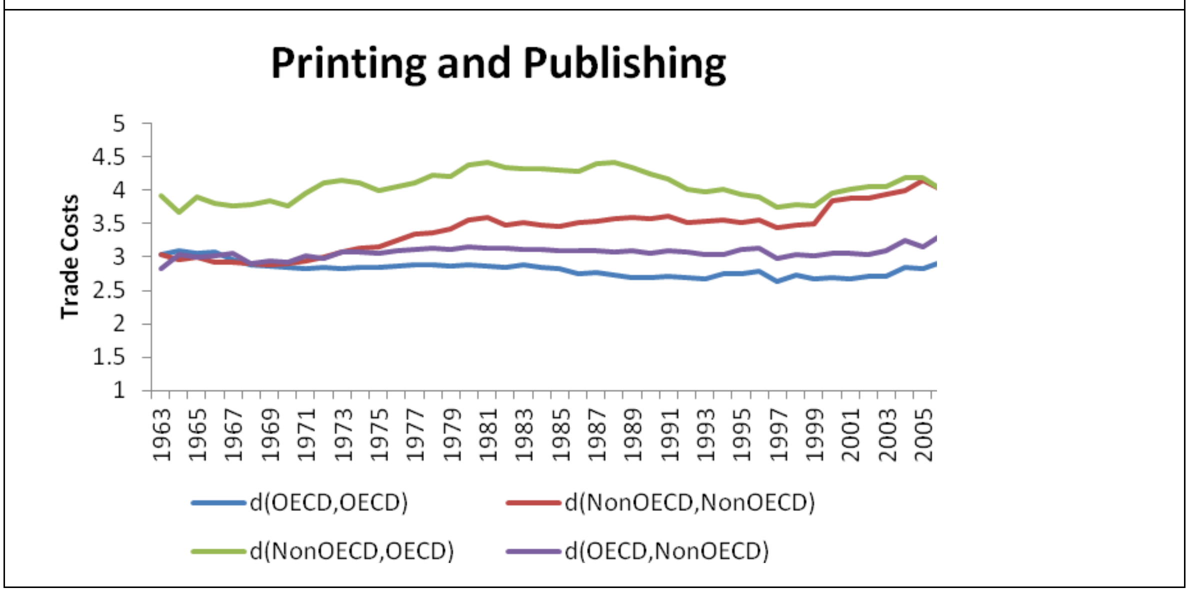

Textiles
Trade Costs
4
3.5
3
2.5
2
1.5
1
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
d(OECD,OECD)
d(NonOECD,NonOECD)
d(NonOECD,OECD)
d(OECD,NonOECD)


Wearing Apparel, Fur
Trade Costs
4
3.5
3
2.5
2
1.5
1
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
d(OECD,OECD)
d(NonOECD,NonOECD)
d(NonOECD,OECD)
d(OECD,NonOECD)


Leather and Leather Products, Footwear
Trade Costs
4
3.5
3
2.5
2
1.5
1
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
d(OECD,OECD)
d(NonOECD,NonOECD)
d(NonOECD,OECD)
d(OECD,NonOECD)


Wood Products (Excl. Furniture)
Trade Costs
4
3.5
3
2.5
2
1.5
1
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
d(OECD,OECD)
d(NonOECD,NonOECD)
d(NonOECD,OECD)
d(OECD,NonOECD)


Paper and Paper Products
Trade Costs
4
3.5
3
2.5
2
1.5
1
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
d(OECD,OECD)
d(NonOECD,NonOECD)
d(NonOECD,OECD)
d(OECD,NonOECD)


Printing and Publishing
Trade Costs
5
4.5
4
3.5
3
2.5
2
1.5
1
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
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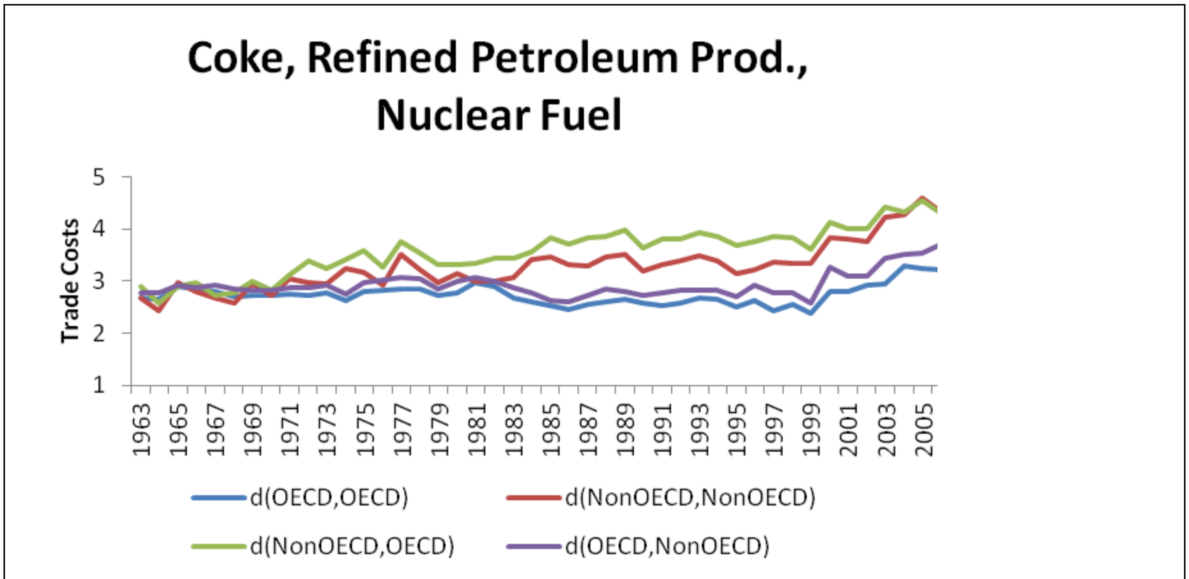
2001
2003
2005
d(OECD,OECD)
d(NonOECD,NonOECD)
d(NonOECD,OECD)
d(OECD,NonOECD)


Coke, Refined Petroleum Prod., Nuclear Fuel
Trade Costs
5
4
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1963
1965
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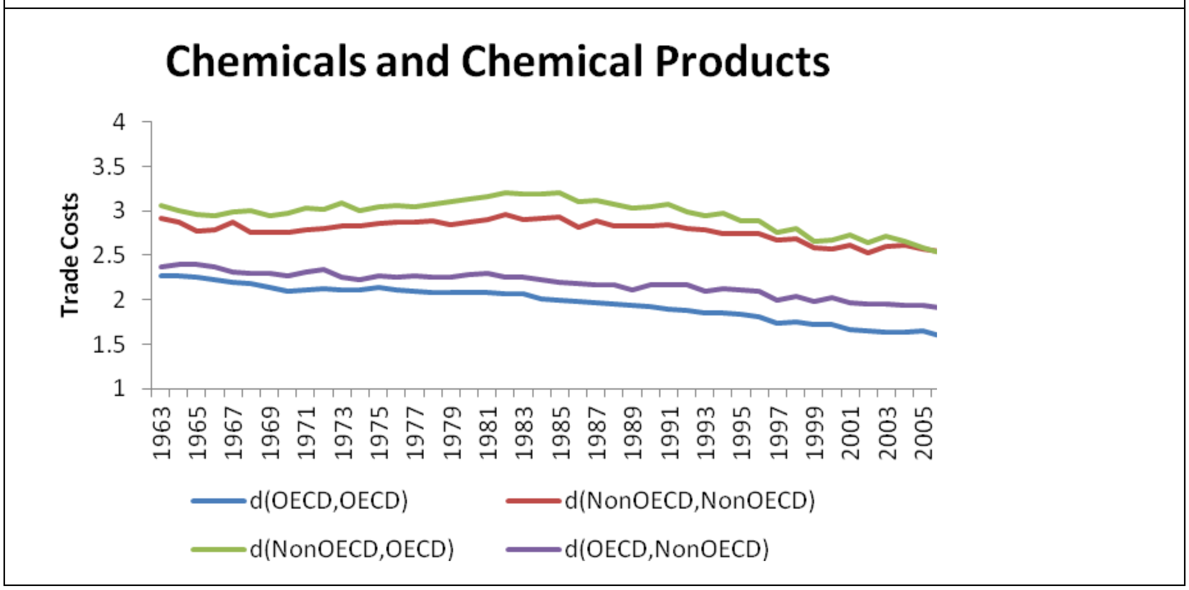
2005
d(OECD,OECD)
d(NonOECD,NonOECD)
d(NonOECD,OECD)
d(OECD,NonOECD)


Chemicals and Chemical Products
Trade Costs
4
3.5
3
2.5
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1.5
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1963
1965
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1973
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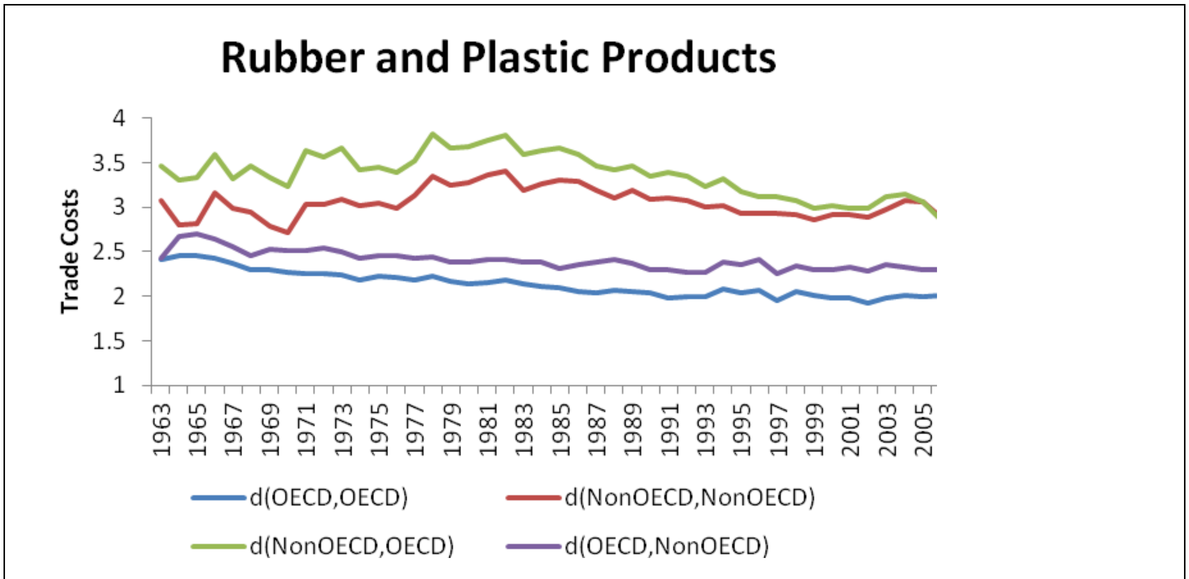
2003
2005
d(OECD,OECD)
d(NonOECD,NonOECD)
d(NonOECD,OECD)
d(OECD,NonOECD)


Rubber and Plastic Products
Trade Costs
4
3.5
3
2.5
2
1.5
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1963
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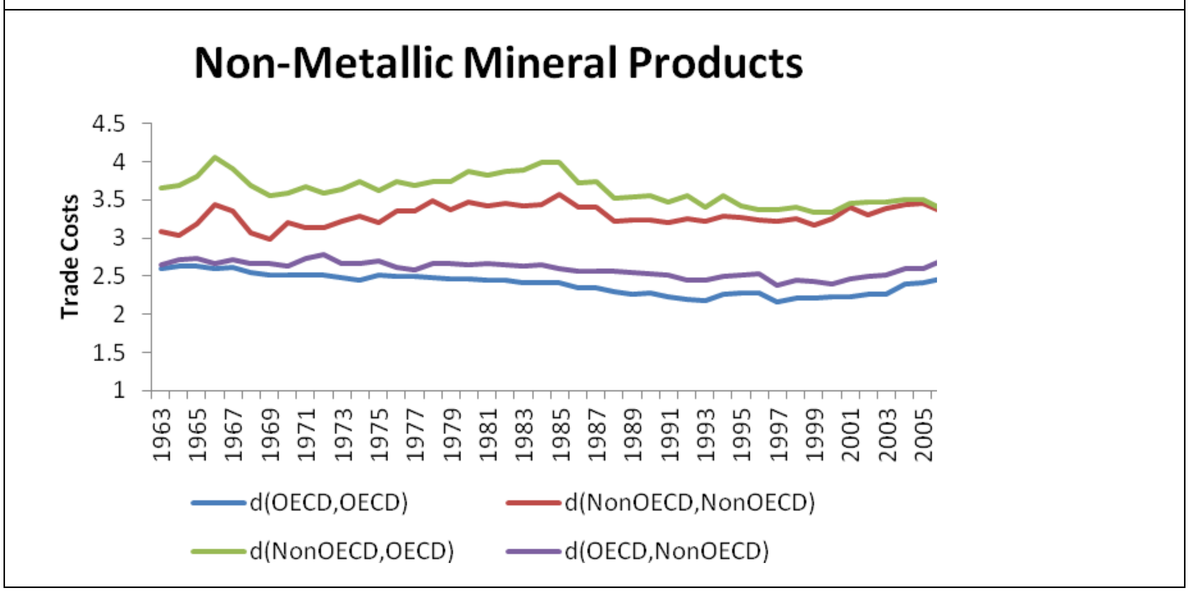
2003
2005
d(OECD,OECD)
d(NonOECD,NonOECD)
d(NonOECD,OECD)
d(OECD,NonOECD)


Non-Metallic Mineral Products
Trade Costs
4.5
4
3.5
3
2.5
2
1.5
1
1963
1965
1967
1969
1971
1973
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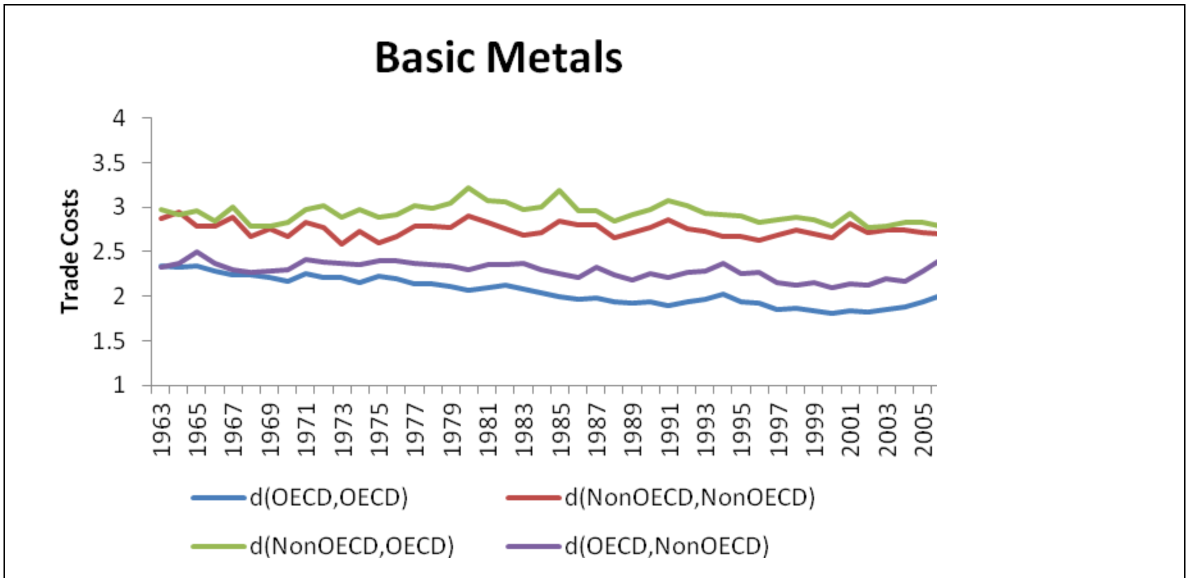
2001
2003
2005
d(OECD,OECD)
d(NonOECD,NonOECD)
d(NonOECD,OECD)
d(OECD,NonOECD)


Basic Metals
Trade Costs
4
3.5
3
2.5
2
1.5
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1963
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1969
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1973
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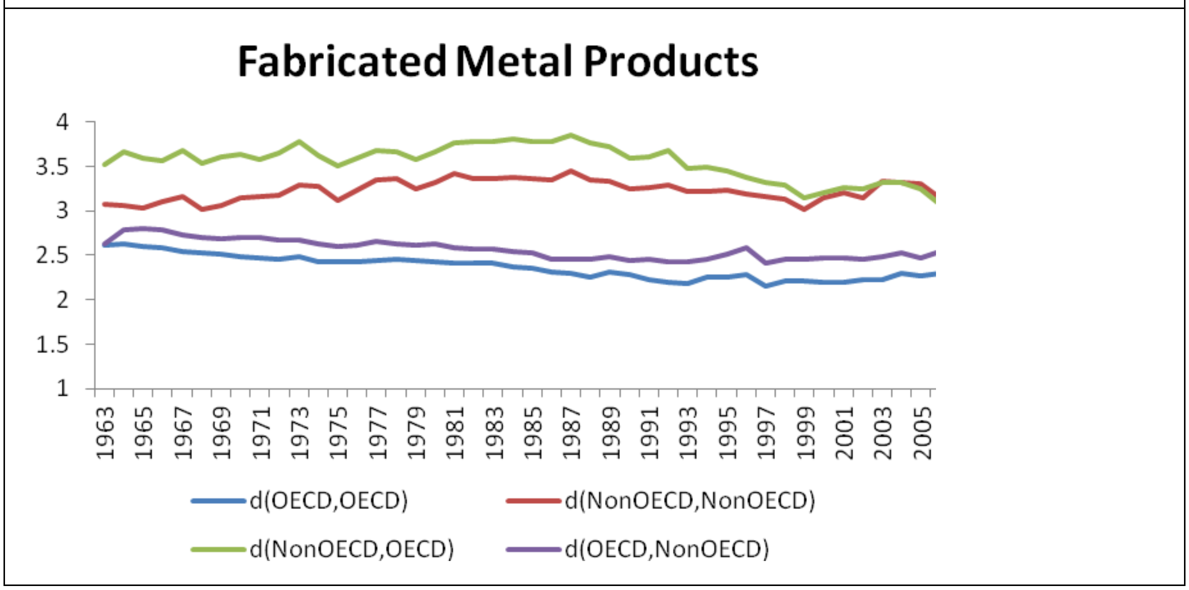
2003
2005
d(OECD,OECD)
d(NonOECD,NonOECD)
d(NonOECD,OECD)
d(OECD,NonOECD)


Fabricated Metal Products
4
3.5
3
2.5
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1.5
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1963
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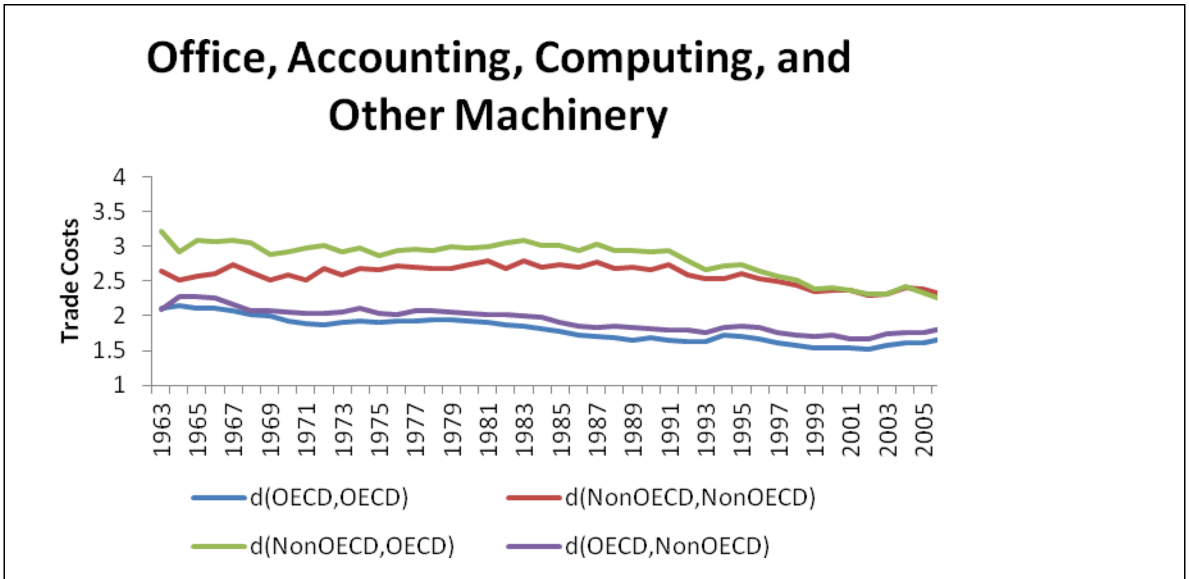
2003
2005
d(OECD,OECD)
d(NonOECD,NonOECD)
d(NonOECD,OECD)
d(OECD,NonOECD)



Office, Accounting, Computing, and Other Machinery
Trade Costs
4
3.5
3
2.5
2
1.5
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1963
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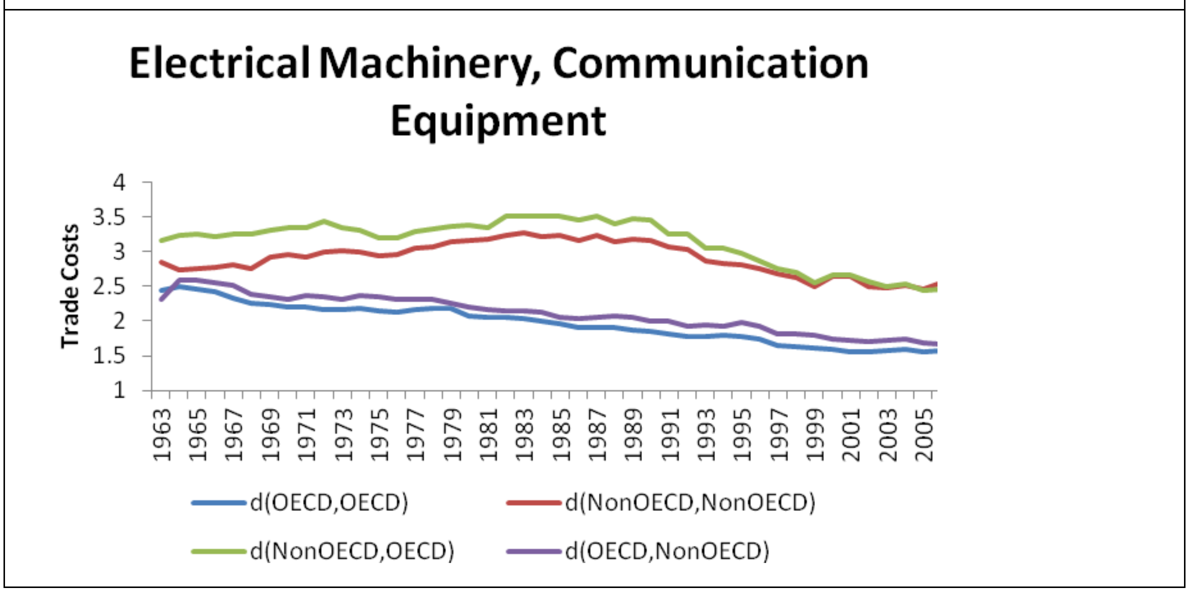
d(OECD,OECD)
d(NonOECD,NonOECD)
d(NonOECD,OECD)
d(OECD,NonOECD)



Electrical Machinery, Communication Equipment
Trade Costs
4
3.5
3
2.5
2
1.5
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1963
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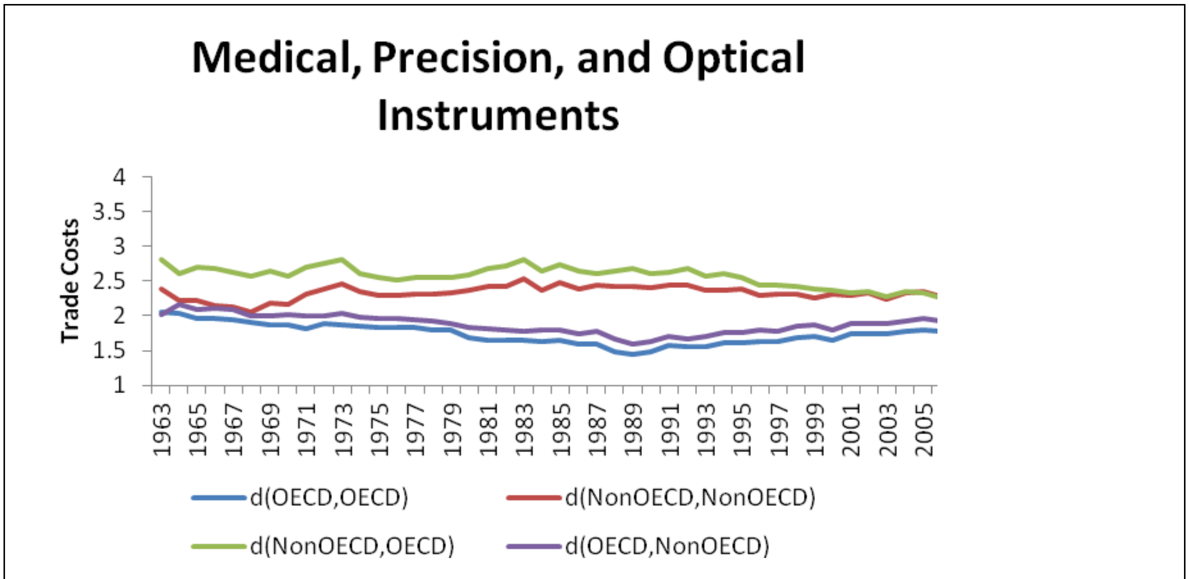
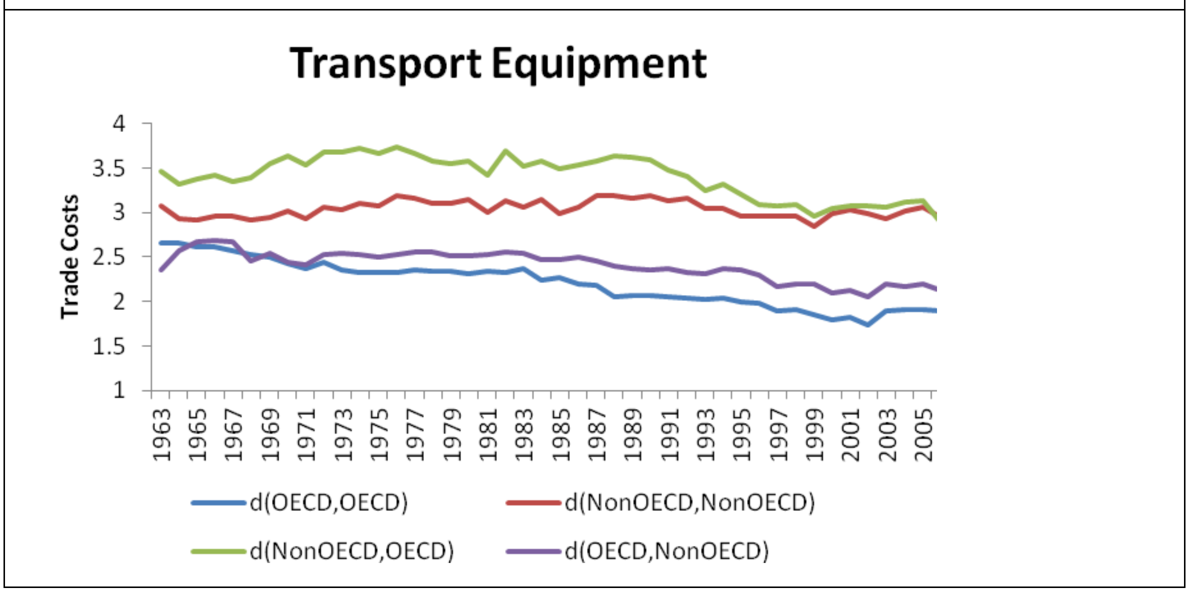
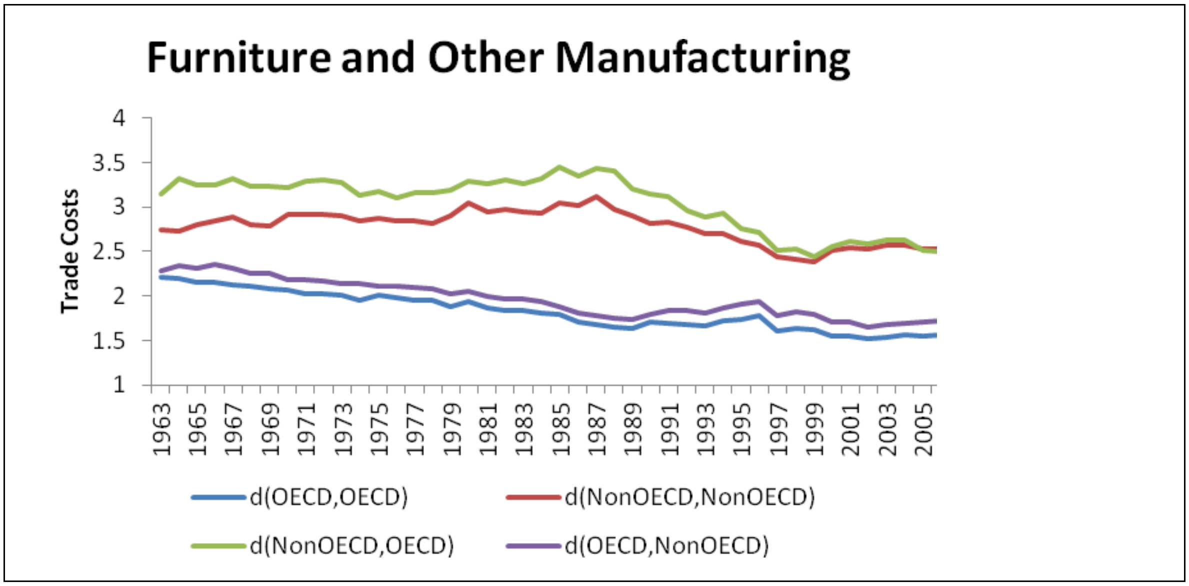
d(OECD,OECD)
d(NonOECD,NonOECD)
d(NonOECD,OECD)
d(OECD,NonOECD)



Medical, Precision, and Optical Instruments
Trade Costs
4
3.5
3
2.5
2
1.5
1
1963 1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005
d(OECD,OECD)
d(NonOECD,NonOECD)
d(NonOECD,OECD)
d(OECD,NonOECD)



Transport Equipment
Trade Costs
4
3.5
3
2.5
2
1.5
1
1963 1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005
d(OECD,OECD)
d(NonOECD,NonOECD)
d(NonOECD,OECD)
d(OECD,NonOECD)


Furniture and Other Manufacturing
Trade Costs
4
3.5
3
2.5
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1.5
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1963
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2003
2005
d(OECD,OECD)
d(NonOECD,NonOECD)
d(NonOECD,OECD)
d(OECD,NonOECD)