Income-Related Biases in International Trade: What Do Trademark Registration Data Tell Us?

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Abstract: Rich countries trade more among themselves than with poor economies due to a closer match of exporter supply structures and importer preferences. In the literature, the closeness of supply and demand has traditionally been determined by the quality of products—as expressed in the Linder hypothesis. This paper examines an extension of the hypothesis by considering the extent of brand differentiation as another determinant of the closeness of supply and demand. The analysis employs information on international trademark registrations to test whether richer countries import more from countries exporting products of higher quality and greater brand differentiation. The hypothesis is confirmed in most consumer goods sectors. JEL no. F 10, O 34
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1 Introduction

Economists have long recognized that richer countries trade more among themselves than with poorer countries due to a closer match of exporter supply structures and importer preferences. Traditionally, the factor that determines the closeness of supply and demand has been the quality of products. Linder (1961) first pointed out that richer countries are likely to spend a larger share of their income on higher quality products. At the same time, more developed economies are likely to have a comparative advantage in producing high quality goods. Hence, one would expect production in the rich world to match more closely consumption in the rich world, thus leading to relatively more trade among developed nations.

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A number of authors have formalized and extended Linder's analysis of the role of product quality in trade. In Murphy and Shleifer's (1997) Ricardian trade model, the key variable determining both a comparative advantage in producing high quality products and a taste for high quality goods is a country's endowment of human capital. Falvey and Kierzkowski (1987) develop a model whereby demand for high quality products increases with consumers' income and analyze how trading patterns are determined by cross-country differences in capital and labor endowments, production technologies and income distribution.[1]

Few empirical studies verify the predictions of the theoretical literature. Applications of the gravity model of bilateral trade have attempted to take into account the Linder hypothesis by adding the absolute difference in trading partners' per capita GDPs as an additional explanatory variable in the regression equation (Leamer and Levinsohn 1995). The most careful study to date, Hallak (2001), develops a model of import demand that explicitly allows for cross-country differences in consumers' preference for quality and estimates it using bilateral trade flows at the sectoral level. Differences in the quality of countries' exports are captured by a quality index based on cross-country differences in unit values of US imports at the ten-digit Harmonized System level. The study confirms that richer economies indeed import more from countries exhibiting a higher value of the quality index.

However, a closer match between exporter supply structures and importer preferences may not only be due to product quality. Exporters often horizontally differentiate their products and employ various forms of marketing to influence consumer preferences in the importing country.[2] If richer countries specialize in the production of more differentiated products and consumers in richer countries have a more pronounced taste for brand differentiation, trading patterns will, inter alia, be biased toward trade among developed nations.[3] Thus the effect postulated in the Linder hypothesis will be reinforced by horizontal brand differentiation.

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[1] Further theoretical research on the trade and quality nexus can be found in Flam and Helpman (1987) and Stokey (1991).

[2] The importance of product branding is frequently recognized in the business press. A 1997 article in the *Fortune* magazine predicted that "In the twenty-first century, branding ultimately will be the only unique differentiator between companies." The article also stated that "Brand equity is now a key asset" (citation from Interbrand 2004).

[3] Hummels and Klenow (2002) find that up to two-thirds of the expanded trade of larger economies can be explained by the fact that they trade a larger set of goods (rather than larger quantities of a common set of goods). This evidence is consistent with the notion that richer countries have a comparative advantage in differentiated goods.

This is the first study to use detailed data on international trademark registrations to test for such income-related biases in international trade. This novel approach has two distinct advantages. First, firms' propensity to seek out trademarks for their products is likely to be a good indicator of both product quality and the extent of brand differentiation. As explained below, high quality and marketing-intensive producers face a higher risk of imitation and, therefore, tend to rely to a greater extent on the protection provided by the trademark system.

Second, the use of trademark registration data can overcome some of the drawbacks of existing empirical research on the Linder hypothesis, which employs information on unit values. Cross-country differences in unit values of imports can be due to quality but can also result from other considerations, such as differences in markups between countries, discounts for large quantities, buyer monopsony as well as transport costs. Moreover, since for most countries unit values are available only at a very aggregated level, researchers resort to employing unit values of US imports from various countries implicitly assuming that a particular country sells goods of the same quality to each of its export markets.[4] Information on trademark registrations does not suffer from these drawbacks. In particular, on account of its wide coverage in terms of countries and time, we do not need to rely on quality proxies derived from the data for a particular importer.

Our analysis proceeds in several stages. We start by reviewing the basic economics of the trademark system (Section 2). Next, we develop a conceptual model that will guide our empirical analysis (Section 3). Then we estimate a gravity type equation which includes a proxy for quality and brand differentiation of exports interacted with the importing country's GDP per capita. We employ two different proxies, based on the information from a newly constructed database of international trademark registrations covering 22 sectors in 100 countries during the period 1994–1998 (Section 4).

Our first proxy is the share of an exporting country's registrations in nonresident trademark registrations in a given sector in the importing economy. When this measure is employed, we find support for income-related trade biases in 10 out of 22 sectors. These biases can mainly be found in consumer goods industries, such as food products, beverages,

[4] Despite their shortcomings, unit values contain useful information and are frequently employed in the international trade literature. See, for instance, work by Schott (2001) on vertical product differentiation. Some authors, however, prefer to rely on retail prices, which in their opinion are more complete and trustworthy (Bradford 2003).

tobacco, wearing apparel and footwear, leather products and furniture. No biases are detected in intermediate input sectors, including petroleum and coal products, industrial chemicals, other chemicals, iron and steel, rubber products, and non-metallic products.

Our second proxy is the residual from a first stage regression describing determinants of trademark registrations in importing countries, which is intended to capture the quality and extent of brand differentiation of exports from a given source country. Using this measure, we find support for the Linder hypothesis in 14 of 22 sectoral estimations. Again the biases are present in consumer goods industries, such as, food products, beverages, wearing apparel and footwear, and textiles. They are also detected in the most trademark-intensive sectors, including other chemicals, professional and scientific equipment; paper and printing.

As we conclude in the final section of the paper (Section 5), the evidence of income-related trade biases suggests that developing countries, which are less likely to produce high quality or horizontally differentiated products, may be at a disadvantage in selling their goods to the rich world. This implies that reductions of trade barriers on manufactured goods in the developing—rather than the developed—world may, ceteris paribus, have a stronger impact on developing country exports.

2 The Economics of the Trademark System

Trademarks are words, signs, symbols or combinations thereof that identify goods as manufactured by a particular person or a company, therefore allowing consumers to distinguish between goods originating from different sources. In order to receive legal protection against unauthorized use by third parties, businesses and individuals file trademarks in official registrars. Such registrations are valid for a limited time period, typically ten years. However, prior to expiration, trademark holders have the option of renewing their registrations. Through continuing renewals, and absent any act or failure to act which might call the rights concerned into question, trademark registrations can virtually last forever.[5]

[5] A special case is when trademarks become part of the public domain. For example, the "Xerox" or "Walkman" trademarks were judged to have become part of the common vocabulary and the trademark holders were asked by certain jurisdictions—against a financial compensation—to give up their exclusive rights.

In practice, the number of trademarks sought out for a product can vary substantially across producers. For example, the brand of the Korean car manufacturer Hyundai is protected by 25 trademarks in the United States, whereas the Mercedes brand has 57 trademarks registered in the United States.[6] Typically, there are a number of ways in which imitators can take advantage of consumers' knowledge of a particular brand—ranging from the name of the brand to its logo, the design and other product-specific features. Obtaining a large number of trademarks serves as a more effective protection against product imitation.

To better understand firms' incentives to register trademarks in foreign nations, it is helpful to briefly review the relevant economic literature. The fundamental economic rationale of trademark protection goes back to Akerlof's (1970) seminal insight regarding the failure of markets to provide for an efficient allocation of resources if consumers are unable to assess the quality of products offered to them. In this situation, information asymmetries between sellers and buyers prevent some transactions in high quality goods from occurring, thus leading to inefficiencies. Trademarks offer a way around this dilemma. As producers of goods develop a reputation for quality over time, consumers can use brand names to distinguish between a premium quality product and a low-end product.[7]

A trademark registration itself, however, says little about the level of quality of the underlying product. Yet, there are a number of reasons why we would expect high quality producers to seek out more trademarks. First, it is important to note that trademarks are not costless, especially when protection is sought in a large number of jurisdictions. Besides the registration fee, firms have to incur expenses for legal services and possibly translation of the trademark application into a foreign language as well as bear the costs of monitoring for potential infringement. Thus, a producer will only file an application if the expected benefits from protection exceed its costs.

A variety of arguments can be invoked as to why the expected benefits from protection are likely to be larger for high quality producers. A key benefit of protection is, of course, the reduced likelihood of brand imitation. This likelihood is usually greater for high quality products, as the price premium relative to low quality products—and thus the payoff from

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[6] These trademark counts are counts of "live" trademarks from the TESS database available at www.uspto.gov as of August 2003.

[7] Shapiro (1982) has shown that reputation mechanism can work only imperfectly, because high quality producers are rewarded only with a lag.

imitation—is larger. Moreover, as originally noted by Nelson (1970), sellers of high quality products have a greater incentive to spend money on advertising to persuade consumers to try their goods, because the present value of a trial purchase is larger than in the case of low quality producers.[8] This also means that for a rational consumer, the fact that a firm spends money on advertisements provides in itself information on product quality—regardless of the advertising content.[9] Hence, consumers may have greater knowledge about advertised high quality products, once again increasing the payoffs from and the likelihood of imitation. Finally, the trademark registration itself may send a signal on quality, as consumers know that high quality producers face a greater risk of brand imitation. Indeed, high quality manufacturers often use symbols, such as "®" or "TM", to convey explicitly that their brands are protected by trademarks.

The rationale for trademark protection goes, however, beyond pure quality considerations. Unless goods take the form of purely homogenous commodities, firms tend to differentiate their products *horizontally*. For example, producers attach features to a product not necessarily linked to quality, such as the shape or color of goods. Much of the marketing effort exerted by companies nowadays is concerned with building "equity" for products whose physical characteristics may be quite close to each other. Consumers derive emotional value and/or prestige from the display of a particular brand and, over time, develop brand loyalty. Coca-Cola and Pepsi-Cola are a case in point. The main factor behind the success of these soft drink brands has been the appeal of their instantly recognizable names, logos, and colors.[10]

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[8] Note, however, that Schmalensee (1978: 499), who analyzes the relationship between advertising and product quality more formally, shows that under certain assumptions and parameter values, it is possible that the lowest quality brands have the largest advertising budgets, market shares, and profits. This is especially likely if buyers' behavior indicates confidence that better brands spend more on advertising. He concludes that "... while many of the natural generalizations of this model seem likely to reduce the incidence of negative advertising/quality correlations, I conjecture that most will not suffice to rule them out."

[9] Klein and Leffler (1981) make a related argument. They develop a model whereby consumers do not buy high quality products below a certain premium price that indeed gives firms an incentive to produce at high quality instead of cashing in on a short-term cheat. If market entry is free, firms engage in nonprice competition, involving sunk investments in the design of a firm logo and advertising. These investments send a signal about high quality to consumers, as their nonsalvageable character acts as a "collateral" that a firm has indeed chosen the high quality business plan.

[10] The importance of branding strategies to develop customer loyalty is well recognized in the business world. Interbrand (2004: 5) quotes John Russell, vice-president and man-

By identifying the original producer of a product, trademarks offer firms an opportunity to recoup their marketing investments. If other firms could free ride on the original producers' brand building efforts, no producer would have an incentive to invest in marketing goods and services. As was the case with high quality goods, the greater the emotional value and the prestige consumers derive from a brand, the greater is the risk of brand imitation and the greater are the benefits from the protection afforded by the trademark system. All else equal, we would expect to see more trademark registrations in sectors in which product differentiation plays a more important role.[11] In addition, high quality producers typically rely to a greater extent on horizontal product differentiation than low quality producers, reinforcing their interest in protection against brand imitation.[12] All of the above-mentioned characteristics make trademark registrations a suitable proxy for product quality and brand differentiation.

3 Testing for Income-Related Biases in Trade: An Empirical Model

In this section, we develop a simple model of bilateral trade that accounts for the "expanded" Linder hypothesis and that results in the well-known gravity type estimation equation. Following Deardorff (1998), let consumer preference be expressed by a utility function that is Cobb–Douglas over sectors and CES within sectors:

$$U^j = \prod_k \left[\left(\sum_i a_{ijk} c_{ijk}^{(\sigma_k - 1)/\sigma_k} \right)^{\sigma_k/(\sigma_k - 1)} \right]^{\rho_{jk}}, \tag{1}$$

$$a_{ijk} = f(\beta_j, \theta_{ik}), \qquad \beta_j, \theta_{ik} > 0, \; f_{\beta_j} > 0, \; f_{\theta_{ik}} > 0, \tag{2}$$

aging director of Harley-Davidson Europe, as observing: "If you move from being a commodity product to an emotional product, through to the real attachment and engagement that comes from creating an experience, the degree of differences might appear to be quite small but the results are going to be much greater."

11 Baroncelli et al. (2005) confirm that differentiated product sectors such as pharmaceuticals, scientific equipment, apparel, footwear, food products, and beverages account for the largest shares of global trademark registrations.

12 In addition to providing incentives to invest in quality and marketing, the trademark system is also sometimes credited for encouraging product innovations by allowing firms to appropriate associated rents. For example, in a case study of the Benelux countries, Allegrezza and Guard-Rauchs (1999) find that firms registering trademarks tend to incur high research and development (R&D) expenditure. Since one would expect a positive relationship between high quality production and R&D intensity, this finding is consistent with the notion that high quality producers seek out more trademarks.

where c_{ijk} is country j's consumption of sector k's good produced by country i, σ_k the elasticity of substitution between any pair of countries' products in sector k, and ρ_{jk} is country j's (constant) share of expenditure devoted to sector k. The parameter a_{ijk} has two possible interpretations. First, it can be seen as a standard CES preference parameter that allows the relative importance of horizontally differentiated products to vary. Consumers may derive greater utility from more exclusive brands, even though the functional characteristics of all brands are the same. Alternatively, a_{ijk} can be interpreted as a vertical multiplier that accounts for quality differences between products (Grossman and Helpman 1991). In this case, consumers derive greater utility from the consumption of goods with superior physical or functional characteristics. For our purposes, it is not important whether a_{ijk} captures branding or quality effects, as both types of product differentiation strategies can lead to the Linder-type biases in international trade and, as explained in Section 2, are captured by firms' propensity to register trademarks.

We assume that a_{ijk} can be represented by a function of the exporter i's extent of product differentiation, θ_{ik}, and the importing consumer j's preference for exclusive brands and quality, β_j—both of which are assumed to be exogenously given. The term a_{ijk} thus captures the Linder effect in our model.

Consumers in j derive their income, Y_j, from producing domestic products x_{jk} at prices p_{jk}. They face trade-cost-inclusive prices of consumption goods $t_{ijk}p_{ik}$, where the trade cost factor t_{ijk} is assumed to be equal to one for the domestically produced good and greater than one for foreign produced goods. Constrained maximization of (1) leads to optimal consumption levels

$$c_{ijk} = \frac{1}{t_{ijk}\, p_{ik}} \rho_{jk}\, Y_j\, a_{ijk}^{\sigma_k} \left(\frac{t_{ijk}\, p_{ik}}{p_{jk}^I} \right)^{1-\sigma_k}, \tag{3}$$

where p_{jk}^I is an index of trade-cost-inclusive prices:

$$p_{jk}^I = \left(\sum_i a_{ijk}^{\sigma_k}\, t_{ijk}^{1-\sigma_k}\, p_{ik}^{1-\sigma_k} \right)^{1/(1-\sigma_k)}. \tag{4}$$

Multiplying (3) by the trade-cost-inclusive price $t_{ijk}\, p_{ik}$ yields the value of exports from country i to j in sector k, T_{ij}^k:

$$T_{ij}^k = \rho_{jk}\, Y_j\, a_{ijk}^{\sigma_k} \left(\frac{t_{ijk}\, p_{ik}}{p_{jk}^I} \right)^{1-\sigma_k}. \tag{5}$$

The variables on the right-hand side are a mix of exogenous and endogenous variables. To fully estimate the model, one would need to specify supply conditions. However, since we are primarily interested in the Linder effect that is identified by bilateral variation in trade flows, we can proceed by employing importer and exporter fixed effects to control for the country-specific exogenous and endogenous variables.[13] The advantage of this approach is that our empirical model embeds alternative supply determinants of trade.[14] The resulting gravity type equation for bilateral trade between i and j in sector k can be expressed as:

$$\ln T_{ij}^{k} = E_{i}^{k} + I_{j}^{k} + (1 - \sigma_k) \ln t_{ijk} + \sigma_k \ln a_{ijk} + \varepsilon_{ij}^{k}, \qquad (6)$$

where E_i^k is a set of exporter fixed effects, I_j^k is set of importer fixed effects, and ε_{ij}^k is a normally distributed error term. A useful feature of our estimation equation (6) is that the inclusion of exporter and importer fixed effects can also correct for the omission of variables that are country specific (e.g., factor endowments, nontariff barriers, differences in inland transportation costs, availability of export finance).

We will capture the trade cost factor t_{ijk} with the bilateral distance and dummy variables for sharing a common language and joint participation in preferential trade agreements (PTAs). The Linder term a_{ijk} will be captured by the product of the importing country's per capita income (a proxy of consumer's preference for brand differentiation and quality) and a measure of the quality and extent of brand differentiation of goods produced by the exporting country (constructed using trademark registration data). Since all these variables do not directly measure t_{ijk} and a_{ijk}, the estimated coefficients will not represent estimates of the elasticity of substitution σ_k, but will also reflect the elasticities in the trade cost function and the Linder preference function, respectively.

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[13] This approach is consistent with recent empirical applications of the gravity equation, including Hummels (1999), Hallak (2001), Redding and Venables (2004), and Fink et al. (2002). Note that the inclusion of importer- and exporter-fixed effects captures the multilateral resistance terms identified by Anderson and van Wincoop (2003).

[14] Indeed, the gravity equation has been shown to be consistent with a variety of trade models, including the simple Ricardian and Heckscher–Ohlin theories as well as newer theories with increasing returns to scale and monopolistic competition. See, for example, Anderson (1979), Helpman and Krugman (1985), Bergstrand (1985, 1989), and Deardorff (1998).

4 Estimation

In this section, we use a database on international trademark registrations to test the expanded Linder hypothesis in the estimation framework developed above. The database was constructed by Baroncelli et al. (2005) using the information published by the World Intellectual Property Organization (WIPO) and is described in detail in their 2005 publication.[15] The database spans from 1994 to 1998 and includes information on bilateral trademark registrations between 22 source and 100 destination countries in 22 three-digit ISIC manufacturing sectors. The Appendix provides a list of all the source and destination countries and describes the concordance employed in matching sectors classified according to the Nice Trademark Classification System to the ISIC system (Table A1).

There are several advantages of employing trademarks for this purpose. First, information on trademark registrations has a wide coverage in terms of countries (and time), and thus in contrast to the earlier work by Hallak (2001) we do not need to rely on quality proxies derived from the data for one particular importer. Second, we do not employ unit value figures which, even at a very disaggregated level, can be problematic, as they may be capturing different products rather than different quality levels of the same good and may also reflect vertical pricing considerations in imperfectly competitive markets.[16]

One drawback of our database is that we only have information on the *flow* of new trademark registrations and not on the *stock* of existing registrations. Surely, one would expect past trademark filings to have an effect on current trade patterns, especially in sectors with long product cycles. At the same time, using the limited data that exist on trademark stocks, we find a strong positive correlation between stocks and flows as well as a strong positive correlation of bilateral trademark registrations over time.[17] Since most of the variation in our data is cross-sectional in nature, the bias from using flow data is likely to be small.[18]

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[15] The database is available from the authors upon request.

[16] For example, see Maskus and Chen (2002) for a model of vertical pricing of a monopoly manufacturer who sells goods in a foreign market through an independent distributor.

[17] WIPO publishes data on countries' total stock of trademarks in a given year (but not broken down by origin of the trademark holder or by industry). The bivariate correlation between this aggregate stock figure and the total number of registration in the same year is 0.86.

[18] Another potential criticism of the use of trademark data is that cross-country differences in the number of registered trademarks may reflect differences in firms' sophisti-

Using trademark registration data, we construct two measures of quality and the extent of brand differentiation of exports—each with its own advantages and drawbacks. First, we calculate the share of country *i*'s trademarks registered in country *j* in sector *k* at time *t* in all nonresident trademarks registered in country *j* in sector *k* at time *t*. As explained in the previous section and reflected in (6), this variable enters the regression equation interactively with per capita GDP.[19] A positive and statistically significant coefficient on this interactive term would lend support to the Linder hypothesis.

The dependent variable, the value of sector *k*'s exports from the source country *i*, to the destination country *j*, comes from the UN COMTRADE database. We estimate our gravity model using disaggregated trade flows, as we expect the importance of the Linder effect to differ across sectors (see Section 2). In particular, we will evaluate to what extent income-related biases in trade flows are present in sectors in which quality and brand differentiation tend to be important.

As other explanatory variables, we employ the well-known bilateral trade cost proxies, such as the distance between the pair of countries, a dummy for common language and a dummy equal to one if both the exporter and the importer belong to the same preferential trade agreement. The distance measure refers to the straight-line distance between nations' capitals and was taken from the City Distance Calculator provided by VulcanSoft.[20] The summary statistics for all the variables used in the estimation are presented in Table 1.

As stated in (6), the model includes fixed effects for the exporting and the importing country. Using fixed effects is preferable to employing GDPs or population sizes in gravity models estimated at the sectoral level (Hummels 1999 and Hallak 2001). The inclusion of exporter fixed effects explicitly controls for the average size of a country's exports during the period considered. While larger exporters are likely to exhibit greater trademark shares in the importing country, our regression approach tests the Linder hypothesis by

cation in using the trademark system. It is not clear, however, whether developing countries are less sophisticated in this regard. Baroncelli et al. (2005) show that middle-income countries are heavy users of the trademark system, as reflected, for example, in the fact that the majority share of national registrations are from domestic residents. For anecdotal evidence on how Chinese consumer-goods makers are starting to pay attention to brand building see *The Economist* (Just do it' Chinese-style, August 2, 2003). In any case, cross-country differences in country's sophistication in using trademarks are absorbed by the exporter fixed effects included in our regressions.

19 The per capita GDP figures come from the World Bank's *World Development Indicators*.

20 The software is available at www.vulcansoft.com.

Table 1: *Summary Statistics*

Variable	Obs.	Mean	Std. dev.
Trademarks registrations	173,574[a]	14.16	88.60
Trade	102,066	67,660.14	394,175.30
Imports from the world	114,708	1,503,654.00	4,125,001.00
Exports to the world	162,659	6,481,474.00	14,600,000.00
GDP per capita destination country	156,574	7,213.55	9,889.46
GDP per capita source country	173,580	21,663.48	10,619.65
Trademark registrations$_{ijkt}$/ trademark registrations$_{jkt}$	161,364	0.05	0.10
Distance	158,224	6,093.10	4,415.05
Madrid membership	173,580	0.22	0.41
Preferential trade agreements	173,580	0.68	0.25
Language	173,030	0.82	0.28

[a] Of which 79,072 are nonzero.

relying only on the bilateral variations in the data within the same exporting country.

The estimation results are presented in Table 2. We find support for the Linder hypothesis in 10 out of 22 sectoral estimations. Interestingly, the Linder effect can be found mainly in consumer goods industries, such as food products, beverages, tobacco, wearing apparel and footwear, leather products, and furniture. All of these sectors are intensive users of the trademark system—as found by Baroncelli et al. (2005). The hypothesis finds no confirmation in intermediate input sectors, such as petroleum and coal products, industrial chemicals, other chemicals, iron and steel, rubber products, non-metallic products. In light of the discussion in Section 2, these results are consistent with quality differences and/or prestige or emotional value associated with products being more important in consumer goods than intermediate input sectors. As for the other variables, we find a negative and significant coefficient on distance and a positive and significant coefficient on the language dummy. The impact of PTA participation, however, shows a mixed performance, which is in line with the existing literature.[21]

The above approach has, however, one drawback. It takes trademark registration shares as given and uses them as proxies for product differentiation without controlling for other bilateral factors driving a decision to register a trademark, such as distance or linguistic differences. There-

[21] See, for example, Soloaga and Winters (1999) and Smarzynska (2001).

Table 2: *Gravity Estimations Using Trademark Shares as Measure of Exporter Quality*

	Other chemicals	Professional and scientific equipment	Paper, printing	Wearing apparel, footwear	Food products	Beverages	Tobacco	Textiles	Leather products	Furniture	Rubber products
Linder term	0.0043	0.0102	0.0167	0.1504***	0.1705***	0.1573***	0.1524**	0.0706**	0.0724*	0.0662**	−0.0095
	(0.0290)	(0.0225)	(0.0216)	(0.0382)	(0.0312)	(0.0380)	(0.0608)	(0.0290)	(0.0390)	(0.0296)	(0.0223)
Ln distance	−1.2092***	−0.8925***	−1.5588***	−1.5181***	−1.4877***	−1.3451***	−1.1773***	−1.6172***	−1.5956***	−1.7471***	−1.4772***
	(0.0321)	(0.0333)	(0.0357)	(0.0435)	(0.0410)	(0.0577)	(0.0963)	(0.0395)	(0.0495)	(0.0463)	(0.0381)
Language	1.1863***	1.0951***	1.1545***	0.9582***	0.9502***	1.1303***	0.7785***	0.8627***	0.9123***	0.9368***	1.0561***
	(0.0958)	(0.0876)	(0.0858)	(0.0883)	(0.0847)	(0.1072)	(0.1874)	(0.0843)	(0.1010)	(0.0896)	(0.1011)
Preferential trade agreements	−0.0663	−0.0257	−0.0917	0.2220**	0.2220**	−0.0415	3.2778***	0.2624***	−0.3000***	−0.0326	0.6833***
	(0.0786)	(0.0696)	(0.0775)	(0.0967)	(0.0881)	(0.1243)	(0.2640)	(0.0812)	(0.1093)	(0.0978)	(0.0876)
Destination dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Source dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	4833	4798	4857	4573	4639	4041	2156	4627	4235	4261	4571
F-stat	223.95	281.58	259.03	239.28	171.15	129.3	28.33	177.12	147.99	170.57	190.91
Prob. > F stat.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R-squared	0.82	0.86	0.83	0.82	0.75	0.71	0.58	0.79	0.76	0.79	0.8

Table 2: *Continued*

	Pottery, china	Non-metallic products	Iron and steel	Non-ferrous metals	Fabricated metal products	Machinery, non-electrical	Machinery, electrical	Transport equipment	Other manufactured goods	Industrial chemicals	Petroleum and coal products
Linder term	−0.0022	0.0020	0.0247	−0.0091	0.0690***	0.0103	0.0472**	0.0501	0.0451*	−0.0158	0.0497
	(0.0242)	(0.0298)	(0.0317)	(0.0375)	(0.0224)	(0.0195)	(0.0241)	(0.0334)	(0.0234)	(0.0235)	(0.0521)
Ln distance	−1.5558***	−1.6113***	−1.7905***	−1.7270***	−1.4452***	−1.1333***	−1.0753***	−1.2720***	−1.1742***	−1.4000***	−1.1681***
	(0.0405)	(0.0436)	(0.0478)	(0.0515)	(0.0356)	(0.0280)	(0.0345)	(0.0436)	(0.0354)	(0.0319)	(0.0807)
Language	1.0717***	1.1009***	0.7003***	0.9662***	1.0866***	1.0675***	1.0804***	0.9866***	1.2355***	0.6317***	0.6681***
	(0.0995)	(0.1025)	(0.0964)	(0.1064)	(0.0854)	(0.0728)	(0.0880)	(0.0940)	(0.0919)	(0.0828)	(0.1535)
Preferential trade agreements	−0.0415	−0.1461	0.2512**	−0.1842	−0.2800***	−0.2829***	0.0119	0.6270***	−0.1545*	−0.1005	−0.0400
	(0.0890)	(0.1004)	(0.1020)	(0.1158)	(0.0745)	(0.0616)	(0.0752)	(0.0996)	(0.0828)	(0.0694)	(0.1914)
Destination dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Source dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	4599	4294	4381	4212	4716	4880	4824	4650	4685	4751	2913
F-stat.	175.02	144.98	135.57	132.46	250.18	326.19	255.01	180.96	257.2	251.83	48.91
Prob. > F stat.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R-squared	0.79	0.76	0.76	0.74	0.83	0.87	0.84	0.78	0.84	0.84	0.54

Robust standard errors are presented in parentheses. ***, **, * denote significance at 1, 5, and 10 percent level, respectively.

fore, in our second approach we explicitly control for determinants of trademark registrations other than brand differentiation. One can think of a simple model whereby the supply of trademarks is perfectly elastic (assuming trademark offices function smoothly) and the equilibrium number of trademarks is determined solely by the demand for registrations. Controlling for the size of the source country's exports, importer-specific effects, as well as the standard set of "bilateral ties", the difference between actual and predicted trademark registrations should reflect the average degree of product differentiation of goods traded between two countries. More specifically, we estimate the following first-stage regression equation:

$$\begin{aligned} lnR_{ijkt} = {} & I_j + \delta_1 lnX_{ikt} + \delta_2 lnM_{jkt} + \delta_3 lnDistance_{ij} \\ & + \delta_4 lnGDPpc_{jt} + \delta_5 Language_{ij} + \delta_6 Madrid_{ijt} \\ & + \delta_7 PTA_{ijt} + \gamma_t + \varepsilon_{ijkt}, \end{aligned} \tag{7}$$

where subscripts i, j, k, and t stand for source and destination countries, sector, and year, respectively. R_{ijkt} is the number of new trademarks registered by country i in country j in sector k at time t. We include the value of sector k's exports from source country i to the world, X_{ikt}, and the value of sector k's imports of destination country from the world, M_{jkt}. We expect that large exporters of sector k products are likely to have a larger number of trademarks in the industry, while large importers are more attractive destinations for trademark registrations. The data on exports and imports come from the UN COMTRADE database. We also control for per capita GDP of the destination country, expecting that richer countries are likely to have a higher demand for high quality and more differentiated products.

We include destination-country fixed effects in the regression. Since we are interested in obtaining a measure of product differentiation of goods supplied from country i to country j in industry k, these fixed effects allow us to control for (time invariant) determinants of demand for differentiated products in the destination country. Due to the inclusion of the destination fixed effects total sectoral imports and per capita GDP of the destination country j now contribute only to the explanation of variations in trademark flows over time. Note that we do not include per capita GDP of the source country, as this would partly take away what we intend to measure with the residuals.

Table 3: *Determinants of International Trademark Registrations*

	Other chemicals	Professional and scientific equipment	Paper, printing	Wearing apparel, footwear	Food products	Beverages	Tobacco	Textiles	Leather products	Furniture	Rubber products
Ln imports from the world	−0.595***	−0.012	−0.355*	0.074	−0.173	0.231**	−0.111**	−0.322**	−0.200	0.112	−0.252
	(0.193)	(0.091)	(0.182)	(0.123)	(0.196)	(0.118)	(0.052)	(0.149)	(0.148)	(0.150)	(0.164)
Ln exports to the world	0.974***	0.933***	0.705***	0.512***	0.588***	0.414***	0.271***	0.749***	0.549***	0.460***	0.537***
	(0.013)	(0.013)	(0.026)	(0.017)	(0.019)	(0.016)	(0.012)	(0.020)	(0.019)	(0.021)	(0.019)
Ln distance	−0.549***	−0.586***	−0.447***	−0.572***	−0.714***	−0.450***	−0.390***	−0.753***	−0.551***	−0.528***	−0.623***
	(0.023)	(0.024)	(0.033)	(0.033)	(0.028)	(0.029)	(0.029)	(0.032)	(0.035)	(0.032)	(0.035)
Madrid	0.272***	0.115**	0.285***	−0.180**	0.012	0.188***	0.143**	0.194***	−0.087	0.240***	0.375***
	(0.056)	(0.058)	(0.077)	(0.070)	(0.065)	(0.069)	(0.072)	(0.069)	(0.070)	(0.071)	(0.066)
Language	0.693***	0.826***	0.891***	0.821***	0.673***	0.619***	0.265***	0.571***	0.591***	0.678***	0.500***
	(0.063)	(0.072)	(0.093)	(0.092)	(0.078)	(0.081)	(0.075)	(0.090)	(0.089)	(0.097)	(0.101)
Ln GDPpc destination	0.418	0.273	0.387	0.096	0.356	−0.134	0.292	0.19	0.271	0.111	0.617**
	(0.254)	(0.212)	(0.324)	(0.300)	(0.288)	(0.294)	(0.271)	(0.305)	(0.298)	(0.305)	(0.284)
Constant	−4.161**	−8.466***	−3.932*	−2.418	−1.307	−0.964	0.559	−0.901	−0.951	−2.37	−3.357*
	(1.762)	(1.420)	(2.063)	(2.021)	(2.471)	(1.887)	(1.747)	(1.991)	(2.100)	(1.992)	(1.916)
Destination dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	3536	3364	2848	3031	3151	2926	2135	2463	2353	2183	2133
F-stat.	103.71	97.74	27.63	28.52	33.89	23.2	16.6	39.09	20.03	23.37	18.11
Prob. > F-stat.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R-squared	0.69	0.68	0.39	0.39	0.44	0.35	0.35	0.49	0.41	0.38	0.41

Table 3: *Continued*

	Pottery, china	Non-metallic products	Iron and steel	Non-ferrous metals	Fabricated metal products	Machinery, non-electrical	Machinery, electrical	Transport equipment	Other manufactured goods	Industrial chemicals	Petroleum and coal products
Ln imports from the world	−0.121	−0.127	−0.319**	−0.13	−0.065	−0.06	−0.168	−0.113	−0.294**	−0.331*	0.087
	(0.222)	(0.110)	(0.144)	(0.156)	(0.145)	(0.138)	(0.134)	(0.106)	(0.139)	(0.173)	(0.085)
Ln exports from the world	0.451***	0.529***	0.578***	0.559***	0.906***	0.761***	0.653***	0.587***	0.614***	0.849***	0.392***
	(0.019)	(0.019)	(0.024)	(0.029)	(0.025)	(0.016)	(0.019)	(0.016)	(0.018)	(0.017)	(0.016)
Ln distance	−0.564***	−0.654***	−0.599***	−0.614***	−0.440***	−0.523***	−0.659***	−0.300***	−0.569***	−0.689***	−0.497***
	(0.033)	(0.031)	(0.029)	(0.033)	(0.030)	(0.024)	(0.028)	(0.025)	(0.031)	(0.027)	(0.031)
Madrid	0.037	0.251***	0.300***	−0.015	0.320***	0.349***	0.370***	0.207***	0.042	0.316***	0.389***
	(0.073)	(0.064)	(0.069)	(0.079)	(0.066)	(0.060)	(0.067)	(0.067)	(0.069)	(0.061)	(0.065)
Language	0.761***	0.769***	0.622***	−0.064	0.608***	0.466***	0.694***	0.182**	0.838***	0.459***	0.457***
	(0.093)	(0.084)	(0.093)	(0.104)	(0.087)	(0.072)	(0.072)	(0.083)	(0.089)	(0.075)	(0.090)
Ln GDPpc destination	−0.043	0.566**	0.249	0.283	0.358	0.289	0.406	0.388	0.251	0.430*	0.198
	(0.330)	(0.266)	(0.295)	(0.333)	(0.276)	(0.236)	(0.267)	(0.270)	(0.271)	(0.251)	(0.270)
Constant	1.742	−3.204*	−0.97	−2.307	−10.899***	−8.186***	−4.465***	−7.000***	−1.751	−5.703***	−1.106
	(2.162)	(1.731)	(1.862)	(2.323)	(1.896)	(1.669)	(1.710)	(1.801)	(1.789)	(1.854)	(1.744)
Destination dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	2265	2220	2366	2186	1879	2757	2637	2569	2573	2768	1918
F-stat.	18.54	21.45	19.77	17.44	49.67	44.24	32.24	25.81	26.68	47.65	13.1
Prob. > F-stat.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R-squared	0.35	0.44	0.41	0.32	0.52	0.57	0.46	0.41	0.46	0.57	0.36

Robust standard errors are presented in parentheses. ***, **, * denote significance at 1, 5, and 10 percent level, respectively.

Further, we employ proxies for trade costs, reasoning that closer commercial ties between nations will lead to more trademark registrations. These are the distance between the pair of countries, a dummy for a common language, and a dummy for participation in the same preferential trade agreement. In addition, we construct a dummy variable that is one if the exporting and importing countries are both members of the Madrid system—the international trademark registration system administered by WIPO that facilitates the filing of one trademark in multiple countries.[22]

Table 3 presents the results from the estimation of (7) for each of the 22 three-digit manufacturing industries. Each regression contains year dummies. The standard errors have been corrected for heteroskedasticity using the White method. We find that the number of newly registered trademarks depends on the worldwide volume of exports from the source country in a particular industry, which seems intuitive as a larger export sector is likely to consist of more firms and cover a wider range of products.[23] The results also indicate that registrations are more likely to take place in less distant economies, in countries where the same language is spoken, and among countries that participate in the Madrid system. Moving on to the destination country characteristics, we find that fluctuations in the total volume of imports and the per capita GDP do not significantly affect the volume of trademark registrations.

We proceed by calculating the residuals from these estimations and employing them (interacted with per capita GDP of the destination country) in the familiar gravity regression on bilateral trade specified in (6). As the figures in Table 4 indicate, the interaction between the proxy for product differentiation of exports (obtained in the first-stage regression) and the importer's GDP per capita lends support to the Linder hypothesis, bearing a positive and statistically significant coefficient in 14 of 22 sectoral estimations. While the presence of the effect in consumer goods industries is less discernible than before, the Linder hypothesis still holds in key consumer goods sectors such as wearing apparel and footwear, food products, beverages, and textiles. Moreover, the effect is also detected in the most trademark-intensive sectors (as identified in Baroncelli et al. 2005),

[22] See Baroncelli et al. (2005) for a brief description of the Madrid registration system.
[23] This result is also consistent with Hummels and Klenow (2002), who find that, adjusted for the size of a country's labor force, richer economies tend to trade a wider range of products.

Table 4: *Gravity Estimations Using Trademark Residuals as Measure of Exporter Quality*

	Other chemicals	Professional and scientific equipment	Paper, printing	Wearing apparel, footwear	Food products	Beverages	Tobacco	Textiles	Leather products	Furniture	Rubber products
Linder term	0.027***	0.014***	0.010***	0.017***	0.025***	0.028***	0.006	0.006**	0.005	0.002	0.010***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)	(0.007)	(0.003)	(0.004)	(0.003)	(0.003)
Ln distance	−1.202***	−0.880***	−1.398***	−1.541***	−1.480***	−1.395***	−1.167***	−1.627***	−1.569***	−1.671***	−1.331***
	(0.029)	(0.031)	(0.036)	(0.050)	(0.041)	(0.058)	(0.116)	(0.039)	(0.057)	(0.048)	(0.040)
Language	1.164***	0.985***	1.201***	0.955***	0.800***	1.106***	0.602***	0.840***	0.933***	1.028***	1.005***
	(0.080)	(0.080)	(0.081)	(0.095)	(0.083)	(0.107)	(0.223)	(0.092)	(0.124)	(0.104)	(0.110)
Preferential	0.129	−0.015	0.258***	0.274**	0.490***	0.209	3.316***	0.210**	−0.169	0.085	0.665***
trade agreements	(0.081)	(0.069)	(0.085)	(0.111)	(0.100)	(0.147)	(0.307)	(0.102)	(0.137)	(0.110)	(0.111)
Constant	13.561***	10.083***	13.833***	13.434***	19.671***	15.183***	10.459***	17.667***	12.887***	15.641***	11.827***
	(0.344)	(0.357)	(0.474)	(0.633)	(0.544)	(0.688)	(1.284)	(0.528)	(1.100)	(0.559)	(0.565)
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	Yes
Destination dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Source dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Number of obs.	3511	3318	2837	2962	3073	2695	1405	2440	2238	2129	2100
F-stat.	200.99	232.51	197.89	157.1	134.45	72.25	17.72	119.49	82.19	117.13	103.25
Prob. > F-stat.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R-squared	0.84	0.87	0.87	0.83	0.79	0.73	0.57	0.82	0.79	0.84	0.83

Table 4: *Continued*

	Pottery, china	Non-metallic products	Iron and steel	Non-ferrous metals	Fabricated metal products	Machinery, non-electrical	Machinery, electrical	Transport equipment	Other manufactured goods	Industrial chemicals	Petroleum and coal products
Linder term	0.002	0.007**	0.003	0.004	0.012***	0.007***	0.003	0.009***	0.002	0.014***	0.019***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.007)
Ln distance	−1.444***	−1.541***	−1.722***	−1.635***	−1.361***	−1.043***	−1.013***	−1.133***	−1.198***	−1.374***	−1.328***
	(0.042)	(0.042)	(0.049)	(0.054)	(0.044)	(0.026)	(0.032)	(0.046)	(0.036)	(0.032)	(0.090)
Language dummy	1.091***	1.103***	0.605***	0.745***	1.066***	0.930***	0.987***	1.012***	1.054***	0.710***	0.730***
	(0.109)	(0.107)	(0.091)	(0.124)	(0.096)	(0.068)	(0.084)	(0.104)	(0.101)	(0.077)	(0.170)
Preferential trade	0.190*	0.173	0.333***	0.332**	0.022	−0.079	0.043	0.865***	−0.221**	0.139*	−0.235
agreements	(0.109)	(0.122)	(0.115)	(0.140)	(0.117)	(0.069)	(0.087)	(0.114)	(0.097)	(0.078)	(0.242)
Constant	13.235***	13.248***	15.046***	15.703***	12.518***	11.936***	11.378***	12.420***	11.972***	14.298***	8.785***
	(0.668)	(0.720)	(0.670)	(0.889)	(0.640)	(0.471)	(0.553)	(0.809)	(0.499)	(0.544)	(1.861)
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Destination dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Source dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Number of obs.	2228	2163	2290	2091	1864	2745	2624	2553	2530	2745	1570
F-stat.	108.85	78.63	96.02	96.99	151.39	232.86	168.78	119.77	150.54	180.65	23.12
Prob. > F-stat.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R-squared	0.82	0.79	0.81	0.8	0.85	0.9	0.86	0.8	0.86	0.86	0.61

Robust standard errors are presented in parentheses. ***, **, * denote significance at 1, 5, and, 10 percent level, respectively.

including other chemicals, professional and scientific equipment; paper and printing.

As for the other variables, distance takes on the usual significantly negative sign, language is mostly positive and significant, and the preferential trading dummy shows a positive and significant coefficient in about half of the sectors, with only one coefficient being negative and significant.

To summarize, we conclude that higher quality and brand differentiation positively affects exports to rich country markets. While each of the two proxies used has its own advantages and drawbacks and produces somewhat different results across sectors, one conclusion emerges from both approaches: The Linder effect matters more for consumer and trademark-intensive goods. Our results can be viewed as complementary to the findings of Rauch (1999), who analyzes the trade-inhibiting effect of distance across three product groups: differentiated products, products for which reference prices exist, and pure homogeneous commodities. Rauch finds that distance exerts the strongest negative effect on trade in the case of differentiated products and argues that the more heterogeneous goods are, the more difficult it is for prices to convey all the information buyers and sellers need in order to trade. While we do not doubt the importance of informational deficiencies, our study emphasizes the role of income-related taste biases as an additional barrier to exports of differentiated products.

5 Conclusions

This study employs a novel approach, based on information on international trademark registrations, to test an expanded Linder hypothesis stating that richer countries tend to import products of higher quality and greater brand differentiation. We derive two proxies for the extent of quality and brand differentiation of traded goods. The two proxies are subsequently interacted with per capita GDP of the importing country and incorporated into a gravity equation estimated at the industry level. The results suggest that the Linder effect is more pronounced in consumer goods and trademark-intensive sectors, but small or nonexistent for a number of intermediate goods sectors.

The evidence in support of the expanded Linder effect has important policy implications. First, it suggests that a developing country's export supply response to foreign market opening may not be uniform across export destinations. Hence, models simulating trade policy changes using uniform export supply elasticities may overestimate export expansion whenever tastes of foreign consumers poorly match the quality and brand characteristics of exported products. In particular, developing countries may be at a disadvantage in selling manufactured products to the rich world (Murphy and Shleifer 1997), which may limit the benefits brought by the reduction of trade barriers in industrialized countries.

A corollary to this proposition is that developing countries' market access interests in the developed world may differ from those in the developing world. Improved access to rich country markets for developing economies is at the core of multilateral trade negotiations, North-South free trade agreements, and preferential trading schemes. This seems justified by the vast size of developed economies. At the same time, the existence of Linder type effects suggests that stronger export responses may result from South-South trade integration, even though export markets themselves are smaller. Thus using the size of foreign markets as the sole basis for a trade negotiation strategy may not always be appropriate.

Appendix

Destination Countries: Albania, Algeria, Andorra, Armenia, Australia, Austria, Azerbaijan, Belarus, Benelux, Bolivia, Bosnia & Herzegovina, Brazil, Brunei, Bulgaria, Chile, China, Colombia, Croatia, Cuba, Czech Republic, Dem. Republic of Korea, Denmark, Ecuador, Egypt, El Salvador, Estonia, Federal Republic of Yugoslavia, Finland, France, Georgia, Ghana, Guatemala, Haiti, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Iran (Islamic Republic of), Ireland, Italy, Jamaica, Japan, Kazakhstan, Kenya, Kyrgyzstan, Lao People's Democratic Republic, Latvia, Lesotho, Liberia, Liechtenstein, Lithuania, Macao, Malawi, Malta, Mauritius, Mexico, Moldova, Monaco, Mongolia, Morocco, Mozambique, Netherlands Antilles, New Zealand, Nicaragua, Norway, Oman, Pakistan, Panama, Peru, Poland, Portugal, Romania, Russian Federation, San Marino, Sierra Leone, Slovak Republic, Slovenia, South Africa, Spain, Sri Lanka, Sudan, Swaziland, Sweden, Switzerland, FYR Macedonia, Tajikistan, Thailand, Trinidad and Tobago, Tunisia, Turkey, Ukraine, United Kingdom, Uruguay, Uzbekistan, Venezuela, Vietnam, Zambia, Zimbabwe

Source Countries: Australia, Austria, Belgium, Canada, China, Denmark, Finland, France, Germany, Hungary, Italy, Japan, Netherlands, Norway, Portugal, Republic of Korea, Russian Federation, Spain, Sweden, Switzerland, United Kingdom, United States

Table A1: *Concordance between Nice Classification and ISIC Classification*

Nice classification	ISIC	ISIC classification
1	351	Industrial chemicals
2, 3, 5	352	Other chemicals
4	354	Miscellaneous petroleum and coal products
6	371	Iron and steel
7	382	Machinery, non-electrical
8	381	Fabricated metal products
9, 10	385	Professional and scientific equipment
11	383	Machinery, electrical
12	384	Transport equipment
13, 15, 28	390	Other manufactured goods
14	372	Non-ferrous metals
16	341, 342, 356	Paper and products, printing and publishing, plastic products
17	355	Rubber products
18	323	Leather products
19	369	Other non-metallic mineral products
20	332	Furniture, except metal
21	361, 362	Pottery, china, earthenware, glass and products
22, 23, 24, 26, 27	321	Textiles
25	322, 324	Wearing apparel; footwear, except rubber or plastic
29, 30, 31	311	Food products
32, 33	313	Beverages
34	314	Tobacco

Source: Developed by authors based on detailed descriptions of product and industry categories.

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