ACROSS-PRODUCT VERSUS WITHIN-PRODUCT SPECIALIZATION IN INTERNATIONAL TRADE*

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Abstract

This paper exploits product-level U.S. import data to test trade theory. Though the U.S. increasingly sources the same products from both high- and low-wage countries, unit values within products vary systematically with exporter relative factor endowments and exporter production techniques. These facts reject factor-proportions specialization *across* products but are consistent with such specialization *within* products. The data are inconsistent with new trade theory models predicting an inverse relationship between price and producer productivity. The existence of within-product specialization is an important consideration for understanding the impact of globalization on firms and workers, the evolution of total factor productivity, and the likelihood of long-run income convergence.

Keywords: Heckscher-Ohlin Model; New Trade Theory; Unit Value; Varieties Trade

JEL classification: F11; F14; F2; C21

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I Introduction

The unit values of U.S. manufacturing imports vary widely even within finely detailed product categories. To take one striking example, men's cotton shirts from Japan are roughly thirty times as expensive as the identically classified variety[1] originating in the Philippines. Across all U.S. manufacturing imports, the mean high-to-low unit value ratio in 1994 was 24. These differences occur within a single country; to put them in perspective, note that according to the *Economist*, the price of a Big Mac in 1999 – across countries – varied by a factor of just 3.

In addition to being large, differences in U.S. import unit values are systematic. Three patterns emerge from the data. First, unit values are higher for varieties originating in capital- and skill-abundant countries than they are for varieties sourced from labor-abundant countries. Second, unit values are positively associated with the capital intensity of the production technique exporters use to produce them. Third, over time skill- and capital-deepening countries experience an increase in unit values relative to the countries they leave behind. Given the potential for misclassification that exists in a product-level trade dataset that is constructed from literally millions of U.S. Customs declaration forms, the strength of the evidence found here is remarkable.

These data provide a rich new dimension for testing the implications of 'old' and 'new' trade theory. In 'old' trade theory, comparative ad-

[1] Throughout the paper, imports from different countries within a product category are referred to as varieties. It is useful to think of varieties as being either *horizontal* (e.g. red versus blue telephones made with identical input intensities) or *vertical* (e.g. high-tech versus low-tech phones made with different input intensities). My use of horizontal and vertical here is not meant to refer to issues associated with multinational enterprises.

vantage drives countries to specialize in unique subsets of goods. The Heckscher-Ohlin factor proportions framework, for example, has labor-abundant Philippines exporting labor-intensive apparel and toys while capital-abundant Japan focuses on capital-intensive machinery and chemicals. Standard tests of this framework find scant evidence in favor of endowment-driven trade at the industry level [e.g. Bowen et al. 1987, Trefler 1995].

I find no evidence of endowment-driven specialization *across* products here either. Over time, the United States increasingly sources the same products from both high- and low-wage countries. However, the data are consistent with specialization *within* products. The relationship between unit values, exporter endowments and exporter production techniques supports the view that capital- and skill-abundant countries use their endowment advantage to produce vertically superior varieties, i.e. varieties that are relatively capital or skill intensive and possess added features or higher quality, thereby commanding a relatively high price. This evidence suggests that conventional tests of trade theory using industry-level data are problematic because much of the endowment-driven specialization occurs at a level that was, until recently, hidden from the researcher.[2]

These trends also provide intuition for why firms and workers in developed economies continue not only to produce but to export in industries like apparel and textiles that are commonly associated with developing coun-

[2] Two recent tests of the framework using industry-level data support this view. Davis and Weinstein [2001] allow country input intensities to vary with country capital abundance in their test of whether the factors embodied in trade equal countries' relative factor abundance. This assumption, which is equivalent to assuming all countries produce a unique set of products, provides a closer match between factor content and factor supplies than previous tests [e.g. Bowen et al. 1987]. Schott [2003] finds strong support for the implication that a country's level of industry participation varies with its relative endowments when industry-level production data are adjusted to allow for intra-industry product heterogeneity.

tries.[3] As exposure to labor-intensive imports from low-wage countries increases, high-wage countries shift their output towards activities within industries that reflect their comparative advantage. Recent research into firm responses to international trade supports this view. Bernard et al. [2003b], for example, find a reallocation of U.S. manufacturing away from labor-intensive plants and towards capital-intensive plants within industries as industry exposure to imports from low-wage countries rises. These results demonstrate that our thinking about international specialization must shift away from industries (e.g. apparel versus machinery) and towards varieties within industries (e.g. analog versus high-definition television).

The link I find between unit values and input intensities also suggests that previously observed differences in country-industry production techniques may not be due solely to variation in factor efficiency, an explanation that has been popular since Leontief [1953].[4] The observed capital intensity of the Japanese electronics industry, for example, may exceed that of the Philippine electronics industry, not just because Philippine labor is less efficient but because the two countries are manufacturing fundamentally different goods.

More generally, accounting for within-product specialization is critical for estimating the technology gap thought to separate developed and developing economies [e.g. Trefler 1993; Hall and Jones 1999; Harrigan 1999; Acemoglu and Zillibotti 2001]. This is because the aggregate price deflators used to measure cross-country and cross-country-industry total factor

[3] Though tariff and non-tariff barriers certainly motivate some high-wage countries to maintain domestic production of labor-intensive industries, protection does not provide an answer for why high-wage countries continue to *export* products in these industries, nor why U.S. consumers would pay a premium for them.

[4] Trefler [1993], for example, recovers estimates of country productivity by selecting country shifters that maximize the fit of the factor proportions framework.

productivity likely do not capture the product-level price variation reported here, potentially biasing productivity estimates and the empirical results which rely upon them.[5]

In 'new' trade theory, international trade patterns are driven by imperfect competition, productivity differences among producers within industries, and consumers' love for variety. New trade models differ depending on whether the focus is on homogeneous firms [e.g. Krugman 1979, 1980] or heterogeneous firms [e.g. Bernard et al. 2003a, Melitz 2003] within countries.[6] In both cases, however, a variety's price varies inversely with its producer's productivity. For these models to be consistent with the import unit values of U.S. trading partners, skill- and capital-abundant countries must have relatively low productivity, an assumption most economists would find implausible. The rejection of new trade models as an explanation of unit value differences between high- and low-wage countries, however, should not be too surprising given that these models were designed to explain trade between similarly endowed countries.

Determining the extent of endowment-driven specialization is a key factor in understanding the current and future effects of globalization. If high- and low-wage countries produce identical goods, their workers are in direct competition: price-wage arbitrage mandates that a decline in the world price of labor-intensive goods – because trade costs fall or because a previously closed labor-abundant country opens up – forces wages down in all

[5] Harrigan [1997] demonstrates that the use of industry deflators in place of aggregate GDP deflators can alter TFP estimates substantially even across OECD countries, which likely have product mixes more similar than those of the low- and high-wage countries studied here.

[6] Helpman [1987], Hummels and Levinsohn [1995] and Debaere [2002] examine the intra-industry trade implications of homogenous firm models. Here, I focus on price variation within products in the same market (the United States) that are sourced from very diverse trading partners.

countries. On the other hand, if high- and low-wage countries specialize in distinct goods, then the wage link between developed and developing countries may be weakened: as the Japanese economy shifts away from the less sophisticated goods produced by the Philippines, the wages of its workers may be less susceptible to price movements of the world's most labor-intensive goods. The extent of insulation is a function of the substitutability of high- and low-wage country varieties.

The results of this paper also relate to research in growth theory, innovation and product cycling. Recent work in growth theory, for example, highlights the role that specialization can play in inhibiting per capita GDP convergence in an open world economy [e.g. Ventura 1997; Acemoglu and Ventura 2002; Cunat and Maffezzoli 2002]. An implication of this research is that otherwise identical late developers may never catch up to the income level achieved by earlier developers, even if they eventually adopt the product mix of the early developers. Results are also consistent with the quality ladder model of Grossman and Helpman [1991], which has high-wage leader countries with an endowment-driven comparative advantage in innovation continually developing improved varieties to replace those copied by low-wage followers.[7] The decline in across-product specialization over time documented here signals greater entry by followers into leader product categories. At the same time, the growing spread between high- and low-wage country unit values is consistent with endowment-based innovation on the part of high-wage leaders.

The remainder of this paper proceeds as follows: Section II describes 'old' and 'new' trade theory and their implications for product-level trade

[7] Feenstra and Rose [2000] demonstrate that the order in which countries first begin exporting industries to the U.S. market is positively associated with estimates of their innovative potential.

data; Section III describes the empirical results; Section IV discusses alternate explanations; and Section V concludes.

II. Old and New Trade Theory

In the Heckscher-Ohlin model of old trade theory, a country's product mix varies with its relative factor endowments.[8] The multiple cone equilibrium of this model is displayed in the Lerner diagram in Figure I. It features a world of two factors and four industries, apparel, textiles, machinery and chemicals, which differ in terms of their capital intensity (production technique). Apparel is the most labor-intensive industry while chemicals is the most capital intensive. Under standard assumptions [Dixit and Norman 1980], the four industries' unit-value isoquants delineate three cones of diversification, where cone refers to the set of vectors selecting a mix of products.

Because production of an industry outside of the cone in which a country resides results in negative profit, GDP-maximizing countries specialize in only the two industries anchoring their cones, i.e. the two industries whose input intensities are most closely related to their endowments.[9] The negative profits capital-abundant Japan would earn in labor-intensive apparel and textiles, for example, can be seen by comparing the amount of capital and labor that can be bought for one dollar in Japan (via the downward sloping isocost curve defined by r_{JPN} and w_{JPN}) with the amount of capital and labor needed to produce one dollar's worth of output (via the unit

[8] The single factor Ricardian model of 'old' trade theory also implies product specialization as a result of international productivity differences [e.g. Dornbusch et al. 1977 and Eaton and Kortum 2002]. I focus here on the Heckscher-Ohlin model because of evidence with respect to multiple factors of production presented below.

[9] Leamer [1987] provides generalizations of these implications for higher dimensional settings.

value isoquants). Relatively high production costs drive countries out of industries at odds with their comparative advantage.

Existing trade datasets are almost exclusively collected at the industry level. As a result, testing whether countries with disparate relative factor endowments export distinct sets of goods within industries to the United States is quite difficult; countries rarely specialize in industries.[10]

This paper exploits the richness of finely detailed product-level trade data to look for specialization both across and within thousands of products. To test for specialization *across* products, I investigate the extent to which capital-abundant (high-wage) countries ship the same products to the United States as labor-abundant (low-wage) countries. To test for specialization *within* products, I examine whether exporter varieties within products are related to exporter per capita GDP, exporter endowments and exporter production techniques. Within-product specialization assumes that the isoquants of Figure I represent product varieties rather than industries. Because data on production techniques at the product level are unavailable, I link product unit values to industry input intensities.[11]

New trade theory is based upon imperfect competition, productivity differences among producers within industries, and consumers' love for variety [via Dixit-Stiglitz 1977 preferences]. Production encompasses a single factor, labor. As is well known given these assumptions, a variety's price

[10] Though evidence of discrete industry specialization is hard to find, research has shown a link between endowments and industry shares. Leamer [1984] groups countries' industry-level exports into ten categories according to their proclivity to be exported together. He then demonstrates a long-term correlation between countries' factor accumulation and changes in the export shares of these categories. More recently, Harrigan and Zakrajšek [2000] show a relationship between countries' factor accumulation and industry-level production. The results in this paper indicate that within-product specialization is a key driver of these industry-level trends.

[11] Lack of product-level input intensity data precludes performance of a product-level factor content test in the spirit of Bowen et al. [1987].

is a constant markup over productivity-adjusted marginal cost. The price ratio of any two varieties is

$$\frac{p_m}{p_n} = \frac{w/\varphi_m}{w/\varphi_n}, \tag{1}$$

where p_m and p_n are the prices of varieties m and n, w represents the return to (homogeneous) labor, and φ indexes productivity.[12] In early models [e.g. Krugman 1980], countries are assumed to be a collection of homogeneous firms, each possessing the same productivity and producing a distinct variety. More recent models [e.g. Bernard et al. 2003a, Melitz 2003] stress firm heterogeneity in an effort to explain issues beyond trade patterns, in particular why some firms become exporters and others do not. Because the data I examine encompass countries and products, I proceed under the assumption that countries produce unique varieties within product categories.

Equation (1) implies that countries with higher productivity will have lower-priced exports.[13] This implication is contradicted by the data: unit values are higher for skill- and capital-abundant countries, i.e. the very countries which enjoy relatively high productivity.

It is possible that firms with relatively high productivity choose to compete on quality, using their productivity advantage to produce high-quality,

[12] Because varieties face the same elasticity of substitution, the constant markup term cancels out of equation (1).

[13] Wages in equation (1) can also be interpreted as efficiency-adjusted. In that case, $w_m = \widetilde{w}_m/\eta_m$, where $\widetilde{w}_m$ and η_m are the raw wage and efficiency of labor in country m, respectively. If workers receive their marginal product, $w_m = w_n = w$ and cross-country variation in wages and worker efficiency have no impact on relative prices. If workers in more productive countries receive exogenously high relative wages that are unrelated to efficiency, variety prices will diverge less than implied by differences in φ. However, such differences would have to be implausibly high to rescue new trade theory: even if Japan and the Philippines are equally productive ($\varphi_m = \varphi_n$), the unit value ratio in men's cotton shirts requires Japanese apparel workers to earn thirty times the wage of Philippine apparel workers *after* adjusting for worker efficiency (η).

high-price varieties rather than lower-priced versions of goods from low productivity firms [Melitz 2000]. Like the quality ladder model of Grossman and Helpman [1991], however, a new trade model incorporating this activity begs an old trade theory interpretation to explain the basis for productivity differentials. Such an interpretation is supported by the empirical link between exporter unit values and input intensities found in this paper.

The next section examines specialization both across and within products. The lack of specialization *across* products is taken as evidence against a standard interpretation of old trade theory. Specialization *within* products is used to test old versus new trade theory directly. In new trade theory, *within*-product specialization is horizontal and variety price varies inversely with producer productivity. In old trade theory, *within*-product specialization is vertical: varieties are related both to exporter endowments and to exporter production techniques.

III. Empirical Results

III.A. Data Description

Product-level U.S. import data, available from the U.S. Census Bureau and compiled by Feenstra [1996], record the customs value of all U.S. imports by exporting country from 1972 to 1994. Customs (i.e. free on board or fob) value is exclusive of any duties or shipping charges. An extremely useful feature of these trade data is the inclusion of both quantity and value information for a large number of goods and countries, rendering possible the calculation of unit values. I compute the unit value of product p from country c, u_{pc}, by dividing import value (V_{pc}) by import quantity (Q_{pc}), $u_{pc} = V_{pc}/Q_{pc}$.[14] Examples of the units employed to classify products

[14] For some years and products, there are multiple country observations of value and

include dozens of shirts in apparel, square meters of carpet in textiles and pounds of folic acid in chemicals. Because units vary by products within industries, unit values cannot be computed at the industry level.

It is important to note that the unit values in this dataset are not perfect. A study by the U.S. General Accounting Office [1995] identified underlying product heterogeneity and classification error as two major sources of unit value error in an in-depth analysis of eight products. Within-product heterogeneity is a focus of this paper, and I explore how unit values vary with respect to exporter endowments and exporter production technique. Classification error involves inaccurate recording of units and misclassification of goods.

Imports are recorded according to thousands of finely detailed categories, which I refer to as 'products' or 'goods'.[15] Imports at higher levels of aggregation, such as the one digit Standard International Trade Classification (SITC1) system, are referred to as 'industries'. Table I lists examples of products by industry in 1994 along with the number of products in each industry in that year. Manufactured Materials, with over four thousand products, has the most categories. The analysis below is restricted to manufacturing imports (SITC1=5,6,7,8), which are more likely to be motivated by exporter skill and capital abundance.

A snapshot of across-industry specialization at various levels of aggregation is provided in Figure II. Each line in the figure traces the share of

quantity. In those cases, I define the unit value to be a value-weighted average of the observations. Availability of unit values ranges from 77 percent of product-country observations in 1972 to 84 percent of observations in 1994.

[15] Imports are classified according to seven digit Tariff Schedule of the US (TS7) codes from 1972 through 1988 and according to the ten digit Harmonized System (HS10) codes from 1989 through 1994. The most salient difference between the two systems is a reduction in the number of Manufactured Materials categories at the expense of Machinery, Chemical and Food categories.

non-zero country-industry observations in the dataset for a different level of aggregation. While 93 percent of SITC1 cells exhibit positive imports in 1994, the share is just 10 percent for products. This discrepancy between industries and products highlights the difficulties of using industry-level data to test for the discrete old trade theory specialization illustrated in Figure I.[16] Product-level data provide much better resolution of specialization than industry-level data.

III.B. U.S. Trading Partners Do Not Specialize *Across* Products

In Heckscher-Ohlin trade theory, countries with different relative endowments export distinct sets of products to the United States Testing this hypothesis requires consideration of the broadest possible sample of countries because specialization is more apt to appear among more dissimilar trading partners. As a result, in this section I use per capita GDP (PCGDP) data to group countries into relative wage cohorts.[17] In the next section, I supplement PCGDP data with measures of capital and skill abundance.

I classify countries as low, middle and high wage if their PCGDP is in the 0 to 30th percentile, the 30th to 70th percentile, or the 70th to 100th percentile of the world PCGDP distribution, respectively. (Below, I show that results are not sensitive to the use of alternate cutoffs, or to classifying

[16] Each years' shares in Figure II are conservative in the sense that they are computed with respect to the set of countries exporting any product to the United States in that year, and not with respect to the set of countries in existence in that year.

[17] Dollar-denominated per capita GDP data are from the 2000 World Bank Development Indicators CD-ROM. These data are available for roughly three times as many countries as endowment data over the sample period. Table II notes countries for which PCGDP data is unavailable for some years. Eliminating these countries from the sample entirely yields results similar to those reported in this section.

countries in terms of relative PCGDP.) These cohorts are meant to correspond to the three cones of diversification in Figure I; low- and high-wage countries are expected to have no products in common. Countries are re-assigned to cohorts each year to control for potential movement through cones of diversification. Though the number of U.S. trading partners increases over time, across all years there are an average of 40 countries in the low- and high-wage cohorts, and 55 in the middle-wage cohort. Countries classified as low wage throughout the sample period under this procedure include China, India, Pakistan and most African countries. Turkey and Chile are persistent middle-wage countries. Table II lists all countries included in the analysis and identifies those classified as low wage, by year.

Products are classified according to the exporter PCGDP cohort from which they originate. Low (L), Middle (M) and High (H) products originate solely in low-, solely in middle-, or solely in high-wage countries, respectively. Products are Low & Middle (LM) or Middle & High (MH) if they are sourced simultaneously from at least one country of each type. Finally, a product is Low, Middle & High (LMH) if it originates in at least one low-wage country and one high-wage country, simultaneously (e.g. both Japan and India export the good to the United States). The six product cohorts – L, M, H, LM, MH and LMH – are mutually exclusive. A stark prediction of old trade theory is that the share of LMH goods is zero.

Figure III plots a breakdown of the number of products by type. The message of this figure is remarkable: even when trade is divided into thousands of products, there is little evidence over time of endowment-related specialization *across* products. In 1972, 38 percent of import products originate solely in high-wage countries (H) and 31 percent in middle-high (MH) wage countries. By 1994, these share fall by roughly half, to 21 percent and 16 percent, respectively. At the same time, the share of LMH products – those imported simultaneously from high- and low-wage countries – rise steadily from 30 percent in 1972 to 62 percent in 1994.[18]

The existence of LMH goods – and their increase over time – is clearly at odds with the spirit of the Heckscher-Ohlin model. The data reject old trade theory specialization due to comparative advantage *across* products.

The evidence in Figure III is robust to a number of sensitivity analyses, which are summarized in Table III. The first row of this table reports the base-case LMH trend illustrated in Figure III.

The first robustness check, in row two of Table III, reveals that the increase in LMH exports is not driven by very small export flows. The upward LMH trend remains even if exporter-product observations of less than $10,000 are excluded from the sample. Thus, the across-product evidence in Figure III represents economically meaningful market participation.

The second set of robustness checks, in rows three through five of Table III, demonstrates that upward trend in LMH shares is not sensitive to the PCGDP percentile cutoffs used to classify countries. Similar trends are found when 20th-80th, 40th-60th and 30th-90th percentiles are used to construct country cohorts. The increase is more muted for the 20th-80th cutoff because it greatly expands the set of middle countries (e.g. under this definition, China moves from low to middle and Korea from high to middle in 1994). Results using the asymmetric 30th-90th split reveal that low-wage countries are penetrating the product markets of even the fifteen or so highest-wage countries.

The third set of robustness checks, in rows six and seven of Table III, shows that the base-case result does not depend on LMH products that

[18] Similar trends are found with respect to the value of imports. Results are also similar across industries within aggregate manufacturing: shares of LMH goods increase between 1972 and 1994 for all two-digit SITC manufacturing industries and for more than three-quarters of five-digit SITC manufacturing industries.

receive an LMH classification because of the presence of a *single* low-wage country. Between 1972 and 1994 roughly one-fifth of LMH goods are imported from just one country with PCGDP less than the 30th percentile. Table II identifies the countries that are responsible for these products and the share of single low-wage country LMH products they define. The two largest contributors are China (55 percent) and India (22 percent). The sixth row of Table III reports results after excluding LMH products that are defined in this manner: an upward trend in the share of LMH goods, from 17 percent to 44 percent, remains. To determine the sensitivity of results to China, the sixth row of the table reports LMH shares using the 30th-70th percentile split but removing LMH products solely defined by China. The resulting increase in LMH products indicates that low-wage countries other than China are increasingly exporting the same goods to the United States as high-wage countries. Note that the influence on the LMH trend of countries like China and India, both of whose PCGDP rises relative to the broader set of low-wage countries over time, is not inconsistent with the factor proportions framework.[19] Indeed, it may be a manifestation of their movement into the cones of diversification occupied by higher wage countries.[20]

[19] Between 1972 and 1994, the Chinese and Indian PCGDP percentiles increase from 11 and 11 to 24 and 18, respectively. These countries also experience an increase their PCGDP relative to the U.S. Over the same period, Chinese and Indian PCGDP as a percent of U.S. PCGDP rises from 0.7 and 1.1 percent to 1.9 and 1.3 percent, respectively. The set of countries whose relative PCGDP advanced during the sample period is reported in Table II.

[20] Recent theoretical research in the macroeconomic growth literature investigates the relationship between economic integration and cross-country income convergence [e.g. Ventura 1997; Acemoglu and Ventura 2002; Cunat and Maffezzoli 2002]. An implication of this research is that low-wage countries may never achieve the steady-state income level of high-wage countries even when they eventually adopt the product mix of high-wage countries. The evidence presented here and in the next section suggests that both specialization and catching up (in terms of product mix) by relatively fast-growing economies are important features of the data.

However, I find that the decline in across-product specialization is not driven by a more general convergence of low- and high-wage countries. Such convergence, if it were extremely pronounced, could push all countries into a single cone of diversification, with the result that all countries specialize in the same mix of goods.

To demonstrate the robustness of the results to potential convergence, I use countries' PCGDP relative to the United States, rather than their PCGDP percentiles, to assign countries to wage cohorts in a fourth set of robustness checks. Results are reported in rows eight to ten of Table III. I use two different cutoffs: 5-95 percent and a more stringent 2-98 percent.[21] Both cutoffs result in increases in the share of LMH goods that are similar to the base case. For an even stricter test, I start with the country cohorts defined by the 5-95 percent cutoffs and make two amendments. First, I remove countries from the low-wage group if their PCGDP relative to the United States increases over the sample period. I then remove countries from the high-wage group if their PCGDP relative to the United States decreases over time. These refinements create new low-and high-wage cohorts whose members pull away from each other between 1972 and 1994.[22] Even these cohorts exhibit a more than doubling of the LMH share over time. Indeed, the 13 percentage point increase of these countries represents more than half the increase experienced by the countries in the basic 5-95 percent split (row 8).

[21] Countries classified as low-wage using the 5-95 percent cutoffs are listed in Table II. The number of low- and high-wage countries over time averages 48 and 12 using the 5-95 percent cutoff (similar to the 30th-90th percentile split used above) and 29 and 10 using the 2-98 percent cutoff.

[22] Bangladesh, Cambodia, China, Egypt, India, Indonesia, Morocco, Pakistan, Sri Lanka, Syria, Taiwan and Thailand are removed from the low-wage cohort. Denmark, Finland, France, Kuwait, Netherlands, Sweden, Switzerland and the UAE are dropped from the high-wage cohort.

The results and sensitivity analyses presented in this section offer compelling evidence that international specialization across products declined between the 1970s and the 1990s.

III.C. U.S. Trading Partners Do Specialize *Within* Products

In this section I demonstrate that U.S. import unit values are positively associated with exporter PCGDP, exporter relative endowments and exporter production techniques across time and industries.

Striking examples of the first relationship are provided in Figure IV, which plots exporter unit value versus exporter per capita GDP for four products in 1994. The first three scatters in the figure are plots of manufacturing products: dyed woven fabrics, men's cotton shirts and CRT monitors. The fourth scatter, of fuel oil, is a natural resource commodity. The manufactured goods exhibit a positive (and significant) relationship between unit value and PCGDP. The natural resource good does not. Across all U.S. manufacturing imports, the median ratio of high to low unit values is 24.

A formal assessment of the within-product relationship between exporter unit values and exporter income across time is obtained via separate OLS estimations of

$$\log(u_{pct}) = \alpha_{pt} + \beta_{pt} \log(PCGDP_{ct}) + \varepsilon_{pct} \tag{2}$$

on each LMH product in each year, where u_{pct} is country c's unit value of product p in year t and $PCGDP_{ct}$ is country c's per capita GDP in year t. This estimation yields approximately 70,000 β_{pt}'s. The percent of these coefficients that are positive and significant (at the 10 percent level) are reported, by year, in the second column of Table IV. Results reveal that an increasing share of LMH products exhibit a positive relationship between unit value and exporter income over time, from roughly 40 percent in the early 1970s to roughly 50 percent in the 1990s.

The third and fourth columns of Table IV demonstrate that more broadly sourced products are more likely to have a positive association with exporter PCGDP. These columns report the share of positive and significant slopes when equation (2) is restricted to goods imported from at least 20 and 40 countries, respectively. Shares jump by 10 to 15 percentage points with each sub-sample, so that by 1994, 60 percent of products sourced from at least 20 countries, and 75 percent of products sourced from at least 40 countries, show unit values increasing with PCGDP.[23] This pattern of results is reassuring because it reveals that differences in unit values are not driven by relatively few countries participating in relatively thin product markets. Indeed, the more varieties imported, the more likely their price rises with exporter PCGDP.

The results in Table IV reject a null hypothesis of no association between unit value and PCGDP across products and years. They are consistent with the factor proportions implication that high-wage countries export vertically superior varieties.

Direct measures of exporter endowments are also positively related to unit values. Table V reports the results of regressing log unit values on exporter characteristics and product-year fixed effects,

$$\log(u_{pct}) = \alpha_{pt} + \beta Z_{ct} + \varepsilon_{pct}, \qquad (3)$$

[23] This winnowing of the sample results in a sharp decline in the number of LMH products analyzed in each column. In 1994, there are 5528, 2229 and 447 LMH products in the full, n>20 and n>40 samples, respectively.

where Z_{ct} represents exporter c's log real PCGDP, log real capital per labor or log skill per labor in year t, and α_{pt} is a product-year fixed effect to control for level differences in unit values across goods and time. To facilitate comparison across exporter characteristics, the estimation sample for equation (3) is restricted to products, countries and years that are available for each independent variable.[24] Capital per labor data are from the Penn World Tables (Mark 5.6), compiled by Summers and Heston [1995]. Skill per labor is defined as the population share attaining secondary or higher education; these data are from Barro and Lee [2000].[25]

The results in Table V reveal that unit values are positively and significantly related both to exporter's PCGDP and to measures of their relative endowments. The coefficients on PCGDP, capital per labor and skill per labor imply that 10 percent increases in these exporter characteristics are associated with 1.3, 4.4 and 5.0 percent increases in exporter unit values, respectively.

The relationships depicted in Table V vary across industries in an intuitive way. Table VI displays the results of estimating a version of equation (3) separately on each SITC1 manufacturing industry i,

$$\log(u_{pict}) = \alpha_{pt} + \beta_i K/L_{ct} + \varepsilon_{pict}, \tag{4}$$

where K/L_{ct} is country c's capital per labor in year t. (Similar results are obtained using PCGDP or skill abundance.) Coefficient estimates are positive and statistically significant at the 1 percent level across all four

[24] This keeps the composition of products and exporters constant. Results are similar if the full sample of available data is used for each independent variable.

[25] Capital per labor data are available from 1972 to 1992. Education attainment data are available from 1970 to 1995 at five-year intervals. For the final 1994 cross-section I use 1992 and 1995 capital and skill data, respectively, in estimating equation (3). Results do not depend on this extension.

industries. They are also economically significant: in Machinery in 1972, for example, a 10 percent increase in capital per labor is associated with a 5.4 percent increase in unit value. The unit value to K/L gradient is steepest for Machinery, which contains many differentiated goods, and shallowest for chemicals, which likely contains relatively fewer differentiated goods.

The results reported in Tables V and VI are robust to controlling for changes in the composition of products or trading partners over time. Table VII, for example, reports industry results from estimating equation (4) on the constant set of products and trading partners that exist between 1972 and 1988. This restriction sharply reduces the sample size and excludes observations after 1988 because of a change in how products were classified in 1989. Even so, the coefficient estimates remain positive and statistically significant. Furthermore, the variation in estimates across industries is similar.

I also find that import unit values are positively related to the manufacturing techniques exporters use to produce them. Though production techniques are unavailable at the product level, they can be constructed for industries in 1990.[26] I estimate the OLS relationship between product-exporter unit values in industry i on industry-exporter production technique via

$$\log(u_{pic}) = \alpha_p + \beta_i k_{ic} + \varepsilon_{pic}, \tag{5}$$

where α_p is a product fixed effect and k_{ic} is the capital per labor ratio of three-digit ISIC industry i in country c. This estimation yields one slope

[26] Country-industry capital intensity estimates are computed using data from the INDSTAT3 database from UNIDO [see Schott 2003 for details on their construction]. For the regression, HS10 products are concorded to three-digit ISIC industries using a combination of Maskus' [1991] SITC to ISIC industry concordance and Feenstra's [1996] product to SITC concordance.

per industry. Slopes, R^2's and the number of product-country observations for each industry are reported in Table VIII. Across exporters, a positive and statistically significant relationship between product price and industry capital intensity is evident in 26 of 28 manufacturing industries. The magnitude of the regression slope is highest for Electrical Machinery (ISIC 383), where the point estimate implies that a 10 percent increase in capital intensity of production is associated with an 8.5 percent increase in unit value.

This demonstration of a positive correlation between goods prices and the capital intensity of their production relates directly to a key implication of the factor proportions framework, which defines goods according to their input intensities. Indeed, establishing a link between price and technique gets to the heart of international specialization irrespective of whether it occurs *across* or *within* products. As a result, the estimation of equation (5) bypasses problems associated with insufficiently disaggregate product classification, a source of concern since Balassa [1966].

Finally, I find that relative exporter-product unit values increase with relative factor accumulation over time. This result cannot be pushed too hard because it, like the results in Table VII, is based upon the severely restricted sample of LMH product codes that are valid in both 1972 and 1988. Nevertheless, Table IX reports OLS regression results from estimating

$$\Delta u_{pc} = \alpha + \beta \Delta Z_c + \varepsilon_{pc}, \tag{6}$$

where Δu_{pc} is the log difference in exporter-product unit value between 1972 and 1988 less the mean change across countries exporting the product, and ΔZ_c is the change in exporter c's PCGDP percentile or factor abundance, also relative to the mean change across countries exporting the product. Table IX reveals that relative changes in unit values are positively and significantly related to relative changes in both exporter PCGDP and exporter skill and capital abundance. These within-product results are consistent with the factor proportions framework because they imply that countries produce more highly priced, more vertically differentiated varieties as they become more capital and skill abundant.

The evidence linking unit values, exporter endowments and exporter production techniques presented in this section supports an old trade theory interpretation of U.S. trade because it is consistent with skill- and capital-abundant countries using their relative endowments to manufacture vertically distinct varieties that incorporate higher levels of capital and skill per worker. In the context of Figure I, this interpretation has high- and low-wage country varieties being represented by distinct isoquants, with each country producing the set of varieties whose input intensities are most similar to its relative endowments: Italy exports sportswear that is capital or skill intensive (fashionable or high quality) while China exports sportswear that is labor intensive (drab or low quality).

The evidence in this section is inconsistent with new trade theory because varieties from countries with high productivity have a higher price than varieties from countries with low productivity.

IV. Additional Interpretations

The analysis in the previous section supports the idea that international product trade proceeds according to comparative advantage. This section discusses additional interpretations of the evidence, and argues, that they, unlike comparative advantage, are not consistent with the evidence.

Specialization may appear stronger within rather than across products because of transfer pricing. To the extent that U.S.-based multinationals source inputs from developing countries with lower labor costs, and seek to minimize tax liability in those locations, 'true' unit values may be higher than those reported on customs documents. Such behavior could increase the likelihood of finding evidence of specialization via unit value differences. On the other hand, if U.S. tax rates are higher than those of low-wage countries, multinationals would have an incentive to over-report the value of exports from low-wage countries. If that is the case, the results of the previous section are likely to be conservative. Unfortunately, controlling for transfer pricing is not possible with existing datasets. As noted above, I am also unable to control more generally for product or value misclassification that occurs when customs declarations forms are filled out.

It is also possible that the unit values of low-wage countries are lower than those from high-wage countries because of the relatively strong bargaining power of U.S. firms. If the United States is able to obtain lower prices from producers in low-wage countries than from producers in high-wage countries, perhaps due to imperfect information or other distortions, the relatively high unit values of high-wage country varieties will be biased upwards. Though it is hard to believe such asymmetry would endure, gathering data to test this hypothesis would be useful.

The evidence is also consistent with demand-side explanations of international trade. To the extent that countries with similar incomes have a taste for similar goods [e.g. Linder 1961], U.S. consumers may be willing to pay relatively high prices for high-wage country varieties. However, for this explanation to render new trade theory consistent with the unit value patterns reported above, this taste must be implausibly strong. Indeed, it must overcome both the relatively high productivity of high-wage countries *and* generate very large relative unit value differences. On the other hand, to the extent that these taste differences are a manifestation of added attributes or higher quality, they are consistent with old trade theory.

Finally, the within-product evidence for comparative advantage may be driven in part by firm outsourcing of the type discussed by Feenstra and Hanson [1996]. If goods from various stages of a production process are included in a single product category, countries with very different endowments may export very different intermediate inputs within the same product category. The increase in unit value differences across products over time is also consistent with the idea that outsourcing has increased since the 1970s. To help determine the extent to which outsourcing influences the trends in this paper, I have re-run the estimations above on a sub-sample of products that excludes products containing the word "part" in their description [Ng and Yeats 1999]. Results are essentially the same.

V. Conclusion

Product-level U.S. trade data provide a rich new dimension for testing and thinking about trade theory. While the data rule against endowment-driven specialization *across* products, the positive association among within-product unit values, exporter capital and skill abundance and exporter production techniques is consistent with factor-proportions specialization *within* products. These relationships suggest that high-wage countries use their endowment advantage to add features or quality to their varieties that are not present among the varieties emanating from low-wage countries.

Unit value patterns are inconsistent with new trade theory models that have producer price varying inversely with producer productivity. To the extent that skill- and capital-abundant countries enjoy relatively high productivity, their varieties should sell at a discount relative to the varieties from labor-abundant countries. They do not. It is of course possible that a closer look at unit value variation within a subset of high-wage countries, or within a subset of low-wage countries, will provide support for new trade theory in the arena it was designed to model. In line with recent theoretical progress in the international trade literature, such an examination may be more fruitful and interesting if undertaken with a focus on heterogenous firms within countries.

Gauging the extent of international specialization is important for understanding past and future effects of globalization. In the standard Heckscher-Ohlin model, specialization can insulate workers in high-wage countries from direct competition with workers in low-wage countries by breaking price-wage arbitrage. As the Japanese economy abandons the labor-intensive products manufactured in the Philippines, for example, its workers may be less susceptible to price movements in those markets. The degree of insulation afforded to workers in high-wage countries will depend upon the substitutability of high- and low-wage country varieties.

The evidence presented in this paper highlights the need for a new round of firm-based trade models that encompass key elements of old and new trade theory. In particular, future models must capture the richness of demand suggested by the proliferation of U.S. product imports as well as the important association between factor endowments, factor input intensities and product prices. These models will lie at the intersection of international economics and industrial organization.

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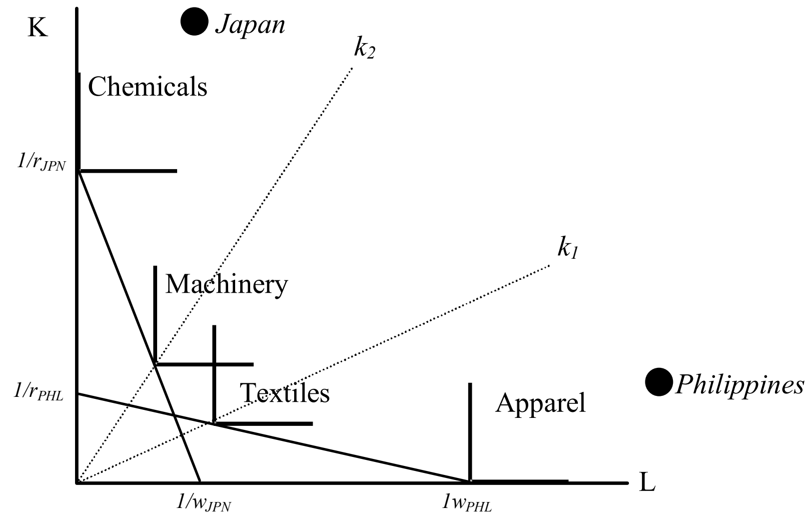

FIGURE I
Figure I Multiple Cone Heckscher-Ohlin Specialization

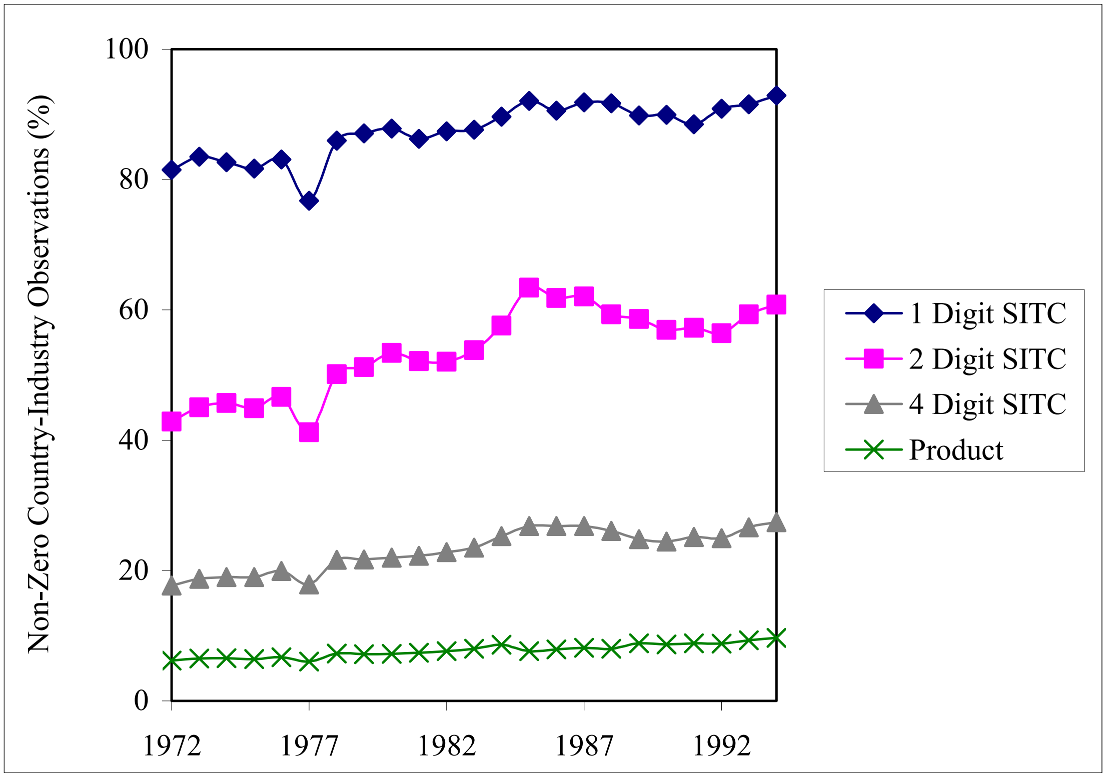

FIGURE II
Percent of Non-Zero Country-Industry and Country-Product Observations in a Panel of U.S. Manufacturing Imports

Notes: Graph displays the percent of non-zero country-industry cells across all U.S. manufacturing imports for the noted level of aggregation. SITC is the Standard International Trade Classification; four-digit industries are more finely defined than one-digit industries. Product refers to the seven-digit TS or ten-digit HS product categories, which are the most detailed description of U.S. trade flows available. Product classification switched from TS to HS in 1989.

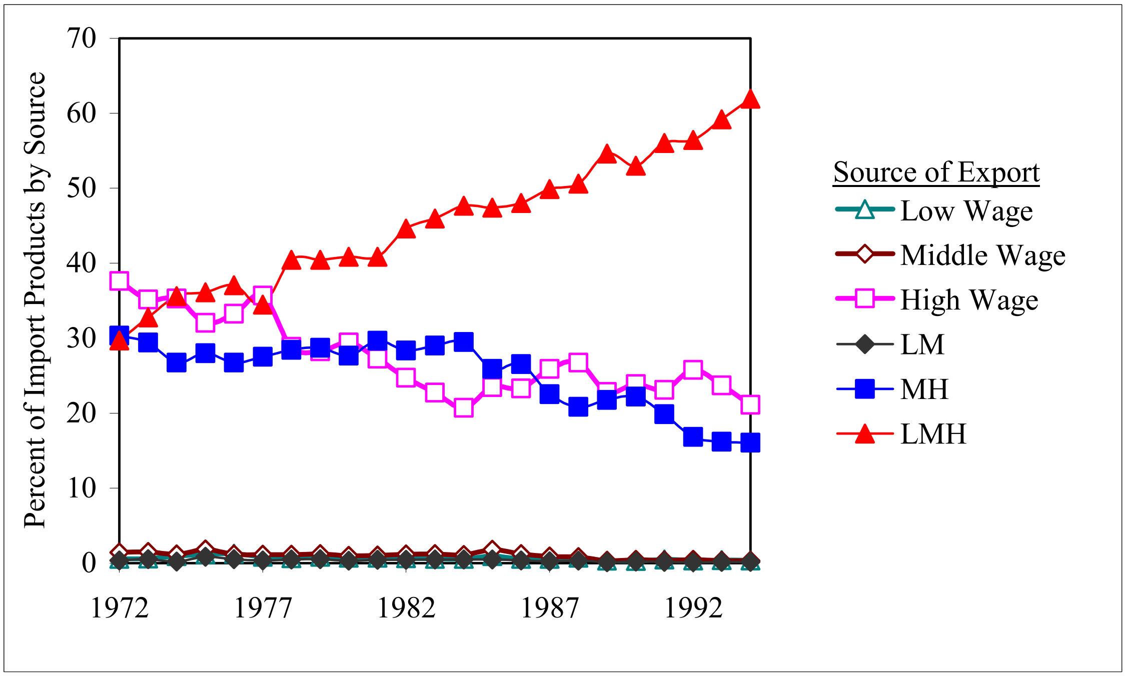

FIGURE III
Breakdown of U.S. Imports By Exporter Per Capita GDP Level, 1972-1994

Notes: U.S. import products are classified according to the income level of the exporting country. Exporters are classified as low-, middle- or high-wage if their per capita GDP is below the 30th, between the 30th and 70th or above the 70th percentiles of world PCGDP, respectively. Low-wage products (L) originate solely in low-wage countries (e.g. China), while LMH products originate simultaneously in at least one low- and one high-wage country. The six product classifications in the figure are mutually exclusive.

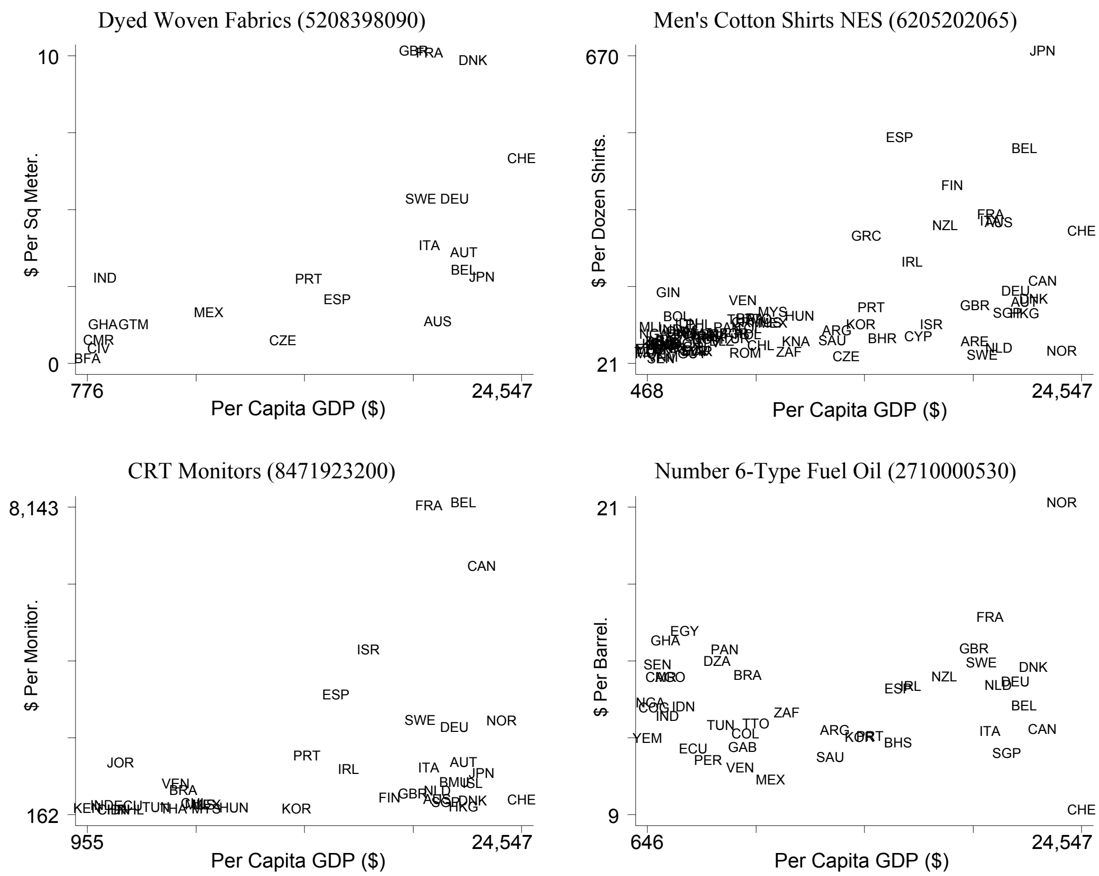

FIGURE IV
Unit Values Versus Exporter Per Capita GDP for Four U.S. Import Products in 1994 (HS Product Code Noted in Parentheses)

TABLE I
Mapping Products to Industries

SITC1 Industry	Example of SITC2 Industries	Example of HS Product	Number of Products (1999)
0 Food	Meat, Dairy Products, Fruit	Sheep, live	1823
1 Beverages and Tobacco	Wine, Cigarettes	Carbonated soft drinks	163
2 Crude Materials	Rubber, Cork, Wood, Textile Fibers	Silkworm cocoons suitable for reeling	833
3 Mineral Fuels	Coal, Coke, Petroleum, Natural Gas, Electric Current	Unleaded gasoline	101
4 Animal and Vegetable Oils	Lard, Soybean Oil, Linseed Oil	Tallow, edible	82
5 Chemicals	Organic Chemicals, Dyes, Medicines, Fertilizers, Plastics	Chloroform	1930
6 Manufactured Materials	Leather, Textile Yarn, Paper, Steel, Cork Products	Diaries and address books, of paper or paperboard	4219
7 Machinery	Power Generating Machinery, Computers, Autos	Ultrasonic scanning apparatus	2898
8 Miscellaneous Manunfactures	Apparel, Footwear, Plumbing, Scientific Equipment, Cameras	Boys' shorts cotton playsuit parts, not knit	3866
9 Not Elsewhere Classified	Special Transactions, Coins, Gold	Sound recordings for State Dept use	65

TABLE II

Countries in Dataset

Country	0-30th Percentile	<5% US PCGDP	Lone (%)	Country	0-30th Percentile	<5% US PCGDP	Lone (%)	Country	0-30th Percentile	<5% US PCGDP	Lone (%)
afghanistan*	72-81	.	0.23	GERMANY	.	.	.	nigeria	72-75;83-94	72-94	0.30
albania	92-94	80-94	0.02	ghana	72-94	72-94	0.36	NORWAY	.	.	.
algeria	.	.	.	greece	.	.	.	OMAN	.	.	.
angola*	92-94	85-94	0.01	greenland*	.	.	.	PAKISTAN	72-94	72-94	2.62
argentina	.	.	.	guatemala	.	.	.	panama	.	.	.
australia	.	.	.	guinea*	88-94	86-94	0.03	papua new guinea	.	76-94	.
AUSTRIA	.	.	.	guinea-bissau	72-94	72-94	0.06	PARAGUAY	.	.	.
bahamas	.	.	.	guyana	82-94	72-94	0.27	peru	.	.	.
bahrain*	.	.	.	haiti	72-94	72-94	2.44	philippines	72-89;91	84-94	7.77
BANGLADESH	72-94	72-94	0.37	honduras	73;75-77;81-83;90-92;94	72-94	0.63	poland*	.	.	.
barbados	.	.	.	HONG KONG	.	.	.	PORTUGAL	.	.	.
BELGIUM	.	.	.	hungary*	.	.	.	qatar	.	.	.
BELIZE	.	.	.	ICELAND	.	.	.	romania*	.	.	.
benin	72-94	72-94	0.02	INDIA	72-94	72-94	21.65	rwanda	72-94	72-94	0.02
bermuda	.	.	.	INDONESIA	72-91	72-94	2.49	saudi arabia	.	.	.
bolivia*	.	79-94	.	iran*	.	88-90	.	senegal	72-91;94	72-94	0.17
brazil	.	.	.	IRELAND	.	.	.	SEYCHELLES	.	.	.
bulgaria*	.	.	.	israel	.	.	.	sierra leone	72-94	72-94	0.10
burkina faso	72-94	72-94	0.03	ITALY	.	.	.	SINGAPORE	.	.	.
burundi	72-94	72-94	0.01	jamaica	.	.	.	somalia*	72-90	.	0.03
cambodia*	89-94	87-94	0.01	JAPAN	.	.	.	south africa	.	.	.
cameroon	72-80	72-94	0.05	jordan*	.	.	.	SPAIN	.	.	.
canada	.	.	.	kenya	72-94	72-94	0.66	SRI LANKA	72-93	72-94	0.59
cen afr rep	72-94	72-94	0.02	kiribati*	87-89	88-90	0.04	st. kitts & nevis*	.	.	.
chad	72-94	72-94	0.01	KOREA	.	.	.	sudan	72-94	72-94	0.05
CHILE	.	.	.	kuwait	.	.	.	suriname	.	72-75;79-94	.
CHINA	72-94	72-94	54.74	lao pdr*	90-94	84-94	0.01	sweden	.	.	.
COLOMBIA	.	.	.	lebanon*	.	.	.	switzerland	.	.	.
congo dr	72-94	72-94	0.23	liberia*	73;78-87	.	0.09	SYRIA	.	72-94	.
congo r	77-78	72-81;86-94	.	madagascar	72-94	72-94	0.10	TAIWAN	.	72-77	.
costa rica	.	.	.	malawi	72-94	72-94	0.06	tanzania*	90-94	88-94	0.04
cote d'ivoire	85	80-94	0.03	MALAYSIA	.	.	.	THAILAND	72-78	73-77	0.96
cyprus*	.	.	.	mali	72-94	72-94	0.22	togo	72-94	72-94	0.03
czech rep*	.	.	.	MALTA	.	.	.	trinidad & tobago	.	.	.
denmark	.	.	.	mauritania	72-94	72-94	0.05	TUNISIA	.	.	.
dominican rep	.	.	.	mauritius	.	.	.	turkey	.	.	.
ECUADOR	.	.	.	mexico	.	.	.	uae*	.	.	.
EGYPT	72-86;89	72-94	0.68	MOROCCO	85-87	72-74;81;84;87;89;92-93	0.31	uganda*	84-94	82-94	0.01
el salvador	81-83	.	0.13	mozambique*	82-94	80-94	0.14	united kingdom	.	.	.
eq guinea*	87-94	85-94	.	nepal	72-94	72-94	0.25	uruguay	.	.	.
ethiopia*	83-94	81-94	0.07	neth antilles*	.	.	.	venezuela	.	.	.
fiji	.	.	.	netherlands	.	.	.	vietnam*	93-94	84-94	0.02
finland	.	.	.	new caledonia*	.	.	.	zambia	78-94	72-94	0.05
france	.	.	.	new zealand	.	.	.	zimbabwe	86	72-94	0.02
gabon	.	.	.	nicaragua	79-82;89-94	72-73;78-94	0.28				
gambia	72-94	72-94	0.06	niger	72-94	72-94	0.37				

Notes: First column indicates years for which the country's PCGDP is within the 30th percentile of the world distribution. Second column of each panel indicates years for which the country's PCGDP is less than 5 percent of U.S. PCGDP. Third column of each panel indicates percent of single low-wage country LMH products, if any, defined solely by the noted country (see text). An asterisk after country name indicates PCGDP for some years is missing. Upper (lower) case letters indicates that the country's PCGDP relative to the U.S. increases (decreases) between 1972 and 1994.

TABLE III
Sensitivity Analysis of Across-Product Specialization Results

Row	PCGDP Percentile Cutoffs	Additional Restrictions	Percent of LMH Products in U.S. Imports 1972	Percent of LMH Products in U.S. Imports 1994
1	30^{th} - 70^{th} (Figure III)	None	30	62
2	30^{th} - 70^{th}	Exclude Exporter-Product Observations where Exports Values is Less than $10,000	15	54
3	40^{th} - 60^{th}	None	45	65
4	20^{th} - 80^{th}	None	25	34
5	30^{th} - 90^{th}	None	27	61
6	30^{th} - 70^{th}	Exclude LMH products exported by just one low-wage country. (See Table II for list of countries.)	17	44
7	30^{th} - 70^{th}	Exclude LHM products where the only low-wage exporter is China	28	49
8	PCGDP Relative to the U.S.	Countries are low wage if their PCGDP relative to the U.S. is less than 5%, and high wage if it is greater than 95%	40	62
9	PCGDP Relative to the U.S.	Countries are low wage if their PCGDP relative to the U.S. is less than 2%, and high wage if it is greater than 98%	38	57
10	PCGDP Relative to the U.S.	Use 5%-95% cutoff. Exclude low-wage countries whose PCGDP rises relative to the U.S. Exclude high-wage countries whose PCGDP falls relative to the U.S.	9	22

Notes: This table reports the share of U.S. import products sourced simultaneously from low-, middle- and high-wage countries in 1972 and 1994 according to different robustness tests. Per capita GDP percentile splits refer to the breakpoints used to classify countries as low, middle and high wage. Products are classified according to the set of countries in which they originate.

TABLE IV
Unit Value and Exporter Per Capita GDP, by Product and Year

Year	Percent of LMH Manufacturing Products With Significant Positive Relationship Between Unit Value and Exporter PCGDP: All LMH Products	LMH Products With More Than 20 Exporters	LMH Products With More Than 40 Exporters
1972	43	55	61
1973	45	57	69
1974	40	53	69
1975	41	57	68
1976	43	54	55
1977	42	55	53
1978	43	53	55
1979	45	56	60
1980	46	56	50
1981	42	53	59
1982	43	50	61
1983	43	49	55
1984	43	50	57
1985	45	56	61
1986	47	56	68
1987	49	58	72
1988	52	62	71
1989	49	60	74
1990	52	63	75
1991	51	63	74
1992	52	63	76
1993	50	61	74
1994	49	60	73

Notes: This table reports the number of manufacturing products exhibiting a positive and significant correlation (at the 10 percent level) between product unit value and exporter PCGDP. The first column reports significance across the full sample of LMH products. Subsequent columns restrict the sample to LMH products imported from the indicated number of countries. Sample size declines across columns: in 1994 there are 5528, 2229 and 447 LMH products in the full, n>20 and n>40 samples, respectively.

TABLE V
Unit Values and Exporter Characteristics

Regressor	Log Unit Value	Log Unit Value	Log Unit Value
Log PCGDP	0.134 ***		
	0.037		
Log Capital per Labor ($000)		0.435 ***	
		0.065	
Log Skill per Labor			0.501 **
			0.089
Product-Year Dummies	Yes	Yes	Yes
Product-Country-Year Observations	214,852	214,852	214,852
Number of Unique Products	12,024	12,024	12,024
Number of Unique Countries	48	48	48
R^2	0.77	0.78	0.77

Notes: This table reports OLS regression results of exporter unit value on real exporter PCGDP, real exporter capital per worker and exporter skill abundance across LMH products (see text). Sample restricted to available data across independent variables. GDP data are from the World Bank [2000]. Capital per labor ratios are from Penn World Tables 5.6; 1992 values are used for 1994. Education attainment data are from Barro and Lee [2000]; 1970 and 1995 data are used for 1972 and 1994, respectively. Robust standard errors adjusted for exporter clustering are noted below coefficients. Results for fixed effects are suppressed. ***, ** and * refer to statistical significance at the 1 percent, 5 percent and 10 percent levels, respectively.

TABLE VI

Unit Values and Exporter Characteristics, by SITC1 Industry

Regressor	Chemicals SITC 5 Log(Unit Value)	Manufactured Materials SITC 6 Log(Unit Value)	Machinery SITC 7 Log(Unit Value)	Miscellaneous Manufactures SITC 8 Log(Unit Value)
Log(K/L)	0.209 ***	0.282 ***	0.539 ***	0.413 ***
	0.076	0.041	0.118	0.051
Product-Year Dummies	Yes	Yes	Yes	Yes
Product-Country-Year Observations	61,771	313,115	144,982	429,478
Number of Unique Products	1,543	5,706	2,932	7,523
Number of Unique Countries	59	59	59	59
R^2	0.59	0.71	0.78	0.78

Notes: Table displays OLS coefficients from a panel regression of exporter-product unit values on log exporter capital per labor across LMH products by SITC1 industry from 1972 to 1994. Robust standard errors adjusted for exporter clustering are listed below each coefficient. Results for fixed effects are suppressed. ***, ** and * refer to statistical significance at the 1 percent, 5 percent and 10 percent levels, respectively

TABLE VII

Unit Values and Exporter Characteristics (Constant Sample), by SITC1 Industry

Regressor	Chemicals SITC 5 Log(Unit Value)	Manufactured Materials SITC 6 Log(Unit Value)	Machinery SITC 7 Log(Unit Value)	Miscellaneous Manufactures SITC 8 Log(Unit Value)
Log(K/L)	0.244 ***	0.247 ***	0.578 ***	0.328 ***
	0.046	0.034	0.139	0.054
Product-Year Dummies	Yes	Yes	Yes	Yes
Product-Country-Year Observations	6,412	66,151	5,205	72,946
Number of Unique Products	54	459	67	522
Number of Unique Countries	56	59	55	59
R^2	0.59	0.78	0.83	0.80

Notes: Table displays OLS coefficients from a panel regression of exporter-product unit values on log exporter capital per labor across LMH products by SITC1 industry from 1972 to 1988. Sample is restricted to trading partners and products existing in 1972 and 1988. Robust standard errors adjusted for exporter clustering are listed below each coefficient. Results for fixed effects are suppressed. ***, ** and * refer to statistical significance at the 1 percent, 5 percent and 10 percent levels, respectively.

TABLE VIII

Product Unit Values and Industry Production Techniques, 1990

ISIC Industry (Rev 2)	Slope	R^2	Product-Country Observations
311 Food products	0.35 ***	0.49	8,505
313 Beverages	0.24 ***	0.46	546
314 Tobacco	0.05	0.30	176
321 Textiles	0.62 ***	0.43	14,440
322 Wearing apparel, except footwear	0.81 ***	0.49	8,276
323 Leather products	0.37 ***	0.44	863
324 Footwear, except rubber or plastic	0.58 ***	0.45	2,177
331 Wood products, except furniture	0.29 ***	0.55	1,053
332 Furniture, except metal	0.33 ***	0.33	547
341 Paper and products	0.03	0.47	1,036
342 Printing and publishing	0.18 ***	0.64	1,393
351 Industrial chemicals	0.30 ***	0.49	4,192
352 Other chemicals	0.45 ***	0.53	2,123
353 Petroleum refineries	0.18 **	0.58	310
354 Miscellaneous petroleum and coal	0.70 ***	0.66	196
355 Rubber products	0.39 ***	0.48	1,108
356 Plastic products	0.43 ***	0.56	2,173
361 Pottery, china, earthenware	0.35 ***	0.56	1,070
362 Glass and products	0.50 ***	0.51	1,296
369 Other non-metallic mineral products	0.27 ***	0.48	1,406
371 Iron and steel	0.66 ***	0.64	2,140
372 Non-ferrous metals	0.67 ***	0.73	852
381 Fabricated metal products	0.47 ***	0.54	5,736
382 Machinery, except electrical	0.46 ***	0.49	7,541
383 Machinery, electric	0.85 ***	0.45	3,134
384 Transport equipment	0.33 ***	0.50	3,864
385 Professional and scientific equipment	0.52 ***	0.37	2,813
390 Other manufactured products	0.30 ***	0.56	3,392

Notes: Table reports OLS regression results of cross-country regressions of log country-product unit value on log country-ISIC industry capital intensity, by ISIC industry. All data are for 1990. Regressions include product fixed effects. Industry-country capital intensities are from Schott [2003]. Products are concorded to industries using Maskus' [1991] SITC to ISIC industry concordance and the product to SITC concordance provided by Feenstra [1996]. Results for constant are suppressed. ***, **, and * refer to statistical significance at the 1 percent, 5 percent and 10 percent levels.

TABLE IX
Unit Value Changes and Relative Factor Accumulation, 1972 to 1988

Regressor	Change in Exporter-Product Unit Value	Change in Exporter-Product Unit Value	Change in Exporter-Product Unit Value
Change in Exporter's Relative PCGDP	0.476 **		
	0.232		
Change in Exporter's Relative Capital per Worker		0.463 *	
		0.246	
Change in Exporter's Relative Skill per Worker			0.006 *
			0.003
Product-Country Observations	2111	1456	1897
Number of Unique Countries	91	49	82
R^2	0.30	0.32	0.30

Notes: This table reports OLS estimation results across the constant set of LMH products exported to the U.S. in both 1972 and 1988. Dependent variable is log difference of exporter-product unit value between 1972 and 1988. First regressor is change in exporter PCGDP percentile between 1972 and 1988. Second regressor is change in exporter real capital per worker (from Penn World Tables Mark 5.6) between 1972 and 1992. Third regressor is change in exporter secondary and higher education attainment [Barro and Lee 2000] between 1970 and 1990. All changes are relative to the mean change for the product. All countries do not export all products. Robust standard errors adjusted for country clustering are noted below coefficients. Results for the constant are suppressed. ***, ** and * refers to statistical significance at the 1 percent, 5 percent and 10 percent levels, respectively.