China and the Manufacturing Exports of Other Developing Countries

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Abstract. In this paper, we examine the impact of China's growth on developing countries that specialize in manufacturing. Over 2000-2005, manufacturing accounted for 32% of China's GDP and 89% of its merchandise exports, making it more specialized in the sector than any other large developing economy. Using the gravity model of trade, we decompose bilateral trade into components associated with demand conditions in importing countries, supply conditions in exporting countries, and bilateral trade costs. We identify 10 developing economies for which manufacturing represents more than 75% of merchandise exports (Hungary, Malaysia, Mexico, Pakistan, the Philippines, Poland, Romania, Sri Lanka, Thailand, and Turkey), which are in theory the countries most exposed to the adverse consequences of China's export growth. Our results suggest that had China's export supply capacity been constant over the 1996-2003 period, demand for exports would have been 0.6% to 1.4% higher in the 10 countries studied. Thus, even for the developing countries most specialized in export manufacturing, China's expansion has represented only a modest negative shock.

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1. Introduction

The explosive growth of China's economy has been a major shock to world markets. What has made China's emergence especially disruptive is that the country is highly specialized in manufacturing. Over the period 2000 to 2005, manufacturing accounted for 32% of China's GDP and 89% of its merchandise exports, making it more specialized in the sector than any other large developing economy (Table 1). In consumer goods and other labor-intensive manufactures, China has become a major source of supply, pushing down world product prices. Meanwhile, China has contributed to a boom in demand for commodities, leading to increases in the prices of metals, minerals, and farm goods.

The impact of China's emergence on other developing countries is just beginning to be appreciated (Devlin, Estevadeordal, and Rodriguez-Clare, 2005; Eichengreen and Tong, 2005; Lopez Cordoba, Micco, and Molina, 2005). In the 1980s and 1990s, international trade became the engine of growth for much of the developing world. Trade liberalization and market-oriented reform in Asia and Latin America steered the regions toward greater specialization in exports. There is a popular conception that for non-oil-exporting developing countries expanding export production has meant specializing in manufacturing. But in actuality there is considerable heterogeneity in the production structures of these economies, which means there is variation in national exposure to China's industrial expansion.

Even excluding oil exporters and very poor countries, there are many countries that specialize in primary commodities. In Chile, Cote d'Ivoire, Kenya, and Peru, for instance, manufacturing accounts for less than 25% of merchandise exports (Table 1). One might expect this group to have been most helped by China's growth, with the commodity boom lifting their terms of trade. Other countries have diversified export production, spanning agriculture, mining, and manufacturing. In Argentina, Brazil, Colombia, Egypt, Indonesia, and Vietnam, manufacturing accounts for 30% to 55% of merchandise exports. For this group, China may represent a mixed blessing, increasing the prices of some of the goods they produce and decreasing the prices of others. A third group of countries is highly specialized in manufacturing. In Hungary, Mexico, Pakistan, the Philippines, and Turkey, manufacturing accounts for more than 80% of merchandise exports. This last group includes the countries most likely to be adversely affected by China, as it has become a rival source of supply in their primary destination markets. Between 1993 and 2005, China's share of total imports rose from 5% to 15% in the United States and from 4% to 12% in the European Union.

In this paper, we examine the impact of China's growth on developing countries that specialize in export manufacturing. Using the gravity model of trade, we decompose bilateral trade into components associated with demand conditions in importing countries, supply conditions in exporting countries, and bilateral trade costs. In theory, growth in China's export-supply capabilities would allow it to capture market share in the countries to which it exports its output, thereby reducing demand for imports from other countries that also supply these markets. We calculate the export demand shock that China's growth has meant for other developing countries, as implied by gravity model estimation results.

To isolate economies that are most exposed to China's manufacturing exports, we select developing countries that are also highly specialized in manufacturing. After dropping rich countries, very poor countries, and small countries, we identify 10 medium to large developing economies for which manufacturing represents more than 75% of merchandise exports: Hungary, Malaysia, Mexico, Pakistan, the Philippines, Poland, Romania, Sri Lanka, Thailand,

and Turkey.[1] This group includes a diverse set of countries in terms of geography and stage of development, hopefully making our results broadly applicable. We focus on developing countries specialized in manufacturing, as for this group the impact of China on their production activities is largely captured by trade in manufactures. Manufacturing is also a sector for which the gravity model is well suited theoretically.

In section 2, we use a standard monopolistic-competition model of trade to develop an estimation framework. The specification is a regression of bilateral sectoral imports on importer country dummies, exporter country dummies, and factors that affect trade costs (bilateral distance, sharing a land border, sharing a common language, belonging to a free trade area, import tariffs). When these importer and exporter dummies are allowed to vary by sector and by year, they can be interpreted as functions of structural parameters and country-specific variables that determine a country's export supply and import demand. Changes in import-demand conditions can be decomposed into two parts, one of which captures changes in income levels in import markets and another of which captures changes in sectoral import price indices for those markets, which are themselves a function of other countries' export-supply dummies.

In section 3, we report coefficient estimates based on our framework. The data for the analysis come from the UN COMTRADE database and the TRAINS dataset, which cover the period to 1996 to 2003.[2] We estimate country-sector-year import dummies, country-sector-year export dummies, and sector-year trade cost elasticities using data on a large set of trading economies that account for much of world trade. We begin by reporting estimated sectoral exporter dummy variables for the 10 developing-country exporters vis-à-vis China. For 9 of the 10 countries, export supply dummies are strongly positively correlated with China's, suggesting

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[1] In Table 1, it is apparent India would also satisfy our criteria. We exclude India because its recent growth represents another important global economic shock for other developing countries.

[2] These are the years for which we have complete trade data for all 10 of the manufacturing exporters.

that their comparative advantage is relatively similar to that of China. The results also describe how each country's export-supply capacities have evolved over time. Relative to each of the 10 countries, the growth in China's export supply capabilities has been dramatic.

The main results, presented in section 4, suggest that had China's export-supply capacity been constant over the 1996 to 2003 period, export demand would have been 0.6% to 1.4% higher in the 10 countries studied. Thus, even for developing countries highly specialized in manufacturing, China's expansion has represented only a modest negative shock. It is important to note that our results do not represent a general equilibrium analysis of China's impact on other developing economies. China's export growth may have increased the number of product varieties available to these countries, thereby improving consumer welfare (Broda and Weinstein, 2005), or had positive effects on the demand for non-manufacturing output. Our approach accounts for neither of these effects or for other possible general-equilibrium consequences. Nevertheless, the results give a sense of the extent to which China is in competition with other large developing country exporters for market share abroad.

By way of conclusion, in section 5, we discuss what China's continued growth may mean for manufacturing-oriented developing countries.

2. Empirical Specification

Consider a standard monopolistic model of international trade, as in Anderson and van Wincoop (2004) or Feenstra (2004). Let there be J countries and N manufacturing sectors, where each sector consists of a large number of product varieties. All consumers have identical Cobb-Douglas preferences over CES sectoral composites of product varieties, where in each sector n there are I_n varieties of n produced, with country h producing I_{nh} varieties. There are increasing returns to scale in the production of each variety. In equilibrium each variety is produced by a monopolistically-competitive firm and I_n is large, such that the price for each variety is a constant markup over marginal cost. Free entry drives profits to zero, equating price with average cost.

Consider the variation in product prices across countries. We allow for iceberg transport costs in shipping goods between countries and for import tariffs. The c.i.f. price of variety i in sector n produced by country j and sold in country k is then

$$P_{injk} = \left(\frac{\sigma_n}{\sigma_n - 1} \right) w_{nj} t_{nk} (d_{jk})^{\gamma_n}, \qquad (1)$$

where P_{inj} is the f.o.b. price of product i in sector n manufactured in country j; σ_n is the constant elasticity of substitution between any pair of varieties in sector n; w_{nk} is unit production cost in sector n for exporter j; t_{nk} is one plus the ad valorem tariff in importer k on imports of n (assumed constant for all exporters that do not share a free trade area with importer k); d_{jk} is distance between exporter j and importer k; and γ_n is the elasticity of transport costs with respect to distance.

Given the elements of the model, the total value of exports of goods in sector n by exporter j to importer k can be written as,

$$X_{njk} = \mu_n Y_k I_{nj} P_{njk}^{1-\sigma_n} G_{nk}^{\sigma_n - 1}, \qquad (2)$$

where μ_n is the expenditure share on sector n and G_{nk} is the price index for goods in sector n in importer k. Equation (2) reduces to

$$X_{njk} = \frac{\mu_n Y_k I_{nj} \left(w_{nj} \tau_{njk} (d_{jk})^{\gamma_n} \right)^{1-\sigma_n}}{\sum_{h=1}^{H} I_{nh} \left[w_{nh} \tau_{nhk} (d_{hk})^{\gamma_n} \right]^{1-\sigma_n}}, \qquad (3)$$

which can be written in log form as,

$$\ln X_{njk} = \ln \mu_n + \ln \frac{Y_k}{\sum_{h=1}^{H} I_{nh} \left[w_{nh} \tau_{nhk} (d_{hk})^{\gamma_n} \right]^{1-\sigma_n}} + \ln\left(I_{nj} w_{nj}^{1-\sigma_n} \right) + \left(1-\sigma_n\right) \ln \tau_{njk} + \gamma_n \left(1-\sigma_n\right) \ln d_{jk} \tag{3'}$$

Regrouping terms in (3'), and allowing for measurement error in trade values, we obtain,

$$\ln X_{njk} = \theta_n + m_{nk} + s_{nj} + \beta_{1n} \ln \tau_{jk} + \beta_{2n} \ln d_{jk} + \varepsilon_{njk}. \tag{4}$$

In equation (4), we see that there are five sets of factors that affect country j's exports to country k in sector n. The first term captures preference shifters specific to sector n; the second term captures demand shifters in sector n and importer k (which are a function of importer k's income and supply shifters for other countries that also export to k); the third term captures supply shifters in sector n for exporter j (which reflect exporter j's production costs and the number of varieties it produces in the sector); the fourth and fifth terms capture trade costs specific to exporter j and importer k (which in the empirical analysis we measure using import tariffs, bilateral distance, whether countries share a common language, whether countries share a land border, and whether countries belong to a free trade area); and the final term is a residual. Exporter j's shipments to importer k would expand if importer k's income increases, production costs increase or the number of varieties produced decreases in the other countries that supply importer k, exporter j's supply capacity expands, or trade costs between the two countries decrease.

Our first empirical exercise is to estimate equation (4). Then, we use the coefficient estimates to examine the role of China in contributing to changes in import demand in other countries. To motivate this approach, consider import-demand conditions in country k, as embodied in the importer dummy variables in (4). In theory,

$$m_{nk} = \ln Y_k - \ln\left(\sum_{h=1}^{H} I_{nh} w_{nh}^{1-\sigma_n} \tau_{nhk}^{1-\sigma_n} d_{hk}^{\beta_n} \right), \tag{5}$$

which captures average expenditure per imported variety by country k in sector n. Import demand conditions in k are a function of income in k, export supply conditions in k's trading partners (embodied in the number of varieties they produce and their production costs), and k's bilateral trade costs. Average expenditure per variety in country k would decrease if the number of varieties produced globally increases (since a given sectoral expenditure level would be spread over more varieties) or production costs in other countries increases (which would deflect expenditure away from their varieties). Using (4), we can write (5) as,

$$m_{nk} = \ln Y_k - \ln\left(\sum_{h=1}^{H} e^{\tilde{s}_{nh}} \tau_{nhk}^{\tilde{\beta}_{1n}} d_{hk}^{\tilde{\beta}_{2n}}\right), \qquad (6)$$

where $\tilde{s}_{nh}$, $\tilde{\beta}_{1n}$, and $\tilde{\beta}_{2n}$ are OLS coefficient estimates from (4). Over time, import-demand conditions in k will change as its income changes, its bilateral trade costs change, or export-supply conditions in its trading partners change. As China's export supply capacity in sector n improves (due either to increases in the number of varieties it produces or decreases in its production costs), average expenditure per imported variety in country k would fall, leading to a decrease in the demand for imports from k's trading partners.

Following this logic, we construct the implied change in demand for imports by country k associated with changes in China's export-supply capacity. Actual import demand conditions in sector n for country k at time t are

$$m_{nkt} = \ln Y_{kt} - \ln\left(\sum_{h\neq c}^{H} e^{\tilde{s}_{nht}} \tau_{nhkt}^{\tilde{\beta}_{1n}} d_{hk}^{\tilde{\beta}_{2n}} + e^{\tilde{s}_{nct}} \tau_{nckt}^{\tilde{\beta}_{1n}} d_{ck}^{\tilde{\beta}_{2n}}\right), \qquad (7)$$

where c indexes China. Suppose China had experienced no growth in its export-supply capacity between time 0 and time t. The counterfactual import-demand term for country k would then be

$$\hat{m}_{nkt} = \ln Y_{kt} - \ln\left(\sum_{h\neq c}^{H} e^{\tilde{s}_{nht}} \tau_{nhkt}^{\tilde{\beta}_{1n}} d_{hk}^{\tilde{\beta}_{2n}} + e^{\tilde{s}_{nc0}} \tau_{nckt}^{\tilde{\beta}_{1n}} d_{ck}^{\tilde{\beta}_{2n}}\right). \quad (8)$$

For each importing country in each sector, we calculate the value,

$$\hat{m}_{nkt} - m_{nkt} = -\left[\ln\left(\sum_{h\neq c}^{H} e^{\tilde{s}_{nht}} \tau_{nhkt}^{\tilde{\beta}_{1n}} d_{hk}^{\tilde{\beta}_{2n}} + e^{\tilde{s}_{nc0}} \tau_{nckt}^{\tilde{\beta}_{1n}} d_{ck}^{\tilde{\beta}_{2n}}\right) - \ln\left(\sum_{h\neq c}^{H} e^{\tilde{s}_{nht}} \tau_{nhkt}^{\tilde{\beta}_{1n}} d_{hk}^{\tilde{\beta}_{2n}} + e^{\tilde{s}_{nct}} \tau_{nckt}^{\tilde{\beta}_{1n}} d_{ck}^{\tilde{\beta}_{2n}}\right)\right], \quad (9)$$

which shows the amount by which import demand in k would have differed at time t had China's export supply capacity remained unchanged between time 0 and time t.

We refer to the quantity in (9) as the counterfactual change in import demand in country k and sector n. For each of the 10 developing country exporters, we calculate the weighted average of (9) across importers and sectors. The resulting value is the difference in the demand for a country's exports implied by growth in China's export-supply capacity. An exporter will be more exposed to China's growth the more its exports are concentrated in goods for which China's export-supply capacity has expanded and the more it trades with countries with which China has relatively low trade costs. Obviously, this counterfactual exercise is not general-equilibrium in nature, and should be interpreted with caution. Still, it may be useful for gauging which export producers have been more exposed to export competition from China.

One might consider estimating (4) subject to the constraint in (6). There are, however, practical difficulties in imposing such a constraint. As is well known, there is zero trade at the sectoral level between many country pairs, especially in pairs involving a developing country. Tenreyro and Santos (2005) propose a Poisson pseudo-maximum likelihood (PML) estimator to deal with zero observations in the gravity model. In our application, this approach is subject to an incidental-parameters problem (Wooldridge, 2002). While in a Poisson model it is straightforward to control for the presence of unobserved fixed effects, it is difficult in this and many other nonlinear settings to obtain consistent estimates of these effects. Since, at the sectoral level, most exporters trade with no more than a few dozen countries, PML estimates of exporter and importer country dummies may be inconsistent.

Our approach is to estimate (4) using OLS for a set of medium to large exporters (OECD countries plus larger developing countries, which together account for approximately 90% of world manufacturing exports) and medium to large importers (which together account for approximately 90% of world manufacturing imports). For bilateral trade between larger countries, there are relatively few zero trade values. Since we do not account explicitly for zero bilateral trade in the data, we are left with unresolved concerns about the consistency of the parameter estimates, which the trade literature has only recently begun to address.[3]

3. Gravity Estimation Results

The trade data for the analysis come from the UN COMTRADE database and cover manufacturing imports over the period 1996 to 2003. We examine bilateral trade at the four-digit harmonized system (HS) level for the union of the 40 largest manufacturing export industries in each of the 10 developing-country exporters (to estimate the gravity we include for each sector bilateral trade between all medium and large importers and exporters).[4] These industries account for the majority of manufacturing exports in these countries, ranging from 71% to 90% for 7 of the 10 countries (the Philippines, Mexico, Turkey, Malaysia, Romania, Sri Lanka, Pakistan) and from 48% to 62% in the 3 others (Hungary, Poland, Thailand). The tariff data come from the TRAINS database and are the simple averages of available tariffs at the 10-digit HS level within each four-digit industry. We use the tariffs that are most applicable to each

[3] See Helpman, Melitz, and Rubinstein (2007).

[4] Choosing a subset of industries helps keep the dimension of the estimation manageable.

sector-country pair. For some country pairs, these are the importer's MFN tariffs, for other pairs (e.g., NAFTA members) it is tariffs governed by a regional trade agreement, and for others (e.g., U.S.-Israel) it is tariffs governed by a bilateral trade agreement.[5]

We estimate the gravity equation in (4) on a year-by-year basis, allowing coefficients on exporter country dummies, importer country dummies, and trade costs to vary by sector and year. The output from the regression exercise is for each sector a panel of exporter and importer country dummy variables, trade-cost coefficients, intercepts, and residuals. The country-sector dummies are the deviation from U.S. sectoral mean trade by year (as the U.S. in the excluded country in all regressions). For these coefficients to be comparable across time, the conditioning set for a given sector (i.e., the set of comparison countries) must be constant. For each sector, we limit the sample to bilateral trading partners that have positive trade in every year during the sample period (which may introduce selection bias into the estimation).

3.1 Summary of Coefficient Estimates

To provide some background on the industries included in the sample, Table 2 shows the 5 largest industries in terms of manufacturing exports for each of the 10 developing-country exporters. For 9 of the countries (all except Hungary), manufacturing exports are concentrated in a handful of industries, with the top 5 industries accounting for at least 20% of merchandise exports, and for 5 of the countries, the top 5 industries account for at least 30% of merchandise exports. For 7 of the countries, at least one of their top 5 export industries is also one that accounts for at least 2% of China's manufacturing exports.

The regression results for equation (4) involve a large amount of output. In each year, we estimate 10,663 country-sector exporter coefficients, 10,757 country-sector importer coefficients,

[5] We replace missing tariff data with interpolated values based on non-missing tariff data. See Robertson (2007).

and 197 trade-cost coefficients. To summarize exporter and import dummies compactly, Figures 1a and 1b plot kernel densities for the sector-country exporter and importer coefficients (where the densities are weighted by sector-country exports or imports). Figure 1a shows that most exporter coefficients are negative, consistent with sectoral exports for most countries being below the United States. Over the sample period, the distribution of exporter coefficients shifts to the right, suggesting other countries are catching up to the United States. The figure indicates using vertical lines weighted mean values for China's exporter coefficients in 1996 (equal to 0.30) and 2003 (equal to 1.12), which rise in value over time relative to the overall distribution of exporter coefficients, suggesting China's export-supply capacity has improved relative to other countries over the sample period. Evidence we report later supports this finding. In Figure 1b, most importer coefficients are also negative, again indicating sectoral trade values for most countries are below those for the United States.

To provide further detail on the coefficient estimates, Table 3 gives median values of the trade cost elasticities by year, weighted by each sector's share of world trade. The estimates are in line with results in the literature. The coefficient on log distance is negative and slightly larger than one in absolute value; adjacency, common language, and joint membership in a free trade agreement are each associated with higher levels of bilateral trade; and the implied elasticity of substitution (given by the tariff coefficient) is slightly less than 4.

3.2 Export Supply Capabilities in Developing Countries vis-à-vis China

Of primary interest is how the 10 countries' export-supply capacities compare to those of China. Figures 2a-2c plot sectoral export coefficients for each country against exporter coefficients for China over the sample period (using sectoral shares of annual manufacturing exports in each country as weights). For each country, there is a positive correlation in its sectoral export dummies with China, with the correlation being strongest for Turkey (0.57), Romania (0.55), Thailand (0.50), Sri Lanka (0.49), Malaysia (0.48), Poland (0.47), and Hungary (0.43); somewhat smaller for Pakistan (0.34) and the Philippines (0.32); and weakest for Mexico (0.01). The correlation for Mexico appears to be driven by industries related to petroleum, which began the period as major export sectors for the country but have since declined in importance.

The positive correlation in sectoral export coefficients with China suggests that most of the large developing countries that specialize in manufacturing have strong export supply capabilities in the same sectors in which China is also strong. In other words, the comparative advantage of these countries is closely aligned with that of China. To the extent that the major trading partners of these countries are the same as those of China, they would be exposed to export-supply shocks in China, meaning that growth in China would potentially reduce demand for the manufacturing exports that they produce and lower their terms of trade.

To see how export supply capacities have evolved over time, Figures 3a-3c plot the year-on-year change in country-sector export dummies for each of the 10 developing countries against those for China, weighted by each country's sectoral trade shares. Immediately apparent is that the range of growth in China's export-supply capacities is large relative to that of any other developing country. Changes in China's export dummies take on a wide range of values, while none of the 10 countries shows nearly as much variation. As a consequence, the correlation between changes in sectoral export dummies between each country and China is weaker than the correlation in levels. The strongest correlations in changes are for Romania (0.48), Malaysia (0.44), Thailand (0.38), and Sri Lanka (0.36); followed by the Philippines (0.29), Pakistan (0.28), Poland (0.28); and then by Turkey (0.18), Hungary (0.14), and Mexico (0.01).

4. Counterfactual Exercises

In this section, we compare the change in import demand conditions facing each of the 10 developing-country exporters under two scenarios, one in which import demand evolved as observed in the data (as implied by the coefficient estimates from the gravity model) and a second in which we hold constant the change in China's export-supply capabilities. This exercise allows us to examine whether China's growth in export production has represented a negative shock to the demand for exports from other developing countries.

4.1 Actual and Counterfactual Estimation of Import Demand Conditions

According to the theory presented in section 2, sectoral import demand in a country is affected by its GDP and by its sectoral import price index. Its price index, in turn, is affected by export supply conditions in the countries from which it imports goods, weighted by trade costs with these countries. From equation (8), this yields the following relationship:

$$\tilde{m}_{nkt} = \alpha_0 + \alpha_1 \ln Y_{kt} + \alpha_2 \ln\left(\sum_{h=1}^{H} e^{\tilde{s}_{nht}} \tau_{nhkt}^{\tilde{\beta}_{1n}} d_{hk}^{\tilde{\beta}_{2n}}\right) + \eta_{nkt}, \qquad (10)$$

where $\tilde{m}_{nht}$, $\tilde{s}_{nht}$, $\tilde{\beta}_{1n}$, and $\tilde{\beta}_{2n}$ are OLS coefficient estimates of the sectoral importer dummy, the sectoral exporter dummy, the tariff elasticity, and the distance elasticity from equation (4). In theory, it should be the case that α_1=1 and α_2=-1.

To verify that the relationships posited by theory are found in the data, Table 4 shows coefficient estimates for equation (10). Departing from equation (10) slightly, we also include log population as an explanatory variable (to allow demand to be affected by market size and average income), though it is imprecisely estimated in most regressions. We show specifications under alternative weighting schemes and with and without including resource-intensive manufacturing industries, whose import demand conditions may differ from other manufacturing industries due to their reliance on primary commodities as inputs. Coefficients on GDP (α_1 in equation (10)) are all positive and precisely estimated, ranging in value from 0.47 to 1.06. Coefficients on the import price index (α_2 in (10)) are all negative and precisely estimated, ranging in value from -0.34 to -0.50. While the coefficient estimates do not exactly match the theoretically predictions, they are broadly consistent with the model.

The next exercise is to use the coefficient estimates to examine the difference in demand for exports faced by the 10 developing country exporters that is associated with the growth in China's export supply capacity. The first step is to calculate for each importer in each sector the value in equation (9), which is,

$$\hat{m}_{nkt} - m_{nkt} = -\left[\ln\left(\sum_{h \neq c}^{H} e^{\tilde{s}_{nht}} \tau_{nhkt}^{\tilde{\beta}_{1n}} d_{hk}^{\tilde{\beta}_{2n}} + e^{\tilde{s}_{nc0}} \tau_{nckt}^{\tilde{\beta}_{1n}} d_{ck}^{\tilde{\beta}_{2n}} \right) - \ln\left(\sum_{h \neq c}^{H} e^{\tilde{s}_{nht}} \tau_{nhkt}^{\tilde{\beta}_{1n}} d_{hk}^{\tilde{\beta}_{2n}} + e^{\tilde{s}_{nct}} \tau_{nckt}^{\tilde{\beta}_{1n}} d_{ck}^{\tilde{\beta}_{2n}} \right) \right].$$

This shows the amount by which average import demand in country k and sector n at time t would have differed had China's export supply capacity (which reflects the number of product varieties it produces and its production costs) had remained constant between time 0 and time t. The second step is to calculate the weighted average value of $\hat{m}_{nkt} - m_{nkt}$ for each of the 10 developing country exporters, using as weights the share of each importer and sector in a country's total manufacturing exports (where these shares are averages over the sample period).

Table 5 shows the results from the counterfactual calculation where year 0 corresponds to 1996 and year t corresponds to 2003. The first column shows results in which we set α_2 from equation (10) equal to -1, as implied by theory. In 2003, the difference in export demand ranges from 2.6% in Hungary and Mexico to -1.3% in Sri Lanka, with Malaysia also being among the most affected countries and Pakistan and Turkey also among the least affected. The mean difference across countries is 1.4%. Thus, in the developing countries we consider, demand for exports on average would have been 1.4% higher had China's export-supply capacity remained constant from 1996 to 2003. The negative difference for Sri Lanka indicates that China's export-supply capacities declined in the country's primary export industries (which include tea). The second column shows results in which we set α_2 equal to -0.46, which is the average coefficient estimate for columns (1) and (3) in Table 4. The mean difference in export demand across countries drops to 0.6%. For no country does China represent a negative export demand shock of greater than 1.2%.

Columns (3) and (4) repeat the results, excluding resource-intensive industries from the sample. China's comparative advantage appears to lie in labor-intensive activities rather than industries that use oil, minerals, timber, or foodstuffs intensively. In column (3), the mean difference across countries is 2.0% (compared to 1.4% in column (1)), indicating that China's impact is indeed larger for industries that do not use resources intensively. The most affected countries are Hungary, Mexico, and Pakistan; the least affected are Sri Lanka and Turkey. In column (4), in which the value of α_2 is set to -0.46, the mean difference across countries is 0.9%.

The counterfactual exercises indicate that had China's export-supply capacities remained unchanged demand for exports would have been modestly larger for other developing countries that specialize in manufacturing exports. To repeat, across all manufacturing industries, the average difference in export demand is 0.6% to 1.4%; for non-resource-intensive industries, the average difference is 0.9% to 2.0%. These are hardly large values, suggesting that even for the countries that would appear to be most adversely affected by China's growth it is difficult to find evidence that the demand for their exports has been significantly reduced by China's expansion.

4.2 Explaining Country Growth in Export Supply Capacities

So far, our analysis has not examined which shocks might contribute to growth in a country's export-supply capacity. Are there factors, beyond overall GDP growth, that might account for the rapid expansion in China's export capabilities (evident in Figure 3)? From equation (4), the country-sector export dummy can be expressed as,

$$s_{nj} = I_{nj} w_{nj}^{1-\sigma_n}, \tag{11}$$

where I_{nj} is the number of product varieties that country j produces in sector n and w_{nj} is unit production costs for country j in sector n. In general equilibrium, either component is likely to be determined by factor supplies and technology in a country. To examine the correlates of countries' export-supply capacities, we regress the change in the estimated s_{njt}'s on measures of country factor supplies and public infrastructure, using the complete set of exporting countries. Following the logic of the Rybczynski Theorem, the impact of factor supplies on export supply capacity may vary across industries, depending on industry relative factor intensities. We estimate regressions by industry, but for simplicity pool data across four-digit industries within a two-digit industry. We focus on the seven two-digit industries that account for 29 of China's top 40 four-digit industries and 44% of its total merchandise exports. These are HS 27 (mineral fuels), 42 (leather goods), 62 (apparel), 64 (footwear), 84 (electric machinery), 85 (electronics), and 95 (toys).

In Table 6, we report regressions by two-digit sector in which the dependent variable is the exporter coefficient for a particular sector, country and year and the independent variables are measures of country factor supplies. We include data on all exporters represented in the sample, not just the 10 developing-country exporters. This allows us to use the entire sample of countries to examine which factors are associated with export supply capacity. The regressors are average years of education, labor force size, size of the national road network, national electricity production, and phone lines per capita. All regressions include controls for exporter fixed effects, four-digit sector fixed effects, and year fixed effects (with exporter fixed effects accounting for the high explanatory power of the regressions). As it turns out, phones lines per capita are strongly positively correlated with telephones per capita, computers per capita, and internet penetration, making the variable a proxy for overall telecommunications infrastructure in a country.

Turing to the results, export capacity in mineral oils, which includes petroleum refining, is positively correlated with electricity production, which is not surprising given the energy intensity of refining. Export capacity in leather goods is nearly entirely explained by country fixed effects, leaving little variation left for other regressors to account. Apparel and footwear are, perhaps surprisingly, positively correlated with average years of education, though the relationship is not precisely estimated. Electrical machinery and electronics are positively correlated with phone lines per capita, suggesting that telecommunications infrastructure is important for export capacity in the industry. In toys, none of the regressors are strongly correlated with export capacity.

In sum, Table 6 provides suggestive evidence that for some industries, notably electronics and related activities, the supply of telecommunications infrastructure is important for a country's export-supply capacity. Results on average education are inconclusive, but this may be associated with measurement error in the variable (since we are forced to impute values for the variable over the 1996 to 2003 period using observations in 1995 and 1999). In unreported results, we experimented with including other variables in the regression. Sectoral exporter dummies tend to be positively correlated with domestic credit as a share of GDP, vehicles per capita, the share of workers with primary education, and the share of workers with secondary education, though few of these relationships are precisely estimated.

5. Discussion

In this paper, we use the gravity model of trade to examine the impact of China's growth on the demand for exports in developing countries that specialize in manufacturing. China's high degree of specialization in manufacturing makes its expansion a potentially significant shock for other countries that are also manufacturing oriented. Of the 10 developing countries we examine, 9 have a pattern of comparative advantage that strongly overlaps with China, as indicated by countries' estimated export-supply capacities. Yet, despite the observed similarities in export patterns, we find that China's growth represents only a small negative shock in demand for the other developing countries' exports. While there is anxiety in many national capitals over China's continued export surge, our results suggest China's impact on the export market share of other manufacturing exporters has been relatively small.

There are several important caveats to our results. Our framework and analysis are confined to manufacturing industries. There may be important consequences of China for developing-country commodity trade, which we do not capture. The counterfactual exercises we report do not account for general-equilibrium effects. There could be feedback effects from China's growth on prices, wages, and the number of product varieties produced that cause us to misstate the consequences of such shocks for other developing countries. There are also concerns about the consistency of the coefficient estimates, due to the fact that we do not account for why there is zero trade between some countries.

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Table 1: Specialization in Manufacturing for Developing Countries

Country	Manufacturing (% merchand. exports)	Manufacturing (% GDP)	GDP per capita (2000 US$)	Population (millions)
China	88.21	32.28	979	1260.3
Philippines	85.83	22.56	996	75.8
Pakistan	84.96	15.91	531	138.4
Hungary	83.09	23.48	4591	10.2
Mexico	82.65	19.96	5682	97.6
Turkey	80.14	15.48	2915	67.3
Romania	79.85	24.11	1805	22.2
Poland	78.32	18.66	4356	38.4
Malaysia	78.26	30.23	3894	23.0
India	75.30	15.79	458	1015.2
Sri Lanka	74.93	16.12	838	18.9
Thailand	74.23	32.60	2085	61.4
Ukraine	68.89	24.99	691	49.2
Morocco	62.55	17.05	1240	27.9
South Africa	56.22	19.36	3072	43.6
Brazil	54.18	--	3441	173.9
Indonesia	52.15	27.62	842	206.4
Vietnam	46.47	18.47	406	78.4
Senegal	42.64	12.44	424	10.4
Egypt, Arab Rep.	35.69	18.54	1456	67.4
Guatemala	34.53	13.23	1694	11.2
Colombia	34.25	15.49	2039	42.1
Argentina	31.36	19.91	7488	36.9
Zimbabwe	28.34	15.50	586	12.5
Kenya	23.43	11.79	420	30.7
Russian Federation	23.18	17.48	1811	146.0
Kazakhstan	22.61	15.10	1329	15.0
Peru	20.44	15.99	2078	25.9
Cote d'Ivoire	18.17	19.81	621	16.6
Chile	16.15	19.45	4924	15.4
Venezuela, RB	12.70	18.82	4749	24.3
Saudi Arabia	10.61	10.20	9086	20.7
Ecuador	9.93	12.00	1368	12.3
Iran, Islamic Rep.	8.93	12.66	1634	63.6
Syrian Arab Republic	8.36	10.30	1128	16.8

Notes: This table shows data for all countries with more than 10 million inhabitants and per capita GDP greater than $400 and less than $10,000 (in 2000 prices).

Table 2: Major Export Industries in 10 Developing Countries

Country	HS4	Description	Mfg rank	Share of Country's Total Exports	Share of China's Total Exports
Hungary	6204	Female Suits	1	0.035	0.026
Hungary	6403	Footwear	2	0.026	0.024
Hungary	8544	Wire	3	0.023	0.003
Hungary	2710	Non-Crude Oil	4	0.022	0.013
Hungary	8708	Motor Vehicle Parts	5	0.020	0.001
Malaysia	2709	Crude Oil	1	0.103	0.048
Malaysia	8542	Electric Circuits	2	0.087	0.001
Malaysia	4403	Rough Wood	3	0.060	0.001
Malaysia	8527	Receivers	4	0.050	0.023
Malaysia	4407	Sawn Wood	5	0.038	0.001
Mexico	2709	Crude Oil	1	0.219	0.048
Mexico	8703	Motor Vehicles	2	0.066	0.000
Mexico	8708	Motor Vehicle Parts	3	0.054	0.001
Mexico	8544	Wire	4	0.041	0.003
Mexico	8407	Engines	5	0.036	0.000
Pakistan	5205	Cotton Yarn	1	0.186	0.002
Pakistan	5201	Cotton	2	0.097	0.004
Pakistan	5208	Cotton Fabrics	3	0.063	0.010
Pakistan	6302	House Linens	4	0.061	0.010
Pakistan	4203	Leather Apparel	5	0.056	0.011
Philippines	8542	Electric Circuits	1	0.124	0.001
Philippines	1513	Coconut Oil	2	0.037	0.000
Philippines	8471	Data Processing Machines	3	0.031	0.005
Philippines	2603	Copper	4	0.029	0.000
Philippines	7403	Refined Copper	5	0.027	0.000

Table 2: Continued

Country	HS4	Description	Rank	Share of Country's Total Exports	Share of China's Total Exports
Poland	2701	Coal	1	0.072	0.008
Poland	7403	Refined Copper	2	0.047	0.000
Poland	6204	Female Suits	3	0.030	0.026
Poland	9403	Furniture NES	4	0.025	0.003
Poland	6203	Not Knit Male Suits	5	0.022	0.017
Romania	9403	Furniture NES	1	0.079	0.003
Romania	7208	Iron and Steel	2	0.076	0.003
Romania	6204	Female Suits	3	0.048	0.026
Romania	2710	Non-Crude Oil	4	0.046	0.013
Romania	9401	Seats	5	0.045	0.002
Sri Lanka	902	Tea	1	0.079	0.003
Sri Lanka	6204	Female Suits	2	0.068	0.026
Sri Lanka	6206	Female Blouses	3	0.062	0.015
Sri Lanka	7103	Precious Stones	4	0.050	0.000
Sri Lanka	6203	Male Suits	5	0.043	0.017
Thailand	8473	Office Mach Parts	1	0.049	0.005
Thailand	8471	Data Processing Machines	2	0.048	0.005
Thailand	4001	Rubber	3	0.039	0.000
Thailand	8542	Electric Circuits	4	0.037	0.001
Thailand	1701	Sugar (Solid)	5	0.028	0.001
Turkey	6110	Sweaters	1	0.049	0.031
Turkey	6204	Female Suits	2	0.048	0.026
Turkey	4203	Leather Apparel	3	0.045	0.011
Turkey	6104	Knit Female Suits	4	0.042	0.003
Turkey	2401	Tobacco	5	0.041	0.001

Notes: This table shows for each country the five largest manufacturing industries in terms of exports, the industry's share in the country's total merchandise exports, and the industry's share in China's merchandise exports (each averaged for the period 1996-2003).

Table 3: Median Estimated Trade Cost Elasticities

Year	Log distance	Common language	Adjacency	Free Trade Agreement	Tariff
1996	-1.144	0.650	0.486	0.354	-3.830
1997	-1.143	0.656	0.491	0.360	-3.877
1998	-1.140	0.684	0.524	0.406	-3.863
1999	-1.139	0.685	0.507	0.408	-3.799
2000	-1.144	0.653	0.452	0.355	-3.761
2001	-1.156	0.648	0.466	0.360	-3.794
2002	-1.152	0.654	0.476	0.374	-3.737
2003	-1.155	0.639	0.465	0.357	-3.805

Notes: Coefficient estimates are expressed as trade-value-weighted median values for manufacturing industries.

Table 4: Correlates of Country Sector Import Dummies

log GDP	0.940	1.063	0.469	0.612
	(0.033)	(0.014)	(0.070)	(0.031)
log population	-0.104	-0.252	0.092	-0.031
	(0.084)	(0.019)	(0.054)	(0.035)
log import	-0.418	-0.341	-0.504	-0.423
price index	(0.122)	(0.026)	(0.115)	(0.045)
R Squared	0.341	0.510	0.146	0.552
Trade weights	No	No	Yes	Yes
Industries	All manufacturing	Exclude resource intensive	All manufacturing	Exclude resource intensive
N	65500	51305	65500	51305

Notes: This table shows regression of country-sector import dummies on log GDP, log population, and the log import price index. The sample spans 1996-2003 and is either all manufacturing industries or non-resource-intensive manufacturing industries. All regressions include sector-year dummy variables. Weighted regressions use the share of a sector in a country's manufacturing exports as weights.

Table 5: Counterfactual Difference in Export Demand

	All manufacturing industries		Excluding resource intensive industries	
	α_2=-1	α_2=-0.5	α_2=-1	α_2=-0.5
Hungary	0.026	0.012	0.027	0.012
Malaysia	0.023	0.011	0.025	0.012
Mexico	0.026	0.012	0.027	0.012
Pakistan	0.003	0.001	0.030	0.014
Philippines	0.016	0.007	0.021	0.010
Poland	0.014	0.006	0.017	0.008
Romania	0.020	0.009	0.025	0.012
Sri Lanka	-0.013	-0.006	-0.001	0.000
Thailand	0.014	0.006	0.019	0.009
Turkey	0.009	0.004	0.009	0.004

Notes: This table shows how manufacturing export demand would have differed in 2003 for a given country had China's export-supply capacities remained unchanged between 1996 and 2003, based on the methodology outlined in the text.

Table 6: Regression Results for Sectoral Exporter Coefficients

	Mineral oils HS 27	Leather goods HS 42	Apparel HS 62	Footwear HS 64	Machinery HS 84	Electronics HS 85	Toys HS 95
Average years of schooling	8.369	0.580	2.736	6.462	0.268	1.081	0.070
	(16.685)	(3.491)	(1.948)	(3.550)	(2.583)	(1.960)	(3.470)
Labor force	-10.858	-0.643	-0.861	1.481	1.142	1.370	0.391
	(10.466)	(1.977)	(1.147)	(2.152)	(1.477)	(1.126)	(2.051)
Road network	-0.077	0.000	-0.003	-0.003	-0.012	-0.006	-0.007
	(0.196)	(0.049)	(0.027)	(0.050)	(0.036)	(0.026)	(0.047)
Electricity Production	7.762	0.155	-0.162	-1.652	0.406	-0.247	-0.540
	(3.406)	(0.686)	(0.403)	(0.752)	(0.509)	(0.385)	(0.707)
Phone lines per capita	-1.860	-0.028	0.154	0.428	0.558	0.694	0.516
	(2.237)	(0.492)	(0.276)	(0.509)	(0.360)	(0.272)	(0.488)
R Squared	0.299	0.922	0.816	0.814	0.790	0.777	0.820
N	934	566	3217	1078	3436	6120	1331

Notes: This table reports regressions in which the dependent variable is the estimated sectoral exporter coefficient from equation (4) for the full sample of exporting countries. Data are pooled across four-digit industries within each indicated two-digit industry. All regressors are in logs and all regressions include controls for exporter fixed effects, four-digit industry fixed effects, and year fixed effects. Standard errors, clustered by exporter, are in parentheses.

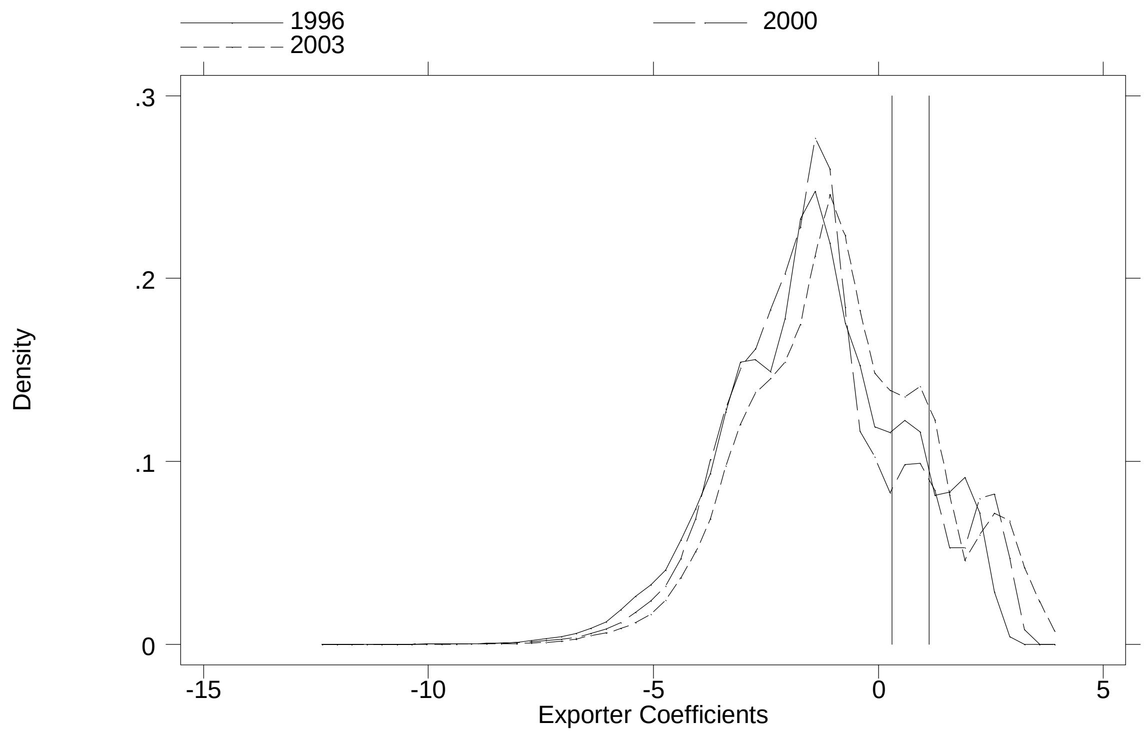

Figure 1a: Estimated Sector-Country Exporter Coefficients, Selected Years

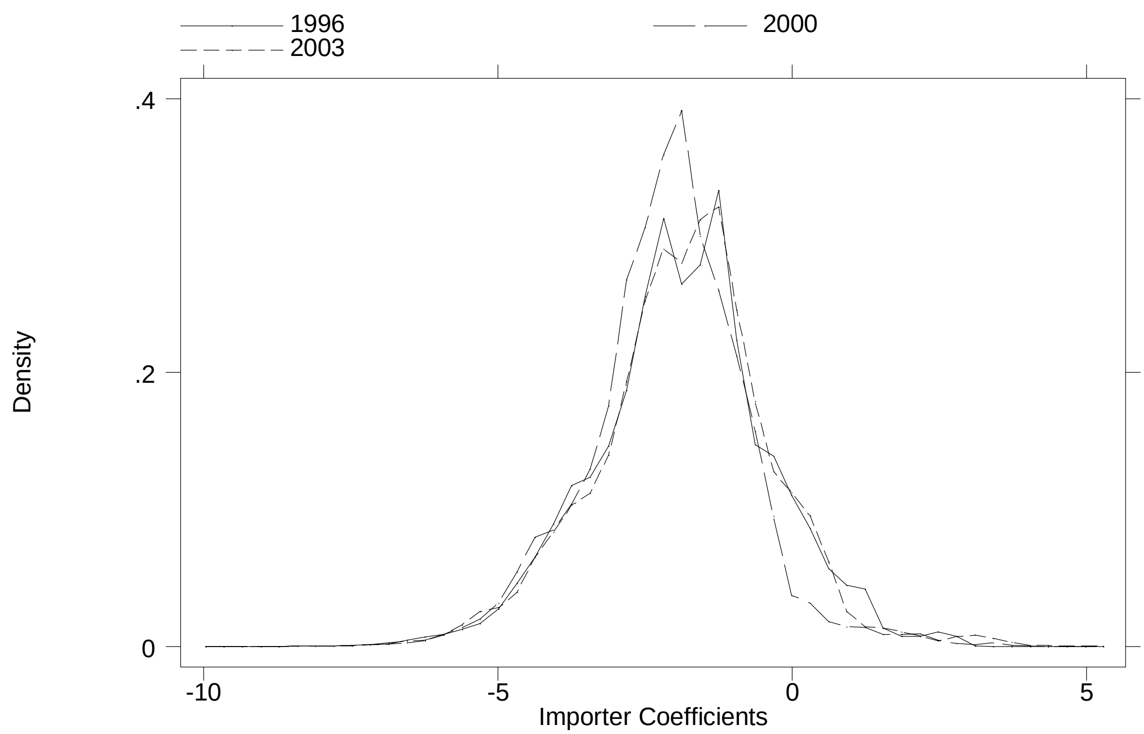

Figure 1b: Estimated Sector-Country Importer Coefficients, Selected Years

Figure 2a: Sectoral Export Coefficients for Individual Developing Countries and China

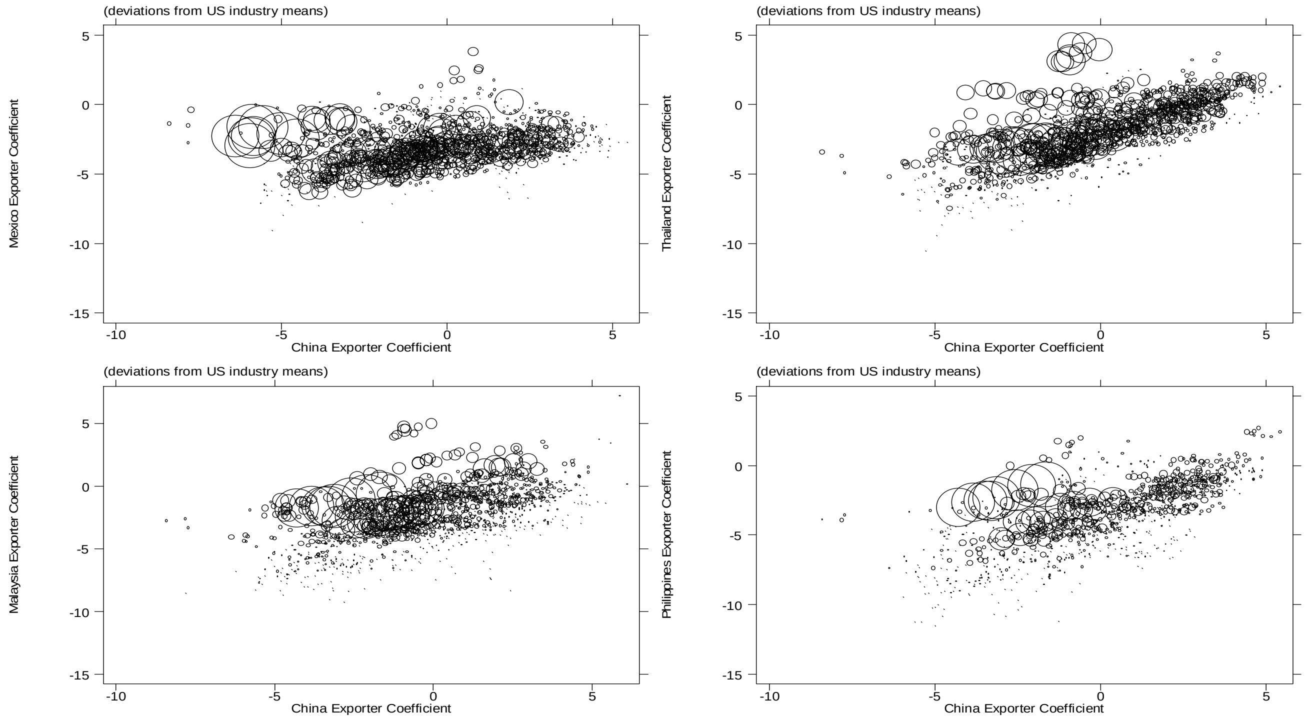

Figure 2b: Sectoral Export Coefficients for Individual Developing Countries and China

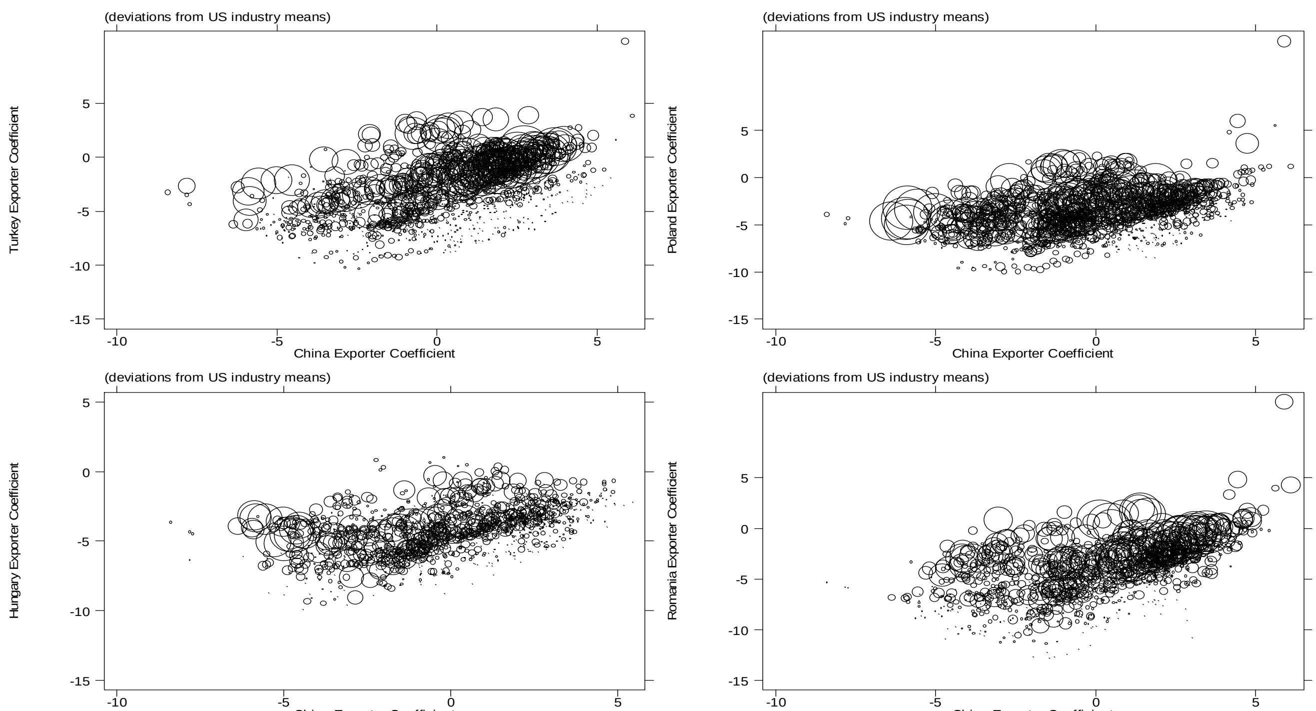

Figure 2c: Sectoral Export Coefficients for Individual Developing Countries and China

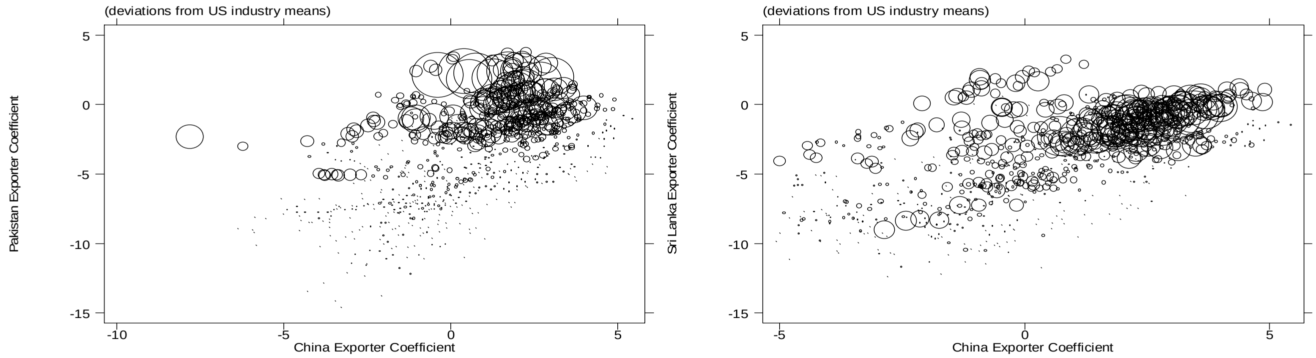

Figure 3a: Changes in Sectoral Export Coefficients, Individual Countries and China

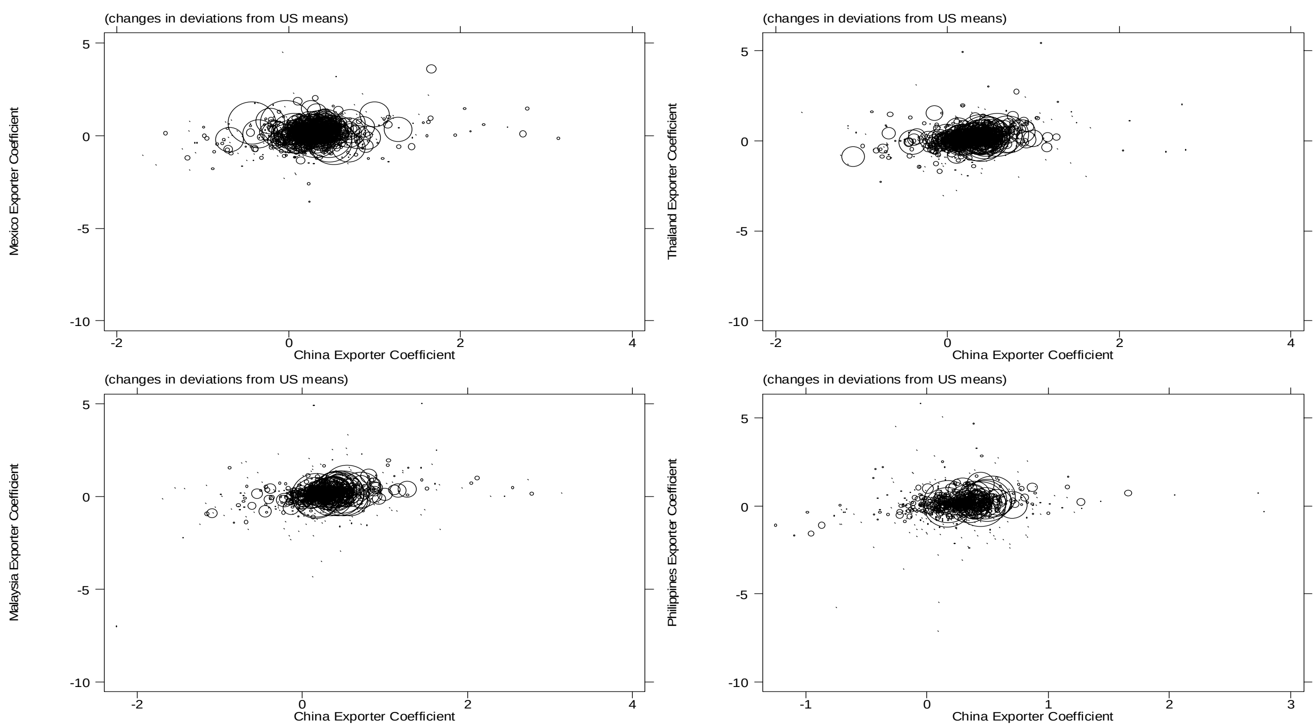

Figure 3b: Changes in Sectoral Export Coefficients, Individual Countries and China

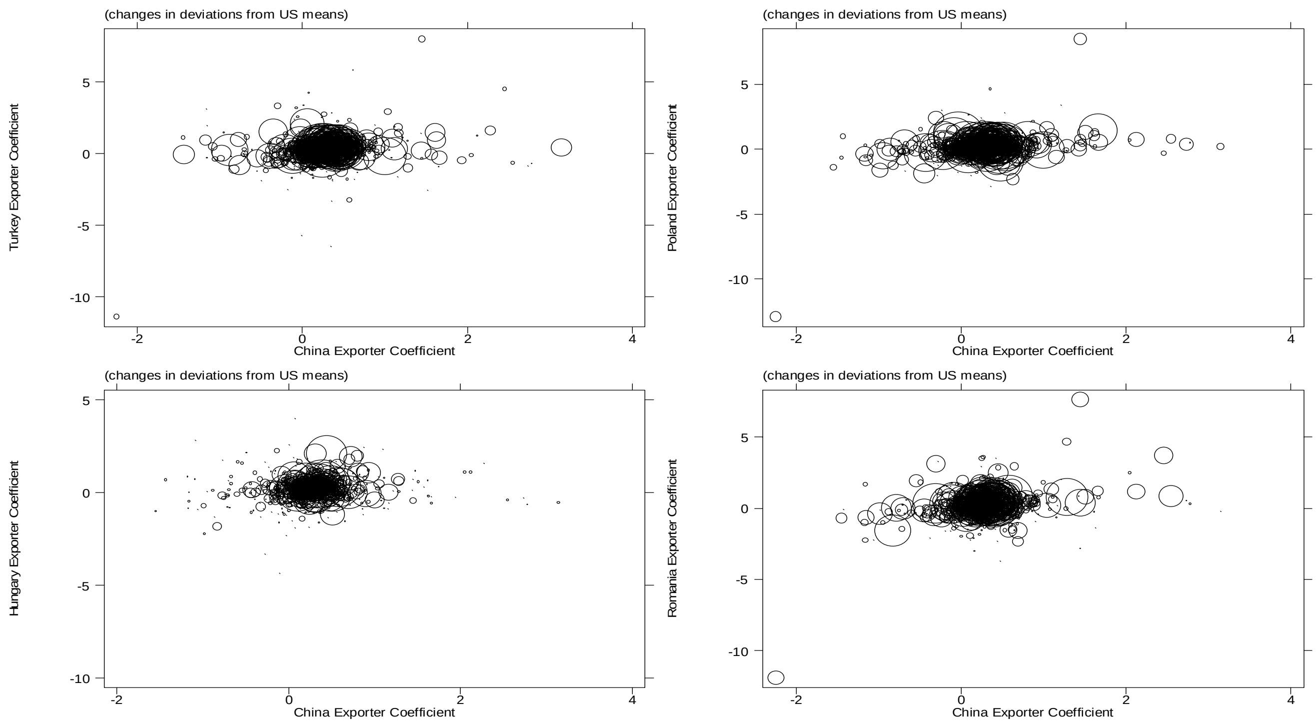

Figure 3c: Changes in Sectoral Export Coefficients, Individual Countries and China