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 1995-2005 period, demand for exports would have been 0.8% to 1.6% 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 extraordinary. Between 1990 and 2005, China's exports increased by 25 times in real terms, compared to an increase of about four times in the 12 largest exporting nations (Table 1). As of 2005, China's exports accounted for 25% of the total exports of all countries outside of the top 12.[1]

What has made China's emergence potentially 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 2). 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.

[1] This share excludes Hong Kong and Singapore, which are entrepot economies and whose exports contain a substantial share of re-exports.

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 2). 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, possibly 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.[2] 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, and 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

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[2] In Table 2, it is apparent India would also satisfy our criteria. We exclude India because its recent growth represents another potentially important global economic shock for other developing countries.

period to 1995 to 2005. 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 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 1995 to 2005 period, export demand would have been 0.6% to 1.8% higher in the 10 countries studied. The impact is somewhat larger when excluding resource intensive industries or when focusing on industries in which China's revealed comparative advantage appears to be strongest (apparel, footwear, electronics, toys). For developing countries highly specialized in manufacturing, it appears 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 j producing I_{nj} 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 cost-including-freight (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 free-on-board (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_{nj} 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 for goods in sector n.

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,

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

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

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

which can be written in log form as

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

(3')

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

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

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 ($\theta_n = \ln \mu_n$) captures preference shifters specific to sector n; the second term ($m_{nk} = \ln(Y_k / \sum_{h=1}^{H} I_{nh} \left[w_{nh} \tau_{nhk} (d_{hk})^{\gamma_n} \right]^{1-\sigma_n})$) 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 ($s_{nj} = \ln(I_{nj} w_{nj}^{1-\sigma_n})$) 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 (where $\beta_{1n} = 1-\sigma_n$ and $\beta_{2n} = \gamma_n (1-\sigma_n)$) 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 (ε_{njk}) 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 other countries that supply importer k, exporter j's supply capacity expands, or bilateral trade costs 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,

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

where $\hat{s}_{nh}$, $\hat{\beta}_{1n}$, and $\hat{\beta}_{2n}$ are OLS coefficient estimates from (4).[3] 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

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

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

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

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

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

[3] One might imagine estimating (4) subject to the constraint in (6). In practice, imposing such nonlinear constraints would greatly complicate the regression analysis. As a simple check on whether the constraints on the value of m_{nk} appear to be satisfied in the data, we estimate equation (6) using OLS (after first estimating (4)), the results for which are reported in Table 4. In most specifications, the coefficient on log income ranges between 0.5 and 1.0 and the coefficient on the import price index (constructed from the coefficient estimates) is -0.3 to -0.5. These coefficient signs and magnitudes are roughly consistent with theory.

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 problem with estimating (4) is that at the sectoral level there is zero trade between many country pairs.[4] Tenreyro and Santos Silva (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

[4] Zero bilateral trade values further complicate estimating (4) subject to the constraint in (6).

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.[5]

3. Gravity Estimation Results

The trade data for the analysis come from the UN COMTRADE database and cover manufacturing imports over the period 1995 to 2005. 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.[6] The 40 industries account for the majority of manufacturing exports in the 10 manufacturing exporters, 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, which are based on Robertson (2007), 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 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.[7]

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

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[5] See Helpman, Melitz, and Rubinstein (2007).
[6] Choosing a subset of industries helps keep the dimension of the estimation manageable.
[7] We replace missing tariff data with interpolated values based on non-missing tariff data. See Robertson (2007).

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.[8]

3.1 Summary of Coefficient Estimates

To provide some background on the industries included in the sample, Table 3 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 over 10,000 country-sector exporter coefficients and country-sector importer coefficients and over 200 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.

[8] This restriction may introduce selection bias into the estimation.

Vertical lines indicate weighted mean values for China's exporter coefficients in 1995 (equal to 0.44) and 2005 (equal to 1.78), 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 4 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 (Anderson and van Wincoop, 2004). 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 close to 3.

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 (0.63), Romania (0.59), Hungary (0.48), Thailand (0.48), Malaysia (0.47), Poland (0.45), Sri Lanka (0.45); somewhat smaller for the Philippines (0.33) and Pakistan (0.32); and weakest for Mexico (0.12). 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 (0.50) and Malaysia (0.47); followed by Thailand (0.32), Sri Lanka (0.31), Hungary (0.30), the Philippines (0.30), Poland (0.22), and Turkey (0.21); and then by Pakistan (0.16) and Mexico (0.14).

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.

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:

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

where $\hat{m}_{nht}$, $\hat{s}_{nht}$, $\hat{\beta}_{1n}$, and $\hat{\beta}_{2n}$ 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 5 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 for three sets of industries: all manufacturing industries, excluding core resource-intensive industries,[9] and excluding all resource-intensive industries.[10] Demand conditions in resource-intensive industries 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 0.52 to 1.05. Coefficients on the import price index (α_2 in (10)) are all negative and precisely estimated,

[9] At the two-digit HS level, these industries are beverages, cereals, animal oils and fats, sugar, meat and seafood processing, fruit and vegetable processing, tobacco, non-metallic minerals, mineral fuels and oils, and inorganic chemicals.
[10] In addition to those industries mentioned in note 9, this excludes organic chemicals, pharmaceuticals, fertilizers, plastics, rubber, leather products, and wood products.

ranging in value from -0.31 to -0.53. 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,

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

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.[11] The second step is to calculate the weighted average value of $\tilde{m}_{nkt} - m_{nkt}$ 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).[12]

Table 6 shows the results from the counterfactual calculation where year 0 corresponds to 1995 and year t corresponds to 2005.[13] The first column shows results in which we set α_2 from equation (10) equal to -1, as implied by theory. In 2005, the difference in export demand ranges

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[11] An alternative to the counterfactual exercise we propose would be to examine the change in China's exports implied by the change in tariffs facing China over the sample period. Were China's economy in steady state, then the change in tariffs would be the primary shock affecting the country's exports. However, over the sample period China very much appears to be an economy in transition to a new steady state, associated with a sectoral and regional reallocation of resources brought about by the end of central planning. Thus, focusing on tariffs alone would miss the primary shock to China's export growth.
[12] In taking this weighted average across industries, we are approximating for the percentage change in imports with the log change. This approximation becomes less precise as the growth in imports becomes larger. In unreported results, we experimented with using the percentage change. The findings are similar to what we report in Table 6.
[13] Because we do not estimate equation (4) subject to the constraint in equation (6), one needs to be careful in interpreting our results. The counterfactual exercises we report apply to changes in demand conditions rather than changes in trade. Absent imposing the equilibrium conditions implied by the model, we cannot interpret the counterfactual exercises as implying how trade would change.

from 3.3% in Romania to -1.1% in Sri Lanka, with the Philippines and Mexico among the most affected countries and Pakistan and Turkey also among the least affected. The mean difference across countries is 1.6%. Thus, in the developing countries we consider, demand for exports on average would have been 1.6% higher had China's export-supply capacity remained constant from 1995 to 2005. 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 -0.5, which is at the upper end of the coefficient estimates for Table 5. The mean difference in export demand across countries drops to 0.8%. For no country does China represent a negative export demand shock of greater than 1.7%.

Columns (3)-(6) 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 2.7% (compared to 1.6% in column (1)), indicating that China's impact is indeed larger for industries that do not use resources intensively. The most affected countries are Pakistan, Romania, Mexico, Malaysia, and the Philippines. In column (4), in which the value of α_2 is set to -0.5, the mean difference across countries is 1.3%.

Finally, columns (7) and (8) show results when we limit the industries to apparel, footwear, electronics, and toys. These include labor intensive industries (or, in electronics, industries with labor intensive stages of production), in which one might imagine that China's comparative advantage is strongest. For these industries, China's impact is indeed larger, at least for some countries. The counterfactual increase in export demand would be 3.0% across all countries, with values over 4.0% occurring in Romania, Poland, Pakistan, and Mexico.

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 0.8% to 1.6%; for non-resource-intensive industries, the average difference is 1.3% to 2.7%. 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.

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: Total Exports by Country Group (billions of 2000 USD)

Exporter	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
China	35.9	72.0	89.7	168.2	211.5	250.8	269.4	297.5	296.3	324.8	388.1	389.8	464.1	582.3	749.0	897.7
Sample of ten developing country exporters	79.6	155.0	180.3	208.7	266.1	330.0	360.4	389.6	393.6	422.6	489.5	464.5	491.4	554.3	644.4	696.6
Twelve largest industrialized exporters	1127.1	1561.6	1889.9	2068.6	2693.9	3273.8	3300.4	3314.6	3299.1	3322.6	3456.9	3186.7	3251.1	3614.6	4175.2	4359.2
Other exporters (developing and developed)	371.6	478.6	563.4	627.7	794.3	937.9	1006.6	1034.2	968.4	994.5	1133.7	1086.7	1148.2	1355.7	1642.6	1878.4

Notes: Sample of 10 developing country exporters is Hungary, Malaysia, Mexico, Pakistan, the Philippines, Poland, Romania, Sri Lanka, Thailand, and Turkey; the twelve largest industrialized exporters (as of 2005) are Canada, France, Germany, Italy, Japan, Korea, the Netherlands, Spain, Switzerland, Taiwan, the U.S. and the U.K.; other exporting nations excludes Hong Kong and Singapore.

Table 2: 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). Figures are averages over the period 2000-2005.

Table 3: 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 3: 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 1995-2005).

Table 4: Median Estimated Trade Cost Elasticities

Year	Log distance	Common language	Adjacency	Free Trade Agreement	Tariff
1995	-1.169	0.732	0.484	0.325	-3.173
1996	-1.174	0.725	0.470	0.313	-3.122
1997	-1.174	0.732	0.468	0.314	-3.109
1998	-1.174	0.761	0.494	0.339	-3.097
1999	-1.171	0.766	0.479	0.337	-3.074
2000	-1.171	0.739	0.432	0.306	-3.051
2001	-1.176	0.744	0.447	0.311	-3.030
2002	-1.176	0.748	0.457	0.323	-3.059
2003	-1.178	0.740	0.448	0.317	-3.031
2004	-1.180	0.733	0.436	0.307	-2.999
2005	-1.181	0.715	0.412	0.289	-2.964

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

Table 5: Correlates of Country Sector Import Dummies

	Without Trade Weights			With Trade Weights		
Sample	All manufact.	Exclude core resource intensive	Exclude all resource intensive	All manufact.	Exclude core resource intensive	Exclude all resource intensive
log GDP	0.939	0.983	1.045	0.529	0.520	0.664
	(0.03)	(0.01)	(0.02)	(0.07)	(0.05)	(0.03)
log population	-0.127	-0.125	-0.228	0.041	0.062	-0.032
	(0.05)	(0.05)	(0.02)	(0.08)	(0.03)	(0.03)
log import	-0.358	-0.386	-0.307	-0.531	-0.477	-0.303
price index	(0.05)	(0.08)	(0.01)	(0.09)	(0.12)	(0.03)
R Squared	0.376	0.378	0.499	0.278	0.184	0.520
N	128942	108097	84724	128942	108097	84724

Notes: This table shows regression of country-sector import dummies on log GDP, log population, and the log import price index. Standard errors (clustered by industry and year) are in parentheses. The sample spans 1995-2005 for one of three groups of industries (all manufacturing, excluding core resource intensive industries, excluding all resource intensive 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 6: Counterfactual Difference in Export Demand

	All manufacturing industries		Excluding core resource industries		Excluding all resource industries		Apparel, footwear, electronics, toys	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
α=	-1	-0.5	-1	-0.5	-1	-0.5	-1	-0.5
Hungary	0.025	0.013	0.028	0.014	0.029	0.015	0.018	0.009
Malaysia	0.019	0.010	0.032	0.016	0.034	0.017	0.020	0.010
Mexico	0.002	0.001	0.032	0.016	0.034	0.017	0.042	0.021
Pakistan	0.014	0.007	0.015	0.007	0.041	0.021	0.049	0.025
Philippines	0.028	0.014	0.028	0.014	0.032	0.016	0.015	0.008
Poland	0.018	0.009	0.018	0.009	0.022	0.011	0.052	0.026
Romania	0.033	0.017	0.034	0.017	0.040	0.020	0.055	0.028
Sri Lanka	-0.011	-0.006	-0.016	-0.008	-0.007	-0.004	-0.006	-0.003
Thailand	0.017	0.009	0.019	0.010	0.023	0.012	0.023	0.012
Turkey	0.018	0.009	0.021	0.011	0.021	0.011	0.033	0.017
Mean	0.016	0.008	0.021	0.011	0.027	0.013	0.030	0.015

Notes: This table shows how manufacturing export demand would have differed in 2005 for a given country had China's export-supply capacities remained unchanged between 1995 and 2005, based on the methodology outlined in the text.

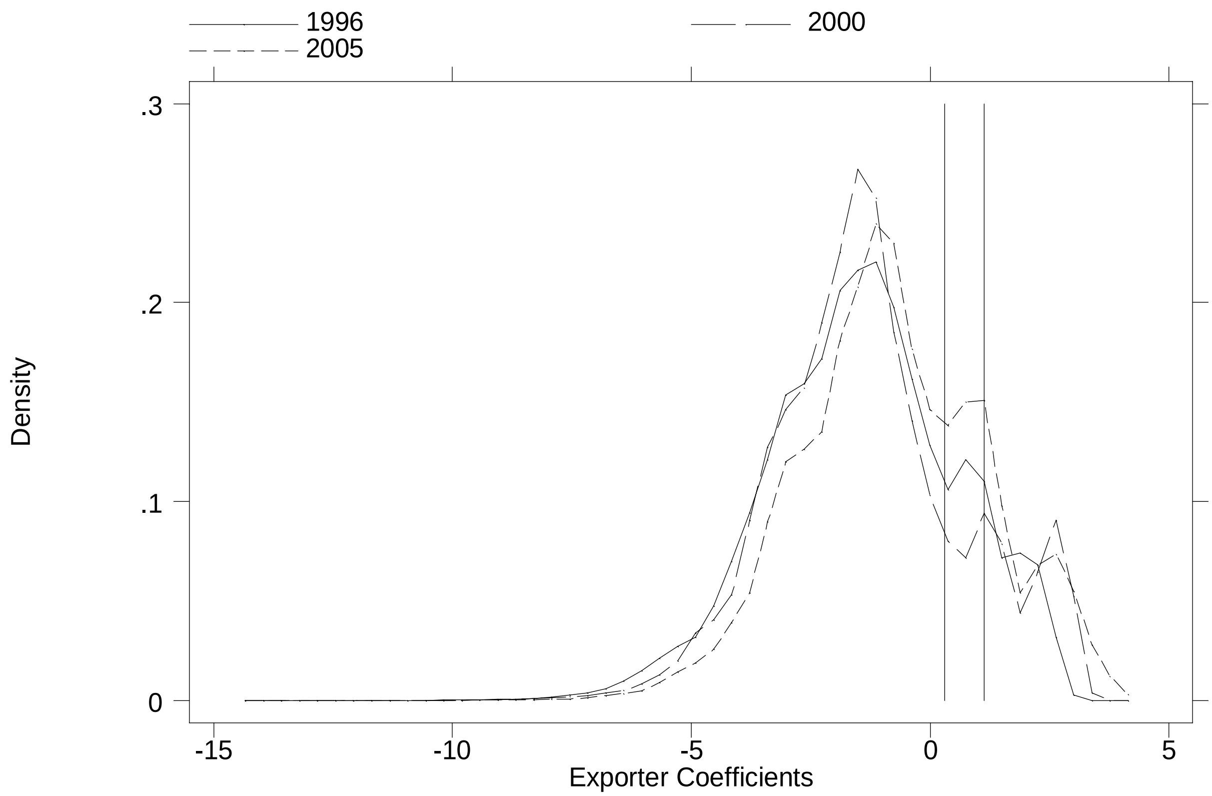

Figure 1a: Estimated Sector-Country Exporter Coefficients, Selected Years

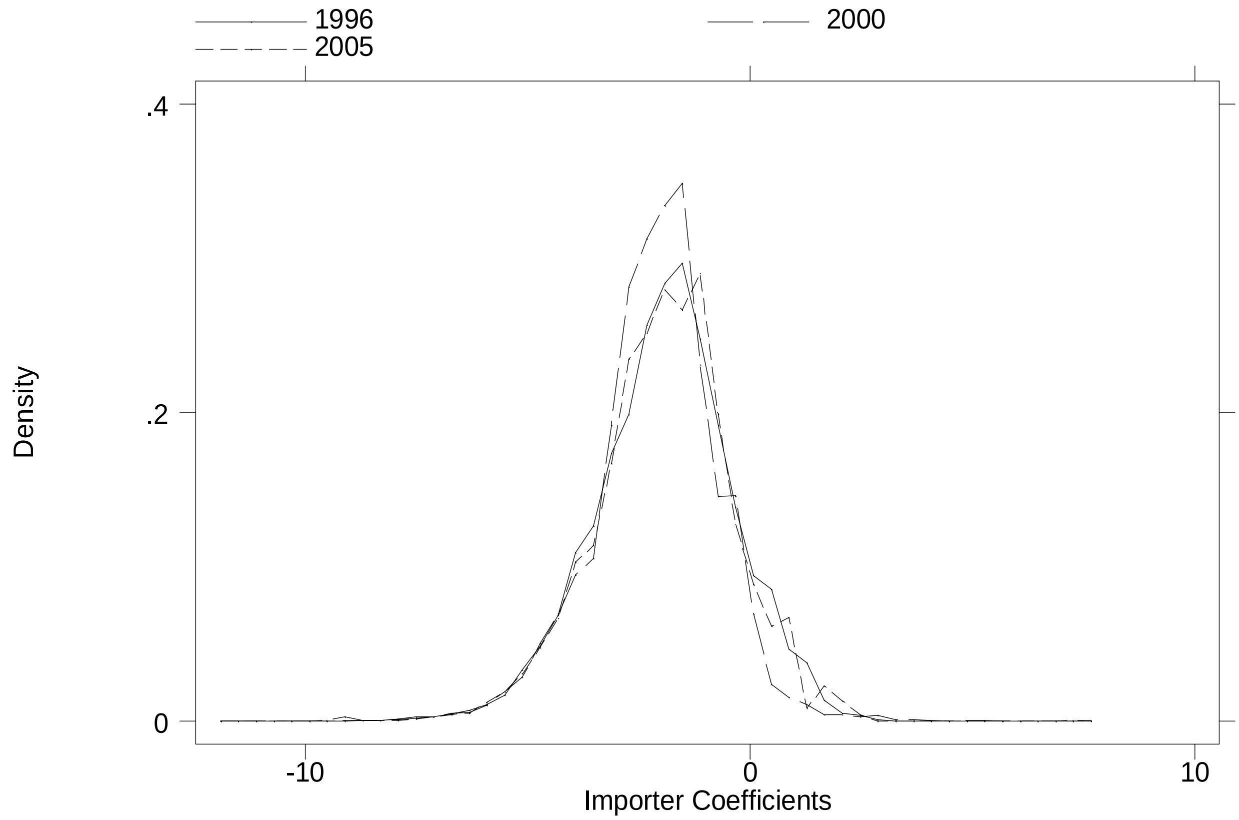

Figure 1b: Estimated Sector-Country Importer Coefficients, Selected Years

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

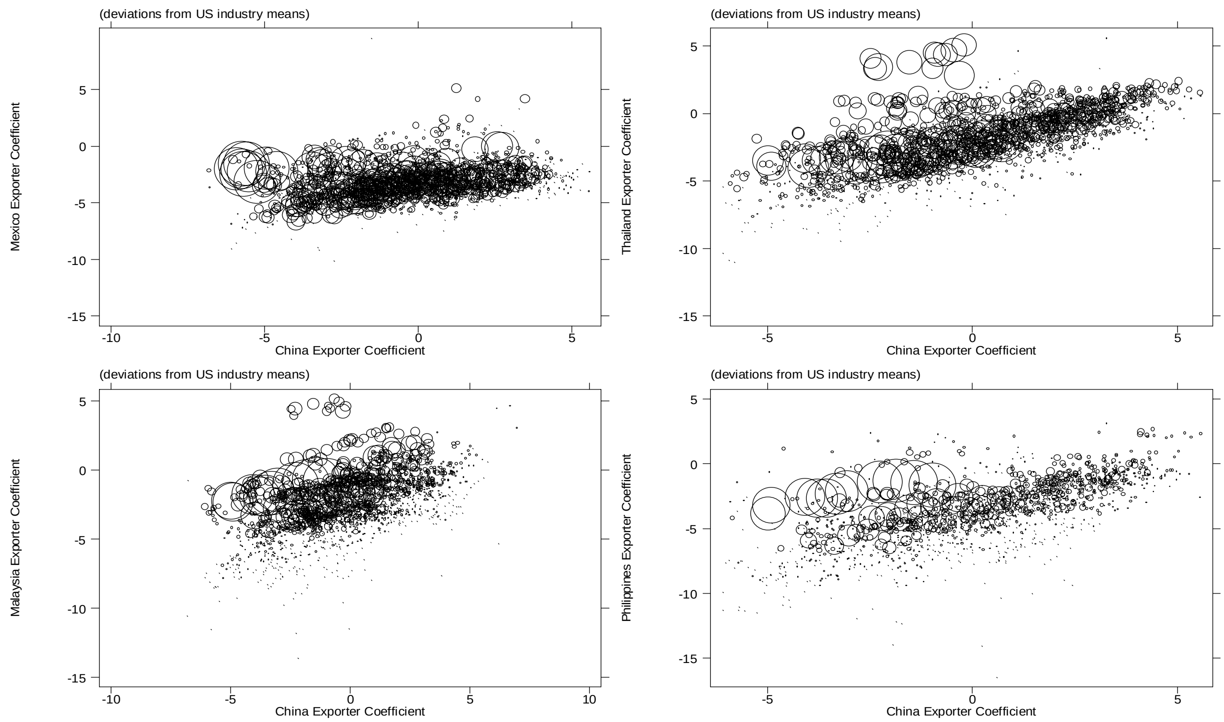

Figure 2b: Sectoral Export Coefficients for Individual Developing Countries and China

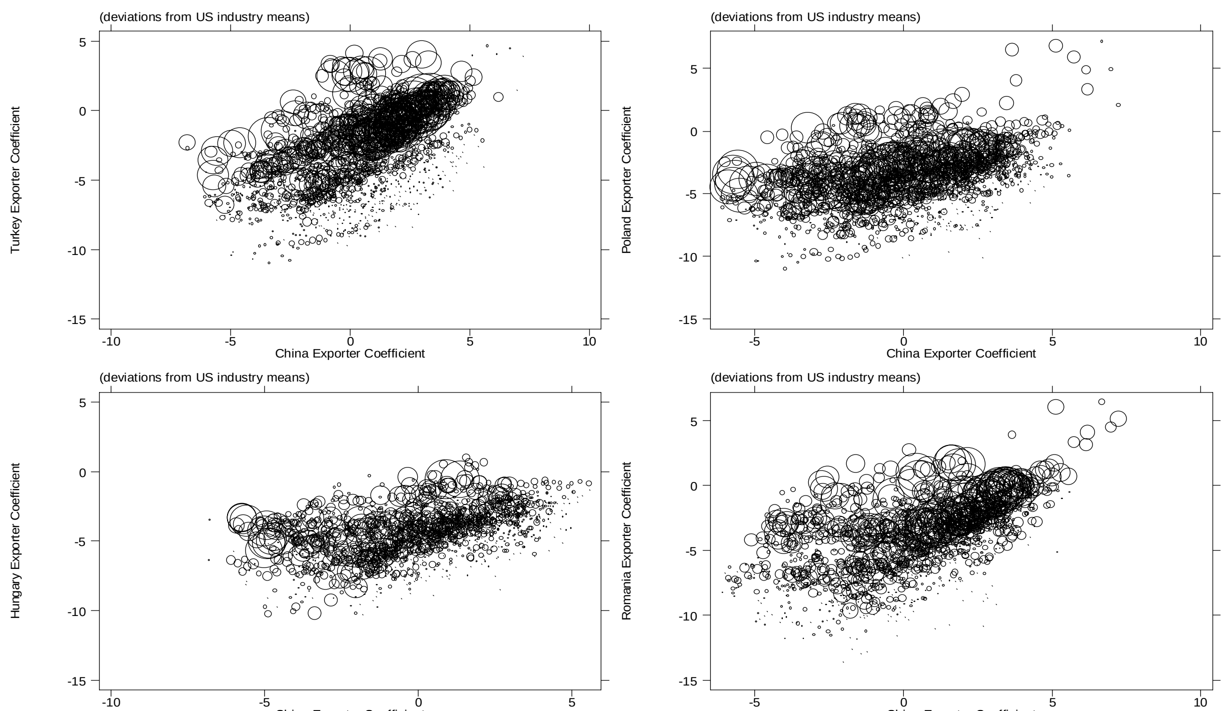

Figure 2c: Sectoral Export Coefficients for Individual Developing Countries and China

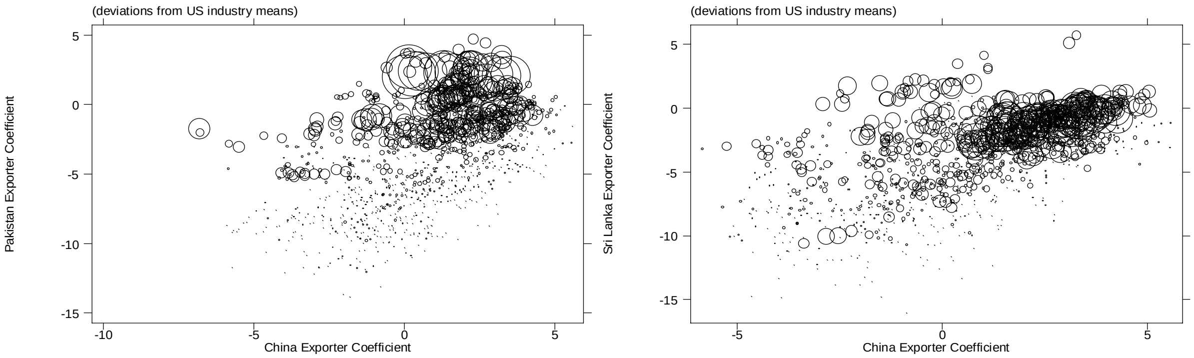

Figure 3a: Changes in Sectoral Export Coefficients, Individual Countries and China

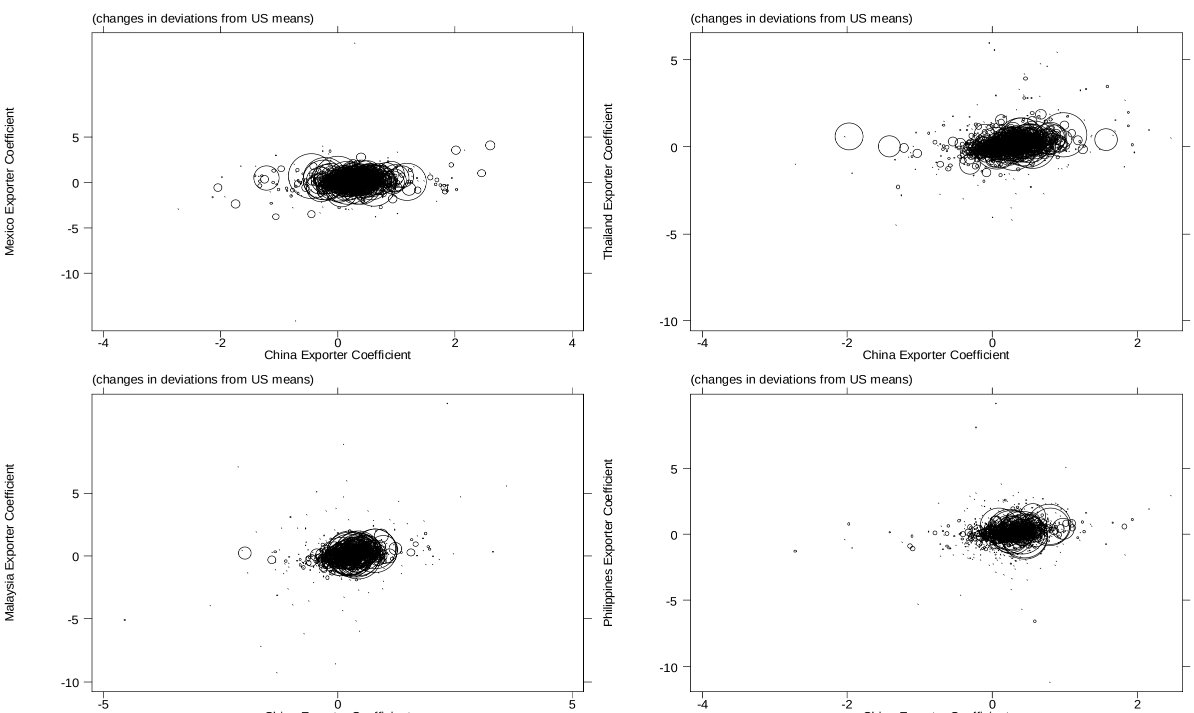

Figure 3b: Changes in Sectoral Export Coefficients, Individual Countries and China

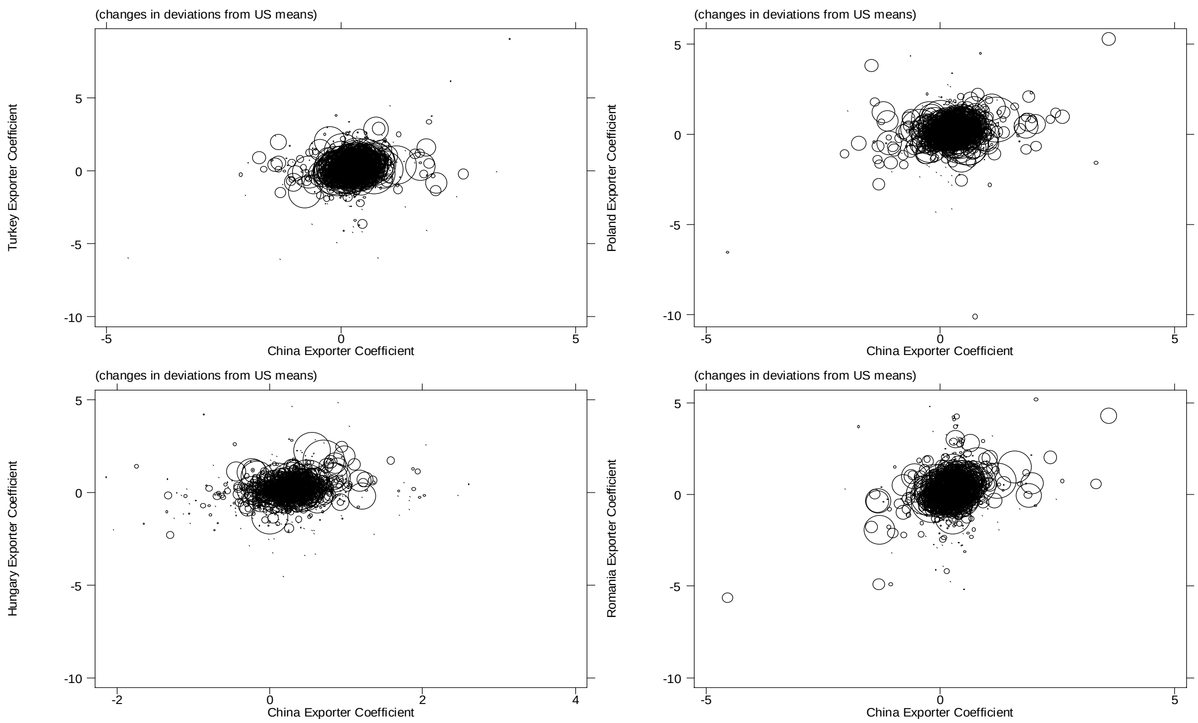

Figure 3c: Changes in Sectoral Export Coefficients, Individual Countries and China