ERNESTO LÓPEZ-CÓRDOVA
ALEJANDRO MICCO
DANIELKEN MOLINA

How Sensitive Are Latin American Exports to Chinese Competition in the U.S. Market?

Chinese exports increasingly compete with Latin American and Caribbean products in world markets.[1] Competition in the U.S. market is particularly relevant. The United States has been Latin America's most important trade partner throughout the postwar era. Trade with the United States stood at 60 percent of the region's total world trade in 2000, up from less than 47 percent in 1960 and a low of 37 percent in 1978.[2] Latin America has also been an important trade partner for the United States, although the region's share has fluctuated over the last three decades. Trade with Latin America as a share of total trade fell in the 1980s, but it has picked up since then. U.S.-China trade has also increased its share, growing from basically zero in the 1960s to more than 5 percent currently.

The remarkable growth of U.S. trade with China and the challenges it portends for Latin American countries are evident in U.S. import data (see table 1). From 1990 to 2003, Latin American exports to the United States increased from $58 billion to $196 billion, growing at an annual rate of 6.9 percent in real terms. Since U.S. imports from the world as a whole grew at 4.8 percent over the same period, Latin America's share of the U.S. market rose from 13.5 in 1990 to 17.5 in 2003. Chinese sales to the United States, however, grew at a breakneck 16.6 percent annually, reaching $147 billion in 2003. China's dynamic export performance led to a fourfold increase in the country's share of U.S. imports to 13.2 percent in 2003.

Although Latin America as a whole had a fair export performance over the last decade, aggregate figures mask important differences among countries

López-Córdova is with the Inter-American Development Bank; Micco is with the Ministry of Finance of Chile; Molina is a third-year doctoral student at the University of California–San Diego.

1. See Devlin, Estevadeordal, and Rodríguez (2006).
2. By trade, we mean here the sum of exports and imports.

TABLE 1. U.S. Imports and Average Tariffs, by Origin[a]

	Volume (millions of dollars)			*Distribution (percent)*			*Annual real growth rate (percent)*			*Average tariff (percent)*		
Region of origin	*1990*	*2000*	*2003*	*1990*	*2000*	*2003*	*1990–2000*	*1990–2003*	*2000–03*	*1990*	*2000*	*2003*
Total trade												
World	431,318	1,152,203	1,116,347	100.0	100.0	100.0	7.3	4.8	−3.2	4.6	2.5	2.1
Latin America and the Caribbean	58,286	198,906	195,848	13.5	17.3	17.5	10.0	6.9	−2.7	3.0	1.3	0.8
Mexico	25,872	128,408	128,430	6.0	11.1	11.5	14.2	10.2	−2.2	2.8	0.8	0.4
Central America	2,704	11,824	11,654	0.6	1.0	1.0	12.7	9.0	−2.7	5.0	5.2	4.4
Caribbean	4,494	9,770	9,193	1.0	0.8	0.8	5.1	2.9	−4.1	4.9	3.3	2.2
Andean	14,670	29,295	25,011	3.4	2.5	2.2	4.2	1.5	−7.2	1.4	0.7	0.5
South America	10,546	19,609	21,560	2.4	1.7	1.9	3.5	2.9	1.0	4.3	2.4	1.6
China	14,254	98,267	146,989	3.3	8.5	13.2	18.0	16.6	11.9	7.8	4.7	3.6
Rest of the world	358,778	855,030	773,510	83.2	74.2	69.3	6.1	3.3	−5.4	4.7	2.6	2.2

Source: Authors' calculations, based on U.S. Customs import data.

a. Annual real growth rates calculated using U.S. consumer price index (CPI) as a deflator. Average tariffs are calculated as duties divided by the value of imports. The regions are defined as follows: South America is composed of Argentina, Brazil, Chile, French Guiana, Guyana, Paraguay, Suriname, and Uruguay. The Andean countries are Bolivia, Colombia, Ecuador, Peru, and Venezuela. The set of Central American countries includes Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama. The Caribbean subgroup is made up of Antigua and Barbuda, Aruba, Barbados, Bermuda, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Netherlands Antilles, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, the Bahamas, Trinidad and Tobago, Montserrat, and the British Virgin Islands. Last, Mexico is listed individually.

in the region. The lion's share of the growth in exports from Latin America, more than 80 percent, came from Mexico, which increased its share of the U.S. market from 6.0 to 11.5 percent from 1990 to 2003. Over the same period, exports from Caribbean, Andean, and other South American countries grew more slowly than world exports to the United States; only Central America, along with Mexico, performed better than the world as a whole. Moreover, even Mexico has not been able to keep up with China's dynamic export performance, despite being bound to the United States by geography and the North American Free Trade Agreement. By 2003, China had surpassed Mexico as the United States' second most important import supplier, after Canada.

Aggregate trade figures also hide differences in the sectoral composition of Chinese and Latin American exports to the United States (table 2). Latin America is an important supplier of agricultural and mining products (including oil) to the United States, with respective shares of around 50 and 30 percent of U.S. import demand. Close to a quarter of all Latin American exports consists of nonmanufacturing goods; this figure is as high as three-quarters in the case of the Andean countries. At the opposite extreme, Mexico has the highest share of manufacturing exports to the United States (86 percent), followed by Central America and South America excluding the Andean countries (84 percent in both cases).[3] Central American countries saw a particularly significant change in the composition of their exports, with a twenty percentage points drop in the share of agricultural exports compensated by an equal rise in manufacturing. In contrast to Latin America, China is a relatively insignificant supplier of agricultural and mining exports, while manufactures represent over 99 percent of exports to the United States.

We find important differences within the manufacturing sector, as well (table 3). In 2003, approximately a fifth of all Chinese exports to the U.S. market was in leather goods (including footwear), textiles, and apparel, compared

3. The Latin American data are disaggregated into five subgroups, with the Andean countries classified separately from the rest of South America. Throughout the paper, we use the term *South America* to cover the following set of countries: Argentina, Brazil, Chile, French Guiana, Guyana, Paraguay, Suriname, and Uruguay. The *Andean countries* are Bolivia, Colombia, Ecuador, Peru, and Venezuela. The set of *Central American* countries includes Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama. The *Caribbean* subgroup is composed of Antigua and Barbuda, Aruba, Barbados, Bermuda, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Netherlands Antilles, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, the Bahamas, Trinidad and Tobago, Montserrat, and the British Virgin Islands. Last, Mexico is listed individually, owing to its strong trade relations with the United States.

TABLE 2. U.S. Imports and Average Tariffs, by Sector and Origin[a]

Sector and region of origin	Volume (millions of dollars)			Regional distribution (percent)			As percentage of manufacturing imports			Annual real growth rate (percent)			Average tariff (percent)		
	1990	*2000*	*2003*	*1990*	*2000*	*2003*	*1990*	*2000*	*2003*	*1990–2000*	*1990–2003*	*2000–03*	*1990*	*2000*	*2003*
Agriculture															
World	10,350	17,621	18,266	100.0	100.0	100.0	2.4	1.5	1.6	2.6	1.8	–1.0	3.6	1.4	0.7
Latin America and the Caribbean	5,243	8,499	8,848	50.7	48.2	48.4	9.0	4.3	4.5	2.1	1.4	–0.9	2.9	0.6	0.3
Mexico	1,873	3,152	3,491	18.1	17.9	19.1	7.2	2.5	2.7	2.5	2.2	1.2	5.2	0.6	0.2
Central America	988	1,820	1,706	9.6	10.3	9.3	36.6	15.4	14.6	3.4	1.6	–4.3	0.7	0.1	0.1
Caribbean	142	163	170	1.4	0.9	0.9	3.2	1.7	1.8	–1.4	–1.3	–0.9	0.6	0.0	0.0
Andean	1,188	1,611	1,622	11.5	9.1	8.9	8.1	5.5	6.5	0.3	–0.2	–2.0	2.2	0.2	0.1
South America	1,052	1,753	1,860	10.2	9.9	10.2	10.0	8.9	8.6	2.4	1.8	–0.2	2.1	1.6	0.7
China	105	298	401	1.0	1.7	2.2	0.7	0.3	0.3	8.0	8.0	8.0	2.4	28.5	1.8
Rest of the world	5,003	8,824	9,017	48.3	50.1	49.4	1.4	1.0	1.2	3.0	1.9	–1.5	4.3	1.2	1.0
Mining															
World	49,326	104,516	126,384	100.0	100.0	100.0	11.4	9.1	11.3	4.9	4.7	4.2	0.3	1.2	0.0
Latin America and the Caribbean	13,100	31,523	36,311	26.6	30.2	28.7	22.5	15.8	18.5	6.2	5.3	2.5	0.2	0.1	0.0
Mexico	5,064	12,116	14,589	10.3	11.6	11.5	19.6	9.4	11.4	6.1	5.7	4.1	0.2	0.0	0.0
Central America	25	154	181	0.1	0.1	0.1	0.9	1.3	1.6	16.6	13.3	3.2	0.3	0.3	0.0

Caribbean	782	980	2,735	1.6	0.9	2.2	17.4	10.0	29.8	−0.5	7.3	37.7	0.2	0.0	0.0
Andean	6,912	17,325	17,110	14.0	16.6	13.5	47.1	59.1	68.4	6.6	4.4	−2.6	0.3	0.2	0.0
South America	318	948	1,696	0.6	0.9	1.3	3.0	4.8	7.9	8.5	10.8	18.8	0.4	0.1	0.1
China	725	608	329	1.5	0.6	0.3	5.1	0.6	0.2	−4.4	−8.3	−20.2	0.7	0.2	0.3
Rest of the world	35,501	72,385	89,743	72.0	69.3	71.0	9.9	8.5	11.6	4.5	4.6	5.1	0.3	1.7	0.0
Manufacturing															
World	371,642	1,030,066	971,697	100.0	100.0	100.0	86.2	89.4	87.0	7.7	4.9	−4.1	5.2	2.7	2.4
Latin America and the Caribbean	39,943	158,884	150,689	10.7	15.4	15.5	68.5	79.9	76.9	11.7	7.9	−3.9	3.9	1.6	1.1
Mexico	18,935	113,140	110,351	5.1	11.0	11.4	73.2	88.1	85.9	16.3	11.5	−3.0	3.3	0.9	0.4
Central America	1,690	9,849	9,767	0.5	1.0	1.0	62.5	83.3	83.8	16.0	11.5	−2.5	7.6	6.2	5.2
Caribbean	3,570	8,627	6,288	1.0	0.8	0.6	79.4	88.3	68.4	6.2	1.7	−12.0	6.1	3.7	3.2
Andean	6,571	10,359	6,279	1.8	1.0	0.6	44.8	35.4	25.1	1.8	−2.9	−17.2	2.5	1.7	1.8
South America	9,177	16,908	18,004	2.5	1.6	1.9	87.0	86.2	83.5	3.4	2.6	−0.1	4.6	2.6	1.8
China	13,424	97,361	146,259	3.6	9.5	15.1	94.2	99.1	99.5	18.6	17.0	12.0	8.2	4.6	3.6
Rest of the world	318,274	773,822	674,749	85.6	75.1	69.4	88.7	90.5	87.2	6.3	3.2	−6.5	5.2	2.7	2.5

Source: Authors' calculations, based on U.S. Customs import data.

a. Annual real growth rates calculated using U.S. consumer price index as a deflator. Average tariffs are calculated as duties divided by the value of imports. Regions defined as in table 1.

TABLE 3. U.S. Manufacturing Imports and Average Tariffs, by Industry and Origin[a]

Industry and region of origin	Volume (millions of dollars)			Regional distribution (percent)			As percentage of manufacturing imports			Annual real growth rate (percent)			Average tariff (percent)		
	1990	*2000*	*2003*	*1990*	*2000*	*2003*	*1990*	*2000*	*2003*	*1990–2000*	*1990–2003*	*2000–03*	*1990*	*2000*	*2003*
Apparel and textiles															
World	43,417	97,872	102,332	100.0	100.0	100.0	11.7	9.5	10.5	5.5	4.0	−0.7	12.9	10.3	8.7
Latin America and the Caribbean	5,678	23,742	21,662	13.1	24.3	21.2	14.2	14.9	14.4	12.2	8.0	−5.1	13.0	6.0	4.6
Mexico	1,211	10,810	8,907	2.8	11.0	8.7	6.4	9.6	8.1	21.1	13.6	−8.3	12.0	2.4	0.8
Central America	876	6,806	7,241	2.0	7.0	7.1	51.8	69.1	74.1	19.4	14.6	−0.1	14.0	8.7	6.8
Caribbean	1,362	3,249	2,769	3.1	3.3	2.7	38.1	37.7	44.0	6.1	2.9	−7.3	13.8	8.5	6.5
Andean	375	952	1,147	0.9	1.0	1.1	5.7	9.2	18.3	6.8	6.1	4.1	14.5	10.6	6.8
South America	1,854	1,925	1,598	4.3	2.0	1.6	20.2	11.4	8.9	−2.4	−3.7	−8.1	12.1	10.6	10.0
China	6,319	21,710	28,680	14.6	22.2	28.0	47.1	22.3	19.6	10.1	9.4	7.3	11.6	11.8	9.4
Rest of the world	31,420	52,420	51,990	72.4	53.6	50.8	9.9	6.8	7.7	2.4	1.2	−2.4	13.1	11.5	10.1
Machinery and equipment															
World	193,344	611,125	563,178	100.0	100.0	100.0	52.0	59.3	58.0	9.1	5.8	−4.8	4.2	1.6	1.3
Latin America and the Caribbean	15,227	93,195	92,528	7.9	15.2	16.4	38.1	58.7	61.4	16.6	11.9	−2.4	2.6	0.7	0.4
Mexico	12,470	85,640	83,570	6.4	14.0	14.8	65.9	75.7	75.7	17.9	12.8	−3.0	2.7	0.7	0.4
Central America	90	1,602	954	0.0	0.3	0.2	5.3	16.3	9.8	29.8	16.8	−17.7	1.9	0.4	0.5

Caribbean	283	881	970	0.1	0.1	0.2	7.9	10.2	15.4	9.0	7.1	1.0	2.0	0.5	0.5
Andean	189	345	315	0.1	0.1	0.1	2.9	3.3	5.0	3.3	1.3	−5.0	1.6	0.5	0.4
South America	2,196	4,728	6,719	1.1	0.8	1.2	23.9	28.0	37.3	5.0	6.2	10.0	1.8	0.6	0.6
China	2,517	44,330	71,850	1.3	7.3	12.8	18.7	45.5	49.1	29.6	26.0	14.9	5.1	2.3	1.9
Rest of the world	175,600	473,600	398,800	90.8	77.5	70.8	55.2	61.2	59.1	7.4	3.7	−7.6	4.3	1.7	1.5
Other manufacturing															
World	134,881	321,069	306,187	100.0	100.0	100.0	36.3	31.2	31.5	6.1	3.7	−3.7	4.1	2.4	2.3
Latin America and the Caribbean	19,039	41,946	36,499	14.1	13.1	11.9	47.7	26.4	24.2	5.3	2.4	−6.6	2.3	1.2	0.7
Mexico	5,254	16,690	17,874	3.9	5.2	5.8	27.7	14.8	16.2	9.2	7.0	0.1	2.7	0.9	0.3
Central America	725	1,441	1,572	0.5	0.4	0.5	42.9	14.6	16.1	4.2	3.4	0.7	0.6	1.1	0.7
Caribbean	1,925	4,497	2,549	1.4	1.4	0.8	53.9	52.1	40.5	5.9	−0.5	−19.0	1.2	0.9	0.6
Andean	6,007	9,062	4,817	4.5	2.8	1.6	91.4	87.5	76.7	1.4	−4.2	−20.8	1.8	0.8	0.6
South America	5,127	10,255	9,687	3.8	3.2	3.2	55.9	60.7	53.8	4.3	2.3	−4.0	3.1	2.1	1.4
China	4,588	31,321	45,729	3.4	9.8	14.9	34.2	32.2	31.3	17.9	16.2	11.0	5.3	2.9	2.8
Rest of the world	111,254	247,802	223,959	82.5	77.2	73.1	35.0	32.0	33.2	5.4	2.8	−5.4	4.4	2.6	2.5

Source: Authors' calculations, based on U.S. Customs import data.

a. Annual real growth rates calculated using U.S. consumer price index as a deflator. Average tariffs are calculated as duties divided by the value of imports. Regions defined as in table 1.

with around 8 to 9 percent in the case of Mexico or South America (excluding the Andean countries) and 75 percent for Central America. Machinery and equipment exports amounted to almost a half of all Chinese sales to the United States, compared with 5 percent for the Andean countries, 10 percent for Central America, and 76 percent for Mexico.

China's strong export performance and Latin America's relative weakness have been made patently manifest since 2000. During the 2000–03 period, the U.S. demand for world goods declined at a rate of 3.2 percent per year, while demand for Latin American goods fell 2.7 percent. In contrast, Chinese exports to the United States expanded at a rate of 11.9 percent per year in the period. Figures for the manufacturing sector are even more dismal: Latin American exports in general recorded a yearly decline of 3.9 percent, while Caribbean exports fell 12 percent annually and Andean exports 17 percent. Chinese exports of leather goods, textiles, and apparel expanded at an annual rate of 7.3 percent, compared with an annual contraction of more than 8 percent for Mexico and South America and more than 5 percent for Latin America as a whole. China's machinery and equipment exports grew by 15 percent annually, while exports from Central America contracted by almost 18 percent per year. The region as a whole performed slightly better in this area.

China's export performance has been undeterred by higher tariffs, relative to Latin America, levied in the United States. In 2003, average tariffs on manufacturing imports were more than three times higher on Chinese than on Latin American goods. Mexican exports of leather goods, textiles, and apparel paid 0.8 percent ad valorem, on average, compared with 9.4 percent in the case of Chinese exports. Although averages hide differences in the composition of exports coming from each country and should be read with caution, tariff provisions under the North American Free Trade Agreement (NAFTA), the Andean Trade Preference Act (ATPA), or the Caribbean Basin Initiative (CBI) clearly give a preferential edge to some Latin American nations over China. While several studies demonstrate that tariff preferences (such as those under NAFTA) have indeed led to increased exports to the United States, China appears to have a comparative advantage that is difficult to compensate through low tariffs on Latin American exports.[4]

The picture that emerges from the trade statistics reveals that China has become a direct competitor with Latin American countries in their prime export destination, and this competition is rapidly eroding Latin America's share of the U.S. market. This is particularly the case for manufacturing exporters, such

4. On increased exports to the United States, see Moreira (2007); Nordas (2004).

as Mexico, Central America, and the Caribbean, and low-wage industries, like leather goods, textiles, and apparel. A key issue in this context is how changes in the policy environment would alter the current situation. Some of the countries that are most vulnerable to Chinese competition have recently established trade agreements granting them preferential access to the U.S. market (for example, the Central America Free Trade Agreement, or CAFTA). The region as a whole has similarly contemplated establishing a hemispheric Free Trade Area of the Americas (FTAA). Such initiatives might help the region compete more effectively with China in the United States. At the same time, the January 2005 removal of quotas in place under the Multi-Fiber Agreement has increased China's presence in U.S. apparel and textile consumption. An additional factor that would affect Latin American exports to the United States is the possibility of a steep appreciation of the Chinese currency, the renminbi.

How much would hemispheric free trade improve the competitiveness of Latin American exports to the United States? How has the elimination of apparel and textile import quotas in place under the Multi-Fiber Agreement (MFA) affected the region's exports of these products? How much would a revaluation of the renminbi translate into increased Latin American and Caribbean exports? To shed light on these questions, we use detailed U.S. import data (specifically, at the six-digit level of the Harmonized System, disaggregated by partner country, over the 1990–2003 period) to measure the elasticity of substitution between Latin American and Chinese exports to the United States. We assume that the preferences for domestic and imported varieties of a representative consumer in the U.S. market are represented by a utility function with constant elasticity of substitution. We then derive an expression for U.S. demand for imports from each country, which is a function of the price of imports from the given country, a sectoral price index, the elasticity of substitution, and U.S. income allocated to the consumption of the product in question.

To correctly estimate the elasticity of substitution in the demand equation, we need to deal with the endogeneity bias that arises between the demand equation and the price level of the good. We therefore instrument the price of the final good with three sets of instruments: transport costs, import tariffs, and input prices (that is, wages, cost of inputs, and cost of capital). Given the level of desegregation of our data, we are able to estimate the elasticity of substitution per economic sector, which is in line with the results obtained by recent studies. We use the estimated elasticities to forecast how alternative policy scenarios that affect the relative price of Latin American and Chinese goods would change U.S. import patterns. We consider three scenarios: a revaluation of the renminbi; the elimination of tariffs on Latin American and Caribbean exports to the United States as a result of a hemispheric free trade agreement; and the elimination of apparel and textile import quotas in the U.S. market.

The rest of the paper proceeds as follows. The next section outlines the empirical strategy followed to correctly estimate the elasticity of substitution per economic sector. The paper then describes the data and presents the estimation results. We use these estimation results to simulate the impact of the policy scenarios described above on Latin American exports to the U.S. market, and the final section concludes.

Empirical Framework

In this section, we present our empirical framework for estimating U.S. import elasticities. We assume that there is a set of goods and that each country can produce a different variety of each good. For goods produced in a given sector, U.S. imports are characterized by a constant elasticity of substitutions (CES) demand function. Therefore, U.S. expenditures ($p^c q_{jsct}$) on good j in sector s from country c in year t are given by the following equation (in logs):

$$p^c q_{jsct} = d_{jsct} + \left(1 - \sigma_s\right)\left(p^c_{jsct} - p^c_{.s.t}\right) + y_{st}, \quad (1)$$

where $p^c_{.s.t}$ is the log U.S. aggregate price for goods in sector s in year t. The term d_{jsct} is a demand shifter (in logs), σ_s represents the elasticity of substitution among goods in sector s, p^c_{jsct} is the CIF price of good j from country c paid by consumers in the United States, and y_{st} is U.S. expenditure on goods classified in sector s (in logs). We assume that the demand shifter could be decomposed into a country-good component (d_{jsc}) plus a country-year component (d_{ct}). This is a flexible specification that allows us to have different preferences for each good and variety. It also allows preferences for goods from a given country, as well as the U.S. expenditure share in each sector, to vary over time.

A standard simultaneity bias arises when we try to estimate the demand elasticity (σ) in equation 1 using ordinary least squares (OLS). We therefore proceed to instrument the CIF price variable (p^c_{jsct}) with a set of three instrumental variables: transport costs, tariffs, and input prices. Once we have instrumented the price of the good, we proceed to estimate equation 1 with country-good fixed effects (d_{jsc}), country-year dummies (d_{ct}), and sector-year fixed effects. The latter controls aggregate prices ($p^c_{.s.t}$) and U.S. expenditure in a given sector (y_{st}).

We assume that firms produce q_{jsct} with labor and capital using a Cobb-Douglas technology. Under this assumption, the producer's price in a given country is given by

$$(2) \quad p^{s}_{jsct} = \ln\left(\mu_{jsc}\right) - a_{jsct} + \alpha^{l}_{jsc} w_{ct} + \alpha^{k}_{jsc} r_{ct} + \left(1 - \alpha^{l}_{jsc} - \alpha^{k}_{jsc} - \alpha^{m}_{jsc}\right) q_{jsct},$$

where μ is the markup (price divided by marginal costs) and α_S are input elasticities, all of them fixed overtime. The term a_{jsct} represents log total factor productivity (TFP), and w_{ct} and r_{ct} are the factor prices of employment and capital required to produce *j* in country *c,* respectively. We assume that TFP could be decomposed into a country-good component (q_{jsc}) and a country-year component (a_{ct}). In equilibrium, the price per unit of consumption that a consumer pays in the U.S. market (in logs) is equal to the producer price (p^{s}_{jsct}) of the good, plus the tariff level (τ_{jsct}) and transport costs (tc_{jsct}):

$$(3) \qquad p^{c}_{jsct} = p^{s}_{jsct} + \ln\left(1 + \tau_{jsct} + tc_{jsct}\right) \approx p^{s}_{jsct} + \tau_{jsct} + tc_{jsct}.$$

Substituting equation 2 into equation 3, we obtain the following equation:

$$(4) \qquad p^{c}_{jsct} = \ln\left(\mu_{jsc}\right) - a_{jsc} - a_{ct} + \alpha^{l}_{jsc} w_{ct} + \alpha^{k}_{jsc} r_{ct} + \left(1 - \alpha^{l}_{jsc} - \alpha^{k}_{jsc} - \alpha^{m}_{jsc}\right) q_{jsct} + \tau_{jsct} + tc_{jsct}.$$

Equation 4 suggests the set of instruments required to correctly estimate the demand elasticity in equation 1. The first set of instruments is given by the interaction between the input requirement and the price of the input used in the production of good *j* in sector *s* of country *c* (one instrument per type of input); a second set of instruments is given by the U.S. tariff on good *j* from country *c* in year *t;* and the final instrument is given by the transport costs of importing good *j* from country *c*. On the one hand, an increase in U.S. demand for goods from country *c* will increase input prices in country *c*. The comovement between exports and input prices does not invalidate our instrument because equations 1 and 4 include a country-year dummy that captures any aggregate movement. More precisely, our first set of instruments is the differential effect of input prices across goods with different input requirements per economic sector. On the other hand, as pointed out by Clark, Dollar, and Micco, transport costs are increasing in the value of the transported good.[5] Our third instrument should therefore be the component of transport costs

5. Clark, Dollar, and Micco (2004).

that is orthogonal to the price of good *j*. For this reason, we regress transport costs against the good price and use the residual as our third instrument.[6]

To compute our proxies for sector input elasticities, we consider the direct and indirect labor and capital requirements.[7] Total input requirements are as follows:[8]

$$\left[\alpha^l_{jsc}, \alpha^k_{jsc}, \alpha^m_{jsc}\right] = \text{inv}\left(I - \mathbf{A}'\right) \times \left[Sh^l_{jsc}, Sh^k_{jsc}\right], \tag{5}$$

where Sh^l_{jsc} and Sh^k_{jsc} are sector expenditures on labor and capital over sector output.[9] When we compute prices using these input requirements (equation 4), we are implicitly assuming that imported and domestic intermediate goods have the same price path.[10]

Data

As mentioned above, equations 1 and 4 determine the set of variables needed to estimate the intersectoral elasticities of substitution. In general, our variables are given by the set of instruments required to estimate equation 4, with a

6. We also include country-year and product fixed effects in this regression.

7. For each of the ten countries in our analysis (besides the United States), we use the country's own input-output matrix (**A**) to compute these requirements.

8. The input-output matrix has the following format: $\begin{bmatrix} \mathbf{A}_{dom} + \mathbf{A}_{imp} \\ VA \end{bmatrix}[D]$, where $\mathbf{A}_{dom}$ and $\mathbf{A}_{imp}$ are the $N \times N$ matrices of required domestic and imported intermediate goods, respectively (N is the number of sectors); D is final demand; and VA is value added, which is made up of labor compensation (WL) and others. Therefore,

$$\left[\alpha^l_{jsc}, \alpha^k_{jsc}, \alpha^m_{jsc}\right] = \left[\overline{\mathbf{VA}}', A'_{imp} \times \mathbf{ones}\ (1, N)\right],$$

where $\overline{\mathbf{VA}}$ is the matrix of sectoral value added as a share of sector output and **ones** (1, N) is a vector of ones with dimension $1 \times N$.

9. The input-output matrix has the following format: $\begin{bmatrix} \mathbf{A} \\ VA \end{bmatrix}[D]$, where **A** is the $N \times N$ matrix of required intermediate goods (N is the number of sectors); D is final demand; and VA is value added, which is made up of labor compensation (WL) and others (which we assume as capital). Therefore,

$$\left[Sh^l_{jsc}, Sh^k_{jsc}\right] = \left[\overline{\mathbf{VA}}'\right],$$

where $\overline{\mathbf{VA}}$ is the matrix of sectoral value added as a fraction of sector output.

10. If we assume that imported and domestic intermediate goods have different prices over time, we need to decompose the input-output matrix into its domestic and imported component. See appendix A.

second set of variables required to estimate equation 1. We performed the estimations using the information available for the period 1990–2003 for the following countries: Brazil, Canada, China, Colombia, Germany, India, Indonesia, Japan, Mexico, Turkey, and the United Kingdom. The country selection is based on the relative importance of trade with the United States and regional representation.

We obtain the data from three sources. First, data related to the value of imports, tariffs levied at the product level in the United States, the price of the product, and transport costs of the product per country of origin are obtained from the U.S. Import Database. These import data are reported at the ten-digit level of the Harmonized System, but we use the information at the six-digit level, which allows us to classify the products within industrial sectors, given by the four-digit International Standard Industrial Classification (ISIC) revision 2.

Second, input requirements calculated by equation 5 are obtained using the information available in the input-output tables in the Global Trade Analysis Project (GTAP) database. As expected, input requirements are calculated at the two-digit GTAP industrial classification, which happens to almost exactly match the ISIC revision 2, industrial classification.

Third, GDP per capita, which we use as a proxy for wages, is taken from the World Bank's *World Development Indicators.* We use this proxy when we interact the factor requirement with wages, following equation 4. We also interact the capital requirement with a time trend and country fixed effects.

The availability of input-output tables limits the number of countries that can be used to estimate the first stage implied by equation 4. A second constraint is given by the lack of time variation in the input-output tables, which are compiled infrequently.[11] Despite these two limitations, we expect that the variation across sectors and countries will enable us to correctly identify equation 4.

Empirical Results

We now turn to our estimates of U.S. import elasticities. Table 4 reports the mean elasticity of substitution estimated from equation 1, setting $\sigma_s = \sigma$ for all sectors, but allowing for changes in U.S. sector expenditures over time

11. For specific information on the year of each input-output table, see the GTAP manual, version 5.

TABLE 4. Mean Sector Elasticity: Second Stage

Explanatory variable	*(1)*	*(2)*	*(3)*
CIF price (1 − σ)	−3.954 (0.085)***	−3.952 (0.085)***	−3.933 (0.037)***
Summary statistic			
No. observations	375,302	375,302	375,302
R^2	0.833	0.833	0.833
Country year dummies	Yes	Yes	Yes
Product–country year dummies	Yes	Yes	Yes
No. sector-year dummies	56	70	210

Source: Authors' calculations.

***Statistically significant at the 10 percent level.

a. The dependent variable is CIF import value (in logs). The regressions are estimated using instrumental variables (IV) with fixed effects. Our instruments for CIF price are as follows: sectoral labor share × GDP per capita; transport costs (orthogonal component of the FOB commodity price); U.S. tariff; and sector capital share × country trend. The reported *R* squared includes the variance of CIF import value explained by the fixed effects. Robust standard errors are in parentheses.

(sector-year dummies). In other words, all sectors have the same within-sector constant elasticity of substitution, but the elasticities between sectors could be different.[12] To recapitulate, CIF import value is the (log) CIF value of U.S. imports of commodity *j* in sector *s* from country *c* at time *t;* CIF price is the (log) instrumented CIF price paid by U.S. consumers on imported commodity *j.* All regressions include unreported country-product, country-year and sector-year fixed effects.[13] Column 1 assumes there are only four sectors (agriculture and mining; textiles; fabricated metal products, machinery, and equipment; and other manufacturing products), which have the same within-sector elasticity, σ, although their expenditure share may change over time. In column 2 we split agriculture and mining, and in column 3 we assume the full range of sectors at two digits of the ISIC revision 2 (fifteen sectors in total). The CIF price coefficient (1 − σ) is of interest because σ is the key determinant of the effect of trade impediments on the bilateral volume of trade. Our estimates suggest that the within-sector U.S. import demand elasticity (σ) is around 4. The coefficient σ is estimated precisely, and it does not vary when we change the number of sectors we use to control for changes on

12. If the constant elasticity of substitution within sectors (σ_w) differs between sectors (σ_b), then the expenditure for a given commodity *j* in sector *s* from country *c* is

$$\begin{aligned} p^c q_{jsct} &= d_{jsct} + \left(1-\sigma_w\right)\left(p^c_{jsct} - p^c_{.s.t}\right) + \left(1-\sigma_b\right)\left(p^c_{.s.t} - p^c_{...t}\right) + y_{.t} \\ &= d_{jsct} + \left(1-\sigma_w\right)\left(p^c_{jsct} - p^c_{...t}\right) + \left(\sigma_w - \sigma_b\right)\left(p^c_{.s.t} - p^c_{...t}\right) + y_{.t}. \end{aligned}$$

The last two terms on the right-hand side are captured by the sector-year dummies.

13. Commodities are defined at the six-digit level of the Harmonized System classification.

TABLE 5. Mean Sector Elasticity: First Stage

Explanatory variable	*(1)*	*(2)*	*(3)*
Sector labor share × GDP per capita (a)	0.532	0.416	0.800
	(0.186)***	(0.185)**	(0.199)***
Transport costs (b)	0.728	0.728	0.726
	(0.028)***	(0.028)***	(0.020)***
U.S. tariff (c)	0.401	0.405	0.397
	(0.059)***	(0.059)***	(0.061)***
Summary statistic			
No. observations	375,302	375,302	375,302
R^2	0.820	0.820	0.820
F test, instruments	253.42	252.36	479.66
Joint significance test for (a), (b), and (c) (Prob > *F*)	0.00	0.00	0.00
Country year dummies	Yes	Yes	Yes
Product–country year dummies	Yes	Yes	Yes
Sector capital share × country trend	Yes	Yes	Yes
No. sector-year dummies	56	70	210

Source: Authors' calculations.
**Statistically significant at the 5 percent level.
***Statistically significant at the 10 percent level.
a. The dependent variable is the CIF price (in logs). The regressions are estimated using ordinary least squares (OLS) with fixed effects. The reported *R* squared includes the variance of CIF import value explained by the fixed effects. Robust standard errors are in parentheses.

sector expenditure over time (columns 1 to 3). Our estimates are in the range of previous studies; in particular, our results for Mexico are in the lower bound of Romalis.[14]

As already mentioned, we need to use two-stage least squares (2SLS) to compute table 4. Table 5 presents the first stage of our previous estimations (equation 4). As in the previous case, columns 1 through 3 assume there are four, five, and fifteen sectors, respectively. All regressions include country-product, country-year, and sector-year fixed effects. Our first instrument is the interaction of the sector's labor share and GDP per capita, which we use as a proxy for wages. As expected, the coefficient is positive and highly significant: a fall in wages reduces prices. Given country-product and country-year fixed effects, all the identification comes from the fact that changes in wages have a stronger effect on labor-intensive sectors than on capital-intensive sectors. In all cases, this coefficient is statistically different from zero. Our second instrument is transport costs (the orthogonal component with respect to the value of the commodity). As expected, this coefficient is positive and significant at one percent. In this case, the coefficient is close to its theoretical

14. Romalis (2005). The estimates are also similar in magnitude to elasticities estimated by Clausing (2001) and Head and Ries (2001).

TABLE 6. Different Sector Elasticities: Second Stage

Explanatory variable	*(1)*	*(2)*
CIF price (1 − σ), sector 10–20	−1.501 (0.119)***	
CIF price (1 − σ), sector 10		−1.969 (0.147)***
CIF price (1 − σ), sector 20		−0.587 (0.195)***
CIF price (1 − σ), sector 32	−3.525 (0.109)***	−5.770 (0.099)***
CIF price (1 − σ), sector 38	−5.749 (0.099)***	−4.172 (0.099)***
CIF price (1 − σ), sector 3, other manufacturing	−4.153 (0.098)***	−3.521 (0.109)***
Summary statistic		
No. observations	375,302	375,302
R^2	0.834	0.834
Country year dummies	Yes	Yes
Product–country year dummies	Yes	Yes
No. sector-year dummies	56	70

Source: Authors' calculations.
***Statistically significant at the 10 percent level.
a. The dependent variable is the CIF import value (in logs). The regressions are estimated using IV with fixed effects. The reported *R* squared includes the variance of CIF import value explained by the fixed effects. Robust standard errors are in parentheses.

value (one). The third instrument is the tariff level. This variable has a positive effect on consumer prices, and it is significant at the 1 percent level. To control for the evolution of the cost of capital, we also include the interaction of the sector's capital share and a country-trend, which we use as a proxy for the different evolution of capital costs per country through time. In sum, our instruments all have the expected signs and are highly significant.

In the previous exercise, we assume that all sectors have the same within-sector demand elasticity. This is a strong assumption that we can relax with our methodology, contrary to previous papers.[15] Table 6 presents our estimates for different within-sector elasticities. In column 1 we compute four different within-sector elasticities (agriculture and mining; textiles; fabricated metal products, machinery, and equipment; and other manufacturing products). Within manufacturing, textile products have significantly larger within-sector elasticity (6.74) with respect to the other sectors. The combined agriculture and mining sector has a surprisingly low elasticity (2.5). When we split

15. Romalis (2005) states that "there is insufficient tariff variation to obtain meaningful substitution elasticity estimates for detailed industries."

agriculture and mining (column 2), the within-sector elasticities increase significantly in both subsectors, to 2.99 for agriculture and almost 1.50 for mining. These results are consistent with what we would expect for a commodity sector like mining. As the results in table 6 show, within-sector elasticities vary significantly across sectors. This sector heterogeneity needs to be taken into account when one estimates the potential effect of any change in trade policies on bilateral trade.

Policy Scenarios

Based on our within-sector elasticity results, this section considers alternative policy scenarios and forecasts their potential implications on exports to the United States from Latin America and the Caribbean, China, and the rest of the world. First, we consider the change in exports to the United States resulting from a 1 percent reduction in the price of all Chinese goods (what we call the Chinese export-price elasticity of U.S. imports in table 7). Our estimates in this regard are relevant for considering, in turn, alternative scenarios such as a revaluation of the Chinese renminbi. Second, we consider the extent to which U.S. trade policy, such as eliminating tariffs on imports from Latin America or quotas on textile imports from China, would affect U.S. import patterns. The methodology for computing the forecasts is described in appendix B.

Elasticity of U.S. Imports to Changes in Chinese Prices

Table 7 presents estimates of the Chinese export-price elasticity of U.S. imports in table 6. A price drop leads to a 3.7 percent expansion of Chinese exports to the United States, according to our results, while exports from other regions fall. In particular, sales from Latin America and the rest of the world decline by nearly 0.1 percent each. Total U.S. imports increase by a mere 0.4 percent. As expected, the biggest impact is in the manufacturing sector, where China's export offer is concentrated. Chinese exports of leather goods, textiles, and apparel rise by 4.6 percent, drastically displacing exports from Mexico (0.3 percent) and South America (0.8 percent). Machinery and equipment sales from Central America decline by nearly 0.2 percent as they are displaced by the 3.7 percent increase in Chinese exports.

Next we apply the export-price elasticities in table 7 to assess how a revaluation of the Chinese renminbi would affect U.S. imports from China and, in turn, help the rest of the world increase exports to the United States. The

TABLE 7. Chinese Export-Price Elasticity of U.S. Imports, by Region, 2003[a]

				Manufacturing			
Region	*Total trade*	*Agriculture*	*Mining*	*Total manufacturing*	*Leather, apparel, and textiles*	*Machinery and equipment*	*Other*
World	0.427	0.039	0.001	0.488	1.029	0.409	0.453
Latin America and the Caribbean	–0.080	–0.002	–0.001	–0.094	–0.245	–0.084	–0.032
Mexico	–0.084	–0.002	–0.001	–0.092	–0.247	–0.085	–0.049
Central America	–0.105	–0.001	–0.001	–0.130	–0.143	–0.182	–0.037
Caribbean	–0.099	–0.003	–0.002	–0.112	–0.208	–0.106	–0.009
Andean	–0.011	0.000	–0.001	–0.046	–0.186	–0.081	–0.010
South America	–0.111	–0.004	–0.002	–0.098	–0.800	–0.049	–0.016
China	3.737	1.921	0.546	3.719	4.553	3.716	3.200
Rest of the world	–0.074	–0.004	–0.001	–0.082	–0.385	–0.072	–0.029

Source: Authors' calculations.

a. The table reports the change in U.S. imports from each region in response to a 1 percent reduction in the price of Chinese goods. Regions defined as in table 1.

analysis is admittedly crude, as we assume that the exchange rate appreciation leads only to changes in the price of Chinese goods and that there are no general equilibrium effects on either the Chinese economy or the rest of the world. We also ignore potential adverse effects of the revaluation on the Chinese economy, such as any disruptions in the financial sector.

The scenario we consider involves a 20 percent revaluation of the renminbi. In such an event, the price of Chinese exports would not increase by the same percentage. Chinese exports embody a large fraction of inputs imported from other countries—as much as 70 percent of the value of exports, according to some authors. We take that figure as valid and thus assume that a revaluation only increases the price of Chinese inputs, including labor, embodied in exports, or 30 percent of their value. Under that assumption, a 20 percent revaluation implies a 6 percent increase in the price of Chinese exports. Table 8 shows our forecasts for U.S. imports under the scenario described.

The revaluation of the renminbi reduces Chinese exports to the United States by more than 22 percent ($43 billion based on 2004 trade figures), although total U.S. imports decline by only 2.6 percent ($24 billion). Chinese sales of leather goods, textiles, and apparel are the most sensitive, falling over 27 percent. The decline in U.S. imports from China is partly offset by increased exports from the rest of the world. Latin American sales grow by 0.5 percent, with South America benefiting the most. Exports of leather goods, textiles, and apparel from the region grow by 1.5 percent, or 4.8 percent in the case of South America.

U.S. Trade Policy

This subsection assesses how changes in U.S. trade policy would affect imports from Latin America and China. We consider, first, the potential impact of preferential tariff access to the United States for Latin American exports resulting from free trade agreements and, second, the expected effects of the elimination of the Multi-Fiber Agreement quotas in January 2005.

ELIMINATION OF U.S. TARIFFS ON LATIN AMERICAN GOODS. We first look at reductions in U.S. tariffs on Latin American goods. Since the United States adopted NAFTA in 1994, the country has engaged in negotiations with other countries in the region to establish similar free trade agreements. In 2002 the United States approved a free trade agreement with Chile; it recently finished negotiating the CAFTA and is holding negotiations with Andean nations to establish a similar agreement. Ultimately, the United States would eliminate tariffs on all Latin American countries under an FTAA.

TABLE 8. Chinese Revaluation and U.S. Imports, by Region, 2003[a]

				Manufacturing			
Region	*Total trade*	*Agriculture*	*Mining*	*Total manufacturing*	*Leather, apparel, and textiles*	*Machinery and equipment*	*Other*
World	−2.560	−0.237	−0.003	−2.930	−6.172	−2.455	−2.718
Latin America and the Caribbean	0.479	0.011	0.006	0.566	1.468	0.502	0.191
Mexico	0.506	0.011	0.006	0.554	1.481	0.511	0.295
Central America	0.628	0.003	0.005	0.777	0.856	1.094	0.221
Caribbean	0.595	0.015	0.012	0.669	1.248	0.634	0.053
Andean	0.068	0.002	0.005	0.274	1.116	0.488	0.060
South America	0.665	0.025	0.013	0.587	4.802	0.292	0.097
China	−22.421	−11.525	−3.277	−22.311	−27.319	−22.294	−19.198
Rest of the world	0.444	0.023	0.005	0.491	2.311	0.433	0.172

Source: Authors' calculations.

a. The table reports the change in U.S. imports from each region in response to a 20 percent currency revaluation. Regions defined as in table 1.

We consider the elimination of U.S. tariffs on imports from Latin America from their 2003 level; results are in table 9. In the aggregate, the region's exports increase by 3 percent, although there is a wide variation among the different subregions. The biggest growth would take place in Central America, which would experience a 21 percent increase in goods shipped to the United States, driven largely by sales of leather goods, textiles, and apparel (36 percent). Exports in this category record the fastest growth for all the Latin American subregions: 21 percent for the Caribbean, 29 percent for Andean countries, and 36 percent for the rest of South America. The smallest increase in exports would come from Mexico, given that tariffs on Mexican exports to the United States were already drastically reduced by 2003 as a result of NAFTA.

Our forecasts are in line with other studies. For example, a United States International Trade Commission (USITC) report analyzing the potential impact of CAFTA on trade patterns estimates that U.S. imports from the five Central American counterparties to the agreement (namely, Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua) and from the Dominican Republic would increase by 21 percent, which falls within our range of forecast for the Caribbean and Central America.[16] With regard to the FTAA, Hertel and others estimate that total U.S. imports worldwide would rise by around 2.2 percent, whereas Watanuki and Monteagudo put that figure at 1.1 percent; in contrast, we estimate an increase of only 0.4 percent in aggregate U.S. imports.[17]

Our results highlight the importance of preferential trade between the United States and Latin America for boosting exports from the region. The flip side is a small reduction in exports from China and the rest of the world to the United States of around 0.3 and 0.1 percent, respectively. The largest declines, as expected, would occur in exports of leather goods, textiles, and apparel.

ELIMINATION OF TEXTILE QUOTAS. Table 10 presents a breakdown of U.S. apparel imports by region. China's share of U.S. apparel imports rose from 13.2 to 18.6 percent from 2000 to 2004. In the same period, Latin America's share of the U.S. market fell from 30.8 to 26.3 percent. China's increasing market share, and Latin America's loss, came despite the fact that tariffs on Latin American imports declined more than those on Chinese goods. One potential explanation for the rising presence of Chinese apparel was the elimination, in 2002, of a number of import quotas on textile and apparel imports originally adopted under the Multi-Fiber Agreement (MFA). MFA quotas

16. USITC (2004, table 4-4).
17. Hertel and others (2007); Watanuki and Monteagudo (2002).

TABLE 9. Tariff Elimination on Latin American Goods and U.S. Imports, by Region, 2003[a]

				Manufacturing			
Region	*Total trade*	*Agriculture*	*Mining*	*Total manufacturing*	*Leather, apparel, and textiles*	*Machinery and equipment*	*Other*
World	0.407	0.363	0.005	0.432	3.113	0.103	0.142
Latin America and the Caribbean	3.078	0.772	0.030	3.718	20.254	0.781	1.350
Mexico	0.802	0.952	0.000	0.837	2.809	0.670	0.634
Central America	20.960	0.000	−0.007	27.085	36.453	0.600	0.000
Caribbean	8.995	−0.125	0.000	9.752	21.210	0.989	0.638
Andean	1.335	−0.015	0.063	5.984	28.973	2.232	0.755
South America	6.463	1.911	0.013	5.807	36.180	2.091	3.374
China	−0.305	−0.031	−0.004	−0.240	−1.103	−0.044	−0.007
Rest of the world	−0.134	−0.020	−0.005	−0.156	−1.703	−0.029	−0.025

Source: Authors' calculations.

a. The table reports the change in U.S. imports from each region in response to a tariff reduction on Latin American imports to the level of Mexico in 2001. Regions defined as in table 1.

TABLE 10. U.S. Apparel Imports and Average Tariffs, by Origin[a]

	Volume (millions of dollars)				Regional distribution (percent)				Average tariffs (percent)			
Region	*1997*	*2000*	*2003*	*2004*	*1997*	*2000*	*2003*	*2004*	*1997*	*2000*	*2003*	*2004*
World	47,084	62,928	66,499	70,533	100.0	100.0	100.0	100.0	12.6	12.1	11.2	10.9
Latin America and the Caribbean	13,669	19,376	18,150	18,517	29.0	30.8	27.3	26.3	5.6	5.5	3.4	3.3
Mexico	5,317	8,704	7,178	6,930	11.3	13.8	10.8	9.8	1.0	0.4	0.7	0.7
Central America	4,781	6,702	7,159	7,560	10.2	10.7	10.8	10.7	8.9	9.9	6.0	6.0
Caribbean	2,871	2,987	2,540	2,481	6.1	4.7	3.8	3.5	6.9	7.5	2.5	2.3
Andean	575	844	1,062	1,331	1.2	1.3	1.6	1.9	13.1	14.7	4.1	1.8
South America	125	140	211	215	0.3	0.2	0.3	0.3	10.3	12.9	14.1	12.3
China	7,279	8,307	10,997	13,106	15.5	13.2	16.5	18.6	11.8	10.5	10.0	9.5
Rest of the world	26,136	35,245	37,352	38,909	55.5	56.0	56.2	55.2	16.6	16.1	15.3	14.9

Source: Authors' calculations.

a. Regions defined as in table 1.

were binding for China and other Asian nations, which limited market access for apparel exports from those countries. During the Uruguay Round, countries agreed to dismantle such quotas gradually, removing them altogether by January 2005. The implementation of the final stage in the elimination of textile quotas in the United States and elsewhere created widespread apprehension in Latin America that unfettered Chinese exports to the United States would continue to erode the region's exports to the U.S. market.

We apply our framework to the analysis of the potential impact of eliminating MFA quotas on exports to the United States. We use available estimates of the export tariff equivalent of the quotas and our estimated elasticities of substitution to explore the implications of the ensuing relative price changes. According to the USITC, the export tariff equivalent of the quota on Chinese apparel sales to the United States was approximately 21 percent.[18] In estimating elasticities in section 4, we assumed that all Chinese apparel exports were subject to the export tariff equivalent rate, in addition to the usual duties applied in the United States. Here we use these elasticities to assess the impact of eliminating the export tariff equivalent.

Columns 1 and 2 of table 11 present our estimations of the impact of quota elimination on U.S. imports. Chinese exports increase by an impressive 40.3 percent, paralleled by drops everywhere else. As a result, U.S. imports grow by a modest 3.6 percent. Latin America is undeniably affected, but our estimations are smaller than the common perception seems to be—between 2 and 3 percent, with a much smaller decline for South America (0.5 percent). Table 11 also reports our estimations of the change in each region's share of the U.S. market (in percentage points). China's share rises by 5.8 points, Latin America's falls by 1.7, and the rest of the world accounts for the balance.

To assess whether our estimates are reasonable, we adopt an alternative strategy to measure the impact of removing quotas on each region's market participation. We employ a difference-in-differences approach in which we compare the change in market shares from 2000 to 2003 in tariff lines that had import quotas removed in 2002 (the treatment group), with those in tariff lines that had quotas eliminated in 2005 (the control group). Specifically, let $Share_{irt}$ stand for region *r*'s share of U.S. imports of good *i* (measured at the ten-digit Harmonized System tariff line level) in period $t \in \{2000, 20003\}$. All goods *i* that had quotas removed in January 2002 are defined as belonging to the treatment group. The control group consists of all *i* that had quotas removed in January 2005. We believe the latter provides a better control group than the

18. USITC (2002).

TABLE 11. Elimination of MFA Quotas and U.S. Apparel Imports, by Region, 2003[a]

Region	*Using elasticities of substitution* Imports (percent change)	Market share participation (change in percentage points)	*Based on difference-in-differences results* Market share participation (change in percentage points)	P value of point estimate
World	3.6	0.0	. . .	. . .
Latin America and the Caribbean	−2.8	−1.7	−2.5	0.3
Mexico	−2.7	−0.7	−2.2	0.3
Central America	−2.9	−0.7	−1.8	0.3
Caribbean	−2.9	−0.2	−0.3	0.8
Andean	−2.7	−0.1	0.4	0.4
South America	−0.5	0.0	−0.6	0.4
China	40.3	5.8	25.3	0.0
Rest of the world	−4.0	−4.1	−24.4	0.0

Source: Authors' calculations.
. . . Not applicable.
a. Regions defined as in table 1.

set of all apparel goods regardless of when their quotas were removed, if they were ever subject to any. We then estimate the following equation separately for each region, *r*:[19]

$$(6) \qquad Share_{irt} = \beta_0 + \beta^{\tau}_{irt} + \beta_2 1(i \in Treatment) + \beta_3 1(t = 2003) + \beta_4 1(t = 2003) \times 1(i \in Treatment) + \varepsilon_{it}.$$

The U.S. tariff on imports of i from r is represented by τ. Coefficient β_2 captures time-invariant differences in the import share of goods in the treatment group. Coefficient β_3 reflects shocks after 2002, other than the quota elimination, on the market share of all goods. The coefficient of interest, β_4, is equal to the change in the market share of goods that had quotas removed in 2002. Our identifying assumption is that there are no unobserved shocks that affect the market share of goods in the treatment group that are contemporaneous with the elimination of the quotas.

We summarize our findings in columns 3 and 4 of table 11, alongside our previous elasticity-based results. For Latin America and the Caribbean, the difference-in-differences point estimates are remarkably similar to our previous

19. We also estimated a variant of this equation in which we pool all regions together and incorporate regional dummies and their interaction with all other regressors, except for the tariff τ. The results were qualitatively the same.

findings—namely, a market-share loss of around 2.5 percentage points—although we cannot reject the null hypothesis that the impact on market share is zero for all subregions of Latin America. In contrast, the difference-in-differences estimates for China and the rest of the world are substantially higher (in absolute terms). Overall, the difference-in-differences approach suggests that Chinese market-share gains have come at the expense not of Latin America, but of the rest of the world.

Finally, as a robustness exercise, we calculated the same policy scenarios using elasticities of substitution estimated by Broda and Weinstein instead of our own estimates.[20] In particular we used their estimates at the four-digit level of industrial classification (ISIC revision 3). The results obtained at this higher level of desegregation are very similar to the results reported in tables 7 through 9.[21]

Conclusions

In this paper we estimate the elasticity of substitution of exports to the United States using detailed trade data over the 1990–2003 period. We use a two-stage least squares framework to correctly identify the elasticity parameter of interest. Our elasticity estimates are in line with those of other recent studies.

We use those estimates to assess the extent to which Latin American and Chinese goods compete in the U.S. market by estimating how alternative policy scenarios could affect exports to the United States. We consider the following three scenarios: currency revaluation in China; the elimination of U.S. tariffs on Latin American exports under a free trade agreement among all countries of the Americas; and the elimination of quotas on apparel and textile exports under the Multi-Fiber Agreement.

We find that a 20 percent appreciation of the renminbi reduces Chinese exports to the United States by a fifth, although U.S. imports decline by only 1.7 percent since other regions increase sales to that market (0.5 percent for Latin America). With respect to productivity, we find that faster TFP growth in China explains about half of the gap in export growth between that country and Latin America. An FTAA would increase Latin America's exports to the United States by around three percent. The removal of MFA quotas would

20. See Broda and Weinstein (2006).
21. Results are available on request.

lead to a sharp increase in Chinese sales to the United States (40 percent), but Latin America would see its share of the U.S. market decline by only 2.5 percentage points. China's gains would come mainly at the expense of other world regions.

Appendix A: Input Requirements

To compute input requirements in the main text, we assume that production only requires labor and capital. In this appendix, we assume that firms produce q_{jsct} with labor, capital, and imported intermediate goods using a Cobb-Douglas technology. Under this assumption, the consumer's price is

$$p^{s}_{jsct} = \ln\left(\mu_{jsc}\right) - a_{jsc} - a_{ct} + \alpha^{l}_{jsc} w_{ct} + \alpha^{k}_{jsc} r_{ct} + \alpha^{m}_{jsc} p^{m}_{ct}$$
$$+ \left(1 - \alpha^{l}_{jsc} - \alpha^{k}_{jsc} - \alpha^{m}_{jsc}\right) q_{jsct} \tau_{jsct} + tc_{jsct},$$

where w_{ct}, r_{ct}, and p^{m}_{ct} are the factor prices for employment, capital, and the imported goods required to produce j in country c, respectively. To compute the proxies for input elasticities, we consider the direct and indirect requirements of labor, capital, and imported intermediate goods of each produced good. Direct and indirect input requirements (α) are computed using each country's input-output matrix (**A**), which is decomposed into domestic and imported intermediate goods ($\mathbf{A} = A_{dom} + A_{imp}$). We compute the direct and indirect input requirements as follows:

$$\left[\alpha^{l}_{jsc}, \alpha^{k}_{jsc}, \alpha^{m}_{jsc}\right] = inv\left(I - A'_{dom}\right) \times \left[Sh^{l}_{jsc}, Sh^{k}_{jsc}, Sh^{m}_{jsc}\right],$$

where Sh^{l}_{jsc}, Sh^{k}_{jsc} and Sh^{m}_{jsc} are sector expenditures on labor, capital, and imported intermediated goods (direct) over sectoral output.[22]

22. The input-output matrix has the following format: $\begin{bmatrix} \mathbf{A}_{dom} + \mathbf{A}_{imp} \\ VA \end{bmatrix} [D]$, where $\mathbf{A}_{dom}$ and $\mathbf{A}_{imp}$ are the $N \times N$ matrices of required domestic and imported intermediate goods, respectively (N is the number of sectors); D is final demand; and VA is value added, which is composed by labor compensation (WL) and others. Therefore,

$$\left[\alpha^{l}_{jsc}, \alpha^{k}_{jsc}, \alpha^{m}_{jsc}\right] = \left[\overline{\mathbf{VA}}', A'_{imp} \times \mathbf{ones}\ (1, N)\right],$$

where $\overline{\mathbf{VA}}$ is the matrix of sectoral value added as a fraction of sector output.

The implicit assumption in this setup is that all imported intermediate goods have the same price—or, more precisely, the same price path. In the main text, the implicit assumption is that imported and domestic intermediate goods have the same price path over time (product by product). In this case, everything collapses to labor and capital requirements. In unreported exercises, we estimate equation 5 under the assumption of different price trends for imported and domestic intermediate inputs, and the results remained statistically equal to the results obtained under the assumption of the same price pattern of domestic and imported intermediate goods.

Appendix B: Policy Scenario Simulations

We assume that the consumer in the U.S. market has a constant elasticity of substitution utility function for goods classified in the same economic sector. The expenditure function of good j imported from country c at time t is thus given by the following equation:

$$p^c q_{jsct} = \left(\frac{p^c_{jsct}}{p^c_{.s.t}}\right)^{(1-\sigma_x)} b_{st} Y_{st},$$

where $p^c_{.s.t} = \left(\sum_{j\in S}\sum_{c} p^c_{jsct}{}^{(1-\sigma_x)}\right)^{\frac{1}{(1-\sigma_x)}}$ and $b_{st} Y_{st} \equiv y_{st}$.

Therefore, the effect on the expenditure of a change in the price of the imported good is given by the following equation:

$$\frac{\partial \ln\left(p^c q_{jsct}\right)}{\partial p^c_{jsct}} = \left(1-\sigma_s\right)\left(\frac{\partial \ln p^c_{jsct}}{\partial p^c_{jsct}} - \frac{\partial \ln p^c_{.s.t}}{\partial p^c_{jsct}}\right)\Delta p^c_{jsct},$$

where the total effect on expenditure per good is explained by two effects: the own price effect and the indirect effect, which is in turn explained by the change in the sectoral price index. The indirect effect is given by the following expression:

$$\frac{\partial \ln p^c_{.s.t}}{\partial p^c_{jsct}} = \frac{p^c_{jsct}{}^{(1-\sigma_s)}}{\left(\sum_{j\in S}\sum_{c} p^c_{jsct}{}^{(1-\sigma_s)}\right)} = \varphi_{jsct}.$$

Therefore, the change in expenditure of a good is given by the following equation:

$$\frac{\partial \ln\left(p^c q_{jsct}\right)}{\partial p^c_{jsct}} = \left(1-\sigma_s\right)\left(1-\varphi_{jsct}\right)\frac{\Delta p^c_{jsct}}{p^c_{jsct}}.$$

Aggregating the effect per economic sector and region, we obtain the following expression:

$$E_{s,reg} = \sum_{c \in reg} \omega_c \sum_{j \in S} \frac{\partial \ln\left(p^c q_{jsct}\right)}{\partial p^c_{jsct}},$$

and

$$E_{s,reg} = \left(1-\sigma_s\right)\sum_{c \in reg} \omega_c \sum_{j \in S}\left(1-\varphi_{jsct}\right)\Delta \overline{p}^c_{jsct},$$

where $\omega_c = \frac{\sum_{j \in S}\left(p^c_{jsct} q^c_{jsct}\right)}{\sum_{c \in reg}\sum_{j \in S}\left(p^c_{jsct} q^c_{jsct}\right)}$ and $\Delta \overline{p}^c_{jsct} = \frac{\Delta p^c_{jsct}}{p^c_{jsct}}$.

The aggregate effect per region is then given by

$$E_{reg} = \sum_{S} \omega_{cs} \sum_{c \in reg} \omega_c \sum_{j \in S} \frac{\partial \ln\left(p^c q_{jsct}\right)}{\partial p^c_{jsct}}$$

and

$$E_{reg} = \sum_{S} \omega_{cs}\left(1-\sigma_s\right)\sum_{c \in reg} \omega_c \sum_{j \in S}\left(1-\varphi_{jsct}\right)\Delta \overline{p}^c_{jsct},$$

where $\omega_{cs} = \frac{\sum_{c \in reg}\sum_{j \in S}\left(p^c_{jsct} q^c_{jsct}\right)}{\sum_{S}\sum_{c \in reg}\sum_{j \in S}\left(p^c_{jsct} q^c_{jsct}\right)}$.

These two equations are the expressions used to estimate the effect of the policy scenarios analyzed in the paper. The simulations assume that any change produced by a policy scenario is reflected in a change in the price of the imported good. We only have to aggregate the effects per economic sector and per region to get the desired calculations.

Comments

Luis F. López-Calva: In their paper, Ernesto López Córdova, Alejandro Micco, and Danielken Molina estimate elasticities of substitution for Chinese versus Latin American imports in the U.S. market, and simulate the effect of three different scenarios on the composition of U.S. imports. The scenarios are the revaluation of the Chinese currency, a total liberalization in U.S. trade flows (FTAA scenario), and the elimination of quotas on apparel and textile exports under the Multi-Fiber Agreement (MFA). The analysis is methodologically solid and adds to the literature, especially in terms of understanding the regionwide competitive position from the Latin American perspective. The key point of the paper is thus the study of trade competition between China and Latin America in the U.S. market, a crucial theme for the region in the medium term. Among the results, a very important finding has to do with the revaluation of the Chinese currency, given that several recent studies estimate the realignment to be around 40 percent. The paper suggests that a realignment would reduce Chinese imports to the U.S. by 20 percent.

The econometric estimation follows a well-established procedure, but the paper enhances solutions of the bias induced by the endogeneity of the price variable. Estimating the elasticity of substitution in the demand equation, which includes the demand for imports from each country, involves potential endogeneity related to the price level of the imported good. The authors employ an IV solution, using three instruments for robustness: transport costs, import tariffs, and input prices (that is, wages, cost of inputs, and cost of capital). The third instrument, however, requires detailed input-output (IO) data. This raises serious doubts regarding the quality of this information. In Mexico, for example, the data are updated from an IO matrix originally constructed in 1980. IO data have similar quality problems in several countries. Nevertheless, the authors correctly address some potential problems of the instruments given the existing data, and robustness checks are important in that respect.

A more general problem related to general equilibrium effects is that input prices could suffer from endogeneity, as well (that is, an increase in exports could increase input prices). The paper therefore includes a first-stage specification to ensure that the instruments reflect the differential effect of input prices across goods, with different input requirements per economic sector. Finally, the potential endogeneity of transport costs with respect to export volume is solved by regressing transport costs against the good price and using the residual as an instrument. The instruments generally seem to work well, suggesting that the exercise provides the best feasible analysis, given the existing data at hand.

The paper adds to the literature by carrying out first the standard exercise of allowing elasticities to vary across sectors while keeping within-sector elasticities constant, but then furthering the empirical analysis by allowing within-sector elasticities to vary. This within-sector variation is crucial for the accuracy and interpretation of the simulations.

The results are intuitive and compare fairly well with related work. An obvious caveat, however, relates to the general equilibrium implications of the hypothetic scenarios, which are not necessarily grasped in the structure of the analysis. In different contexts but based on similar assumptions, general equilibrium exercises have been shown to result in higher elasticities of substitution compared to previous literature; this tendency is related to the need to distinguish between short- versus long-run elasticities.[1] The bias in the magnitude of the elasticities stems from the fact that all the resource reallocations induced by demand shifts are taken as partial equilibrium adjustments.

The paper would be strengthened by a more careful analysis of some of the strong results. For example, the realignment of the renminbi (by 20 percent) reduces Chinese exports to the United States by a fifth, while increasing Latin American exports by only 0.5 percent. What could be driving the loss of competitiveness of Latin America with respect to the rest of the world? Moreover, the authors do not address the repositioning of countries within Latin America in terms of trade with the United States. For example, South America has the largest gains in some simulations, while Central America best enhances its relative position in others. Clearly, the different scenarios are not neutral in terms of the intersectoral composition of imports, thus reflecting relative changes consistent with patterns of specialization by subregion.

This type of exercise could shed light on intraregional gains and losses, to further our understanding of the coalitions formed around issues like

1. Wear (1990).

FTAA-related schemes. Although the purpose of the exercise is to examine Latin America as a whole, and the methodology is shaped accordingly, researchers and policymakers alike know that Latin America does not compete against China as a monolithic group. Rather, specific countries are looking to enhance their relative positions. Overall regional competitiveness is important analytically, but it has little relevance for those making decisions and discussing the use of specific policy instruments.

Peter K. Schott: China's penetration of world markets has been unprecedented since its opening to international trade in the 1980s. Between 1972 and 2005, for example, its share of U.S. manufacturing imports rose from essentially zero to 19 percent. Over the same period, the manufacturing market share of all of Latin America increased from 3 to 14 percent, while the share of OECD economies declined from 83 to 48 percent.[1] China has achieved this growth by extending the range of products it exports, as well as by increasing its exports per product. By 2005, China was present in 85 percent of all U.S. manufacturing product import markets. Latin America and the OECD, by contrast, were present in 69 and 97 percent, respectively.

López Córdova, Micco, and Molina explore the implications of Chinese export growth for Latin America by investigating the intensity with which Chinese and Latin American exports compete in the U.S. market. In particular, they estimate how Latin American export volumes would respond to four policy experiments: a 1 percent decline in the price of all Chinese exports; a 20 percent appreciation of the renminbi; an elimination of U.S. import tariffs on Latin American exports; and the elimination of quantitative export restrictions under the global Multi-Fiber Arrangement (MFA). The first three experiments do not (yet) have any real-world analogue; the results of the last experiment, however, can be compared to the actual response of Latin American and Chinese textile and apparel exports to the United States in 2005, the first year following the removal of the MFA restrictions.

In the first part of the paper, the authors use a standard approach to estimate the elasticity of substitution between exports from China and other countries, taking into account the techniques by which countries manufacture their exports. While the latter detail is a nice contribution to this literature, it necessarily restricts the range of countries for which data are available to just eleven. In the second part of the paper, the authors use their estimated elasticities to

1. Schott (2008).

TABLE 12. Summary of López Córdova, Micco, and Molina's Results
Percent

Experiment	*China's exports*	*Latin America's exports*	*U.S. imports*
1 percent decline in China's import prices	3.7	−0.1	0.3
20 percent appreciation of the RMB (6 percent price increase)	−22.1	0.5	−1.7
Elimination of Latin American import tariffs	−0.3	3.1	0.4
Elimination of MFA quotas	40.3	−2.8	2.2

MFA = Multi-Fiber Arrangement; RMB = renminbi.

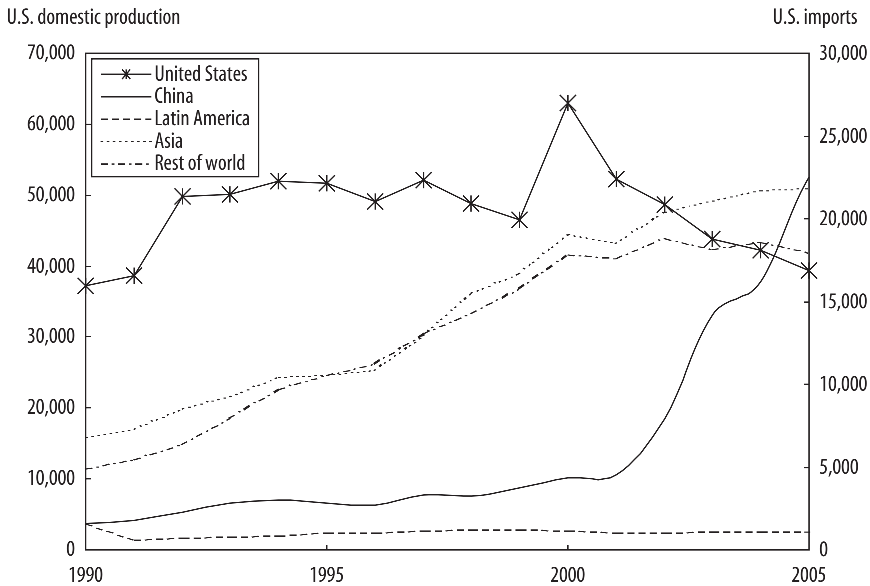
back out the change in Latin American and Chinese export volumes mandated by the price changes implied by the above experiments. The authors are careful to stress that their results ignore potentially important general equilibrium effects.

The basic results of the authors' experiments are summarized in table 12, which shows that the appreciation of the renminbi and the abolishment of the MFA induce the largest responses on the part of China and U.S. imports. As mentioned above, the results of the latter experiment provide a rough gauge of the usefulness of the authors' approach, since they can be compared to actual outcomes associated with the abolition of the MFA. The authors predict that the elimination of U.S. textile and apparel quotas will result in a 40 percent increase in Chinese textile and apparel exports and a concomitant 3 percent decline in Latin American exports of these products. In fact, total Chinese textile and apparel export volumes rose 39 percent in 2005, while Latin American exports fell 5.3 percent, as displayed in figure 1.[2] The actual U.S. import response was much stronger than predicted, growing 9 percent instead of the estimated 2 percent.

A key message of table 12 is that relatively large swings in Chinese export growth do not imply similarly large swings in Latin American export growth, and vice versa. This outcome is influenced, in part, by the fact that China and Latin America incompletely specialize in different sets of goods: as noted by the authors, China's exports lean toward manufactured products, while Latin American exports are relatively more resource based. An interesting avenue to explore in future research is how exports of raw materials from Latin America to China respond to the types of policy experiments noted in the

2. Brambilla, Khandelwal, and Schott (2007) These growth rates are for all textile and apparel exports, whether or not their quotas were already relaxed in prior rounds of the phase out of the MFA. Chinese exports of the textile and apparel products bound by quotas in 2004 grew in excess of 150 percent in 2005.

FIGURE 1. U.S. Textile and Apparel Market[a]



Source: Brambilla, Khandelwal, and Schott (2007).
a. In billions of square meter equivalents.

paper. Anecdotal evidence of Chinese firms' seeking to secure access to raw materials in Latin America and Africa abounds.

Another generalization worthy of exploration is vertical differentiation. Countries' export prices are correlated with their level of development.[3] This correlation has been interpreted as capturing vertical differentiation in terms of quality or other hedonic attributes: capital- and skill-abundant countries use their endowment advantage to produce vertically superior varieties that are relatively capital or skill intensive and possess added features or higher quality, thereby commanding a relatively high price. Chinese export products generally sell at a discount relative to Latin American products in the U.S. market.[4] It would be both useful and interesting to estimate elasticity parameters that allow for differential substitutability between high- and low-quality products, as well as to investigate the extent to which vertical differentiation

3. See Schott (2004); Hummels and Klenow (2005).
4. Schott (2003).

might rise or fall endogenously as a result of the types of policy experiments outlined above. Removal of U.S. import quotas, for example, might prompt changes in the quality of textiles and clothing China exports to the United States, which might prompt a reaction by Latin American firms.[5]

Finally, although the paper does a good job at highlighting the responsiveness of Latin American exports to changes in their own and other countries' export prices, it would be useful to relate those outcomes to changes in welfare. Such changes undoubtedly depend a great deal on the particular channels of trade that are modeled, but guiding the reader through these relationships would be quite instructive.

5. Aw and Roberts (1986); Feenstra (1988).

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