

# Substitutability and protectionism: Latin America's trade policy and imports from China and India\*

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## Abstract

This paper examines the trade policy response of Latin American governments to the rapid growth of China and India in world markets. There is evidence of higher levels of protection throughout the region in sectors where a large share is imported from the two Asian economies, but this effect is driven by China. Imports from India often faced lower levels than imports from the rest of the world. To explain these patterns, we extend the 'protection for sale' model to allow for different degrees of substitutability between domestically produced goods and goods imported from different regions. The extension suggests that higher levels of protection towards Chinese goods can be explained by high substitutability between domestically produced goods and Chinese goods, whereas lower levels of protection towards goods imported from India can be explained by low substitutability with domestically produced goods. The data supports the extension to the 'protection for sale' model, which performs better than the original specification in terms of explaining Latin America's structure of protection.

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# 1 Introduction

China's and India's fast economic growth during the past decade is paralleled by their growing presence in policy discussions throughout Latin America. The success of the two Asian economies is not only looked upon with admiration, but is often accompanied by concerns on the effects that growing trade integration with China and India has on the manufacturing sector throughout the region. Textiles, apparel, shoe manufacturing and toys are amongst the sectors worst hit by international competition.

In many Latin American countries requests for explicit protection are becoming more and more common. Brazilian manufacturers have officially asked their government to limit imports of Chinese silk, velvet and polyester thread by imposing import quotas and/or increasing tariffs. Furthermore, an additional 70 Chinese products are being reviewed by the textile industry to determine whether similar protective measures are to be requested. A communiqué by Argentina's Association of Medium Enterprise calls for not repeating the "of the nineties, when an 'invasion' of Chinese products destroyed entire sectors of the manufacturing sector."

And this has been noticed by local politicians. After a recent meeting with its Chinese counterpart, the Brazilian Minister for Industry, Development and Commerce Luiz Furlan was quick in highlighting that "I made it very clear to Minister Bo Xilai that we will take the legal steps to give Brazilian industry the right to protect itself".<sup>1</sup> Notwithstanding their country's privileged access to the US market, Mexican politicians show similar feelings and are growing more and more nervous about Mexico's burgeoning trade deficit with China. It is not surprising then that after a recent meeting with the Chinese leaders, president Fox was very happy to report that "Today we heard from President Hu his enthusiasm, his help, his support in closing the commercial gap...".<sup>2</sup>

While GATT-WTO bounds in principle do not allow countries to increase protection *vis à vis* China and India's products, most developing countries have bound tariffs well above

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<sup>1</sup>As reported by Yahoo! on October 4 2005. See <http://sg.biz.yahoo.com/051004/1/3veny.htm>.

<sup>2</sup>See "Mexico builds trade ties with China" by J.C. Mckinley in The New York Times of September 19, 2005.

their applied levels, a situation that de facto enables them to significantly increase protection without violating their GATT obligations.<sup>3</sup> Similarly, antidumping and safeguard rules are quite lax and these instruments have been often used by both developed and developing countries against Chinese imports (at least until China’s accession to the WTO).<sup>4</sup>

Given the substantial degree of flexibility enjoyed by domestic policy makers in implementing trade policies within the WTO rules, we are interested in exploring whether the characterization of China and India as sources of “cheap” and “unfair” imports has led to increased protectionism on goods that are heavily imported from the two Asian economies.<sup>5</sup>

Our initial analysis indicates that this is indeed the case for Latin American imports from China. On average, tariffs and non tariff barriers tend to be higher in goods that are heavily imported from China. Goods imported from India on the other hand tend to face lower levels of protection than imports from the rest of the world. Within Latin America, this result holds for the Andean countries, the Southern Cone and Mexico, while in the case of Central America there is evidence of lower levels of protection on goods imported from both China and India.

Although we control for the potential endogeneity of imports from China and India by instrumenting the share of imports from these two countries, and by controlling for industry effects (that we also allow to vary by year) so that the results do not simply reflect that tariffs tend to be higher on goods that are heavily exported by China and India, the approach remains ad-hoc, and does not provide us with an explanation of why we observed these patterns.

We therefore turn to a more structural explanation of the differences in the levels of protection observed in goods imported heavily from China and India, based on an extension

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<sup>3</sup>For example, Brazil’s bound tariff in textiles, apparel and footwear are bound at 35% in the WTO, and applied tariffs on these products have varied between 16 and 30 percent during the 1990s.

<sup>4</sup>See Hoeckman and Kostecki (2001).

<sup>5</sup>Below are some common characterizations of China as a source of “cheap” and “unfair” imports: “Countries around the world are bracing for a surge of cheap imports from China, which benefits from cheap, union-free labor and rising productivity” Taipei Times, January 2nd 2005. “And a villain always helps. Our polling indicates that 31% of Americans see China as the country that ignores agreements and breaks rules the most often.” Frank Lutz in *Republican Playbook*.

of Grossman and Helpman's (1994) 'protection for sale' model to accommodate for imperfect substitution between domestic goods and varieties that are imported from different regions. The extension suggests that if Chinese exports are closer substitutes to domestically produced goods in Latin America than imports from the rest of the world, then one would observe higher protection levels on goods heavily imported from China. Similarly, if goods imported from India tended to be less substitutable with domestically produced goods, then we will observe lower levels of protection on imports from India. The reason is that domestic lobbying forces are stronger on goods that are close substitutes to what is domestically produced. Our estimates confirm that China's imports are closer substitutes to domestically produced goods than imports from the rest of the world, whereas goods imported from India tend to be more distant substitutes to domestically produced goods than goods imported from the rest of the world.

We then estimate the extended model that accommodates for imperfect substitution between goods imported from different regions, and domestically produced goods, using the classic 'protection for sale model' (Grossman and Helpman, 1994) as a benchmark. The extended model performs better than the traditional 'protection for sale model' along two dimensions: first, it explains better the tariff structure of Latin America economies (in terms of R-squared and a non-nested specification  $J$  test); and second, the results are economically more reasonable. Indeed, the weight that the government puts on social welfare relative to industry lobbying are closer to what common sense suggests. The traditional model estimates the weight governments put on industry lobbying at levels that represent less than 1 percent of the weight put on social welfare. This is a well-known problem of the empirical literature on 'protection for sale' (see Gawande and Krishna, 2004 for a careful discussion). Similar results were obtained by Gawande and Bandyopadhyay (2000), and Goldberg and Maggi (1999) for the United States. McCalman (2004) found that industry lobbying accounts for 2 percent of the Australian government objective function and Mitra et al. (2002) found that industry lobbying accounts for 1 percent of the Turkish government's objective

function.<sup>6</sup>

The extended model that allows for imperfect substitution between domestically produced goods, and goods imported from different regions indicates that in our sample of Latin American countries, governments' weight on industry lobbying is on average 27 percent of the weight governments put on social welfare; and is as high as 50 percent in Central America.

The rest of the paper is organized as follows. Section 2 provides some *prima-facie* evidence regarding Latin American tariffs on goods heavily imported from China and India. In section 3 we develop the extension to Grossman and Helpman's (1994) "protection for sale" model. Section 4 presents the empirical methodology and results. Section 5 concludes.

## **2 Is LAC protection stronger against goods imported from China and India?**

In order to answer the above question we will explore the correlation between Latin America's structure of protection and the relative importance of China and India as a source of imports. This exercise is undertaken at the highest level of disaggregation that is possible for trade data to be internationally comparable: the six digit level of the Harmonized System. The period covered is 1992-2004 and the country coverage and data sources are discussed in the Data Appendix.

Latin America's average import-weighted tariff on imports from the world is 13 percent. The import-weighted tariff on imports from China and India is 9 percent higher. The largest protectionist bias towards China and India is to be found in Central American and Andean countries with average levels of protection that are 66 and 26 percent higher, respectively, on imports from China and India than on imports from the rest of the world. But tariffs, are only part of the story, antidumping duties, quantitative restrictions and technical regulations have become an important and often more arbitrary mode of trade protection. Latin America's

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<sup>6</sup>For a different approach on how to deal with this issue, see Mitra et al. (2006).

import-weighted overall level of protection (i.e., including ad-valorem equivalents of non tariff barriers) on imports from the world is 27 percent, and on imports from China and India 10 percent higher. The largest protectionist bias against China and India once we include ad-valorem equivalents of non tariff barriers is to be found in the Southern Cone with average levels of protection 20 percent higher on imports from China and India than on imports from the rest of the world.

But one has to be careful before interpreting these averages as evidence that imports from China and India lead to higher tariffs in Latin America. There are three issues that need to be dealt with before reaching such a conclusion. First, there may be reverse causality. Higher tariffs may hurt harder the less competitive trading partners, and this may lead to a growing share of imports from China and India. Second, there may be endogeneity as products in which China and India have a comparative advantage are those in which Latin American countries have the highest protection because of internal policy economy forces that have little to do with imports from either China or India. For example, China and India are likely to have a comparative advantage in unskilled labor, and these are the sectors which have the strongest political clout in Latin America. Third, the ad-hoc nature of the approach does not help us explain the observed patterns, but simply describe them.

We address the first problem by instrumenting the share of imports from China and India with their share in world trade by product, and the capital-labor ratio of the United States in each industry. The assumption is that individual Latin American countries tariffs are neither affecting the overall competitiveness of China and India in world markets, nor the capital-labor ratio of industries in the United States. These are relatively reasonable assumptions, as none of the Latin American countries in our sample represents more than 2 percent of world trade. We address the missing variable problem by introducing dummy variables that vary by country, year and 2 digits of the Harmonized System. This helps us address, for example, the issue that China may have a comparative advantage in sectors that happen to be strongly protected in Latin America, to the extent that the forces for comparative advantage in China and India, and for protection in Latin America do not vary

(too much) within 2 digits of the Harmonized System. The third problem is addressed in the next section, where we propose a more structural approach to help explain the patterns observed in this section.

Thus, the equation to be estimated is the following:

$$t_{k,c,t} = \beta_0 \beta_I I_{k \in 2 \text{ digit}, c, t} + \beta_m m_{k,c,t} + \beta_S s_{k,c \text{ from C\&I}, t} + \mu_{k,c,t} \quad (1)$$

where  $t_{k,c,t}$  is the level of protection on good  $k$  (at the six digit of the Harmonized System) in country  $c$  at time  $t$ ,  $I_{k \in 2 \text{ digit}, c, t}$  are a full set of fixed effects that vary by country, year and sector (at the level of the 2 digit Harmonised system),  $m_{k,c,t}$  are imports and  $s_{k,c,t}$  is the share of imports that comes from China and India in sector  $k$  of country  $c$  at time  $t$ ;  $\mu_{k,c,t}$  is a mean zero error term. We use two specifications. In the first the share of imports from China and India is computed jointly, while in the second specification they are computed separately

The instrumental variable results are reported in Tables 1 and 2 for a pool of 10 Latin American countries, and four sub-regions: Andean countries (Bolivia, Colombia, Peru and Venezuela), Central America (Costa Rica and Nicaragua), Mexico, and the Southern Cone (Argentina, Brazil and Uruguay). Table 1 reports results using tariffs as the endogeneous variable, and Table 2 reports results using ad-valorem equivalents of non tariff barriers as well. Because the ad-valorem equivalents are only available for the year 2001, there is no time variation in the results reported in Table 2.<sup>7</sup>

With the exception of Central America tariffs throughout the region tend to be higher on goods imported from China and India. But this is mainly driven by China. When we separately include the import shares of China and India in the regressions, the share of imports from China enters positively (with the exception of Central America again), and is statistically significant, whereas the share of imports from India is negative and statistically significant, suggesting lower tariffs on goods heavily imported from that country. Note, however, that the coefficient in front of the Chinese import share is always much larger

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<sup>7</sup>For data sources and variable descriptions see the Data Appendix.

than the coefficient in front of the Indian import share, probably illustrating the relative importance of these countries as an import source for Latin American countries, but also indicating that the protectionist bias towards goods imported from China is much larger than the anti-protectionist bias towards goods imported from India.

Does the pattern of higher protection applied to Chinese goods and lower protection applied to Indian goods hold when we also consider non tariff barriers? The answer is yes, and the results are reported in Table 2, where we use the same specification as in Table 1, but add to the six digit Harmonized System tariffs, the ad-valorem equivalents of non tariff barriers in Kee, Nicita and Olarreaga (2006).<sup>8</sup> The statistical significance of the estimates is not as good as those in Table 1, but the same pattern is present. Note that we do not have results for Central America, because there are no estimates available of the trade restrictiveness of their non tariff barriers.

In sum, protection towards imports from China tends to be higher in Latin America, whereas imports from India tend to face lower levels of protection. In order to try explain these patterns we extend the Grossman and Helpman (1994) ‘protection for sale’ model to allow for imperfect substitution between domestically produced goods and imported goods. We then confront the model to the data.

### **3 Introducing imperfect substitution in the protection for sale model**

To analyze the political economy consequences of imports from emerging economies such as China and India, we consider a model in which a small open economy sets trade policy vis-a-vis imports from the rest of the world (ROW). The key hypothesis in our model is that goods are differentiated by location of origin, that is, we adopt the Armington assumption and regard imports and domestically produced varieties as imperfect substitutes. Our model

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<sup>8</sup>Note that these estimates only exist for the year 2001, so we lost the time dimension in our sample. Results reported in Table 2 are for the year 2001 only.

features  $n + 1$  different types of goods, and we allow each type to be produced either domestically or imported from abroad. Later on we will allow for three different types of imported goods, depending on whether they originate in India, China or elsewhere. The extension is trivial so to simplify the presentation of the extended model we focus on a composite imported variety.

Indicating by subscript  $k$  the type of good, consumers in the home country maximize the following quasi-linear utility function:

$$U = c_0 + \sum_{k=1}^n U_k(X_k).$$

where  $U_k(\cdot)$  are strictly concave subutility functions (for example  $U_k = E_k \ln X_k$ , that is, an upper tier Cobb-Douglas) that depend on a CES aggregate of the imported and domestic variety of the good, denoted with subscripts  $d$  and  $i$  respectively, i.e.

$$X_k = [x_{kd}^{\rho_k} + x_{ki}^{\rho_k}]^{\frac{1}{\rho_k}} \quad 0 < \rho_k < 1 \quad (2)$$

where  $x_{k,d}$  stands for the consumption of the domestic variety of good  $k \in \{1, \dots, n\}$ ,  $x_{k,i}$  is the consumption of the imported variety,  $\sigma_k = \frac{1}{1-\rho_k} > 1$  is the elasticity of substitution between the two varieties, and good zero the numéraire. Note that quasi-linearity implies that there is neither an income nor a substitution effect for non-numéraire goods, as is standard in the protection for sale model.

The supply side is a specific-factor model where the primary inputs are sector-specific capital and mobile labor. The specifics of supply in each sector are summarized by profit functions  $\pi_k(p_{k,d})$  where  $p_{k,d}$  is the price of the domestic variety. To make things tractable, we are going to work with linear supply schedules, i.e. we will assume that the profit functions are quadratic. Production of good zero uses only labor under constant returns to scale, and by appropriate choice of unit its price as well as the wage rate are normalized to one.

Maximization of the above utility function yields demands for the domestic and imported

varieties of each product:

$$x_{k,d}(p_{k,d}, p_{k,i}, E_k; \rho_k) = \frac{E_k p_{k,d}^{\frac{1}{\rho_k}}}{p_{k,d}^{\frac{\rho_k}{\rho_k-1}} + p_{k,i}^{\frac{\rho_k}{\rho_k-1}}} \quad (3)$$

$$x_{k,i}(p_{k,d}, p_{k,i}, E_k; \rho_k) = \frac{E_k p_{k,i}^{\frac{1}{\rho_k}}}{p_{k,d}^{\frac{\rho_k}{\rho_k-1}} + p_{k,i}^{\frac{\rho_k}{\rho_k-1}}} \quad (4)$$

where  $p_{k,d}$  again is the price of the domestic variety and  $p_{k,i} = p_k^* + t_k$  is the price of the imported variety that results as the sum of the exogenous world market price and the import tariff, and  $E_k$  is the expenditure on good  $k$  (see the parameter of the Cobb-Douglas above). Note that — in line with a substantial part of the literature and in view of the goal of this paper — we do not explicitly consider export policies.

The price of the domestic variety results from the interplay of domestic supply and domestic demand, where the latter varies not only with the price of the domestic variety but also with the price of the imported variety, and this relation depends on the degree of substitutability. In particular, setting demand equal supply in the market for the domestic variety, i.e.  $x_{k,d}(p_{k,d}, p_{k,i}, E_k; \rho_k) = \pi'(p_{k,d})$ , implicitly defines the equilibrium price of the domestic variety

$$p_{k,d} \equiv p_{k,d}(p_k^* + t_k; \rho_k) \quad (5)$$

as a function of the price of the imported variety, where the relationship depends on the elasticity of substitution. To obtain further insights into this relationship between the price of the domestic variety and the price of the imported variety, and on how it is influenced by the elasticity of substitution, we assume that the supply of the domestic variety takes the following linear form:

$$y_{k,d} = p_{k,d} \quad (6)$$

Setting supply equal demand in the market for the domestic variety then results in the

following equilibrium condition:

$$p_{k,d} = \frac{E_k p_{k,d}^{\frac{1}{\rho_k - 1}}}{p_{k,d}^{\frac{\rho_k}{\rho_k - 1}} + p_{k,i}^{\frac{\rho_k}{\rho_k - 1}}} \quad (7)$$

Since we are unable to explicitly solve for  $p_{k,d}$ , we proceed by totally differentiating the equilibrium condition. Keeping in mind that the demand function is given by equation (3) above, we obtain

$$dp_{k,d} - \frac{\partial x_{k,d}}{\partial p_{k,d}} dp_{k,d} - \frac{\partial x_{k,d}}{\partial p_{k,i}} dp_{k,i} - \frac{\partial x_{k,d}}{\partial \rho_k} d\rho_k = 0 \quad (8)$$

We are interested in analyzing the relationship between the price of the domestic and foreign varieties, i.e.  $\frac{dp_{k,d}}{dp_{k,i}}$ . Holding  $\rho$  constant, equation (8) implies:

$$\frac{dp_{k,d}}{dp_{k,i}} = \frac{\frac{\partial x_{k,d}}{\partial p_{k,i}}}{1 - \frac{\partial x_{k,d}}{\partial p_{k,d}}} \quad (9)$$

The denominator is clearly positive. The numerator,

$$\frac{\partial x_{k,d}}{\partial p_{k,i}} = - \frac{\frac{\rho_k}{\rho_k - 1} E_k (p_{k,d} p_{k,i})^{\frac{1}{\rho_k - 1}}}{[p_{k,d}^{\frac{\rho_k}{\rho_k - 1}} + p_{k,i}^{\frac{\rho_k}{\rho_k - 1}}]^2}, \quad (10)$$

is also positive since  $0 < \rho_k < 1$ . We have thus shown that  $\frac{dp_{k,d}}{dp_{k,i}} \geq 0$ , i.e. that the price of the domestic variety increases if the price of the imported variety does, for example because of an increase in the tariff.

How does a change in the substitutability between the two varieties affect the relationship between the price of the domestic and the imported varieties? First, consider two extreme cases at each end of the spectrum: If the elasticity of substitution between the domestic and the imported variety equals one ( $\rho_k = 0$ ), we are in the case of Cobb-Douglas substitutability functions. In this case, the price of the domestic variety is unaffected, in other words  $dp_{k,d}/dp_{k,i} = 0$ . on the other hand if the domestic and the imported varieties are perfect substitutes ( $\rho_k = 1$ ), a price change of the imported variety translates one-for-one

( $dp_{k,d}/dp_{k,i} = 1$ ) into the price of the domestic variety. This puts us back in the standard framework of the Grossman-Helpman protection for sale model.<sup>9</sup>

To analyze intermediate cases and to show more formally that  $dp_{k,d}/dp_{k,i}$  is increasing in  $\rho$ , we need to differentiate equation (9) with respect to  $\rho$ :

$$\frac{\partial(\frac{dp_d}{dp_i})}{\partial\rho} = \frac{\frac{\partial(\frac{\partial x_d}{\partial p_i})}{\partial\rho}(1 - \frac{\partial x_d}{\partial p_d}) + \frac{\partial x_d}{\partial p_i} \frac{\partial(\frac{\partial x_d}{\partial p_d})}{\partial\rho}}{(1 - \frac{\partial x_d}{\partial p_d})^2} \quad (11)$$

Solving explicitly, this can be shown to be positive (see the appendix), as long as demand and supply of the domestic variety do not diverge too much.<sup>10</sup> We can therefore conclude that  $p'_k \equiv dp_{k,d}/dp_{k,i}$  is a positive function of  $\rho_k$ .

### 3.1 Lobbying Game

We model the lobbying game along the lines of the familiar protection for sale model of Grossman-Helpman. In the first stage, owners of sector specific capital in the home country lobby the government for advantageous trade policies on imported substitutes. In particular, they offer contribution schedules  $C_k(\mathbf{t})$  that depend on the full vector of import tariffs. Their objective functions — gross of contributions — take the following form:<sup>11</sup>

$$W_k(\mathbf{t}) = l_k + \pi_k(\mathbf{t}) \quad (12)$$

In the second stage, each government chooses trade policy and collects the contributions that were offered. Formally, it seeks to maximize the following objective function:

$$G(\mathbf{t}) = \sum_k C_k(\mathbf{t}) + aW(\mathbf{t}) \quad (13)$$

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<sup>9</sup>If both varieties were complementary ( $\rho_k < 0$ ) then we would obtain a negative correlation between both prices, a case we do not consider as we are modelling two varieties of the same good.

<sup>10</sup>A sufficient condition is that  $|\ln p_d - \ln p_i| < (1 - \rho)/\rho$ .

<sup>11</sup>Note that we assume that owners of specific capital are sufficiently concentrated so that they have mass zero in terms of consumption and lump sum redistribution of tariff revenue.

where  $\mathbf{t}$  is the vector of tariffs applied by the Home country and  $a$  is the weight the government puts on social welfare on its objective function.  $W(\mathbf{t})$  denotes the aggregate social welfare function which is defined as follows:

$$W(\mathbf{t}) = L + \sum_k \pi_k(\mathbf{t}) + CS(\mathbf{t}) + TR(\mathbf{t}) \quad (14)$$

where  $L$  denotes the labor force (hence labor income because  $w = 1$ ),  $TR$  denotes tariff revenue, and  $CS$  is consumer surplus. Note that these components should in principle depend partly on the price of the domestic variety and we have made use of expression (5) to express them in terms of tariffs. The tariff revenue and consumer surplus can be written in the following manner:

$$\begin{aligned} TR(\mathbf{t}) &= \sum_k t_k x_{k,i}(p_{k,d}(p_k^* + t_k), p_k^* + t_k) \\ CS(\mathbf{t}) &= \sum_k [U_k(X_k) - p_{k,d}(p_k^* + t_k)x_{k,d} - (p_k^* + t_k)x_{k,i}] \end{aligned} \quad (15)$$

Because we do not have information on political organization by sector in Latin America (i.e., there is no legal requirement for public disclosure of industries' political contributions), when solving for the optimal tariff we will assume that all industries are organized (which is not unreasonable given the high level of industry disaggregation in our data), and that contribution functions are differentiable.

Taking the first order condition of the government's maximization problem in (14), and rearranging we obtain:

$$\frac{t_k}{1 + t_k} = \frac{1}{a} \times \frac{z_k}{\epsilon_k} \times p'_k \quad (16)$$

where  $z_k = x_{k,d}/x_{k,i}$ . The last term is the main innovation vis-à-vis the standard model ( $p'_k$  given by equation (9) and fully derived in the appendix). We have shown above that it depends positively on the elasticity of substitution. Thus in the presence of high substitution between domestically produced goods and imported goods, tariffs are likely to be higher.

## 4 Empirical Analysis

For the above model to be able to explain the protection bias against goods imported from China and in favor of goods imported from India discussed in section 2, we need two hypothesis to be satisfied. First, the substitution between domestically produced goods in Latin America and imported goods from China (and India) needs to be larger than the elasticity of substitution between domestically produced goods and goods imported from the rest of the world. Second, the extended ‘protection for sale’ model would need to perform better than the one traditionally estimated with imported and domestically produced goods being homogeneous. We address these two issues in turn.

### 4.1 Estimating the substitutability between domestically produced goods and imports from China and India

Denote the share of imports of good  $k$  from China good  $k$  by  $s_{k,C}$ , from India by  $s_{k,I}$ , and from the rest of the world by  $s_{k,ROW} = 1 - s_{k,C} - s_{k,I}$ . The degree of substitutability between domestically produced good  $k$  and the composite imported good  $k$ , is denoted by  $\rho_k$  and was defined in (2). The substitutability between the composite imported good  $k$  and the domestically produced good  $k$  can be further decomposed according to the substitutability with goods imported from different regions (China, India and rest of the world) weighted by the share of imports from each region:

$$\rho_k = \rho_{k,C} s_{k,C} + \rho_{k,I} s_{k,I} + \rho_{k,ROW} s_{k,ROW} \quad (17)$$

Using equation (4) we can derive the price elasticity of the composite of imported goods,  $\epsilon_k$ . Solving for  $\rho_k$  we have  $\rho_k = 1 + 1/\epsilon_k$ . Thus, with an estimate of the price elasticity of the imported composite good  $k$  (that we borrow from the existing literature), we can obtain an estimate for  $\rho_k$ .

Then, with data on  $\rho_k$ ,  $s_{k,C}$  and  $s_{k,ROW}$ , we can the use (17) to obtain estimates for the degree of substitutability between domestically produced goods on the one hand, and

Chinese, Indian and rest of the world imported goods on the other hand. Note that this will only capture the average degree of substitutability  $\rho_C$ ,  $\rho_I$ , and  $\rho_{ROW}$ , as with the parametric estimation we will necessarily lose some degrees of freedom.

There are two problems with the estimation of (17). The first one is that the shares are perfectly collinear and therefore we need to rearrange the expression to be able to estimate the parameters. Equation (17) becomes:

$$\rho_k = (\rho_C - \rho_{ROW})s_{k,C} + (\rho_I - \rho_{ROW})s_{k,I} + \rho_{ROW} \quad (18)$$

The second problem is that theory tell us that the estimates for  $\rho_C$ ,  $\rho_I$  and  $\rho_{ROW}$  need to lie in the range (0 ; 1). We will impose this constraint (although it is not necessarily binding) and estimate  $\rho_C$ ,  $\rho_I$ , and  $\rho_{ROW}$  non linearly. The equation to be estimated becomes:

$$\begin{aligned} \rho_k &= ([C/(C+1)]^2 - [ROW/(ROW+1)]^2)s_{k,C} \\ &+ ([I/(I+1)]^2 - [ROW/(ROW+1)]^2)s_{k,I} + [ROW/(ROW+1)]^2 \end{aligned} \quad (19)$$

where  $C$ ,  $I$  and  $ROW$  are the parameters to be estimated;  $\rho_C = [C/(C+1)]^2$ ,  $\rho_I = [I/(I+1)]^2$ , and  $\rho_{ROW} = [ROW/(ROW+1)]^2$ . Equation (19) is the basis for our estimation of the relative degrees of substitutability between domestically produced and imported goods from different regions. Results are discussed in subsection 4.3.

## 4.2 Does the extended model perform better?

In order to assess whether the extended model with imperfect substitution between domestically produced goods and imported goods performs better than the traditional ‘protection for sale’ model with homogeneous goods, we will run both models on our Latin American sample: the extended model provided by equation (16) and the traditional model where the last term in (16) is not present. We will then explore which of the two models better explains Latin America’s tariff structure by comparing their R-squared, as well as performing

a Davidson-McKinnon non-nested specification J-test.<sup>12</sup>

We will also assess the two specifications in terms of their economic significance. One problem with the empirical literature on the ‘protection for sale’ model is that the estimates for  $a$  are unreasonably high (see Krishna and Gawande, 2004 for a survey of the empirical literature). According to the existing estimates using the traditional ‘protection for sale’ model with homogeneous goods, the weight put by the government on industry lobbying when setting trade policy represent less than 1 percent of the weight the government puts on social welfare. This is not consistent with observed behavior and tariff structures. If we were to obtain a lower, and more reasonable estimate for  $a$  with the extended model, this would suggest that the model is also economically more meaningful.

Note that in order to estimate the extended model, we need an estimate for  $p'_k$ , the derivative of domestic prices with respect to the price of the composite imported good provided in (9). Using (9) and the derivative of domestic demand with respect to the price of domestically produced goods with the help of (3), and then substituting into (9) we obtain an expression for  $p'_k$ . It is nasty and it can be found in the appendix. To be able to calculate  $p'_k$  we will need data on the prices of the domestic and the composite imported good, as well as consumer expenditure in sector  $k$ . The relative price between domestic goods and the composite imported good is obtained using the two first order conditions of the consumer maximization problem. More precisely, we take the ratio between (3) and (4) and solve for the relative price. Unit import prices are available from trade data. Consumption is readily obtained from trade and production data.<sup>13</sup> One concern with this term is measurement error, but we instrument this term  $p'$  jointly with the rest of the right hand side term to address this problem.

Finally, a well-known problem with the estimation of the ‘protection for sale’ model in its

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<sup>12</sup>This consists of running the two specifications, taking the predicted value of each specification and adding the predicted of the alternative specification to the null specification. If the predicted value is statistically significant, then we cannot reject that the alternative is the right specification. The problem with this test is that we may not be able to reject either of the alternatives, or we may be able to reject both, i.e., the test may be inconclusive.

<sup>13</sup>Or rather apparent consumption which equals imports plus domestic production minus exports.

traditional or extended form is the endogeneity of the right-hand-side variables. In order to correct for this we use as instruments the share of labor in value-added, and the US capital to labor-ratio. The results of the estimation of the extended and traditional ‘protection for sale model’ are discussed in section (4.3).

### 4.3 Results

We first report the results of the estimation of the degree of substitutability between domestically produced goods and imported goods from either China, India or the rest of the world. Results of the estimation of (18), as well as the implied  $\rho$ s are provided in Table 3. A quick look suggest that indeed the degree of substitution between Chinese goods and domestically produced goods in Latin America, as measured by  $\rho_C$  is much higher than the degree of substitution between goods imported from the rest of the world and domestically produced goods. The estimates for  $\rho_C$  is always statistically larger than the estimates for  $\rho_{ROW}$ , with the exception of Mexico. For India, the estimates are statistically not different from zero in all regions, and therefore smaller than the estimates of  $\rho_{ROW}$ .

Thus, combining the theoretical extension to the ‘protection for sale’ model with the estimates of degree of substitutability between domestically produced goods and goods imported from different regions, we could explain the patterns of protection found in section 2 (with the exception of Mexico). However, in order to reach this conclusion we first need to check whether our empirical results validate the extension to the theoretical model.

Table 4 provides the results of the estimation of (16) and the traditional ‘protection for sale model’ for the whole pooled sample and the four sub-regions. Results for the pooled sample, and the Southern Cone always have the expected positive sign on the coefficient of the GH term and the extended GH term. For Andean countries, Central America, and Mexico the coefficient is negative when using the tradition GH specification, which is at odds with theory, but is positive when using the extended GH specification, which is consistent with theory. In fact, in all cases the extended GH coefficient has the expected sign and is statistically different from zero.

Estimates also suggest that the extended GH model performs better in terms of R-squared, which are always larger when allowing for imperfect substitution between imported and domestically produced goods. The Davidson-McKinnon non-nested  $J$  test for model specification is inconclusive for the pooled sample and the Southern Cone, but the extended GH model dominates the model with homogenous goods in the case of Andean countries, Central America and Mexico.

As can be seen from (16) the coefficient in front of the GH term (both in its traditional and extended form) is given by  $1/a$ , i.e., the inverse of the weight the government puts on social welfare relative to industry lobbying (which weight is set exogenously at 1) when setting trade policy. In the case of the extended GH model they are all positive (as expected) and statistically different from zero with the exception of Mexico.

More interestingly, the estimates for the weight the governments put on welfare relative to industry lobbying are closer to common sense in the case of the extended GH model, oscillating around 1 and 5 rather than negative, or between 600 and 1000 for the traditional GH model. Allowing for imperfect substitution between domestically produced goods and imported goods seems to solve the puzzle of large estimates of  $a$ . The estimates from the traditional GH model would suggest that the relative weight the government puts on industry lobbying is around 0.1 percent of the weight put on social welfare for the pooled LAC sample ( $0.001 = 1/[a = 506]$ ). If this were the case, we should be observing zero tariffs throughout Latin America (assuming no other market imperfections). On the other hand, the estimates from the extended GH model suggest that the weight the government puts on industry lobbying relative is 27 percent of the weight it puts on social welfare ( $0.27 = 1/[a = 0.27]$ ). This is more in line with observed patterns of trade protection in Latin America. Governments with the least concern for social welfare are to be found in Central America (where  $a$  is estimated at 1.06), and the governments with the highest concern for social welfare are to be found among Andean countries with an average  $a$  estimated at 4.64.<sup>14</sup>

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<sup>14</sup>We also estimate (16) and the traditional ‘protection for sale model’ using the overall level of protection that includes ad-valorem equivalents of non tariff barriers as the left hand side variable. Results for the pooled sample suggest that the parameter  $a$  equals 676 in the case of the traditional GH model, and is equal to 2.34 in the case of the extended GH model. However none of the estimates are statistically different from

## 5 Conclusion

The growing presence of China and India in world markets and as a source for Latin American imports has caught policy makers attention. This paper explores the response of Latin American policy-makers to growing imports from China and India in their markets. We found that sectors in which the share of imports from China is growing, generally tend to have higher tariffs (with the exception of Central America), controlling for reverse causality, and industry, year and country effects. The reverse pattern is observed in sectors where India's presence is growing.

In order to explain this, we develop an extension to the Grossman and Helpman (1994) 'protection for sale' model to allow for imperfect substitution between domestically produced goods and goods imported from different regions. The model suggest that as the elasticity of substitution between domestically produced goods and imported goods increases, the incentives to lobby also increase, and the resulting equilibrium tariff is higher.

This could explain the patterns of protection described above if we observed the following. First, goods imported from China would need to have a larger elasticity of substitution with domestically produced Latin American goods than goods imported from the rest of the world, and the opposite would need to be true for goods imported from India. Second, the extended 'protection for sale' model with imperfect substitution would need to outperform the traditional model with homogeneous goods.

Thus, we first estimate the degree of the substitution between domestically produced goods in Latin America and goods imported from China, India and elsewhere and our estimates suggested that indeed goods imported from China are closer substitutes to domestically produced goods than goods imported from elsewhere, while the opposite holds for goods imported from India. Finally, the extended 'protection for sale' model outperforms the traditional model in two aspects. It better explains the tariff structure in Latin America, and it provides estimates of the weight the government's puts on industry lobbying relative to social welfare that are closer to common sense than the ones obtained using an homogenous zero (although they are different from each other). The same pattern is observed for the four sub-regions.

good specification.

An explanation for this would be that if there is imperfect substitution between domestically produced goods and imported goods, estimating a model which assumes homogeneity means that we are estimating the wrong model. Also, by ignoring imperfect substitutability between imported and domestically produced goods, we will observe that large variations in the political economy term of the Grossman Helpman model ( $z_k/(\epsilon_k)$ ) lead to little variations on levels of protection. One may conclude that the government does not react to lobbying pressure, i.e., it puts a high weight on social welfare in its objective function. Statistically, this will bias the estimates of  $1/a$  towards zero, leading to very large estimates for  $a$ . But the reason the government does not react is not that it cares mainly about social welfare, but rather that there is no lobbying pressure when imported goods are very low substitutes for domestically produced goods.

To conclude, higher levels of protection on goods imported from China and lower levels of protection on goods imported from India are consistent with a model where we allowed imported goods to have different degrees of substitutability with domestically produced goods. Lobbying forces will be stronger against products that are closer substitutes. More worrying, the efficiency loss associated with high tariffs is larger in the presence of closer substitutes, and therefore the welfare cost of even constant levels of protection will be increasing as China continues to grow in world markets. On the other hand India's growth is likely to lead to lower levels of protection in Latin America, and smaller efficiency losses as imports from India tend to be distant substitutes of goods produced in Latin America.

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# Appendix

There are three parts to this appendix. First the derivation of the derivative of domestic prices with respect to imported goods' prices. Second, the derivative of this term with respect to the degree of substitutability between domestically produced goods and imported goods. Third, a data appendix.

## Derivation of the derivative of domestic prices with respect to imported goods's prices

The derivative of domestic prices with respect to the import price of the composite good is given by equation (9). Thus, we need the derivation of  $\partial x_{k,d}/\partial p_{k,i}$ , and  $\partial x_{k,d}/\partial p_{k,d}$ . The former is given by equation (10). The latter is obtained by differentiating (3) with respect to  $p_{k,d}$ . It yields:

$$\frac{\partial x_{k,d}}{\partial p_{k,d}} = \frac{E p_{k,d}^{\frac{2}{\rho_k-1}} (1 - \rho_k + (p_{k,d} p_{k,i})^{\frac{-\rho_k}{\rho_k-1}})}{[p_{k,d}^{\frac{\rho_k}{\rho_k-1}} + p_{k,i}^{\frac{\rho_k}{\rho_k-1}}]^2 (\rho_k - 1)}, \quad (20)$$

Substituting (10) and (20) into (9) we obtain our estimate of  $p'_k$ :

$$p'_k = \frac{dp_{k,d}}{dp_{k,i}} = \frac{-\frac{\frac{\rho_k}{\rho_k-1} E_k(p_{k,d} p_{k,i})^{\frac{1}{\rho_k-1}}}{[p_{k,d}^{\frac{\rho_k}{\rho_k-1}} + p_{k,i}^{\frac{\rho_k}{\rho_k-1}}]^2}}{1 - \frac{E p_{k,d}^{\frac{2}{\rho_k-1}} (1 - \rho_k + (p_{k,d} p_{k,i})^{\frac{-\rho_k}{\rho_k-1}})}{[p_{k,d}^{\frac{\rho_k}{\rho_k-1}} + p_{k,i}^{\frac{\rho_k}{\rho_k-1}}]^2 (\rho_k - 1)}} \quad (21)$$

## Derivative of $p'_k$ with respect to $\rho_k$

Differentiating (21) with respect to  $\rho_k$ , setting all international prices equal to 1, and denoting  $p_k = p_{k,d}/p_{k,i}$  as the relative price of domestic to imported goods yields:

$$\begin{aligned}
 \frac{\partial p'_k}{\partial \rho_k} &= E_k p_k^{\frac{\rho_k+1}{\rho_k-1}} \left[ \left( E_k p_k^{\frac{2}{\rho_k-1}} + p_k^{\frac{2\rho_k}{\rho_k-1}} \right) (\rho_k - 1) - p_k^{\frac{\rho_k}{\rho_k-1}} \left( E_k p_k^{\frac{2}{\rho_k-1}} \right. \right. \\
 &\quad \left. \left. + 2 p_k^{\frac{2\rho_k}{\rho_k-1}} \right) (1 - \rho_k + \rho_k \log(p_k)) + p_k^{\frac{\rho_k}{\rho_k-1}} (\rho_k - 1 + \rho_k \log(p_k)) \right] \\
 &\quad / \left[ p_k^{\frac{3\rho_k}{\rho_k-1}} (\rho_k - 1) - E_k p_k^{\frac{2}{\rho_k-1}} + 2 p_k^{\frac{2\rho_k}{\rho_k-1}} (\rho_k - 1) \right. \\
 &\quad \left. + p_k^{\frac{\rho_k}{\rho_k-1}} \left( E_k p_k^{\frac{2}{\rho_k-1}} + 1 \right) (\rho_k - 1) \right]^2 (\rho_k - 1)
 \end{aligned} \tag{22}$$

And it can be shown that a sufficient condition for the right hand side of (22) to be positive is  $\log(p_k) = \log(p_{k,d}) - \log(p_{k,i}) < (1 - \rho_k)/\rho_k$ . To see this note that the denominator is non-positive as  $\rho_k \leq 1$ . The first two terms in the squared parenthesis are also non-positive as long as  $\log(p_k) > 0$  (which will be the case in this world with horizontal differentiation and tariffs on imported goods). Thus, a sufficient condition is that the third term in the squared parenthesis in the numerator is negative. And this will be the case if  $\log(p_k) < (1 - \rho_k)/\rho_k$ .

## Data Appendix

There are 10 Latin American countries in our sample (Argentina, Bolivia, Brazil, Colombia, Costa Rica, Guatemala, Mexico, Peru, Uruguay, Venezuela), which represent more than 90 percent of Latin America's GDP. Results are either reported for the whole pooled sample or for four sub-regional samples: Andean (Bolivia, Colombia, Peru and Venezuela), Central America (Costa Rica and Guatemala), Mexico, and the Southern Cone (Argentina, Brazil and Uruguay).

The countries in the sample are those for which we have data available on tariffs, trade, output, and elasticities of import demand during the period 1992-2004, all of which are needed to estimate (16).<sup>15</sup>

Trade data comes from United Nations Comtrade, the output data comes from Unido, and tariff data from UNCTAD's TRAINS. For a discussion of data availability see Nicita and Olarreaga (2006). Data ad-valorem equivalents of non tariff barriers comes from Kee, Nicita and Olarreaga (2006). The elasticities of import demand are borrowed from Kee, Nicita and Olarreaga (2004).

Table A provides some summary statistics of levels of protection *vis-à-vis* the world and *vis-à-vis* China and India for LAC and each of the sub-regions considered in the paper. The first column provides the import-weighted MFN tariffs in 2001, and the second column the marginal increase in protection *vis-à-vis* China and India (i.e., using imports from China and India as weights). The third and fourth column provide similar statistics but using the overall level of protection in 2001, that is including the AVEs of non tariff barriers in Kee, Nicita and Olarreaga (2006). Thus, in Latin America, the import-weighted tariff on imports from the world is 13 percent. The import-weighted tariff on imports from China and India is 9 percent higher. Similarly, the import-weighted overall level of protection (i.e., including ad-valorem equivalents of non tariff barriers) on imports from the world is 27 percent, and on imports from China and India 10 percent higher.

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<sup>15</sup>We also had data for Chile, but because it has a uniform tariff structure, there is little to explain. We therefore decided to drop Chile from our sample.

Table A: Average Levels of protection *vis-à-vis* the world, and China and India in 2001.<sup>a</sup>

	Tariffs, 2001		Overall level of protection, 2001	
	World	China & India	World	China & India
Andean countries	11	+26%	23	-4%
Central America	5	+66%	NA	NA
Mexico	11	+13%	24	+9%
Southern Cone	15	+9%	30	+19%
Latin America	13	+9%	27	+10%

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<sup>a</sup>All averages are import-weighted. For China and India, we provide the change in protection with respect to the MFN levels in percentages.

Table 1: Tariffs in LAC and imports from China and India<sup>a</sup>

	Latin America	Andean countries	Central America	Mexico	Southern Cone
Total imports	0.1 ** (0.0)	0.3 ** (0.0)	-0.2 ** (0.0)	0.0 * (0.0)	0.1 ** (0.0)
( $m_{k,c,t}$ )					
Share of imports from China & India	3.4 ** (0.4)	4.3 ** (1.0)	-2.4 ** (0.1)	5.7 ** (0.5)	2.7 ** (0.1)
( $s_{k,c}$ from C&I, $t$ )					
Share of imports from China	3.8 ** (0.1)	6.4 ** (0.2)	-2.7 ** (0.1)	7.1 ** (0.5)	3.1 ** (0.1)
( $s_{k,c}$ from C, $t$ )					
Share of imports from India	-0.1 ** (0.0)	-0.1 ** (0.0)	-0.4 ** (0.2)	-1.7 ** (0.7)	-0.1 ** (0.0)
( $s_{k,c}$ from I, $t$ )					
R-squared	0.53	0.67	0.64	0.56	0.64
# observations	298617	111926	37151	15085	99796
# countries	10	4	2	1	3

<sup>a</sup> Regressions are estimated using an instrumental variable approach, where all variables are instrumented. Instruments are the share of China and India in world markets, and the size of the world market. All regressions include dummies that vary by 2 digit HS sector, year and country. White robust standard errors are reported in parenthesis. \*\* stands for statistical significance at the 1 percent level, and \* for statistical significance at the 5 percent level.

Table 2: Overall levels of protection in LAC and imports from China and India<sup>a</sup>

	Latin America	Andean countries	Central America	Mexico	Southern Cone
Total imports	0.0 ** (0.0)	0.0 (0.0)	NA	0.0 ** (0.0)	0.0 (0.0)
( $m_{k,c,t}$ )					
Share of imports from China & India	1.0 ** (0.17)	0.4 (0.3)	NA	4.3 ** (0.7)	0.2 (0.3)
( $s_{k,c}$ from C&I, $t$ )					
Share of imports from China	0.9 ** (0.2)	0.3 (0.3)	NA	4.5 ** (0.7)	0.1 (0.4)
( $s_{k,c}$ from C, $t$ )					
Share of imports from India	-0.3 ** (0.1)	0.2 (0.2)	NA	-0.9 (0.6)	-0.2 * (0.1)
( $s_{k,c}$ from I, $t$ )					
R-squared	0.16	0.25		0.21	0.14
# observations	23665	7887		3945	11833
# countries	10	4	0	1	3

<sup>a</sup> Regressions are estimated using an instrumental variable approach, where all variables are instrumented. Instruments are the share of China and India in world markets, and the size of the world market. All regressions include dummies that vary by 2 digit HS sector and country. White robust standard errors are reported in parenthesis. \*\* stands for statistical significance at the 1 percent level, and \* for statistical significance at the 5 percent level.

Table 3: Estimating the degree of substitutability with domestically produced goods<sup>a</sup>

	Latin America	Andean Countries	Central America	Mexico	Southern Cone
<i>ROW</i>	0.40**	0.38**	0.27**	0.41	0.49**
(Rest of the world)	(0.02)	(0.02)	(0.04)	(0.05)	(0.03)
$\rho_{ROW}$	0.08**	0.08**	0.05**	0.09**	0.11**
(Rest of the world)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
<i>C</i>	1.76**	1.93**	0.51	> 1000	3.89**
(China)	(0.29)	(0.51)	(0.52)	(> 10E+9)	(1.17)
$\rho_C$	0.41**	0.41**	0.11	0	0.63**
(China)	(0.06)	(0.10)	(0.50)	(NA)	(0.13)
<i>I</i>	> 1000	> 1000	> 1000	> 1000	> 1000
(India)	(> 10E+9)	(> 10E+9)	(> 10E+9)	(> 10E+9)	(> 10E+9)
$\rho_I$	0	0	0	0	0
(India)	(NA)	(NA)	(NA)	(NA)	(NA)
R-squares	0.03	0.04	0.01	0.002	0.05
Number of observations	2072	668	190	196	759
Number of countries	10	4	2	1	3

<sup>a</sup>All regressions used a non-linear estimator to introduce the required constraints as in equation (19). The coefficients of the non-linear regression are *ROW*, *C* and *I*, and we also provide the implied substitution parameters  $\rho_{ROW}$ ,  $\rho_C$ , and  $\rho_I$ . White robust standard errors are provided in parentheses, both for the coefficients and the implied substitution parameters. \*\* stands for statistical significance at the 1 percent level and \* stands for statistical significance at the 5 percent level.

Table 4: Estimating the classic and extended Grossman-Helpman (GH) model.<sup>a</sup>

	Latin America	Andean countries	Central America	Mexico	Southern Cone
GH term ( $z_{k,c,t}/\epsilon_{k,c,t}$ )	0.002 ** ( 0.0 )	-0.006** ( 0.001 )	-0.021 ** ( 0.006 )	-0.003 ( 0.012 )	0.001** ( 0.007 )
Implied $a$ (weight on welfare)	652 ** ( 75 )	-182** ( 28 )	-49** ( 9 )	-388 ( 229 )	1006** (133)
Extended GH term ( $z_{k,c,t}p'/\epsilon_{k,c,t}$ )	0.27** (0.02)	0.22** ( 0.02 )	0.94** ( 0.12 )	0.27** ( 0.10 )	0.34** ( 0.03 )
Extended implied $a$ (weight on welfare)	3.75** ( 0.32 )	4.64** ( 0.55 )	1.06** ( 0.18 )	3.75 ( 6.67 )	2.98** ( 0.20 )
R-squared	0.23	0.30	0.15	0.10	0.24
# observations	1374	532	155	100	587
# countries	10	4	2	1	3
$J$ -non nested test <sup>b</sup>	Incl.	Ext-GH	Ext-GH	Ext-GH	Incl.

<sup>a</sup> Regressions are estimated using an instrumental variable approach, where the GH terms are instrumented using the United States capital labor ratio in that industry, and the share of labor in value-added in each country and industry. All regressions include country and year dummies. White robust standard errors are reported in parenthesis. \*\* stands for statistical significance at the 1 percent level, and \* for statistical significance at the 5 percent level.

<sup>b</sup> Davidson-McKinnon (1981)  $J$  non-nested test for model specification. "Incl." stands for inconclusive; none of the models dominates the other at the 1 percent level. "GH" stands for the traditional GH model dominating the extended model at the 5 percent level, and "Ext-GH" stands for the extended GH model dominating the traditional GH model at the 5 percent level.