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Indian Buyers in Global Markets: Quality, Prices, and Productivity

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F1, F10, F12, F14

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Indian Buyers in Global Markets: Quality, Prices, and Productivity

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Abstract

We examine import prices paid by direct-sourcing Indian manufacturing firms in the early 2000s using a unique data set that matches firm characteristics with product and source-country trade data, offering a theoretical and empirical extension of Halpern and Koren (2007). We find that import prices are positively associated with firm productivity, distance from source-country, and source-country GDP per capita, and negatively associated with source-country remoteness, an effect we attribute to the higher scope for quality differentiation in less remote locations. Further, we find that source-country characteristics matter more, and cost factors less, for differentiated than for non-differentiated goods.

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1. Introduction

This paper offers a broad empirical exploration of Indian manufacturing firms' direct sourcing of imported intermediate inputs. We focus exclusively

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on firms that directly purchase products from abroad, an expensive activity involving searching for suppliers, working at a distance to contract for products of particular characteristics, and bearing risk that comes from those activities.

In recent decades international economics scholarship has lavished theoretical and empirical attention on the *exporting* behavior and consequences of trade by heterogeneous firms. The productivity advantages of exporters compared to non-exporters, and the behavior of export prices and quantities with respect to destination market and firm characteristics (particularly productivity), are now well understood with evidence from many countries.[1] Imports and importer behavior, as noted in the surveys by Bernard et al. [12] and Wagner [24], have been relatively neglected.

To date the literature on firm importing does not feature examples of disaggregated import data at the firm, product, and source-country level to examine import price determination. The influence of source country characteristics on prices paid is entirely unexamined.[2] As such these studies are still at a distance from the detailed firm-level work undertaken on exporting and the determination of export prices. In addition, the import behavior of heterogeneous Indian firms, in particular, remains almost completely unstudied.[3] And although firm capabilities appear to play an important role in importers behavior, to the extent that imports are studied, indirect measures of firm capabilities (such as size, age in export markets, and number of import sources) are used more frequently than direct measures of productivity.

A particular gap in the import-pricing literature is the lack of studies which directly model firms' willingness to pay for imports. Halpern and Koren [16] (hereafter HK) is an exception. They offer a model of "pricing to firm" in which producers of differentiated imported inputs take buyers' characteristics— firm size and market power, and production-side elasticities of demand and substitution for imports—into account in setting prices. They

[1] In Anderson, et al. [4], [2] we ourselves have contributed to this literature with two studies of the behavior of Indian manufactured goods exporters.

[2] Halpern and Koren [16] use Hungarian firm level data to study import prices, though they do not control for source country characteristics.

[3] Indian importers appear in broader data sets (for example Grazzi and Tomasi [14] include Indian firms in their sample covering 107 countries), or in an aggregated way (for example, Hallak and Sivadasan [15]. Bas and Berthou [8] consider the role of financial constraints in conditioning Indian firms' demand for capital goods imports.

test their model on Hungarian import data at the firm and product level.

Our paper addresses all of these gaps in the literature. We construct a unique firm, product, and import source data set on the imported inputs of Indian manufacturers. We extend HK's theoretical model of importers' behavior to include source country characteristics and, among firms that export as well as import, the effect of their exports' quality on willingness to pay for imported inputs from a range of sources. It is well established in the firm-level export-pricing literature that selling higher quality, higher priced goods abroad is associated with buying higher-priced, and therefore higher quality imports.[4]

As this is the first study (to our knowledge) that examines the importing behavior of Indian manufacturing firms we are able to make a number of specific contributions.

First, we are able directly to measure the effect on import prices (which proxy quality) of the GDP, GDP per capita, distance from India, and remoteness of source countries. Second, we measure the relationship between firm capability, measured directly as a firm's total factor productivity, and the quality of imported inputs (proxied by import price), controlling for a full range of firm, source market, and production costs characteristics. Third, controlling for productivity, we examine whether firms that export source higher quality inputs, compared to firms that import but do not export. Firms that both export and import—"two-way traders"—merit careful attention. These firms bear the fixed costs of both importing and exporting, and have been shown to be exceptional compared to firms that only import, or "one-way traders."[5] Fourth, for two-way traders we examine how the quality of a firm's exports, and the firm's market power in its product markets, influences the price (and therefore quality) of its imports. To do this we employ a new measure of the quality of a firm's exports across all products and destinations to use as a predictor of imported input price (quality).

Finally, we examine how prices are influenced by the degree of product differentiation using the Rauch [22] categorization of differentiated products.

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[4] For example, see Kugler and Verhoogen [20], Feng, et al. [13], Bastos, Silva, and Verhoogen [11], and Anderson, et al. [2], [4].

[5] Anderson et al. [4] find that two-way traders among Indian exporters were exceptional in their quality upgrading. Grazzi and Tomasi [14] find that the relationship between trading activities (exporting and importing, either directly or indirectly through intermediaries) and productivity is strongest for direct two-way traders.

This data segmentation is important; we find larger clinical effects in differentiated goods (compared to non-differentiated goods) for all of the firm, product, and source-country variables in the model.

Our results point toward several findings about Indian importers. First, source country characteristics, firm characteristics including productivity, and production-side characteristics regarding the role of imported inputs in production costs, all matter strongly for determining a firm's willingness to pay for imports. Second, firms that both export and import, two-way traders, are different in behavior relative to import-only firms. They import more products from more locations, and import from more OECD locations, than do one-way traders. In our conditioned results we find that they pay significantly more for differentiated goods. Taken together these results suggest greater quality upgrading for this class of firms. Studies which omit one or more of these distinct determinants of import demand are incomplete.

Among source country characteristics—all of which turn out to be significant—our theory suggests and the estimations confirm a new finding that greater remoteness of a source relative to other sources of Indian imports is associated with lower import prices. Among other findings:

- Higher productivity firms are willing to pay more for imports and are willing to pay a premium for imports from high-income countries.
- For two-way trader controlling for productivity, firms are willing to pay more for imports the more market power they have in their export markets.
- Controlling for productivity and output market pricing, firms are willing to pay less for imports the larger the share of imported inputs in total costs consistent with HK.
- The scope for quality differentiation matters. The prices of differentiated products imports—products known for having high scope for quality improvement—show dramatically higher sensitivity to firm and source-country variables, as well as to variables reflecting the role of imported inputs in production, than non-differentiated products.

Overall, the evidence from Indian importers suggests that import prices emerge from a complex process. Importers do face sellers who "price to firm," to use HK's helpful phrase. But importers also exhibit a "willingness to pay" seeking out sources for high quality imported inputs that facilitate high-quality output and quality upgrading.

The next section offers a brief literature review. Section 3 offers several suggestive theoretical extensions of HK's theoretical model that highlight the importance of source country features in import pricing and motivate their inclusion in the empirical work. Section 4 describes our data and offers several descriptive findings; sections 5 and 6 discuss our regression model and the conditioned findings that emerge from it, respectively. Section 7 concludes.

2. Literature Review

The literature that focuses on imports and importers is relatively new and sparse compared to the literature on exporter behavior. It examines the role of productivity in determining whether firms import at all;[6] the role that imports play in improving firm productivity;[7] and the role, for exporters that also are importers, of product quality differentiation and quality upgrading as revealed by the prices firms pay for imported inputs.[8] This literature offers convincing evidence that firms select into direct importing. It is high-productivity firms that are able to pay the fixed costs of importing as well as the variable costs such as transport and trade taxes. These costs are presumably balanced by expected benefits that may include greater input variety, higher quality and more control over quality, and higher productivity.

Bastos, Silva, and Verhoogen [11] and Bastos, Dias, and Timoshenko [10] use Portuguese firm-level data to examine the determination of input prices (including, but not specifically breaking out, import prices) in order to address a possible endogeneity problem in studies of export prices. A finding in the export-pricing literature is that firms sell higher-quality products to high-income destinations, where quality is measured by the price of the product. But changes in mark-ups are a competing explanation for the higher prices charged, perhaps confounded with quality upgrading. To unbundle the two explanations the authors explore how firms' average real input prices are related to the destination market characteristics of the same firms' exports. The authors find a strong positive relationship between per capita income in firms' export destination markets and firms' average input prices, and conclude that quality upgrading, not variable markups, drives the relationship

[6] Wagner [24], Grazzi and Tomasi [14].

[7] Bas and Strauss-Kahn [9]; Zhang [26].

[8] Kugler and Verhoogen [20]; Feng et al. [13]; Bas and Strauss-Kahn [9]; Bastos, Silva, and Verhoogen [11]; Bastos, Dias, and Timoshenko [10]; Hallak and Sivadasan [15]; and Anderson et al. [4].

between export prices and destination market income.

Bastos, Dias, and Timoshenko [10] employ a learning model in which firms use high quality inputs, including specifically imported inputs, to raise output product quality. Firms with longer experience—measured literally by "age in export market" or in sales, both highly correlated with age and experience—use more expensive imported inputs. In both Bastos, Dias, and Timoshenko [10] and Bastos, Silva, and Verhoogen [11], import prices are measured as firm averages.

Bas and Strauss-Kahn [9] explore the relationship between the number of varieties a firm exports and the number of varieties it imports, conceiving of varieties as unique product-destination (source) pairs. Using firm-level data on French firms and directly-measured productivity, the authors find that even after controlling for size and productivity the number of import varieties is strongly positively associated with the number of export varieties.

Hallak and Sivadasan [15] use firm-level data across a range of countries, including India, to examine how, for producers of differentiated goods, conditional exporter input-price premia are related to firm size and product fixed effects. For Indian firms over 1997-98 they find that conditional on size and product, firm-average input prices rise by 5 to 13% for firms that export (Table 4, p. 64), where the control group is all firms that do not export. The authors do not distinguish imports specifically from inputs in general.

Kugler and Verhoogen ([19], [20]) study input prices using Colombian plant-level data. Among their many findings are that there is a conditional importer premium of approximately 22% on plant-level average input prices (relative to all firms that are not importing), and that the elasticity of import prices with respect to domestic input prices is in the 0.28-0.62 range ([19], Table 2). They find a conditional exporter premium on input prices of 3% ([20], Table 2). The analysis in both papers is correlative and descriptive, in that they employ fixed effects and measures of product differentiation as independent variables but do not control for specific firm- or plant-level characteristics (apart from size), or for input source characteristics.

The findings in these articles are for the most part not directly comparable to ours. They are not focused on understanding the determinants of import prices, per se. They use firm- or plant-level average prices and do not directly control for source country characteristics or, beyond firm fixed effects of various kinds, for the firm-level characteristics such as productivity that are the focus of our interest. Yet they all point to the importance of firms' exports (be it the number of exports, their price, or simply accumulated experience on export markets) for the quality, price, and sourcing of firms' desired imports. And in particular they suggest that there is a positive relationship between a firm's export abilities and its willingness to pay for high-quality imports.

HK, by contrast, offer a direct analysis of import price determination with firm level data, an analysis similar to our own in important ways. They model import buyers' behavior with a nested CES production function that relates the elasticity of import demand to the elasticity of substitution between inputs, the shares of each input in intermediate and total costs, and the elasticity of demand for firms' output. Sellers, who take competitors' output as given, mark up prices over marginal cost using an inverse elasticity rule. The authors, testing the model on a large sample of Hungarian firms over 1992-2001, find evidence of "pricing to firm," that is, of sellers adjusting prices according to importers' import demand elasticities, where the elasticities are in part determined by technologically-driven production costs. Neither the model nor the estimation includes directly-measured productivity or source country characteristics of imported goods. The latter omission means they are unable to measure the extent to which firms source imports from different countries for the sake of quality upgrading. Such behavior is best understood as reflecting firms' willingness to pay, over and above any pricing to firm that may also occur relative to firms' production technology as emphasized by HK.

In the context of this literature on firms' import behavior, one of the main contributions of our paper is to bring together firm characteristics, source country characteristics, and production-side cost considerations into a single unified empirical analysis. But there are direct theoretical connections between source country characteristics and HK's model of firms' import demands, which we turn to first.

3. Theory

In this section we develop theoretical arguments to augment HK's model and point to the role of source-country characteristics in importing firms' willingness to pay for imported inputs. Firms receive a productivity draw which is elemental in the sense that it determines the quality of the output the firm produces and the quality of the inputs it uses to produce that output. It is widely accepted in the literature that more capable or productive firms produce more expensive and higher quality goods (Baldwin and Harrigan [7]) using higher quality inputs (Kugler and Verhoogen [20], Antoniades [5]).

Firm f uses multiple inputs, indexed i, to produce a final good f (each firm produces one good - we collapse the distinction between firm (f) and product (p) here). Each firm f receives productivity draw, λ_f. This determines the quality of the products they produce, q_f, and also the quality of the inputs they require for production, c_f, as we describe below. Following Kugler and Verhoogen [20], firm productivity and input quality are complements

$$q_f = \left(\frac{1}{2} \left(\lambda_f^b \right)^{\upsilon} + \frac{1}{2} \left(c_f^2 \right)^{\upsilon} \right)^{\frac{1}{\upsilon}} \tag{1}$$

where υ determines the degree of complimentarity between firm productivity,λ_f , and input quality, c_f. As υ becomes more negative then the degree of complementarity between λ and c increases. Imposing that $\upsilon < 0$, then λ and c are complements and $q(\lambda, c)$ is log-supermoduar in λ and c, and firms will choose them such that $c_f(\lambda_f) = \lambda_f^{\frac{b}{2}}$.[9] It follows from (1) that $q_f(\lambda_f) = \lambda_f^b$.The parameter b represents the scope for quality differentiation, which reflects the technology, and therefore the incentive, for the firm to turn higher firm productivity into higher product quality. That is, given $b > 0$, then higher b means that quality ladders are steeper inducing the firm to produce higher quality output. Thus, more capable firms produce higher quality output.

We follow the structure of HK for production of goods, where the output of final good f is given by

$$Q_f = \left[\left(1 - \beta_f\right)^{\frac{1}{\phi}} L_f^{1-\frac{1}{\phi}} + \beta_f^{\frac{1}{\phi}} X_f^{1-\frac{1}{\phi}} \right]^{-\phi/(\phi-1)}$$

where L_f is domestic labor and X_f is a composite of intermediate inputs which are combined with elasticity of substitution ϕ. The composite X_f is produced from intermediate inputs, X_{if}, according to the CES production function

$$X_f = \left[\Sigma_i b_{if}^{\frac{1}{\theta}} X_{if}^{1-\frac{1}{\theta}} \right]^{-\theta/(\theta-1)}$$

where θ is the elasticity of substitution for intermediate inputs, and $\theta > \phi$ indicating that intermediate inputs are closer substitutes with each other than

[9] Log-supermodularlity means that a marginal increase in output quality for a given increase in input quality is greater for more capable firms.

with other inputs. The quality of intermediate inputs used in production, reflecting the cross-complimentarities between them, for firm f is given by

$$c_f = \min\{c_{1f}, ..., c_{Nf}\} \Rightarrow c_{if} = c_f \text{ for all inputs } i$$

where $c_f = \lambda_f^{\frac{b}{2}}$. The quality of the final good is then $q_f = c_f^2 = \lambda_f^b$. Since higher quality inputs are more costly, then higher quality goods (which require higher quality inputs) are more costly than lower quality ones. From HK, the inverse elasticity of demand for input i for good (firm) f, $1/\sigma_{if}$, is given by

$$\frac{1}{\sigma_{if}} = \frac{1}{\theta} + \left(\frac{1}{\phi} - \frac{1}{\theta}\right) s_{if} - \left(\frac{1}{\phi} - \frac{1}{\varepsilon_f}\right) \alpha_{if} \tag{2}$$

The benefit of putting the results in this form is that it decomposes the inverse elasticity of demand for input i into measurable components, where s_{if} is the share if input i in total spending on intermediates, α_{if} is the share of input i in total costs of firm f, and ε_f is the elasticity of demand for firm $f's$ output.

We now discuss the characteristics of the countries from which intermediate inputs are sourced. We begin by noting from the export pricing literature that higher productivity firms produce higher quality goods (which have higher prices), and higher productivity firms export to more distant and less remote (more competitive) locations. As noted in Baldwin and Harrigan [7] and Harrigan, et at. [17], export prices are increasing in distance and decreasing with remoteness. As we note above higher quality goods require higher quality inputs which make them more expensive. However, as price (and quality) increase, the price per unit of quality is falling. This means that the most competitive goods (the goods with the lowest price per unit of quality) are goods with the highest prices and they reach the most distant and least remote locations. Hence, not only are prices a good proxy for quality, but the most competitive goods are the goods with the highest prices.

As noted above, an Indian firm with productivity draw λ_f will seek intermediate inputs of quality c_f from suppliers that produce goods of this quality. We rely on the nexus between productivity and quality noted widely in the export pricing literature to make the link between input quality and the source-country characteristics.

Source country s has $j \in 1, .., n$ firms which each receive a productivity draw λ_{sj} from a distribution with support $[\lambda_{Low}, \lambda_{High}]$. Technology of firm

j in source country s is Ricardian and is given by $Y_{sj} = \lambda_{sj} L_{sj}$. Then GDP per capita of the source country s is given by

$$\frac{Y_s}{L_s} = \frac{1}{L_s} \Sigma_{j=1}^{n} Y_{sj} = \Sigma_{i=1}^{n} \lambda_{sj} \frac{L_{sj}}{L_s} = A_s \tag{3}$$

The parameter A_s measures GDP per capita (and also total factor productivity) in source country s and is a labor share (L_{sj}/L_s) weighted average of all individual firm productivities in source-country s. From this, it follows that countries with higher GDP per capita have on average higher productivity firms (the distribution from which firms draw their productivities dominates those of countries with lower GDP per capita). Since more productive Indian firms choose higher quality (and therefore higher priced) inputs they will source these from countries with higher GDP per capita.

In terms of the effect of size of the source-country's economy, or GDP, on input prices, a larger economy has a larger domestic market. This has two possible and opposing effects. Firstly, a larger market allows domestic firms to exploit greater economies of scale thus driving down prices for specialized inputs. On the other hand, a larger market pushes up the scope for quality differentiation, meaning that firms with a given productivity choose to produce higher quality goods than firms of equivalent productivity in smaller source-countries facing a smaller domestic market. Since higher quality goods are more expensive, this pushes up the price of specialized inputs. This channel relates to, and is elaborated on, in the next paragraph.

Remoteness refers to the concentration of economic activity in the neighborhood of a country. A less remote country faces a higher level of economic activity in close proximity to it and therefore greater surrounding competition. Greater competition leads to an increase in the scope for quality differentiation or steeper quality ladders. Firms respond to a higher scope for quality differentiation by increasing the quality of the goods they produce; in essence, they escape competition by innovating. For a given productivity draw, a firm located in a less remote country will produce higher quality goods than an equally productivity firm in a more remote country.

We model the situation for firms in source country s with level of remoteness ρ_s as follows. Firms with productivity draw λ_{sj} make a choice about the quality of the output they produce. For simplicity, we abstract from firm input choices, and taking a simplified version of (1) then[10]

$$c_{sj}(\lambda_{sj}) = \lambda_{sj}^{a(\rho_s)} \quad \text{where } a(\rho_s) > 0 \text{ and } a'(\rho_s) < 0$$

where $c_{sj}(\lambda_{sj})$ is the quality of firm j's output. The scope for quality differentiation in country s, $a(\rho_s)$, depends on the level of remoteness, ρ_s. Since we impose that $a'(\rho_s) < 0$, then as remoteness falls, the scope for quality differentiation, $a(\rho_s)$, increases. Then for given firm productivity, λ_{sj}, the quality of the good produced by the firm, $c_{sj}(\lambda_{sj})$ increases due to the greater incentive for the firm to turn higher firm productivity into a higher quality product. Thus, holding source country GDP per capita constant, firms in less remote countries will produce higher quality inputs due to the higher scope for quality differentiation they face. It follows that controlling for source-country GDP per capita, more productive Indian firms will source higher quality (more expensive) inputs from source countries which are less remote.

From HK inputs are classified into differentiated (D) and non-differentiated (N) products. Differentiated inputs are produced by a single supplier while non-differentiated inputs are produced by atomistic suppliers with no market power. Suppliers maximize profit taking competitors' quantities as given, with the firm problem

$$\max \; R_{if}(X_{if}, X_{-if}) X_{if} - \tau_i(X_{if}) - c_{if} Z_i X_{if} \tag{4}$$

where $R_{ik}(X_{ik}, X_{-ik})$ is the inverse demand equation with elasticity given by (2), X_{if} is firm f's output, and X_{-if} is the output of other suppliers, τ_i is shipping costs, $c_{if} Z_i$ is the production cost per unit of output, where c_{if} is the quality of the input, with higher quality inputs being more expensive, and Z_i is the marginal cost (of quality). Taking a log-linear approximation of the first order condition to (4) gives

$$r_{if} = \begin{cases} c_{if} + z_i + \omega_{if} + \frac{1}{\theta} + \left(\frac{1}{\phi} - \frac{1}{\theta}\right) s_{if} - \left(\frac{1}{\phi} - \frac{1}{\varepsilon_k}\right) \alpha_{if} \text{ if } i \in D \\ c_{if} + z_i + \omega_{if} \text{ if } i \in N \end{cases} \tag{5}$$

where $\omega_{if} = \tau_i'(X_{if}) / c_{if} Z_i$ is the ad valorem marginal cost of shipping good i to firm f, and $z_i = \ln Z_i$. Thus, as noted in HK, there are three reasons for pricing heterogenity across a given product: i. different demand elasticities; ii. the quality of the input differs, and iii. ad valorem shipping costs are different.

[10]Here, for simplicity we drop the firm's input quality choice in (1), making the firm's output quality choice, c_{sj}, dependent only on its productivity λ_{sj}.

4. Data and Descriptive Results

We construct a firm-level price, good, source and firm characteristics dataset for Indian importers. These detailed data comprise one of our contributions in this paper. We provide an overview here of the procedures and data sources used, and refer interested readers to Appendix 4.[11]

Detailed firm-level daily import data are taken from TIPS, a database collected by Indian Customs. TIPS data includes the identity of the importer, date, product type by 8-digit HS code, source country, entrance port, and import quantity and value, drawn from transactions at eleven major Indian seaports and airports.[12] We aggregate the data to fiscal-year import values and quantities by firm and product, and measure import prices as unit values: import revenue by product category divided by the number of units imported in that category. The final data set covers four full fiscal years, 2000-2003.

Products within the same HS8 category are often imported in different units, such as kilos, boxes, or pieces, which suggest that they differ in terms of quality and level of processing.[13] We calculate unit values at the level of these units and, for each HS8 category, the four top units in value terms are included as distinct products. Kilos and pieces are the most commonly-observed units in the data.

Detailed firm-level data comes from Prowess,[14] which provides information on the wage bill and capital use, expenses on intermediates, and other firm-level variables for manufacturing firms (our sector of interest). We use this information to estimate annual firm productivity with the Levinsohn-Petrin technique, which we convert to index form (by NIC 4-digit industry) using the Aw et al. [6] method.

Matching firms between TIPS and Prowess brings together data about firms' trading behavior and firm characteristics. The results in this paper are based on a matched dataset of 1,930 unique manufacturing firms. All

[11] Data construction is similar to that in Anderson et al. [2], [4] of a firm-level data set of export quantities, prices, and destinations.

[12] Indian fiscal years run from April 1 through March 31; thus the actual data run from April 1999 through March 2003. All told, TIPS records more than 6.6 million import transactions over 1999-2003.

[13] For example, metal parts may be individually packaged or shipped in boxes of loose metal parts.

[14] Prowess, a proprietary database, is now frequently used in research on India; see, for example, Topalova and Khandelwal [23] and Ahsan [1].

of these firms import at least one good from one source-country in at least one of our sample years. But not all firms export; we call a firm a "two-way trader" in a particular year if it exports at least one good to one destination. Firms that only import we call "one-way traders." There are 868 two-way traders and 1,531 one-way traders in the sample, where these counts include 469 firms that switch status from one year to another.

Country characteristics (income, population, and distance from India) come from the CEPII Gravity database (Head et al. [18]) to control for features of import source locations. All told, the final estimating data set contains close to 130,000 observations at the firm, product, unit, source, and year levels. Summary statistics on all variables in the data set are in Table 1. The range in import prices is very large: the median unit value is $14.40, the 75th percentile is $185.54, and the mean is $2,388.47.

[Insert Table 1 around here]

Table 2 presents firm characteristics by export status, that is, by whether the firm is an importer only or a two-way trader. The last column of Table 2 compares these two groups across four variables. Compared to one-way traders, two-way traders are larger, with a wage bill 54% larger. They are on average 5% more productive, but they also 19% less capital intensive and have a 32% lower value added relative to their wage bill.[15]

[Insert Table 2 around here]

In Table 3 we compare the import behavior of one-way traders to two-way traders. We noted earlier that directly sourcing imports is both expensive and a way to obtain higher quality products. We see in this table clear evidence that two-way traders are more assertive in the number of: products they import, source country partners, and higher-income source (OECD) partners, the medians of which exceed the medians for one-way traders by a factor of 2 or more. Though unconditioned, these comparisons suggest that

[15] In Anderson et al. [2] we compare two-way traders to firms that export only (a different kind of "one-way" trader), and interestingly the story there is a bit different. That comparison found that TFP was substantially higher for two-way traders compared to exporters-only, and moreover value-added relative to the wage bill was also higher, not lower, for the two-way traders. The differences may reflect sampling error: Anderson et al. [2] had a sample of 310 exporters-only and 898 two-way traders, a ratio of one-way to two-way firms of 35 percent. Here our ratio of importers-only to two-way traders is 57 percent. Alternatively, one-way traders really may differ according to whether the firm exports only or imports only, with the former more productive and with higher value added.

exporters may be better able to source high-quality imports directly from abroad, compared to firms that import directly but do not export.

[Insert Table 3 around here]

Table 4, in contrast to Table 3, surveys the sourcing of individual imported products rather than the overall number of a firm's imported products and sources. Here the difference between one-way and two-way traders shrinks to insignificance. Individual products are sourced from a small number of countries—across all firms and years the median share of imports that come from the largest source country is 91% for one-way traders and 93% for two-way traders. Expanding this to the share of imports from the top 3 sources, the median value is 100% both types of importers, indicating considerable concentration of sources.

[Insert Table 4 around here]

Summing up these points, import-sourcing is persistent in the number of sources and their identity. In sourcing individual goods the behavior of one-way and two-way traders is virtually indistinguishable but, overall, two-way traders source more products.[16]

Table 5 offers our final descriptive look at Indian importers. It reports the proportion of the variance in log import prices that can be explained simply by firm-year or source-year fixed effects, for all imports and by sections of the HS2 classification, for goods measured in kilos and pieces.[17] For kilos, the mean log standard deviation in import prices is 1.50, while for pieces it is 1.86. Firm-by-year fixed effects explain 40% and 34% of that variation, respectively, while source-year fixed effects alone explain 14% and 13% of it. Regressions at the HS section level show that firm-year and source-year fixed effects explain an even higher share of price variance, with source fixed effects explaining 40% or more of the price variance for several sections. Thus while differences between firms account for more of the variation in import prices

[16] Changing from value terms to counts also shows concentration in country sourcing. Across the years in our sample the median number of unique country sources for each product is 2. At the 90th percentile, the number of unique source countries is 9 for one-way traders and 8 for two-way traders. And if we look at the number of unique country sources that ever rank in the "top 3" sources, considered annually that number is 6 at the 90th percentile for both one- and two-way traders. If a product's top three suppliers in year 1 are China, the United States and Germany, and in year 2 the top three suppliers are China, the United States, and France, the product would measure 4 unique top-3 suppliers.

[17] Here we follow HK with the addition of distinguishing between between types of unit.

than do differences in sources, they both have a big effect on prices.[18] The influence of source-country variation on prices reflects, in part, firms selecting for product quality. Taken together, this evidence is consistent with both "pricing to firm" and "willingness to pay" as determinants of import prices.

[Insert Table 5 around here]

5. The Estimating Model

We turn now to conditioned analysis of importers' behavior. We first examine the relationship between the price (quality) of firms' imports against a comprehensive set of source market and firm characteristics that exploit our data's variation at the source, firm, and product levels. The basic relationship we estimate, with all quantitative variables in logs, can be expressed as

$$P_{pfst} = f\left(X_{st}, X_{ft}, X_{fpt}, D_{pt}\right) \tag{6}$$

where P_{pfst} is the price of product p (that is, each unique product-unit), imported by firm f from source s, in year t. We will present three sets of results: for all imported goods taken together (in Appendix 3), and separately for differentiated goods imports and non-differentiated goods imports in Table 7.

On the right hand side we begin with X_{st}, the vector of source-country characteristics: GDP per capita ("GDPpc" in what follows), GDP or economic size ("GDP"), and distance from India ("distance," the great circle distance in kilometers from capital to capital). We include size in addition to per capita income to account possible scale economies afforded by size per se. In the empirical gravity literature, income per capita and size often perform well when included jointly. We also include "remoteness," an index of the remoteness of each of India's import source countries from India's other trading partners, using distance-weighted GDPs and the formulation from Harrigan, et al. [17].

X_{st} is motivated by the theory in Section 3 and by the related literature on the value of high quality imported inputs to exporters noted above.[19] Taking the source country variables in order, and recalling that we are using

[18] HK's results for Hungary (Table 4), also show that firm-year variation explains a higher proportion of price variation than source-year variation, though in our more detailed Indian data the explained variation is higher in both cases than for Hungary.

[19] Adding X_{st} is a particular distinction between our work and HK, along with our more

"import prices" and "import product quality" interchangeably, we expect import prices to:

- Rise with GDP per capita. Our theory suggests these imports are likely higher in quality than products within the same HS code that are produced in low-income countries; Indian importing firms are willing to pay a premium price for that quality.
- Be ambiguously related to GDP, as discussed in the theory. Further, the literature on firm export pricing regularly finds a positive sign on destination size; we are not aware of findings to date relating to import prices.
- Rise with distance, as discussed in the Theory section.
- Fall with remoteness—a prediction of our theory. For example, products imported from Australia are expected to be lower in price, ceteris paribus, than products imported from Belgium. The countries are roughly equidistant from India, but Belgium's less-remote location (in the center of the EU) means it faces a higher scope for quality differentiation than Australian firms face.

X_{ft} is a vector of firm characteristics. We begin with total factor productivity, capital-to-labor ratio, and size as proxied by the labor bill (wages and salary). We also add multiple variables that measure the firm's characteristics as a trader. The first of these is a "two-way" dummy equal to one when the firm is also an exporter (of any product) in a given year, to capture the significant differences between the two types of traders. Second, we include a dummy equal to one if a firm exports a product in the same HS6 category as the given imported product in a year ("x_same_year").

In the export literature, higher productivity, larger, and more capital intensive firms are all expected to produce higher quality goods and to be able to charge a premium for them. The analog for importers is that these firms will be willing to pay higher prices for higher quality inputs. Likewise, two-way traders, and among them the firms that can charge higher prices for exports, will also be expected to be willing to pay higher prices for high quality imports.

Finally, X_{ft} includes two variables that measure the firm's market power in its output market(s), which we expect will drive its willingness to pay

detailed data. HK include an "EU" variable that measures the source of an import in binary terms (from the EU, or not), which offers a modest control for source country characteristics.

for high-quality imported inputs. "Markup," defined simply as total sales relative to total costs, is a rough proxy relating to a firm's market power in all its markets. Then, for two-way traders, we measure the firm's power in export markets with a composite export-price variable we call "x_price_power." To our knowledge this variable has not been used in the empirical literature on firm pricing, and so we explain its construction here.

The first component of x_price_power is the annual export value-weighted average of the firm's export prices, expressed as standard deviations from the mean export prices of those products by all firms, annually. We call this component "x_sigma". The second component is the export value-weighted average coefficient of variation in export prices, by HS6 product lines, annually, across all firms (call this "CoV_x6"). Then "x_price_power" is the product of these two components and measures firms' effective pricing power.[20]

In brief, our sign expectations are as follows. We expect import prices to:

- Rise with firm productivity. Higher productivity firms produce higher quality goods which require the use of higher quality imported inputs.
- Rise with firm size and with the firm's capital-to-labor ratio. We expect larger firms, and more capital-intensive firms, to produce higher-quality goods and to demand high-quality imports.
- Rise if the firm is also an exporting firm, measured by the two-way dummy.
- Fall if the firm exports the same or closely related product, measured by the x_same_year dummy. Firms in this circumstance are not necessarily using the imported good as an input so much as modifying it or acting as a wholesaler.

[20] "x_sigma" tells us where the firms' export prices (unit values) are relative to mean export prices in the sample across all firms. All else equal, a higher value indicates more market power. "CoV_x6" tells us the export-share-weighed coefficient of variation for these products, indicating how wide is the distribution of export prices across all firms. Thus the variable x_price_power captures both where the firm's price is relative to the average, and the overall spread of product prices. In a market where the coefficient of variation is 50%, a firm that can charge a price 3 standard deviations above the mean has more power than a firm that can only price 1 standard deviation above the mean. Likewise, a firm that can price 1 standard deviation above the mean in a market with a coefficient of variation of 50% has more power than a firm that can price 1 standard deviation above the mean in a market with a coefficient of variation of 10%. x_price_power by construction ranges from negative to positive values so it enters regressions in levels.

- Rise if the firm has the ability to charge a high price for its output, as measured by either the x_price_power variable for exports (of two-way traders) or markup for all firms: firms with price power can afford the quality upgrades that sustain price power.

X_{fpt} is a vector of measures of the importance of each imported input in the firm's costs and which therefore are relevant for its import elasticity of demand. The share of imports of a product in the value of spending on all intermediate inputs is "mshare_intermediates," where we calculate intermediates using the Prowess categories of materials and power expenditures. This term is s_{if} in equation (2). The imported product's share in total costs (intermediates plus the wage and salary bill) is "mshare_costs" (corresponding to the term a_{if} in (2) . The share of imports from each source country in the firm's overall imports of any given product is "mshare_source."

Inclusion of X_{fpt} is motivated by HK's theoretical model and their estimation of the effects on import prices of the firm's input elasticities of demand and of imported products' cost shares. Following HK, and as noted in our theory section, we expect that import prices:

- Rise with the share of imports in intermediates, as the firm's demand is less elastic for these crucial imports.
- Fall with the share of imports in total costs, as the firm's demand is more elastic because of the product's impact on marginal costs.
- Rise with the share of imports of a particular product from a source, as the firm's demand is less elastic the more important a particular source is for an import. Procuring a large portion of an imported item from a particular source suggests dependence on that source (likely because of desirable quality and other source-specific attributes).

Finally, D_{pt} is a product-unit-year fixed effect. As noted earlier, we divide our sample into differentiated and non-differentiated goods. Our expectation is that the clinical significance of all of the X_{st}, X_{ft}, and X_{fpt} coefficients will be larger for differentiated-goods imports compared to non-differentiated imports, given the greater potential for quality upgrading.

In estimating equation (6) we consider a selection correction to account for importing firms' self-selection into imports from some markets and not others. Modeled after the correction in Harrigan, et al. [17], and adding an exclusion restriction, it is a three-step selection correction where the first step is a Probit on a (0,1) condition of importing from a particular market or not. Studies that examine export prices are concerned by data that show firms exporting particular products to particular locations while not exporting those same products to other locations. The data thus presents authors with a potential selection bias in the form of only observing firms that have selected into a given market. The typical response is to correct for selection. In principle, studies of import pricing like ours suffer from a similar selection problem. Firms that, say, purchase an intermediate input from Germany could have purchased a similar input from France or the United States.[21] Full details of our selection correction and its associated exclusion restriction are offered in Appendix 5. As an aid to the reader Table 6 presents a summary of expected signs.

6. Regression Results

Our results align well with the discussion earlier on theory and anticipated signs, and moreover we find both statistically and economically significant results. Our main results are detailed in Table 7, which reports both estimated regressions and the clinical, or economic, impacts implied by each regression on import prices from changes in each of the independent variables, ceteris paribus. For ease of viewing, therefore, Table 7 indicates statistical significance but omits standard errors. The panels in the table mirror the order of variables in equation (6).

[Insert Table 6 around here]

[Insert Table 7 around here]

Our first finding is that our selection correction has little effect on the results.[22] This is good news for the import-pricing literature, which has left possible selection problems unexamined.

Our model predicts that products' scope for quality upgrading, roughly proxied by the distinction between differentiated and non-differentiated products, should yield higher absolute values for regression coefficients for differentiated goods compared to non-differentiated goods. We therefore present results separately for non-differentiated and differentiated goods.[23]

[21] Employing the correction here is an innovation; the import literature cited in this paper omits it entirely.

[22] Reflecting that finding, Table 7 omits the selection-corrected results, which are available to interested readers in Appendix 2.

[23] We use Rauch's [22] widely-used taxonomy to create this distinction, defining differentiated goods according to his "liberal" criterion. Non-differentiated goods consist of reference-priced goods and commodities. Results estimated over all goods combined are in Appendix 3.

Compare the results for the source-country variables for all firms, in non-differentiated goods, Table 7 column (1), with those in differentiated goods, column (3). We find uniformly (absolutely) larger coefficients in column (3) as we expect, reflecting the greater scope for quality upgrading in differentiated goods. For non-differentiated goods, the coefficients on GDP per capital and GDP are small and not statistically significant, but for differentiated goods they are absolutely larger and highly statistically significant. The coefficients on distance and remoteness, while both are statistically significant, are substantially larger for differentiated, than for non-differentiated, goods. The sign on GDP is negative for differentiated goods, suggesting that the economies of scale effect is larger than the diversity-of-output effect. All the other signs, for both differentiated and non-differentiated goods, show as expected: positive for per capita GDP and distance, negative for remoteness.

The lower panel in Table 7 presents economic significance calculations, indicating the impact on import prices of changes in the independent variables. In our double-log specification all of the estimated coefficients on the source country variables can be interpreted as elasticities. For a normalized prediction of how import prices respond to changes in the independent variables, we apply that elasticity to the percent change in the independent variable caused by a one standard deviation increase from its mean. The clinical effects are substantial for differentiated goods. A one-standard deviation increase in source country per capita GDP over its mean predicts a 9.7% increase in import prices for differentiated goods (column 3), but only a 1.4% increase for non-differentiated goods (column 1). For source country size, a one standard deviation increase in GDP lowers import prices by 16% for differentiated goods, compared to a statistically insignificant -0.1% for non-differentiated goods. A similar increase in distance (equivalent to about 1600 miles), predicts a 39% increase in prices of differentiated-goods imports, about twice the size of the effect for non-differentiated goods. Remoteness, likewise, has a strikingly-large clinical effect: a one-standard-deviation increase in remoteness, roughly equivalent to changing the source country from Hungary to Russia, predicts a 28% decrease in price.

We conclude that source-country characteristics are important in explaining the prices paid by Indian firms, and especially so for differentiated goods. Importers clearly are willing to pay different prices for the same products when they are sourced from different countries and thus embody different attributes.

Consider next the X_{ft} (firm-level) variables. Firm characteristics are also strongly associated, statistically and economically, with prices paid for imports. We focus again on columns (1) and (3) in Table 7, and on the economic significance results in the bottom panel, to make the comparison between differentiated and comparatively homogenous goods. We see again that the relationship between the firm-level variables and import prices is larger for differentiated goods, for all but one X_{ft} variable, in some cases by a factor of two or more. All results are statistically significant (again, with one exception).

An increase in a firm's TFP predicts a 12% versus a 10% increase in import prices for differentiated goods relative to non-differentiated. The clinical effects for the capital-labor ratio and the wage bill are particularly striking: one standard-deviation changes in these variables over their means predict, respectively, an increase in import prices of 70% and 101% for differentiated goods, compared to 54% and 22%, respectively, for non-differentiated goods.

If the firm is a two-way trader ("two_way" = 1), the sign is positive as expected. The firm pays 20% more for differentiated goods imports, compared to a firm that only imports, while paying 8% more for imports of non-differentiated goods.[24] We find a similar pattern when firms export within the same HS 6 category as the import good in a given year ("x_same_year" = 1). Prices are predicted to decline by 16% in the case of differentiated goods compared to 10% for non-differentiated goods. HK also find a negative coefficient on this variable and attribute it to processing trade—firms buying an input inexpensively and at a lower quality grade, then processing it for resale. But this behavior is also consistent with market knowledge effects—firms knowing a product market particularly well when they both buy and sell in it.[25]

The results on firm's markup are the exception to all of the foregoing. For differentiated products, the coefficient is not statistically significant; larger markups do not appear to be associated with willingness to pay higher prices for such imports. For non-differentiated products, the coefficient is negative and highly significant, suggesting that as markups rise firms are less willing

[24] Empirically this effect is similar to Hallak and Sivadasan's [15] estimate of 5-13 percent for a related statistic, namely, exporters' willingness to pay for inputs (imported and local), relative to all users of inputs.

[25] For the binary variables x_same_year and two_way we assess economic significance as the percent change implied by switching from 0 to 1: $[\exp\left(\hat{\beta}\right) - 1]\text{x}100$.

to pay higher prices for such imports. These results are anomalous, and may reflect the weakness of our particular proxy for firms' markups. They contrast with HK's finding that import prices on differentiated goods rise with markups, and that import prices of non-differentiated goods do not change with markups (for which none of the point estimates were significant).

We turn next to the results for X_{fpt} (firms' import characteristics). These variables include the share, annually, of an import from a particular source in a firm's total intermediates, in total costs, and in the firm's total imports of that good. In columns (1) and (3) of Table 7, all of these estimated coefficients are highly statistically significant with the expected signs.

In these results, Indian firms unequivocally display the dual effect of import expenditure shares on import prices first noted by HK: higher import shares relative to a firm's expenditure on intermediates raise import prices, while higher import shares relative to a firm's total costs lower import prices. Our standard metric for estimating the economic significance of these effects fails us here, yielding the unreasonably high estimates shown in Table 7, because of these shares' extremely low means relative to their standard deviations.[26] To better gauge their economic significance we calculate the effect on import prices of a 10% increase in these shares. The effects are large: for non-differentiated goods, import prices rise by 8.6% for that increase in the share of intermediate expenditures, and fall by 8.1% for that increase in the share of total costs; for differentiated goods, the effects are a rise of 7.0% and a decrease of 5.4%, respectively. Here, in contrast to all the other independent variables, the absolute effect is greater for non-differentiated than differentiated goods.

The final import characteristic to consider is the share from each source of a particular good. This is positive as expected for both non-differentiated and differentiated goods, highly statistically significant, and substantially larger for the latter in clinical terms (8.8% versus 14.7%). Firms making differentiated goods are willing to pay a substantial premium to obtain imports from key sources as revealed by the share they buy from those sources.

Columns (2) and (4) offer an additional pair of regressions for comparison. These restrict the sample to only two-way traders and their imports of non-

[26] Keeping in mind that the mshare_intermediate and mshare_costs are calculated on the basis of annual imports of a single product (from a single source) relative to the firm's total expenditures on intermediates or overall costs, the means are 0.031% and 0.026%, respectively, with standard deviations of 0.331% and 0.260%, respectively.

differentiated (column 2) and differentiated (column 4) goods. Across source-country, firm, and firm-product variables, estimated coefficients show the same pattern of near-uniform statistical significance as in the all traders results of columns (1) and (3), and the same pattern of larger effects for differentiated goods than for non-differentiated goods, except for the import shares of intermediates and costs. Within differentiated goods and non-differentiated goods, and comparing two-way traders to all traders—that is, comparing column (2) to (1), and (4) to (3)—coefficients and their associated economic significances are generally larger for two-way traders. Import shares of intermediates and costs are again exceptions: these coefficients are smaller for two-way traders than for all traders.

Columns (2) and (4), by focusing on two-way traders, allow a fresh look at the role of a firm's power in output markets to influence its willingness to pay for imports. Markup remains negative and (for non-differentiated goods) statistically significant. The firm's pricing power in its export markets, specifically, measured by x_price_power, displays positive point estimates but is significant only for non-differentiated goods. These mixed results are puzzling. The literature on export prices has demonstrated for many countries including India that firms willing to pay higher prices for high-quality imports are able to charge higher export prices than otherwise. We have no ready explanation of why we are not consistently finding the inverse relationship, that firms charging high output prices are willing to pay a premium for imported inputs.

Finally, consider the final two columns of Table 7, which can most naturally be compared to column (4). All these columns restrict the sample to two-way traders of differentiated goods only, and column (4) includes all such traders. Column (5) narrows this to traders whose import prices are in the highest quartile of the coefficients of variation (where the coefficient of variation is measured against the universe of all import prices paid, by HS6 product category, by all firms). These are the differentiated goods for which the scope for quality upgrading is the highest. The biggest change relative to column (4) occurs in the coefficient on firm TFP, which rises by more than 50%, and in the dummy variable x_same_year, which more than doubles in absolute value. In other words, for two-way trading firms already paying at the higher end of the import price distribution for high quality imports, increments to their TFP translate into large further increases in their willingness to pay for imports, while their experience in export markets translates into an enhanced ability to strike cost-effective deals for imports.

Column (6) in Table 7 considers the small group of two-way traders importing differentiated goods that are in the top quartile of TFP in the entire sample. In this rarefied group of high-performing firms, the effect of TFP on prices is the largest that we measure at 0.536. In other words, increased productivity in this quartile translates into substantially more willingness to pay import price premia. The coefficients on the capital-to-labor ratio, and on the wage bill, similarly rise. Interestingly, exporting in the same HS6 category is no longer statistically significant; we suspect that the top productivity firms are little engaged in exporting the same good (after quality upgrading) that was imported, leaving that activity for firms with lower levels of productivity.

Markup is not significant, while the export price measure, x_price_power, with a coefficient of 0.136, is statistically and clinically significant. A one standard deviation increase predicts a 15% increase in import prices. The coefficients on an import's share in intermediates and in total costs both become statistically insignificant, while the coefficient on the source share variable is high (0.260) and significant, suggesting that these firms' demands for imports are overall quite elastic, even as the firms are committed to buying those imports from particular key source countries.

For these top-performing firms, selling high quality, high price exports requires paying for the right imported inputs from the right source countries. Sellers surely try to take advantage of this and price to firm, but just as surely these firms are willing to pay what it takes to maintain quality.

7. Conclusion

In this paper we add to a new and growing literature that examines firms' direct sourcing of imports. To our knowledge we are the first to examine in detailed the import-pricing behavior of Indian firms, by source and product, using a full array of firm, source country and cost covariates.

Several important results stand out. First, source country, firm, and cost characteristics all matter for import prices, but in different ways depending upon whether products are non-differentiated or differentiated products. Direct importing is a costly activity that allows firms to source high-quality inputs; consistent with this expectation we find that firm total-factor productivity is positively associated with import prices, for all products. But it matters least for non-differentiated goods. Likewise, source-country characteristics GDP and GDP per capita, which index source country abilities to produce high quality inputs, do not matter at all for importers of non-differentiated goods but have large effects on import prices of differentiated goods. The positive effect of distance on import prices is approximately twice as large for differentiated goods as for non-differentiated goods.

These points suggest that firms quality upgrade in ways that mirror what the literature has found for exporting firms. The consistency of these findings, along with their clinical significance, supports our claim that the literature's analysis of firm importing behavior is incomplete.

Second, for diffentiated goods, firms that both import and export (two-way traders) really are different from firms that only import (one-way traders); they exhibit greater willingness to pay for higher priced imports based on TFP, size and distance in our conditioned results.

Other results also stand out. Remote source countries produce lower quality goods: India is able to import from them at prices between 26% to 31% lower than otherwise. In this tight range, whether the product is differentiated or not, or whether the importer is a two-way trader or not, makes little difference (though the price discounts are a tick bigger for two-way traders, and on differentiated goods).

There is strong evidence that source country and firm characteristics matter more, and cost factors matter less, than they do for differentiated products exhibiting lower coefficients of variation. Source country and firm characteristics also matter more, and cost factors matter less, for the highest productivity firms when they import differentiated goods. Among the highest productivity firms, their willingness to pay higher prices for imports appears to be magnified by the extent of their pricing power in their export market.

HK introduced the term "pricing to firm" to describe how suppliers of imports will adjust prices according to buying firms' elasticities of demand for inputs, which are rooted in buyers' elasticities of substitution in production and cost shares. Indian firms appear to face the same forces, and respond in much the same way, as Hungarian firms. Yet in the widened context of our study, encompassing source country characteristics and a richer set of firm and product covariates that address firms' differential needs for quality in their imported inputs, "willingness to pay" seems an equally reasonable and complementary explanation for Indian buyers' behavior on global markets.

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Data Availability Statement: While some of the data employed in this study come from open-access sources noted in the text and appendices, the underlying firm and trade data that support the findings of this study were purchased from Prowess and TIPS, as discussed in the paper. Restrictions apply to the availability of these data, which were used under license for this study.

8. Tables

Table 1. Variables in Estimating Sample

n = 129,437 for all variables, with the exception of x_price_power for which n = 59,353.
By Indian fiscal year, 17.6% of the observations are from 2000, 20.9% from 2001, 22.5% from 2002, and 39.0% from 2004.
See Data Appendix for details about sources and construction.

Variable	Definition	Unit of Measure	Mean	SD	Min	Max
mPrice	Import unit value by HS8 product, unit, firm, source, annually	USD	2,388	29,849	0.0000116	4,185,622
GDPpc	Import source country GDP per capita, annual	USD	23,069	10,184	92.12	50,987
GDP	Import source country GDP, annual	USD millions	2,389,106	3,053,834	142	10,400,000
distance	Distance between India and source country	Kilometers	6,655	2,596	683	16,937
remoteness	Remoteness of a source country in relation to India's other sources, annual	n.a.	0.000077	0.000060	0.000029	0.0003714
TFP	Firm productivity, Levinsohn- Petrin method, annual index	n.a.	157.80	132.50	22.53	696.99
klabor	Capital per dollar of wage bill, by firm, annual	USD	19.48	38.14	0.337	1,204
labor	Wage bill: total wages and salaries paid, by firm, annual	USD millions	911	2487	0.059	16,673
two_way	Dummy = 1 if firm exports and imports, annual	n.a.	0.461	0.498	0	1
x_same_year	Dummy = 1 if firm exports in same HS6 category as the import, annual	n.a.	0.343	0.475	0	1
x_price_power	Measure of firm's pricing power in export markets, annual. See text and footnote 19.	n.a.	0.460	2.062	-1.730	23.354
markup	Total firm sales divided by total costs, annual	n.a.	2.504	1.456	0.527	102.466
mshare_intermediates	An imported good's share in firm's spending on materials plus power, annual	Percent	0.031	0.331	2.83E-10	75.95
mshare_costs	An imported good's share in firm's spending on intermediates plus wages, annual	Percent	0.026	0.260	2.44E-10	62.07
mshare_source	The share of a firm's imports of a good that come from this source, annual	Percent	71.15	38.44	1.0200E-06	100.00

Table 2. Firm Characteristics by Export Status

Characteristic	Mean, Two-Way Traders, n = 868	Mean, One-Way Traders, n = 1,531	Ratio, Two-Way Traders/ One-Way Traders
Wage Bill	110.9	71.9	1.54
Capital-Labor Ratio	19.2	23.6	0.81
TFP (index)	148.4	141.8	1.05
Value Added/Wage Bill	15.3	22.6	0.68

Table 3. Importer Behavior by Export Status

	Two-Way Trader		One-Way Trader	
Category	Median	Mean	Median	Mean
Number of Products Imported	12	34.9	5	21.3
Number of Sources	8	9.7	4	6.9
Number of OECD Sources	4	5.4	2	3.8

Table 4. Characteristics of Imported Products

Across all firms and all years; "products" are defined at the HS8 product-unit level.

	Firm Type	10th percentile	Q1	Median	Q3	90th percentile
Share of imports (%) from top source	One-way	43.3	60.0	91.3	100	100
	Two-way	43.2	60.7	93.1	100	100
Share of imports (%) from top 3 sources	One-way	84.8	98.0	100	100	100
	Two-way	84.9	98.7	100	100	100
Number of unique sources	One-way	1	1	2	4	9
	Two-way	1	1	2	4	8
Number of unique "top 3" sources	One-way	1	1	2	4	6
	Two-way	1	1	2	4	6
Number of importing firms	One-way	1	2	5	15	38
	Two-way	1	2	6	18	45

Table 5. Within-Product Price Dispersion

Product Category: HS Section	Goods Measured in Kilograms			Goods Measured in Pieces		
		Price Variation Explained by…			Price Variation Explained by…	
	Price Dispersion	Firm-Year Fixed Effects (%)	Source-Year Fixed Effects (%)	Price Dispersion	Firm-Year Fixed Effects (%)	Source-Year Fixed Effects (%)
V: Mineral Products	1.07	69	41	2.00	78	33
VI: Chemicals	1.13	40	15	1.60	61	17
VII: Plastics	1.32	55	23	1.71	53	16
X: Pulp, Paper Prods	1.33	77	30	1.85	72	22
XI: Textiles, Apparel	1.07	71	30	1.50	92	52
XIII: Stone, Glass	1.70	72	26	1.72	58	15
XV: Metals	1.39	60	21	1.85	41	10
XVI: Machinery	2.49	47	17	2.15	43	16
XVII: Vehicles	1.88	77	44	1.57	59	24
XVIII: Instruments	2.15	88	51	1.71	44	19
XX: Miscellaneous	1.49	63	59	1.49	83	40
XXI: Works of Art	3.21	45	40	2.76	60	41
Total	1.50	40	14	1.86	34	13

Price dispersion measure: standard deviation of natural log of import prices

Notes:

(i) Sections I-IV, VIII-IX, XII, XIV, and XIX are dropped for observation counts under 500.

(ii) Price dispersion is the equal-weighted average within each HS section of the standard deviations in import price calculated by product at the HS6 level.

(iii) Firm specific shocks report the percent of the variation in import prices that is explained by firm-year dummies.

Table 6. Expected Signs in Estimating Model

Variable	Expected Sign
Source characteristics (X_{st})	
ln_GDPpc	Positive
ln_GDP	Ambiguous
ln_distance	Positive
ln_remoteness	Negative
Firm characteristics (X_{ft})	
ln_TFP	Positive
ln_klabor	Positive
ln_labor	Positive
two_way	Positive
x_same_year	Negative
x_price_power	Positive
ln_markup	Positive
Import characteristics (X_{fpt})	
ln_mshare_intermediates	Positive
ln_mshare_costs	Negative
ln_mshare_source	Positive

For variable definitions see Table 1.

Table 7. Import Price Determination

Dependent variable: logged import price, ln_mPrice_{fpst}. All regressions include product-unit-year fixed effects; SEs are clustered by source country and are reported in full in Appendix Table 1.
"Economic significance" is the percent change in import prices for a one standard deviation increase from the mean (for quantitative variables), and for a 0 to 1 change (for binary variables).
*** p<0.01, ** p<0.05, * p<0.1

	Non-Differentiated Goods		**Differentiated Goods**			
				Two-Way Traders		
Estimated Coefficients	**All**	**Two-Way Traders**	**All**	**All**	**Top Quartile, Price CoV**	**Top Quartile, TFP**
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Source characteristics (X_{st})						
ln_GDPpc	0.027	0.000	0.255***	0.191*	0.101	0.222*
ln_GDP	-0.001	-0.021	-0.131***	-0.187***	-0.248***	-0.168***
ln_distance	0.481***	0.415***	1.070***	1.119***	1.463***	1.120***
ln_remoteness	-0.325***	-0.379***	-0.372**	-0.420***	-0.511**	-0.525***
Firm characteristics (X_{ft})						
ln_TFP	0.129***	0.169***	0.144***	0.264***	0.418***	0.536*
ln_klabor	0.126***	0.133**	0.341***	0.398***	0.176**	0.446***
ln_labor	0.187***	0.225***	0.382***	0.440***	0.612***	0.563***
two_way	0.075**	-	0.183**	-	-	-
x_same_year	-0.104*	-0.189***	-0.172**	-0.272***	-0.703***	0.003
x_price_power	-	0.032***	-	0.009	-0.042	0.136**
ln_markup	-0.148**	-0.207***	-0.026	-0.126	0.098	-0.617
Import characteristics (X_{fpt})						
ln_mshare_intermediates	0.863***	0.659***	0.699***	0.493***	0.569***	-0.208
ln_mshare_costs	-0.810***	-0.586***	-0.540***	-0.309**	-0.429***	0.456
ln_mshare_source	0.165***	0.161***	0.269***	0.248***	0.211***	0.260***
Observations	48,635	21,597	80,802	37,749	13,394	10,627
R-squared	0.730	0.771	0.659	0.695	0.719	0.772
Economic Significance (%)						
Variables	(1)	(2)	(3)	(4)	(5)	(6)
ln_GDPpc	1.4	0.0	9.7	7.0	3.5	7.8
ln_GDP	-0.1	-2.8	-16.4	-22.7	-29.7	-20.7
ln_distance	20.7	17.9	39.0	41.1	53.2	40.7
ln_remoteness	-25.6	-29.4	-27.8	-31.0	-36.6	-41.8
ln_TFP	10.5	13.2	12.3	22.0	35.4	22.1
ln_klabor	22.2	21.2	69.8	61.9	15.6	87.6
ln_labor	54.4	76.2	100.6	134.0	120.1	141.2
two_way	7.8	-	20.1	-	-	-
x_same_year	-9.9	-17.2	-15.8	-23.8	-50.5	0.3
x_price_power	-	6.5	-	1.8	-8.4	14.9
ln_markup	-22.4	-24.3	-3.7	-17.4	12.0	-64.5
ln_mshare_intermediates	582.8	328.1	1264.9	427.7	671.8	-250.3
ln_mshare_costs	-511.6	-198.7	-967.3	-215.5	-379.0	398.7
ln_mshare_source	8.8	8.4	14.7	13.1	12.3	13.8

9. Appendix

Appendix 1. Table 7 with Full Standard Errors (in parentheses)

	Non-Differentiated Goods		Differentiated Goods			
				Two-Way Traders		
	All	Two-Way Traders	All	All	Top Quartile, Price CoV	Top Quartile, TFP
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Source characteristics (X_{st})						
ln_GDPpc	0.0270	0.000291	0.255***	0.191*	0.101	0.222*
	(0.0416)	(0.0437)	(0.0912)	(0.104)	(0.145)	(0.123)
ln_GDP	-0.000622	-0.0214	-0.131***	-0.187***	-0.248***	-0.168***
	(0.0257)	(0.0247)	(0.0373)	(0.0552)	(0.0850)	(0.0548)
ln_distance	0.481***	0.415***	1.070***	1.119***	1.463***	1.120***
	(0.125)	(0.125)	(0.232)	(0.304)	(0.441)	(0.335)
ln_remoteness	-0.325***	-0.379***	-0.372**	-0.420***	-0.511**	-0.525***
	(0.0783)	(0.0809)	(0.147)	(0.159)	(0.231)	(0.179)
Firm characteristics (X_{ft})						
ln_TFP	0.129***	0.169***	0.144***	0.264***	0.418***	0.536*
	(0.0328)	(0.0520)	(0.0399)	(0.0391)	(0.0619)	(0.306)
ln_klabor	0.126***	0.133**	0.341***	0.398***	0.176**	0.446***
	(0.0345)	(0.0513)	(0.0428)	(0.0353)	(0.0688)	(0.0797)
ln_labor	0.187***	0.225***	0.382***	0.440***	0.612***	0.563***
	(0.0286)	(0.0245)	(0.0305)	(0.0311)	(0.0554)	(0.0503)
two_way	0.0749**	-	0.183**	-	-	-
	(0.0328)	-	(0.0821)	-	-	-
x_same_year	-0.104*	-0.189***	-0.172**	-0.272***	-0.703***	0.00290
	(0.0532)	(0.0630)	(0.0673)	(0.0677)	(0.183)	(0.120)
x_price_power	-	0.0323***	-	0.00852	-0.0416	0.136**
	-	(0.0111)	-	(0.0200)	(0.0368)	(0.0599)
ln_markup	-0.148**	-0.207***	-0.0260	-0.126	0.0979	-0.617
	(0.0610)	(0.0685)	(0.0343)	(0.0849)	(0.172)	(0.385)
Import characteristics (X_{fpt})						
ln_mshare_intermediates	0.863***	0.659***	0.699***	0.493***	0.569***	-0.208
	(0.121)	(0.129)	(0.141)	(0.102)	(0.110)	(0.641)
ln_mshare_costs	-0.810***	-0.586***	-0.540***	-0.309**	-0.429***	0.456
	(0.129)	(0.135)	(0.168)	(0.130)	(0.142)	(0.667)
ln_mshare_source	0.165***	0.161***	0.269***	0.248***	0.211***	0.260***
	(0.0266)	(0.0306)	(0.0439)	(0.0422)	(0.0477)	(0.0519)
Observations	48,635	21,597	80,802	37,749	13,394	10,627
R-squared	0.730	0.771	0.659	0.695	0.719	0.772

*** p<0.01, ** p<0.05, * p<0.1

Appendix 2: Import Price Determination with Selection Correction

Table 7 regressions estimated with the selection correction described in text. Dependent variable: logged import price. Ethnic Indian 1990 population share in source country is included in first stage and excluded subsequently.

	Non-Differentiated Goods		Differentiated Goods			
				Two-Way Traders		
Estimated Coefficients	**All**	**Two-Way Traders**	**All**	**All**	**Top Quartile, Price CoV**	**Top Quartile, TFP**
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Source characteristics (X_{st})						
ln_GDPpc	0.039	0.001	0.247**	0.156	0.047	0.216
ln_GDP	0.000	-0.034	-0.170***	-0.232***	-0.328***	-0.191***
ln_distance	0.452***	0.432***	1.238***	1.348***	1.749***	1.206***
ln_remoteness	-0.310***	-0.377***	-0.403***	-0.470***	-0.549**	-0.554***
Firm characteristics (X_{ft})						
ln_TFP	0.133***	0.184***	0.141***	0.265***	0.477***	0.537*
ln_klabor	0.128***	0.135**	0.339***	0.400***	0.135*	0.442***
ln_labor	0.177***	0.212***	0.379***	0.438***	0.613***	0.565***
two_way	0.081**	-	0.179**	-	-	-
x_same_year	-0.114**	-0.194***	-0.169**	-0.265***	-0.646***	-0.016
x_price_power	-	0.036***	-	0.008	-0.041	0.138**
ln_markup	-0.162***	-0.217***	-0.036	-0.134	0.001	-0.615
Import characteristics (X_{fpt})						
ln_mshare_intermediates	0.902***	0.760***	0.696***	0.482***	0.885***	-0.302
ln_mshare_costs	-0.847***	-0.685***	-0.539***	-0.299**	-0.747***	0.549
ln_mshare_source	0.161***	0.162***	0.267***	0.247***	0.220***	0.256***
selection variable	-0.199***	-0.149**	-0.049	0.035	-0.286***	-0.045
Observations	48,143	21,426	79,878	37,444	13,288	10,539
R-squared	0.732	0.772	0.660	0.696	0.720	0.772
*** p<0.01, ** p<0.05, * p<0.1						
Economic Significance[†]						
Variables	(1)	(2)	(3)	(4)	(5)	(6)
ln_GDPpc	2.0	0.0	9.1	5.6	1.6	7.4
ln_GDP	-0.1	-4.4	-21.0	-28.0	-39.1	-23.4
ln_distance	19.4	18.6	44.4	49.1	63.1	43.4
ln_remoteness	-24.5	-29.3	-29.9	-34.6	-38.8	-43.9
ln_TFP	10.8	14.4	12.1	22.1	40.5	22.1
ln_klabor	22.6	21.4	69.7	62.4	12.0	87.0
ln_labor	51.7	71.8	100.1	133.4	120.1	141.7
two_way	8.4	-	19.6	-	-	-
x_same_year	-10.8	-17.6	-15.5	-23.3	-47.6	-1.6
x_price_power	-	7.3	-	1.6	-8.3	15.2
ln_markup	-24.5	-25.6	-5.1	-18.5	0.1	-64.4
ln_mshare_intermediates	613.6	264.1	1266.4	421.3	1057.8	-365.2
ln_mshare_costs	-539.0	-233.1	-971.7	-209.7	-669.5	481.4
ln_mshare_source	8.5	8.4	14.5	13.0	12.8	13.5

[†]See text discussion or note on Table 7 for description.

Appendix 3. Import Price Determination, All Goods, With and Without Selection Correction.

	No Selection Correction		With Selection Correction	
Estimated Coefficients	**All Firms**	**Two-Way Traders**	**All Firms**	**Two-Way Traders**
Variables	(1)	(2)	(3)	(4)
Source characteristics (Xst)				
ln_GDPpc	0.127*	0.0931	0.132*	0.0804
ln_GDP	-0.069**	-0.111**	-0.081*	-0.132**
ln_distance	0.800***	0.789***	0.834***	0.877***
ln_remoteness	-0.355***	-0.396***	-0.357***	-0.415***
Firm characteristics (Xft)				
ln_TFP	0.136***	0.237***	0.134***	0.241***
ln_klabor	0.277***	0.330***	0.276***	0.329***
ln_labor	0.319***	0.379***	0.314***	0.375***
two_way	0.140**		0.140**	
x_same_year	-0.146**	-0.252***	-0.148**	-0.251***
x_price_power		0.017		0.018
ln_markup	-0.0557	-0.135**	-0.0620	-0.143**
Import characteristics (Xfpt)				
ln_mshare_intermediates	0.763***	0.548***	0.767***	0.565***
ln_mshare_costs	-0.638***	-0.397***	-0.643***	-0.415***
ln_mshare_source	0.236***	0.221***	0.233***	0.220***
selection variable	-	-	-0.105	-0.0322
Observations	129,437	59,346	128,021	58,870
R-squared	0.693	0.727	0.694	0.727
*** p<0.01, ** p<0.05, * p<0.1				
Economic Significance				
Variables				
ln_GDPpc	5.6	4.1	5.7	3.4
ln_GDP	-8.8	-13.9	-10.3	-16.4
ln_distance	31.2	30.9	32.2	34.1
ln_remoteness	-27.8	-30.6	-27.9	-32.0
ln_TFP	11.4	19.3	11.2	19.7
ln_klabor	54.2	51.7	54.2	51.6
ln_labor	87.1	119.8	86.0	118.5
two_way	15.0	-	15.0	-
x_same_year	-13.6	-22.3	-13.8	-22.2
x_price_power	-	3.5	-	3.6
ln_markup	-3.2	-17.7	-9.0	-18.8
ln_mshare_intermediates	814.1	298.1	823.9	309.0
ln_mshare_costs	-643.3	-190.5	-652.9	-200.0
ln_mshare_source	12.8	11.6	12.5	11.5

Appendix 4. Data Construction

Our data on Indian firms' imports and exports are obtained from TIPS Software Services. Firm characteristics data are obtained from Prowess. Our main analysis relies on a merged dataset built from a firm-by-firm match of TIPS and Prowess data.

TIPS data required considerable preparation for this merge, over and above simply aggregating its daily data to a fiscal year basis. Firm names are recorded by hand at the point of collection (ports) with spelling errors and frequent variants. We use Levenshtein distance and bigram comparisons to match firm names in the sample, supplemented at times with simple inspection based on the values reported by the two aforementioned fuzzy-logic techniques.

To focus on the trading behavior of production firms, we exclude wholesalers. Firms whose name contained "EXIM" or other key words associated with wholesale trade were removed from the sample. We also excluded firms that import goods in more than nine two-digit HS chapters.

Finally, quantity units varied widely within HS8 lines. Our dependent variable, the import price, is defined as an import unit value. But in many firm-product-source categories, import values are reported in multiple units (such as kilos, boxes, and our favorite, "buckles"), rendering aggregation and meaningful comparison of unit values impossible. We therefore dropped all observations that are measured in unofficial units not recognized by Indian Customs. We then aggregated the remaining values where there are well-established conversion factors, converting pounds to kilos, and tons to metric tons, and so on, prior to calculating unit values. The largest harmonization involved pieces (PCS) and numbers (NOS), the two most commonly-appearing units in the data, which we combined into the single category of pieces on the strength of the one-to-one conversion factor recommended by the U.S. Census Bureau. We kept the top four units in each HS8 line, by value. Dropping the others costs approximately 2.5% of all observations.

The index x_sigma of the price (quality) of importing firms' exports was constructed from TIPS export data (aggregated as described above). We calculate an annual z-score for the price a firm charges for each exported product (relative to the universe of prices received for that good by all exporting firms in TIPS), and then calculate an annual export value-weighted mean z-score across the firm's export bundle each year. The higher is x_sigma, the higher the relative price (and, by implication, the quality) of the firm's exports. Our final measure of importing firms' market power in their export markets (x_price_power) multiplies the x_sigma variable with the coefficient of variation of prices (CoV_x6) in each firm's export markets (calculated at the HS6 level).

Merging the data from TIPS and Prowess with CEPII destination market characteristics yielded a data set with 129,437 individual firm-product-unit-source-year observations over fiscal 2000-2003 for 1,930 unique importers. Although by name alone we were able to match more firms, many observations were lost because they were not manufacturing firms (e.g., wholesalers), had incomplete information (e.g., missing input information in Prowess or TIPs), or did not survive our procedures to clean the data.

We calculated TFP with the Levisohn and Petrin [21] technique, and put each firm's productivity into index form (with the technique in Aw et al. [6]), which allows productivity comparisons within and between industries (an approach also used by Topalova and Khandelwal [23], pp. 998–999). We measured firm output with value added (Topalova and Khandelwal [23] used sales), and capital was measured as the size of each firm's gross fixed assets. Labor was proxied by the wage and salary bill (as Prowess does not include the number of employees) in both the TFP calculations and in all the reported regression results using "ln_labor" as a proxy for firm size. The capital/labor ratio ("ln_klabor") was also calculated from these capital and labor variables.

We estimated TFP at the 4-digit National Industrial Classification (NIC) code level where possible, and at the 3-digit level if there were less than 20 firms at the 4-digit level. Prowess data on firms' spending on raw materials and electric power provided the proxy for productivity shocks. To obtain real values, output was deflated by two-digit industry-level wholesale prices indices from Ahsan [1]; capital expenditures were deflated by a capital goods wholesale price index we constructed from several sub-industry wholesale price indices (including machine tools, electric machinery, and other capital goods); materials and power were likewise deflated with separate materials and power wholesale price indices we constructed; and finally the wage and salary bill was deflated by the Economist Intelligence Unit's Indian labor cost index.

Appendix 5. Selection Correction

As described in the main body of the paper we implemented a selection correction procedure in estimating equation (6) to correct for possible sample selection bias. The three step procedure we employ comes from Harrigan, et al. [17], which we supplement with an exclusion condition.

The first stage is a Probit of entry (of a firm into importing from a particular source in a particular year) on all our exogenous source-country characteristics (X_s), firm characteristics (X_f), and a year-specific intercept α. We also include in X_s a variable measuring the Indian ethnic share of the source country's population in 1990 (i.e. a decade prior to our earliest data), on the expectation that all else equal a higher Indian ethnic share will positively affect the likelihood of trade with a source, given the trade-enhancing benefits of the ethnic Indian global diaspora network. (On this point, see Anderson et al. [3].) Omitting time subscripts we have:

$$PR\left(M_{fs} > 0\right) = \Phi\left(\alpha + \delta_1 X_s + \delta_2 X_f\right) \tag{7}$$

Equation (7) is estimated over a "rectangularized" sample of all possible firm-source-year combinations, with zeros added where there are no trade flows.

The second stage explains observed (i.e., positive) firm-product-unit-source expenditure on imports, based upon import source country market characteristics (now excluding the ethnic Indian share), firm characteristics, product-unit fixed effects (α_p), and the inverse Mills ratio $\hat{\lambda}_{fs}$ from the first stage:

$$\ln M_{fps} = \alpha_p + \zeta_1 X_s + \zeta_2 X_f + \zeta_3 X_{fp} + \gamma \hat{\lambda}_{fs} + u_{fs} \tag{8}$$

For the third stage, quasi-residuals are formed by adding the residuals from the second stage regression to the estimated term for the inverse Mills ratio, $\hat{\eta}_{fps} = \hat{u}_{fps} + \gamma\hat{\lambda}_{fs}$. This term is entered as a selection control in the final price regression reported as (6) in the main text:

$$\ln P_{fps} = \alpha_p + \beta_1 X_s + \beta_2 X_f + \beta_3 X_{fp} + \psi \hat{\eta}_{fps} + \varepsilon_{fps} \tag{9}$$

Alternatives are possible. Wooldridge's [25] proposed two-step Tobit approach would fit a Tobit regression of import expenditures on the rectangularized data with zero expenditures, the residuals from which are used to control for selection bias in the price regression. We are persuaded by the argument that Harrigan's approach is more flexible because the estimated effects on entry, the δ's in equation (7), are allowed to differ from the effects on import intensity, the ζ's in equation (8).

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