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Export Modes and Adjustments to Exchange Rate Movements*

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Abstract

This work investigates the differential adjustments of the direct and intermediated export channels in the aftermath of an exchange rate movement. We do this with the help of a relatively parsimonious model that, while replicating the main findings from the literature on export intermediaries, also puts forth new testable predictions. Exporting through intermediaries entails lower fixed costs, but as a consequence of double marginalization, it also entails lower variable profits. If firms apply heterogeneous pricing-to-market, the joint outcome at the very micro level is a lower exchange rate pass-through for goods traded via intermediaries, whereas at a more aggregate level, there is an adjustment in the number of varieties reaching the foreign destination over the two export channels that varies with the level of country fixed costs. These conjectures are tested employing the Italian cross-border transaction level data; taken together they shed light on the determinants of the impact of intermediaries on aggregate trade flows.

JEL codes: F12, F14, D22, L22.

Keywords: firms heterogeneity, export intermediaries, heterogeneous markups, pricing to market, double marginalization, exchange rate pass-through, export mode selection.

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1 Introduction

A well-established body of research has shown the existence of a variety of modes available to business firms for reaching foreign destinations with their products. Manufacturers not only can directly manage the export of their goods, but also might indirectly take part in international trade by resorting to an intermediary that assists them in reaching overseas markets. Theoretical models in this field introduce an intermediation technology that allows indirect exporters to enjoy a fixed-cost advantage. These models generate a number of empirically tested predictions about how exporting is conducted in the presence of intermediation. First, the evidence suggests that producers sort according to productivity in determining their mode of exporting. Second, exports through an intermediary increase the number of manufacturing firms that can reach foreign markets with their goods; indirect exports are often preparatory to direct involvement in international trade. Moreover, intermediaries facilitate exports to relatively “difficult-to-access” markets and focus on products that are less differentiated. Finally, aggregate exports to destinations with high shares of intermediary exports are less responsive to changes in the real exchange rates than exports to markets served primarily by direct exporters.

This work moves on from the last piece of evidence concerning aggregate trade flows and contributes to the literature on the role of intermediaries in international trade by investigating the drivers of the different adjustments to exchange rate variation over the direct and intermediated export channels. For this purpose, the paper focuses on the firm level margin of adjustment to exchange rate changes in terms of export pricing. By showing evidence of a heterogeneous response between manufacturing exporters and intermediaries, the work proposes a previously unexplored channel through which firms’ characteristics might influence the transmission of exchange rate movements into consumer prices. The micro-level differences between the two modes of export also have important implications at a more aggregate level. As a consequence of the different productivity cut-off levels required to export indirectly and directly, the paper shows that, following a change in the real exchange rate, the relative number of varieties that are exported over the two channels is different.

The paper outlines a relatively parsimonious model of trade that, in addition toputting forth a series of predictions that we empirically test, replicates most of the major findings from the existing literature on intermediaries in international trade. The model features heterogeneous, monopolistically competitive firms that—in line with most of the related literature—face a trade-off

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1 Many producers indeed seem to opt for this solution, given the quantitative relevance of wholesalers’ exports. Bernard et al. (2010) report that 35% of US exporters are wholesalers, accounting for 10% of the export value. Figures are similar for Italy (Bernard et al. 2015), whereas the shares of intermediaries’ exports are larger (respectively, 15% and 20%) in Sweden (Akerman forthcoming) and France (Crozet et al., 2013). In China, approximately one quarter of the total export value is generated through wholesalers (Ahn et al., 2011). Smaller numbers are observed when considering retailers, although they might play a more significant role on the import side. Given our focus on the behavior of exporting firms, we will use the terms intermediaries and wholesalers as interchangeable hereinafter.

2 This advantage can arise by assumption, as in Ahn et al. (2011) or in Felbermayr and Jung (2011) (where intermediaries originate abroad, hence having cheaper access to the foreign market) or because intermediaries exploit significant economies of scope, as in Akerman (forthcoming).

3 These stylized facts are documented in a wave of papers which includes Bernard et al. (2010); Ahn et al. (2011); Bernard et al. (2015); Crozet et al. (2013); Davies and Jeppesen (2015) and Grazzi and Tomasi (2016), among others.
between the higher fixed costs of exporting directly and the lower variable profits associated with exporting indirectly, i.e., through an intermediary. The theoretical framework that we propose features two peculiar characteristics: (i) the lower variable profits associated with the indirect export channel is because both the manufacturer and the intermediary apply their own markup and, related, (ii) this form of double marginalization operates on top of an endogenous and heterogeneous strategy of pricing-to-market, generated by a linear demand system à la Melitz and Ottaviano (2008). These features differentiate our setting from other models of intermediated trade where the reduction in variable profits originates from ad hoc per-unit costs (Ahn et al., 2011), from intermediaries taking their cut of the unit price of each variety (Raff and Schmitt, 2009), or from the lack of complete contracts (Felbermayr and Jung, 2011). Moreover, by introducing linear demand, we innovate with respect to Akerman (forthcoming) where double marginalization is the endogenous outcome of a CES demand structure that delivers constant and homogeneous markups across all markets and firms.

Combining double marginalization with heterogeneous pricing-to-market is key to generate new theoretical predictions of the differential response of direct exporters and wholesalers to a common external shock, in a way consistent with the insights generated by previous theoretical frameworks and with the stylized facts found in the literature on intermediaries in international trade. However, because different mechanisms can generate heterogeneity in firms’ pricing-to-market strategy, we show that predictions observationally equivalent to those derived from our model with linear demand can be obtained from alternative models of intermediated trade. In particular, in the Appendix, we report the case of a model with CES preferences and local distribution costs in the manner of Corsetti and Dedola (2005). The new theoretical predictions generated by our model are tested using a dataset that collects all cross-border transactions of Italian firms from 2000 to 2007.

Our result highlights a heterogeneous response of wholesalers and manufacturers to real exchange rate movements in terms of export prices. Both direct exporters and wholesalers decrease (increase) their export prices in response to the real exchange rate appreciation (depreciation). However, the exchange rate elasticity is higher for goods exported through intermediaries, implying a lower degree of exchange rate pass-through for these products. As rationalized in our model, this occurs because along the intermediated trade channel, both the indirect exporter and the intermediary adjust their markup in response to the real exchange rate shock, so that the overall price adjustment is larger than the one observed for products exported directly by their producers.

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4A well-established literature in industrial organization, starting from Spengler (1950), shows that economic efficiency typically requires the adoption of a two-part tariff to avoid double marginalization along the vertical channel. However, there are many reasons (discussed at length in Section 3.1) to believe that non-linear prices, at least in their most common versions, are not much suited for the case of export intermediation. To anticipate, even unconditionally from exchange rate movements, intermediaries tend to change their product mix more than manufacturers (Bernard et al., 2011); this clearly plays against the arrangement of stable relationships between intermediaries and indirect exporters, thereby complicating the adoption of non-linear prices.

5The choice to build on Melitz and Ottaviano (2008) to set up the benchmark model for our analysis is motivated by the growing popularity of this framework in the current research in trade; moreover, the conditions to be imposed on model parameters for the emergence of well-consolidated patterns in international trade are simpler in this framework than in the alternative one, featuring CES utility and local distribution costs.
As in many other theoretical frameworks of export intermediation, in our model, producers sort according to productivity to select their mode of export. Following real exchange rate movements, the productivity cut-off levels for exporting indirectly and directly move. There is indeed an adjustment in response to the shock in terms of a manufacturing firm’s choice whether to serve the foreign market and whether to do so directly or indirectly. A currency appreciation, for instance, makes exporting more difficult, thus implicitly shifting the productivity cut-offs for both direct and indirect entry into the foreign market to the right. As a result, a marginal indirect exporter might eventually exit from international trade while some manufacturers that used to directly reach foreign markets now find it more convenient to resort to intermediaries. This process has implications at a more aggregate level, as it affects the number of varieties that reaches a country along the direct and the intermediated export channels. As predicted by our theory, we empirically document that, in the aftermath of a real appreciation, the number of varieties exported to a given destination that are discontinued from the wholesale sector tends to be proportionally larger than the number of varieties dropped by the manufacturing sector (direct exporters), the higher the entry cost in the market of interest.

Overall, the results presented in the paper contribute to explaining cross-country heterogeneity in the sensitivity of aggregate behavior to exchange rate variations (Campa and Goldberg, 2005). In this respect, the observed differences in the way direct exporters and intermediaries react to exchange rate variations suggest that the presence of the latter in foreign markets can contribute to shaping the sensitivity of a country’s aggregate reactions to the shock.

Our paper relates to various strands within the international trade literature. First, our results shed light on the role played by intermediaries in international trade and, in particular, on the different reactions of the two categories of firms (direct exporters and export intermediaries) to a common exogenous shock. In this respect, the empirical evidence that we provide here at a very disaggregate level, as well as our theoretical framework, are complementary to the findings in Bernard et al. (2015), where at a more aggregate level, the authors show that exports to countries served relatively more by intermediaries are less sensitive to real exchange rate movements.

Second, the findings of this work also contribute to the literature assessing how heterogeneous exporters react to common external shocks, such as exchange rate movements. The seminal article by Berman et al. (2012) shows that more productive exporters are able to absorb more of these movements into their consumer import prices. Amiti et al. (2014) observe that import-intensive exporters have significantly lower exchange rate pass-through. Chatterjee et al. (2013) study the effect of exchange rate shocks on the export behavior of multi-product firms, while Bernini and Tomasi (2015) investigate the heterogeneous response of exporters to real exchange rate fluctuations due to the quality of imported inputs and exported output.

Our paper contributes to this literature on the heterogeneous pricing to market strategies of export-

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6The cut-off for direct entry in the foreign market corresponds to a higher level of productivity than the cut-off for indirect entry, such that only the most productive firms will export directly, whereas firms with intermediate levels of productivity will resort to intermediaries and the least productive firms will serve the domestic market only. This pattern is well documented in several studies, e.g., Davies and Jeppesen (2015) and Grazzi and Tomasi (2016).

7Both in our theory and empirics, this result is derived from a partial equilibrium analysis, which abstracts away from interdependence, at the firm level, of both entry/exit and export mode decisions across markets.
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Exporters by bringing empirical evidence on the difference between intermediaries and direct exporters in their response to real appreciations and depreciations. Interestingly, our findings do not conflict with the key conclusion of Berman et al. (2012), according to which more productive firms decrease producer prices more than less productive firms in the event of an exchange rate appreciation.

Due to productivity sorting in the export mode selection, intermediaries trade goods produced by firms with lower levels of productivity than manufacturers that export directly. However, the price adjustment is larger in the case of goods exported through intermediaries as a result of a double adjustment. The price adjustments of the manufacturing firms, either direct or indirect exporters, are increasing with the level of marginal productivity. Nevertheless, along the intermediated export channel, the wholesale firm also adjusts its own markup over the procurement price that it pays to the indirect exporter. As a result, the overall price adjustment is larger for goods subject to double marginalization, that is, those exported via intermediaries.

The paper is organized as follows. Section 2 introduces the model in its basic setup without intermediaries, while in Section 3 we introduce trade intermediaries and derive all the theoretical predictions of our model. Those are tested in Section 4 after a brief description of our data. Section 5 concludes.

2 The model: basic setup without intermediaries

2.1 Preferences and production

We consider an economy in which a tradeable non-homogeneous good is available in many differentiated varieties. We index each of these varieties by \( i \) and assume a quadratic utility function in the manner of Melitz and Ottaviano (2008). The final demand in the destination country is then

\[
q^*\left(p^*_i\right) = \left(a - dQ^* - ep^*_i\right)/b,
\]

where \( p^*_i \) is the export price set by firm \( i \); \( e \) is the nominal exchange rate between the domestic and the foreign currency; and \( Q^* \) is global spending in the foreign country over all varieties available there. Finally, \( a, b, \) and \( c \) are positive constants. Each firm is assumed to produce a unique differentiated variety, according to the linear technology

\[
q_i = \varphi_i L_i,
\]

where \( L_i \) is the amount of labor employed by firm \( i \) and \( \varphi_i \) is the level of firm \( i \)'s marginal productivity, which is drawn from a generic distribution \( G(\varphi) \).

Consider now a generic exporting firm \( i \). When selling abroad, its profit-maximizing price is

\[
p^*_i = \mu^*_i \cdot \frac{\tau}{\varphi_i}, \text{ where } \mu^*_i = \frac{1}{2} \left(1 + \frac{\varphi_i}{\varphi^*}\right) \text{ and } \varphi^* = \frac{w^* \varepsilon \sigma}{a - dQ^*}. \tag{1}
\]

In the above expression, \( \tau \geq 1 \) is a standard iceberg cost that we assume to be incurred when shipping goods across borders, whereas \( \varphi^* \) corresponds to the threshold at which operating profits from exporting (hence excluding sunk costs) are positive. This means that any exporter has to match the restriction \( \varphi_i > \varphi^* \). We denote the real exchange rate between home and the foreign country with \( \varepsilon = w_e/w^* \), where \( w = 1 \) and \( w^* \) are the wage rates at home (our numeraire) and abroad, respectively.

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8The hypothesis put forth in Berman et al. (2012) is tested and verified also on our Italian transaction-level data; see Appendix B2.
When markets are geographically segmented, exporting firms engage in pricing-to-market, discriminating between foreign and domestic consumers (and among foreign consumers located in different regions, when considering a trivial multi-country version of this model). The export sales markup, denoted with \( \mu_i^* \), indeed differs from the markup applied to domestic sales, namely,

\[
\mu_i = \frac{1}{2} \left( 1 + \frac{\varphi_i}{\varphi'} \right), \quad \text{where} \quad \varphi' = \frac{1}{a - dQ},
\]

as far as \( \varphi' \neq \varphi^* \), i.e., the thresholds for positive operating profits vary between foreign and domestic markets.

When export intermediaries are not accounted for, our model replicates the framework outlined in the appendix of Berman et al. (2012). The export sales markup is (i) increasing with firm productivity and with the size of the destination market (namely, \( a - dQ^* \)) and (ii) decreasing with the nominal exchange rate (denoted above as \( e = \varepsilon w^* \)) and with the level of iceberg trade costs. However, in our model, equation (1) only applies to direct export sales; in Section 3, we show what occurs when introducing the export intermediation sector.

### 2.2 Productivity cut-offs for entry in the markets

After having sunk \( f_E \) units of labor to develop a new variety, a firm may learn about its marginal productivity \( \varphi_i \), drawn from a probability distribution \( G(\varphi) \), and therefore decide on entry in the domestic market (by paying a fixed cost \( f_D \)) as well as on entry in the foreign market (by paying a fixed cost \( f_X \)). The critical level of productivity for entry in the domestic market is then

\[
\varphi_D = \frac{1}{a - dQ - 2\sqrt{bf_D}},
\]

whereas the cut-off for entry in the foreign market is

\[
\varphi_X = \frac{w^* \varepsilon \tau}{a - dQ^* - 2\sqrt{bw^* \varepsilon f_X}}. \quad (2)
\]

Conditional on imposing a lower bound for the size of \( f_X \) with respect to \( f_D \), it is easily proved that \( \varphi_X > \varphi_D \). This means that among firms operating in the domestic market, only those with productivity greater than \( \varphi_X \) will choose to export; the others will either (i) serve the domestic market only, if \( \varphi_i \in [\varphi_D, \varphi_X] \), or (ii) will exit immediately, if \( \varphi_i < \varphi_D \). This corresponds to the well-known mechanism of self-selection in the foreign market, described by Melitz (2003).

Notice that here \( \varphi_X \) denotes the export cut-off that applies in the model without export intermediaries. We will show (see Section 3.3) that once such an alternative is available, the productivity threshold associated with direct exporting namely, \( \varphi_{X^{\text{dir}}} \), is different from the \( \varphi_X \) above.

### 3 The model with export intermediaries

#### 3.1 Pricing of wholesale exporters

We now introduce the intermediary sector, made up of firms that do not engage in any production activity but simply operate as wholesalers. Similarly to previous theoretical settings, we will show...
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by exporting through intermediaries, indirect exporters can enjoy an advantage and pay lower fixed costs of export than those required to serve the foreign country directly. This advantage can arise, for instance, because some or part of these costs, such as distribution or marketing costs or costs related to personnel with skill to manage foreign networks, are paid by the wholesaler. Alternatively, although intermediaries pay the entire cost of serving foreign markets, the indirect manufacturer exporter still has to incur a cost for resorting to the wholesaler: as mentioned by [Ahn et al. (2011)], “a sort of membership fee to deposit varieties at the warehouse where the intermediaries are located”.

Manufacturing firms willing to export may now decide either (i) to directly sunk the cost of entry in the foreign market, denoted as $f_{X_{dir}} = f_X$, thereby exporting their product directly, or (ii) save on this cost by delivering their product to some wholesaler $j$, that will resell this product to the foreign consumer. This second option requires the manufacturer to pay a fixed cost, $f_{X_{ind}}$, which is smaller than $f_{X_{dir}}$. This cost is defined as $f_{X_{ind}} = \lambda f_X$, where $\lambda \in (0,1)$ defines the extent to which the fixed costs associated with the two modes of export, direct and indirect, differ.

As simplifying assumptions, we finally assume that wholesalers are symmetric and randomly matched with indirect exporters; this implies that, in equilibrium, any intermediary will feature the same productivity as the average indirect exporter.

Wholesalers face the same foreign demand as manufacturing firms that export on their own. The intermediary $j$ then sells the variety manufactured by producer $i$ at the price

$$p^*_ij = \mu^*_ij \cdot \tau \cdot p_{ij},$$

where $\mu^*_ij = \frac{1}{2} \left( 1 + \frac{1}{\varphi^*_ij} \right), \quad (3)$

this being the price that maximizes its own profits, given $p_{ij}$, i.e., the price that the indirect manufacturing exporter $i$ charges to the intermediary $j$ that sells its variety. By backward induction, firm $i$ then sets $p_{ij}$ at the level

$$p_{ij} = \mu_{ij} \cdot \frac{1}{\varphi_i},$$

where $\mu_{ij} = \frac{1}{2} \left( 1 + \frac{\varphi_i}{\varphi^*_ij} \right), \quad (4)$

thereby maximizing its own profits. For goods exported by wholesalers, the price paid by foreign consumers is then the result of a double marginalization. Intermediary $j$ charges its own markup, denoted as $\mu^*_j$, over the procurement price paid to the manufacturer of good $i$. The manufacturer, in turn, already includes the markup $\mu_{ij}$ that firm $i$ imposes over its marginal cost of production when selling to the intermediary. This can be easily illustrated by combining equations (3) and (4).

Notice that, as in [Felbermayr and Jung (2011)] and [Akerman forthcoming], we assume that manufacturing firms incur destination-specific costs to use intermediaries. An alternative way would be to have, as in [Ahn et al. (2011)], global fixed costs in form of the membership fee mentioned above in the text. Yet, this would require a different source for the lower variable profit typically associated with indirect export, other than double marginalization.

There are a few studies that specifically address the role of heterogeneity among intermediary firms. For instance, [Rauch and Watson (2004)] consider a setting in which economic agents are differentiated by the size of their network of contacts abroad and can endogenously decide whether to be intermediaries or producers. In [Raff and Schmitt (2006)] export intermediaries can instead be of two types, so that manufacturing firms can always choose between exclusive dealing and common agency, their decision depending on the level of trade barriers incurred when shipping goods abroad.
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to derive the *unconditional* optimal export price for the wholesale firm, that is

\[
p_{ij}^* = \frac{1}{2} \left[ 1 + \frac{1}{\varphi^* \cdot \frac{1}{2} \left( \frac{1}{\varphi^* + \varphi_i} \right)} \cdot \frac{1}{\varphi_i} \right] \cdot \frac{1}{2} \left( \frac{\varphi_i + 3\varphi_i}{\varphi^* + \varphi_i} \right) \cdot \frac{1}{\varphi_i} \cdot \tau = \frac{1}{2} \left( \frac{\varphi^* + 3\varphi_i}{\varphi^* + \varphi_i} \right) \cdot \frac{\tau}{\varphi_i}. \tag{5}
\]

To summarize, for products exported by trade intermediaries, the overall markup imposed on foreign consumers, namely,

\[
\mu_{ij}^* = \mu_j^* \cdot \mu_{ij} = \frac{1}{2} \left( \frac{\varphi^* + 3\varphi_i}{\varphi^* + \varphi_i} \right),
\]

is the result of the multiplicative interaction between the *indirect exporter’s markup*, that is,

\[
\mu_{ij} \equiv \frac{1}{2} \left( 1 + \frac{\varphi_i}{\varphi^*} \right),
\]

and the *intermediary’s markup*, namely,

\[
\mu_j^* \equiv \frac{1}{2} \left( 1 + \frac{1}{\varphi^* p_{ij}} \right) = \frac{1}{2} \left( \frac{\varphi^* + 3\varphi_i}{\varphi^* + \varphi_i} \right),
\]

where the latter is easily proved to be greater than one. A series of theoretical results then follows from equations (1) and (3)-(5). First, a manufacturing firm charges the same markup when choosing the export mode: indeed, the markup imposed on the intermediary exporter (\(\mu_{ij}\)) is equal to the markup that the same firm would charge in case of direct export sales (\(\mu_i^*\), as expressed in equation (1)). Furthermore, the indirect exporter’s markup, \(\mu_{ij}\), is larger than the intermediary’s markup on the same product, i.e., \(\mu_j^*\), insofar as \(\varphi_i > \varphi^*\), a condition that is necessarily verified for any exporting firm (\(\varphi^*\) is in fact the threshold for which operating profits in the foreign market are strictly positive). Finally, as a consequence of these results, the overall markup charged on goods exported via intermediaries, \(\mu_{ij}^*\), is larger than the markup that would be imposed in case of direct export, \(\mu_i^*\).

Before proceeding, let us further ponder the hypothesis of double marginalization. A well-known result in the Industrial Organization literature is that firms engaged in a vertical relationship might seek to get rid of the inefficiency associated with double marginalization by means of a two-part tariff (TPT), which can reproduce, under vertical separation, the same outcome as the vertically integrated firm. However, in the case of export intermediation, the adoption of the TPT, or, for that matter, of a similar tool, is complicated by the fact that the downstream firm (the wholesaler)

\[11\] In full analogy with \(\mu_i^*\) (the direct exporter’s markup), the indirect exporter’s markup, namely, \(\mu_{ij}\), is increasing with firm productivity and the size of the destination market; and decreasing with the level of iceberg costs and the nominal exchange rate. This is easily proved, noting that \(\varphi^* = \frac{w^* \tau}{(a - dQ^*)}\).

\[12\] This is a direct consequence of assuming linear demand *à la* Melitz and Ottaviano (2008); different results would come up in alternative models of intermediated trade, such as the one outlined in Appendix A3, featuring CES utility and local distribution costs, in the spirit of Chatterjee et al. (2013).
requires a margin to operate, as far as it is the intermediary that pays (at least part of) the entry cost in the overseas market. With this in mind, one might expect intermediaries and indirect exporters to engage in Nash bargaining over the extra-profit arising from the elusion of double marginalization. However, in this framework, intermediaries are likely to have an overwhelming bargaining power vis-à-vis their counterpart, since (i) they are relatively few compared to the mass of indirect exporters and (ii) they are less committed to exporting a given variety (as documented in [Bernard et al., 2011]), insofar as they can more easily switch from one product/manufacturer to another, as opposed to the counterpart. For these reasons, we do not expect that the relationship between each producer and the wholesaler will be particularly stable over time, or that indirect exporters will be particularly interested in proposing non-linear pricing schemes to their partners. In the lack of empirical evidence on the nature of contractual arrangements between manufacturing firms and export intermediaries, double marginalization (or at least, some degree of it) thus appears as a plausible feature of trade intermediation.

3.2 Export price elasticities to real exchange rate movements

The different pricing structure that characterizes the two modes of export (direct and indirect) bears relevant implications regarding firm adjustment in the event of external shocks. In particular, we focus here on adjustments to real exchange rate movements. In this respect, we put forth a set of predictions, derived from equations (1), (4) and (5), that specifically refers to the different export-price elasticity to real exchange rate movements of varieties traded directly and varieties traded through export intermediaries. All these predictions can be directly tested using our data.

For goods exported directly by their producers, the export price elasticity with respect to the real exchange rate can be proved to be

\[
E_{p_i^*:\varepsilon} = -\frac{\varphi_i}{\varphi_i + \varphi^*} \in (-1, 0),
\]

whereas the corresponding elasticity for goods exported by wholesalers is

\[
E_{p_i^{ij*:\varepsilon}} = -\frac{3\varphi_i}{3\varphi_i + \varphi^*} \in (-1, 0).
\]

Based on these two equations, we can derive a first testable prediction of our model.

**Proposition 1.** Both direct exporters and intermediaries adjust their export prices in response to real exchange rate movements, to limit the transmission of exchange rate variations into consumer prices: if the domestic currency appreciates (depreciates), the final export price set in the domestic currency by both direct exporters and intermediary firms will decrease (increase).

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13 The wholesalers’ lack of commitment to exporting a specific variety may result in manufacturing firms exporting indirectly having more limited knowledge of the buyers’ willingness to pay for their products. According to [Calzolari et al., 2016], this corresponds to a situation in which firms’ optimal strategy is setting prices over marginal costs, insofar rent extraction to the detriment of the buyer turns out to be costly. With regard to the bargaining power enjoyed by export intermediaries, [Raff and Schmitt, 2009] shed light on the (non-trivial) trade liberalization effects that originate from the existence of trade intermediaries with sufficient market power to make take-it-or-leave-it offers to the producers.
Proposition 1 implies that the exchange rate pass-through is incomplete for both manufacturers and intermediary exporters. Furthermore, by simply comparing (6) and (7), we can show that

\begin{equation}
|E_{\mu_{ij};\varepsilon}| > |E_{\mu_{j};\varepsilon}|.
\end{equation}

A second testable prediction then follows.

**Proposition 2.** Because of the combination of the two price adjustment mechanisms, the export price elasticity with respect to real exchange rate movements is always larger for goods traded through intermediaries, than for goods traded directly.

It is worth emphasizing that Propositions 1 and 2 have observationally equivalent counterparts when considering an alternative model with heterogeneous pricing-to-market, featuring CES preferences and local distribution costs (see Appendix A3). This makes it clear that Proposition 2, in particular, hinges on the combination of heterogeneous pricing-to-market by all exporting firms and double marginalization for products traded by wholesalers.

Moreover, it is worth noting that the degree of pass-through incompleteness for varieties traded along the intermediated export channel originates from two different price adjustments. On one hand, the indirect exporter reacts to the real exchange rate shock by adjusting its markup \(\mu_{ij}\) over the marginal cost of production, when selling its product to the intermediary. On the other hand, the intermediary also adjusts its own margin \(\mu_{j}\) over the procurement price. To shed light on the relative contribution of these two responses over the final price adjustment, we compute the elasticity to the real exchange rate of both \(\mu_{ij}\) and \(\mu_{j}\). These elasticities are, respectively,

\begin{align*}
E_{\mu_{ij};\varepsilon} &= -\frac{\varphi_i}{\varphi^* + \varphi_i} \in (-1, 0) ; \text{ and} \\
E_{\mu_{j};\varepsilon} &= -\frac{2\varphi_i\varphi^*}{(\varphi^* + \varphi_i)(\varphi^* + 3\varphi_i)} \in (-1, 0) .
\end{align*}

Since \(|E_{\mu_{ij};\varepsilon}|\) is increasing with \(\varphi_i\), more productive firms will tend to adjust their markup to a greater extent than less productive firms, consistent with the findings of Berman et al. (2012). In contrast, \(|E_{\mu_{j};\varepsilon}|\) is a non-monotone function of \(\varphi_i\), i.e., the marginal productivity of the indirect exporter that delivers product \(i\) to \(j\). In particular, it first increases with \(\varphi_i\); then, it reaches a peak at \(\varphi^*/\sqrt{3}\), and it eventually starts declining, approaching zero for \(\varphi_i \to \infty\).

Given the above two elasticities, it is easily proved that \(|E_{\mu_{ij};\varepsilon}| > |E_{\mu_{j};\varepsilon}|\). For products traded along the intermediated export channel, most of the weight of the overall price adjustment that follows an RER shock is therefore borne by the indirect exporter. In light of the indirect exporter’s markup being greater than the intermediary’s markup on the same product, the producer of good \(i\) has a larger margin than intermediary \(j\) for adjusting the corresponding price.

\(^{14}\)Regardless of the export mode that is used, the extent of the price adjustment (that is, the absolute value of the export price elasticity to the RER) is always increasing with firm productivity (as in Berman et al. [2012]) and the size of the foreign market, whereas it is decreasing with the level of iceberg trade costs.

\(^{15}\)Notice that it will not be possible to empirically test the relative contribution of manufacturers and intermediary exporters to the price adjustment: in the dataset employed in Section 4, one cannot observe the procurement price \(p_{ij}\). We then leave this exercise to further work.
3.3 Adjustment in the export mode choice to exchange rate movements

Section 3.2 has shown that, in the event of real exchange rate movements, different types of exporters adjust their export prices to a different extent. In this section, we focus instead on the adjustment that any manufacturing firm puts in place regarding the choice of whether serving the foreign market, if so, whether to do so directly or indirectly.

In our model, any producer self-selects as non-exporter, indirect exporter or direct exporter based on the well-known mechanism of productivity sorting. As shown in Appendix A1, the condition to be imposed for the emergence of this pattern is simply \( \lambda < \bar{\lambda} = 1/2 \), which ensures that manufacturing firms, when choosing indirect export, save enough on the fixed cost of export to compensate for the implicit cost of double marginalization. Under this assumption, the cut-off level of productivity for direct export, namely,

\[
\varphi_{X^{\text{dir}}} = \frac{w^* \varepsilon \tau}{a - dQ^* - 2\sqrt{2bw^*\varepsilon(1-\lambda)f_X}},
\]  

turns out to be higher than the cut-off level for indirect export, which is

\[
\varphi_{X^{\text{ind}}} = \frac{w^* \varepsilon \tau}{a - dQ^* - 2\sqrt{2bw^*\varepsilon\lambda f_X}}.
\]

This means that the most productive firms (those with productivity higher than \( \varphi_{X^{\text{dir}}} \)) will export directly; firms with intermediate levels of productivity will resort to intermediaries to reach the overseas market; finally, the least productive firms (those with productivity lower than \( \varphi_{X^{\text{ind}}} \)) will serve the domestic market only. A pattern of the same type emerges in other models of export intermediation, such as Ahn et al. (2011) and Felbermayr and Jung (2011); and it is well documented by empirical evidence (Davies and Jeppesen, 2015; Grazzi and Tomasi, 2016). A derivation of this result is provided in Appendix A1 for the purpose of showing that the conditions that we impose for the emergence of this pattern have similar implications to those required in simpler models with Dixit-Stiglitz markups.

To proceed with the analysis on the effects of exchange rate shocks, we now introduce a simplifying assumption on how firm productivity is distributed. With limited loss of generality, it is enough to assume that both export cut-offs always occur in the domain of the density function in which firm density is strictly decreasing and convex in the level of marginal productivity. Quite obviously, the more restrictive case in which \( G(\varphi) \) is Pareto with shape \( \theta > 0 \) would ensure the assumption above to be always verified. Moreover, for trade to exist, \( f_X \) must be bounded from above, in such a way that both \( \varphi_{X^{\text{dir}}} \) and \( \varphi_{X^{\text{ind}}} \) are strictly positive (see Appendix A2).

\[\text{In the trade literature on heterogeneous firms and monopolistic competition, particularly on that inspired by Melitz (2003), assuming CES preferences and Pareto productivity in the manner of Chaney (2008) largely increases model tractability, yet at the cost of firm sales being Pareto-distributed, too. This is challenged by the empirical evidence, which seems to be more in favor of a log-normal distribution (Head et al., 2014; and Eaton et al., 2011). However, the Pareto matches well the upper tail of the observed sales distribution, where most of global trade actually occurs (exporting firms are indeed typically larger and more productive than the others). Moreover, a recent work of Mrázová et al. (2015) shows that, to explain sales and markup distributions, the assumptions about the structure of the demand function are far more relevant than the choice between a Pareto and a log-normal distribution for firm productivity. For all these reasons, the class of monotonically decreasing distributions, hence including Pareto, appears appropriate.}\]
First, notice that according to equations (8) and (9), both the export cut-offs turn out to be increasing in $f_X$. Hence, the higher the fixed cost of exporting is, the higher the critical level of productivity for either direct or indirect entry in the foreign market and the fewer the domestic varieties that will be shipped abroad in one of the two modes. Under Pareto, this will also imply that the higher the level of the fixed cost is, the larger the measure of varieties exported indirectly (namely $N^{ind}$) over the whole measure of varieties exported either directly or indirectly to the foreign market ($N^{tot}$). As shown in Appendix A2, the ratio between these two measures, namely,

$$\frac{N^{ind}}{N^{tot}} = 1 - \left(\frac{\varphi_{X^{ind}}}{\varphi_{X^{dir}}}\right)^\theta,$$

is indeed strictly increasing in $f_X$. While a direct empirical validation of this result is reported in Appendix B1, indirect evidence is provided by the finding of [Bernard et al. (2015)], according to which the incidence of wholesale export in a given location tends to be larger, the higher the level of trade barriers incurred in that country. However, notice that we look here at the measure of varieties exported, rather than at the value of the corresponding export transactions.

Second, let us focus on the shift of the export cut-offs induced by real exchange rate shocks. Both $\varphi_{X^{dir}}$ and $\varphi_{X^{ind}}$ are increasing in $\varepsilon$, which means that real appreciations will induce marginal direct exporters to switch to indirect export; and marginal indirect exporters to exit the export market and serve the domestic market only. Furthermore, the elasticities of both cut-offs to real exchange rate movements turn out to be increasing with the level of country fixed costs (see Appendix A2). This implies that the more difficult it is to enter into a foreign market, the greater the measure of varieties that, following a real exchange rate appreciation, will switch from being exported directly to being exported indirectly and from being exported indirectly to exiting the foreign market.\footnote{Following the approach used in most of our closest relatives (e.g. Ahn et al. 2011, Akerman forthcoming, Chatterjee et al. 2013), our theory abstracts away from any inter-temporal element which might affect the firm’s choice to stay in the foreign market or leave it, possibly related to the incidence of the “sunk-cost” component over the total fixed cost of export.}

Nevertheless, $\lambda < \bar{\lambda}$ implies that $\varphi_{X^{dir}}$ is more elastic to real exchange rate movements than $\varphi_{X^{ind}}$. In the event of a real appreciation, we should therefore expect the direct export cut-off to shift relatively more than the cut-off for indirect export; even more so, this would be observed when $f_X$ is large, as higher fixed costs tend to amplify the elasticity of both cut-off levels.

This fact generates ambiguous implications on the relative change in the number of varieties exported directly and indirectly to the foreign market in the aftermath of a real exchange rate movement. Nevertheless, some predictions in this regard can be still derived from the model, relying on the properties of the Pareto distribution.

To unravel the reasoning, let us assume that a real appreciation occurs, so that domestic products that manage to reach the foreign market will be fewer. We denote with $\varphi'_{X^{ind}}$ and $\varphi'_{X^{dir}}$ the new levels of the export cut-offs following the real exchange rate movement, with $\Delta^{ind}$ the overall measure of varieties that switch from being exported indirectly to serving only the domestic market (i.e., exit the foreign market) and with $\Delta^{dir}$ the measure of varieties that switch from being exported directly to being exported indirectly (i.e., change the mode of export).
When $G(\varphi)$ is Pareto, the ratio between the two measures, namely,
\[
\frac{\Delta^{\text{ind}}}{\Delta^{\text{dir}}} = \frac{(\varphi_{X}^{\text{ind}})^{-\theta} - (\varphi'_{X}^{\text{ind}})^{-\theta}}{(\varphi_{X}^{\text{dir}})^{-\theta} - (\varphi'_{X}^{\text{dir}})^{-\theta}},
\]
turns out to be strictly increasing in $f_{X}$. The same applies to the case of real depreciation, when $\Delta^{\text{ind}}$ denotes the measure of varieties that switch from being domestic to serving foreign market through intermediaries (i.e., entry into foreign market) and $\Delta^{\text{dir}}$ is the measure of varieties that switch from the indirect to the direct export channel (i.e., change the mode of export).

While a more formal argumentation can be found in Appendix A2, here we convey the intuition. When $f_{X}$ is high, both $\varphi_{X}^{\text{ind}}$ and $\varphi_{X}^{\text{dir}}$ are located more to the right of the productivity distribution, where firm density is thinner. In the event of a real appreciation, the direct export cut-off increases relatively more than the cut-off for indirect export, the more so the higher $f_{X}$. At the same time, however, the rightward shift of the two cut-offs implies a reduction in firm density that is disproportionately smaller in the class of direct exporters, as their cut-off is the one more to the right, where firm density is thinner. This effect dominates the first and opposed one, induced by the larger shift of $\varphi_{X}^{\text{dir}}$ with respect to $\varphi_{X}^{\text{ind}}$. We can then put forth a new prediction of the effects of exchange rate shocks, to be tested on our data.

**Proposition 3.** In the event of a real appreciation (depreciation), the measure of varieties that switch from being exported indirectly to exiting the foreign market (that enter the foreign market through the intermediated channel) increases compared to the measure of varieties that switch from being exported directly to being exported indirectly (from the indirect to the direct export channel), the higher the level of entry costs incurred in the foreign market.

Under the same assumptions introduced in this section regarding the distribution of firm productivity, Proposition 3 can also be proved to hold in the alternative model of heterogeneous pricing-to-market featuring CES preferences and local distribution costs (see Appendix A3).

4 Data and empirical evidence

4.1 Trade and firm-level data

To test the propositions put forth in the theoretical framework, we employ two datasets collected by the Italian statistical office (ISTAT): Statistiche del Commercio Estero (COE), and Archivio Statistico Imprese Attive (ASIA).

COE contains all cross-border transactions (both exports and imports) of Italian firms over the period 2000-2007. For all export flows defined at the firm-product-destination level we observe

\[
\begin{align*}
\text{As already pointed out above and at greater detail in Appendix A2, the same prediction could be obtained under log-normal or other distributions than Pareto, but only under the restriction of locating both the export cut-offs in the domain of the density function in which firm density is strictly decreasing and convex in the level of marginal productivity.} \\
\text{The database has been made available for work after careful screening to avoid disclosure of individual information. The data were accessed at the ISTAT facilities in Rome.}
\end{align*}
\]

13
both annual values and quantities expressed, respectively, in euros and in kilograms. Products are defined as a six-digit category in the Harmonized System (HS6). Because some product categories are assigned different HS6 product codes at different points in time, we use concordance tables provided by Eurostat to harmonize the classifications to the 2002 version. COE data are used to obtain the unit-values ($\text{UnitValue}_{fcp}$) of the exported varieties as the ratio of export values to export quantities, where the subscripts $f$, $c$, $p$ and $t$ respectively identify firms, HS6 product classes, destination countries and years.

Using the common firm identifier, we link the firm-level export data to ISTAT’s registry of active firms (ASIA), which provides the sectoral classification of businesses for identifying manufacturing and wholesale businesses. We employ the ATECO industrial classification, which is derived from NACE Rev. 1.1, at five digits. More in detail, as in Bernard et al. (2015), we classify firms in sectors 151 to 372 as manufacturers and firms in sectors 501 to 519 (with the exclusion of 502, which concerns the activity of repair of motor vehicles) as wholesalers or intermediaries. The combined dataset that results from matching COE to ASIA is not a sample but includes all active firms and is our preferred dataset for testing the model.

In 2000, manufacturers were responsible for the largest share (85%) of Italian aggregate exports; intermediaries accounted approximately 10%; the share of retailers was less than 1%; and other firms accounted for the remaining 4%. The share of exports generated by intermediaries was slightly but constantly growing from 9.85% in 2000 to 11.27% in 2007. In 2000, the intermediaries’ export share of 10% was due to 26% of Italian exporters classified as wholesalers, whereas the manufacturers’ export share of 85% was generated by 57% of Italian exporters recorded as manufacturing exporters (Bernard et al., 2015). Intermediaries reporting sales abroad are, on average, smaller than exporting manufacturers, albeit this difference largely disappears when considering exports per employee. Furthermore, both exporting intermediaries and manufacturers sell several products to each destination, but the former are active in a wider range of products compared to similarly sized manufacturers. Detailed descriptive evidence on the characteristics of wholesalers and manufacturing exporters, also focusing on product and geographic diversity, is available in Bernard et al. (2011).

The transaction-level data are used to test the propositions put forth in the theoretical setting. Notice that in our data, a relevant share of the manufacturing firms that export directly tends to reach the foreign market with more than one product category. In this respect, the implicit assumption of our model is that each producer can potentially engage in manufacturing many products, but all of all products correspond to businesses that are independent from each other. In the empirical analysis, each product exported by a firm to a destination, i.e., a firm-product-country combination, corresponds to the differentiated variety introduced in the model. Hence, we consider the variety-specific component of the fixed cost of exporting to a specific destination.

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20 ISTAT collects data on trade based on transactions. The European Union sets a common framework of rules but leaves some flexibility to member states. A detailed description of requirements for data collection on trade in Italy is provided by Bernard et al. (2015). Although only annual values which exceed a certain threshold are reported in the dataset, this is unlikely to affect our analyses, as the transactions collected cover about 98% of the total Italian trade flows (http://www.coeweb.istat.it/default.htm).

21 The final dataset is the same as the one employed in Bernard et al. (2015).
as the relevant one, compared to the other component, represented by a standard firm-level sunk cost.\footnote{In principle, neither assuming a pure firm-specific nor a variety-specific formulation for the fixed costs of export appears as fully satisfactory. Under firm-specific costs, it would be hard to justify why multi-product firms tend to react to external shock, such as RER appreciations, by continuing to export only their core products and dropping the marginal products in their portfolio, as documented in Chatterjee et al. (2013).}

### 4.2 Empirical evidence on price elasticity to the real exchange rate

In this section, we test the validity of our model with respect to firms’ price adjustments following a change in the real exchange rate. We focus on Propositions 1 and 2 that relate the export price adjustment in the event of real exchange rate movements to the mode of export. Do intermediary exporters have different price responses to exchange rates than manufacturing exporters?

To explore the sensitivity of the firm’s export price response to annual movements of the exchange rate for a given country-product pair, we explore information on unit values of the exported products and consider the following equation

\[
\Delta \ln \text{UnitValue}_{f, c, p, t} = \beta_0 + \beta_1 D_{W, f, t} + \beta_2 \Delta \ln \text{RER}_{c, t} + \beta_3 \Delta \ln \text{RER}_{c, t} \times D_{W, f, t} + d_j + \nu_{f, c, p, t},
\]

where \(\Delta \ln \text{UnitValue}_{f, c, p, t}\) is annual difference in the (log) unit value of product \(p\) in country \(c\) by individual firm \(f\) between time \(t - 1\) and \(t\), whereas \(d_j\) indicates a set of fixed effects. We denote with \(D_{W, f, t}\) the dummy variable that identifies \(f\) as an intermediary firm (\(W\) stands for wholesaler). The (log) real exchange rate is denoted as \(\ln \text{RER}_{c, t}\), and is here defined as the nominal Italian exchange rate, expressed as the number of foreign currency units per home currency unit (i.e., \(\text{ER}_{c, t}\)), multiplied by the ratio between the domestic consumer price index and the corresponding index abroad (i.e., \(\text{CPI}_{t} / \text{CPI}_{c, t}\)). An upward (downward) movement of the RER therefore represents a real appreciation (depreciation) of the domestic currency. Real exchange rates are measured using data from the International Financial Statistics database (IMF, 2010). In the above equation, both the dependent variable and the RER are defined as annual differences.

The extent to which exchange rate variations are transmitted into consumer prices can be computed as \(\text{ERPT} = 1 - |\beta_2|\) where \(\beta_2\) is the coefficient of \(\text{RER}_{c, t}\) in regressions on \(\text{UnitValue}_{f, c, p, t}\). Accordingly, if exporters do not adjust their export prices in response to exchange rate variations, then \(\beta_2 = 0\) and the ERPT is complete. In contrast, the closer \(|\beta_2|\) is to 1, the greater the offsetting adjustment of export prices to neutralize ERPT into consumer prices. We expect a negative sign for both \(\beta_2\) and \(\beta_3\). While the first coefficient measures the pricing-to-market of manufacturing firms, the second captures the heterogeneity of pricing strategies with respect to the mode of exports. According to Proposition 2 of our model, intermediaries decrease their export price more following an appreciation.

Columns 1 and 2 of Table 1 report the results from the regression model of equation (12). We cluster standard errors at the destination-year level to allow for correlation of the error terms across destination-year; however, the results are robust to alternative treatments of the error terms, such

\footnote{We use annual averages of the monthly official exchange rate, that can be either the rate determined by national authorities or the rate determined in the legally sanctioned exchange market.}
Table 1: Firm’s unit value elasticity to exchange rate movements

<table>
<thead>
<tr>
<th>Dep. Var.</th>
<th>Δ ln UnitValue_{f,pt}</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>D_{ft}^{W}</td>
<td>-0.002</td>
</tr>
<tr>
<td>Δ ln RER_{ct}</td>
<td>-0.032***</td>
</tr>
<tr>
<td>×D_{ft}^{W}</td>
<td>-0.022**</td>
</tr>
</tbody>
</table>

| Country FE | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes |
| Product FE | Yes | No | No |
| Firm-Product FE | No | Yes | Yes |
| Clustering Country-Year | Yes | Yes | Yes |

| Adj. R-squared | 0.002 | 0.034 | 0.033 |
| Observations | 4,008,339 | 4,008,339 | 3,655,626 |

Note: Table reports the results of regressions at the firm-product-country level, obtained by using data on unit values between 2000 and 2007. The dependent variables and the real exchange rates (RER) are defined as annual differences. D_{ft}^{W} is a dummy for intermediaries; × D_{ft}^{W} is the interaction term with real exchange rates in annual differences. In columns 1 and 2 the real exchange rate is created by using the consumer price index, while in column 3 we use the wholesale price index. Robust standard errors clustered at country-year level are reported in parenthesis below the coefficients. Asterisks denote significance levels (***: p<1%; **: p<5%; *: p<10%). Source: Our elaboration on Italian micro-data.

as clustering by destination. In column 1, we show the estimated coefficient from a specification that includes year, country and product fixed effects to control for time trends and shocks that affect all firms exporting the same HS6 product and serving the same destination. Column 2 reports the results from a specification including year, destination and firm-product fixed effects, which thereby also takes into account possible idiosyncratic firm-product attributes that might be correlated with the evolution of export value, prices or quantities.

The results of columns 1 and 2 represent a direct test of Propositions 1 and 2 of the theoretical framework that we propose here. Unit values decrease both for manufacturers and intermediaries, which is coherent with what was put forth in Proposition 1. The coefficient on Δ lnRER_{ct}, i.e., β2, corresponds to the average elasticity of export prices to RER variations for manufacturing firms. The exchange rate elasticity of export prices for these firms is estimated to be in a range between -0.029 and -0.032, which implies an exchange rate pass-through into the import prices of approximately 0.97. The interaction term between exchange rates and a dummy for wholesaler D_{ft}^{W} reveals that price adjustment is larger for intermediaries, as predicted by Proposition 2 of our model. According to column 1, the estimated exchange rate elasticity of wholesalers’ export prices is approximately -0.05, which implies an exchange rate pass-through into the import prices of about 0.97.

Using the same dataset, Bernini and Tomasi (2015) find an exchange rate pass-through into import prices of about 0.97. Using similar micro-level data for French exporters, Berman et al. (2012) find an exchange rate pass-through of around 0.88, while in Chatterjee et al. (2013) the producer price elasticity for Brazilian exporters is estimated to be of approximately 0.23, implying 0.77 pass-through.
of approximately 0.95. When considering the firm-product fixed effects, column 2, the effect is slightly larger with an elasticity to RER movements of about -0.06.

As reported in column 3 of Table II using a wholesale price index to construct the RER reduces the number of countries in the sample, but does not affect the main results.

Table 2: Firm’s unit value elasticity to exchange rate movements: firms, product and country characteristics

<table>
<thead>
<tr>
<th>Dep. Var</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Δln RER_{ct}</td>
<td>-0.031**</td>
<td>-0.026**</td>
<td>-0.026**</td>
<td>-0.032**</td>
<td>0.138</td>
<td>-0.188***</td>
<td>-0.028**</td>
</tr>
<tr>
<td>×DW_{ft}</td>
<td>(0.017)</td>
<td>(0.016)</td>
<td>(0.014)</td>
<td>(0.013)</td>
<td>(0.088)</td>
<td>(0.040)</td>
<td>(0.010)</td>
</tr>
<tr>
<td>×In Nce_{ft}</td>
<td>-0.030**</td>
<td>-0.020**</td>
<td>-0.048***</td>
<td>-0.062**</td>
<td>-0.060**</td>
<td>-0.042***</td>
<td>-0.034**</td>
</tr>
<tr>
<td>×ln Npc_{fct}</td>
<td>0.013</td>
<td>(0.010)</td>
<td>(0.014)</td>
<td>(0.029)</td>
<td>(0.029)</td>
<td>(0.013)</td>
<td>(0.013)</td>
</tr>
<tr>
<td>×ln Empl_{ft}</td>
<td>-0.009**</td>
<td>0.001</td>
<td>(0.004)</td>
<td>(0.004)</td>
<td>(0.004)</td>
<td>(0.004)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>×ln TFP_{ft}</td>
<td>-0.010**</td>
<td>-0.035**</td>
<td>(0.013)</td>
<td>(0.013)</td>
<td>(0.013)</td>
<td>(0.013)</td>
<td>(0.013)</td>
</tr>
<tr>
<td>×Market Costs_{c}</td>
<td>0.017</td>
<td>(0.016)</td>
<td>(0.017)</td>
<td>(0.017)</td>
<td>(0.017)</td>
<td>(0.017)</td>
<td>(0.017)</td>
</tr>
<tr>
<td>×Governance Indicator_{c}</td>
<td>-0.017</td>
<td>-0.054</td>
<td>(0.055)</td>
<td>(0.055)</td>
<td>(0.055)</td>
<td>(0.055)</td>
<td>(0.055)</td>
</tr>
<tr>
<td>×min(entry,exit)_{p}</td>
<td>0.205***</td>
<td>(0.050)</td>
<td>(0.050)</td>
<td>(0.050)</td>
<td>(0.050)</td>
<td>(0.050)</td>
<td>(0.050)</td>
</tr>
<tr>
<td>×Relation Specificity_{p}</td>
<td>0.205***</td>
<td>(0.050)</td>
<td>(0.050)</td>
<td>(0.050)</td>
<td>(0.050)</td>
<td>(0.050)</td>
<td>(0.050)</td>
</tr>
<tr>
<td>Country FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Firm-Product FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Clustering Country-Year</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Adj. R-squared</td>
<td>0.034</td>
<td>0.033</td>
<td>0.034</td>
<td>0.035</td>
<td>0.034</td>
<td>0.033</td>
<td>0.033</td>
</tr>
<tr>
<td>Observations</td>
<td>4,008,339</td>
<td>3,852,915</td>
<td>4,008,339</td>
<td>2,136,352</td>
<td>2,136,352</td>
<td>3,843,906</td>
<td>3,807,225</td>
</tr>
</tbody>
</table>

Note: Table reports results of regressions at the firm-product-country level, using data on unit values of exported products for the period 2000-2006. The dependent and independent variables are defined as annual differences. DW_{ft} is a dummy for intermediaries; × DW_{ft} is the interacted dummy; ln Nce_{ft} is the (log) number of countries a firm is exporting to; ln Npc_{fct} is the (log) number of product-countries a firm is exporting; ln Empl_{ft} is the (log) number of employees; ln TFP_{ft} is the (log) total factor productivity. In Column 4 we re-run the baseline model on the restricted sample, including only firms in Micro.3. All the regressions include these variables interacted (×) and in level (not shown in the Table). Robust standard errors clustered at country-year level are reported in parenthesis below the coefficients. Asterisks denote significance levels (***: p<1%; **: p<5%; *: p<10%).

Source: Our elaboration on Italian micro-data.

4.2.1 Robustness checks

In this section, we consider a set of exercises to test the robustness of our results to the inclusion of additional controls in the baseline specification and changes in the sample composition. Because
firm-product fixed effects provide a better control for firms’ idiosyncratic attributes, they will be included in all the specifications that follow.

As a first robustness check, we run equation \(12\) by including the (log) number of countries \((\ln N_{cft})\) to which a firm is exporting and its interaction with \(RER\), thereby controlling for the possible shift of exports to other countries in response to real exchange rate appreciation. This regression is reported in column 1 of Table 2. Moreover, since the sunk entry costs can be at country-product level, we include the (log) number of country-product pairs \((\ln N_{pc_{fct}})\) where the firm has positive exports, with the exclusion of the country under investigation (so that, even for the same firm, such a variable may take different values across countries). Column 2 of Table 2 reports the results. The main findings are robust across these specifications. The coefficient of the interaction term remains negative and statistically significant, suggesting that export price adjustment is higher (and ERPT is lower) for products exported by wholesale firms.

Although the exchange rate movement can be safely considered as a shock that is exogenous to the firm, as shown for French firms in Berman et al. (2012), the firm-level adjustment might be related to some firm characteristics, such as individual size and productivity. In particular, one might argue that the different responses in terms of unit values between direct exporters and intermediaries may be driven by the lack of specific controls for productivity differences across firms. To perform this check, we first include the (log) number of employees and its interaction with \(RER\) to control for firm size, thereby (indirectly) controlling for firm efficiency: on average, bigger firms are indeed more productive. This test can be done by using the previous sample since the information on firms’ number of employees is available for the the entire population. As a second test, we link our Italian trade data to firm-level characteristics, retrieved from Micro.3, a dataset containing information on 148,604 Italian firms (those with more than 20 employees, 71,437 of which are classified as manufacturers) for the period 1989-2006 (see Grazzi et al., 2013, for further details on the dataset). Using these data, we measure exporters’ productivity by means of the total factor productivity (TFP), as computed by applying the semi-parametric estimation technique of Levinsohn and Petrin (2003). In Appendix B2 (see Table B2), we verify that the results of Berman et al. (2012) also hold for Italian firms.

It is now possible to estimate a slightly modified version of equation \(12\), augmented with the inclusion of a firm’s characteristics \(X_{f_{t-1}}\) and its interaction with \(\Delta \ln RER_{ct}\). Hence, the new equation to be estimated is

\[
\Delta \ln \text{UnitValue}_{f_{pc_t}} = \beta_0 + \beta_1 D_{f_{t}}^W + \beta_2 \Delta \ln RER_{ct} + \beta_3 \Delta \ln RER_{ct} \times D_{f_{t}}^W + \\
+ \beta_4 \Delta \ln RER_{ct} \times \ln X_{f_{t-1}} + \beta_5 \ln X_{f_{t-1}} + d_j + \nu_{f_{pc_t}} ,
\]

where \(\ln X_{f_{t-1}}\) is either a firm’s number of employees or its TFP. Columns 3-5 of Table 2 report the results. In column 3, we control for the response to exchange rate movements by firms of different size. The coefficient of the dummy for wholesalers’ interacted with the RER remains negative and statistically significant, suggesting that ERPT is lower for intermediaries. Moreover, we observe that bigger firms tend to react to a real appreciation by decreasing their export price more.

Linking trade transaction-trade data with the firm-level information contained in Micro.3 significantly reduces the number of observations available. For this reason, in column 4 of Table
we first replicate our baseline model on the restricted sample to check whether the results of the regression might be driven by the selection of relatively larger firms. The restricted sample confirms our findings, according to which, in the event of currency appreciations, intermediaries tend to reduce their unit values more than the manufacturing exporters; hence, the pass-through along the intermediary export channel is lower. As column 5 of Table 2 shows, including the TFP variable, interacted with the annual movement of the RER, does not alter this result.

Previous empirical studies have shown that export intermediaries serve different markets and export different products than manufacturing exporters (Ahn et al., 2011; Bernard et al., 2015; Akerman, forthcoming). Indeed, wholesalers are more likely to sell to markets with high entry costs and typically focus on products with lower contract intensity and a higher level of sunk costs. This is because these firms are able to overcome barriers to international trade at a lower cost than manufacturers, as they can generally spread country or product-specific fixed costs over a wider range of products. It is indeed possible that omitted product and destination-specific characteristics are contributing to the differential responses of firms’ price to exchange rate movements and that the wholesaler dummy is a proxy for these omitted variables.

To alleviate this possible bias, we include interactions of the RER changes with the proxies of country and product fixed costs of export, previously used by Bernard et al. (2015). Specifically, as proxies of country fixed costs we use (i) Market Costs\(_c\), obtained using information on the number of documents for importing, cost of importing and time to import from the World Bank Doing Business dataset and (ii) Governance Indicator\(_c\), built from the World Bank’s Governance dataset. An increase in both variables implies a rise in the associated fixed costs required to export to the country. As proxies of product-fixed costs, we use an industry-level measure of contract intensity developed by Nunn (2007), namely, Relation Specificity\(_p\), and a variable \(\min(\text{entry, exit})\) that is the minimum between the entry rate and the exit rate in that market. The results, reported in column 6 of Table 2, suggest that, even when controlling for the heterogeneous effects of RER movements across countries and products with high fixed costs, exports by intermediaries still feature a lower degree of exchange rate pass-through.

Finally, we add a sensitivity check, reported in column 7 of Table 2, regarding the phenomenon of the so-called “carry-along trade”, i.e., the increasing propensity of manufacturing firms to export products that they do not produce (Bernard et al., 2012). In principle, we would need information on both production and exports at the product level to identify carry-along firms. Since these data are not available, we make an approximation by excluding products that are contemporaneously exported and imported by the same firm, thereby controlling whether the core results of our analysis are driven by the different propensity of manufacturers and wholesalers to engage in pure re-export activities. However, our findings appear robust to these changes.

### 4.3 Empirical evidence on the export mode selection

One further implication of our theoretical framework concerns the extent to which the selection of the export mode is affected by RER movements. In particular, according to Proposition 3 (Section 25) we refer to Bernard et al. (2015) for further details on how these variables are constructed.
Export Modes and Adjustments to Exchange Rate Movements

3.3), granted some mild assumptions on the productivity distribution, one should expect that, following a RER appreciation, the number of varieties that switch from being exported indirectly to exiting the foreign market increases compared to the number of varieties that switch from being exported directly to being exported indirectly, the higher the entry-cost in the foreign market.

Ideally, one would want to track whether a firm that exported directly changes its export mode and starts serving the foreign market through intermediaries in the aftermath of an exchange rate appreciation, thereby observing the measure $\Delta^{dir}$ as defined in Section 3.3. Similarly, we would need to observe whether, in response to a RER movement, a firm that exported indirectly stops serving the foreign markets and sells only domestically, hence observing also $\Delta^{ind}$. In the absence of such information, an indirect way to test Proposition 3 is to proxy $\Delta^{dir}$ using the number of varieties dropped by manufacturing exporters, assuming that these products, which are no longer exported directly, reach the foreign markets through intermediaries. Likewise, the number of varieties dropped by wholesalers proxies for $\Delta^{ind}$, again assuming that, once dropped by intermediary firms, these products are sold in the domestic market only. To this purpose, we count the number of varieties dropped in a given market by the two categories of firms between $t - 1$ and $t$.

To test Proposition 3, we estimate the following regression model at the product-country level

$$\ln \#\text{Drop}_{pct}^W = \beta_0 + \beta_1 \Delta \ln \text{RER}_{ct} + \beta_2 \Delta \ln \text{RER}_{ct} \times D_t^W + \beta_3 \ln \text{RER}_{ct} \times \text{Country Fixed Costs}_c + \beta_4 \ln \text{RER}_{ct} \times D_t^W \times \text{Country Fixed Cost}_c + \beta_5 D_t^W + \beta_6 D_t^W \times \text{Country Fixed Cost}_c + \beta_7 X_t^W + d_j + \nu_{pct},$$

(14)

where $\#\text{Drop}_{pct}^W$ is the number of varieties of product $p$ in country $c$ dropped by the wholesale and the manufacturing categories (the former identified by $W$) between $t - 1$ and $t$. $D_t^W$ is a dummy that takes the value 1 for the wholesale category and zero for manufacturers, while $\Delta \ln \text{RER}_{ct}$ is the change in the (log) real exchange rate of the Italian currency vis-à-vis the currency of the partner country $c$. As before, we proxy the variable Country Fixed Costs$_c$ either with Market Cost$_c$, obtained from the World Bank Doing Business dataset, or with Governance Indicator$_c$, from the World Bank’s Governance dataset. To control for attributes that might be associated with the difference between the dropping behavior of the two groups, i.e., manufacturers and wholesalers, we include a vector of controls, denoted as $X_t^W$. As indeed shown by Bernard et al. (2011), there are significant differences between wholesale and manufacturing exporters in terms of both product and geographic diversity. To account for this, we include a proxy for the product diversification of the two categories, namely, $\ln \text{NP}_{pct}^W$, which is the (log) number of products exported to country $c$ at time $t$; and a proxy for their geographic diversification, namely, $\ln \text{NC}_{pct}^W$, which is the (log) number

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26 To avoid capturing the effect of external causes of firm mortality, we restrict the analysis to wholesalers and manufacturers that keep on serving the foreign market in two consecutive years. Our findings are anyway robust when including the number of varieties dropped by firms disappearing between $t - 1$ and $t$. These results, available upon request, appear to be driven by the fact that, both among wholesalers and manufacturers, relatively few firms exit each year, accounting on average for around 5% of the observations.
of countries served with product \( p \) at time \( t \). In the regression we also include year and product-country fixed effects that allow controlling for the possibility that the category of wholesalers might export to country \( c \) products with characteristics that make them more likely to be dropped.

The coefficients \( \beta_1 \) and \( \beta_1 + \beta_2 \) capture the effect of RER movements for the categories of manufacturers and wholesalers, respectively, when they are exporting to a country characterized by low fixed costs of entry. We then focus on the triple interaction term \( \Delta \ln \text{RER}_{ct} \times D^W_t \times \text{Country Fixed Costs}_c \) to assess the differential responses of the two export channels in their adjustment in the aggregate number of varieties exported to relatively more difficult markets, in the aftermath of a RER shock. Specifically, when country fixed costs are high, the effect for the category of wholesalers is given by the sum of the coefficients \( \beta_1 + \beta_2 + \beta_3 + \beta_4 \), while the impact for manufacturers is measured by \( \beta_1 + \beta_3 \).

Estimation results are reported in Table 3. Columns 1 to 3 show the results when using the variable Market Cost\(_c\) as a proxy of country fixed costs, while columns 4 to 6 run the same regressions using Governance Indicator\(_c\). In columns 1-2 and 4-5, Market Cost\(_c\) and Governance Indicator\(_c\) are dummies that take the value 1 if the country is characterized by high fixed entry costs and zero otherwise. We define the dummies using the median (column 1 and 4) or the mean (column 2 and 5) as a threshold to distinguish between high and low entry costs. In columns 3 and 6, we run the regression using Market Cost\(_c\) and Governance Indicator\(_c\) as continuous variables.

Proposition 3 is tested by capturing the extent to which the reaction of the wholesale category compared to the manufacturing category depends on the level of country fixed costs. The relative magnitude of the estimated coefficients can be used to compute the total effect for wholesale firms in relation to the level of the fixed costs. By taking column 1 as example, we observe that in markets that are more difficult to access (Market Costs\(_c\) = 1), a 10% increase in the exchange rate implies a 2.6% drop in the number of varieties exported by the wholesale category (\( \beta_1 + \beta_2 + \beta_3 + \beta_4 \)), while the effect is reduced to 2% for the manufacturing category (\( \beta_1 + \beta_3 \)). This result holds across the different specifications and using the two different proxies for country fixed costs. This is in line with Proposition 3 delivered by our model, put forth in Section 3.3.

Moreover, consistent with our model, we observe that for both the wholesale and the manufacturing categories, adjustments to exchange rate variation turn out to be weaker when serving countries characterized by relatively lower fixed costs. By looking at column 1, we observe that, when exporting to less “difficult” markets (Market Costs\(_c\) = 0), a real exchange rate appreciation of 10% implies a reduction in the number of varieties exported by wholesalers and manufacturers of 0.7% (\( \beta_1 + \beta_2 \)) and 0.9% (\( \beta_1 \)), respectively. These effects are much smaller than those reported above for markets characterized by high entry costs. This is consistent with the prediction of our theoretical framework, according to which the elasticity of both the productivity cut-offs to the exchange rate is increasing in \( f_X \). Again the results are robust to the alternative specifications.

Notice here that, while in our model, this result is driven by the different RER elasticities of the two export cut-offs in combination with the shape of the distribution of firm productivity, one might also contemplate a different yet coherent micro-level explanation. Intuitively, since intermediaries are less committed to their products than direct manufacturing exporters and since they face lower
fixed costs per product, because of their ability to spread industry-specific fixed costs across many varieties, they can adjust more easily to a negative shock by dropping relatively more products than manufactures.

Table 3: Product dropping in the aftermath of exchange rate movements

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<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
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<td>0.073***</td>
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<td>0.064***</td>
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<td>(0.007)</td>
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<td>× DI&lt;sub&gt;W&lt;/sub&gt;</td>
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<td>0.006</td>
<td>-0.041**</td>
<td>-0.058***</td>
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<td>(0.015)</td>
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<td>(0.021)</td>
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<td>0.064***</td>
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<td>× DI&lt;sub&gt;W&lt;/sub&gt; × Market Costs&lt;sub&gt;c&lt;/sub&gt;</td>
<td>0.082***</td>
<td>0.040**</td>
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<td>(0.012)</td>
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<tr>
<td>× Governance Indicator&lt;sub&gt;c&lt;/sub&gt;</td>
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<td>0.063***</td>
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<tr>
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<td>(0.013)</td>
<td>(0.005)</td>
<td>(0.012)</td>
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<td>(0.007)</td>
</tr>
<tr>
<td>× DI&lt;sub&gt;W&lt;/sub&gt; × Governance Indicator&lt;sub&gt;c&lt;/sub&gt;</td>
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<td>0.070***</td>
<td>0.044***</td>
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<td>0.229***</td>
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<td>(0.005)</td>
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<td>(0.002)</td>
<td>(0.004)</td>
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<td>(0.002)</td>
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<td>0.297***</td>
<td>0.272***</td>
<td>0.286***</td>
<td>0.279***</td>
<td>0.270***</td>
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<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.003)</td>
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<tr>
<td>ln NC&lt;sub&gt;W&lt;/sub&gt;&lt;sub&gt;pt&lt;/sub&gt;</td>
<td>0.309***</td>
<td>0.308***</td>
<td>0.309***</td>
<td>0.309***</td>
<td>0.310***</td>
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<tr>
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<td>1,272,941</td>
<td>1,305,283</td>
<td>1,305,283</td>
<td>1,305,283</td>
</tr>
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</table>

Note: Table reports the results of regressions at product-country-category level, where category refers either to manufacturing and intermediary sector. The dependent variable ln # Drop<sub>W</sub><sub>pct</sub> is the number of varieties of product <i>p</i> exported to country <i>c</i> in year <i>t</i> − 1 but not in year <i>t</i>. DI<sub>W</sub> is a dummy for wholesaler sector; ln NP<sub>W</sub><sub>ct</sub> and ln NC<sub>W</sub><sub>pt</sub> are the number of products exported within country <i>c</i> and the number of countries served with product <i>p</i>, respectively; Deviation<sub>W</sub><sub>pct</sub> measures the relevance of product <i>p</i> in the exports to destination <i>c</i> for each category of firms. All variables are computed at time <i>t</i>. Interaction terms are included in the regressions. Robust standard errors in parentheses are adjusted for clustering by product-country. Asterisks denote significance levels (***: p<1%; **: p<5%; *: p<10%). Source: Our elaboration on Italian micro-data.

This is consistent with the micro-level results reported in Bernard et al. (2011), according to which wholesalers display a larger adjustment on the extensive margin, i.e., the number of distinct products exported by a firm to a country, while their response on the intensive margin, i.e., the average exports, is weaker. Because intermediaries feature a cost advantage and are more prevalent in markets with higher destination-specific fixed costs, this effect should be more pronounced for exports to relatively more difficult countries. At a more aggregate level, this would translate into a result similar to that predicted by our model and verified empirically that is, the total number
of varieties dropped by the wholesale sector is greater than that of dropped by the manufacturing sector, the higher the level of country fixed costs.

5 Conclusions

Previous works have documented a different responsiveness of aggregate direct and indirect exports to exchange rate movements and that intermediaries are relevant, as their presence contributes to generating more stable trade patterns. Starting from this evidence, in this paper, we further delve into the differences between intermediaries and manufacturing firms in terms of their reactions to exchange rate movements. In particular, we investigate through which margins and to what extent adjustment to such an exogenous shock occurs along the intermediated export channel. The paper then contributes to the existing literature on intermediaries in international trade by providing new empirical evidence and offering a theoretical framework able to account for most of the evidence available to date.

Assuming heterogeneous pricing-to-market and double marginalization for goods exported via intermediaries, export prices of intermediaries are more responsive to RER movements, implying a lower pass-through. This theoretical prediction has been tested on Italian export transactions at the firm-product-country level, and the evidence available supports our theory.

Moreover, manufacturing firms may react to exchange rate shocks by reconsidering whether to serve the foreign market and, if so, whether to do so directly or indirectly. In this regard, our theory predicts, that in the event of a real appreciation, the measure of varieties that switch from being exported indirectly to exiting the overseas market will increase compared to the measure of varieties that switch from being exported directly to being exported indirectly, the higher the level of entry costs incurred in the destination market. Empirically, we look at the number of varieties dropped by the manufacturing sector, as a reflection of the direct exporters’ decision to switch their export mode from direct to indirect export, and at the number of varieties dropped by the wholesale sector, as a reflection of the indirect exporters’ choice to stop export activities. As predicted by our theory, the level of entry costs in the overseas market is crucial to determine whether there are more adjustments in terms of number of varieties in the wholesale sector or in the manufacturing sector.

Our model offers insights to interpret the different behavior of export intermediaries and manufacturing exporters and to understand how such differences contribute to shaping the aggregate patterns of trade flows. Our findings also help explain cross-country heterogeneity in the sensitivity of aggregate behavior to exchange rate variation. Notwithstanding, a few relevant questions remain open for further research.

First, our findings on the relative propensity of direct and indirect exporters to adjust their behavior to real appreciations/depreciations are derived from a partial equilibrium analysis, which ignores the interdependence (at the firm level) of exports, export mode and pricing decisions across markets. For a more comprehensive analysis of the effects of exchange rate shocks, one might want to consider a more sophisticated variant of our model, augmented with the inclusion of multi-product firms and featuring a structure of the fixed costs of export with multiple layers. This would
help clarify first to what extent these costs are sunk or not; and, second, to what extent they are product- and/or market- specific, with clear implications for the type of adjustment that firms may use in response to exogenous trade shocks.

Second, our theory could be of some use in quantifying the welfare effects of the existence and size of the sector of export intermediation, thereby establishing whether these effects are positive or negative. At first, our evidence in this respect is of a positive impact: by being more flexible along different margins, wholesalers can contribute to generating more stable trade at both firm and aggregate levels. Indeed, whenever they are hit by a negative shock, intermediaries adjust along different margins and contribute to lowering the response of aggregate exports. However, as noted by Bai et al. (2016), exporting indirectly may reduce the learning-by-exporting of some manufacturing firms, with negative dynamic implications for social welfare. Moreover, Antrás and Costinot (2011) have shown that welfare gains from the presence of trade intermediaries may significantly differ (and even turn negative) under different market institutions, which can limit intermediaries to being necessarily local, when global ones might be overall more efficient. To understand this issue, it will be key to finally shed light on what sort of relationship is typically established between indirect exporters and trade intermediaries, going beyond the simplifying assumptions of random matching and symmetric intermediary firms. Needless to say, this will require an appropriate set of data.

References


Export Modes and Adjustments to Exchange Rate Movements


Appendix A: Mathematical Appendix

A1 - Self-selection in the markets and choice of the mode of export

This Appendix illustrates the result of productivity sorting in the selection of the mode of export of each producer.

For manufacturing firm $i$, expected profits from direct and indirect export sales are, respectively,

$$\pi_i^* = (p_i^* - \tau/\varphi_i) \cdot q^*(p_i^*) - f_{X_{\text{dir}}}$$

and

$$\pi_{ij} = (p_{ij} - 1/\varphi_i) \cdot \tau \cdot q^*(p_{ij}^*) - f_{X_{\text{ind}}},$$

where $f_{X_{\text{dir}}} = f_X$ and $f_{X_{\text{ind}}} = \lambda f_X$. Given prices in (1), (4) and (5), exporting directly will be profitable for all firms with productivity higher than $\varphi_X$, as defined in (2); exporting via intermediaries will instead yield positive profits to all firms with productivity higher than $\varphi_{X_{\text{ind}}}$, that is, the threshold established in (9).

Consider now a generic firm $i$, which is productive enough to comply with both these conditions. To establish its preferences over the export mode, notice that $\pi_i^* > \pi_{ij}$ necessarily requires $\varphi_i > \varphi_{X_{\text{dir}}}$, where the latter is the critical level of productivity delivered in (8). It is easily proved that $\varphi_{X_{\text{dir}}} > \varphi_{X_{\text{ind}}}$, as long as $\lambda < \bar{\lambda} = 1/2$. Under this mild assumption, a standard productivity sorting pattern arises:

- the most productive firms (those with productivity $\varphi_i > \varphi_{X_{\text{dir}}}$) will export directly, as they are productive enough to take the fixed cost of export themselves, thereby avoiding double marginalization for their products;
- firms with intermediate levels of productivity (those with $\varphi_i \in (\varphi_{X_{\text{ind}}}, \varphi_{X_{\text{dir}}})$) will export through the intermediary sector;
- the least productive firms (those with productivity $\varphi_i \in (\varphi_{D}, \varphi_{X_{\text{ind}}})$) will not engage in export activity and will serve the domestic market only.

The existence of a range of non-traded products, in particular, hinges on the following condition:

$$\varphi_{X_{\text{ind}}} > \varphi_D = 1/(a - dQ - 2\sqrt{bD}),$$

which means that a lower bound for the entry cost in the foreign market must be imposed, given the cost to be paid for entry in the domestic market.

It is worth noting that the assumption on the size of $\lambda$ implies not only $\varphi_{X_{\text{dir}}} > \varphi_{X_{\text{ind}}}$, but also $\varphi_{X_{\text{dir}}} > \varphi_X$ and $\varphi_{X_{\text{ind}}} < \varphi_X$. Hence, we can pose

$$\lambda \in (0, 1/2) \Rightarrow \varphi_{X_{\text{ind}}} < \varphi_X < \varphi_{X_{\text{dir}}}.$$  

The above result can be interpreted as follows. When the fixed cost of export is significantly reduced by the presence of trade intermediaries, then the basket of products exported by wholesale firms will include both: (i) varieties produced by manufacturers that would be able to export by their own, even in the absence of an intermediation sector, but find more profitable to use intermediaries, when the latter are available; and (ii) varieties produced by firms that, because of lower marginal productivity, would not be able export if not assisted.

This is fully in line with what has been predicted and/or observed in previous studies, such as [Ahn et al. (2011)] or [Akerman [forthcoming]].
A2 - Adjustment in the number of products per export mode

This appendix provides a more formal ground for the results put forth in Section 3.3. First, we derive the admissible range of values for the level of the entry costs in the foreign market, such that trade may exist. According to (8) and (9), both the export cut-offs are positive numbers when

\[ f_X < \min \left\{ \frac{(a - dQ^*)^2}{8bw^*\varepsilon(1 - \lambda)}, \frac{(a - dQ^*)^2}{8bw^*\varepsilon\lambda} \right\}, \]

where the minimum is represented by the first term in brackets for any \( \lambda < 1/2 \); and by the second otherwise. Furthermore, the same condition on \( \lambda \) implies that \( \varphi_{X_{dir}} > \varphi_{X_{ind}} \), in line with the evidence that the most productive firms tend to export by their own. We then set at \( \bar{\lambda} = 1/2 \) the upper bound for the value of parameter \( \lambda > 0 \); and at \( \bar{f}_X = (a - dQ^*)^2/[8b(1 - \lambda)w^*\varepsilon] \) the one for the level of \( f_X \). Now, let us assume that \( G(\varphi) \) is Pareto with shape \( \theta > 0 \). The measure of varieties exported indirectly to the foreign market is then

\[ N_{ind} = \int_{\varphi_{X_{ind}}}^{\varphi_{X_{dir}}} \frac{\varphi}{(\varphi_i)^{\theta+1}} d\varphi_i = -\left[ \varphi^{-\theta} \right]_{\varphi_{X_{ind}}}^{\varphi_{X_{dir}}} = (\varphi_{X_{ind}})^{-\theta} - (\varphi_{X_{dir}})^{-\theta}, \]

whereas the overall measure of varieties exported there, either directly or indirectly, is

\[ N_{tot} = \int_{\varphi_{X_{dir}}}^{+\infty} \frac{\varphi}{(\varphi_i)^{\theta+1}} d\varphi_i = -\left[ \varphi^{-\theta} \right]_{\varphi_{X_{dir}}}^{+\infty} = (\varphi_{X_{dir}})^{-\theta}, \]

The ratio between these measures, reported in equation (10), can now be expressed as

\[ \frac{N_{ind}}{N_{tot}} = 1 - \left( \frac{c - \xi_1\sqrt{f_X}}{c - \xi_2\sqrt{f_X}} \right)^{\theta}, \]

where \( c = a - dQ^* \), \( \xi_1 \equiv 2\sqrt{2bw^*\varepsilon(1 - \lambda)} \) and \( \xi_2 \equiv 2\sqrt{2bw^*\varepsilon}\bar{\lambda} \). For \( \lambda \in (0, \bar{\lambda}) \) it is easily proved that \( \xi_1 > \xi_2 > 0 \); given \( f_X \in (0, f_X) \), the ratio \( N_{ind}/N_{tot} \) is therefore strictly increasing with the level of \( f_X \). This means that the higher is the level of entry costs in the foreign market, the higher the proportion of varieties exported indirectly (\( N_{ind} \)) over the total measure of varieties exported to the foreign market (\( N_{tot} \)).

We now turn our attention to the effects of RER shocks on the measure of varieties traded along the two export channels. As stated in Section 3.3, the direct export cut-off is more sensitive to real exchange rate variation than the cut-off for indirect export. For \( \lambda \in (0, \bar{\lambda}) \) and \( f_X \in (0, f_X) \), the elasticity of \( \varphi_{X_{dir}} \) with respect to \( \varepsilon \), namely,

\[ E_{\varphi_{X_{dir}}; \varepsilon} = 1 + \frac{\sqrt{2bw^*\varepsilon(1 - \lambda)f_X}}{a - dQ^* - \sqrt{2bw^*\varepsilon(1 - \lambda)f_X}} > 0, \]

is larger than the corresponding elasticity of \( \varphi_{X_{ind}} \), that is

\[ E_{\varphi_{X_{ind}}; \varepsilon} = 1 + \frac{\sqrt{2bw^*\varepsilon\lambda f_X}}{a - dQ^* - \sqrt{2bw^*\varepsilon\lambda f_X}} > 0. \]

Hence, a given variation in \( \varepsilon \) will lead to a wider shift of \( \varphi_{X_{dir}} \) compared to \( \varphi_{X_{ind}} \). Moreover, under all the restrictions imposed so far on the value of model parameters, both \( E_{\varphi_{X_{dir}}; \varepsilon} \) and \( E_{\varphi_{X_{ind}}; \varepsilon} \)
turns out to be increasing with the level \( f_X \in (0, \bar{f}_X) \). The same percentage change in the RER will therefore induce a proportionally wider shift of both the entry cut-offs in markets that are more difficult to access (high \( f_X \)); and a less pronounced shift in markets that are more easily accessible (low \( f_X \)).

To proceed with the analysis, we denote the change in the RER with respect to the foreign country as a movement from \( \varepsilon \) to \( \varepsilon' = \gamma \varepsilon \), with \( \gamma > 0 \), so that the change may correspond to either a real appreciation or a real depreciation. The productivity cut-offs will consequently move from \( \varphi_{X_{dir}} \) to \( \varphi'_{X_{dir}} \) and from \( \varphi_{X_{ind}} \) to \( \varphi'_{X_{ind}} \), where the new values are obtained from equation (8) and (9), plugging \( \varepsilon' = \gamma \varepsilon \), instead of \( \varepsilon \).

Some of the varieties that keep being exported to the foreign market will now switch from the indirect to the direct export channel, in case of depreciation, or from the direct to the indirect channel, in case of appreciation. The measure of these “switching” varieties is

\[
\Delta_{dir} = \int \frac{\theta}{\varphi_{X_{dir}}} d\varphi_i = - \left( \frac{\varphi_{X_{dir}}^{-\theta}}{\varphi_{X_{dir}}} \right) \left( \frac{\varphi'_{X_{dir}}^{-\theta}}{\varphi_{X_{dir}}} \right) - \left( \frac{\varphi_{X_{dir}}^{-\theta}}{\varphi_{X_{dir}}} \right).
\]

At the same time, some other varieties will enter (or re-enter) the foreign market or exit, following, respectively, real depreciation or appreciation. The measure of this “entry/exit” varieties is

\[
\Delta_{ind} = \int \frac{\theta}{\varphi_{X_{ind}}} d\varphi_i = - \left( \frac{\varphi_{X_{ind}}^{-\theta}}{\varphi_{X_{ind}}} \right) \left( \frac{\varphi'_{X_{ind}}^{-\theta}}{\varphi_{X_{ind}}} \right) - \left( \frac{\varphi_{X_{ind}}^{-\theta}}{\varphi_{X_{ind}}} \right).
\]

The above two measures have a graphical representation in Figure I, where we plot the density of firm productivity and we show the location of the two productivity cut-offs, namely \( \varphi_{X_{ind}} \) and \( \varphi_{X_{dir}} \), before and after a real appreciation occurs (here we consider a real appreciation, as the RER moves for \( \varepsilon \) to \( \varepsilon' = \gamma \varepsilon \), with \( \gamma > 1 \)).

**Figure I**

![Graph showing productivity cut-offs before and after a real appreciation](image)

The productivity cut-offs are plot for a given level of entry costs in the foreign market, which is arbitrary set. In compliance with \( E_{\varphi_{X_{dir}}; \varepsilon} > E_{\varphi_{X_{ind}}; \varepsilon} \) (as established above), \( \varphi_{X_{dir}} \) shifts more
than $\varphi_{X,ind}$. In the figure, the light-grey shaded area corresponds to $\Delta^{ind}$, whereas the dark-grey one to $\Delta^{dir}$. As the figure suggests, whether $\Delta^{ind}$ is larger or smaller than $\Delta^{dir}$ crucially depends on where the export cut-offs are located along the horizontal axis. Shedding light on this point, analytically, would require specifying the magnitude of the RER movement (parameterized by $\gamma$) compared to the level of other variables and parameters of the model, such as $f_X$ and $\theta$ (the shape of the Pareto distribution).

It is however possible to draw some conclusions on the effects of RER shocks, without imposing any further assumption. Indeed, consider the ratio between $\Delta^{ind}$ and $\Delta^{dir}$, as reported in (11). Under Pareto, this ratio can be reduced to a form of the type

$$\frac{\Delta^{ind}}{\Delta^{dir}} = -\frac{[c_1 - \phi_1 \sqrt{f_X}]^\theta + [c_2 - \phi_2 \sqrt{f_X}]^\theta}{[c_3 - \phi_3 \sqrt{f_X}]^\theta + [c_4 - \phi_4 \sqrt{f_X}]^\theta},$$

where $c_j$ and $\phi_j$ with $j = 1, ..., 4$ are, respectively, positive constants and positive coefficients collecting all variables and parameters other than $f_X$. More precisely, their analytical expressions are the following ones:

- $c_1 \equiv a - dQ^*$ and $\phi_1 \equiv 2\sqrt{2bw^*}\gamma\varepsilon\lambda$;
- $c_2 \equiv \gamma(a - dQ^*)$ and $\phi_2 \equiv 2\gamma\sqrt{2bw^*}\varepsilon\lambda$;
- $c_3 \equiv c_1$ and $\phi_3 \equiv 2\sqrt{2bw^*}\gamma\varepsilon(1 - \lambda)$;
- $c_4 \equiv c_2$ and $\phi_4 \equiv 2\gamma\sqrt{2bw^*}\varepsilon(1 - \lambda)$.

Given $\lambda < 1/2$, it is easily proved that $\phi_3 > \phi_1$ and $\phi_4 > \phi_2$. Moreover, if we set $\gamma > 1$ (which corresponds to a real appreciation, with the RER moving from $\varepsilon$ to $\varepsilon' = \gamma\varepsilon$), then it is always verified that $\phi_1 < \phi_2$ and $\phi_3 < \phi_4$. In light of this hierarchy among coefficients, for any value of $\theta > 0$, the ratio $\Delta^{dir}/\Delta^{ind}$ turns out to be inversely related with the level of $f_X < f_X$. We come to the same conclusion when considering the case of real depreciation, with $\gamma < 1$ implying both $\phi_1 > \phi_2$ and $\phi_3 > \phi_4$.

Notice that this result, established as Prediction 3 in Section 3.3, does not imply anything as regard to $\Delta^{dir}$ to be necessarily larger or smaller than $\Delta^{ind}$ at given levels of $f_X$. Neither we have assumed before $N^{dir}$ to be larger or smaller than $N^{ind}$ conditional on $f_X$. We then let empirical evidence shed light on these two possible outcomes.

In concluding, it is worth stressing that $\Delta^{dir}/\Delta^{ind}$ can be proved to be decreasing with the level of entry costs in the foreign market under productivity distributions other than Pareto, such as log-normal, for instance. Yet, in this case we must first verify whether the two cut-offs, $\varphi_{X,ind}$ and $\varphi_{X,dir}$, both before and after the shock in the exchange rate, are located in the part of the domain of $g_\varphi(\varphi)$ where firm density is strictly decreasing and convex in level of $\varphi$.

---

27For sufficiently low variation in $\varepsilon$ (i.e., a value of $\gamma$ sufficiently close to 1), the relation among coefficients is: $\phi_4 > \phi_3 > \phi_2 > \phi_1$ for $\gamma > 1$ (real appreciation) and $\phi_3 > \phi_4 > \phi_1 > \phi_2$ for $\gamma < 1$ (real depreciation). When the RER movement is disproportionately large to become quite unrealistic, the order may turn into $\phi_4 > \phi_2 > \phi_3 > \phi_1$ in the event of real appreciation; and $\phi_3 > \phi_1 > \phi_4 > \phi_2$ in the event of real depreciation. Notwithstanding, even in these cases, the ratio $\Delta^{dir}/\Delta^{ind}$ turns out to be strictly increasing with $f_X$. 

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A3 - An alternative model with heterogeneous pricing-to-market

In this section we consider a model of intermediated trade featuring an alternative source of heterogeneous markups and pricing-to-market, other than a linear demand system à la Melitz and Ottaviano (2008). In particular, we assume CES, instead of quadratic utility; and we introduce distribution costs in each market, to be paid in the local currency, as in Corsetti and Dedola (2005). The resulting setting is similar to the one analyzed in Chatterjee et al. (2013), except for our firms not being multi-product. We allow instead for export intermediation, regulated by the same assumptions put forth in Section 3.1 for the case of our benchmark model.

In this alternative framework, production technology is still linear in the amount of the labor input. Likewise, firm productivity is still drawn from a distribution $G(\varphi)$, that we conveniently assume to be Pareto with shape $\theta > 0$, as done in Appendix A2. The foreign demand for variety $i$ is simply $q^*_{i} = A^*(p^*_i)^{-\sigma}$, where $A^*$ is a demand shifter; $\sigma > 2$ is the elasticity of substitution among varieties; and $p^*_i$ is the consumer price of the variety when expressed in the foreign currency, which is related to the producer price $p^*_i$, set by the exporter, as follows

$$ p^*_i = e p^*_i + \eta^* w^* . $$

In the above expression, $e$ is the nominal exchange rate between the two currencies and $\eta^* w^*$ is the level of the distribution costs, expressed in terms of the wage rate abroad, namely $w^*$.

**Pricing.** Since we assume standard iceberg costs (denoted with $\tau \geq 1$) when shipping goods across borders, the optimal price for a direct exporter is

$$ p^*_i = \mu^*_i \cdot \frac{\tau}{\varphi_i} , \text{ where } \mu^*_i \equiv \frac{\sigma}{\sigma - 1} \left( 1 + \frac{\eta^* \varphi_i}{\sigma \varepsilon \tau} \right) , $$

while the same product, when exported by a generic wholesaler $j$, is priced at

$$ p^*_{ij} = \mu^*_ij \cdot \frac{\tau}{\varphi_i} , \text{ where } \mu^*_ij \equiv \frac{\sigma}{\sigma - 2} \left( 1 + \frac{2\eta^* \varphi_i}{\sigma \varepsilon \tau} \right) . $$

In the above price equations, $\varepsilon = ew/w^*$ (with $w = 1$) denotes the real exchange rate between home and the foreign country. It is straightforward to show that

$$ |E_{p^*_i;\varepsilon}| = \frac{2\eta^* \varphi_i}{\sigma \varepsilon \tau + 2\eta^* \varphi_i} > \frac{\eta^* \varphi_i}{\sigma \varepsilon \tau + \eta^* \varphi_i} = |E_{p^*_ij;\varepsilon}| , $$

where $E_{p^*_i;\varepsilon}$ and $E_{p^*_ij;\varepsilon}$, both defined in the interval $(-1, 0)$, are the export price elasticities to the RER of varieties exported directly and varieties exported by wholesalers, respectively. Exchange rate pass-through is then incomplete for both the categories of exported products; and lower for those exported along the intermediated export channel. Hence, Propositions 1 and 2, as established in Section 3.2, hold also for the model with local distribution costs and CES preferences.

As a main difference with respect to our benchmark model with quadratic utility, it is worth stressing that manufacturing firms here discriminate between foreign consumers and wholesalers providing export intermediation services. Indeed, the indirect exporter’s markup is

$$ \mu_{ij} \equiv \frac{\sigma - 1}{\sigma - 2} \left( 1 + \frac{\eta^* \varphi_i}{(\sigma - 1) \varepsilon \tau} \right) , $$
which differs from $\mu^*_i$, i.e., form the markup applied on direct export sales, already defined above. More precisely, for any admissible value of our parameters, $\mu_{ij}$ turns out to be larger than $\mu^*_i$. Given the structure of the demand, the additional markup imposed by wholesaler $j$ disproportionately reduces the quantity sold in the foreign market, and hence the revenues obtained from these sales. By internalizing this, the indirect exporter raises its own markup, compared to the level that it would apply if exporting directly, thereby extracting more of the surplus of the intermediary. The same does not apply to the case of a linear demand, as the reduction in sales induced by double marginalization is proportional.

This fact implies that, exactly as in the benchmark model (Section 3.2), the overall markup applied on intermediated export sales is larger than the one imposed on direct export sales. Indeed, $\mu^*_{ij} = \mu_{ij} \cdot \mu^*_j$ can be proved to be larger than $\mu^*_i$, since the intermediary’s markup, namely,

$$\mu^*_j \equiv \frac{\sigma}{\sigma - 1} \left( 1 + \frac{\eta^* \varepsilon}{\varepsilon \tau \varepsilon \rho_{ij}} \right) = \frac{\sigma \varepsilon \tau + 2 \eta^* \varphi_i}{(\sigma - 1) \varepsilon \tau + \eta^* \varphi_i},$$

is always larger than 1, albeit lower than $\mu_{ij}$. Hence, also in this case, along the intermediated export channel most of the weight of the overall price adjustment that follows RER movements is borne by the indirect exporter: in formal terms, $|E_{\mu_{ij}; \varepsilon}| > |E_{\mu^*_j; \varepsilon}|$.

**Export mode selection.** In this alternative model of heterogeneous pricing-to-market, the emergence of a standard pattern of productivity sorting requires assuming

$$\lambda < \bar{\lambda} = 2 \left( \frac{\sigma - 2}{\sigma - 1} \right)^{\sigma - 1},$$

which is the counterpart of $\lambda < 1/2$ in the benchmark model with linear demand. Under this mild assumption, the most productive firms will always prefer to export by their own. The direct export cut-off, which is

$$\varphi_{X_{\text{dir}}} \equiv \frac{\varepsilon \tau}{(w^*)^{-\frac{\sigma}{\sigma - 1} \left( \frac{\Psi \Lambda^*}{\varepsilon (1 - \lambda) j_X} \right)^{\frac{1}{\sigma - 1}} - \eta^*}},$$

indeed corresponds to a higher level of productivity than the indirect export cut-off, namely,

$$\varphi_{X_{\text{ind}}} \equiv \frac{\varepsilon \tau}{(w^*)^{-\frac{\sigma}{\sigma - 1} \left( \frac{\Omega \Lambda^*}{\varepsilon (1 - \lambda) j_X} \right)^{\frac{1}{\sigma - 1}} - \eta^*}},$$

Assuming $\lambda < \bar{\lambda}$ has two important implications, the same as in the benchmark model. First, the export cut-off that would arise in the absence of export intermediaries, namely $\varphi_X$, lies in the interval $(\varphi_{X_{\text{ind}}}, \varphi_{X_{\text{dir}}})$: wholesale firms therefore export products that would not be exported if intermediaries were not available, as well as others products that would be exported anyway, but are more profitably traded along the intermediated export channel when this option is viable.

The second implication is $|E_{\varphi_{X_{\text{dir}}}; \varepsilon}| > |E_{\varphi_{X_{\text{ind}}}; \varepsilon}|$, that is, the direct export cut-off is more elastic to the RER than the indirect export cut-off. However, also in this case it can be proved that,

---

28 Both the export cut-off elasticities to the RER turns out to be positive, as far as both $\varphi_{X_{\text{dir}}}$ and $\varphi_{X_{\text{ind}}}$ corresponds to positive numbers. This is true insofar as we impose an upper bound for the level of entry costs in the foreign market, i.e., $f_X < \bar{f}_X = \Psi \eta^* \Lambda^* \lambda^\text{max} / [2(1 - \lambda) \varepsilon (\eta^* w^*)^\varepsilon]$ with $\lambda < \bar{\lambda}$.
when the RER moves, the measure of products that entry/exit the foreign market (i.e., $\Delta^{\text{ind}}$) tends to increase, compared to the measure of products switching from one export mode to the other ($\Delta^{\text{dir}}$), the higher the level of entry costs in the foreign market. Following the same steps reported in Appendix A2, the ratio between these two measures can be expressed as

$$\frac{\Delta^{\text{ind}}}{\Delta^{\text{dir}}} = \left[ \frac{\phi_1 \left( \frac{1}{f_X} \right)^{\frac{1}{\gamma - 1}} - \eta^*}{\phi_3 \left( \frac{1}{f_X} \right)^{\frac{1}{\gamma - 1}} - \eta^*} \right]^\theta - \left[ \frac{\phi_2 \left( \frac{1}{f_X} \right)^{\frac{1}{\gamma - 1}} - d\eta^*}{\phi_4 \left( \frac{1}{f_X} \right)^{\frac{1}{\gamma - 1}} - d\eta^*} \right]^\theta,$$

where $\phi_j$ with $j = 1, \ldots, 4$ are positive coefficients collecting all variables and parameters other than $f_X$ and $\eta^*$; and $\gamma > 0$ gives the direction and size of the RER movement. For any possible combination of the admissible values of such variables and parameters, the hierarchy of the $\phi$ coefficients is such that $\Delta^{\text{ind}}/\Delta^{\text{dir}}$ is always a positive function of $f_X$. Hence, Proposition 3 in Section 3.3 holds also for this alternative model of heterogeneous pricing-to-market with CES preferences and local distribution costs, given a suitable assumption on how firm distributivity is distributed.
Appendix B: Empirical Appendix

B1 - The ratio $N^{ind}/N^{tot}$

We provide evidence that the ratio between the number of varieties exported indirectly (namely $N^{ind}$) and the whole number of varieties exported either directly or indirectly ($N^{tot}$) increases with the level of country fixed costs. For each destination, we compute the total number of varieties (firm-product combinations) exported, and the number of varieties exported indirectly, i.e., through wholesalers. The ratio between these measures is then regressed on a set of country characteristics:

$$
N^{ind}/N^{tot} = \beta_0 + \beta_1 \text{Country Fixed Costs}_c + \beta_2 X_c + d_t + d_p + \epsilon_{tc},
$$

where the variable Country Fixed Costs$_c$ include Market Costs$_c$ and Governance Indicator$_c$ as described in Section 4.2.1. The vector $X_c$ includes a set of country-level controls such as the GDP per capita; the level of population; the corruption perceptions index, taken from the Transparency International Organization; the distance, taken from the CEPII dataset, that proxies for variable trade costs related to transportation expenses; a dummy continent; and finally the average level of tariffs. We also include year and product fixed effects, denoted as $d_t$ and $d_p$, respectively.

Table B1: Number of varieties exported by wholesalers over the total number of exported varieties

<table>
<thead>
<tr>
<th>Dep. Var</th>
<th>$N^{ind}/N^{tot}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Costs$_c$</td>
<td>0.025***</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
</tr>
<tr>
<td>Governance Indicator$_c$</td>
<td>0.034***</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
</tr>
<tr>
<td>ln GDPPC$_{ct}$</td>
<td>-0.010***</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
</tr>
<tr>
<td>ln POP$_{ct}$</td>
<td>-0.013***</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
</tr>
<tr>
<td>ln Dist$_c$</td>
<td>0.025***</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
</tr>
<tr>
<td>Corruption Index$_c$</td>
<td>0.010***</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
</tr>
<tr>
<td>Continent$_c$</td>
<td>-0.003***</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
</tr>
<tr>
<td>Tariff$_{ct}$</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
</tr>
<tr>
<td>Year FE</td>
<td>Yes</td>
</tr>
<tr>
<td>Product FE</td>
<td>Yes</td>
</tr>
<tr>
<td>Clustering Country</td>
<td>Yes</td>
</tr>
<tr>
<td>Adj. R-squared</td>
<td>0.19</td>
</tr>
<tr>
<td>Observations</td>
<td>1,072,523</td>
</tr>
</tbody>
</table>

Note: Table reports the results of regressions obtained by using Italian trade data between 2000 and 2007. Robust standard errors clustered at country level are reported in parenthesis below the coefficients. Asterisks denote significance levels (***: p<1%; **: p<5%; *: p<10%).

Source: Our elaboration on Italian micro-data.
**B2 - Firm’s unit value elasticity to exchange rate movements**

In this Appendix we verify that the result of Berman et al. (2012, BMM hereinafter) holds also for the case of Italian firms. To accomplish this task, we focus on manufacturing firms only and we exploit the same methodology as in BMM to deal with the existence of multi-product firms. Hence, we consider three samples. The first *(Single Product)* contains single product-and-destination specific observations, i.e., observations referred to firms that export only one product to a given location. The second *(Main Product by value)* keeps only the top product (in terms of export value) exported by the firm worldwide. Finally, the last *(Main Product by destination)* considers again the top product only, but here the latter is defined as the variety exported to the largest number of destinations.

The estimated equation is

\[
\ln Y_{fct} = \beta_0 + \beta_1 \ln TFP_{ft-1} + \beta_2 \ln RER_{ct} + \beta_3 \ln TFP_{ft-1} \times \ln RER_{ct} + d_j + \nu_{fct},
\]

where \(Y_{fct}\) is, alternatively, the firm-level unit value or the export value of the single or main product (depending on the sample used), whereas \(\ln TFP_{ft-1}\) denotes the productivity of the firm \(f\) in year \(t - 1\), normalized by the average industry productivity computed in that year. The results, reported in Table B2, are coherent with the findings of BMM: more productive firms tend to increase more their export prices in response to currency depreciations. As a result, their export sales display a smaller increase when compared to those of firms characterized by a lower TFP.

<table>
<thead>
<tr>
<th>Dep.var.</th>
<th>(\Delta \ln \text{UnitValue}_{fct})</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>(\ln TFP_{t-1})</td>
<td>0.027***</td>
</tr>
<tr>
<td>(\Delta \ln RER_{ct})</td>
<td>-0.015</td>
</tr>
<tr>
<td>(\times \ln TFP_{t-1})</td>
<td>-0.005**</td>
</tr>
<tr>
<td>Year FE</td>
<td>Yes</td>
</tr>
<tr>
<td>Firm-Country FE</td>
<td>Yes</td>
</tr>
<tr>
<td>Cluster Country-Year</td>
<td>Yes</td>
</tr>
<tr>
<td>Adj. R-squared</td>
<td>0.951</td>
</tr>
<tr>
<td>Observations</td>
<td>308,748</td>
</tr>
</tbody>
</table>

Note: Table reports results of regressions at the firm-product-country level, using cross-border Italian data on unit values of exported products for the period 2000-2006. We merged the ISTAT trade data with Micro.3, which contains firm-level variables to be used for computing firm-level TFP. We keep single product, main product by value and main product by destination observations and we run the regression as in [Berman et al., 2012].

Source: Our elaboration on Italian micro-data.