Trade Liberalization, Intermediate Inputs and Firm Competitiveness: Direct versus Indirect Modes of Import

Michele Imbruno*

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Abstract

This paper is aimed at studying the impact of input trade liberalization on final good firm’s competitiveness, aggregate productivity and welfare, by developing a theoretical framework à la Melitz (2003), which incorporates: a) trade in final goods/intermediate inputs between similar countries, b) firm’s decisions to import intermediate inputs and to export final output.

This model shows different effects from reducing input tariffs, according to if all intermediates are assumed to be imported directly by final good firms – through incurring additional fixed cost – or indirectly – through an efficient wholesale system, without making any further fixed investment. If all foreign intermediates are ‘indirectly imported’, all final good firms uniformly gain in competitiveness from trade liberalization in intermediates, since they are able to substitute the worst domestic inputs with the best foreign ones (gains from input switching). These uniform competitiveness gains will translate entirely into an increase in consumers’ welfare without any particular firm dynamics within final good sector. Whereas, if all foreign intermediates are ‘directly imported’, only the more productive firms (importers) will be able to use foreign inputs, and therefore enjoy some competitiveness gains from input trade liberalization. Conversely, the other firms (non-importers) will suffer some competitiveness losses, mainly due to a decrease in domestic input varieties available. That would force the least productive firms to exit the domestic market and the least productive exporters to leave international market, causing some business reallocation towards the more productive firms (import-export firms), and consequently some aggregate productivity gains and some final variety losses. Nevertheless, consumer’s welfare seems to increase again by considering altogether these effects.

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*GEP – University of Nottingham. E-mail address: lexmi7@nottingham.ac.uk. The author would like to thank Fabrice Delever and Richard Kneller for their helpful comments and suggestions. All remaining errors remain his own.
1 Introduction

In the last few years, international trade literature has emphasized the important role played by firm heterogeneity in productivity in order to explain the microeconomic relationship between trade openness and economic growth. Most of these studies focus on export behaviour and trade liberalization in final goods, without paying any attention about import behaviour and trade liberalization in intermediate inputs.

Amiti and Konings (2007) first investigated empirically the impact of reducing input tariffs on firms, by isolating importers from other firms. They found that all firms enjoy productivity gains from trade liberalization in intermediate inputs, although importers would benefit relatively more than nonimporters, by arguing that this larger effect for importing firms might be linked to several channels as the theory predicts – such as access to more input varieties, access to higher quality inputs, and learning effects (Ethier 1982; Markusen 1989; Grossman and Helpman 1991). However, they did not attempt to disentangle any single channel and to mention any peculiar reason why nonimporters’ performance also enhances.

1 The majority of empirical studies (from Bernard and Jensen (1995) for US) focus on the export-productivity linkage and show that exporters are actually more productive than non-exporters, because of self-selection mechanism, rather than some post-entry effects – see Wagner (2007) and Greenaway and Kneller (2007) for a survey – as well as productivity gains from trade might arise from resources or market shares reallocation across firms within industry – from the least productive which exit the domestic market (Aw et al. (2000)) and the most productive which also serve international market (Bernard and Jensen (1999)). In light of these facts, Melitz (2003) develops a general equilibrium trade model à la Krugman – i.e. assuming monopolistic competition and increasing returns to scale – with heterogeneous firms, incorporating both self-selection and business reallocation mechanisms, above described.

2 All these theoretical frameworks are based on firm homogeneity assumption. However recently, some empirical evidences have analyzed the import-productivity linkage at a firm-level, arguing importers are on average more productive than non-importers, thanks to some positive post-import effects within firm. In particular, Kasahara and Rodrigue (2008) find importing intermediate goods improves Chilean plant-level productivity, and Halpern et al. (2005) show theoretically and empirically – by using firm-level data from Hungary – as imports raise aggregate productivity, because of an increase in importer-level productivity, as well as some reallocation effects towards importers. Similarly, Gibson and Graciano (2009) develop a trade model à la Melitz by focusing on the import side. They assume there are two different technologies: the first uses only the domestic inputs, and the second one uses both domestic and foreign inputs. In particular, the latter is associated with higher fixed cost compared to the former. Thus, firms would self-select to import inputs, and trade liberalization (or terms of trade improvement) would cause resources reallocation from the least productive firms (exiters) to the best ones (importers) – determining an increase in aggregate productivity (welfare). Halpern, Koren and Szeidl (2009) show more specifically – through a theoretical model and using data from Hungarian firms during 1992-2003 period – that imported inputs generate productivity gains linked to two channels: quality (foreign inputs are better than domestic ones) and complementarity mechanism (gains from intermediates’ combination are larger than the sum of the parts). In particular, they highlight how complementary mechanism governs the quality elasticity of import demand: if intermediates are perfect substitutes, even a small quality improvement would determine a large increase in imports in intermediates; however, if intermediates’ complementarity is strong, import demand would change a little despite a substantial improvement in quality.

3 An increase in nonimporters’ productivity has been attributed to some spillover effects, i.e. importers can transfer their benefits to other firms along the vertical production chain through the sale of their goods,
The main purpose of this paper is to study the impact of trade liberalization in intermediate inputs on final good firm’s competitiveness, aggregate productivity and welfare, by developing a theoretical framework à la Melitz (2003), which incorporates: a) trade in final goods/intermediate inputs between similar countries, b) firm’s decisions to import intermediate inputs and to export final output. In particular, this paper aimed at addressing 1) whether a further channel through which importers improve their competitiveness exists; as well as 2) why and whether nonimporters always benefit from input tariff cutting.

To address the first research question (i), we have to consider that Ethier (1982) demonstrated that trade openness can increase firms’ competitiveness, because firms can access to more differentiated intermediate varieties (*gains from input varieties*). Thus, by considering that firms’ competitiveness is inversely related to the price index of intermediate inputs, which in turn is decreasing in both number and average productivity of input suppliers, he showed that trade liberalization would basically entail an improvement in firm competitiveness thanks to a higher number of input suppliers (or input varieties) available, while the related average productivity remains constant, given that all input suppliers have been assumed to be homogeneous in productivity. Now, through assuming that intermediate good firms are actually heterogeneous in productivity, following Melitz (2003), we can show that trade in intermediates can also determine an increase in average productivity of input suppliers, due to the exit of the least productive domestic firms and the entry of the most productive foreign ones within the intermediate sector, entailing a further increase in final good firms’ competitiveness. In other words, final good firms can replace the worst domestic intermediates with the best ones from abroad, becoming more competitive (*gains from input switching*).

As concerns the second research question (ii), a reason why nonimporters also increase their performance, might be that some of them are ‘invisible’ importers. Firms can have access to some foreign inputs only through *directly* importing them, by incurring an additional fixed cost (*official or direct importers*). However, firms can also use some foreign inputs by *indirectly* importing them, i.e. through very efficient wholesalers, without making any further fixed investment (*invisible or indirect importers*). Thus, some firms can actually or alternatively, domestic producers of intermediates can be induced to become more competitive, entailing some indirect benefits for the users of such domestic intermediates.
use foreign inputs and enjoy competitiveness gains, although they look like non-importers in the data. This argumentation is coherent with some recent empirical evidences (Bernard, Grazzi and Tomasi (2010), Bernard, Jensen, Redding and Schott (2010)) and theoretical models (Ahn et al. (2010), Akerman (2010), Blum et al. (2011)) stressing the role of trade intermediaries from export point of view: in particular, all these studies show theoretically and/or empirically that the least productive firms serve only the domestic market, the most productive ones serve also the foreign market through *direct exports*, whereas the remaining firms *export indirectly* through wholesalers – by assuming that the direct channel is associated with higher fixed cost and lower marginal cost compared to the indirect channel.

In our framework, we assume to have two similar countries, where any heterogeneous firm enters the home market by paying a fixed cost of entry, with the purpose to produce either a differentiated intermediate good – through using only labour – or a differentiated final good – by combining also all differentiated intermediates available – under increasing returns to scale. In particular, the intermediate inputs enter under CES form within final good firm’s production function, implying that the marginal cost is decreasing in the number of intermediate varieties used and in average productivity of input suppliers as in Ethier (1982). Then, two scenarios have been allowed for: 1) *indirect imports scenario* (i.e. zero fixed cost of importing) and 2) *direct imports scenario* (i.e. high fixed cost of importing).

Under the first scenario, any firm within both final good and intermediate good sectors can choose to serve the whole foreign market, by paying additional fixed costs of exporting and facing per-unit iceberg trade costs. Thus, as in Melitz’s model, all final good exporters match with all foreign final consumers, and similarly, all intermediate good exporters match with all final good firms abroad (‘indirect importers’), i.e. all final good firms within a country would have an easy access to foreign intermediates arising from the best input suppliers abroad, through a very efficient wholesale system. In this environment, trade liberalization in intermediates would imply an increase in average productivity of intermediate good firms through some reallocation effects from the least productive firms (which quit the market) to more productive firms (which export), entailing an uniform increase in final good firms’ competitiveness, and consequently, an increase in consumers’ welfare, without any particular entry-exit dynamics within final good sector. Therefore, a new source of competitiveness gains from input trade liberalization can be highlighted: all final good firms would become
more competitive since they can replace the worst domestic intermediates with the best ones from abroad (gains from input switching) – regardless of the change in total number of input varieties available (gains form input variety à la Ethier).

However, under the second scenario (direct imports scenario) only some final good firms can actually import some additional intermediates by paying some fixed costs of importing (which are assumed to be larger than fixed costs of exporting, coherently with several empirical evidences\(^4\)), and consequently, intermediate good firms are assumed to be able to serve only a portion of foreign final good firms, by incurring a variable selling cost increasing in the fraction of foreign importers, as in Arkolakis (2008), rather than a fixed cost of exporting. Hence, all final good exporters match with all foreign final consumers again as in Melitz (2003), whereas, all intermediate good exporters match only with more productive final good firms abroad (‘direct importers’), i.e. solely the best final good firms within a country can have an access to intermediates arising from the best input suppliers abroad, through paying a huge fixed cost of importing. Therefore, following input tariff reducing, only importers would enjoy some competitiveness gains from input switching, as described above. Conversely, nonimporters would suffer some competitiveness losses, due mainly to a decrease in domestic input varieties available, causing some reallocation effects towards the more productive firms (import-export firms), at the expenses of the least productive firms (quitters) and the least productive exporters (which leave the international market). As a consequence, consumers’ welfare improvement occurs thanks to aggregate productivity gains from reallocation effects within final good sector, in addition to heterogeneous competitiveness gains and despite some losses in final varieties.

Our theoretical framework is closely related to Kasahara and Lapham (2008) and Bas (2009) studies. Kasahara and Lapham (2008) have also extended the Melitz’s model in order to account for both import and export decisions simultaneously. However, by assuming that firms are homogeneous within intermediate input sector, they focus only on final good sector

\(^4\)By using Belgian firm-level dataset, Muuls and Pisu (2009) stress that two-way traders outperform importers, who in turn exhibit a higher performance respect to exporters, reaching the conclusion that self-selection would take place in both international activities. The same findings have been achieved by Castellani, Serti and Tomasi (2010), through using Italian firms’ data: in particular, they certificate more accurately the self-selection hypothesis in import (export) markets, recognizing the existence of an ex-ante productivity premium – i.e. a productivity differential between future importers (future exporters) and permanent pure domestic firms. Altomonte and Bekes (2009) find similar results in Hungary; however, following a deeper exploration about self-selection mechanism across international firms, they realize it actually takes place via importing, rather than via exporting (maybe because the choice of importing would require a more complex organization of production, compared to the choice of exporting).
where firms are assumed to be heterogeneous in productivity. In addition to Melitz’s export story, they show that trade liberalization in intermediates would determine an increase in aggregate productivity and welfare, because of both firm-level improvement in importers’ productivity (due to the use of a higher number of intermediates, i.e. the additional use of foreign intermediates which is allowed only to firms able to pay some fixed costs of importing) and some reallocation effects from pure domestic firms (exiters) to import-export firms. Unlike their model, our framework pays more attention about the intermediate sector, where firms are assumed to be heterogeneous and consequently the price index of intermediates is assumed to be endogenous (i.e. decreasing in the number of input varieties used and in the average productivity of input suppliers) and different between importers and non-importers. In terms of predictions, our framework is able to show that some gains from input trade liberalization are due to some input switching effects, rather than a simple increase in input varieties available, and that these gains can concern all firms, regardless of their import status, or only some of them (importers), given that the low productive firms can actually suffer some competitiveness losses. Bas (2009)’s study is an extension of Melitz-Ottaviano (2008) framework aimed at analyzing the impact of a fall in input trade barriers (i.e. relative factor price movements) – in addition to trade liberalization in final goods (i.e. import competition effect) – on firms’ production and exports decisions. More specifically, by examining solely the final good sector and the firm’s export behaviour, she argues that a removal of input import barriers (or simply an increase in input import intensity) within industry would cause an increase in consumers’ demand, as well as a proportional enhancement in competitiveness of all domestic firms such that both intensive (export volume) and extensive (number of new exporters) margins of exports would rise. Thus, unlike her model, we consider both import and export decisions at final good firm level, by assuming firm heterogeneity within both intermediate and final good sectors, through which we are able to demonstrate that the change in competitiveness is different across final good firms (i.e. between importers and non-importers) and the total number of exporters (thus, the total number of final good varieties) can also decrease following a fall in trade costs of intermediates.

The rest of the paper is organized as follows. Section 2 introduces the model in both Closed and Open Economy. Section 3 explores the impact of trade liberalization in inter-
mediate inputs on the economy. Section 4 concludes. All details about proofs are provided in Appendix.

2 Set-up of the model

2.1 Closed Economy

The basic framework can be considered an extension of Melitz (2003)'s monopolistic competition model, since an intermediate good ($m$) sector has been added to the final good ($y$) sector, and all firms within each sector turn out to be heterogeneous in productivity and produce differentiated varieties under increasing returns to scale. A country has been assumed to be endowed with $L_m$ units of $m$-specific labour and $L_y$ units of $y$-specific labour, which are inelastically supplied at the common wage rate $w$, where $w$ has been normalized to one, and the total number of workers (final consumers) is $L = L_m + L_y$.

2.1.1 Intermediate good sector

All final good firms ($y$-firms) have the same CES preferences in available differentiated intermediates, therefore, the industry aggregate demand of intermediates takes the following functional form: $Q_m = \left[ \int_0^M q_m^\rho d_m \right]^{\frac{1}{\rho}}$, where $q_m$ is the demand for each intermediate variety $m$, and $M$ is number of intermediate varieties available (i.e. the number of incumbent intermediate good firms). The intermediates are substitutes, implying $0 < \rho < 1$ and an elasticity of substitution between any two intermediate varieties is $\sigma = \frac{1}{1-\rho} > 1$. The related industry aggregate price – which corresponds to the price index of intermediates for each final good firm, since all firms within final good sector are assumed to use all intermediates available within country – is $P_m = \left[ \int_0^M p_m^{1-\sigma} d_m \right]^{\frac{1}{1-\sigma}}$, where $p_m$ is the price of individual intermediate variety.

The production technology within intermediate good sector assumes there is a continuum of firms producing a differentiated variety, by using a single factor $l_m$ ($m$-specific labour), through the cost function\(^5\) $c_m = (wf + w \frac{q_m}{\varphi_m}) = w \left( f + \frac{q_m}{\varphi_m} \right)$, where the fixed cost $f$ is common, and the productivity level $\varphi_m$ is constant but different across firms. It becomes

\(^5\)Both fixed and variable costs are assumed to use labour.
\[ c_m = \left( f + \frac{2m}{\varphi_m} \right) \] since the common wage has been normalized to one. Intermediate good firms enter the market by paying a fixed cost of entry \( f \) to draw their productivity \( \varphi_m \) from the Pareto cumulative distribution \( G(\varphi_m) = 1 - \varphi_m^{-k} \), where \( k > 1 \), and then decide whether to exit the market or to stay.

Each intermediate firm faces a residual demand curve with constant elasticity \( \sigma \), i.e. it chooses the same profit maximizing mark-up \( \frac{\varphi}{\sigma - 1} = \frac{1}{\rho} \). Consequently, the pricing rule is \( p_m(\varphi_m) = \frac{w}{\rho \varphi_m} \), while the output, the revenues and the profits are respectively: \( q_m(\varphi_m) = R_m P_m^{\sigma - 1} (\rho \varphi_m)^\sigma \), \( r_m(\varphi_m) = R_m (P_m \rho \varphi_m)^{\sigma - 1} \), and \( \pi_m(\varphi_m) = \frac{r_m(\varphi_m)}{\sigma} - f \). The latter function is represented by the Figure 1, which shows that only firms whose productivity is high enough to make non-negative profit (\( \varphi_m > \varphi^*_m \)) will survive in the market.

Moreover, the price index of intermediates can be written as follows:

\[
P_m = \left[ \int_0^M [p_m(\varphi_m)]^{1-\sigma} d\varphi_m \right]^{\frac{1}{1-\sigma}} = M^{\frac{1}{1-\sigma}} p_m(\tilde{\varphi}_m) = \frac{M^{\frac{1}{1-\sigma}} p_m(\tilde{\varphi}_m)}{\rho \tilde{\varphi}_m} \quad (1)
\]

where \( \tilde{\varphi}_m(\varphi^*_m) = \left[ \frac{1}{\rho \varphi_m} \int_{\varphi_m}^{\varphi^*_m} \varphi_m^{\sigma-1} g(\varphi_m) d\varphi_m \right]^{\frac{1}{1-\sigma}} \) is the weighted average productivity of intermediate good firms and \( \varphi^*_m \) is the related survival productivity cutoff, i.e. the minimum level of productivity required to survive in the intermediate good market\(^6\).

2.1.2 Final good sector

Consumers have identical ‘love for variety’ preferences for differentiated final goods, therefore, the related aggregated demand is assumed to take a CES functional form \( Q_y = \left[ \int_0^N q_y \left( \frac{1}{y} \int_0^1 d_y \right) \right]^{\frac{1}{\sigma}} \), whose the aggregate price \( P_y = \left[ \int_0^N p_y \left( \frac{1}{y} \int_0^1 d_y \right) \right]^{\frac{1}{1-\sigma}} \) is – where \( q_y \) and \( p_y \) are respectively the demand and the price of each final variety, \( N \) is the number of final varieties available (i.e. the mass of incumbent final good firms) and \( \sigma = \frac{1}{1-\rho} > 1 \) is the constant elasticity of substitution across them.

The production technology in the final good sector assumes a continuum of firms producing a differentiated variety, by combining the \( y \)-specific labour \( l_y \) with intermediate inputs \( m \) arising from all firms within intermediate sector. In particular, the related cost function

\[^6\text{In aggregate terms, the output is } Q_m = M^{\frac{1}{\sigma}} q_m(\tilde{\varphi}_m), \text{ the revenues are } R_m = P_m Q_m = M r_m(\tilde{\varphi}_m) \text{ and the profits are } \Pi_m = M \pi_m(\tilde{\varphi}_m).\]
takes the following form \[ c_y = (w + P_m \frac{q_y}{\varphi_y}) \], where the fixed cost \( f \) is common, and the productivity level \( \varphi_y \) is constant but different across firms, as in the intermediate sector. It becomes \[ c_y = (f + P_m \frac{q_y}{\varphi_y}) \] since the common wage has been normalized to one. Notice that \( P_m = \frac{M_1}{\rho_1} \) is the aggregate price of intermediates used, which is decreasing in both number and average productivity of all input suppliers (corresponding to the mass of intermediate good firms).

Like the intermediate sector, final good firms enter the market by paying a fixed cost of entry \( f_e \) to draw their productivity \( \varphi_y \) from the Pareto cumulative distribution \( G(\varphi_y) = 1 - \varphi_y^{-k} \), where \( k > 1 \), and then decide whether to leave the market or to produce. According to all assumptions above, the final good firm will charge the price \( p_y(\varphi_y) = \frac{P_m}{\varphi_y^\sigma} \), and the firm level output, revenues and profits will respectively be \( q_y(\varphi_y) = R_y P_y^{\sigma-1} \left( \frac{P_m}{\varphi_y^\sigma} \right)^{-\sigma} \), \( r_y(\varphi_y) = R_y \left( \frac{P_m}{\varphi_y^\sigma} \right)^{-1} \), and \( \pi_y(\varphi_y) = \frac{r_y(\varphi_y)}{\sigma} - f \). The profit function is represented by the Figure 1, which displays that only firms whose productivity is high enough to make non-negative profit (\( \varphi_y > \varphi^*_y \)) will decide to stay in the market. It is worth noting that an increase in intermediate firms’ average productivity as well as an increase in intermediate varieties can affect positively final good firms’ output, revenues and profits.

Finally, the price index of final good will be

\[
P_y = \left[ \int_0^N p_y(\varphi_y)^{1-\sigma} d\varphi_y \right]^{\frac{1}{1-\sigma}} = N^{\frac{1}{1-\sigma}} p_y(\tilde{\varphi}_y) = N^{\frac{1}{1-\sigma}} P_m = \frac{(NM)^{\frac{1}{1-\sigma}}}{\rho^{\sigma}\tilde{\varphi}_y \varphi_m} \tag{2}
\]

where \( \tilde{\varphi}_y (\varphi^*_y) = \left[ \frac{1}{1-G_y(\varphi^*_y)} \int_{\varphi^*_y}^\infty \varphi_y^{\sigma-1} g(\varphi_y) d\varphi_y \right]^{\frac{1}{1-\sigma}} \) is the weighted average productivity of final good firms and \( \varphi^*_y \) is the related survival productivity threshold, i.e. the minimum level of productivity required to survive in the final good market\(^8\). By considering that it is inversely related to the consumers’ welfare, we can see that the latter is increasing in both number and average productivity of input suppliers, in addition to be positively related to both number and average productivity of final good firms as in Melitz (2003).

\(^7\)Fixed costs are assumed to use labour, whereas variable costs are assumed to use intermediates inputs.

\(^8\)In aggregate terms, the output is \( Q_y = N^{\frac{1}{\sigma}} q_y(\tilde{\varphi}_y) \), the revenue is \( R_y = P_y Q_y = M r_y(\tilde{\varphi}_y) \) and the profit is \( \Pi_y = M \pi_y(\tilde{\varphi}_y) \).
2.1.3 Equilibrium

Any firm will stay in the market till its profit is positive \( \pi_j (\varphi_j) > 0 \); for \( j = m, y \). Thus, we can define the zero profit cutoff \( \varphi_j^* \) such that \( \pi_j (\varphi_j^*) = 0 \) (Zero Profit Condition). Furthermore, it will take into consideration the possibility to enter the market only if the net value of entry is positive \( v_e^j (\varphi_j) > 0 \) – i.e. only if the present value of expected profits \( \int_{\varphi_j^*}^\infty \pi_j (\varphi_j) dG (\varphi_j) = \frac{1-G(\varphi_j)}{\delta} \tilde{\pi}_j \) is higher than the sunk fixed cost of entry \( f_e \). Consequently, the free entry cutoff \( \varphi_j^* \) is such that \( v_e^j (\varphi_j) = 0 \Leftrightarrow \frac{1-G(\varphi_j)}{\delta} \tilde{\pi}_j = f_e \) (Free entry condition).

By allowing for both conditions above, we can highlight the uniqueness of equilibrium in both sectors \( (\varphi_j^* \text{ and } \tilde{\pi}_j \text{ for } j = m, y)^9 \).

The steady state equilibrium requires that the aggregate variables are constant over time, whereas the market clearing conditions entail that final good firms’ aggregate revenues \( R_y \) must equal the sum of the total payments to y-specific workers \( (wL_y = L_y) \) and intermediate good firms’ aggregate revenues \( R_m \), while the latter must be equivalent to the total payment to m-specific workers \( (wL_m = L_m) \):

\[
R_y = L_y + R_m = L_y + L_m
\]  

(3)

From the respective average profits levels \( (\tilde{\pi}_m \text{ and } \tilde{\pi}_y) \) and survival productivity thresholds \( (\varphi_m^* \text{ and } \varphi_y^*) \), the mass of firms in both sectors \( (M \text{ and } N) \) can be derived, which in turn can be used to determine the equilibrium price indexes \( (P_m \text{ and } P_y) \):

\[
M = \frac{R_m}{\tilde{\pi}_m} = \frac{L_m}{\sigma (\tilde{\pi}_m + f)} \implies P_m = \frac{M \frac{1}{\sigma} \tilde{\pi}_m}{\rho \tilde{\varphi}_m (\varphi_m^*)}
\]  

(4)

\[
N = \frac{R_y}{\tilde{\pi}_y} = \frac{L_y + L_m}{\sigma (\tilde{\pi}_y + f)} \implies P_y = \frac{N \frac{1}{\sigma} P_m}{\rho \tilde{\varphi}_y (\varphi_y^*)}
\]  

(5)

2.2 Open Economy

This section considers two symmetric countries (i.e. countries with same endowments, wage rate and all the other aggregates) involved in international trade. In particular, the first subsection is related to the scenario of “Indirect Imports”, where any firm within both final

\footnote{See the Appendix A.}
good and intermediate good sectors can choose to serve the whole foreign market, by paying 
additional fixed costs of exporting (common across sectors) and facing per-unit iceberg trade 
costs (different across sectors). Thus, as in Melitz’s model, all final good exporters match 
with all foreign final consumers, and similarly, all intermediate good exporters match with 
all final good firms abroad (‘indirect importers’), i.e. all final good firms within a country 
can easily access to foreign intermediates arising from the best input suppliers abroad, 
without any particular effort through a very efficient wholesale system. Whereas, the second 
subsection concerns the “Direct Imports” scenario, where only some final good firms can 
actually import some additional intermediates by paying some fixed costs of importing 
(which are assumed to be larger than fixed costs of exporting, coherently with several 
empirical evidences), and consequently, intermediate good firms are assumed to be able 
to serve only a portion of foreign final good firms, by incurring a variable selling cost 
increasing in the fraction of foreign importers, as in Arkolakis (2008), rather than a fixed 
cost of exporting. Hence, all final good exporters match with all foreign final consumers 
again (as in Melitz (2003)), whereas all intermediate good exporters match only with more 
productive final good firms abroad (‘direct importers’), i.e. solely the best final good firms 
within a country can have an access to intermediates arising from the best input suppliers 
abroad, through incurring additional searching effort and investment in an own distribution 
network.

2.2.1 Indirect imports scenario

Intermediate good sector An intermediate good firm within each economy can serve 
all foreign final good producers, by paying additional fixed costs \( f_x > f \) and facing per-unit 
iceberg intermediate trade costs \( \tau_m > 1 \). For this reason, the firm will set a higher export 
price \( p_m^X(\varphi_m) = \frac{\tau_m}{\varphi_m} = \tau_m p_m^D(\varphi_m) \), and will obtain lower revenues \( r_m^X(\varphi_m) = \tau_m^{1-\sigma} r_m^D(\varphi_m) \) 
and profits \( \pi_m^X(\varphi_m) = \frac{r_m^X(\varphi_m)}{\sigma} - f_X \) from the international market, compared to the domestic 
one. Therefore, exporter’s total profit will be \( \pi_m^{D+X}(\varphi_m) = \left(1 + \tau_m^{1-\sigma}\right) \frac{r_m^X(\varphi_m)}{\sigma} - (f + f_X) \).

Now, the aggregate price index of intermediates \( (P^T_m) \) is decreasing in both number 
\( M_T = M + M_X = \left(1 + \psi_m^X\right) M \)\(^{10}\) and average productivity \( (\varphi_m^T) \) of all intermediate good

\(^{10} M_X = \psi_m^X M \) is the mass of intermediate good exporters, where \( \psi_m^X \) represents the fraction of exporters 
or the probability of exporting within intermediate good sector.
firms competing within a country: $P_m^{T} = M_T^{\frac{1}{\rho_y}} p_m \left( \frac{\varphi_m^T}{g_m} \right) = \frac{(M+M_Y)^{\frac{1}{\rho_y}}}{g_m}$. 

**Final good sector** Similarly, a final good firm can choose to export by paying additional fixed costs $f_x > f$ and facing per-unit iceberg output trade costs $\tau_y > 1$. Therefore, it will charge a higher export price $p_y^X (\varphi_y) = \frac{\tau_y P_y^m}{\rho_y} = \tau_y p_y^D (\varphi_y)$, and obtain lower revenue $r_y^X (\varphi_y) = \tau_y^{1-\sigma} p_y^D (\varphi_y)$ and profit $\pi_y^X (\varphi_y) = \frac{r_y^X(\varphi_y)}{\sigma} - f_X$ from foreign market, respect to home one. In particular, the final good exporter’s total profit will be $\pi_y^{D+X} (\varphi_y) = (1 + \tau_y^{1-\sigma}) \frac{r_y^X(\varphi_y)}{\sigma} - (f + f_X)$. Notice that the price index of intermediates ($P_y^m$) is common across all final good firms, as in the closed economy model, therefore, any change in it will reflect uniformly upon all firms within final good sector.

Here, the aggregate price index of final goods ($P_y^T$) is decreasing in the price index of intermediates, in addition to be negatively related to both number ($N_T = N + N_X = (1 + \psi^X) N$) and average productivity ($\bar{\varphi}_y^T$) of all final good firms competing within a country as in Melitz (2003): $P_y^T = N_T^{\frac{1}{\rho_y}} p_y \left( \bar{\varphi}_y^T \right) = \frac{(N+N_X)^{\frac{1}{\rho_y}}}{g_y^m} P_y^m$.

**Equilibrium** As in the closed economy model, a firm will stay in the home market till its profit is positive ($\pi_j^D (\varphi_j^D) > 0$; for $j = m, y$). Thus, the survival productivity threshold is $\varphi_j^D$ such that $\pi_j^D (\varphi_j^D) = 0$ (Zero Domestic Profit Condition). Moreover, a firm will serve the foreign market only if the export profit is positive ($\pi_j^X (\varphi_j^X) > 0$; for $j = m, y$). Therefore, the export productivity threshold $\varphi_j^X$ is such that $\pi_j^X (\varphi_j^X) = 0$ (Zero Export Profit Condition). The free entry condition in the open economy scenario is $v_j (\varphi_j) = 0 \Leftrightarrow 1 - G(\varphi_j^D) \bar{\pi}_j = f$ for $j = m, y$, where $\bar{\pi}_j = \pi_j^D \varphi_j^D \psi_j^X \pi_j^X \bar{\varphi}_j^X$.

From all conditions above, the uniqueness of equilibrium ($\varphi_j^D$, $\varphi_j^X$ and $\bar{\pi}_j$ for $j = m, y$) can be highlighted in both final good and intermediate good sectors$^{13}$, and the export threshold $\varphi_j^X$ can be written as function of survival threshold $\varphi_j^D$: $\varphi_j^X = \varphi_j^D \tau_j \left( \frac{f_X}{\tau} \right)^{\frac{1}{\rho_y}}$. Thus, $\varphi_j^X > \varphi_j^D$ if trade costs are sufficiently higher than fixed production cost ($f_X \tau_j^{\sigma-1} > f$).

From the Figure 2, we can see as a country opens to trade, the least productive good

$^{11}$Notice that the price of intermediates is still the same amongst all final good firms (i.e. both exporters and non-exporters) $P_y^m$, but lower compared to the closed economy scenario $P_m$.

$^{12}$Notice that the mass of intermediate good exporters, where $\psi_y^X N$ represents the fraction of exporters or the probability of exporting within final good sector.

$^{13}$See the Appendix B.
firms will exit the market (i.e. all firms whose productivity \( \varphi_j \) is such that \( \varphi_j^* < \varphi_j < \varphi_j^D \)), the best ones will also serve the whole market abroad (i.e. all firms whose productivity \( \varphi_j \) is such that \( \varphi_j > \varphi_j^X \)), and the remaining firms will continue to produce only for the home market (i.e. all firms whose productivity \( \varphi_j \) is such that \( \varphi_j^D < \varphi_j < \varphi_j^X \)) in both sectors. Therefore, some reallocation effects occur across firms within each sector, implying an increase in aggregate productivity. Notice that the aggregate productivity gains within intermediate sector due to reallocation effects entails some uniform competitiveness gains within final good sector due to input switching effects: i.e. all final good firms are basically able to replace the worst domestic intermediate inputs with the best ones from abroad, becoming more competitive.

From the average profit levels and productivity thresholds, the mass of both intermediate firms and final good firms \((M\text{ and }N)\) can be derived, which in turn can be used to determine the equilibrium price indexes \((P_{m}^T\text{ and }P_{y}^T)\)\(^{14}\). In particular, within intermediate sector, firms’ average profit is \(\bar{\pi}_m(\varphi_m) = \frac{\tau_m(\varphi_m)}{\sigma} - \left(f + \psi_m^X f_X\right)\); the mass of home firms is \(M = \frac{R_m}{\bar{\pi}_m} = \frac{L_m}{\sigma(\bar{\pi}_m + f + \psi_m^X f_X)}\); whereas, the mass of firms competing within a country is \(M_T = M + M_X = \left(1 + \psi_m^X \right)M\), which equals the number of intermediate varieties available for final good firms; and the related price index is \(P_{m}^T = \frac{M_T \bar{\pi}_m}{\rho \sigma m}\), which can be simply written as function of survival cutoff \(\varphi_j^D\): \(P_{m}^T = \left(\frac{L_m}{\sigma\bar{\pi}_m}\right)^{\frac{1}{1 + \rho m}}\). Whereas, within final good sector, firms’ average profit is \(\bar{\pi}_y(\varphi_y) = \frac{\bar{\tau}_y(\varphi_y)}{\sigma} - \left(f + \psi_y^X f_X\right)\); the mass of domestic firms is \(N = \frac{R_y}{\bar{\tau}_y} = \frac{L_m + L_y}{\sigma(\bar{\tau}_y + f + \psi_y^X f_X)}\); the mass of firms competing within a country is the \(N_T = N + N_X = \left(1 + \psi_y^X \right)N\), which is in turn equivalent to the number of final good varieties available for all consumers, whose the price index is \(P_{y}^T = \frac{N_T \bar{\tau}_y^\frac{1}{1 + \rho y}}{\rho \bar{\varphi}_y^T}\). The latter can be easily expressed as function of survival cutoff and the price index of intermediates: \(P_{y}^T = \left(\frac{L_m + L_y}{\sigma\bar{\tau}_y}\right)^{\frac{1}{1 + \rho y}}\frac{P_{m}^T}{\rho \bar{\varphi}_y^T}\).

2.2.2 Direct imports scenario

**Intermediate good sector**  Unlike the former scenario, an intermediate good firm is assumed to be able to serve solely a fraction of foreign final good producers \((\psi_y^{MX})\) – i.e. exclusively those final good firms which are productive enough to cover some fixed costs

\(^{14}\text{See the Appendix C for more details.}\)
of importing (direct importers) – by making additional investments proportional to the share of foreign customers \((\psi_y^{MX} f_x)\) and facing as before per-unit iceberg intermediate trade costs \(\tau_y > 1\). Therefore, an intermediate exporter will charge the same export price \(p_m^X(\varphi_m) = \frac{\tau_y}{\rho \varphi_m} = \tau_m p_m^D(\varphi_m)\) as in “Indirect exports scenario” and yield however relatively lower export revenues \(\psi_y^{MX} r_m^X(\varphi_m) = \psi_y^{MX} r_m^D(\varphi_m)\) and export profit \(\psi_y^{MX} \pi_m^X(\varphi_m) = \psi_y^{MX} r_m^X(\varphi_m) - \psi_y^{MX} f_X\) – since they are proportional to fraction of foreign customers served – entailing that exporter’s total profit will be \(\pi_m^{D+X}(\varphi_m) = \left(1 + \tau_y^{1-\sigma} \psi_y^{MX}\right) r_m^D(\varphi_m) - \left(\bar{f} + \psi_y^{MX} f_X\right)\). The price index of intermediates used by all final good firms located within a country is on average \(P_T = \frac{\pi_m^{D+X}}{\psi_y^{MX} \varphi_m} = \frac{P_m^T}{\rho \varphi_m}\), which is decreasing in both number \((M_T = M + \psi_y^{MX} M_X = \left(1 + \psi_y^{MX} \varphi_m\right) M\) and average productivity \((\varphi_m^T)\) of input suppliers competing within country. However, the portion of final good importers also plays a relevant role now to determine the current price index: an increase in the fraction of importers within final good sector entails a fall in the price index of intermediates, since a relatively higher number of final good firms can access to better foreign inputs.

**Final good sector** A final good firm can still choose to serve the whole foreign market as in Melitz (2003), and not only a share of it, by paying additional fixed costs \(f_x > 1\) and facing per-unit iceberg output trade costs \(\tau_y > 1\).

Furthermore, some final good firms can also import directly foreign intermediates – arising from the most productive foreign intermediate firms (i.e. foreign m-exporters) – in order to yield higher variable profits. Indeed, within-importer aggregate price of intermediates \(P_m^M = \frac{\tau_y}{\rho \varphi_m} = \frac{\left(M + M_X\right)}{\rho \varphi_m}\) turns out to be lower than within-nonimporter one \(P_m^D = \frac{M \tau_y}{\rho \varphi_m}\) (i.e. \(P_m^D = \alpha P_m^M\) where \(\alpha = \left[1 + \tau_y^{-k} \left(\frac{f_x}{\bar{f}}\right)^{\frac{\tau_y-1}{\tau_y}}\right]^{\frac{1}{\bar{f}}} > 1\))

However, firms have to pay some fixed costs of importing \(f_M\), which have been assumed

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15. The foreign market entry costs are assumed to be increasing in relative foreign market size as in the models of Arkolakis (2008) and Akerman and Forslid (2009): they argue that marketing costs of establishing a new brand would be relatively higher in markets with a higher share of potential buyers. It is worth noting that if all final good firms are able to import directly by paying the fixed cost of importing (i.e. if \(\psi_y^{MX} = 1\)) implies that intermediated good exporters can serve the whole market abroad, by paying the fixed cost of exporting \(f_x\) as in the former scenario.

16. \(M_X = \psi_y^{MX} M\) is the mass of intermediate good exporters, \(\psi_y^{MX}\) and \(\psi_y^{MX}\) represent the fraction of exporters within intermediate good sector and the fraction of import-export firms within final good sector, respectively.

17. \(M\) and \(\varphi_m^M\) are respectively the number and the trade-cost-adjusted average productivity of intermediate good firms supplying – i.e. of intermediate varieties available for – final good nonimporters (final good importers). See the Appendix C for more details.
to be larger than costs of exporting $f_X$. As a consequence, within final good sector, importers charge lower domestic price and are associated with larger revenues and profits from home market respect to nonimporters on the one hand, and import-export firms set lower export prices and exhibit larger revenues and profits from foreign market, compared to only-exporters on the other hand:

<table>
<thead>
<tr>
<th>Firm-level variables</th>
<th>Nonimporters</th>
<th>Importers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic price</td>
<td>$n^D_y(\varphi_y) = \frac{P^D_y}{\sigma_y}$</td>
<td>$n^M_y(\varphi_y) = \frac{P^M_y}{\sigma_y} = \alpha^{-1}n^D_y(\varphi_y)$</td>
</tr>
<tr>
<td>Domestic revenue</td>
<td>$r^D_y(\varphi_y) = R_y \left( \frac{P^D_y}{\sigma_y} \right)^{-1}$</td>
<td>$r^M_y(\varphi_y) = R_y \left( \frac{P^M_y}{\sigma_y} \right)^{-1} = \alpha^{-1}r^D_y(\varphi_y)$</td>
</tr>
<tr>
<td>Domestic profit</td>
<td>$\pi^D_y(\varphi_y) = r^D_y(\varphi_y) - f$</td>
<td>$\pi^M_y(\varphi_y) = r^M_y(\varphi_y) - (f + f_M)$</td>
</tr>
<tr>
<td>Export price</td>
<td>$p^X_y(\varphi_y) = \frac{r^P_y N^y}{\sigma_y} = \pi_y P^D_y(\varphi_y)$</td>
<td>$p^M_X(\varphi_y) = \frac{r^P_y M^y}{\sigma_y} = \pi_y P^M_y(\varphi_y) = \tau_y^{-1} P^M_y(\varphi_y)$</td>
</tr>
<tr>
<td>Export revenue</td>
<td>$r^X_y(\varphi_y) = 1 - \tau_y^{-1} r^D_y(\varphi_y)$</td>
<td>$r^M_X(\varphi_y) = 1 - \tau_y^{-1} r^M_y(\varphi_y)$</td>
</tr>
<tr>
<td>Export profit</td>
<td>$\pi^X_y(\varphi_y) = \frac{r^X_y(\varphi_y)}{f_X}$</td>
<td>$\pi^M_X(\varphi_y) = \frac{r^M_X(\varphi_y)}{f_X} - f_X$</td>
</tr>
<tr>
<td>Exporter’s total profit</td>
<td>$\pi^{D+X}_y(\varphi_y) = \left( 1 + \tau_y^{-1} \right) \frac{1}{f_D(\varphi_y)} - (f + f_X)$</td>
<td>$\pi^{M+X}_y(\varphi_y) = \left( 1 + \tau_y^{-1} \right) \frac{1}{f_M(\varphi_y)} - (f + f_X + f_M)$</td>
</tr>
</tbody>
</table>

**Equilibrium** Under the current scenario, intermediate good firms still make two decisions: whether producing for the home market and whether serving also a portion of a foreign market. Therefore, by allowing for the zero domestic profit condition ($\pi^D_m(\varphi^D_m) = 0$), zero export profit condition ($\psi^M_X \pi^X_m(\varphi^X_m) > 0$) and the free entry condition ($\nu^e_m(\varphi_m) = 0 \iff \frac{1 - G(\varphi^D_m)}{\sigma_m} \bar{\pi}_m = f_e$ where $\bar{\pi}_m = \pi^D_m(\varphi^D_m) + \psi^M_X \psi^M_X \pi^X_m(\varphi^X_m)$)\(^{18}\), the uniqueness of equilibrium within sector can be highlighted – i.e. both survival and export productivity thresholds as well as the average profit ($\varphi^D_m$, $\varphi^X_m$ and $\bar{\pi}_m$) – and $\varphi^X_m$ can be written again as a function of $\varphi^D_m$: $\varphi^X_m = \varphi^D_m(\varphi^D_m) \left( \frac{f_X}{f_D} \right)^{\frac{1}{\sigma_D}}$ – entailing that $\varphi^X_m > \varphi^D_m$ only if export costs are high enough respect to fixed cost of production ($f_X \tau_D^{-1} > f$ ). Consequently, trade openness leads the least productive intermediate good firms to exit the market (i.e. firms whose productivity $\varphi_m$ is such that $\varphi^*_m < \varphi_m < \varphi^D_m$), the most productive ones to serve also a fraction of foreign final good producers (i.e. firms whose productivity $\varphi_m$ is such that $\varphi_m > \varphi^X_m$), and the remaining firms to supply only all domestic final good producers (i.e. firms whose productivity $\varphi_m$ is such that $\varphi^D_m < \varphi_m < \varphi^X_m$): some reallocation effects occur again within intermediate good sector, implying an increase in aggregate productivity (see the Figure 3).

Whereas, final good firms make three decisions now: whether producing for the home

\(^{18}\) $\psi^M_X$ is firms’ probability of exporting (or fraction of exporters) within intermediate sector, and $\psi^M_X$ is firms’ probability of two-way trading (or fraction of import-export firms) within final good sector, which equals firms’ probability of importing (or fraction of importers) in our model.
market, whether exporting the final output and whether directly importing intermediate inputs. Since $f_M > f_X$, all final good importers are assumed to be able to serve international markets, whereas some final good exporters cannot import additional intermediates.

A firm will decide to buy intermediates from abroad, only if the related extra-profit is positive ($\pi_{y}^{M+MX} (\varphi_{y}^{MX}) > \pi_{y}^{D+X} (\varphi_{y}^{MX})$). Thus, the import-export productivity threshold $\varphi_{y}^{MX}$ is such that $\pi_{y}^{M+MX} (\varphi_{y}^{MX}) - \pi_{y}^{D+X} (\varphi_{y}^{MX}) = 0$ (Zero Import-Export Profit Condition). By considering the latter condition with zero domestic profit condition ($\pi_{y}^{D} (\varphi_{y}^{D}) = 0$), zero export profit condition ($\pi_{y}^{X} (\varphi_{y}^{X}) = 0$) and the free entry condition ($\psi_{y} (\varphi_{y}) = 0 \iff \frac{1-G(\varphi_{y})}{\pi_{y}} = f_{e}$, where $\pi_{y} = \psi_{y}^{D} \pi_{y}^{D} (\varphi_{y}^{D}) + \psi_{y}^{X} \pi_{y}^{X} (\varphi_{y}^{X}) + \psi_{y}^{MX} \pi_{y}^{M+MX} (\varphi_{y}^{MX})$), the uniqueness of equilibrium within sector can be found — i.e. survival, export, and import-export productivity thresholds, as well as the average profit ($\varphi_{y}^{D}$, $\varphi_{y}^{X}$, $\varphi_{y}^{MX}$ and $\pi_{y}$)$^{19}$ — and import-export cutoff $\varphi_{y}^{MX}$ can be written as function of export cutoff $\varphi_{y}^{X}$

$$\varphi_{y}^{MX} = \left[ \frac{1}{f_{X}^{X}} \left( \frac{f_{X}^{D}}{f_{X}^{D}} - \frac{1}{\varphi_{y}^{X}} \right) \right]^{\frac{1}{\alpha^{\sigma} - 1}} (\varphi_{y}^{D}),$$

which in turn can be expressed as function of survival threshold $\varphi_{y}^{D}$ ($\varphi_{y}^{X} = \varphi_{y}^{D} \tau_{y} \left( \frac{f_{X}}{f_{X}^{D}} \right) \frac{1}{\alpha^{\sigma} - 1}$). Notice that $\varphi_{y}^{D} < \varphi_{y}^{X} < \varphi_{y}^{MX}$ if and only if fixed cost of importing is sufficiently higher than the fixed cost of exporting ($f_M > f_X \tau_{y}^{\sigma - 1} \left( 1 + \tau_{y}^{\sigma - 1} \left( \alpha^{\sigma - 1} - 1 \right) \right)$), which in turn is high enough respect to fixed cost of production ($f_{X} > f_{X}^{1 - \sigma}$).

The Figure 4 shows as trade openness induces the worst firms to leave the market (firms whose productivity $\varphi_{y}$ is such that $\varphi_{y}^{*} < \varphi_{y} < \varphi_{y}^{D}$) and the best ones to import from the best foreign input suppliers and serve all foreign consumers at the same time (i.e. all firms whose productivity $\varphi_{y}$ is such that $\varphi_{y} > \varphi_{y}^{MX}$). While the remaining firms can be distinguished in two groups: the less productive firms which are able to serve only the domestic market (i.e. all firms whose productivity $\varphi_{y}$ is such that $\varphi_{y}^{D} < \varphi_{y} < \varphi_{y}^{X}$) and the more productive firms which are also able to export without importing (i.e. all firms whose productivity $\varphi_{y}$ is such that $\varphi_{y}^{X} < \varphi_{y} < \varphi_{y}^{MX}$). Therefore, some reallocation effects occur again within final good sector, implying an increase in aggregate productivity. However, it is worth noting that now only direct importers (import-export firms in our model) can actually enjoy some competitiveness gains from input switching mechanism, whereas the remaining firms (pure domestic firms and only-exporters) basically would suffer some competitiveness

$^{19} \psi_{y}^{D} = 1 - \psi_{y}^{MX}$ is firms’ probability of non-importing (or fraction of non-importers) and $\psi_{y}^{X}$ is firms’ probability of only-exporting (or fraction of only-exporters) within final good sector.

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losses, due mainly to a decrease in domestic intermediate varieties available. In other words, productivity-enhancing reallocation effects within final good sector linked to trade in final goods (as in Melitz (2003)) are further boosted through these heterogeneous competitiveness effects arising from trade in intermediate inputs.

From the average profit levels and productivity thresholds in both sectors, the mass of both intermediate good firms and final good firms \((M \text{ and } N)\) can be derived, which in turn are needed to determine the equilibrium price indexes \((P^T_m \text{ and } P^T_y)\). \(^{20}\)

In particular, in the intermediate good sector, the average profit is \(\bar{\pi}_m (\varphi_m) = \frac{\tau_m(\varphi_m) - \left(f + \psi^X M X F_X\right)}{\sigma}\); the mass of home firms is \(M = \frac{R_m}{\tau_m} = \frac{L_m}{\sigma(\tau_m + f + \psi^M M X F_X)}\), which equals the number of intermediate varieties available for final good nonimporters; whereas, the number of input varieties available for final good importers is \(M_M = M + M_X = \left(1 + \psi^X\right) M\). Thus, the number of intermediate varieties available for all final good firms within a country is on average \(M_T = M + \psi^M M_X = \left(1 + \psi^M M X\right) M\), and the related price index is \(P^T_m = \frac{M_T}{\rho^T_M}\). It is worth noting that the price index of intermediates within a country is now also decreasing in the fraction of importers: a change in relative number of final good firms able to import matters as a change in either number or average productivity of intermediate firms competing within a country, to understand the dynamics of the price index of intermediates. However, it can be again expressed as a function of survival threshold \(P^T_m = \left(\frac{L_m}{\sigma}\right) \frac{1}{\rho^T_M}\).

Similarly, in the final good sector, final good firms’ average profit is \(\bar{\pi}_y (\varphi_y) = \frac{\tau_y(\varphi_y) - \left(f + \psi^X M X F_X + \psi^M M X F_M\right)}{\sigma}\); the mass of domestic firms is \(N = \frac{R_y}{\tau_y} = \frac{L_y + L_M}{\sigma(\tau_y + f + \psi^M M X F_X + \psi^M M X F_M)}\); whereas, the mass of firms competing within a country is the \(N_T = N + N_{X+M X} = \left(1 + \psi^X M X\right) N\), which in turn equals the number of final good varieties available for all consumers, whose the price index is \(P^T_y = N_{T}^{-1} \frac{1}{\rho^T_y} p_y (\varphi_y) = \frac{N_{T}^{-1} P^{TT}_m}{\rho^T_T} \). Notice that \(P^{TT}_m\) is the price index of intermediates used by all firms competing within a country, whereas \(P^T_m\) is the price index of intermediates used by all firms located within a country (see the Appendix C for more details). Therefore, a decrease in the former price index of intermediates in addition to an increase in average productivity of final good firms and a possible higher number of available final goods would imply a fall in average price of final goods (i.e.

\(^{20}\)See the Appendix C for more details.
an increase in consumers’ welfare). However, the latter variable can be expressed as a function of survival threshold and the price index of intermediates used by all firms competing within an economy: 

\[ P^T_y = \left( \frac{L_m + L_y}{\sigma T} \right)^{\frac{1}{1-\gamma}} \frac{P^T_{m}}{P^T_{y}}. \]

3 Impact of trade liberalization in intermediate goods

This section aims at studying the impact of trade liberalization in intermediate goods on firm behaviour within both intermediate and final good sectors, as well as on welfare’s consumers, in both scenarios described in the previous section.

3.1 Indirect imports scenario

3.1.1 Intermediate good sector

As we can see from the Appendix D, following a fall in trade cost of intermediates goods the survival productivity cutoff increases \( \frac{\partial \sigma^D}{\partial \tau_m} < 0 \), which is confirmed by a decrease in the fraction of surviving firms (or firm’s probability of surviving) \( \frac{\partial \sigma^m}{\partial \tau_m} > 0 \). Whereas, the export productivity cutoff decreases \( \frac{\partial \sigma^X}{\partial \tau_m} > 0 \), indeed, the fraction of exporters (or firm’s probability of exporting) increases as well \( \frac{\partial \sigma^X}{\partial \tau_m} < 0 \). Therefore, as in Melitz (2003), the least productive firms are forced to exit the home market, but now more firms can also start exporting, implying an increase in aggregate productivity within sector, due to such reallocation effects towards the more productive firms (see the Figure 5). This aggregate productivity enhancement would entail on average a fall in the price index of intermediates \( (\frac{\partial P^T}{\partial \tau_m} > 0) \), although the change in the total number of intermediates available seems to be ambiguous \( (\frac{\partial M^T}{\partial \tau_m} =?) \).

3.1.2 Final good sector

As concerns the effects of trade liberalization in intermediates on final good sector, we can notice that only a fall in price of final goods takes place \( \frac{\partial P^T}{\partial \tau_m} > 0 \). In other words, all final good firms uniformly enhance their competitiveness following trade liberalization in intermediates – since they can replace the worst domestic intermediated inputs with better foreign ones \( (gains\ from\ input\ switching) \) – which would reflect as whole on consumers’ welfare, without any particular dynamics within final good sector.
3.2 Direct imports scenario

3.2.1 Intermediate good sector

Trade liberalization in intermediate inputs implies similar effects as in the former scenario: *productivity gains from reallocation effects seem to prevail on possible losses in varieties within intermediate goods sector* \(^{21}\) (see the Figure 6). Therefore, final good firms’ competitiveness seems to increase on average, although heterogeneously as we will see later.

3.2.2 Final good sector

As concerns the effects of trade liberalization in intermediates on final good sector, we can notice that both survival and export cutoffs increase \(\frac{\partial \psi_y^D}{\partial \tau_m} < 0, \frac{\partial \psi_y^X}{\partial \tau_m} < 0\); whereas the import-export cutoff decreases \(\frac{\partial \psi_y^{MX}}{\partial \tau_m} > 0\). Thus, we have two kinds of effect linked to the more intense import activity: the worst final good firms exit completely the market on the one hand, and the least productive exporters also leave the international market and decide to focus exclusively on the home market again on the other hand (see the Figure 7). Indeed, we can see clearly that both fractions of survivors and only-exporters (i.e. both probabilities of surviving and of only-exporting) decrease \(\frac{\partial \psi_y^m}{\partial \tau_m} > 0, \frac{\partial \psi_y^X}{\partial \tau_m} > 0\), whereas the fraction of import-export firms (i.e. the probability of two-way trading) increases \(\frac{\partial \psi_y^{MX}}{\partial \tau_m} < 0\).\(^{22}\) Therefore, some reallocations effects also take place within final good sector from less productive firms (nonimporters) to more productive ones (import-export firms), implying an aggregate productivity improvement, mainly due to some heterogeneous competitiveness gains from input trade liberalization. In particular, we can see an overall fall in price index of intermediates \(\frac{\partial P_T}{\partial \tau_m} > 0\) is associated with an increase in input price differential between importers and nonimporters within final good sector \(\frac{\partial \alpha}{\partial \tau_m} < 0\). More specifically, we can notice that

\(^{21}\) It is worth noting that the change in the export productivity cutoff is not so straightforward \(\frac{\partial \psi_y^X}{\partial \tau_m} = ?\), since we have an increase in both export variable profit opportunities – due to a fall in trade costs and an increase in the portion of y-importers – and fixed cost of exporting – which is positively related to the increasing fraction of y-importers. However, the fraction of m-exporters (or m-firm’s probability of exporting) undoubtedly increases \(\frac{\partial \psi_y^m}{\partial \tau_m} < 0\): this might mean that the number of m-exporters decreases less than the number of m-surviving firms or even increases. In a few words, we have a certain domestic selection effect and an ambiguous export selection effect across m-firms following trade liberalization in intermediates (see the Figure 6).

\(^{22}\) However, the fraction of all exporters (i.e. the probability of exporting) seems to be not affected \(\frac{\partial \psi_y^{X+MX}}{\partial \tau_m} = 0\), since both number of surviving firms and number of all exporters decrease proportionally (or simply because the probability of exporting final goods is marginally affected by trade liberalization in intermediate inputs).
the price of intermediates for nonimporters actually increases \[ \frac{\partial P_D}{\partial \tau_m} < 0 \]. Therefore, we can reach the conclusion that: following input tariff cutting, firm competitiveness on average enhances within final good sector, although actually, only some firms (import-export firms)\(^{23}\) would enjoy competitiveness gains from input switching mechanism, whereas the remaining firms would suffer some competitiveness losses, due mainly to a fall in input varieties available\(^{24}\).

### 4 Conclusion

This paper attempts to study the impact of trade liberalization in intermediate inputs within a general equilibrium framework à la Melitz (2003), where all firms are assumed to be heterogeneous in productivity and can produce either intermediate goods or final goods under monopolistic competition. In particular, our model shows different effects from reducing input tariffs, according to if all intermediates are assumed to be imported directly by final good firms – through incurring additional fixed cost – or indirectly – through an efficient wholesale system, without making any further fixed investment. If all foreign intermediates are ‘indirectly imported’, all final good firms gain uniformly in competitiveness from trade liberalization in intermediates, since they are able to substitute the worst domestic inputs with the best foreign ones (gains from input switching). These uniform competitiveness gains will translate entirely into an increase in consumers’ welfare without any particular firm dynamics within final good sector. Whereas, if all foreign intermediates are ‘directly imported’, only the more productive firms (importers) will be able to use foreign inputs, and therefore enjoy some competitiveness gains from input trade liberalization. Conversely, the other firms (non-importers) will suffer some competitiveness losses, mainly due to a

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\(^{23}\)In spite of the change in price of intermediates for importers is not so straightforward \( \frac{\partial P_M}{\partial \tau_m} = ? \), we can highlight that this price falls, since we have shown that the price of intermediates for all final good firms within a country decreases \( \frac{\partial P_T}{\partial \tau_m} > 0 \), although the price of intermediates for nonimporters rises \( \frac{\partial P_D}{\partial \tau_m} < 0 \).

\(^{24}\)In other words, if final good firm’s performance incorporates the effects arising from intermediate sector through the related price \( P_m \) (which is endogenous) in addition to the technology component \( \varphi_y \) (which is constant at firm level), we would have an improvement in importers’ productivity \( \Phi_M = \frac{\varphi_y}{P_m} \) and a worsening in nonimporters’ productivity \( \Phi_D = \frac{\varphi_y}{P_m} \) within final good sector, following trade liberalization in intermediates. That could contribute to explain why several empirical studies find insignificant learning-by-exporting effects, given that some exporters (only-exporters) will lose and some others (import-export firms) will gain in performance terms from trade liberalization policies.

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decrease in domestic input varieties available. That would force the least productive firms
to exit the domestic market and the least productive exporters to leave international market,
causing some market shares reallocation towards the more productive firms (import-export
firms), and consequently some aggregate productivity gains and some final variety losses.
Nevertheless, consumer’s welfare seems to increase again by considering altogether these
positive and negative effects. An empirical investigation on main predictions of the current
theoretical model is left for future research.
References


Figure 1: Closed Economy – Intermediate good (m) and Final good (y) sectors (j = m,y)
Figure 2: Open Economy – Indirect Imports – Intermediate good (m) and Final good (y) sectors (j = m,y)
Figure 3: Open Economy – Direct Imports – Intermediate good (m) sector

\[ \pi_m = f + \psi^M f_x \]

\[ \pi_m^{D+X} \]

\[ \pi_m^D \]

\[ \pi_m \]

\[ (\varphi_m) \]

\[ (\varphi_m^0)^{-1} \]

\[ (\varphi_m^X)^{-1} \]

m-Exiters m-DOMs m-EXPs
Figure 4: Open Economy – Direct Imports – Final good (y) sector
Figure 5: Trade liberalization in intermediate goods – Indirect Imports – Intermediate good (m) sector
Figure 6: Trade liberalization in intermediate goods – Direct Imports – Intermediate good (m) sector
Figure 7: Trade liberalization in intermediate goods – Direct Imports – Final good (y) sector