Mixed market structure, competition and market size: How does product mix respond?

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Abstract

Assuming a double heterogeneity; within industry firm heterogeneity and within firm product heterogeneity, this paper investigates how multi-product firms respond to tougher competition and greater market size across destinations. Building a theoretical model where monopolistically competitive and oligopolistic firms coexist in the same market, the paper studies how an increase in market size affects both types of firms' behavior. The model shows that the final impact of bigger market size on the product-mix of multiproduct firms depends on the level of fixed entry costs. For low level of entry costs, big firms increase their product-mix when they export to larger markets as they benefit from scope economies. Yet, when fixed costs are prohibitive, a larger market induces firms to skew their export sales toward their core product. Very strong confirmation of this non-monotonic effect of market size was found for Egyptian exporters across export market destinations.

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1 Introduction

Heterogeneity among firms existing in the same industry is a common feature of all industries around the world. Yet, there is no exact distribution known for these heterogeneous firms. Despite that, it is well known that a few firms dominates the market structure. According to Bernard *et al.* (2007), only 4% of American firms are exporters, and among these firms the top 10% dominate 96% of US exports. On the other hand, Bernard and Jensen (1995) show that in the US manufacturing sector exporting firms represent only 18% of the total sector.

Over the last decade, multi-product firms dominate world trade flows. In the US, approximately 60% of the firms export more than one product and they account for 99.6% of total exports (Bernard et *al.*, 2007). Nevertheless, existing trade theories were assuming a representative firm producing only one variety. More recently, international trade literature, empirically and theoretically, has been interested in studying how trade openness affects multi-product firms' behavior through adjusting their intensive and extensive margins, according to the destination market characteristics (see, e.g. Bernard et *al.* 2010; Eckel and Neary 2010; Mayer et *al.* 2014).

It is well known that the firm size distribution in advanced economies is highly skewed. According to Axtell (2001), within the same industry, there exists a small number of big firms and a large number of small firms coexisting together. Despite this heterogeneity in firm size within the market, theoretical works studying firm behavior were assuming that decisions made by small or big firms have the same weight on economic outcomes.

This paper follows the new trend in the literature, assuming a mixed market structure where big and small firms coexist together (See, e.g. Eckel and Yeaple, 2015; Parenti, 2017; Shimomura and Thisse, 2012). More precisely, the paper is interested in studying how multi-product firms respond to greater competition and larger market size through their intensive and extensive margin when the market is characterized by the coexistence of single and multi-product firms.

To the best of my knowledge, it is the first paper that assumes a double heterogeneity: a within industry firm heterogeneity and a within firm product heterogeneity.

This model assumes an intra-firm and inter-firm heterogeneity to study how market size and higher competition affect firms' behavior and their choice of product scope. The model emphasizes the fact that each firm has a core product that is produced with the lowest marginal cost. Firms produce less efficiently products far from their core competence[1].

Doing so, this model tries to fill the gap between empirical and theoretical findings in trade literature concerning the impact of greater destination market size and tougher competition on the product mix of multi-product firms.

Aside from Qiu and Zhou (2013) and despite the different assumptions and techniques underlying theoretical models in this area, almost all these models

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[1]This increasing marginal cost function is a source of scope economies for multi-product firms.

conclude that trade liberalization will encourage firms to reduce their product scope and focus on their core competence which increases the average productivity in the market.

However, on the empirical side the results were not consistent, on one hand, some works confirmed this fact showing that trade liberalization induces firms to drop their marginal products and focus on their "core competencies" (Baldwin and Gu, 2009; Bernard et *al.*, 2010; Mayer et *al.*, 2014). This within firm reallocation of resources has largely contributed to aggregate output growth in the US manufacturing sector (Bernard et *al.*, 2006), and increase in French firms' productivity (Mayer et *al.*, 2014).

Yet, on the other hand, some other works show that scope product adjustment after trade openness depends on firm productivity. Berthou and Fontagné (2013) showed that, reduction in trade costs after the introduction of the euro, induces firms to increase their product range as well as their intensive margin especially the most productive ones. Moreover, Iacovone and Javorick (2010) showed that Mexican firms, after NAFTA, create new varieties to export.

In summarizing some of the results, in contrast with the most of theoretical works on multi-product firms, a larger market size in the destination country does not have a unique impact on the firm's product scope. This impact depends on the level of barriers to entry. In other words, a larger market size leads to a more diversified product mix. But, this effect is dampened when fixed costs are high enough.

Using cross-section Egyptian firm-level data, the results obtained confirm the theoretical model's prediction. The impact of destination's market GDP varies with the level of fixed costs[2] to enter this market.

The rest of this paper is organized as follows: Section 2 highlights the main literature Section 3 represents the model set-up and assumptions. Section 4 studies firms' behavior and their reaction to greater competition and market size, section 5 presents the empirical results and finally section 6 concludes.

2 Literature review

According to the new literature on multi-product firms, firms vary both their product scope (how many products to export) and product range (how much to export from each product) according to destinations and products characteristics.
These new theoretical works give new explanations to gravity relationship using extensive (number of destinations and number of products) and intensive (value of exports per product) margins.

Almost all the theoretical models that were interested in studying how multi-product firms respond to higher market size and greater competition due to trade openness were assuming that the market consista of multi-product firms only. That is not so true as, single product firms usually coexist with multi-

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[2]To proxy for barriers to entry, institutional variable like cost to export and time to export are used to measure the impact of these barriers on firms' product scope.

product ones even if the latter dominates the market.

This paper follows the new trend in the literature and assumes the coexistence of oligopolistic large multi-product firms with small monopolistically competitive single product firms in the same market.

Doing so, this model lies in between two main trends in the literature. **The first** trend is Industrial Organization with multi-product firms[3]. Multi-product firms attracted industrial organization theorists' attention. However, these models use partial equilibrium environment. These studies were interested by intra-firm adjustment through modifying their product scope, and they conclude that these adjustments are totally different from adjustment through entry and exit of firms.

The second trend is the growing literature on International trade with multi-product firms.

Recently, international trade theorists start to include multi-product firms in their analysis. Feenstra and Ma (2008) build a theoretical model of monopolistic firms that produce more than one product. They conclude that trade openness reduces the cannibalization effect for these firms. Thus, less efficient firms exit the market and number of varieties available increases as these less efficient firms are replaced by more efficient ones that have a higher number of varieties.

Moreover, Eckel and Neary (2010), using a general equilibrium framework, build a model of oligopolistic firms. They assume that each firm has a core competence product that has a lower marginal cost than other products. They found a new source of trade gains: firms drop their worst performing products and focus on their core product, hence this increases average productivity in the market. Thus, the selection effect in their model is at the product level. Nevertheless, trade reduces the number of varieties in contrast with traditional trade theories. Moreover, Nocke and Schutz (2016) in a more generalized framework, show that with oligopolistic market structure, multi-product firms may choose not to produce products far from their core product, as the markup for these products is lower thanks to the cannibalization effect.

Arkolakis et al. (2015), using Brazilian firm-level data, estimate export entry barriers that are product specific and found that, firms incur higher unit cost for products far from their core product but face lower market access costs.

Futhermore, in their model with monopolistic competition Mayer et *al.* (2014) found that larger market size and tougher competition induces firms to skew their exports towards their best performing product. This model is different from theirs in two main points: First, taking the cannibalization effect into account allows to study the strategic interaction between oligopolistic firms. Strategic interactions are of a great importance for firm's reaction to changes in competition and market size. Second, the model allows for the coexistence of two types of firms: large oligopolistic firms, their number is exogenously determined and small monopolistically competitive firms whose number is set through free entry condition.

This paper is directly related to Parenti (2017). In his model, he assumes a

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[3]See for example : Brander and Eaton, 1984, Klemperer, 1992; Ottaviano and Thisse, 1999; Hallak, 2000; Baldwin and Gu, 2005; Bernard et *al.*, 2010.

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mixed market structure where small monopolistically competitive firms coexist with large oligopolistic ones in the market. He found that trade reinforces small firms to exit and large firms to expand.

3   The model

The model is based on an extension of Parenti (2017) to allow for the existence of a core product for multi-product firms with higher marginal cost for varieties far from the core product.

3.1   Basic set-up

3.1.1   Preferences and Demand

Consider an economy with L consumers each supplying one unit of labor. There exists a continuum of small single product firms $i \in [0, M]$ and Ω multi-product big firms $\omega = 1, ..., \Omega$ with mass[4] $N_\omega > 0$. So the total varieties available in the market equals $\nu = \sum\limits_{\omega=1}^{\Omega} N_\omega + M$.

Big firms have more market power than small ones and they affect aggregate market outcomes as long as $N_\omega > 0$. It is worth noting that $N_\omega \forall \, \omega \in [1, \Omega]$ is endogenously determined by firms as it will be described below.

The economy involves one homogeneous good produced under perfect competition and a horizontally differentiated good produced under increasing returns.

Denote by x_i, $x_\omega(k)$ and X the individual consumption from a single consumer of the variety (i) produced by a single product firm, of the variety k produced by the firm ω and of all varieties available on the market.

$$X = \int_0^\nu x_\nu d\nu = \sum_{\omega=1}^{\Omega} \int_0^{N_\omega} x_\omega(k)dk + \int_0^M x_i di$$

All consumers share the same utility function given by :

$$U = Q_0 + \alpha \int_0^\nu x_\nu d\nu - \frac{1}{2}\beta \int_0^\nu (x_\nu)^2 d\nu - \frac{1}{2}\gamma \left(\int_0^\nu x_\nu \right)^2$$

where Q_0 is the individual consumption of the numéraire good. The demand parameters α, β and γ are all positive. The parameters α and γ capture the substitution between the numéraire good and other varieties. An increase in α or a decrease in γ shift out the demand towards the differentiated varieties relative to the numéraire. The parameter β represents the degree of differentiation between varieties. In other words, it indexes consumers love for variety. In the extreme case where $\beta = 0$, consumers care only about their overall consumption level X. Thus, the varieties are perfect substitutes. The consumers do not care whether the variety is produced by a single or a multi-product firm. The degree

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[4] The mass of a player is a source of market power. See Parenti (2017) for more details about the mass of a player

of product differentiation increases with β as consumers give higher weight to the distribution of consumption level across varieties.

The marginal utilities are bounded, thus a consumer does not have positive demand for each variety. Assuming $Q_0 > 0$ and under the budget constraint given by :

$$Q_0 + \int_0^\nu p_\nu x_\nu d\nu \leq I$$

where I is the consumer's total income. Consumers maximize their utility subject to their budget constraint which gives the following individual inverse demand function :

$$p_i = p(x_i, X) = \alpha - \beta x_i - \gamma X \tag{1}$$

$$p_\omega(k) = p(x_\omega(k), X) = \alpha - \beta x_\omega(k) - \gamma X \tag{2}$$

The total market demand for varieties i and k can be expressed, respectively, by the following inverse demand functions:

$$p_i = p(x_i, X) = \alpha - \frac{\beta}{L} x_i - \frac{\gamma}{L} X$$

$$p_\omega(k) = p(x_\omega(k), X) = \alpha - \frac{\beta}{L} x_\omega(k) - \frac{\gamma}{L} X$$

Thanks to the quasi-linear utility, the elasticity of demand is not constant, however it is related to the toughness of competition. Any increase in the level of competition due to higher market size L or lower differentiation β increases the demand elasticity.

3.1.2 Production and firm behavior

Labor is the only factor of production available. Its market is competitive. Moreover, the homogeneous good is produced under constant returns to scale and a competitive market. Entry to the differentiated sector is costly and requires an irreversible investment that implies a sunk cost $f_E > 0$[5] which is incurred by all firms. Following Parenti (2017), the model assumes that for a multi-product firm, adding a new variety requires an additional fixed cost $f > 0$. Thus, while a single product firm has a total fixed cost equals $f_E + f$, a multi-product firm ω with mass $N_\omega > 0$ affords a fixed cost equals to $N_\omega f$ [6].

Each multi-product firm produces a set of varieties $k \in [0, N_\omega]$. In contrast with Parenti (2017) and following the literature on multi-product firms with a core product[7] , the model assumes that a multi product firm incurs a higher marginal cost for varieties far from the core product. Therefore, the marginal cost is given by "ck". Nevertheless, a single product firm has a constant marginal cost equals to "c". It is clear that for the core product, i.e. $k = 0$, a multi-product firm is more efficient than a single product one. However, for the last variety, if and only if $N_\omega > 1$, the single product firm is more efficient and that is why it is profitable to the single product ones to exist in the market.

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[5]This implies the existence of scope economies.

[6]If this multi-product firm has a mass $N = 0$, its fixed cost would be $f_E + f$ like the single product one.

[7]See, e.g. Eckel and Neary, 2010; Melitz and Ottaviano, 2008; Mayer et al., 2014.

As X is defined as market aggregate, a proxy for the intensity of competition, a multi-product firm with mass $N_\omega > 0$ behaves like an oligopolistic firm whose decision affects this market aggregate X. On the other hand, a single product firm behaves like in monopolistic competition and takes X as a parameter.

The profit of a multi-product firm is given by

$$\Pi_\omega(x_\omega(k), N_\omega, X) = L. \int_0^{N_\omega} [p(x_\omega(k), X) - ck]x_\omega(k)dk - N_\omega f \quad \forall \, \omega = 1, ..., \Omega \tag{3}$$

while the profit earned by a single product firm is given by

$$\pi_i(x_i, X) = L.[p(x_i, X) - c]x_i - (f_E + f) \quad \forall \, i \in [0, M] \tag{4}$$

As multi-product firms behave strategically, profits of single product firms depend on their behavior as they could affect market outcomes.

3.2 The game

Assuming that firms compete à la Cournot, they are quantity setters. The number of small firms is determined by the free entry condition, while the number of multi-product firms is exogenously determined. Oligopolistic firms choose their product scope N_ω and output $x_\omega(k)$ per variety, and single product ones decide to enter the market and determine their output simultaneously.

Both types of firms maximize their profits and determine the Nash equilibrium $x_\omega^*(k), N_\omega^*, M^*, x_i^*$ and X^* such that

$$\Pi_\omega(x_\omega^*(k), N_\omega^*, X^*) \geq \Pi_\omega(x_\omega(k), N_\omega, X_{-\omega}^* + \int_0^{N_\omega} x_\omega(k)dk) \, \forall x_\omega > 0 \text{ and } N_\omega > 0$$

$$\pi_i(x_i^*, X^*) \geq \pi_i(x_i, X^*) \quad \forall x_i > 0 \text{ and } i \in [0, M^*]$$

$$\pi_i(x_i, X^*) < 0 \quad \forall x_i > 0 \text{ and } i > M^*$$

This Nash equilibrium is characterized by the coexistence of both types of firms if $M^* > 0$ and $N_\omega^* > 0$ for at least one firm.

It is worth noting that big firms take into their account the cannibalization effect when they maximize their profits. That's why, when they decide about their optimal quantity $x_\omega(k)$ they divide the remaining production in the market to $X_{-\omega}^* + \int_0^{N_\omega} x_\omega dk$.

In the next section, it will be shown that there is a unique equilibrium where both types of firms exist in the market. Moreover, as the number of single product firms is determined by the free entry condition, any variation in the market size or the level of competition affects both the intensive $x_\omega(k)$ and the extensive N_ω margins of multi-product firms.

4 Equilibrium outcomes and market structure

4.1 Maximization problem and Nash equilibrium

Single product firms maximize their profit with respect to their output, they take the total output X as a parameter. They face a downward-sloping demand given by (1). Their maximization problem is given by :

$$\max_{x_i} L.x_i[\alpha - \beta x_i - \gamma X - c] - (f_E + f) \tag{5}$$

As these firms share the same marginal cost c, they produce the same output $X_i(X) = L.x_i$ where :

$$x_i(X) = \frac{\alpha - \gamma X - c}{2\beta} \tag{6}$$

On the other hand, a multi-product firm chooses simultaneously its product scope N_ω and the output of all its varieties $x_\omega(k)$ for all $k \leq N_\omega$.

$$\max_{N_\omega, x_\omega(k)} L. \int_0^{N_\omega} x_\omega(k)(\alpha - \beta x_\omega(k) - \gamma X - ck)dk - N_\omega f \tag{7}$$

Maximizing this function gives us the following first order condition :

$$\frac{\partial \Pi_\omega}{\partial x_\omega(k)} = \alpha - 2\beta x_\omega(k) - \gamma X - ck - \gamma X_\omega = 0 \tag{8}$$

where $X_\omega = \int_0^{N_\omega} x_\omega(k)\,dk$ denotes the firm's total output. Equation (8) shows the cannibalization effect, the marginal profit for a multi-product firm on the variety k is proportional not only to the output of this variety, but also to the firm's total output. This gives the equilibrium output of each variety for multi-product firms as following ;

$$x_\omega(k) = \frac{\alpha - \gamma X - ck - \gamma X_\omega}{2\beta} \tag{9}$$

which leads to a total output

$$X_\omega = L. \int_0^{N_\omega} x_\omega(k)dk = L.\frac{N_\omega(\alpha - \gamma X) - \frac{1}{2}cN_\omega^2}{2\beta + \gamma N_\omega} \tag{10}$$

From equation (9), it is clear that, given its total output, the quantity produced from each variety is proportional to its distance from the firm's core product. The quantity of the core product, i.e. $k = 0$, is the highest
Combining (2) and (9), shows that the price for each variety is given by:

$$p_\omega(k) = \frac{\alpha + ck - \gamma(X - X_\omega)}{2}$$

Hence, the multi-product firm charges higher prices for varieties far from the core product. Yet, for these varieties, the firm realize lower profit margins as the price mark-up is lower for varieties far from the core product as follows :

$$p_\omega(k) - ck = \frac{\alpha - ck - \gamma(X - X_\omega)}{2}$$

Moreover, it is seen from equation (10) that the total output of a multi-product firms is a concave function of its product scope. This is a direct effect of the cannibalization effect. Each firm internalizes demand linkages between its varieties. It is a direct source of market power for these firms.

Consider now the firms' choice of their product scope. Multi-product firms add varieties as long as the marginal profit on the last variety is positive. These firms maximize their profits with respect to N_ω to determine their equilibrium product breadth as follows :

$$\frac{\partial \Pi_\omega}{\partial N_\omega} : Lx_\omega(N_\omega)[\alpha - \beta x_\omega(N_\omega) - \gamma X_\omega - \gamma X - cN_\omega] = f \qquad (11)$$

Firms' profits are a concave function of the product breadth. Profit is maximized when the marginal profit of the last variety produced is equal to the fixed cost afforded to add this variety as shown by equation (11).
Combining this equation (11) with the first order condition of each variety output in (8) gives the quantity produced of the last variety as follows :

$$x_\omega(N_\omega) = \sqrt{\frac{f}{\beta L}} \qquad (12)$$

Doing the same, combining (8) and (12) gives the firm's choice of product scope as follows:

$$N_\omega = \frac{\alpha - \gamma X - 2\beta\sqrt{\frac{f}{\beta L}} - \gamma X_\omega}{c} \qquad (13)$$

4.2 Free-entry condition and Market equilibrium

Using free entry condition for monopolistically competitive firms to find the sector's total output X, it is shown that small firms produce at equilibrium if they realize positive profits, i.e., if $\frac{(\alpha - \gamma X - c)^2}{4\beta} > \frac{f_E + f}{L}$.
Replacing in (5) with (6) gives the condition for single product firms to produce in equilibrium :

$$\alpha - \gamma X - c - 2\sqrt{\frac{\beta(f_E + f)}{L}} \geq 0 \qquad (14)$$

Free-entry condition implies that, at equilibrium, small firms realize zero profit such that

$$\pi_i^*(x_i^*, X^*) = 0 \quad \& \quad x_i^* = \sqrt{\frac{f_E + f}{\beta L}} \qquad (15)$$

Free-entry condition of small firms is used to find the differentiated sector's total output X:

$$X^* = \frac{\alpha - c - 2\sqrt{\frac{f_E + f}{\beta L}}}{\gamma} \qquad (16)$$

Replacing with the value of X^* and X_ω in (13), gives the equilibrium value of N_ω^* as a function of f_E and L as follows :

$$N_\omega^* = 2\frac{\theta - \gamma\sqrt{\frac{\beta f}{L}} - \beta c}{\gamma c} \tag{17}$$

where $\theta = \sqrt{\beta^2 c^2 + \gamma^2 \frac{\beta f}{L} + \gamma\beta c^2 + 2\gamma\beta c\sqrt{\frac{\beta(f_E+f)}{L}}}$

At equilibrium, N_ω^* is always positive even if $f_E = 0$. This means that multi-product firms decide to be large at equilibrium in the presence of single product ones. This result is different from the result got by Parenti (2016) where multi-product firms have the same marginal cost for all varieties. In his model, multi-product firms decide to be large at equilibrium only when they benefit from economies of scope $f_E > 0$. However, in the other case, market structure is characterized by monopolistic competition only.

This result is due to the fact that for the varieties near the core product $k = 0$, multi-product firms are more efficient than single product ones.

4.3 Coexistence of both types of firms

The asymmetry between small and large firms in terms of their marginal costs assures the coexistence of multi-product in equilibrium in the presence of the monopolistically competitive fringe.

Combining the industry's total output X in equation (16) with the identity $X = \Omega X_\omega + M x_i$ in order to find the condition under which both muti-product and single product firms coexist at equilibrium shows that $M^* > 0$ if and only if

$$\Omega < \frac{(2\beta + \gamma N_\omega)(\alpha - c - 2\sqrt{\frac{\beta(f_E+f)}{L}})}{\gamma N_\omega(c - \frac{1}{2}cN_\omega + 2\sqrt{\frac{\beta(f_E+f)}{L}})}$$

On one hand, this condition requires having a large market, i.e. greater L and/or α, for the small firms to exist in equilibrium. Moreover, the number of big firms Ω should be small enough to allow for the coexistence of both types of firms.

At equilibrium, this condition depends on the sunk entry cost f_E as follows :

$$\Omega < \frac{(\theta - \gamma\sqrt{\frac{\beta f}{L}})(\alpha - c - 2\sqrt{\frac{\beta(f_E+f)}{L}})}{(\theta - \gamma\sqrt{\frac{\beta f}{L}} - \beta c)(c - \frac{\theta - \gamma\sqrt{\frac{\beta f}{L}} - \beta c}{\gamma} + 2\sqrt{\frac{\beta(f_E+f)}{L}})} \tag{18}$$

On the other hand, this inequality holds only for lower values of sunk cost of entry f_E.

Lemma 1 *Assuming $f_E < \tilde{f}_E$, there exists a unique Nash equilibrium where single product firms and multi-product ones coexist in equilibrium.*

There exists a prohibitive value of the entry cost $\tilde{f}_E$ above which the market is dominated by oligopolistic firms only and small firms find that it is not

Figure 1: Market Structure
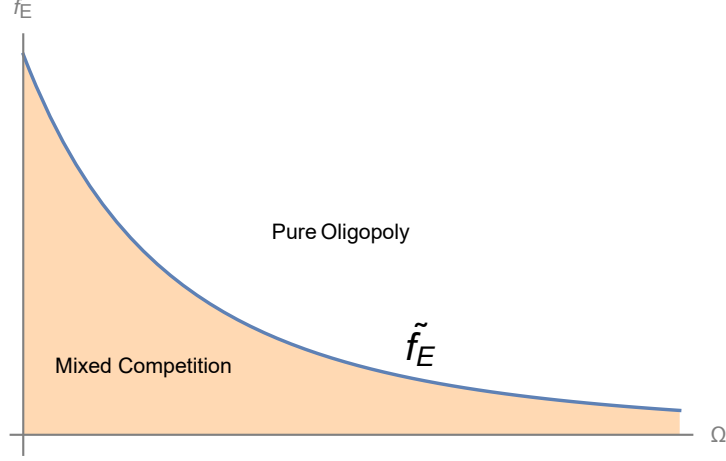
profitable to remain on the market.

Figure 1 shows how the market structure varies with different values of the entry cost f_E. For a given number of oligopolists Ω , if barriers to entry is high enough $f_E > \tilde{f}_E$ single product firms do not enter the market. As well, for given entry cost, if number of oligopolistic firms are high enough, single product firms find it is not profitable to enter the market. Thus, the market structure is dominated by pure oligopoly.

Using the equilibrium value of X^* the number of single product firms M^* is given by :

$$M^* = [\frac{2\beta}{\gamma}][\frac{\alpha - c}{2}\sqrt{\frac{L}{\beta(f_E + f)}} - 1] - \Omega\sqrt{\frac{\beta L}{f_E + f}}\frac{N_\omega(c + 2\sqrt{\frac{\beta(f_E+f)}{L}} - \frac{1}{2}cN_\omega)}{2\beta + \gamma N_\omega}$$

(19)

Thus, to sum up, if the sunk entry cost is lower than the prohibitive value and the number of big firms is not too large; there exists a unique equilibrium characterized by a mixed market structure where both types of firms coexist.

5 Trade openness

The following part will study how, in the presence of a mixed market structure, trade openness will affect multi-product firms' choice of their product scope.

Assuming that we have η symmetric countries that are freely trading between each others. Following Eckel and Neary (2010), trade is seen as an increase in the number of countries, which in his turn, induces a higher number of consumers and a greater number of firms.

International trade has two different effects on domestic firms: first, when they start to export, home firms face a higher market size, i.e. greater L. Second,

trade increases the competition faced by these firms due to the pressure of foreign firms.

The final impact of trade openness is the sum of these market size and competition effects, so they will be analyzed successively.

5.1 Market size and product scope of large firms

Assuming that the homogeneous good is freely traded between countries to avoid changing the relative wage.

When they start to export, domestic firms face a greater demand to their varieties. So, they start to adjust both their product scope and output per variety to respond to the new demand.

A larger market size increases the aggregate firms and industry output: LX_ω, X_i and X. Thus, this leads to an increase of the output of all varieties already produced.

Moreover, in line with models of multi-product firms with "core competence", the product scope of multi-product firms at equilibrium N_ω^* depends on the market size L. Thus, an increase in market size faced by large firms due to openness of trade affects their choice of product mix.

The increase in market size L does not have a unique impact on the product mix of large firms. Yet, the final impact of a larger market size depends on the entry barriers f_E. Therefore, there exists a threshold value for this entry cost denoted by $\bar{f}_E$, if sunk entry cost f_E is low than this threshold $\bar{f}_E$, higher L will encourage big firms to increase their product scope. On the other hand, for higher values of f_E, but less than the prohibitive value $\tilde{f}_E$, increase in market size encourages multi-product firms to drop some of their products and to reduce their product mix.

Proposition 1 *Assume $f_E < \bar{f}_E$, an increase in market size due to trade openness implies higher product scope for multi-product firms.*

To study how big firms respond to greater market size due to trade openness, I take the derivative of N_ω with respect to L :

$$\frac{\partial N_\omega}{\partial L} = \frac{1}{c}\sqrt{\frac{\beta f}{L^3}} - \frac{\frac{\gamma\beta f}{L^2} + \beta c\sqrt{\frac{\beta(f_E+f)}{L^3}}}{c\sqrt{\beta^2 c^2 + \gamma^2\sqrt{\frac{\beta f}{L}} + \gamma\beta c^2 + 2\gamma\beta c\sqrt{\frac{\beta(f_E+f)}{L}}}} \quad (20)$$

Equation(20) is positive if and only if

$$f_E < \bar{f}_E = \frac{\gamma f}{\beta}$$

Corollary 1 *If $\bar{f}_E < f_E < \tilde{f}_E$, higher market size induces firms to drop some of their varieties and to reduce their product scope.*

Figure 2 shows how the choice of product scope varies with larger market size. In the benchmark case with no "core competence" like in Parenti (2016),

Figure 2: The market-size effect of trade openness on product scope
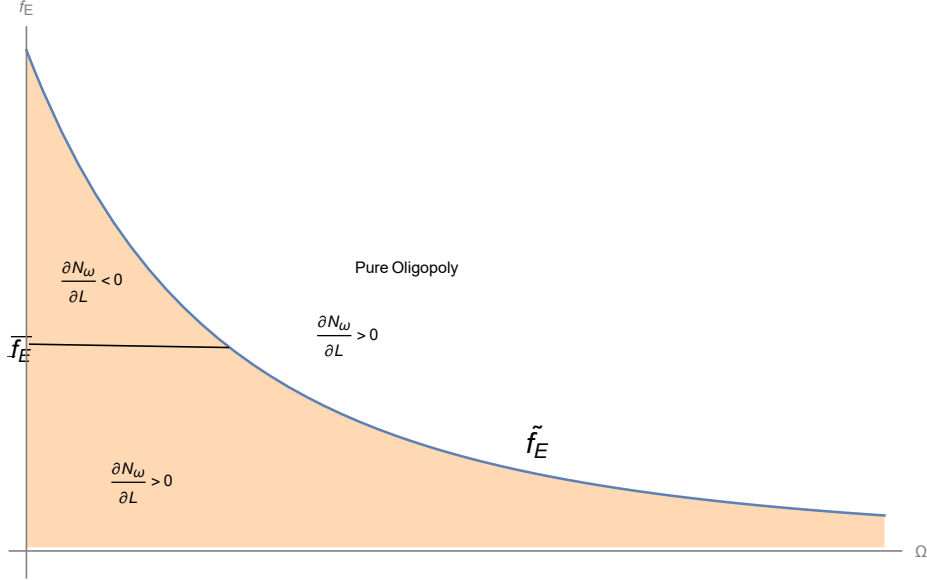
the increase in market size does not affect the choice of product scope by firms. Yet, when we add a core product assumption, i.e. the marginal cost increases when the product is far from the core competence, the market size affects the choice of product mix.

Adding a higher marginal cost for varieties far from the core product is a way to describe the firm's scope economies. Thus, when f_E [8] is low, this reflects a higher level of competition and a greater number of small firms. In that case, multi-product firms benefit from scope economies, and hence an increase in the market size induces them to increase the number of their varieties.

Nevertheless, in the other case where f_E is high enough, multi-product firms face diseconomies of scope, that's why an increase in market size encourages these firms to drop some of their products and skew their exports towards their best performing one.

Unless $0 < f_E < \tilde{f}_E$, the market structure is characterized by pure oligopoly. In this case, an increase in market size has a unique and positive impact on firms product mix[9] .

When there is pure oligopoly in the market, X is determined big firms decisions $(N_\omega, x_\omega(k))$. In other words, $X = \sum\limits_{\omega=1}^{\Omega} \int_0^{N_\omega} x_\omega(k)dk$. In that case, the derivative

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[8]f_E captures, implicitly, the level of competition in the market through the free entry condition and its impact on the total market output X.

[9] This result is different from Eckel and Neary (2010) as they do not have a fixed cost per variety f in their model, which implies that the output of the last variety is null, and, hence the choice of product scope is not affected by larger market size.

of N_ω with respect to L is monotone and positive for all values of f_E.

$$\frac{\partial N_\omega}{\partial L} =$$

$$\frac{[(2\beta + \gamma N_\omega)(1 + \Omega)]^2 (\sqrt{\frac{f}{\beta L^3}})(\beta + \frac{1}{2}\gamma N_\omega)}{[2\beta + \gamma N_\omega(1 + \Omega)]^2 (c + \gamma\sqrt{\frac{f}{\beta L}}) + \gamma\Omega[(2\beta(\alpha - cN_\omega) - \frac{1}{2}\gamma c N_\omega^2(1 + \Omega)]} > 0$$

Nevertheless, in the mixed market structure, when entry costs are low enough, the number of single product firms is very high. Thus, multi-product firms respond to greater competition from small firms by increasing their product mix when L increases.
When sunk entry cost f_E are low enough, multi-product firms benefit from scope economies, that's why an increase in the market size encourages them to increase the number of varieties supplied.
This result is in line with Qiu and Zhou (2013) who found that more productive firms may increase their product mix when fixed cost of introducing more varieties increases with the product scope.

Yet, for higher values of f_E, small firms have less incentive to enter the market. Hence, large firms respond to greater market size by dropping some of their products. This could be explained by two main forces : First, the fact that N_ω is a convex and decreasing function of the number of small firms M. Hence, when f_E is high enough, i.e. $f_E > \bar{f_E}$, the number of small firms is low. Thus, the impact of the small number of single product firms on the product scope of multi-product firms is higher thanks to the convexity.[10] Second, for higher values of sunk entry cost, large firms face decreasing returns to their scope. That's why increase in market size induces firms to drop some products and concentrate on their core product.

5.2 Greater competition and product mix of large firms

Trade openness, beside expanding market size, increases the competition faced by domestic firms due to the existence of foreign firms. To simplify, trade openness, in this part, is seen as a higher number of firms available on the market.
For the sake of simplicity, I assume the exogenous and costless entry of an additional big firm into the domestic market.

Assuming that the condition of coexistence still holds for $\Omega + 1$ big firms. From (19), it is clear that, an increase in the number of large firms leads to the exit of small firms. Yet, the total output X^* remains not affected as the number of small firms will adjust to keep the free-entry condition satisfied. Moreover, at equilibrium, the product mix of large firms remains not affected.

Trying to understand how the entry of a big firm affects the domestic market, it is important to analyze what happens in the short run before the number of small firms adjusts to recall equilibrium.

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[10]It is worth noting that $\frac{\partial N_\omega}{\partial M} < 0$ and $\frac{\partial^2 N_\omega}{\partial M^2} > 0$.(See the next section for more details.)

Using the identity $X = \Omega X_\omega + M x_{sp}$, N_ω could be expressed as a function of number of small and big firms (Ω, M) as follows :

$$N_\omega = \frac{\alpha - \gamma[M x_{sp} + \Omega X \omega] - 2\beta x_{N_\omega} - \gamma X_\omega}{c} \tag{21}$$

Following the exogenous entry of a large foreign firm, multi-product firms will decrease their product scope as $\frac{\partial N_\omega}{\partial \Omega} < 0$ due to greater competition faced:

$$\frac{\partial N_\omega}{\partial \Omega} =$$

$$\frac{-2\gamma\beta N_\omega(\alpha - \gamma M x_{sp} - \frac{1}{2}c N_\omega)}{c(2\beta + \gamma N_\omega(1+\Omega))^2 + 2\gamma\beta(1+\Omega)(\alpha - \gamma M x_{sp} - c N_\omega) - \frac{1}{2}\gamma^2 c N_\omega^2(1+\Omega)^2} < 0$$

Moreover, according to (6) small firms will shrink following the increase in the total industry output X^* due to the increase in the number of large firms available in the market. This will reduce their operating profits so they could not afford the fixed cost. Thus, the number of small firms M decreases with (19). The exit of small firms re-establishes the equilibrium assuring null profit for small firms at equilibrium.
The exit of small firms shifts market demand towards both surviving single product and multi-product firms. Single product firms raise their mark-up again and large firms increases their product mix.

$$\frac{\partial N_\omega}{\partial M} = \frac{-\gamma x_{sp}[2\beta + \gamma N_\omega(1+\Omega)][c[2\beta + \gamma N_\omega(1+\Omega)] - \gamma N_\omega(1+\Omega)]}{c[2\beta + \gamma N_\omega(1+\Omega)]^2 + \gamma(1+\Omega)[2\beta(\alpha - \gamma M x_{sp} - c N_\omega) - \frac{1}{2}c N_\omega^2 \gamma(1+\Omega)]} < 0^{[11]}$$

Thus, the final result is that the number of varieties supplied by multi-product firms remains the same after the entry of a foreign large firm in the domestic market.

Proposition 2 *As long as $f_E < \tilde{f}_E$, an exogenous entry of a multi-product firm reduces the number of small firms in the market. Yet, aggregate industry output X and large firms' product-mix remains unaffected.*

5.3 Globalization and its impact on firms behavior

Combining the two effects of trade to assess the final impact on the market structure and firms' behavior. Assuming that there are η symmetric countries that freely trade between them. So the market size is now given by ηL and the number of oligopolists is $\eta\Omega$. Following Eckel and Neary(2010), trade openness in each country is then measured by η. Under free-trade,the number of small

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[11]From these 2 equations $\frac{\partial N_\omega}{\partial M}$ and $\frac{\partial N_\omega}{\partial \Omega}$, it is clear that, in the short run, tougher competition encourages large firms to drop some of their products and focus more on their core product. This result is consistent with Melitz et al.(2014). However, in the long run thanks to the free-entry condition of small firms, the product scope of large firms remains not affected by greater competition.

firms is now given by :

$$M^* = [\frac{2\beta}{\gamma\eta}][\frac{\alpha-c}{2}\sqrt{\frac{\eta L}{\beta(f_E+f)}} - 1] - \eta\Omega\sqrt{\frac{\eta\beta L}{f_E+f}}\frac{N_\omega(c+2\sqrt{\frac{\beta(f_E+f)}{\eta L}} - \frac{1}{2}cN_\omega)}{2\beta+\gamma N_\omega}$$

(22)

From this equation, it is clear that there are two main forces that affect the number of small firms after trade openness. The first one appears in the first term in (22), an increase in the market size due to trade openness increases the number of small firms operating on the market. The second one, stems from the second term, trade increases also the number of oligopolistic firms Ω which induces the exit of small firms as explained in the previous section. Yet, the total number of varieties in the market increases.

Moreover, the condition for the coexistence of both types of firms is different from autarky and is given by :

$$\Omega < \frac{1}{\eta}\frac{(2\beta+\gamma N_\omega)(\alpha-c-2\sqrt{\frac{\beta(f_E+f)}{\eta L}})}{\gamma N_\omega(c+2\sqrt{\frac{\beta(f_E+f)}{\eta L}} - \frac{1}{2}cN_\omega)}$$

(23)

Thus, under free trade, both types of firms coexist in the same market if and only if $0 < f_E < \tilde{f}_E^{trade}$.
As the threshold, of entry cost f_E, satisfying the condition of coexistence of both types of firms changes after free-tarde, it is important to study how the market structure changes after trade openness. To do that, it is crucial to study how the condition of coexistence of both types of varies with η.
Taking the derivative of equation (23) with respect to η, to assess how the interval of existence of mixed competition varies after trade openness, shows that:

$$\begin{cases} \frac{\partial\Omega}{\partial\eta} > 0 & \text{if } \frac{\partial N_\omega}{\partial L} > 0 \\ \frac{\partial\Omega}{\partial\eta} < 0 & \text{if } \frac{\partial N_\omega}{\partial L} < 0 \end{cases}$$

Figure 3 shows how the market structure changes after trade openness. It is clear that, combining the market-size effect and the competition-effect of an increase η, moves the curve that defines the boundary of the existence of the two types of firm as follows :

Figure 3: Trade openness and market structure
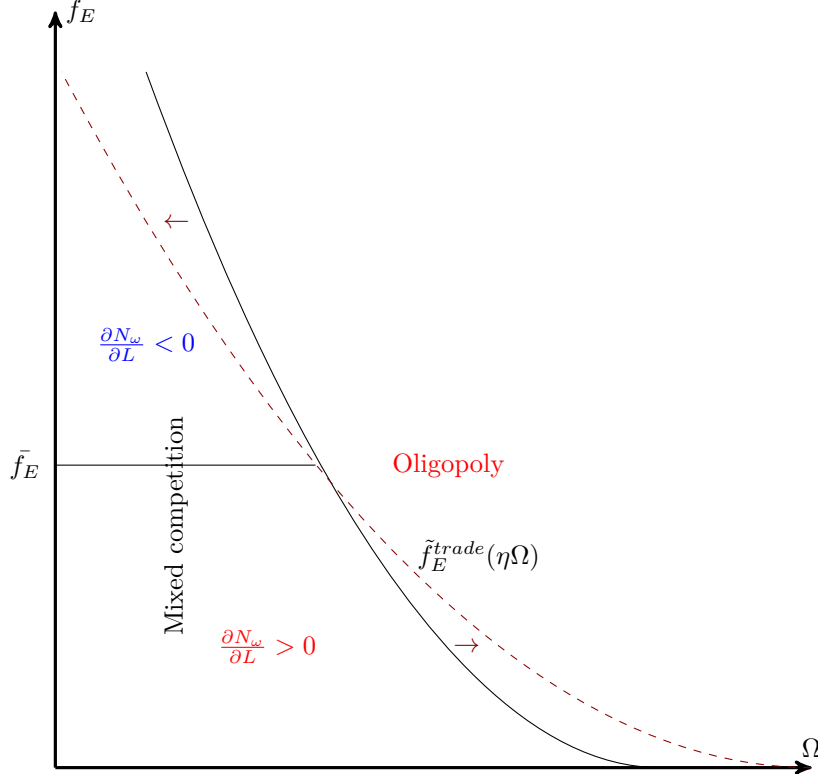
To sum-up, the combination of the two effects of trade openness (increase in L and Ω) leads to an increase in the total number of output and varieties available to the consumers as the increase in the number of big firms leads to the exit of small firms. Yet, the product scope of each multi-product firm, at equilibrium, is not affected by the number of big firms operating in the market.

However, the increase in the market size L induces multi-product firms to adjust their product scope. This adjustment depends on the level of fixed costs of entry that the firms afford to enter the market. For low values of barriers to entry, firms benefit from scope economies and increase the number of varieties supplied. Nevertheless, when these barriers are high enough, an increase in the market size, encourages big firms to drop some of their varieties and focus more on their core competence.

Proposition 3 *The total effect of trade openness is the exit of small firms due to the increase in the number of oligopolistic firms. The total output and the total number of varieties available in the market increase.*

6   Empirical Analysis

This part will be interested in studying the main prediction of the theoretical model regarding the impact of higher market size in the destination market on the firm's exported product mix.

6.1   Data and Methodology

The model predicts that a larger market size in the destination market does not have a monotonic impact on the firm's exported product mix. Yet, barriers to entry play an important role in determining the final impact of the market size on firms' choice of the product mix.
Lower entry cost increases the number of small firms operating in the market. Thus, an increase in market size induces large firms to increase their product mix and to expand their product portfolio.
Nevertheless, higher values of barriers to entry induces the exit of small firms. As such, a multi-product firm drops some products and skews her exports towards her best performing products.
As explained above, a multi-product firm charges higher price for products near the core product, as well the firm undertake lower cost for these products, this leads to a higher mark-up for products not far from the core product. Therefore, when the firm faces lower number of small firms i.e. lower competition, she concentrates the exports around the core product to realize higher profit and face the high fixed cost.

To test this empirically, firm-level data on firms' exports is needed to assess how the exported product mix is affected by the destination market size. Therefore, firm-level data on Egyptian annual shipments to all countries in the world is used to assess how Egyptian exporters respond to greater market size and intensive competition in their destination countries.

The firm-level data[12] comes from the General Organization for Export and Import Control (GOEIC), the Ministry of Industry and Foreign Trade in Egypt. This dataset is collected by Egyptian customs and include exports sales for each HS6 product by destination country. It is worthy to note that most of the firms are multi-product, remain in the market for more than a year but export to one destination.
Interested in the cross section of firm-product exports across destinations, I limit the observations for a single year, 2014.[13] It is the last year for which the data is available.

The theoretical model measures the trade by an increase in η which combines an increase in the market size L and in the number of operating firms. To control for country size, I use data on GDP expressed in common currency from the *World Development Indicators*. As for the number of operating firms[14] , the

[12]OAMDI, 2015. Exports Data, 2005-2014, Exports and Imports Data (EID),http://erf.org.eg/data-portal/. Version 1.0 of Licensed Data Files; Egypt EID-EXP 2005-2014. Egypt: General Organization for Export and Import Control (GOEIC) & Economic Research Forum (ERF).

[13]Regressions from other years gave similar results.

[14]As a robustness check, I use the imports per destination for each HS6 product from all

total number of the destination's partners is used as a proxy for the number of firms operating in the market.

Concerning the barriers to entry, the main variable that determines the impact of the destination market size on firms' choice of product mix, I use the institutional variable "time to import" in a destination country as a proxy to measure it. Moreover, as a robustness check, following Helpman *et al.* (2008), I construct a dummy variable for this variable that takes the value of 1 if the time to import in the destination country is above the median and 0 otherwise. Data for these variables are from the *Doing Business* database.
Furthermore, I use "cost to import" and "number of documents" needed to import in the destination country as proxies for the measure of entry barriers.

Regards trade barriers/enhancers between Egypt and her trading partners, I use a set of control barriers : distance, contiguity, common language and dummies for Free Trade Agreement, membership in WTO. As well, I construct a variable to measure the degree of trade freeness ϕ_{ij} between Egypt and the destination country[15]. Data for these variables comes from the CEPII database.

6.2   Model specification and Results

In order to test how exporters change their product mix according to the destination market characteristics, and to measure the skewness of a firm's product mix, an index accounting for the concentration within firm "Herfindahl index"[16] is calculated to capture changes in skewness of a firm's exported product mix over the entire range of exported products[17].

Then, this index is regressed on a set of independent variables explained in the above section as follows :

$$HHI_{fj} = \alpha_0 + \alpha_1 \ln GDP_j + \alpha_2 \ln cost_j + \alpha_3 GDP_j \times cost_j +$$
$$\alpha_4 \ln partners_j + \alpha_5 \phi_{ij} + \delta_f + \epsilon_{fj} \quad (24)$$

where GDP_j is the destination market size, $partners_j$, proxy for the competition is the number of trading partners of the destination, ϕ_{ij} is a vector of independent variables controlling for the freeness of trade between Egypt and the destination, $cost_j$ is a measure for the entry cost in the destination, δ_f is the firm fixed effect and ϵ_{fj} is the discrepancy term. I add an interaction term between the destination's GDP and the fixed cost to test how the level of entry barriers affect the firms' choice of exported product mix.

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countries except Egypt weighted by the share of this product in each firm's total exports to all destinations except the one considered. Data on product imports per destination comes from COMTRADE database. The results are reported in Table A.1 in the Appendix.

[15] Following Mayer *et al.* (2014), freeness of trade is calculated using a gravity model like the one used for calculating the market potential but after getting rid of origin and destination fixed effects to measure only bilateral trade barriers impact.

[16] Regressions using alternative measures for the firms' product mix, like the number of products exported, Table A.3, are reported in the appendix.

[17] It is worthy noting that $\frac{\partial q_\omega}{\partial L} > 0$ and, $\frac{\partial^2 q_\omega}{\partial L^2} < 0$ where $q_\omega(k) = L.x_\omega(k)$. So, the total output per variety increases with the market size. But, this increase in the output is relatively higher for products near the core product. Therefore, the within firm HHI is the most suitable index to account not only for the number of products exported but also to the skewness of exports towards the core product.

Since, I aim to study how the product concentration within firms vary with different market characteristics, I include firm-fixed effects throughout. Yet, the remaining independent variables are destination-country specific as there is no variation in the origin country.

Obviously, there are unobserved destination characteristics, other than the ones included in the regression, that affect the dependent variable. These unobserved characteristics are common to firms exporting to the same destination which generates a correlated error term structure.[18]
Moreover, the standard clustering procedure could not be used as the data does not have he structure of a "cluster sample" because each firm has observations across many countries, i.e. the level of clustering is not nested within the level of fixed effects.

Thus, following Moulton (1990) and Wooldridge (2006), the best way to estimate such a model is to use generalized least square (GLS) with country random effect and robust covariance matrix estimation on firm-demeaned data[19].

Table 1: Skewness Measures for Export Sales of All Products

	(1) HHI	(2) HHI	(3) HHI	(4) HHI
ln GDP	-0.0265***	-0.0260***	-0.0299***	-0.0253***
	(0.00443)	(0.00387)	(0.0109)	(0.00353)
ln Time to import	0.0473***	0.0307***	0.0261*	0.0210*
	(0.0124)	(0.0115)	(0.0154)	(0.0111)
Time to import $\times$ GDP	0.00738**	0.00727***	0.00537**	0.00766***
	(0.00337)	(0.00269)	(0.00248)	(0.00271)
ln freeness of trade		-0.0423***		-0.0341**
		(0.0158)		(0.0172)
ln partners				-0.0557***
				(0.0145)
FTA			-0.0401	
			(0.0522)	
WTO			0.0189	
			(0.0349)	
Common language			-0.100*	
			(0.0543)	
ln distance			-0.0264*	
			(0.0135)	
Constant	0.00567	0.0132	-0.00314	
	(0.0212)	(0.0202)	(0.00992)	
Observations	8789	8789	8789	
Within R^2	0.0783	0.0804	0.0829	

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All columns include firm fixed effect. Standard errors are clustered by destination country.

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[18]This may affect the significance of the variable of interest as standard errors of our coefficients may be downward biased.
[19]Harrigan and Deng (2010) as well as Mayer et *al.* (2014) face the same problem and they use the same technique for estimation.

Table 1 reports regression results for the baseline model. Column (1) shows that the impact of an increase in the market size of the destination country has a negative impact on the firm's skewness of product mix. Yet, fixed-cost "equivalent to f_E in the theoretical model" plays an important role in the determination of the final impact of the market size in the destination on the firm's choice of product mix. The positive and significant coefficient of the interaction term between the market size and time to import reflects that for high values of fixed cost the final impact of an increase in the market size induces a positive impact on the skewness of the firm's product mix. In other words, in countries with higher barriers to entry, a higher GDP will encourage firms to reduce their product scope.
This result is consistent and robust for different model specification throughout the table.

The variable "freeness of trade" capturing the degree of trade freeness between Egypt and her trading partners has a negative and significant impact on the skewness of the Egyptian exporters' product mix. Exporters diversify more their exported product mix in countries where trade barriers are lower.
The negative coefficient associated with the variable "number of trading partners", the proxy for the number of firms operating in the destination country, in column (4) is in line with Nocke and Schutz (2016). They found that greater competition induces firms to worry less about self-cannibalization and introduce new varieties.

Table 2 reports the estimation results using different proxies for barriers to entry f_E. Column (1) use the cost to import as a measure of fixed costs to enter the destination country. Column (2) uses the number of documents to export to a destination. Finally, column (3) follows Helpman *et al.* (2008) and uses a dummy variable that takes the value of 1 if the variable "time to import" is above the median and 0 otherwise.
The results are consistent with the theoretical predictions and confirm that when fixed costs are high enough, an increases in the market size reduces the product scope of multi-product firms.

Finally, Table A.2, in the Appendix, reports the same set of results for the Herfindahl index for product concentration within firm by adding the development level of trade partners. The aim of these regressions is to disentangle the unmeasured product quality exported to developed and developing countries and to show that the results are robust when we control for the destination country's income.[20] The positive and significant coefficient of the interaction term between the fixed cost and the GDP coupled with the negative coefficient of the GDP confirms the non monotonic relationship between the market size and the firms' product scope.

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[20] It is worth noting that it would be better if I run the regressions after dividing the data to subsets according to the GDP per capita. Yet, due to the small number of observations, this could not be done. Thus, I explicitly include the GDP per capita in the regressions.

Table 2: HHI with alternative measures of fixed costs

	(1)	(2)	(3)
	HHI	HHI	HHI
ln GDP	-0.0366***	-0.0209***	-0.0198***
	(0.00242)	(0.00494)	(0.00528)
ln cost to import	0.00113		
	(0.0109)		
ln cost to import $\times$ GDP	0.00505*		
	(0.00296)		
ln freeness of trade	-0.0582***	-0.0129	0.0166
	(0.0154)	(0.0316)	(0.0372)
ln # of documents		0.130**	
		(0.0572)	
# of documents $\times$ GDP		0.0393***	
		(0.00788)	
Fixed cost			0.123***
			(0.0423)
Fixed cost $\times$ GDP			0.0153**
			(0.00686)
Constant	0.00273	0.0343	0.0266
	(0.0218)	(0.0264)	(0.0272)
Observations	8789	5298	8789
Within R^2	0.0787	0.0716	0.0813

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All columns include firm fixed effect. Standard errors are clustered by destination country.

7 Conclusion

It is well known that in most industries, single product firms and multi-product ones coexist together in the same market. However, trade models, that were recently interested in analyzing how multi-product firms react to trade liberalization by modifying their product scope, were studying market structures characterized by the existence of multi-product firms only.

This paper is interested in studying the impact of bigger market size on the product-mix of multi-product firms when the market is characterized by the presence of small and big firms.
Multi-product firms produce a set of varieties $k \in [0, N_\omega]$. They incur a higher marginal cost for varieties far from their core product.
In a framework with few oligopolistic multi-product firms and a monopolistic competitive fringe, it has been shown that there exists a unique Nash equilibrium where both firms coexist when barriers to entry f_E are not too high for small firms to afford.

In a mixed market structure, when trade openness occurs, the increase in market size L induces multi-product firms to change their product scope. When entry costs f_E is low enough, the number of small firms is high, so increasing market size encourages large firms to increase their product mix, as they benefit

from scope economies, to face competition from single product firms. For low entry cost, large firms benefit from scope economies, that's why an increase in the market size encourages them to diversify more their product mix. Yet, when barriers to entry are high, big firms face diseconomies of scope thanks to the convexity of the number of small firms with respect to the market size "L"[21]. Hence multi-product firms reduce their product scope following an increase in market size thanks to the convexity of the product breadth N_ω in the number of small firms.

Moreover, when entry costs are high enough, large firms skew their exports towards their best performing products as they have a higher mark-up for products not far from their core product.

Trying to assess the impact of destination market size on the product mix of large firms, and using cross-section data for Egyptian exporters, the results show strong evidence of the role of fixed cost in determining the final impact of market size on firms' skewness of product mix.

The empirical results are robust for different model specifications. Whether the skewness is measured for all the products (with the herfindahl index), or with the number of products the results obtained confirm the theoretical prediction that multi-product firms diversify more their portfolio of products in countries where the fixed entry cost are low.

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[21] $\frac{\partial M}{\partial L} > 0$ and $\frac{\partial^2 M}{\partial L^2} > 0$

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Appendix

Table A.1: Robustness check with alternative definition of competition

	(1) HHI	(2) HHI	(3) HHI	(4) HHI
ln GDP	-0.0303***	-0.0364***	-0.0397***	-0.0291***
	(0.00157)	(0.00122)	(0.000868)	(0.00666)
ln Time to import	0.0140***			
	(0.00460)			
Time to import $\times$ GDP	0.00731***			
	(0.00225)			
ln imports	-0.000620	-0.000992	-0.00105	-0.00272
	(0.00175)	(0.00182)	(0.00180)	(0.00233)
ln freeness of trade	-0.0401***	-0.0466***	-0.0435***	-0.0142***
	(0.0115)	(0.0130)	(0.0133)	(0.00542)
Fixed cost		-0.00826		
		(0.00829)		
Fixed cost $\times$ GDP		0.0103**		
		(0.00436)		
ln cost to import			-0.0102	
			(0.00771)	
cost to import $\times$ GDP			0.00419**	
			(0.00206)	
ln documents to import				0.109**
				(0.0476)
documents to import $\times$ GDP				0.0231***
				(0.00861)
Constant	0.00230	-0.0129	-0.0164	-0.0163
	(0.0178)	(0.0150)	(0.0150)	(0.0174)
Observations	7756	7756	7756	4654
Within R^2	0.0747	0.0737	0.0735	0.0668

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All columns include firm fixed effect. Standard errors are clustered by destination country.

Table A.2: Product skewness with GDP per capita

	(1) HHI	(2) HHI	(3) HHI
ln GDP	-0.0262***	-0.0252***	-0.0237***
	(0.00371)	(0.00284)	(0.00261)
ln time to import	0.0616***	0.0529***	0.0527***
	(0.0196)	(0.0144)	(0.0128)
Time to import × GDP	0.00741**	0.00754***	0.00778***
	(0.00332)	(0.00265)	(0.00270)
ln GDP per cap	0.00978	0.0163**	0.0222***
	(0.00788)	(0.00696)	(0.00548)
ln freeness of trade		-0.0491***	-0.0409**
		(0.0171)	(0.0182)
ln partner			-0.0657***
			(0.0128)
Constant	0.00555	0.0115	0.0134
	(0.0206)	(0.0195)	(0.0193)
Observations	8789	8789	8789
Within R^2	0.0784	0.0809	0.0828

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All columns include firm fixed effect. Standard errors are clustered by destination country.

Table A.3: Regression for the # of products

	(1) # of products	(2) # of products	(3) # of products
ln GDP	0.112***	0.108***	0.139***
	(0.0141)	(0.0132)	(0.0351)
ln time to import	-0.159***	-0.0599	-0.0491
	(0.0583)	(0.0449)	(0.0595)
time to import × GDP	-0.0645***	-0.0688***	-0.0576***
	(0.0151)	(0.0148)	(0.0133)
ln freeness of trade		0.232***	
		(0.0624)	
FTA			0.280
			(0.209)
WTO			-0.353**
			(0.171)
Common language			0.393**
			(0.194)
ln distance			0.156*
			(0.0845)
Constant	-0.193*	-0.225**	-0.141**
	(0.112)	(0.101)	(0.0582)
Observations	8789	8789	8789
Within R^2	0.301	0.310	0.318

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All columns include firm fixed effect. Standard errors are clustered by destination country.