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Firms' export decisions: selection versus trial-and-error

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Abstract

In this paper, an original and simple theoretical model is developed to better integrate various dimensions of the firms' decision to export. The model sheds light on the affirmations of the founding models of the 'new theory of international trade', in particular the role of productivity and sunk costs of exporting in the firms' export decisions. It can also explain stylized facts that seem difficult to reconcile with the implications of the founding models: 1) flows of export market entry and exit are substantial; 2) entry into export markets would be rather gradual in the sense that firms start exporting small quantities and, if they survive, quickly expand their exports.

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Keywords Firm heterogeneity; self-selection; sequential exporting

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1. Introduction

This paper proposes a simple theoretical model for concurrently studying the two competing and complementary mechanisms that may explain the decision to export companies: 1) the self-selection mechanism by which firms choose the productivity improvement option specifically for their future entry into export markets, and 2) the trial and error mechanism whereby firms test their profitability export by exporting temporally and marginally.

In fact, it is admitted that few firms export and exporting firms are on average more productive (Wagner, 2012; Wagner, 2007; Greenaway & Kneller, 2007). To explain these two facts, the founding models of the 'new new theory of international trade' are based on two elements. The first is the heterogeneity of firms in terms of their level of productivity, and the second is the sunk costs of exporting (Melitz, 2003; Bernard, Eaton, Jensen, & Kortum, 2003). According to these models, the firms decide to export or not, depending to the profits that they expect to generate by exporting. These depend mainly on the firms' productivity level and the sunk costs of exporting, both assumed to be exogenous. More specifically, for given export costs, only sufficiently high level of productivity can generate a positive export profit and can favor the decision to export. The firms enter the foreign markets by selling optimal production quantities in order that export profits recover the sunk costs of exporting. Finally, although export costs hinder the entry into export markets, they are mostly a barrier to exit from. Therefore, taking into account productivity levels and sunk costs of exporting, if the expected export profit is positive, then the firm will opt for intensive and continuous export.

However, two major findings have imposed progressively: 1) the heterogeneity of firms in terms of innovation as the determining factor of the relative productivity advantage of exporters (Cassiman, Golovko, & Martínez-Ros, 2010; Bellone & Guillou, 2011), and 2) export as the progressive process with frequent entry and exit dynamics rather than the stationary phenomenon (Albornoz, Calvo, Corcos, & Ornelas, 2012; Nguyen, 2012; Eaton, Eslava, Krizan, Kugler, & Tybout, 2012). These findings seem difficult to reconcile with the implications of the founding models.

The theoretical model proposed in this work consists in better integrating two observations mentioned above. This model could help to moderate the main role of productivity in the firms' export decision as it is supposed by the founding models. It allows considering other elements likely to play on the firms' export decision: the willingness to export on the part of the firm manager (Movahedi, Shahbazi, & Gaussens, 2017) and the confidence of the firm in the success of the export project.

The rest of this article is structured as follows. Section 2 analyzes the central assumptions of the standard models of self-selection into export markets whereby productivity is the key determinant of entry to export markets. All of the analyzes lead, in section 3, to the development of original model rationalizing both the role of productivity and trial and error of exporting in the firms' export decision. In section 4, we discuss the implications of our model. Finally, conclusion is presented in section 5.

2. Literature review

The reality of export flows seems inconsistent with the assumptions of the selection models, starting with Melitz (2003), characterized by the role of sunk costs of exporting.

On the one hand, the export process can be rather a gradual or dynamic process, unlike the basic models such as Melitz where the firm does not export or export some optimal quantities. In fact, many firms are beginning to export small quantities. A large number of them stop exporting in the short term, while some surviving exporters have a tendency to gradually increase their presence in international markets.

For example, in France, each year, about 25% of exporters are the new exporters often with a very marginal presence in international markets. Almost 21% of exporters abandon their export activities every year. Thus, the retention rate among new exporters is very low. Close to 60% and 80% of them abandon their export activities, respectively, after one year and three years (French Customs, 2012). The new French exporters who survive tend to expand their presence in terms of the quantities and the number of markets served (Buono & Fadinger, 2012). Lawless (2009), Van Biesebroeck, Yu and Chen (2010), Schmeiser (2012), Amador & Opromolla (2013), Sheard (2014) and Cebeci & Fernandes (2014) made similar observations, respectively, for Ireland, Canada, Russia, Portugal, Sweden and Turkey.

On the other hand, selection models put great emphasis on the high productivity which firms have to obtain to start exporting, so the non-exporting firms have low productivity. However, some studies show that not all productive firms feel the need to export (Lileeva & Trefler, 2010). This may be the case for firms located in domestic markets where demand is relatively high enough to have good productivity and good results. For example, the International Export and Productivity Study Group (ISGEP, 2008), based on a comparative study of 14 countries, including 11 developed and 3 developing countries, found that the high domestic market size (as measured by GDP) reduces significantly the participation rate of firms in exports. Indeed, the participation rate is low in the big countries¹ because companies can expand their activities by obtaining larger part of domestic market in a less expensive and less risky way. This result is consistent with model predictions of Hallak & Sivadasan (2013) that high productivity firms prefer to increase their sales in the domestic market instead of investing in quality for export.

These observations suggest that the access to export markets would not solely depend on high productivity in order to overcome exogenous sunk costs of exporting. It also depends on an export strategy associated with trial and error of exporting. The trial and error of exporting allows a return of experience thanks to the information and knowledge acquired in the field. Indeed, the trial and error of exporting aids the firms in assessing the opportunities, understanding the new managerial practices and the firm's competitive advantages, and building the new relationship network. The company can better appreciate the risk associated with exporting and better define its commitment to foreign markets.

The basic model does not sufficiently take into account the lack of information and knowledge on foreign markets. The lack of information is one of the most export barriers signaled by SMEs (OECD, 2009). From the top five export barriers, three of them are related

¹ For example, in the United States only about 4% of companies exports (Bernard A., Jensen, Redding, & Schott, 2007).

to information issues (Table 1, items 3, 4 and 5). This problem is a recurring point, cited by all the studies on the exporting challenges of SMEs (Leonidou, 2004; EFIC, 2008).

Table 1: The top five barriers to exporting, OECD (2009) ¹

1.	Shortage of working capital to finance exports
2.	<i>Identification of opportunities abroad</i>
3.	<i>Limited information to locate / analyze markets</i>
4.	<i>Inability to contact potential overseas customers</i>
5.	Obtaining reliable foreign representation
¹ Ranked according to their relative impact (OECD, 2009)	

The information deficit leads to make high manager's risk perception, which delays international development. The company can acquire information on foreign markets in two complementary ways: by market research or by trial and error of exporting. Market research allows companies to obtain information before the decision to export. Knowledge about foreign markets can also be acquired *ex post* through the trial and error of exporting, means through a low commitment to export markets but sufficient to collect information on the markets on which the company wants to develop.

Our problem is to better integrate the two previously described observations: a productive firm does not necessarily have an interest in exporting and the export process can be a gradual and discontinuous process (entry, exit, low export quantities).

The main contribution of the model presented here is to differentiate export strategies in order to endogenise sunk costs of exporting. Indeed, the sunk costs depends, in this model, on the firm' willingness to export, the firm' information level on the markets in which it wishes to export, and finally its current productivity.

3. Model

We start from a more precise analysis of the export process. We consider the phase preceding the factual export during which the firm carries out the feasibility studies and gather the necessary investments for exporting (design, development, capacity, adaptation).

To evaluate the profitability of the export, the firm must first perform the feasibility studies of exporting that lead to the decision to continue the export project or not. This preliminary diagnosis must determine whether the export objective is realistic and whether the risks to be taken are worth it. This study evaluate the interest of the export for the firm, estimate the availability of the resources and the accessibility to the external resources, specify the supply and target market(s), and consider the opportunities for foreign partnerships. This first step must lead the firm to engage or not in the export activities. To improve the quality of the decision, the feasibility study must be accompanied by expertise and advice outside the firm.

If the decision to continue is made, the firm must invest in the finalization of export plan and then in the design and development of the project.

The export plan must be based on the feasibility study to clarify and formalize the firm's product-country-partner strategy and to evaluate the expected returns on investments. The execution of plan involves realizing the market studies, the financing plan and the partnerships with foreign companies. Likewise, firm must invest in consulting and training, the recruitment of export specialists, the increase of production capacities and the adaptation of products.

We posit that all *ex-ante* costs associated with the export project (feasibility, design, development, capacity, adaptation) are endogenous sunk costs.

Finally, the profitability of an export project is evaluated by assuming than:

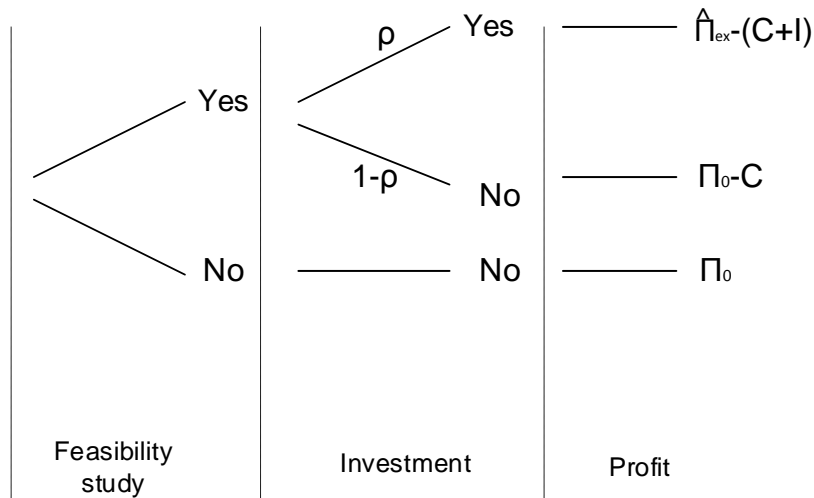
1) the export project consists of two-phase sequence: feasibility phase (with C the feasibility costs) and investment phase (with I the *ex ante* investment in design, development, capacity or adaptation dedicated to export).

2) the investment phase is conditioned on the results of the feasibility study. We refer to $\rho \in]0,1]$ as the likelihood that firm continues the export project which depends on the result of feasibility study. We assume that ρ depends on the level of information that firm has on export projects. For example, ρ will be realistically higher for firms has already exported or tried to export or for there has favorable information on export projects conducted by neighboring firms. This is more especially the case if the firm has experimented exporting (*trial and error of exporting*) in order to gain greater confidence in its ability to earn profits abroad.

3) $\hat{\Pi}_{ex}$ denotes the firm's expected profit from both domestic and export sales.

4) Π_0 denotes the firm's assured profit without export or the firm's normal profit from domestic sales. We assume that the firm's normal profit Π_0 depends on its productivity.

The export project and firm's profits can then be represented using a decision tree (Figure 1) :



$\hat{\Pi}_{ex}$: expected profit with export; Π_0 : actual profit (domestic); C : feasibility cast; I : investment.

Figure 1: The decision tree concerning an export project

Finally, applying the criterion ‘mean-variance’, a non-exporting firm plans to export if:

$$\underbrace{\rho(\hat{\Pi}_{ex} - C - I) + (1 - \rho)(\Pi_0 - C)}_{\text{expected profit from the export project}} \geq \Pi_0$$

So, if²

$$\hat{\Pi}_{ex} \geq \Pi_0 + \frac{C}{\rho} + I \quad \text{Eq. 1}$$

We assume that firms prefer the self-financing to invest in their export projects (external financing is more expensive than self-financing). Therefore, the expenses associated with the feasibility studies (C) and with the investment amounts (I) depend on the current financial capacities of firm.

In addition, we assume that export expenditures and investments depend on the firm's export effort level (measured by $a \in]0,1[$). The effort is directly related to the export desire of the company's management. This desire of management is embodied in the fact of export culture acquired through experiments or trial and error in exporting (taste for foreign languages, opening vis-à-vis the outside ...). Thus, the amounts invested in the export project (C and I) are supposed to depend on the effort level that the firm chooses to export (a), the financial capacities (Π_0) and ρ which measures the confidence that the firm has in the success of the project. Therefore, for given ρ , higher (low) a or Π_0 makes higher (low) investments and for a, Π_0 and C given, a higher (low) ρ makes a higher (low) investment. In other words, a higher (weak) confidence in the success of export project presupposes making a favorable (unfavorable) impact on the investment (I).

If we put the function $F(C, I, \Pi_0, a, \rho) = 0$, so $\frac{dI}{d\Pi_0} > 0$, $\frac{dI}{da} > 0$, $\frac{dI}{d\rho} > 0$, (likewise for C) and $\frac{dI}{dC} < 0$. The profitability condition of the export project can therefore be rewritten as follows :

$$\hat{\Pi}_{ex} \geq (1 + a)\Pi_0 \quad \text{Eq. 2}$$

Indeed, the firm plans to export if it considers that profit with export is greater than profit without export, that is, if the firm's expected profit from both domestic and export sales is greater than the opportunity cost (current profit) and the investment made.

We also assume that the expected profit with export ($\hat{\Pi}_{ex}$) depends on the expenditure and the investment made (C and I). We will assume that the more the firm invests in export project, the better can prepare it and can therefore expect higher export profits. Moreover, we have seen that expenditure and *ex ante* investment depend on the normal profit Π_0 , the export effort a and confidence in the success of the project ρ . We put so:

² $\rho(\hat{\Pi}_{ex} - I) - C \geq \rho\Pi_0 \rightarrow \rho\hat{\Pi}_{ex} - (\rho I + C) \geq \rho\Pi_0 \rightarrow \rho\hat{\Pi}_{ex} - \rho\Pi_0 \geq \rho I + C$

$$\hat{\Pi}_{ex} = f(a, \rho, \Pi_0) \quad \text{with } a\Pi_0 = \frac{c}{\rho} + I \quad \text{Eq. 3}$$

and

$$\frac{\partial \hat{\Pi}_{ex}}{\partial \alpha}, \frac{\partial \hat{\Pi}_{ex}}{\partial \rho} \text{ and } \frac{\partial \hat{\Pi}_{ex}}{\partial \Pi_0} > 0; \quad \frac{\partial^2 \hat{\Pi}_{ex}}{\partial \Pi_0^2} < 0$$

Finally, the profitability condition can be rewritten as follows:

$$\hat{\Pi}_{ex} = f(a, \rho, \Pi_0) \geq (1 + a)\Pi_0 \quad \text{Eq. 4}$$

The expected profit function for a given firm can be specified as follows:

$$\hat{\Pi}_{ex} = f(a, \rho, \Pi_0) = \rho \log [((1 + a)\Pi_0)^{(1+a)} - a^\beta]^{\beta(1+a)} + \beta \quad \text{Eq. 5}$$

where β denotes a strictly positive parameter that captures the impact of non-controlled variables on the profitability of export project, for example, size and industry or group membership. Therefore, we can assume that higher β , all other things being equal, for a firm belonging to a sector of activities with a strong export culture or for a subsidiary of an international group.

Thus, the heterogeneity in our model is not limited to productivity but integrates the firm's export strategy: the desire to export from the manager firm (α) and the confidence of firm in the success of export project (ρ).

4. Results and discussion

For a and ρ given, the relationship above (Eq. 2 and Eq. 3) set a profitable area of export project framed by a minimum domestic profit ($\Pi_{0,min}$) and a maximum profit ($\Pi_{0,max}$) (Figure 2)³. For a domestic profit below the minimum profit (Π_{min}), the firm does not have the financial resources to make the export project enough profitable. Also, a high domestic profit generates a high export opportunity costs that can make the export project unprofitable (this is the case if the domestic profit is greater than the maximum profit).

³ Figure 2 is a representation of equations 2 and 3: $\rho \log [((1 + a)\Pi_0)^{(1+a)} - a^\beta]^{\beta(1+a)} + \beta \geq (1 + a)\Pi_0$, for α and ρ given, there are the values of Π_0 for which the export project is profitable. For example, for $a = 0.1, \rho = 1$ and $\beta = 2$ the two curves intersect in $\Pi_{0,min} = 0.51$ and $\hat{\Pi}_{ex,min} = 0.38$ and in $\Pi_{0,max} = 6.05$ and $\hat{\Pi}_{ex,max} = 6.52$. For $a = 0.9, \rho = 0.8$ and $\beta = 2$ the two curves intersect in $\Pi_{min} = 0.68$ and $\hat{\Pi}_{ex,min} = 1.24$ et in $\Pi_{max} = 10.59$ and $\hat{\Pi}_{ex,max} = 18.35$.

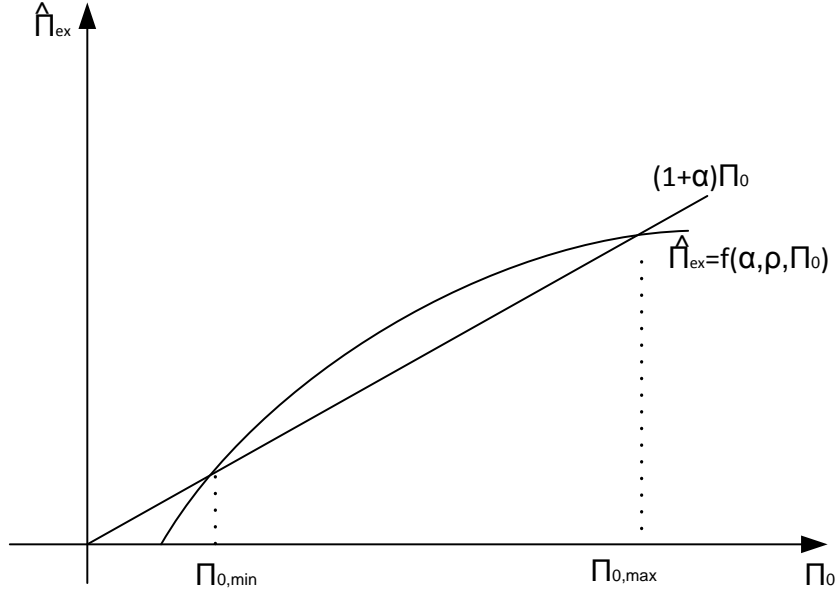


Figure 2: Profitability zone for α and ρ

Therefore, we can now characterize the several firms' export decisions. First, using Figure 2, we can compare a firm with high willingness to invest in exports (high α) to a firm with low α (identical ρ).

The profitability zone corresponding to the first case (high α) is shifted to the right with an enlargement of this zone (minimum and maximum profit increases, Figure 3)⁴. This increase is relatively larger for the maximum profit. Moreover, the expected profit with export is, on average, higher in the case where α is high.

In the first case (high α), a high willingness to export is associated with a higher level of profitability and therefore a higher level of productivity. However, a firm with a strong desire to export (α high) but with insufficient productivity (productivity associated with profit below $\Pi_{0,min}$) will not find it profitable to export.

⁴ Cf. previous note, taking successively, $\alpha = 0.1$, and $\alpha = 0.9$, $\rho = 1$ and $\beta = 2$. In the first case the two curves intersect in $\Pi_{0,min} = 0.51$ and in $\Pi_{0,max} = 6.05$ and in the second case the two curves intersect in $\Pi_{0,min} = 0.69$ and in $\Pi_{0,max} = 14.12$.

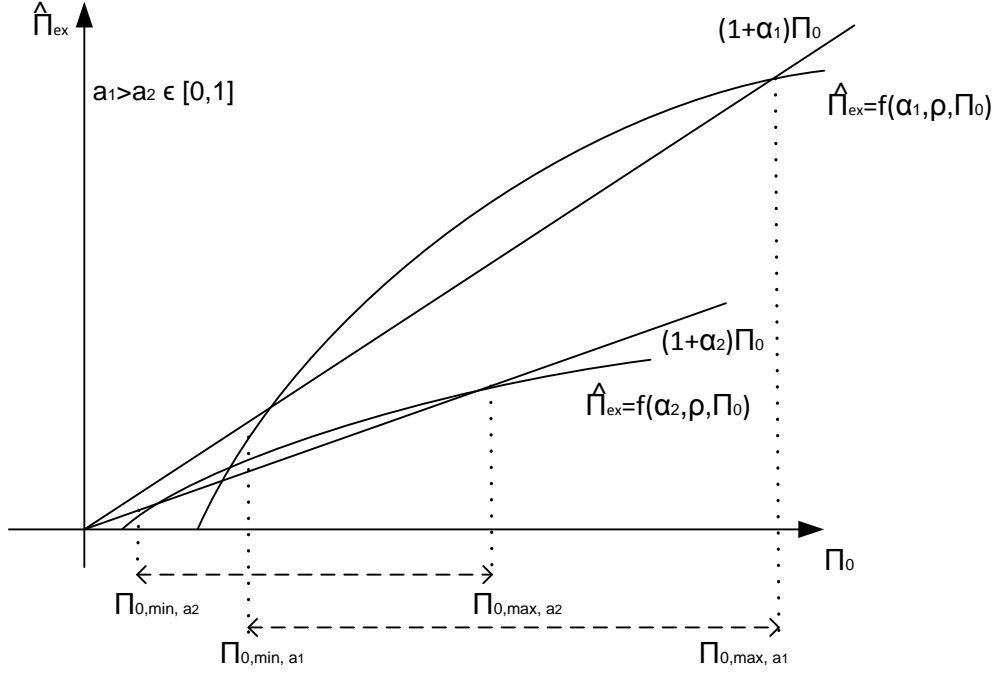


Figure 3: Profitability zone for two different α

In addition, we can demonstrate that a firm investing heavily in exports will have no interest in moving out of export given the *ex ante* irreversible investment of exporting. This case is in line with the classic explanation of the selection models (Melitz, 2003) that, first, threshold for export profitability is fairly high and second, a small number of firms enter into export markets. However, Melitz (2003) assumes that, for the same level of productivity, all firms have the same desire to export (the same a) and the same confidence in the success of their export project (ρ). He assumes that the level of willingness and confidence are high enough, so only productivity plays a role in the firms' export decisions.

Therefore, we enrich the model of Melitz (2003) by assuming that the willingness to export is a heterogeneous characteristic, so there can be a continuum of a making the deferent relationship between profitability and export decision. For taken level of productivity we can associate a level a making export profitable or not. Moreover, our model shows for a given level of willingness to export, too high productivity can make the export unprofitable. In this case, the opportunity cost of exporting is high enough to make the export project unprofitable.

Moreover, for the same a and the same level of domestic profit Π_0 , we can always find a level of confidence in the export project (ρ) sufficiently high to make the export project profitable. In these conditions, the monotonous relationship between productivity and export profitability is no longer valid (Figure 4⁵).

⁵ cf. footnote 3; Taking successively for $a = 0.9$, $\rho = 1$ and $\beta = 2$ and $a = 0.9$, $\rho = 0.8$ and $\beta = 2$. In the first case the two curves intersect in $\Pi_{min} = 0.69$ and in $\Pi_{max} = 14.12$, in the second the two curves intersect in $\Pi_{min} = 0.68$ and in $\Pi_{max} = 10.59$.

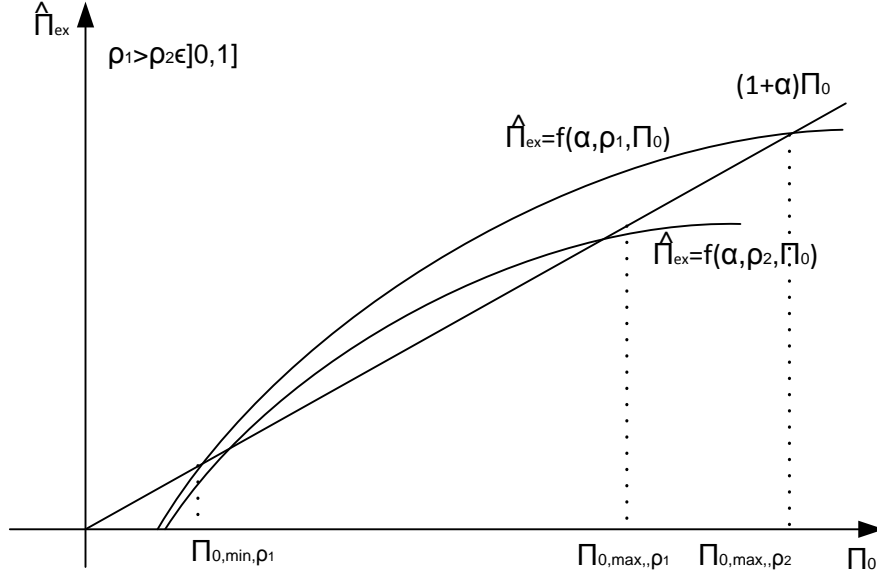


Figure 4: Profitability zone with two different ρ

4. Conclusion

We propose a theoretical model that provides a moderating light on the implications of the founding models of the 'new new theory of international trade', represented by Melitz (2003). It can also explain stylized facts that contradict the implications of the founding models, especially the existence of sunk costs to entry into export markets. (1) many domestic firms, often exporting small quantities, enter and exit foreign markets every year, and 2) entry into export markets would be rather gradual in the sense that firms start their exports with a small quantities and, those who survive, tend quickly to develop their exports. The model shows than:

1) The phenomenon of a low initial commitment to export and the phenomenon of exit flow from export markets are rational and not mere random phenomena. This model shows that export by achieving a low level of *ex ante* investment can be profitable for firms. In this case, a relatively low profit (thus a productivity), corresponding to a low export opportunity costs, can allow a profitable export. The commitment to export is not very important but it allows the firm to acquire *ex post* information on the export market. This information may allow the firm to gradually expand its export activities. In other words, the firm can choose to pay the sunk cost and a small initial operational loss in order to test its competitiveness. Finally, this case corresponds to a process of 'sequential exporting' (Albornoz, Calvo, Corcos, & Ornelas, 2012) in which firms use their initial export experience to infer information on their future success. Furthermore, given the low opportunity cost, the firm can exit from foreign markets without recur high export costs if does not register the expected profits.

2) Trial and error parameters (a and ρ) determine the incentive to export. This is, higher a and ρ increases the productivity fields for which exporting is profitable. More specifically, the presence of these variables breaks the perfect correlation between productivity and the incentive to export. Indeed, for the same productivity, the differences in the parameters a or ρ may result in various incentives to export. Thus, the model can explain why some productive firms do not export. This is the case of productive firms with parameters a or

ρ relatively low. For example, the insufficient export experience or the lack of willingness of manager can expect the profits from entering foreign market relatively small compared to the opportunity costs of this activity.

Finally, this simplified model suffers from a certain number of limits, but these offers one avenue for future research and could be extended to another specification.

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