Multimarket entry in exporting
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Abstract

This paper develops a model to explain a firm’s optimal export entry strategy in an economy where the firm has multiple potential export markets. The firm’s costs of entry to an export market are reduced by the experience gained from other markets already entered, so that both the set of markets and the timing of entry to those markets are important. The model is able to explain why different firms enter different numbers of markets in the long-term, as well as explaining patterns of entry that involve either simultaneous or sequential entry, where sequential entry may involve progressions of increasing or decreasing market sizes. The model predicts that more productive firms employ strategies that generally involve entering more markets, larger markets, and entering markets more rapidly. More productive firms also tend to enter larger then smaller markets whereas less productive firms tend to enter smaller then larger markets. Though firms enter different sets of markets and the orders in which exporters enter markets are different, the model predicts a hierarchy of export markets and a correlation in the orders of market entry.

Keywords: export market entry, learning by exporting, fixed costs, heterogeneous firms

1. Introduction

Though much of the theoretical and empirical literature in international trade treats the destinations of traded goods as a single entity, the recent appearance of datasets that detail the destinations of exports and locations of foreign affiliates has facilitated a flourish of research into the composition of trade by destination. For instance, studies have detailed the distribution of numbers of export locations by firm (Eaton, Kortum and Kramarz, 2004) and the correlation between firm productivity and the number of export destinations (De Loecker, 2007). The current paper contributes to this growing literature by establishing a framework to understand the optimal pattern of export market entry in an economy with more than one potential export destination. By understanding the optimal pattern of export market entry, it is possible to gain insight into the process by which firms become exporters.

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In order to represent the firm’s optimal export market entry strategy when faced with several potential export markets, this paper develops a theoretical model that takes account of learning and adaptation effects related to export experience. By considering these effects, the model is able to explain several characteristics of patterns of export market entry observed in data, driven by variation in firm productivity levels. Furthermore, the model produces new and testable predictions regarding the patterns of entry employed by exporting firms.

The main prediction of the model is that the strategies employed by firms will generally involve entering a larger number of markets, a larger total market size, and entering export markets more rapidly for more productive firms. These three factors work in combination, so that a strategy may be employed by a more productive firm even if, for example, it involves entering fewer markets or entering a particular market later, provided that the other factors or markets more than compensate for this. The model also predicts and provides an intuitive explanation for different patterns of export market entry for different firms. This arises from the opposing incentives that the firm has to enter larger markets first, as these yield higher revenues, and to enter smaller markets first in order to gain experience in exporting before entering larger markets. In general, more productive firms tend to enter larger then smaller markets, while less productive firms tend to do the opposite.

The model developed in this paper is based on the heterogeneous firms framework of Melitz (2003) and developed further by Chaney (2008), in which firms realise their productivity level when they are formed, then decide whether to operate and, if so, whether to export. In this paper, the firms have several potential export markets and therefore, if they decide to export, also decide on an optimal strategy for entering some set of these. The firm is assumed to learn from the experience of exporting, which can be beneficial in entering other markets in the future, so that in many cases it is optimal for the firm to stagger entry into the various export markets. Though there is some evidence that exporting activity may increase a firm’s productivity (Aw, Chung and Roberts, 2000; Van Biesebroeck, 2006; De Loecker, 2007; Aw, Roberts and Xu, 2008), these results are still somewhat controversial, contradicting the well-accepted results of Clerides, Lach and Tybout (1998) and Bernard and Jensen (1999) that exporting does not have a significant effect on productivity. Therefore, the benefits of experience are assumed here to accrue through the more intuitive route of decreasing the costs of establishing a new export market. This mechanism involves the firm learning how to adapt its products, run an advertising campaign, and establish a distribution network: all processes that the firm could be thought to improve with experience.

Firms in the model are heterogeneous in terms of their productivity levels but are otherwise identical, so the variation in the strategies employed across firms is driven by variation in firm productivity levels. Consistent with established theory, the model predicts that the least productive firms do not engage in exporting at all. The next least productive firms optimally employ a strategy that involves entering only one or a small number of markets. Higher productivity firms enter several markets, with both the number of markets entered in the long-term and the pace of entry to new markets increasing with productivity. Those firms

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3 In isolation, the prediction of a positive relationship between the firm’s productivity and its number of export destinations is not new; indeed it has been demonstrated for Slovenian data by De Loecker (2007).

4 The model would yield very similar results with some alternative dimensions of heterogeneity, such as in firms’ inherent capacities to establish new export destinations or to adapt their products to export.
that enter a number of markets over several periods may either progress from smaller to larger markets or vice versa, depending on the relative gains from experience and productivity, the tendency being for less productive firms to enter smaller markets first while more productive firms begin with larger markets. The most productive firms choose to enter all or a large number of markets immediately. All of these types of strategies may be employed by different firms in the same model economy, the only required source of heterogeneity being in the firms’ productivity levels.

The model shares similarities with that of Lawless (2009), who also attempts to represent a firm’s pattern of entry into many export markets. Her model is also based on the heterogeneous firms model of Melitz (2003) and Chaney (2008) and allows for heterogeneity in the fixed costs of entry, real incomes, and price levels across export markets. As she assumes no learning effects this leads to a hierarchy of markets, with all markets being entered in the same order by all firms, the more productive firms simply entering a larger number of markets along the chain. Although this prediction was only partly upheld when tested on data for Irish firms, the current paper, by allowing for learning effects to lower the fixed costs of entering subsequent markets, is able to explain heterogeneity in the orders of market entry employed by different firms. Furthermore, while Lawless does not predict how rapidly different firms will enter export markets, the model presented here generates the intuitive prediction that more productive firms will enter export markets more rapidly. On the other hand, Lawless is able to offer interpretations of the exit as well as entry of firms from export markets, which the current model does not do and which she shows to be empirically important as the frequency of exit from export markets is high.

Further research on the entry and exit of exporting firms by destination includes the work of Eaton, Eslava, Krizan, Kugler and Tybout (2008). Their model contains firm- and destination-specific uncertainty, with firms learning about their profitability in a potential market by identifying consumers, which takes effort, and observing the success of other exporters. Buono, Fadinger and Berger (2008) consider the relationships between exporters and distributors in destination countries, providing evidence of the costliness of establishing new export markets and justification for a certain inertia in exports to a given destination. As they focus on the selection of each individual market, these models treat a different aspect of the firm’s choice of destination than the model in the current paper, which aims to understand the strategic choice of export market entry.

The remainder of the paper is organised as follows: the model is presented in section 2; a discussion of a firm’s optimal strategies and the relationships to firm productivity is presented in section 3; a discussion of the hierarchy of export destinations is presented in section 4; the factors affecting the selection of a firm’s optimal strategy is explained in the relatively simple case involving only two potential export markets in section 5; an elaboration of optimal patterns in the case of three potential export markets is given in section 6; uncertainty is discussed in section 7; and the conclusion is presented in section 8.

2. Model

The economy in the model is comprised of the firm’s home country and I foreign countries that the firm may choose to export to. There are a large number of other firms operating in the economy, so that the firm we focus on does not consider the effects that its export decisions have on price levels in the destination countries or the strategies of other potential export firms. To enter any given export market, the firm must sink an initial fixed cost, which is an increasing function of the market’s size but, due to learning effects, a decreasing
function of the number of destinations that the firm already exports to. After entering the market, the firm receives a permanent stream of revenues. As the fixed cost of entry is decreasing in the number of export destinations, the firm is able to benefit in the long-term by entering markets gradually. The model is outlined in more detail in this section.

2.1. Consumers

The consumers in the model are assumed to have identical, constant elasticity of substitution preferences of the Dixit and Stiglitz (1977) type, with demand elasticity parameter $\sigma > 1$. Where there is a continuum of $\Omega$ goods available in the economy, the utility of a representative individual is:

$$U = \left[ \int_{0}^{\Omega} \frac{x_{\omega}^{\frac{1}{\sigma}}}{x_{\omega}^{\frac{1}{\sigma}}} d\omega \right]^{\frac{\sigma}{\sigma-1}}$$

The price of good $\omega$ is denoted $p_{\omega}$ and the income of the individual is denoted $Y$. The demand of the representative consumer for good $\omega$ is therefore:

$$x_{\omega} = \frac{p_{\omega}^{\frac{1}{\sigma}}}{P^{1-\sigma}} Y$$

Where $P = \left[ \int_{0}^{\Omega} p_{\omega}^{1-\sigma} d\omega \right]^{\frac{1}{1-\sigma}}$ reflects the overall level of prices in the market.

2.2. Firms

The firms in this model are assumed to be of the increasing returns to scale, heterogeneous productivity variety proposed by Melitz (2003), in which a firm realises its productivity after it is formed. Upon realising its productivity, the firm decides whether to produce and what strategy to employ in entering export markets. There is some fixed cost associated with establishing a firm, which in equilibrium offsets the expected operating profits and ensures that firms in the economy are formed at a positive and finite rate. After formation, the firm realises its idiosyncratic per-unit cost of production, $a_{\omega}$, which further defines its productivity $a_{\omega}^{1-\sigma}$. Normalising the price of the sole production input to one, the firm maximises profits by setting its output price equal to $p_{\omega} = \frac{a_{\omega}^{\frac{1}{\sigma}}}{\sigma-1}$. 
2.3. Export revenues

The firm is faced with \( I \) potential export markets, where market \( i \) has gross domestic product (GDP) \( Y_i \) and an overall level of prices represented by the index \( P_i \). There is assumed to be a common transportation cost parameter, \( \phi \), which represents the freeness of trade with the destination market\(^5\). When exporting to market \( i \) the firm, given its output price \( p = \frac{a \sigma}{\sigma - 1} \), receives the following single-period revenues:

\[
\pi(P_i, Y_i) = \phi \left( \frac{\sigma}{\sigma - 1} \right)^{1-\sigma} \frac{a^{1-\sigma}}{P_i^{1-\sigma}} Y_i
\]

We may simplify this expression slightly by considering the size of an export destination to be a multiple of its GDP scaled up for prices, \( s_i = \alpha P_i^{\sigma-1} Y_i \), which reflects the increased potential for exporters from operating in a market where competing products are sold at higher prices. Without loss of generality, the further simplifying assumption that \( \alpha = \left( \frac{\sigma}{\sigma - 1} \right)^{1-\sigma} \) yields the following:

\[
\pi(s_i) = \phi a^{1-\sigma} s_i
\]

Once a firm has entered an export market, it receives a permanent stream of single-period revenues. The fixed costs associated with exporting to a market are sunk upon entry, so the firm has no incentive subsequently to abandon the market. Where the firm has discount factor \( \beta \), the discounted long-term revenues of entering export market \( i \) are given by:

\[
\sum_{t=0}^{\infty} \beta^t \pi(s_i) = \frac{\pi(s_i)}{1 - \beta} = \frac{\phi a^{1-\sigma} s_i}{1 - \beta}
\]

2.4. Fixed costs of entry to export markets

A number of studies have found positive plant-level fixed costs associated with entry into new export markets (Bernard and Jensen, 2004; Bernard and Wagner, 2001; Das, Roberts and Tybout, 2007). However, there is little evidence of ongoing fixed costs associated with continuing to export, with Das, Roberts and Tybout (2007) finding that such ongoing fixed costs were not significantly different from zero. The model design follows this result, with the assumption made that positive fixed costs are associated with entry into a new market, but that continuing to export to a given market incurs no ongoing fixed cost. This restriction implies that a firm should never exit an export market, as it receives a positive revenue stream but incurs no costs by simply continuing to export, though the model could easily be extended to explain patterns of entry and subsequent exit by including an ongoing fixed cost.

\(^5\) These transportation cost parameters could more realistically be assumed to be heterogeneous. However, the insight gained from such an extension to the theory would be limited. The model would predict that a firm would enter a nearby market before an otherwise similar market that is further away, less productive firms would enter only the nearby market, while the most productive firms would enter these markets simultaneously.
The fixed cost of entry into export market $i$ at time $t$ is represented by the function $f^X(s_t, d_t)$, where $d_t$ is the number of export destinations that the firm has already entered at the beginning of period $t$. The fixed cost is assumed to be increasing in the size of the destination market, to reflect that it is more costly to enter a larger market, but concave, so that there are some economies of scale, as in the model of Akerman and Forslid (2008). Again the size reflects both the GDP of the market and the overall price level, both of which are believed to be correlated with the cost of setting up an export operation.

In terms of the number of export destinations, the firm is able to use the experience of exporting to a market to reduce the fixed cost of entering further markets. This reduction in the fixed cost provides an incentive for firms to delay entry into some export markets until it has gained experience from other markets. An alternative explanation for delayed entry could be that there is some kind of management constraint on establishing new export markets, so that the fixed cost of entering each export market would be increasing in the number of markets that are entered simultaneously. In a sense, however, this would be an equivalent explanation, as the benefits-of-experience mechanism effectively makes it more costly to enter multiple markets simultaneously. As more markets are entered the potential for further such gains is assumed to be reduced, so that the fixed cost is decreasing but convex in the number of export destinations.

Furthermore, the reduction in the fixed cost that results from the experience of having entered a market is larger in absolute terms the larger is the subsequent export destination, so that at least some of the reduction depends on the size of the market that is subsequently entered. Intuitively, improvement to processes involved in establishing new export markets, such as advertising or building new plants and machines, are likely to involve higher cost savings in absolute terms with experience. This assumption drives the results involving firms entering markets in different orders, as it produces the incentive for firms to delay entry into larger markets. We therefore have the following conditions for the fixed cost function:

$$
\begin{align*}
    f^X_s > 0, & \quad f^X_{ss} < 0, \\
    f^X_d < 0, & \quad f^X_{dd} > 0, \\
    f^X_{sd} < 0.
\end{align*}
$$

The model is assumed to run over a series of discrete time periods, with one period’s delay being necessary for the benefits of experience to accrue. This means that if several markets are entered simultaneously, the firm is not able to use the experience of entering any of these markets to reduce the fixed cost of entering the others. Therefore, there exists a trade-off between entering any given export market immediately to begin receiving the revenue stream earlier, and delaying entry to an export market until other markets have been entered to benefit from the reduced fixed cost. The model is therefore able to explain why some firms enter export markets simultaneously while other firms within the same economy employ gradual patterns of market entry.

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6 This setup is able to explain a single-period delay between entering consecutive export markets. An assumption that reductions in the fixed costs of entering other markets would continue to accumulate over many periods would render the model capable of explaining longer delays before entry into further markets. However, this would essentially yield the same prediction as the framework used in this paper, with more productive firms entering export markets more rapidly, so the additional insight would be limited.
3. Optimal export market entry

Taking into account the potential revenues from exporting to each destination and the function of fixed costs of entry, the firm devises its optimal strategy for which markets to enter and when to enter these markets. The firm’s decision may be expressed as a dynamic programming problem. The state variables in this problem are \( \{y_{i,t-1}\}_{i=1}^m \), where \( y_{i,t} \) is an indicator variable for the firm exporting to country \( i \) at time \( t \), while the control variables are \( \{y_{i,t}\}_{i=1}^m \). The Bellman equation for this problem, which may be used to solve the model recursively, is:

\[
V\left(\{y_{i,t-1}\}_{i=1}^m\right) = \max_{\{y_{i,t}\}_{i=1}^m} \left\{ \sum_{i=1}^m \pi_{i,t} + \beta V\left(\{y_{i,t}\}_{i=1}^m\right) \right\} \\
\pi_{i,t} = \begin{cases} 
\pi(s_i) - f^X(s_i, d_t) & \text{if } y_{i,t-1} = 0 \text{ and } y_{i,t} = 1 \\
\pi(s_i) & \text{if } y_{i,t-1} = 1 \text{ and } y_{i,t} = 1 \\
0 & \text{if } y_{i,t} = 0
\end{cases} \\
\text{s.t.} \quad d_t = \sum_{i=1}^m y_{i,t-1}
\]

As there is no uncertainty in the model, it is never optimal to drop out of an export market once the firm has entered, as the revenue in each period must be positive for the firm to enter in the first place\(^7\). The policy function yielded by the dynamic programming problem can therefore be expressed as a vector \( E \) of integer values representing the period in which each particular market is entered. That is, the firm is defined to enter market \( i \) in period \( E_i \), where by convention \( E_i = \infty \) if the firm does not enter market \( i \) at all. The discounted payoff of the strategy represented by \( E \) is therefore:

\[
\Pi = \sum_{i=1}^m \beta^{E_i} \frac{\pi(s_i)}{1 - \beta} - \sum_{t=0}^{\infty} \sum_{i=1}^m I_{(E_i = t)} \beta^{E_i} f^X(s_i, d_t)
\]

Substituting in the expression for single-period revenue, this simplifies to:

\[
\Pi = \alpha^{1-\sigma} \left( \phi \sum_{i=1}^m \beta^{E_i} s_i - \sum_{t=0}^{\infty} \sum_{i=1}^m I_{(E_i = t)} \beta^{E_i} f^X(s_i, d_t) \right)
\]

(1)

A relationship between the productivity levels of firms and the characteristics of the strategies that they would optimally employ may be inferred from the strategy payoff represented by (1). To see this, observe that the second term in (1), which combines the discounted fixed costs of entry, is independent of the firm’s productivity level. The first term in (1), the sum of discounted revenue streams, is positive and linear in the firm’s productivity

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\(^7\) With a positive ongoing fixed cost of exporting this inference may not hold true, as the firm may enter a market to benefit from that experience even if revenue from exporting to that market falls short of the ongoing fixed cost, in which case the firm would not continue exporting to the market.
factor $a^{1-\sigma}$. The multiplier on the productivity level is proportional to the term \(\sum_{i=1}^{m} \beta^{E_i} s_i\), a combination of the number, sizes, and speeds of entry to export markets that is henceforth referred to as the ‘aggressiveness’ of the strategy $E$. The discounted payoff of a given strategy is therefore an increasing, linear function of the firm’s productivity, with the gradient of the function depending on the number of markets entered, the size of the markets entered, and the timing of entry. The productivities of the firms that optimally employ the strategies are thus ordered in the combination of these three factors, with the caveat that some strategies may not be optimal for any firms to employ and are therefore excluded from the productivity ordering. Considering each of the three factors in isolation yields the following proposition.

**Proposition 1.** Holding all else constant, each of the following implies a more aggressive export market entry strategy, which therefore may only be optimally employed by a more productive firm:

1. Entering one or more additional markets;
2. Entering a larger market instead of a smaller market;
3. Entering any number of the markets earlier.

**Proof.** See appendix.

As the aggressiveness term \(\sum_{i=1}^{m} \beta^{E_i} s_i\) is a combination of the three factors outlined in the above proposition, it is possible that a strategy would be more aggressive than another and thus be employed by more productive firms despite being less aggressive in terms of one or even two of the factors, if there was a more-than-compensating difference in the remaining factor. Therefore, while there is not a strict ordering of all potential strategies in terms of each factor, each factor is generally increasing in the level of aggressiveness of the strategy, which is expressed in the following proposition.

**Proposition 2.** It is optimal for a more productive firm to employ a strategy that, in general, involves:

1. Entering a larger number of markets in the long-term;
2. Entering a larger total market size in the long-term;
3. Entering markets earlier.

**Proof.** See appendix.

The corollary of this proposition is that a strategy that involves entering more markets, larger markets, or entering these markets more quickly is generally employed by a more productive firm. The prediction that more productive firms will enter a larger number of markets in the long-term fits with existing empirical evidence (De Loecker, 2007). The intuition behind this is that a more productive firm generates more revenue from each export market, and is therefore able to cover the fixed costs of entry for a larger number of markets, which fits with the mechanism in Lawless (2009). As the advantage in revenue from higher productivity is increasing in the size of the export market, a more productive firm is also able to cover the
fixed costs of entry into larger markets, which further motivates the prediction of the larger total market size.

The model also predicts that more productive firms will enter markets more rapidly, with the most productive firms entering all markets simultaneously. The benefit of delaying entry to a further export market at any point in time is that if the firm waits until it gains experience from the other markets, then the fixed cost it faces of entering the market will be reduced. However, this benefit is offset by a period of foregone revenue. The fixed costs do not depend on the firm’s productivity, while revenue is directly related to productivity, so the more productive firms have relatively less incentive to delay export market entry and therefore enter export markets more rapidly⁸.

Furthermore, the model represents the contrasting incentives that the firm has either to enter smaller markets first, in order to gain exporting experience at a relatively low cost, or to enter larger markets first, in order to receive more revenue in the near-term, and is therefore able to generate either type of pattern. In fact, it is possible that some firms may enter unprofitable markets, simply in order to gain experience that makes it more profitable to export elsewhere. The relationship between firm productivity and the order of markets entered by size is summarised in the following proposition.

**Proposition 3.** For firms that enter several markets sequentially, it is optimal for more productive firms to begin by entering larger markets and then to enter smaller markets, while less productive firms begin with smaller markets and progress to larger markets.

**Proof.** See appendix.

This proposition reflects the fact that for a more productive firm, the revenues from each market are higher, which implies a greater incentive to enter larger markets sooner in order to maximise discounted long-term revenues. On the other hand, a less productive firm earns less revenue from each market and therefore the fixed costs of entry to individual export markets are relatively important, so that the firm has a greater incentive to enter the smaller markets first, as the absolute decreases in the fixed costs of entry are larger for larger markets. Lawless (2009) does not include the possibility of firms benefiting from the experience of exporting and therefore predicts that all firms, other factors being equal, always choosing to enter the larger market first. A pattern of market entry that progresses from smaller to larger markets is related to the theory of Rauch and Watson (2003) that less productive exporters would begin by exporting small volumes, which could correspond either to exporting progressively larger amounts to the same markets, entering progressively larger export markets, or some combination of both.

An implication of this is that firms that have different productivity levels, but are otherwise identical, may optimally enter export markets in different orders. This implies that heterogeneity in productivity levels is sufficient to explain why the first export market entered is not necessarily the same for all firms, and so on. The model therefore presents an

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⁸ This result also holds under the alternative explanation that delaying entry into some export markets is the result of some kind of management constraint, whereby establishing several new export markets simultaneously puts a strain on resources. More productive firms would enter markets more rapidly as they earn more revenue, which offsets the additional costs from entering markets simultaneously. Indeed, the model’s mechanism could be interpreted as a type of management constraint, it being more costly to enter markets simultaneously.
alternative theoretical explanation for the heterogeneity in orders of export market entry by French firms in Eaton, Kortum and Kramarz (2008) that does not require firm-specific heterogeneity in demand or the fixed costs of entry. The model may also explain why the prediction of a uniform order of market entry by Lawless (2009) was only partially confirmed by the data.

4. Export destination hierarchy

Export markets have been shown in French data by Eaton, Kortum and Kramarz (2004) to follow a hierarchy, with a few markets being exported to by many firms while many markets are exported to by only a few firms. The current model has the attractive property of generating such a hierarchy, as is outlined in this section. To begin with, consider that in the long-term no firm would choose not to enter a market or set of markets that would yield a positive profit, which leads to the following proposition.

**Proposition 4.** No two firms that employ optimal strategies may export to mutually exclusive sets of export markets in the long-term.

**Proof.** See appendix.

This finding would hold even if adaptation were highly country-specific, so that firms could adapt their products in different ‘directions’. Though there may be a strong tendency for firms that adapt their products to one country with a certain technological requirement, language, or taste to carry on to export to other similar countries, the argument that if one of these sets of markets is profitable for one firm then it must also be profitable for a more productive firm still holds. The situation would be different, of course, if firms were somehow heterogeneous in their capacity to adapt their products to different markets, or if transportation costs were heterogeneous across combinations of firm and market.

By extending the reasoning from proposition 4, an ordering of markets can be inferred. To see this, consider that given any initial sequence of export markets, the same prediction as in proposition 4 can be made about the remaining markets. Repeating this logic using backward induction yields a sort of tree of export destinations, built on paired sets of potential markets where the firm must either enter neither, one set, or both, where the two sets may be entered in either order or simultaneously. Though there is of course variation in the choices between firms and some firms end up entering more or fewer markets, this implies structure in the progressions of export markets entered. The following proposition clarifies a related point.

**Proposition 5.** In the long-term under optimal strategies, all exporting firms must share one common export destination.

**Proof.** See appendix.

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9 A natural result of proposition 4 is that there may be no more than one market that features in an optimal single-market strategy. Though heterogeneous goods and transportation costs and the difficulty of isolating long-term single-market exporters in cross-section data make the picture less clear in reality, this result fits with the result that a large proportion of the single-destination exporters in the French data analysed by Eaton, Kortum and Kramarz (2004) exported to the same destination (Belgium).
Propositions 4 and 5 imply that, despite the heterogeneity in sets of long-term export destinations and orders of market entry, a hierarchy of export markets exists, with one market entered by all exporting firms, a small number of markets entered by many firms, and so on down the scale to a few markets that are entered by only a small number of firms. This prediction generally matches the empirical findings for French exporters of Eaton, Kortum and Kramarz (2004).

5. Two-market example

In order to understand the factors that affect the firm’s decision, it is useful to analyse the case where the firm has only two potential export destinations. This case is relatively simple to understand while also representing the most important characteristics of market entry patterns in a basic form, so its analysis is useful in understanding the intuition behind the model and the factors influencing the relative profitability of the various strategies.

The two potential markets are defined to be a smaller market of size $s_1$ and a larger market of size $s_2$. Due to discounting and the fact that the benefits in terms of a lower fixed cost for entering other markets are fully realised after one period, it is never optimal for the firm to wait before entering the first market, nor to wait more than one period before entering the other market. Therefore, the optimal strategy must be one of six options: (1) enter neither market; (2) enter market 1 in the first period but do not enter market 2; (3) enter market 2 in the first period but do not enter market 1; (4) enter market 1 in the first period and then market 2 in the second; (5) enter market 2 in the first period and then market 1 in the second; or (6) enter both markets immediately. The discounted profits of these six strategies are:

$$
\Pi^1 = 0 \\
\Pi^2 = \frac{\phi \alpha^{-\sigma}}{1-\beta} - f^X(s_1,0) \\
\Pi^3 = \frac{\phi \alpha^{-\sigma}}{1-\beta} - f^X(s_2,0) \\
\Pi^4 = \frac{\phi \alpha^{-\sigma}}{1-\beta} \left[ s_1 + \beta s_2 \right] - f^X(s_1,0) - \beta f^X(s_2,1) \\
\Pi^5 = \frac{\phi \alpha^{-\sigma}}{1-\beta} \left[ \beta s_1 + s_2 \right] - \beta f^X(s_1,1) - f^X(s_2,0) \\
\Pi^6 = \frac{\phi \alpha^{-\sigma}}{1-\beta} \left[ s_1 + s_2 \right] - f^X(s_1,0) - f^X(s_2,0)
$$

As discussed above, only one of the strategies with long-term entry into only one market may be optimal for some nonempty set of productivity levels. For simplicity then, but without leaving out too much in the way of intuition, I discuss in detail just one of these cases, where entering only the larger market (strategy 3) is not optimal for any level of productivity. This narrows our scope to a maximum of five optimal strategies, which are ordered 1, 2, 4, 5, 6 in increasing levels of aggressiveness and therefore firm productivity levels.

In order to understand some of the intuition behind the model, we now consider the threshold levels of productivity for each strategy in this scenario. In each instance, the more aggressive
strategy involves a level of productivity above the given threshold, in line with the findings above. To begin with, strategy 2 is preferred to strategy 1 if \( \Pi^2 > \Pi^1 \), or:

\[
\phi a^{1-\sigma} s_1 > f^X(s_1,0)
\]

That is to say, whether exporting only to the small market is preferred to not exporting at all depends on the relative values of a number of parameters. Generally, exporting to the small market is preferred to not exporting at all if transportation costs are low, productivity is high, the size of the market is large (in terms of its effect on revenue rather than fixed costs), discounting is slight, and the fixed cost of entering the small market with no experience is low. Similarly, strategy 4 is preferred to strategy 2 if \( \Pi^4 > \Pi^2 \), or:

\[
\phi a^{1-\sigma} s_2 > f^X(s_2,1)
\]

Here we are comparing the discounted profits from entering the smaller market and then the larger market with those from entering the smaller market alone. The problem, then, is to determine if positive profits are yielded from entry into the larger market once the smaller market has already been entered. Again there is a threshold level of productivity associated with this choice, but now with the size of the larger market and the fixed costs of entering that market second being pivotal. Considering now the two strategies where one market is entered in the first period and then the other market is entered in the second period, strategy 5 is preferred to strategy 4 if \( \Pi^5 > \Pi^4 \), or:

\[
\phi a^{1-\sigma} [s_2 - s_1] > \left[f^X(s_2,0) - \beta f^X(s_1,1)\right] - \left[f^X(s_1,0) - \beta f^X(s_1,1)\right]
\]

For it to be optimal to enter the larger market first, productivity must be above a certain threshold, but here the decision depends upon the relative revenues gained in the first period and the reductions in the levels of the fixed costs of entry. In the above inequality, the left hand side represents the difference between one period of revenue from the larger market and one period of revenue from the smaller market, while the right hand side represents the difference in discounted fixed cost reductions. The more productive a firm is, the more likely it is that the revenue difference exceeds the fixed cost difference, so that the larger market is entered first. Clearly then, if the reduction in fixed entry costs was an absolute amount that did not depend on the size of the market, the right hand side of the above inequality would be equal to zero and it would never be optimal to enter the smaller market first. Finally, strategy 6 is preferred to strategy 5 if \( \Pi^6 > \Pi^5 \), or:

\[
\phi a^{1-\sigma} s_1 > f^X(s_1,0) - \beta f^X(s_1,1)
\]

Here we are comparing the strategy of entering both markets immediately with that of entering the larger market and then the smaller market. Once again, there is a threshold level of productivity for employing the more aggressive strategy. The left hand side of the above inequality represents the revenues received in one period of exporting to the smaller market, while the right hand side represents the discounted benefit of reducing the fixed cost of entry into the smaller market by deferring entry until after the larger market has been entered. The absolute reduction in this fixed entry cost for the smaller market should be relatively small and discounting relatively light for immediate entry into both markets to be optimal, as both
of these would imply a lower benefit from staggering entry. This implies that a firm that
discounts the future less chooses to enter more markets immediately, foregoing the benefits
that come in the long-term from gaining experience before entering further markets.

6. Three-market example

In the case where there are three potential export markets, the set of possible strategies and
array of productivity thresholds become vastly more numerous than in the two-market case. However, with an additional market we are able to observe a richer variety of possible
strategies that yield some interesting trends, natural extensions of those present in the two-
market case. Some such trends are explained here with reference to the numerical example
that is shown, as a parameter space, in Figure 1\textsuperscript{10}.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure1.png}
\caption{Optimal strategies in the 3-destination case.}
\end{figure}

The numerical example given in Figure 1 illustrates the optimal strategies across a parameter
space of productivity levels on the horizontal axis and discount rates on the vertical axis.
Each distinctly shaded area in Figure 1 represents a set of parameter values that imply a
common optimal strategy. The labels include three values that indicate the periods in which
the small, medium, and large markets, respectively, are entered, with a dash indicating a
market that is not entered at all. Taking horizontal slices of the parameter space in Figure 1

\textsuperscript{10} The parameters in this example are $\phi = 1$, $s = [1, 4, 10]$, $f^X(1, 0) = 1.50$, $f^X(1, 1) = 1.00$, $f^X(1, 2) = 0.75$, $f^X(4, 0) = 3.00$, $f^X(4, 1) = 2.00$, $f^X(4, 2) = 1.25$, $f^X(10, 0) = 4.50$, $f^X(10, 1) = 3.00$, and $f^X(10, 2) = 1.75$. 

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we are able to compare firms with heterogeneous productivity levels but otherwise identical parameter values, allowing us to observe the relationship between firm productivity and the optimal pattern of entry. Three such slices, which are indicated by dotted lines in Figure 1, are discussed in this section.

Firstly, consider the slice of the parameter space with a discount factor of $\beta = 0.95$. As in any situation with positive discounting and fixed costs, it is not optimal for firms at the lower limit of productivity to export to any markets. The next least productive firms to export enter the smallest market first, the medium-sized market one period later, and then the largest market in the third period. These are followed by three groups of firms that enter all markets over two periods: the least productive of these enter the two smallest markets first, the next least productive enter both the smallest and the largest markets first, and the most productive enter the two largest markets first. This follows the pattern of less productive firms tending to begin in smaller markets and then progress to larger markets, to gain from the experience, while more productive firms go from larger to smaller markets, in pursuit of higher revenues. Again as with other parameter values, it is optimal for the most productive firms to enter all markets immediately, as beyond a certain level of productivity the revenues simply overwhelm the fixed costs. In this sequence of strategies, the more productive firms clearly enter markets more quickly, and tend to enter larger-then-smaller markets rather than the other way around.

Consider now the slice of the parameter space with a discount factor of $\beta = 0.8$. Once again, the more productive firms tend to enter the export markets more quickly, with the least productive firms taking three periods to enter all of the markets, some firms taking two periods, and the most productive firms enter all markets in the first period. However, these parameter values present more variety in the orders of entry for those firms taking three periods than in the case with $\beta = 0.95$. The least productive of these enter the markets in a strictly increasing order of size, while the most productive enter the markets in a strictly decreasing order of size, with two intermediate orders in between. These strategies strictly follow the relationship between productivity and the tendency to enter larger markets first.

Finally, consider the case where the discount factor is $\beta = 0.55$. Here we again see the trend of more productive firms entering markets more quickly, but as some strategies involve entering only a subset of markets, this example represents the relationship between productivity and the number and total size of markets entered. The least productive firms do not export, the next least productive firms only export to a single market, more productive firms enter the same market initially but then enter one further market in the second period, while still more productive firms also enter the remaining market in the third period. There is therefore a clear trend of more productive firms entering a larger number of markets.

7. Uncertainty
When allowing for uncertainty about the revenues and any potential costs associated with exporting to a given market, the model would yield further predictions about firms’ optimal exporting behaviour. In a case where there are ongoing fixed costs of exporting, a change in parameters that leads to a decrease in a firm’s revenue or an increase in its costs from a given export market may cause its current and expected future profits from that market to become negative, which would lead the firm to exit the market. At the level of the market, the firms that exit a given market would naturally be those with relatively low productivity levels, as these firms would be nearest the threshold level for exporting profitably. At the level of the
firm, the firm would be expected to exit export markets with relatively low profitability, that is to say relatively low revenues and high ongoing fixed costs.

8. Conclusion

The model developed in this paper is capable of explaining a variety of export market entry strategies for firms in an economy. The model offers novel predictions about the relationships between firm characteristics and the type of exporting pattern employed that fit with intuition. Particularly, more productive firms are predicted to enter a larger number of markets and a larger total market size, while also entering new export markets at a faster rate, and tending to enter larger markets before smaller markets rather than the other way around. Some of these predictions have been tested and fit with existing empirical evidence, while those remaining are proposed to be tested against data in a future project. If verified empirically, the predictions of the model could add valuable insight into the process by which firms enter export markets, indeed how firms become exporters.

The variety in firms’ export entry patterns that is generated by the model offers a theoretical explanation for the variation in orders of export market entry found by Lawless (2009) in data for Irish firms. Furthermore, a rough hierarchy of export markets is predicted by the model, with all exporting firms having at least one common export destination, some export markets being entered by most exporting firms, and some export markets being entered by very few or no firms, with a gradient in between. This fits with the empirical findings of Eaton, Kortum and Kramarz (2004).

References


Appendix

Proof of proposition 1

If we consider the strategy payoffs, which are linear and increasing functions of productivity with gradients given by the levels of aggressiveness, it is clear that the difference between a more and a less aggressive strategy is also a linear and increasing function. Therefore, for any given pair of strategies there must either be one strategy that yields a higher level of revenue for all potential levels of productivity, or a unique productivity level at which the difference between the strategy payoffs is zero. In the latter case, the point at which the difference is zero represents a threshold level of productivity, whereby the more aggressive strategy would yield a higher payoff for any productivity levels above this point, while the less aggressive strategy would yield a higher payoff for any productivity levels below this point. So the more aggressive strategy is optimally employed by more productive firms.

Then, the value of the aggressiveness term $\sum_{i=1}^{m} \beta^x_s i$ clearly increases with the following isolated changes to the strategy:
1. Adding an additional market \( i \) of nonzero size entered some finite length of time in the future to the strategy, which increases the aggressiveness term by \( \beta^E s_i > 0 \);

2. Replacing a smaller market \( i \) with a larger market \( j \), but entering it in the same period \( E_j = E_i \), which increases the aggressiveness term by \( \beta^E [s_j - s_i] > 0 \);

3. Entering one of the markets (\( i \)) earlier, so that the period of entry becomes \( E^1_i < E^0_i \). If market \( i \) is nonzero in size, the aggressiveness term increases by \( \beta^E [\beta^E - \beta^E_i] s_i > 0 \).

It is not necessarily the case that any given strategy is optimally employed by some firms, as there may simply be other strategies that yield a higher payoff for all possible productivity levels.

**Proof of proposition 2**

At the two limits, the least aggressive strategy involves not entering any markets, while the most aggressive strategy involves entering all markets immediately. These two possibilities represent the minimum and maximum, respectively, of all three factors. Between these two endpoints, there must therefore be an overall trend of increasing numbers and total size of export destinations, and of the earliness of market entry. As explained in the body of the paper, it is possible that a strategy is more aggressive than another despite being less aggressive in terms of a single factor or even two factors, but that this requires the difference in the remaining factor or factors to be relatively large, so that an ordering of potential strategies from the least to most aggressive would have a prevailing increase in the aggressiveness of each of these factors.

**Proof of proposition 3**

Comparing two strategies that involve entering the same set of markets in the long-term, the strategy that involves entering a larger market earlier and a smaller market later naturally has a higher value of \( \sum_{i=1}^{m} \beta^E s_i \). As explained in the proof to proposition 1, this implies that such a strategy is optimally employed by more productive firms. Such a comparison reflects the difference between a strategy that involves entering a larger market and then a smaller market as opposed to the opposite pattern.

**Proof of proposition 4**

If we consider the set of export markets and the order of entry of one firm, a more productive firm that did not enter any of these markets in the long-term would be foregoing profit. Of course a less productive firm could not make a profit by exporting to a separate set of markets, as the same reasoning would apply then to the firm we are considering. As the order of entry to a set of markets can be important in determining the payoffs for firms with different productivity levels, this rule does not require that the set of export destinations for a less productive firm be a subset of the export destinations for a more productive firm, but simply that there be some overlap between the export destinations of any given pair of firms.

**Proof of proposition 5**

As with all other firms, the firm that exports to the fewest destinations must have at least one destination that is profitable, which must also profitable for all of the more productive firms
that by definition have at least as many export destinations. Less productive firms that nevertheless export to more destinations must do so by entering some unprofitable markets as part of a longer-term strategy, but after doing so must find the same markets as the firm with the least destinations to be the most profitable.