Market Penetration Cost and International Trade*

Costas Arkolakis
Yale University, NBER & CESifo

Olga Timoshenko †
Yale University

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1 Introduction

For the past decade a large number of studies have documented important empirical regularities for the role that individual firms play in international trade. One predominant finding is that at any given year only a small fraction of firms export, typically less than 15%.[1] In addition, the distribution of sales of exporters in a destination country is dominated by small exporters: for example the 25% of French firms with the lowest sales in an exporting market sell less than $10,000 in that market, as pointed out by Eaton, Kortum, and Kramarz (2008).[2] Related evidence have also been documented using datasets that report trade in goods at a very disaggregated level. An important finding relates to the growth of trade for individual goods during trade liberalization episodes. In particular, the percentage increase

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†Contact: Department of Economics, Yale University, 37 Hillhouse ave., New Haven, CT, 06511. Email: costas.arkolakis@yale.edu. web: http://www.econ.yale.edu/~ka265/research.htm

[1]See Bernard, Jensen, Redding, and Schott (2007) for facts about the US manufacturing firms; Eaton, Eslava, Kugler, and Tybout (2008) - for Colombian firms; Eaton, Kortum, and Kramarz (2008) - for French firms

[2]This fact is true for each one of more than 100 exporting markets that Eaton, Kortum, and Kramarz (2008) study. The fact that sales of the most exporters are small compared to the total volume exported has also been confirmed by Arkolakis and Muendler (2007) among others.

in the trade flows is higher for the goods that were traded in small but positive volumes prior to the liberalization which implies a reallocation of market shares within goods. Arkolakis (2008a) studies the case of imported Mexican goods from the US that were positively traded before the NAFTA liberalization episode. He finds that the least traded amongst these goods that accounted for the 15% of total imports in 1990-92 increased their share to almost 25% after the liberalization.[3]

Models of trade with heterogeneous productivity firms and love for variety –constant elasticity of substitution (CES) Dixit-Stiglitz– preferences such as Melitz (2003) and Chaney (2008) have served as the benchmark specification in understanding the patterns of firm-level trade data. These models typically assume fixed per-period cost of exporting, which imply that only the firms that are able to generate sufficiently high profit to overcome the fixed cost will become exporters. Thus, such models can explain the limited participation of firms in the exporting markets. Furthermore, since profitability of a firm is increasing in its productivity in these models, only the most productive firms export, thus, explaining the productivity difference between exporters and non-exporters. Some important empirical regularities, however, remain puzzling for the fixed cost models: the dominance of many small exporters, and the growth in trade of individual goods in response to policy changes.

This note discusses the implications of a new formulation of market penetration costs developed by Arkolakis (2008a) and incorporated into a framework of firm productivity heterogeneity such as the one of Melitz (2003) and Chaney (2008). In this formulation, the per-period export costs depend on the number of consumers a firm chooses to reach in an export market, and, therefore, are endogenous to the firm. A firm enters a market if it makes profits by reaching a single consumer there and pays an increasing marginal cost to access additional consumers. The formulation we discuss intends to broadly capture marketing costs that the firm incurs in order to increase its sales in a given market.

The model improves significantly upon puzzling predictions of the fixed cost models and, therefore, has important implications for policy analysis. First, it reconciles the typically

[3]Similar findings are reported in Kehoe and Ruhl (2003) and Kehoe (2005)

large estimates of the fixed cost with evidence on the existence of many firms exporting small amounts to particular markets through the extensive margin of consumers mechanism.[4] It implies that even small market entry costs could exclude many firms from the market and imply low levels of market penetration of others. In the policy context, if we think of these market penetration costs as per-consumer marketing costs, policies that could reduce this component of the costs (such as advertisement of foreign products, trade fairs, etc) could be beneficial for entry of new exporters and growth of existing small ones.

Second, the endogenous formulation of market penetration costs and, as a result, the departure from the Dixit-Stiglitz demand structure enables the model to account for the heterogeneous response of trade flows by goods to changes in variable costs of trade, such as tariffs. The new framework implies a higher growth rate in trade for firms or goods with positive but little previous trade, a result which is largely consistent with various studies on trade liberalization such as Kehoe (2005), and Kehoe and Ruhl (2003). As a result, the model is well suited to analyze and predict the behavior of trade flows in response to policy changes.

The rest of the note is organized as follows. Section 2 discusses the limitations arising within models of trade with fixed entry costs. Section 3 presents the details of the theory of endogenous market penetration costs and section 4 illustrates its predictions. Section 5 offers the discussion on how the theory of endogenous costs is useful in the context of industrial policy in developing countries. Section 6 summarizes current research on the sunk entry costs. Section 7 concludes.

[4]For example, Das, Roberts, and Tybout (2005), examine a sample of Colombian exporters for the period of 1981 to 1991. Using a dynamic model, they estimate (one-time) fixed cost for new exporters ranging between $300,000 and $500,000 per firm. These estimates are rather large compared to the predominance of French exporters that sell less than $ 10,000 reported by Eaton, Kortum, and Kramarz (2008)

2 Models of trade with fixed cost and trade facts

In this section we briefly discuss the extent to which the fixed cost model can explain international trade facts. In this model the assumption of fixed per-period costs allows the model to explain the limited participation of firms in the exporting markets, and the productivity difference between exporters and non-exporters. A number of empirical regularities, however, remain puzzling for the fixed cost model: the dominance of many small exporters, and the high growth in trade for goods with low but positive volume of trade prior to trade policy changes. As shown in Arkolakis (2008a), a fixed cost model parameterized to match the fraction of exporters over-predicts the sales of the smallest percentiles of firms by a factor of 150. The problem partially arises from the indivisibility property of the fixed costs: large fixed costs are necessary to account for the small fraction of exporters, while small costs are consistent with the large number of exporters selling small amounts in the destination market. The mechanism of the model suggests that only the firms with exporting sales that are high enough to overcome the fixed costs will become exporters. On the one hand if the fixed costs are assumed to be high, very few firms will export with export sales being at least as high as the assumed value of the fixed costs. On the other hand if the fixed costs are assumed to be negligible, most of the firms will become exporters and many will export tiny amounts.

The extensions of the uniform fixed cost models that allow heterogeneous fixed costs across firms would alleviate the puzzling predictions regarding the predominance of small exporters. However, such assumption by itself is not enough to resolve the predictions regarding the larger growth of goods with positive but little trade in foreign markets. This problem arises due to the assumption of the love for variety preferences (specifically CES Dixit-Stiglitz demand). Such preference structure yields constant elasticity of trade flows of a good with respect to trade costs. Thus, a decrease in trade costs will cause the same percentage increase in trade volumes across the goods of different types.

Rather than arbitrary specifying a fixed cost structure that would work we will describe a procedure that starts from the first principles and which models how firms reach foreign

consumers. The result is a market penetration cost structure that not only alleviates the puzzling predictions of the fixed cost model but also retains its desirable properties: the prediction that few firms export and the sales distribution of large exporters that seem to be described very well by the fixed cost model.[5] We present such a structure in the next section.

3 A new theory of market penetration costs: The idea

The contribution of the recent work of Arkolakis (2008a) is to offer an alternative formulation of entry costs. This formulation postulates that market penetration costs are an endogenous choice of the firm. The more of a pre-specified marketing cost the firm pays the more it can sell to a given market. This abstract interpretation of market penetration costs can take more precise and deterministic representations which we describe below.

A first interpretation of these costs is that of marketing costs to reach foreign consumers. The main argument assumes that the marginal costs of reaching consumers are increasing in the fraction of consumers reached.[6] In this case a more productive firm, which generates more sales per consumer, will choose to reach more consumers and generate higher sales. A less productive firm will reach a small fraction of consumers and generate low sales. A firm with sales per consumer not high enough to cover the marketing costs of reaching the first consumer will choose not to participate in the export market. Thus, the model can explain both endogenous export participation (if firms optimally decide not to reach any consumer) and small sales (if firms optimally decide to enter a country but reach few consumers).

Increasing market penetration cost to reach consumers is not the only explanation how-

[5] See the discussion in Eaton, Kortum, and Kramarz (2008)

[6] Decreasing returns in marketing outlays may arise as (i) less responsive consumers are reached or the same consumers respond less to additional marketing efforts, or (ii) an increasing amount of effort has to be taken in order to reach a consumer that has not yet been reached as discussed in Bagwell (2007) p. 51. The analytical representation of these marketing costs builds on seminal contributions in the advertising literature such as those of Butters (1977) and Grossman and Shapiro (1984)

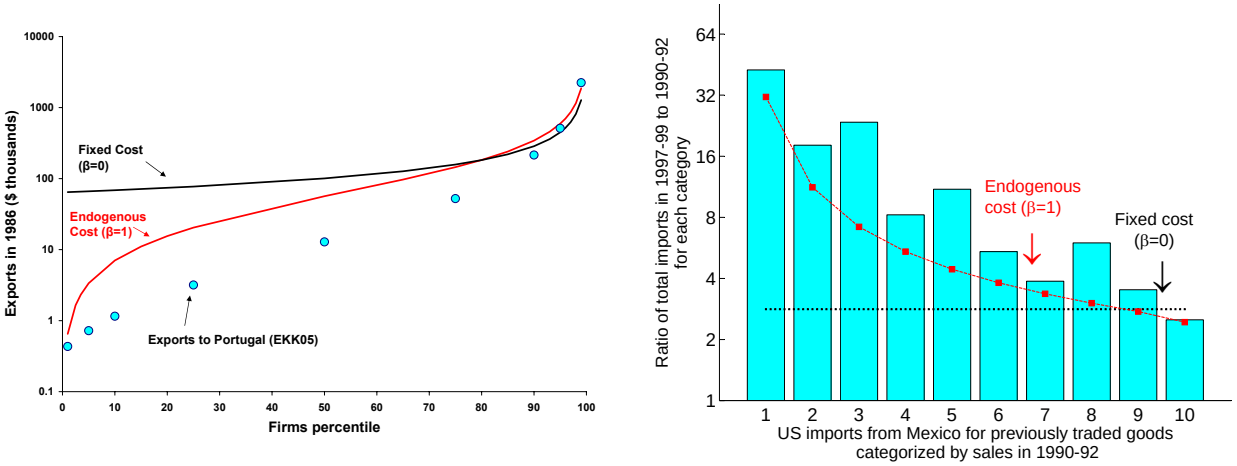
ever. The same logic applies if the model is re-interpreted as a model where marginal market penetration costs are constant but result to declining marginal revenues from market penetration. This interpretation can be precisely stated as declining marginal revenues from introducing new products as formalized by Arkolakis and Muendler (2007) or also from consumers with heterogeneous tastes. The common assumption of all these specifications is that there is another margin of firm sales that the firm can regulate using payments to marketing costs versus simply reducing its price. Of course this assumption has a variety of relevant policy implications that are different from the assumption of fixed cost of market penetration.

4 Implications of modeling market penetration costs

The model of endogenous market penetration costs improves the predictions of the uniform fixed cost model in two important dimensions: size distribution of exporters, and growth in trade in response to policy changes. The assumption of endogenous increasing marginal cost of reaching consumers allows firms with potentially small sales to export into a destination market, thereby explaining the dominance of the distribution of sales by small exporters. The data on the sales of French firms in Portugal (similar results are true for the other markets where French firms sell) is plotted against the predictions of the endogenous cost model versus the fixed cost model in the left panel of Figure 1.[7] The data shows that the sales distribution is dominated by small exporters: the individual sales of at least 25% of French firms in Portugal are below $ 10,000. The fixed cost model over-predicts the sales of the smallest exporters, however predicting well the sales of the largest exporters. The model with endogenous costs does well where the fixed cost model does well, but, in addition, it also predicts the predominance of small exporting firms. The reason for the improved

[7]The distribution of the sales of French firms in a destination market is robust across different the markets as established in the Eaton, Kortum, and Kramarz (2008) study. Portugal is considered here as a representative example. The calibration procedure for the endogenous and fixed cost models is described in Arkolakis (2008a)

Sales Distribution of French Firms **Ratio of US imports from Mexico in 90-97 and 90-92**



Data Source: Eaton, Kortum, and Kramarz (2008) and www.sourceoecd.org tabulated by Arkolakis (2008a)

Figure 1: **Cross-sectional and comparative statics predictions of the model**

predictions is that firms with low productivities are able to penetrate the market by paying small endogenous market entry costs to reach only a few consumers and, as a result, attain low levels of export sales in the market.

The model of endogenous market penetration costs yields non-trivial predictions regarding the response of trade flows by goods to changes in trade policy. Since firms are allowed to make decisions regarding what fraction of consumers to reach, the demand function departs from the Dixit-Stiglitz demand used in the fixed cost models. As a result the elasticity of demand with respect to trade costs is not constant across goods of different types. In contrast, the elasticity of trade has two components. The first component (intensive margin) is the same as in the Dixit-Stiglitz context and originates from the per-consumer sales elasticity. The second component (extensive margin) originated due to the fact that the number of consumers reached changes in response to a change in trade costs. Thus, as trade costs fall, the sales of a firm increase per consumer as well as due to the increase in the number of consumers. The interplay of the intensive and extensive margins of trade is what allows the endogenous cost model to match the prediction of the trade flows more closely.

Arkolakis (2008a) shows that the implications of the endogenous cost model are consistent with the recent findings regarding trade liberalization episodes: goods with little, but positive, trade before a liberalization are the ones that experience the highest growth rates after the episode as depicted in the right panel of Figure 1. The figure uses the data on US total imports from Mexico in 1997-1998 and 1990-1992. The previously traded goods are split into deciles depending on how much they were traded before the liberalization. The data reveals an interesting pattern: the growth rate of the goods is higher the less traded the goods were before the liberalization episode. This pattern is predicted by the calibrated model with endogenous market penetration costs. In addition, goods that were not traded before liberalization have much smaller share in new trade, given that they are traded in very small amounts after the liberalization episode. In this case the calibrated model with fixed entry costs predicts identical changes in trade flows for each category of goods, while the endogenous cost model delivers a close match to the data. It captures very well the growth of the goods with least trade since the model predicts higher trade elasticity with respect to trade costs for lower productivity firms.

In a follow up paper, Arkolakis (2008b) shows that adding market penetration costs is a fruitful assumption when considering individual firm growth. In particular, a model of productivity dynamics combined with endogenous market penetration costs would imply that new entrants are small and grow fast in accordance to the data. Both are predominant empirical findings for individual exporters and firms overall as reported by Eaton, Eslava, Kugler, and Tybout (2008) and Dunne, Roberts, and Samuelson (1988). Instead, the fixed cost benchmark implies large entrants with growth rates that are smaller than the ones implied in the data. In the next section we discuss the implications of modeling endogenous market penetration costs for international development.

5 Development applications

Direct evidence on marketing expenditures that exporters incur can give us an idea of the type of the entry costs that the formulation of endogenous market penetration costs could be capturing. These costs potentially include the costs incurred by a firm during the process of promoting its product and reaching consumers as well as establishing the related distribution channels in order to sell its product. Evidence about the exact nature of these market penetration costs for the case of exporting is provided by Keesing (1983) and Roberts and Tybout (1997b). The authors discuss a number of costs reported by managers of exporting firms in a series of interviews. These data indicate that firms must research the foreign market by identifying and contacting the potential consumers of their good.

The additional insight that the modeling of market penetration costs offers is that these costs are likely not be large for small firms in a market. However, since penetration in foreign markets is increasingly difficult firms can optimally chose not to enter a market or to enter and sell little. Moreover, the model implies that for small changes of these costs small firms can expand their market shares substantially. Therefore, policies that are targeted towards improving marketing technology of exporters (such as advertisement of national products abroad, trade fairs, etc) could be very beneficial for entry of new exporters and growth of existing small ones. In addition, to the extent that marketing technologies in developing countries are outdated this type of investment could enhance the ability of developing countries to attract foreign trade and investment. The theory also implies that these types of policies are likely to make a small difference for large exporters: to the extent that these exporters have already established their distribution channels little change in their market shares is expected. Thus, a dollar spend in improving the marketing of small firms would be more beneficial for overall exports versus a dollar in improving the marketing of large firms.

In addition, the modeling of endogenous market penetration costs has implications for the growth of trade of firms or goods with respect to changes in variable costs of trade, such as tariffs. Existing firms (or goods) with low levels of market penetration, and thus

low sales, would increase their market share much faster in response to changes in these costs. This feature of the model can be used to explain the large growth of trade for goods with little trade before liberalization reported by Kehoe (2005), Kehoe and Ruhl (2003) and Arkolakis (2008a). Potentially, a mechanism like the one implied by the formulation of endogenous market penetration costs could be incorporated in an applied general equilibrium framework. This framework could then be used in predictions for the growth of trade during trade liberalization episodes.

6 Current research on sunk entry costs

Arkolakis (2008b) has shown that a model with endogenous market penetration costs and firm productivity dynamics can go far in explaining dynamic facts on exporter growth. In particular, such a model that is based on persistence in firm productivity shocks can generate persistence in exporting status: a firm that is currently exporting is more likely to export next year versus a firm not exporting. An outstanding question for the Arkolakis (2008b) formulation is whether the predictions of this model conflict previous evidence on hysteresis behavior in export participation. Hysteresis behavior refers to the asymmetric decisions of firms regarding exporting participation in response to a positive or negative shock at the macro or at the firm level. [8]

To account for the hysteresis phenomenon, previous literature postulated the existence of sunk costs of exporting. Sunk costs of exporting are defined as one-time entry costs that a firm has to pay before it starts to export. These costs have to be paid every time the firm exits and re-enters a market. A firm that is hit by a beneficial productivity shock pays the sunk cost and becomes an exporter. When the productivity reverts to its original level, a firm will continue to be an exporter in order to avoid paying the sunk costs in the future in response to another beneficial productivity shock. Thus, conditional on productivity, or

[8]For a greater discussion on hysteresis phenomenon see Dixit (1989), Baldwin and Krugman (1989), Roberts and Tybout (1997a)

in the empirical context, on sales, a firm that is an exporter will have a higher probability of continuing to be an exporter compared to a non-exporting firm. However, the discussion in previous sections regarding indivisibilities in exporting costs leads to the conclusion that sunk costs may not be a realistic representation of these exporting costs.[9]

Current research on entry costs is motivated by these findings and looks at sources of hysteresis in exporting behavior without assigning a particular large role to indivisibilities in entry costs. One mechanism that can create hysteresis in exporting behavior is learning or experience accumulation. As a firm enters a destination market learning occurs: the longer a firm exports the more information it gains about the appeal of its product.[10] In a reduced form evaluation of the learning mechanism in the form of age dependent sales Timoshenko (2009) finds that age in the destination market is an important predictor of the future probability of exporting, and the effect of sunk costs, typically captured by the one period lagged exporting status, declines by almost one half when age is properly controlled for. Controlling for the depreciation of the sunk costs, Timoshenko (2009) finds that those costs do not depreciate as quickly when the effect of age in the destination market is taken into account. These findings substantially weaken the support for the sunk entry cost, and rather provide supporting evidence that the effect of the accumulated knowledge on sales makes firms continue exporting their products.

The above imply that the learning mechanism is a promising avenue for future research related to entry costs. The avenue of modeling learning into a model of international trade has been recently adapted by Eaton, Eslava, Krizan, Kugler, and Tybout (2008), Ruhl and Willis (2008).[11] Of course an outstanding challenge is to relate and connect this research to

[9]The assumption of sunk costs of entry is also inconsistent with the observation that the average sales size of the exitors and the new entrants is approximately the same Eaton, Eslava, Krizan, Kugler, and Tybout (2008). As suggested by the analysis above in a model of sunk costs exitors are typically smaller than entrants. In addition, as shown by Ruhl and Willis (2008), the sunk cost model performs poorly in predicting the survival rate of exporters.

[10]See for example Eaton, Eslava, Krizan, Kugler, and Tybout (2008) and also the recent work of Ruhl and Willis (2008)

[11]Arkolakis and Papageorgiou (2009) also model learning into a model of firm heterogeneity.

the findings of the theory of endogenous market penetration costs as done for example by Eaton, Eslava, Krizan, Kugler, and Tybout (2008).

7 Conclusions

In this note we have briefly discussed the implications of a new theory of entry costs to foreign markets. This theory postulates that entry costs are endogenous rather than fixed in the sense that paying higher costs allows firms to increase their market share in a country. We have shown that such a formulation of entry costs is consistent with a number of important regularities on international trade. In addition, we argue that this the new modeling of entry costs can have valuable practical implications related to the way we think about adjustments to trade opportunities.

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