Non-Market Interactions and Entry into Export Markets

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Abstract

Previous research suggests that firms that penetrate foreign markets reduce entry costs for other potential exporters, generating export spillovers. This paper continues this line of research by developing a general empirical framework to study whether export participation decisions at the firm level are influenced by the characteristics of firms that belong to a common reference group (defined by industry and geographical region). It is shown that, in the presence of entry costs, group composition affects the degree of state dependence of individual export decisions, thus making its impact contingent on export status. I test this idea applying the dynamic panel data estimator introduced by Blundell and Bond (1998) to a data set of Argentine manufacturing firms. Group composition influences individual export decisions and most of this effect is channeled through entry costs. However, these non-market interactions are not driven by export spillovers, but by average firm size at the group level.

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1 Introduction

Politicians and policymakers often consider access to export markets central to promoting growth and development. Governments in both rich and poor countries set up offices and invest resources to assist firms in selling goods and services abroad, believing that helping exporters is good policy.

Economists, on the other hand, have only recently begun to gain a better understanding of the role of firms in mediating countries' imports and exports. The increased availability of microdata in recent years has spurred a growing literature concerned with a range of aspects of firm level adjustment to trade liberalization that complement traditional theories of comparative advantage, increasing returns and consumer love of variety.[1]

One dimension which has received particularly close attention is the identification of the factors that determine export participation decisions. What explains the export behavior of firms? It is now clear that a combination of entry costs and heterogeneity in the underlying characteristics of firms explains why only some firms export (Bernard and Jensen, 2004). At the most basic level, microdata have revealed two empirical regularities. First, exporters are larger, more productive and more skill-intensive than non-exporters, even before exporting begins (Bernard et al., 1995). Second, export status (i.e. prior export experience) has a substantial effect on current export participation, which is consistent with the existence of sunk entry costs in exports markets (Roberts and Tybout, 1997). These findings have, in turn, stimulated the development of theoretical models showing how firm heterogeneity and sunk costs generates the self-selection of the most productive firms into export markets (Melitz, 2003 and Bernard et al., 2003 among others).

While most of the research at the micro level has centered on analyzing which characteristics of a firm affect its propensity to export, a number of studies have taken a different approach by focusing

[1] Bernard et al. (2007) and Greenaway and Kneller (2007) are two recent surveys of this literature.

on whether the characteristics of firms located close to each other play a role in shaping individual entry decisions. Intuitively, proximity among firms could influence individual export decisions if it enables interactions such as learning or imitation.[2] The literature on *export spillovers* searches for a specific learning interaction generated by exporters and influencing the export decisions of firms belonging to the same reference group. The reference group describes the space of interaction (i.e. who interacts with who) and is usually defined in terms of product similarity and geographical proximity in the export spillovers literature. In particular, these studies suggest that firms that penetrate foreign markets reduce entry costs for other potential exporters in the same industry and region, either through learning effects or by establishing commercial linkages. However, in a recent survey, see Greenaway and Kneller (2007, p. 143) conclude that the evidence of export spillovers is "somewhat mixed".

The objective of this paper is to re-examine the role of group composition (i.e. variation in the characteristics of the reference group) as a determinant of export decisions while addressing three issues that, to the best of my knowledge, have been overlooked in previous research. First, nine out of the eleven papers surveyed in Greenaway and Kneller (2007, table 2) apply static estimation frameworks to analyze entry decisions. Modeling the firm's export decision in the presence of entry costs as in Bernard and Jensen (2004), I illustrate the well-known result (Roberts and Tybout, 1997) that a static approach is incompatible with the existence of entry costs in export markets, resulting in misspecified empirical models and complicating the interpretation of the results.

The remaining two studies reviewed in that survey, Clerides et al. (1998) and Bernard and Jensen (2004) apply dynamic frameworks and find weak evidence of export spillovers.[3] However, a

[2] Note that, in principle, learning does not require firms to cooperate actively; the observation of the actions of competitors could potentially reveal information that facilitates entry to export markets. Aitken et al. (1997, p. 104) provide an example.

[3] Clerides et al (1998) examine the role of exporter concentration within regions and industries on the export decision of Colombian plants. They find only weakly significant evidence that the presence of other exporters makes it easier for domestically oriented firms to break into foreign markets, but find no spillovers reducing marginal costs

maintained assumption in these studies (and, in general, in the export spillovers literature) is that, once differences in productivity across firms and prior export experience have been controlled for, the influence of group composition on export decisions is the same for every firm belonging to the reference group. A second goal of this paper is to show that this assumption is inappropriate for testing whether exporter concentration reduces entry costs in export markets. On the contrary, if group composition affects entry costs, its impact on individual decisions should depend on the firm's export status. The intuition behind this result is that any effect of group composition on entry costs should only influence the decision of firms considering whether to *start* exporting or not, and be irrelevant in the export decision of firms with recent experience in export markets (since, by definition, the latter have already incurred entry costs).

As mentioned above, the literature on export spillovers has exclusively focused on whether individual export decisions are driven by the concentration of exporters in the reference group. However, interactions could be related to other features of group composition. Therefore, a third objective of this paper is to provide a general framework to account for alternative sources of non-market interactions. As an example, instead of learning from other exporters, a firm considering entry could plausibly learn from the R&D investment of firms in its reference group (perhaps, by learning new ways to upgrade its products, making them more appealing to foreign consumers). Another alternative is for firms to become more productive (and, as a result, more prone to exporting) by tapping into a group-specific stock of innovations that have already been made by past innovators in the group. The idea of firms catching up to a *technological frontier* is applied by Aghion and Howitt (2006) to study the role of technological spillovers in explaining growth rates across countries, but it can also be used to think about the transfer of knowledge within firms

of exporters. Using a panel of U.S manufacturing firms, Bernard and Jensen (2004) find significant entry costs to foreign markets but negligible market access spillovers from export activity of firms in the same industry or region.

belonging to the same group.

In general, sorting out which features of group composition generate interactions on individual behavior is likely to have policy implications. As an example, if firms learn from exporters (as suggested in the spillovers literature), government support to any single exporter will generate an indirect benefit for other firms considering entry to export markets. But if firms learn how to export as a result of the R&D investment of other firms located nearby, then resources allocated to export promotion may end up being socially more productive if redirected to R&D support programs.

Overall, exploring the link between individual export decisions and group outcomes is appealing for a number of reasons. First, from a general perspective, because it is in line with a relatively recent and growing interest among economists of various fields in understanding how social factors beyond the marketplace affect individual decisions and outcomes.[4] Second, because it may provide a better foundation for evaluating specific policy issues, such as the case of government support to exporters. As shown in Melitz (2003), access to export markets leads to inter-firm resource reallocation towards the more productive firms, contributing to welfare gains from trade liberalization. If entry decisions at the firm level are influenced by non-market interactions, then there is likely to be a positive role for government intervention in, for example, coordinating or promoting entry to export markets.

The firm-level data used for empirical analysis in this paper is a representative sample of manufacturing firms in Argentina between 1992 and 2001. Argentina has substantially increased its openness to foreign trade during the 1990s and entry into foreign markets has since been seen as a critical issue for the long run success of this policy. Therefore, these data provide an interesting and relevant ground for analyzing entry into export markets.

[4] The study of social interactions in economic decision making is also referred to as the *new social economics* (Durlauf and Young (2001, p.1)). Soetevent (2006) is a recent survey of the empirical literature on social interactions, including neighborhood effects, substance use among teenagers and peer effects among university roommates

The econometric approach relies on the GMM dynamic panel data estimator developed by Blundell and Bond (1998) in order to deal with unobserved heterogeneity and the dynamic effects generated by entry costs into export markets. This approach is also convenient for dealing with the potential endogeneity of group composition, including the *reflection* problem that arises in the identification of the effect of group behavior on individual export decisions (Manski, 1993).

Briefly, the results indicate that variation group composition plays an important role in the determination of individual export decisions, after controlling for the effect of the firm-level determinants usually emphasized in the empirical micro literature (past export experience and firm heterogeneity). As suggested by the export spillovers literature, most of this effect is channeled through its influence on entry costs and is, therefore, contingent on export status. However, group composition effects are not driven by the concentration of exporters, but by average firm size in the group. Furthermore, the benefit (in terms of increased likelihood of exporting) of belonging to a group characterized by a higher average firm size is larger for small firms than for large firms. If average firm size at the group level is viewed as proxying for a group-specific stock of past innovations or technological frontier, a possible interpretation of the result is that non-market interactions lead to a "backwardness advantage" -Gerschenkron (1965)- that, ceteris paribus, increases the likelihood of exporting in smaller firms.

The outline of the paper is as follows. The next section presents a model of entry into export markets with sunk costs in order to characterize export decisions at the firm level and to illustrate different channels through which non-market interactions could exert their influence on individual behavior. Section 3 describes the data set and presents descriptive statistics of the export decisions of manufacturing firms during the 1990s in Argentina. Section 4 offers a preliminary exploration of the links between individual export behavior and group composition that can be found the raw data. Section 5 begins with a discussion on the identification of non-market interactions and then sets up the econometric model to formally analyze the determinants of export decisions. Section 6 presents the estimation results and section 7 concludes.

2 A model of entry into export markets with sunk costs

In order to examine whether group composition generates non-market interactions that reduce entry costs to potential exporters, it is crucial to apply an empirical framework designed to identify the effects of entry costs on export participation decision at the firm level. In this section, I present a simple model of export decisions that explicitly incorporates the role of entry costs in export markets, a modified version of the models in Roberts and Tybout (1997) and Bernard and Jensen (2004).[5] As an additional feature, group composition is introduced into the analysis in a stark way with the goal of illustrating its potential impact on export decisions.

The model provides a useful framework that will guide the specification and interpretation of the empirical analysis in sections 4 and 5. As shown below, a consequence of the existence of entry costs is that the export decision of a firm will exhibit state dependence. This implies that a proper econometric evaluation of the influence of group composition on entry costs requires modelling export decisions in a dynamic framework. An additional feature of the model is that it explicitly separates the role of profit heterogeneity and entry costs. This is convenient to allow for different channels through which non-market interactions could influence individual entry decisions. In particular, the model also shows that the influence of group composition on individual export decisions is contingent on export status, a result that plays a central role in the empirical analysis.

Consider a firm i that in any given period τ can earn profits by selling in the domestic (d)

[5] The description of the model closely follows that in Clerides et al (1998).

and/or export (f) markets. Let this firm belong to a *reference group* $g \in G$, where g indexes a specific industry and geographical location where the firm carries out its production activities in the domestic market. G is the finite set of all groups producing in this market. Assume that the firm's profit function is separable by letting $\pi^k_{g,\tau}$ represent the profit obtained by selling in market $k = \{d, f\}$ in this period.[6]

Let the per-period, fixed costs of being an exporter (e.g. dealing with customs and intermediaries) be $M_{g,\tau}$. Then, the firm will earn positive profits from exporting in τ whenever $\pi^f_{g,\tau} \geq M_{g,\tau}$. Accordingly, if there were no start-up costs associated with becoming an exporter (and no learning-by-exporting effects) firms would simply participate in foreign markets whenever this condition was satisfied. However, as noted in Bernard and Jensen (2004), the existence of an entry cost (denoted by $\lambda_{g,\tau}$) makes the firm's entry decision forward-looking and opens up the possibility that firms export today in anticipation of cost reductions, or foreign demand increases, later on. In particular, it may be optimal to keep exporting even if $\pi^f_{g,\tau} < M_{g,\tau}$ since, by remaining in the export market, the firm avoids future re-entry costs.

Perhaps the simplest possible way to introduce non-market interactions in this framework is to model λ, M and π^k as functions of a group-specific vector $S_{g,\tau}$ that summarizes characteristics of group g that are thought to generate externalities. As a result, $\lambda_{g,\tau} \equiv \lambda(S_{g,\tau})$, $M_{g,\tau} \equiv M(S_{g,\tau})$ and $\pi^k_{g,\tau} \equiv \pi^k(z^k_{g,\tau}, S_{g,\tau})$ where, in addition, $z^k_{g,\tau}$ captures both individual characteristics of the firm and usual exogenous demand shifters in k (income level, exchange rates and goods' prices). These functions provide a reduced-form link between individual export decisions and group composition through different channels; i.e. through their influence on marginal, fixed and entry costs of exporting.

[6] Profit separability can be derived from a model of monopolistically competitive firms that can price discriminate between foreign and domestic buyers, and produce at constant marginal costs –see Clerides et al (1998).

In empirical studies, $S_{g,\tau}$ is usually a measure of the concentration of exporters in group g, period τ. In general, non-market interactions could be generated by export decisions or by other exogenous characteristics of firms belonging to reference group g (such as the proportion of foreign firms in g). An implicit assumption in this formulation is that firms interact only with firms belonging to the same group. I also assume throughout this section that the number of firms belonging to each group $g \in G$ is large so that, when solving their export decision problem, firms can ignore the impact of their decision on the vector of non-market interactions $S_{g,\tau}$. In other words, firms take $S_{g,\tau}$ as given, although some of its components could be endogenous variables determined in the general equilibrium -for example, if $S_{g,\tau}$ contains the average export decision of firms in group g. For the purposes of this paper, however, I will only study the partial equilibrium of this model.

Letting y_τ be a binary indicator equal to one if the firm decides to export in τ, assume that in an initial period t the firm chooses a sequence of export participation decisions $\{y_{t+\tau}\}_{\tau=0}^{\infty}$ in order to maximize the expected value of future discounted profits:

$$V_t(y_{t-1}, z_{g,t}, S_{g,t}) \equiv \max_{\{y_{t+\tau}\}_{\tau=0}^{\infty}} E_t \sum_{\tau=0}^{\infty} \delta^\tau \{y_{t+\tau}[\pi^f_{g,t+\tau} - M_{g,t+\tau} - (1 - y_{t+\tau-1})\lambda_{g,t+\tau}] + \pi^d_{g,t+\tau}\}$$

where E_t is an expectations operator conditioned on the set of information available at time t and δ is the one-period discount rate. This formulation implies that producers who exit the market and re-enter face the same start-up costs as producers who never exported.[7] Note that the entry cost, $\lambda_{g,t+\tau}$, is incurred if and only if the firm decides to start exporting in $t+\tau$ without recent export experience -i.e. if and only if $y_{t+\tau} = 1$ and $y_{t+\tau-1} = 0$. The firm's problem can equivalently be

[7] This will be assumed in the empirical analysis of this paper. However, it can be generalized by allowing start-up costs to depend upon previous exporting experience –see Roberts and Tybout (1997).

viewed as choosing y_t to satisfy Bellman's equation:

$$V_t(y_{t-1}, z_{g,t}, S_{g,t}) = \max_{y_t \in \{0,1\}} \{y_t[\pi^f_{g,t} - M_{g,t} - (1 - y_{t-1})\lambda_{g,t}] + \pi^d_{g,t} + \delta E_t(V_{t+1}(y_t, z_{g,t+1}, S_{g,t+1})\}$$

After evaluating the right-hand side of this equation at $y_t = 0$ and $y_t = 1$, comparing the resulting expressions and recognizing that h^*_t and $\lambda_{g,t}$ are functionally dependent on $S_{g,t}$, the firm's export decision in period t can be written as

$$y_t = 1[h^*_t(z_{g,t}, S_{g,t}) - [1 - y_{t-1}]\lambda_{g,t}(S_{g,t}) \geq 0] \tag{1}$$

where 1[.] denotes an indicator function equals 1 if the expression is true and zero otherwise, and

$$h^*_t(z_{g,t}, S_{g,t}) \equiv \pi^f_{g,t} - M_{g,t} + \delta[E_t(V_{t+1}(y_t = 1, z_{g,t+1}, S_{g,t+1}) - E_t(V_{t+1}(y_t = 0, z_{g,t+1}, S_{g,t+1})] \tag{2}$$

Equation (1) implies that incumbent exporters continue exporting whenever current net operating profits from exports plus the expected discounted payoff from remaining an exporter (which includes avoiding the entry cost next period) is positive, and non-exporters begin exporting whenever this sum, net of entry costs, is positive. Therefore, the existence of sunk costs ($\lambda_{g,t} > 0$) generates state-dependence, introducing a dynamic component in the export decision of the firm.

Equation (1) suggests two distinct channels through which non-market interactions may influence entry decisions. Firstly, through net profits h^*_t. This effect would arise if, for example, the presence of other exporters in the same group g increases the availability of specialized capital and labor inputs, lowering the firm's marginal cost of production. I'll refer to this channel as a *productivity spillover*. A second channel of externalities operates on the sunk cost of access to export markets, generating an *entry cost spillover*.

This result bears important implications for the empirical analysis of non-market interactions and entry to export markets. First, it shows that in order to conduct a proper evaluation of the existence of entry cost spillovers it is necessary to identify the degree of state dependence on individual export decisions. Second, as opposed to productivity spillovers, only the decisions of firms with no prior export experience can be influenced by entry cost spillovers -since only these firms need to incur the sunk cost to export in period t. In other words, the influence of group composition $S_{g,t}$ on individual export decisions is contingent on export status. These two observations play an important role in the empirical analysis of this paper.

3 Export decisions in Argentina during the 1990s

The data set used in the empirical analysis comes from a variety of sources that are described in detail in the appendix, section A. Briefly, the firm-level data is a random sample of manufacturing firms in Argentina, collected during two Innovation Surveys carried out by I.N.D.E.C. (Argentina's National Statistical Agency). The first survey provides information on 1639 firms in 1992 and 1996, while the second survey collected information on 1688 firms in 1998 and 2001 (Bisang and Lugones 1998, 2003). The rest of this section presents summary statistics of exporters and non-exporters, and documents the persistence of entry decisions in the data.

3.1 Exporters and non-exporters

Table 1 summarizes the characteristics of exporters and non-exporters in the Argentine manufacturing industry after pooling all observations for 1992, 1996, 1998 and 2001. Exporters comprise slightly more that half of the observations in the sample (53%). In line with previous research, exporters are clearly larger and better performing firms, invest more heavily in capital and R&D,

and demand relatively more skilled employees than non-exporters. The presence of foreign firms among exporters is substantially larger as well.

Table 2 shows the distribution of firms and exporters across provinces in Argentina. The activity of firms is highly concentrated in the three most populated provinces, Buenos Aires, Cordoba and Santa Fe. These provinces account for 64% of the country's population in 2001, over 85% of the observations and almost 90% of the exporters in the data set.

3.2 Transitions in and out of exporting and the persistence of entry decisions

Figure B.3 shows the magnitude of the flows in and out of exporting that occurred in the manufacturing industry during the 1990s. While most of the firms where non-exporters in 1992, the reverse occurred later in the sample. The number of exporters peaked in 1996, driven by both high entry and very low exit rates. The reduction in the number of exporters in 1998 comes more from a rise in exits than a decline in entry. On average, 15.6% of exporters were entrants in any given year (i.e. they were non-exporters in the previous sample year). Similarly, 12.1% of non-exporters were, on average, previous exporters. The degree of variation in export decisions displayed in this sample is similar to that reported in Bernard and Jensen (2004, p. 563) for U.S. manufacturing firms during 1984-1992 -their average entry and exit rates are 13.9% and 12.6%, respectively.

Though a substantial number of firms enter and exit the export market each year and exporting became more prevalent over time, there is still a large degree of persistence in the export status of an individual plant. Columns (1) and (2) of table 3 report the fractions of exporters and non-exporters in 1992 who were exporters in subsequent years. Among plants that exported in 1992, 84% were exporting in 2001. Non-exporters show a smaller persistence: 68% remained with the same export status in 2001. Columns (3) and (4) of table 3 report the predicted rates of persistence if exits and entrants were chosen randomly according to the calculated annual transition rates. At all horizons, the predicted persistence is substantially lower than that observed in the sample. From this we conclude that there is a high degree of reentry by former exporters, that is, they have a higher probability of reentering export markets. Similarly, former non-exporters have a higher probability to continue producing exclusively for the domestic market. This is consistent with the predictions of the export decision model presented in section 2. The empirical analysis intends to examine whether this persistence in exporting results from firm heterogeneity or from sunk costs, and the extent to which these sources of persistence are affected by the characteristics of reference groups.

4 Why Do Firms Behave Similarly?

4.1 A Look at the Raw Data

I now turn to exploring the link between individual entry decisions and group export behavior in the raw data. To characterize the latter, I'll measure the concentration of exporters in reference group g by $Y_{(-i)gt}$, the proportion of exporters in group g and year t excluding firm i,

$$Y_{(-i)gt} \equiv (\sum_{j \in g, j \neq i} y_{jgt})/(N_g - 1)$$

where N_g is the number of firms in g.[8] Alternatively, $Y_{(-i)gt}$ can be interpreted as the average export decision in group g. How are groups defined? In this paper, I follow the usual practice in the literature and assume that non-market interactions operate within groups of firms that produce similar products and are located close to each other. Product similarity is measured at the 3-digit ISIC level of aggregation and geographical locations are defined by provincial boundaries.[9]

A starting point in the analysis is the observation that a firm's decision to enter export markets

[8] $Y_{(-i)gt} \equiv 0$ if $N_g = 1$

[9] The findings of this section are robust to changing the level of industry aggregation to 2 and 4 digits of ISIC.

is positively correlated with the decisions of firms belonging to the same group. Column (1) in table 4 shows the results of the linear projection of individual entry decisions on group behavior, obtained by means of an OLS estimation of equation 3,

$$y_{igt} = \delta_t + \beta_y Y_{(-i)gt} + u_{igt} \tag{3}$$

where δ_t is a time-varying intercept common to all groups and u_{igt} captures variation in export decisions that is orthogonal to $Y_{(-i)gt}$. The results indicate a strong positive correlation between y_{igt} and $Y_{(-i)gt}$. Figure B.4 plots the fitted values of this regression against $Y_{(-i)gt}$.

The finding that members of the same group tend to behave similarly is an empirical regularity observed in different contexts in the social sciences. Researchers have hypothesized that this observation could be driven by interactions in which the propensity of an agent to behave in some ways varies positively with the prevalence of this behavior in the group. As noted in Manski (2000), according to the context, these interactions may be alternatively called "peer influences", "neighborhood effects" or "herd behavior", among others.

As mentioned in the introduction, a maintained assumption in the export spillovers literature is that, once differences in productivity across firms and prior export experience have been accounted for, the influence of group composition on export decisions is the same for every firm belonging to a given group. While this assumption may be reasonable in other contexts, the analysis presented in section 2 showed that it is inappropriate for testing whether exporter concentration reduces entry costs in export markets. If group composition affects entry costs, its impact should depend on a firm's export status. The intuition behind this result is that any effect of group composition on entry costs should only influence the decision of firms considering whether to start exporting or not, and be irrelevant in the export decision of firms with recent experience in export markets. In other words, we should expect the correlation illustrated in figure B.4 to be contingent on export status.

As a first step towards analyzing this hypothesis more formally, it is interesting to verify if it can be observed in the raw data. This requires introducing y_{igt-1}, export status, in equation 3 and allowing its coefficient λ_{gt} to depend on the average export decision in group g; that is,

$$\lambda_{gt} = \lambda_0 + \lambda_y Y_{(-i)gt}$$

In this way, the effect of $Y_{(-i)gt}$ on y_{igt} can now operate through a direct and an indirect channel, captured by λ_y and β_y, respectively. Substituting λ_{gt} in equation 3 yields,

$$y_{igt} = \alpha_t + \lambda_0 y_{igt-1} + \lambda_y y_{igt-1} Y_{(-i)gt} + \beta_y Y_{(-i)gt} + u_{igt} \tag{4}$$

The results of the OLS estimation of equation 4 are presented in column (2) of table 4. The coefficient of interest, λ_y, is negative and highly significant. This has two main implications. First, consistent with the analysis in section 2, the correlation illustrated in figure B.4 is contingent on export status. In particular, a higher concentration of exporters is correlated with a smaller influence of export status on export decisions. This is illustrated in figure B.5, a plot of the fitted values of this regression against $Y_{(-i)gt}$, contingent on export status. The vertical distance between the fitted lines illustrates how the persistence of export decisions at the firm level, λ_{gt}, decreases with export concentration. Second, a negative sign of λ_y together with the fact that β_y is positive and significant also implies that the export decision of firms considering whether to *start* exporting in period t is more sensitive to changes in export concentration than the decision of firms that exported in period $t-1$.[10] Note in figure B.5 that the fitted line for $t-1$ exporters is almost flat. In fact, a Wald test of $\lambda_y + \beta_y = 0$ in equation 4 cannot be rejected at conventional significance levels.[11]

4.2 Three Challenges for the Empirical Analysis

Overall, a simple examination of the raw data points to the importance of allowing the influence of group behavior to be contingent on export status and, as a consequence, to operate indirectly through its effect on the degree of persistence in export decisions. The literature on export spillovers, on the other hand, has focused on studying the uncontingent effect (i.e. independent of export status), albeit after controlling for export status as in Clerides et al. (1998) and Bernard and Jensen (2004).

The primary objective of the empirical analysis is to assess whether the geographical concentration of exporters in the same industry generates non-market interactions on individual export decisions. Are the correlations between individual and group behavior shown in figures B.4 and B.5 evidence of this hypothesis? Not necessarily. An appropriate test of this hypothesis has to meet three basic challenges.

First, it must disentangle persistence in export decisions due to state dependence (export status) from persistence due to unobserved heterogeneity in firm characteristics.[12] The analysis in section 2 implies that entry costs generate state dependence. The econometric analysis thus needs to isolate this source of persistence as a prior condition to evaluating the relevance of export spillovers on entry costs.

A second task is to isolate an exogenous source of variation in group export propensity (and,

[10] This follows because $\frac{\partial y_{igt}}{\partial Y_{(-i)gt}} = \beta_y + \lambda_y y_{igt-1}$ in equation 4.

[11] The p-value for this hypothesis is 0.1541.

[12] In a series of papers, Heckman (1978, 1981b, 1981a) discusses these two sources of serial persistence.

in general, in group composition). Although export spillovers within provinces would generate feedback loops in export decisions that stimulate the agglomeration of exporters such as in figures B.4 and B.5, other alternative mechanisms could be at work. A most natural alternative is to imagine that some provinces provide firms with institutional and economic environments that are more conducive to exporting than others. This could be driving the agglomeration of firms described in table 2. In this story, the geographical characteristics of provinces and the quality of both local public goods and provincial governments are likely to play key roles. Alternatively, the co-movement of export decisions could be simply reflecting firms adjusting to changes in fundamentals across industries, such as export prices or transport costs. These issues are discussed in detail in section 5.2.

Conditional on the previous two, a final task of the empirical analysis is to identify the source of non-market interactions. The concentration of exporters may still be driven by non-market interactions, but of a different kind than suggested in the export spillovers literature. Exporter agglomeration may be related to features of group composition other than export propensity. Instead of learning from other exporters, a firm considering entry could plausibly learn from the R&D investment of firms in the same group (perhaps, by learning new ways to upgrade its products, making them more appealing to foreign consumers). Another plausible alternative is for firms to become more productive (and, as a result, more prone to exporting) by tapping into a stock of innovations that have already been made by past innovators belonging to a given group, catching up to a group-specific *technological frontier*. There is no reason to rule out these possibilities a priori and, as suggested in the introduction, sorting out which features of group composition generate interactions on individual behavior is likely to have policy implications.

As a summary of this section, stripped to its basics, the correlations shown in figures B.4 and

B.5 could be driven by (Manski (2000)):

a) Endogenous interactions, wherein the export propensity of a firm varies with the export propensity at the group level -the export spillovers hypothesis.

b) Exogenous interactions, wherein the export propensity of a firm varies with other exogenous characteristics of group composition.

c) Correlated effects, wherein firms in the same group tend to behave similarly because the have similar individual characteristics or face similar institutional environments (including market fundamentals).

Notice that while endogenous and exogenous effects represent genuine non-market interactions between firms of the same group, correlated effects operate entirely at the individual level and, therefore, should not be regarded as any form of interaction.

5 Econometric Analysis

In this section, I start by presenting the econometric framework for analyzing export decisions at the firm level. I then turn to a discussion of the identification of non-market interactions that leads to the empirical strategy used in this paper.

5.1 A Linear Specification

As a first step in setting up the econometric model, I follow Bernard and Jensen (2004) and Bernard and Jensen (2004) and express y_t^* in equation 2 as a reduced linear form of observable firm and group-specific (including group composition) characteristics and unobservable idiosyncratic firm effects. Furthermore, as shown in section 2, if non-market interactions influence entry costs λ_{gt}, its effect on individual entry decisions is contingent on the export status of a firm. Therefore, I allow

λ_{gt} to depend linearly on group composition. As a result, the firm's export decision in equation 1 can be expressed as

$$y_{igt} = 1[\lambda_{gt} y_{igt-1} + z_{igt}{}^T \eta + S_{gt}{}^T \beta + x_{gt}{}^T \gamma + \delta_t + u_{igt}] \geq 0 \tag{5}$$

for $t = 1, ..., T$, where

$$\lambda_{gt}(S_{gt}) = \lambda_0 + S_{gt}{}^T \lambda_1 \tag{6}$$

As in previous sections, reference groups $g \in G$ are defined by product similarity and geographical proximity. Therefore, $G \equiv \{(industry, location)\}$, where *industry* is defined by 3-digit industries of the ISIC classification and *location* is defined by Argentine provinces. Since the Innovation Surveys provide data on export decisions for 1992, 1996, 1998 and 2001, then $T = 3$ for the model in equation 5.

Using the notation in section 2, y_{igt} is the export decision of firm i, in group $g \in G$ and period t; (z_{igt}, u_{igt}) are firm-specific attributes that directly affect y_{igt}; x_{gt} are attributes characterizing group g in period t; δ_t controls for aggregate time effects; S_{gt} describes the composition of the set of firms in group g during period t. In particular, as mentioned in the previous section, non-market interactions arising from group composition S_{gt} can comprise both endogenous and exogenous effects. While endogenous effects are generated by the export decisions of firms belonging to group g, exogenous effects are generated by the predetermined characteristics z_{igt} of these firms. In order to capture these features of group composition explicitly, I define[13]

$$S_{gt} \equiv [E(y_{gt}|g), E(z_{gt}|g)]^T$$

[13] The use of expected average choice rather than the realized average choice is made for analytical convenience. As noted in Blume and Durlauf (2006), the assumption makes most sense for larger groups where the behaviors of the rest of group are not directly observable. The assumption that individuals react to expected rather than actual behaviors is not critical for the identification analysis I describe below.

Also, let $\beta \equiv [\beta_y, \beta_z]^T$ and $\lambda_1 \equiv [\lambda_y, \lambda_z]^T$ be the coefficients of $[E(y_{gt}|g), E(z_{gt}|g)]$ in equations 5 and 6, respectively.

The unobserved term, u_{igt}, is assumed to have the following structure:

$$u_{igt} = \alpha_i + \varepsilon_{igt} \quad (7)$$

where α_i captures time invariant unobserved characteristics of the firm, including geographical location and industry effects (since these two characteristics are time invariant in the data set used in this paper). Geographical effects that could influence export decisions include the institutional environment and accessibility to major markets. Industry effects include factor endowments and other time-invariant determinants of comparative advantage. ε_{igt} is an error term that I'll describe in detail below.

In this setup, $\lambda_y \neq 0$ implies that exporter concentration in group g affects entry costs for firms with no prior export experience, thus generating entry cost spillovers. If $\beta_y \neq 0$, exporter concentration affects export decisions independently of export status; in light of equation 1, this is interpreted as a spillover on productivity. Both λ_y and β_y thus capture endogenous interactions. λ_z and β_z have similar interpretations, but they measure the effect of exogenous interactions on export decisions. If $\gamma \neq 0$ in equation 5, the model expresses correlated effects: firms in group g tend to behave similarly because they face similar institutional environments and market fundamentals.[14]

The specification of $(z_{igt}, x_{gt}, S_{gt})$ for the empirical analysis of manufacturing firms in Argentina is the following:

z_{igt} includes: firm size (log of total number of employees), output per worker (log of total sales of goods produced by the firm per employee), foreign ownership dummy (equal to 1 if the majority

[14] Actually, γ captures correlated effects arising from group characteristics that change over time. Time-invariant correlated effects are, in turn, captured by α_i.

of the firm's shares are held by non-Argentine residents), skilled labor (proportion of employees with completed college or higher education) and R&D intensity (share of R&D expenditures in total sales).

x_{gt} includes industry and location time-varying controls. Industry controls: producer price index in ISIC industry, export price index in ISIC industry, total exports in ISIC industry. Location controls: province population, share of public employees in province population and provincial government's per capita expenditure in education, health and infrastructure services.[15]

Regarding group composition, $E(y_{gt}|g)$ and $E(z_{gt}|g)$ are estimated non-parametrically using sample data by

$$Y_{(-i)gt} \equiv (\textstyle\sum_{j\in g, j\neq i} y_{jgt})/(N_g - 1) \quad \text{and} \quad Z_{(-i)gt} \equiv (\textstyle\sum_{j\in g, j\neq i} z_{jgt})/(N_g - 1) \tag{8}$$

respectively, where N_g is the number of firms in g.[16] Excluding firm i's decision (y_{igt}) or characteristic (z_{igt}) does not affect the consistency of $Y_{(-i)gt}$ or $Z_{(-i)gt}$ and avoids a mechanic positive correlation between individual and group outcomes.

Equations 5 through 7 define a dynamic binary choice decision model with unobserved heterogeneity that characterizes export decisions in the presence of entry costs and non-market interactions. There are several potential estimation strategies for this type of models. A first decision is whether to use a linear or non-linear estimation framework to model export decisions. Linear probability models are robust to arbitrary correlation between the unobserved heterogeneity α_i and the regressors, and can be used to eliminate the incidental parameters associated with the unobserved heterogeneity in fixed effects probit models. Random effects probit models, which parameterize the distributions of α_i and ε_{igt}, rely more strongly on the functional form assumptions made, are

[15] See section A for details on data sources.
[16] $Y_{(-i)gt} \equiv 0$ and $Z_{(-i)gt} \equiv 0$ if $N_g = 1$

computationally more demanding and require dealing with the problem of specifying the initial conditions of the dynamic process.[17] For these reasons, the estimation approach in this paper is to use a linear probability model.[18]

Substituting equations 6 and 7 into a linear probability model specification of equation 5 yields the estimating equation for the econometric analysis of this paper:

$$y_{igt} = \lambda_0 y_{igt-1} + y_{igt-1}[E(y_{gt}|g)\ E(z_{gt}|g)]^T \lambda_1 + z_{igt}{}^T \eta + [E(y_{gt}|g)\ E(z_{gt}|g)]^T \beta + x_{gt}{}^T \gamma + \alpha_i + \delta_t + \varepsilon_{igt} \tag{9}$$

It will be useful to write this equation in a compact way. Letting $\psi \equiv (\lambda_0, \lambda_1, \eta, \beta, \gamma)^T$ and W_{igt} denote the vector of explanatory variables,

$$W_{igt} \equiv (y_{igt-1}, y_{igt-1}E(y_{gt}|g), y_{igt-1}E(z_{gt}|g), z_{igt}, E(y_{gt}|g), E(z_{gt}|g), x_{gt}, \delta_t)$$

equation 9 can be reformulated as

$$y_{igt} = W_{igt}{}^T \psi + \alpha_i + \varepsilon_{igt} \tag{10}$$

5.2 Identification

Next, I study the identification of non-market interactions in equation 9. Although most of the discussion is centered on dealing with the endogeneity of export status and group composition, it is essential to begin with a comment on what the causal effect of interest is. An important point to acknowledge is that, in general, group composition may influence individual export decisions *directly* through non-market interactions such as learning or imitation processes, or *indirectly* through its

[17] Hyslop (1999) provides an overview of linear and non-linear models and an application of these approaches to the analysis of labor participation decisions of married women.
[18] Bernard and Jensen (2004) also rely on linear probability models in their econometric analysis.

effect on market prices in the general equilibrium. While the direct channel is emphasized in the spillovers and social interactions literatures, Melitz (2003) provides an example of the indirect channel by showing how average firm productivity within industry determine aggregate price and income indices that, in turn, affect entry into export markets in the general equilibrium.[19] Since the objective of this paper is to learn whether group composition generates non-market interactions that influence individual export decisions, the focus is to isolate the effect of the direct channel. Therefore, even if the variation in group composition were completely exogenous in my sample it would be necessary to control for market prices as a necessary step in interpreting the correlation between export decisions and group composition as evidence of non-market interactions. This motivates the inclusion of domestic and export prices and aggregate expenditure at the industry level controls in vector x_{gt} in the empirical analysis (see page 21).

The causes of the endogeneity of group composition in equation 9 can be grouped into two broad categories (see Moffitt, 2001):[20]

(i) the simultaneity problem

(ii) the correlated unobservables problem

The simultaneity problem complicates the identification of non-market interactions because group composition is itself determined by the behavior of group members. Hence, data on outcomes do not necessarily reveal whether group behavior actually affects individual behavior, or group behavior is simply the aggregation of individual behavior. This problem was formally analyzed in Manski (1993), and has since been also known as the 'reflection problem'. To illustrate Manski's argument, consider a version of equation 9 where, for the sake of the argument, there are no

[19] See Melitz (2003, p. 1700).

[20] Actually, Moffitt (2001) adds a third category, the endogenous group membership problem, which arises from the self-selection of firms into groups due to factors that are also correlated with the dependent variable. However, endogenous membership can be considered as a particular case of the correlated unobservables problem -see Moffitt (2001, p. 65).

spillovers on entry costs; i.e. $\lambda_1 = 0$,

$$y_{igt} = \lambda_0 y_{igt-1} + {z_{igt}}^T \eta + \beta_y E(y_{gt}|g) + E(z_{gt}|g)^T \beta_z + {x_{gt}}^T \gamma + \alpha_i + \delta_t + \varepsilon_{igt} \tag{11}$$

Assume, for the moment, that 11 represents a structural equation for y_{igt}, so that

$$E[\varepsilon_{igt}|y_{igt-1}, z_{igt}, x_{gt}, \alpha_i, g] = 0$$

It follows that, for a given $g \in G$, the mean regression of y_{igt} on $(y_{igt-1}, z_{igt}, x_{igt}, \alpha_i)$ has the linear form

$$E(y_{igt}|y_{igt-1}, z_{igt}, x_{gt}, \alpha_i, g) = \lambda_0 y_{igt-1} + {z_{igt}}^T \eta + \beta_y E(y_{gt}|g) + E(z_{gt}|g)^T \beta_z + {x_{gt}}^T \gamma + \alpha_i + \delta_t$$

Integrating this expression with respect to $(y_{igt-1}, z_{igt}, x_{gt})$ reveals that $E(y_{igt}|g)$ solves the following equilibrium equation in every period $t = 1, ..., T$

$$E(y_{gt}|g) = \lambda_0 E(y_{gt-1}|g) + \beta_y E(y_{gt}|g) + E(z_{gt}|g)^T (\beta_z + \eta) + {x_{gt}}^T \gamma + E(\alpha|g) + \delta_t$$

Therefore, assuming $\beta_y \neq 1$,

$$E(y_{gt}|g) = \frac{\lambda_0}{(1-\beta_y)} E(y_{gt-1}|g) + E(z_{gt}|g)^T \frac{(\beta_z + \eta)}{1-\beta_y} + {x_{gt}}^T \frac{\gamma}{1-\beta_y} + \frac{E(\alpha|g)}{1-\beta_y} + \frac{\delta_t}{1-\beta_y}$$

Therefore, $E(y_{gt}|g)$ is a linear function of $[E(y_{gt-1}|g), E(z_{gt}|g), x_{gt}, d_t, d_g]$, where dt and d_g denote time-varying and group-specific intercepts. Identification of non-market interactions in equation 11 is not possible if either $\lambda_0 = 0$ or $E(y_{gt-1}|g)$ is included as an additional explanatory variable, since in these cases $E(y_{gt}|g)$ becomes perfectly collinear to the rest of the explanatory variables in equation 11. When $\lambda_0 = 0$, the model becomes a static linear case similar to that analyzed in Manski (1993).[21]

The last observation suggests that the existence of dynamic effects, in this case arising from the presence of entry costs, may help to mitigate the simultaneity problem. However, this will be true as long as $E(y_{gt-1}|g)$ is (correctly) excluded from equation 11. Intuitively, if excluded, $E(y_{gt-1}|g)$ acts as an instrument for $E(y_{gt}|g)$ breaking the reflection in the same way as exclusion restrictions are used to solve standard simultaneous equations in econometrics. This idea is formalized in the next section. Briefly, the identifying restriction is that individual export decisions are not *directly* influenced by $E(y_{gt-1}|g)$; that is, y_{igt-1} does not generate non-market interactions in period t once $E(y_{gt}|g)$ has been controlled for.[22] The assumption becomes more plausible if the value of non-market interactions depreciates rapidly over time. This appears to be a reasonable approximation to the case I study in this paper, considering that the average time gap between the available data points (1992, 1996, 1998 and 2001) is 3 years and the fact that, during the 1990s, manufacturing firms in Argentina were in the midst of a radical process of structural change and adjustment to increased competition stemming from trade liberalization and a reduction of government intervention in the economy.

In turn, the problem of correlated unobservables arises if there is some individual or group-specific component of the error term ε_{igt} that is correlated with the explanatory variables in equation 9. Thus, it is equivalent to a standard omitted variable problem in econometrics. The unobservables may arise from unobserved product attributes or managerial ability at the firm level or may represent group effects. As mentioned in section 3, some provinces are likely to provide firms with

[21] Manski (1993) considers the case with no unobserved heterogeneity; i.e. $\alpha_i = 0$.

[22] As noted by Moffitt (2001), this example shows that there might be a larger class of exclusion restrictions consisting of characteristics of firms that can be argued on some basis to not have a direct influence on others.

institutional and economic environments that are more conducive to exporting than others. Alternatively, the co-movement of export decisions could simply reflect firms adjusting to changes in fundamentals across industries, such as export prices or transport costs, or other idiosyncratic shocks to comparative advantage. In these cases, unobservable determinants of the export decision are also correlated with z_{igt}, $E(y_{gt}|g)$ or $E(z_{gt}|g)$.

The empirical strategy for dealing with correlated unobservables in this paper is the following. First, I will use an estimator that allows for arbitrary correlation between time-invariant unobservables (α_i) and the explanatory variables. This feature covers some important cases mentioned above such as geographic and, to the extent they remain roughly constant over time, industry effects and managerial ability. Second, I will control for several sources of time-varying correlated unobservables, including local government performance and demand shocks at the industry level (see details in page 5.1). Finally, in order to deal with any residual correlation in the error term ε_{igt}, I will use an instrumental variables strategy similar to the one outlined in the context of the simultaneity problem. Next, I turn to describing this approach.

5.3 Estimation Framework

Consistent estimation of the parameters in equation 9 requires dealing with the presence of a lagged dependent variable (export status) as a regressor and, as analyzed previously, with the endogeneity of group composition.

It is well known that OLS and standard panel data estimators yield inconsistent estimates in the presence of a lagged dependent variable and unobserved heterogeneity -see Cameron and Trivedi (2005, p. 764). The consistency of OLS estimators depends on the assumption that firm heterogeneity α_i is uncorrelated with the regressors in W_{igt}. This assumption is violated by equation 9, due to the presence of export status y_{igt-1} as an explanatory variable. Thus, a first step in obtaining consistent estimates is to eliminate α_i. The 'within' panel data (or fixed-effects) estimator transforms equation 9 to express the original observations as deviations from their firm-specific means. OLS is then used on the transformed equation. Consistent estimation requires the right-hand side variables of equation 9 to be strictly exogenous.[23] That is, strict exogeneity requires $E(\varepsilon_{igt}|W_{ig1},...,W_{igT},\alpha_i) = 0$. This implies $E(W_{igs}.\varepsilon_{igt}) = 0$ for $s,t = 1,...,T$ and $g \in G$, an assumption that is violated in equation 10 since $y_{igt} \in W_{igt+1}$.

In general, strict exogeneity rules out feedback effects from the dependent variable y_{igt} to future values of W_{igt}. In the context of this paper, this is not only incompatible with the existence of entry costs in export markets, but it also rules out other phenomena of interest such learning by exporting, which involves the effect of exporting activity on future firm productivity.[24] In other words, in the presence of either entry costs or learning by exporting effects, the fixed-effects estimator is inconsistent.

An alternative GMM-based approach can be applied by first removing unobserved firm heterogeneity α_i and then searching for instrumental variables. I start by relaxing strict exogeneity and introducing a set of *sequential moment conditions*

$$E(\varepsilon_{igt}|W_{igt},W_{igt-1},...,W_{ig1},\alpha_i) = 0, \text{ for } t = 1,...,T \tag{12}$$

That is, the explanatory variables in equation 10 are sequentially exogenous in the sense of being uncorrelated with current and future values of ε_{igt}. However, no restriction is imposed on their correlation with past values of ε_{igt}. Below, I explain how to treat endogenous regressors, such as

[23] The random effects estimator also requires strict exogeneity in order to achieve consistency. These results are shown in Wooldridge (2002, chapter 10).

[24] The empirical relevance of learning by exporting is far from being settled. Clerides et al (1998), Bernard and Bradford Jensen (1999), Isgut (2001) and Delgado et al. (2002) are firm level studies that do not find evidence of learning by exporting. An exception is Van Biesebroeck (2005), who finds that past export experience has a causal effect on the performance in a panel of sub-Saharan African firms.

group composition, that are likely to be contemporaneously correlated with ε_{igt}.

Given the model in equation 10, assumption 12 is equivalent to

$$E(y_{igt}|W_{igt}, W_{igt-1}, ..., W_{ig1}, \alpha_i) = E(y_{igt}|W_{igt}, \alpha_i) = {W_{igt}}^T \psi + \alpha_i, \text{ for } t = 1, ..., T \tag{13}$$

The first equality makes it clear what sequential exogeneity implies about the explanatory variables: after W_{igt} and α_i have been controlled for, no past values of W_{igt} affect the expected value of y_{igt}. In other words, under sequential exogeneity, the model in equation 10 is assumed to be *dynamically complete* conditional on α_i. It means that one lag of y_{igt} is sufficient to capture the dynamics in the conditional expectation of export decisions; neither further lags of y_{igt} nor lags of other components of W_{igt} are important once W_{igt} and α_i have been controlled for. The second equality is an implication of equation 10.

First differencing equation 10 to remove unobserved firm heterogeneity α_i gives

$$\Delta y_{igt} = \Delta {W_{igt}}^T \psi + \Delta \varepsilon_{igt} \tag{14}$$

Note that ΔW_{igt} is necessarily endogenous in this equation since, in any period t, $\Delta y_{igt-1} = y_{igt-1} - y_{igt-2} \in \Delta W_{igt}$ is correlated with $\Delta \varepsilon_{igt} = \varepsilon_{igt} - \varepsilon_{igt-1}$. Group composition is also likely to be endogenous for the reasons given in the previous section. Next, note that sequential exogeneity implies

$$E(W_{igs} \varepsilon_{igt}) = 0, \text{ for } s = 1, ..., t$$

and $t = 1, ..., T$. Therefore,

$$E(W_{igs} \Delta \varepsilon_{igt}) = 0, \text{ for } s = 1, ..., t-1 \tag{15}$$

This implies that, in period t, W^0_{igt-1} can be used as potential instruments for ΔW_{igt} in equation 14, where

$$W^0_{igt} \equiv (W_{ig0}, W_{ig1}, ..., W_{igt})$$

The moment conditions in equation 15 form the basis of the Arellano and Bond (1991) GMM 'difference estimator' for dynamic panel data, that uses lagged levels of the explanatory variables W^0_{igt-1} as instruments in the estimation of equation 14. A convenient feature of this framework is that it can easily accommodate for endogenous regressors. If some component of W_{igt}, such as group composition, is presumed to be correlated with unobservables influencing export decisions in period t, then W^0_{igt-2} can be used in place of W^0_{igt-1} as an instrument for W_{igt}.

The difference estimator has the statistical shortcoming that if the regressors in equation 9 are persistent, then lagged levels of W_{igt} are weak instruments, that is, they are not highly correlated with the regressors, and so the estimated coefficients may be biased. This problem is particularly serious the shorter the length of the panel is (that is, the smaller T is), see Baltagi (2005). To overcome these problems, Arellano and Bover (1995) and Blundell and Bond (1998) developed a 'systems estimator' that combines the differenced model in 14 with the levels model in equation 10. In order to be able to use lagged differences of the variables on the right-hand side of equation 14 as valid instruments for the regression in levels, the following identifying assumptions are introduced:

$$E(\Delta W_{igt}\alpha_i) = 0 \tag{16}$$

which imply that there is no correlation between the differences of the regressors and the country-specific effect; in other words, the firm-specific effect and the regressors are still allowed to be arbitrarily correlated, but this correlation should be constant over time. Given 16, the following moment conditions can be added to those specified above in equation 15[25]:

$$E(\Delta W_{igt}\varepsilon_{igt}) = 0 \tag{17}$$

Endogenous regressors can be treated in a similar way as in the difference estimator, by using ΔW_{igt-1} as an instrument for W_{igt}.

In a nutshell, where Arellano and Bond (1991) instrument differences with levels, Blundell and Bond (1998) suggest instrumenting levels with differences. The Blundell-Bond estimator stacks the data for the levels and the difference equations (numbers 10 and 14, respectively) and estimates them simultaneously in a GMM framework using the moment conditions in 15 and 17. Further details can be found in Roodman and Floor (2006).

6 Estimation Results

Table *5* reports the estimation results of different specifications of equation 9, using Blundell and Bond's (1998) GMM system estimator for dynamic panel data.[26] Every specification uses instruments for export status and group composition as explained above, two-period and deeper level lags in the difference equation and one-period and deeper difference lags in the levels equation. Although not reported, all estimations include time dummies, export prices, and total industry exports. Industries are defined at the 3-digit ISIC level, but the results are qualitatively robust to changes in the level of aggregation.

The first two columns present an endogenous interactions model that borrows two distinctive features from usual specifications found in the spillovers literature. First, I assume that the impact

[25] Using 7 and 16, we have $E(\Delta W_{igt}u_{igt}) = E(\Delta W_{igt}(\alpha_i + \varepsilon_{igt})) = E(\Delta W_{igt}\varepsilon_{igt}) = 0$

[26] All estimations were implemented in Stata 9.0, using the program 'xtabond2'. A detailed description of this command can be found in Roodman (2006).

of average export intensity at the group level is the same for every firm belonging to a given group -i.e. it is not contingent on export status. However, I do control for export status -as in Clerides et al. (1998) and Bernard and Jensen (2004). Second, I do not consider the influence of other features of group composition (exogenous interactions). In terms of the notation in equation 9, I assume $\lambda_1 \equiv [\lambda_y, \lambda_z]^T = [0, 0]^T$ and $\beta \equiv [\beta_y, \beta_z]^T = [\beta_y, 0]^T$.

As in Clerides et al. (1998) and Bernard and Jensen (2004), the evidence on export spillovers is very weak. In column (1), the effect of export intensity on individual export decisions, β_y, is statistically insignificant. In line with the empirical literature that has analyzed the determinants of exporting at the micro level, export status and heterogeneity in firm characteristics (output per worker, firm size and R&D investment) are highly significant. In particular, the significance of export status provides evidence of the importance of entry costs in export markets.[27] Column (2) repeats this specification, but instrumenting for firm-level characteristics. The results are qualitatively invariant to this modification -except in the case of R&D investment.

Columns (3), (4) and (5) explore the consequences of introducing the interaction between export status and exporter concentration at the group level to allow for a contingent effect of the latter on export decisions. For the moment, I still rule out exogenous interactions (that is, $[\lambda_z, \beta_z]^T = [0, 0]^T$ is maintained) and focus on the vector of endogenous interactions $[\lambda_y, \beta_y]$. These specifications differ in terms of the inclusion of both location controls (see page 21) and IVs for firm-level controls.

The results show that the coefficient of the interaction λ_y is negative and becomes significant at the 5% level when location controls and IVs for firm-level controls are included. This implies that the influence of export status declines in groups where the proportion of exporters is larger. In the context of the model of section 2, this is equivalent to stating that a higher export propensity at

[27] Actually, the magnitude of the estimated coefficient for export status in these specifications is very similar to the point estimate in Bernard and Jensen (2004, table 5, page 567).

the group level reduces entry costs into export markets. The fact that β_y is insignificant in all three specifications actually means that the proportion of exporters at the group level does not affect the export decisions of firms with export experience in period $t-1$. These results provide evidence supporting endogenous spillovers on entry costs and against endogenous spillovers on productivity.

With respect to the influence of firm characteristics, the results in columns (3) to (5) show that export status, output per worker and firm size remain significant determinants of export decisions. The binary indicator for foreign firms becomes highly significant in (4) and (5).

In column (6), I allow for general group composition effects by allowing every individual characteristic of a firm to potentially generate exogenous interactions on the export decisions of other firms in the same group. These group variables are denoted with a subscript g in table *5* to distinguish them from firm-level controls. For example, $Size_g$ is the within-group average firm size. As in (3) to (5), the impact of group composition is allowed to be contingent on export status.

The results change considerably when exogenous interactions are explicitly introduced in the analysis. Endogenous interactions from other exporters are no longer significant. Spillovers on entry costs are now driven by both average firm size and the share of foreign firms at the group level. Interestingly, there's no evidence of spillovers on productivity, which were also absent in previous specifications. Therefore, the impact of group composition is channeled through entry costs rather than productivity. Note that the estimated coefficients of average firm size and the share of foreign firms have opposite signs. A negative sign in the coefficient of the interaction with export status λ_z implies that larger average firm size generates positive spillovers on entry costs. On the other hand, a higher proportion of foreign firms at the group level generates negative spillovers on entry costs.

The first two columns in table *6* show that the results derived from the last specification in table *5* are largely robust to the level of industry aggregation -in columns (1) and (2) industries are defined at 2 and 4 digits of the ISIC classification, respectively. So, why do export spillovers vanish when other features of group composition are controlled for? Columns (3) to (6) in table *6* examine the sensitivity of endogenous interactions to the inclusion of average firm size and the share of foreign firms at the group level. Columns (3) and (4) show that if average firm size ($Size_g$) is excluded, endogenous spillovers reappear. This does not occur if only the share of foreign firms in the group is excluded -columns (5) and (6). Therefore, the positive effect of exporter concentration present in columns (4) and (5) of table *5* was actually driven by average firm size at the group level.

As mentioned in the introduction, average firm size at the group level can be viewed as a proxy for a stock of past innovations or technological frontier,[28] a group-specific public good that firms can access to upgrade their products. In this interpretation, it becomes interesting to evaluate whether the intensity of the exogenous interactions generated by average firm size on export decisions increases in smaller firms. This hypothesis is reminiscent of Gerschenkron's (1965) 'advantage of backwardness'. In the present context, the advantage for a smaller firm could arise from the fact that implementing innovations allows it to make larger quality improvements the further it has fallen behind the frontier.[29] The thought experiment is the following: we would like to evaluate the effect of shifting the group's technological frontier while holding the size of the firm constant; that is, to evaluate an increase in the firm's 'distance to the frontier'. Furthermore, we'd like to assess whether this effect is stronger in smaller firms. To implement this test, I augment specification (6) in table *5* by allowing the effect of average firm size to depend on the individual size of a firm. This requires a triple interaction between export status, $Size_g$ and *Size*. An additional interaction between *Size* and export status is also included to allow entry costs to vary with firm size. The last

[28] After all, firm size can be naturally viewed as a measure of a firm's past success.

[29] Aghion and Howitt (2006) applly Gerschenkron's analysis to study the role of technological spillovers in explaining growth rates across countries.

column of table *6* presents the estimation results. Smaller firms face higher entry costs (significant at 5%) and the positive estimated coefficient of the interaction between export status, *Size_ G* and *Size* suggests that the exogenous interactions on entry costs are weaker for larger firms. This result provides support for the advantage of backwardness hypothesis at the 10% level.

Overall, the picture that emerges from tables 5 and 6 is that group composition plays an important role in the determination of individual export decisions, beyond the effect of the firm level determinants that have been usually emphasized in the micro literature (past export experience and firm heterogeneity). Group composition generates non-market interactions that influence individual export decisions. As suggested by the export spillovers literature, most of this effect is channeled through its influence on entry costs and is, therefore, contingent on export status. However, group composition effects are not driven by the average export propensity at the group level, but by average firm size and the share of foreign firms.

7 Conclusions

This paper examined the role of group composition in shaping export decisions at the firm level. Particular attention was given to the hypothesis that exporters belonging to the same group reduce entry costs for other firms considering entry. Theory indicates that the influence of group composition on entry costs changes the degree of state dependence of individual export decisions.

A proper empirical evaluation of this implication required disentangling the effect of state dependence from other sources of persistence in export decisions and obtaining a source of exogenous variation in group composition. I used a dynamic panel data approach that relies on sequential moment conditions to achieve identification. It would be interesting to search for other identification strategies in order to provide more robust evidence on the findings. Nevertheless, the methodological contribution of the paper is independent of the effectiveness of the identification strategy used.

The results show that group composition influences individual export decisions and that most of this effect is channeled through entry costs. This holds after controlling for the key determinants of export participation emphasized in recent research, past export experience and firm heterogeneity. Interestingly, these non-market interactions are not driven by export spillovers, but by other features of group composition, namely average firm size and the share of foreign firms at the group level. I have provided a tentative interpretation for the effect of average firm size as a proxy for a group-specific technological frontier, in which non-market interactions generate a "backwardness advantage" that, ceteris paribus, increases the likelihood of exporting in smaller firms. In this story, firms become more productive (and, as a result, more prone to exporting) by tapping into the stock of innovations that have already been made by past innovators belonging to the same group. The results show that once this effect is controlled for, spillovers arising from exporters to other firms considering entry become statistically insignificant. Of course, nothing in this interpretation rules out a mechanism where spillovers from exporters could still impact export decisions by generating a shift in the group-specific technological frontier which, in my argument, was taken to be exogenously determined. These issues are beyond the scope of this paper and are left to future research.

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A Appendix - Data sources

The data set used in the empirical analysis comes from a variety of sources. The firm-level data is comprised of manufacturing firms in Argentina, sampled in two Innovation Surveys carried out by I.N.D.E.C. (Argentina's National Statistical Agency). The first survey provides information for 1639 firms in 1992 and 1996, while the second survey collected information for 1688 firms in 1998 and 2001 (Bisang and Lugones 1998, 2003). These samples were randomly drawn from the National Economic Census of 1993 and from the Input–Output Matrix survey of 1997, respectively. The surveys provide information on sales of goods produced in the firm, educational attainment of employees, investments in innovation activities (including R&D) and ownership for the years 1992, 1996, 1998, 2001. There is also information on the geographical location (i.e. Argentine provinces) and the industry to which firms belong (at a 4-digit ISIC level).

I also use geographical data to account for differences in the institutional and economic environment in which firms carry out their activities and interact with each other. The data was collected by the Ministry of Economy and Production of Argentina, it is publicly available through the internet and includes population levels and several indicators of overall performance of the provincial economy and local government (see page 21).[30]

Finally, I constructed series of export prices for 4-digit ISIC industries using the NBER-U.N. Trade Data compiled by Robert C. Feenstra.[31] Since the latter was coded according to the SITC classification, the task also required matching SITC to ISIC industries. This was done with the help of a concordance provided by the O.E.C.D., available at Jon D. Haveman's website.[32] Following Schott (2004), the unit value of an SITC product was computed by dividing import value by import quantity.[33]

Before moving on to the description of the data, it is important to point out that the empirical analysis in this paper is restricted to the subset of firms that were sampled in both surveys, 827 firms. The reason is that the estimation of a dynamic model of export decisions that accounts for unobserved firm heterogeneity requires the availability of at least three data points (see section 5), while each survey provides only two. As described above, the importance of previous export experience and firm heterogeneity as determinants of entry in export markets is well documented in the recent empirical literature.

However, restricting the analysis to a balanced panel may raise concerns of potential inferential biases due to ignoring both the attrition of firms from the First Survey and the appearance of a set of firms in the Second Survey that were not previously surveyed.[34] This trade-off is attenuated in this study due to the fact that, by design, the set of firms sampled in each survey were randomly drawn from two different sources (as mentioned above), a situation which resembles that of rotating

[30] http://www.mecon.gov.ar/hacienda/dncfp/index.html

[31] The data is available at http://cid.econ.ucdavis.edu/

[32] http://www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources/TradeConcordances.html

[33] For some years and products there are multiple country observations of value and quantity. In those cases, I follow Schott (2004) in defining the unit value to be a value-weighted average of the observations. Availability of unit values ranges from 77 percent of product-country observations in 1972 to 84 percent of observations in 1994.

[34] This issue appears to have received little attention in recent research. Clerides et al (1998) and Bernard and Jensen (2004) apply estimation methods that are similar to this paper, but using longer panels than in this study. However, both papers restrict their analyses to the set of firms sampled in every year, ignoring potential selection bias.

panels. As shown in see Wooldridge (2002, p. 569), in rotating panels where the decision to rotate units out of the panel is made randomly, the identifying conditions required for obtaining consistent panel data estimators are the same regardless of whether the selected or a full (unrestricted) sample are used in the estimation. Additionally, the empirical analysis in this paper is robust to systematic selection based on time-invariant and other observable characteristics of firms.

	Non-exporters	Exporters
Sales (thousands of pesos)	10652	56221
	26093	157565
Labor	109	377
	204	650
Investment K (thousands of pesos)	428	3501
	2182	34637
Skilled labor (share)	0.043	0.075
	0.077	0.088
Foreign Ownership (dummy)	0.052	0.293
	0.222	0.455
R&D (thousands of pesos)	17.30	133.44
	118.27	1069.63
Observations	1565	1771

Pooled data for 1992, 1996, 1998, 2001

Table 1: Descriptive statistics - Mean and S.D. (in italics)

Geographical distribution of firms and exporters - Pooled data

Province	Population in 2001	Firms		Exporters		
		Number	% in total	Number	% in prov	% in total
Buenos Aires	16,485,462	2,357	70.59	1,364	58	77.02
Cordoba	3,052,747	216	6.47	79	37	4.46
Santa Fe	2,975,970	291	8.72	143	49	8.07
Mendoza	1,573,671	70	2.10	43	61	2.43
Tucuman	1,331,923	47	1.41	13	28	0.73
Entre Rios	1,152,090	31	0.93	13	42	0.73
Salta	1,065,291	24	0.72	5	21	0.28
Chaco	978,956	8	0.24	4	50	0.23
Misiones	961,274	45	1.35	28	62	1.58
Corrientes	926,989	12	0.36	3	25	0.17
Santiago	795,661	12	0.36	0	0	0.00
San Juan	617,478	35	1.05	10	29	0.56
Rio Negro	549,204	12	0.36	2	17	0.11
Formosa	489,276	4	0.12	0	0	0.00
Neuquen	471,825	7	0.21	0	0	0.00
Chubut	408,191	29	0.87	14	48	0.79
San Luis	367,104	96	2.88	41	43	2.32
Catamarca	330,996	20	0.60	2	10	0.11
La Pampa	298,772	12	0.36	2	17	0.11
La Rioja	287,924	4	0.12	0	0	0.00
Tierra del Fuego	100,313	7	0.21	5	71	0.28
ARGENTINA	**35,221,117**	**3,339**	**100.00**	**1,771**	**53**	**100.00**

Pooled data for 1992, 1996, 1998, 2001

Table 2: Geographical distribution of firms and exporters

Fraction of 1992 plants with the same export status (%)

	Actual		Expected	
	(1)	(2)	(3)	(4)
Year	Exporters	Non-Exporters	Exporters	Non-Exporters
1996	0.97	0.69	0.97	0.69
1998	0.82	0.70	0.76	0.60
2001	0.84	0.68	0.72	0.53

Table 3: Persistence in Export Decisions

OLS estimation - Equations 3 and 4		
	(1)	(2)
Export Status (y_{igt-1})		0.747
		(0.022)**
Export Status * Exporter Concentration		-0.095
		(0.040)*
Exporter Concentration ($Y_{(-i)gt}$)	0.338	0.129
	(0.023)**	(0.032)**
Time dummies	Yes	Yes
Observations	3336	2444
R-squared	0.07	0.52

The dependent variable (y_{igt}) is a dummy that equals 1 if firm i in group g exports in period t. Robust s.e. in parentheses. * and ** indicate significance at 5% and 1%, respectively.

Table 4: Correlations between individual and group behavior

Blundell and Bond (1998) estimator - Equation 9. (continues on next page) Dependent Var: Export decision y_{igt}						
	(1)	(2)	(3)	(4)	(5)	(6)
Entry Cost Spillovers						
y_{igt-1}*$Y_{(-i)gt}$			-0.294	-0.373	-0.416	-0.064
			(0.189)	(0.201)†	(0.207)*	(0.280)
y_{igt-1}* Output/worker$_g$						-0.075
						(0.056)
y_{igt-1}* Investment K$_g$						-0.006
						(0.008)
y_{igt-1}* Skilled$_g$						2.602
						(1.810)
y_{igt-1}* R&D$_g$						-0.027
						(0.281)
y_{igt-1}* Foreign$_g$						1.130
						(0.490)*
y_{igt-1}* Size$_g$						-0.232
						(0.096)*
Productivity Spillovers						
$Y_{(-i)gt}$	-0.006	0.053	0.158	0.235	0.279	0.174
	(0.100)	(0.112)	(0.138)	(0.154)	(0.172)	(0.199)
Output/worker$_g$						0.007
						(0.006)
Investment K$_g$						-1.675
						(1.462)
Skilled$_g$						0.085
						(0.233)
R&D$_g$						-0.022
						(0.039)
Foreign$_g$						-0.415
						(0.281)
Size$_g$						0.056
						(0.065)

Blundell and Bond (1998) estimator - Equation 9. (continued) Dependent Var: Export decision y_{igt}						
	(1)	(2)	(3)	(4)	(5)	(6)
Firm-level controls						
y_{igt-1}	0.380	0.414	0.525	0.603	0.627	0.656
	(0.042)**	(0.044)**	(0.107)**	(0.114)**	(0.117)**	(0.222)**
Output/worker	0.031	0.062	0.027	0.053	0.050	0.035
	(0.015)*	(0.029)*	(0.015)†	(0.029)†	(0.030)†	(0.030)
Size	0.119	0.062	0.117	0.059	0.058	0.076
	(0.020)**	(0.026)*	(0.020)**	(0.026)*	(0.026)*	(0.027)**
Foreign	0.036	0.104	0.044	0.128	0.136	0.163
	(0.045)	(0.056)†	(0.045)	(0.056)*	(0.057)*	(0.059)**
Investment K	-0.000	0.001	-0.000	0.001	0.001	0.001
	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Skilled	0.323	0.046	0.339	0.079	0.102	0.092
	(0.203)	(0.211)	(0.205)†	(0.206)	(0.208)	(0.220)
R&D	-0.005	0.003	-0.004	0.006	0.008	0.009
	(0.002)*	(0.031)	(0.002)†	(0.032)	(0.033)	(0.030)
Observations	2440	2440	2440	2440	2440	2440
IV for firm-level controls	No	Yes	No	Yes	Yes	Yes
Location controls	No	No	No	No	Yes	Yes

Robust standard errors in parentheses, ** p<0.01, * p<0.05, † p<0.1. All regressions include firm fixed-effects, time dummies, export prices and total exports in ISIC sector. Group variables are defined by province and industry -at the 3-digit ISIC level.

Table 5: Dynamic Panel Data Estimation - Main Results

Blundell and Bond (1998) estimator - Equation 9. (continues on next page)

Dependent Var: Export decision y_{igt}

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Entry Cost Spillovers							
y_{igt-1}*Y_{gt}	-0.189	-0.045	-0.422	-0.457	0.060	0.128	0.020
	(0.279)	(0.224)	(0.255)†	(0.241)†	(0.335)	(0.305)	(0.278)
y_{igt-1}* Output / worker$_g$	-0.073	-0.094	0.037	0.029	-0.016	-0.020	-0.056
	(0.055)	(0.053)†	(0.036)	(0.035)	(0.051)	(0.050)	(0.055)
y_{igt-1}* Investment K$_g$	-0.006	0.000	-0.013	-0.014	-0.003	-0.003	-0.004
	(0.007)	(0.008)	(0.008)†	(0.007)†	(0.007)	(0.007)	(0.008)
y_{igt-1}* Skilled$_g$	4.323	1.751	3.607	3.552	4.816	4.736	2.941
	(2.409)†	(1.422)	(2.100)†	(2.003)†	(1.818)**	(1.619)**	(1.924)
y_{igt-1}* R&D$_g$	0.739	-0.016	0.090	0.034	0.172	-0.019	-0.078
	(0.518)	(0.159)	(0.336)	(0.299)	(0.331)	(0.288)	(0.285)
y_{igt-1}* Foreign$_g$	0.968	0.946	0.716	0.678			0.946
	(0.454)*	(0.394)*	(0.546)	(0.478)			(0.495)†
y_{igt-1}* Size$_g$	-0.186	-0.249			-0.163	-0.161	-0.560
	(0.093)*	(0.091)**			(0.092)†	(0.089)†	(0.222)*
y_{igt-1}* Size							-0.467
							(0.198)*
y_{igt-1}* Size$_g$ * Size							0.077
							(0.044)†
Productivity Spillovers							
Y_{gt}	0.371	0.145	0.244	0.445	0.006	0.028	0.126
	(0.184)*	(0.163)	(0.170)	(0.212)*	(0.260)	(0.230)	(0.200)
Output / worker$_g$	-0.014	0.011	-0.057	-0.099	-0.013	-0.015	-0.008
	(0.044)	(0.034)	(0.026)*	(0.034)**	(0.037)	(0.037)	(0.040)
Investment K$_g$	0.004	0.002	0.010	0.011	0.003	0.003	0.005
	(0.006)	(0.007)	(0.006)†	(0.006)†	(0.005)	(0.005)	(0.006)
Skilled$_g$	-2.770	-0.464	-2.580	-2.401	-2.888	-3.143	-2.010
	(1.758)	(1.090)	(1.537)†	(1.562)	(1.409)*	(1.352)*	(1.493)
R&D$_g$	-0.596	0.002	-0.002	0.047	-0.073	0.084	0.146
	(0.413)	(0.145)	(0.266)	(0.245)	(0.276)	(0.241)	(0.239)
Foreign$_g$	-0.309	-0.644	-0.236	-0.094		0.096	-0.393
	(0.265)	(0.235)**	(0.298)	(0.286)		(0.186)	(0.285)
Size$_g$	0.054	0.072		-0.103	0.070	0.055	0.206
	(0.069)	(0.061)		(0.058)†	(0.064)	(0.067)	(0.164)
Size$_g$ * Size							-0.034
							(0.033)

Blundell and Bond (1998) estimator - Equation 9. (continued) Dependent Var: Export decision y_{igt}							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Firm-level controls							
y_{igt-1}	0.415	0.635	0.600	0.583	0.729	0.686	2.805
	(0.318)	(0.173)**	(0.226)**	(0.226)*	(0.230)**	(0.222)**	(0.887)**
Output / worker	0.051	0.045	0.037	0.031	0.053	0.046	0.023
	(0.032)	(0.030)	(0.031)	(0.031)	(0.033)	(0.032)	(0.030)
Size	0.078	0.053	0.070	0.077	0.081	0.086	0.275
	(0.027)**	(0.029)†	(0.027)**	(0.027)**	(0.025)**	(0.025)**	(0.152)
Foreign	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Investment K	0.007	0.274	0.117	0.076	0.023	0.029	-0.009
	(0.227)	(0.216)	(0.234)	(0.237)	(0.243)	(0.248)	(0.253)
Skilled	0.185	0.256	0.154	0.157	0.165	0.145	0.204
	(0.059)**	(0.076)**	(0.062)*	(0.060)**	(0.058)**	(0.056)**	(0.062)**
R&D	-0.036	0.023	0.015	0.007	0.013	0.012	-0.012
	(0.042)	(0.030)	(0.030)	(0.030)	(0.031)	(0.030)	(0.028)
Observations	2440	2421	2440	2440	2440	2440	2440
IV for firm-level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Location controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses, ** p<0.01, * p<0.05, † p<0.1. All regressions include firm fixed effects, time, dummies, export prices and total exports in ISIC sector. Group variables are defined at the 3-digit ISIC level. In columns(1) and (2), ISIC industries are defined at 2 and 3 digits of aggregation, respectively. Columns (3) to (6) examine the sensitivity of the results column (7) of Table 5 by excluding average firm size and proportion of foreign firms at the group level. In column (7), entry time costs and spillovers are allowed to depend on firm size.

Table 6: Dynamic Panel Data Estimation - Sensitivity Analysis