Universidad de la República
Facultad de Ciencias Sociales
DEPARTAMENTO DE ECONOMIA

Documentos de trabajo

Cross industry entry. The case of a small developing economy

W. García Fontes
Ruben Tansini
Marcel Vaillant

Documento No. 04/95
Agosto, 1995

Cross industry entry

The case of a small developing economy

Walter García Fontes[*]
Ruben Tansini[**]
Marcel Vaillant[**]

Documento No. 4/95

Agosto, 1995

[*] Universitat Pompeu Fabra
[**] Universidad de la República

We gratefully acknowledge useful comments and suggestions received from participants at the Symposium "Free Trade and the Uruguayan Industry", held on April 1993 in Montevideo, Uruguay, as well as seminar participants at Universitat Pompeu Fabra and at the Central Bank in Uruguay (Jornadas Anuales de Economía del BCU, 1994). All remaining errors and omissions are our own responsibility. We thank the financial support received from ICI (Instituto de Cooperación Iberoamerica). The information used in this paper, as well as instructions about how to replicate the estimations, can be obtained through the Internet by *anonymous ftp* at puna.upf.es (130.206.64.8) in a directory called "entry".

Abstract

In an empirical model of firm entry into manufacturing industries, we identify the determinants of the speed and easiness of new firm creation and expansion. In previous empirical studies for industrialized countries it had been found that the speed of entry is very low, and that very few entrants are able to capture a significant market share from incumbent firms. In this paper we show that these results hold also for less industrialized countries. We study the case of the Uruguayan manufacturing sector, which is confronted with an increasing degree of exposure to international competition. Our results show that in this kind of economies incumbent firms raise significant barriers to entry and position themselves in such a way as to maintain their market shares.

JEL Classification Keywords: L11 (Production and Market Structure. Size Distribution of Firms), L60 (Industry Studies. Manufacturing, General).

1 Introduction

Entry and exit processes are key variables in explaining the reallocation of resources both within and across industries. Several studies on the patterns of entry and exit have analyzed the factors that facilitate or impede the mobility of resources and the processes of industrial restructuring [1].

A long–run economic equilibrium implies that entry and exit will converge to an optimal number and mix of firms for each industry. If an industry is in a long–term equilibrium there is no scope for excess profits. Therefore, excess profits attract new entry, while the reaction of incumbents adopting strategies to deter or block entry causes the exit of some firms due to insufficient profitability.

While this is a fairly well studied issue for industrialized countries, there has been very little research on the processes of entry and exit in developing countries. The increased degree of economic openness that face developing economies is likely to imply a process of dynamic restructuring of domestic industries, as they face entry and competition from foreign rivals. The economic environment, particularly the degree of international exposure of the economy and the expectations about economic integration, is likely to have an effect on the reaction of incumbent firms, as well as on the strategies adopted by potential entrants.

In this paper we use data from Uruguayan manufacturing industries [2] to study the patterns of entry and exit for a small developing country increasingly exposed to international integration and competition. During the last two decades, the Uruguayan industry has been facing an increased exposure to international competition. The process of opening of the Uruguayan economy to international trade adopted the form of a unilateral reform. Contrasting with other experiences in the region, this process was characterized by a gradual and stable orientation of economic policies toward free trade [3].

Liberalization policies were accompanied by market deregulation for a significant number of economic activities. This implied that domestic industries were increasingly involved in competition both internally and in regional markets. Regional competition in turn implied a process of learning in regional protected markets. The gradualism of the trade liberalization process can be evaluated by considering that, even in the 1990s, there are still some industries in Uruguay with a very low expo-

[1] See for instance Dunne, Roberts y Samuelson (1988) for the American manufacturing sector. For an international comparison see Geroski y Schwalbach (1991).

[2] We use the Census of Manufacturers for Uruguay, that contains detailed microeconomic information. This information is complemented with the Annual Industrial Survey to construct a time series of average profits for each industry.

[3] The opening of the Uruguayan economy to free trade and the effects of this process on the specialization pattern of manufacturing industries has been analyzed extensively in national studies, such as Macadar (1987), Lorenzo and Laens (1988), Vaillant and Cassoni (1991), Vaillant and Montado (1991) and Laens and Osimani (1992).

sure to foreign trade. The fact that the trade liberalization process was stable can be verified by considering that those industries with comparative advantages were increasingly oriented towards exports, while import–substitution[4] industries were gradually fading in importance.

The goal of this paper is to propose a simple testable model in order to analyze the determinants of entry for the case of the manufacturing sector of a small developing economy with increased exposure to international competition. In the process of estimating this model, we hope to develop some understanding on the main patterns of entry and behavior of entrants and incumbents in small developing economies. We estimate the speed of entry and construct an index of the height of barriers to entry, using the methodology proposed by Orr (1974) and Geroski (1988). We extend this methodology by proposing an entry measure constructed from the information of surviving firms, while we take explicitly into account the problem of data censoring that arises from this kind of measure. We use information about past profitability to approximate expected profits for each industry.

The plan of the paper is the following: in section 2 we discuss the specification of the model of entry. In section 3 we describe the main features of the Uruguayan industry, while in section 4 we present the main empirical results. Finally, in section 5 we discuss these results and present concluding remarks.

2 The Model of Entry

For a developing economy with an increasing degree of openness it is likely that both entry and exit will be affected by domestic and international factors.

We base our analysis on Orr (1974) simple model of entry. Entry in industry j at time t depends on the difference between expected profits π^e_{jt} and b_j, the profits that would be obtained in the limit when the industry is in equilibrium and there is no more scope for further entry or exit [5]. It is assumed that b_j, which can also be defined as the height of entry barriers, depends on different factors such as market size, growth, product differentiation or concentration. Entry can be thought as a response to profit opportunities at a rate γ:

$$(1) \quad E_{jt} = \gamma(\pi^e_{jt} - b_j) + \mu_{jt}$$

[4]Import–substitution was a common developing strategy for Latinamerican countries during the 1940s and 1950s. It consisted on allowing foreing investment in economic activities oriented mainly to the domestic demand, and protecting these industries from further imports

[5]This model neglects the fact that some industries may be composed by producers of differentiated products and may therefore show a substantial departure of the relation of excess profits to entry. This a well–known shortcome of this kind of models, that is not very important if industries are classified in fairly homogenous production groups, as discussed in Geroski (1991b) , chapter 3.

where μ_{jt} is a stochastic perturbation that collects the unexplained factors of the entry process [6].

For a small economy with a developing industry and increasing international exposure, domestic firms will behave as price–followers in international markets. Entry and exit could then be governed by the behavior of firms in a fringe of domestic firms with profit and growth patterns determined by their degree of international exposure. This implies that potential entrants behavior is determined both by structural characteristics of domestic industries and by profit opportunities in international markets. These considerations lead us to formulate an empirical model of entry that includes international and domestic factors. Based on equation (1) we propose the following model:

$$(2) \quad \text{ENTRY}_{jt} = \gamma\, \text{PROFIT}^{e}_{jt} + \alpha\, \text{GROWTH}_{j,t-1} + \sum_{k=1}^{K} \beta_k X_k + \mu_{jt}$$

where ENTRY_{jt} is a measure of entry, PROFIT^{e}_{jt} is a measure of expected profits, $\text{GROWTH}_{j,t-1}$ is a measure of industry growth, and X_k are industry characteristics, associated with barriers to entry and to other structural parameters that determine long-run limit profits.

There are three separate issues to address in order to specify an estimable equation. First it is necessary to establish which kind of entry measure we will use. Second, since expected profits are unobservable, it is necessary to use a proxy variable or estimate expected profits from past information on profits. And third, some variables have to be proposed in order to estimate the height of barriers to entry. We will analyze these three issues separately.

2.1 Measures of Entry

Two factors determine the choice of a measure of entry. First, the goal of the study is to analyze the determinants of market expansion, so that our measure of entry should be either entry rates or market penetration rates. Secondly, data availability will also drive our choice.

In our case, it is not possible to construct a measure of gross entry and exit, since we only have information about the stock of firms in each industry for the year 1988, and some information on past profits and date of birth of surviving firms. If the analysis is restricted to the net increase in aggregate supply for each industry, a measure of net entry (gross entry minus gross exit) will give a good approximation of the increase in competition caused by new firms.

[6] In Geroski (1991a) it is shown that equation (1) can be deduced as the reduced form of a dynamic program for profit maximization.

We propose a measure of net entry based on the survivors for the year 1988. We exploit a well known empirical fact: most of the firms that enter an industry exit in a very short period of time. Therefore recent survivors are a good approximation of net entrants in recent periods, since most of the firms that exit in recent years will be firms that had entered in those same recent years.

The available information allows us to express the total number of firms as a stock of firms with their dates of birth. Denote by S_t the stock of survivors at date t. Recent and past survivors are related as follows:

$$(3) \quad S_t = S_{t-k} + NE^t_{t-k} + GE^t_{t-k}$$

where NE^t_{t-k} are net entrants during the period $(t-k, t)$ and GE^t_{t-k} are gross exits during the same period of firms that existed before $t-k$. This equation simply states that the stock of survivors is updated through recent firm turnover and exit of old firms. If the latter is small, as we assume, recent and past survivors allow us to approximate net entry.

The farther apart we go, the less likely that the number of recent survivors is equal to the number of net entrants at any period in time. Instead if we take the number of a recent generation of survivors, we can be fairly confident that it will be a good approximation of net entry in the last period. We choose a three-year period to compute net entry and compute annual net entry as the average observed over this three-year period. Consequently, the following is our measure of the rate of net entry (E_t) for the year 1988:

$$(4) \quad E_{1988} = \frac{(F_{1986} + F_{1987} + F_{1988})/3}{S_{1985}}$$

where F_t are firms surviving from year t and S_{1985} is the stock of survivors from 1985 or previous years.

If net entry is negative, or in other words if more firms exit than enter for some year, our measure of entry will be zero. This could happen if gross exit from previous periods, G^k_{t-k}, is not negligible for some industry. Therefore we will have to correct our estimation for left–censoring of our entry measure, since negative net entry will be censored to zero.

2.2 Expected profits

The estimation of expected profits is crucial in our model. The simplest specification that we can adopt in order to approximate post-entry expected profits is to use profits lagged one period, assuming that firms have adaptive expectations about future profits: in this case firms adjust their future expectations on profits taking into account their recent experience. This kind of expectations does not incorporate the

effects that entrants have on future profits. Incumbents would be able to manipulate pre–entry profits strategically in order to discourage entry.

Rational firms will form their expectations about expected post–entry profits taking into account all the available information. Post–entry profits are unobservable at the moment of the entry decision, but a rational firm will take into account:

- Information reflecting performance of the market in the past.
- A priori knowledge of the characteristics of the market

We propose a rational expectations estimator for expected profits, based on a measure of success:

$$(5) \quad \rho_{jt} = \pi_{jt} - \bar{\pi}_t$$

where ρ_{jt} is the deviation of profits in industry j (π_{jt}) from average profits in period t ($\bar{\pi}_t$).

In Appendix A we show that expected profits can be approximated by the fitted values of the following regression model:

$$(6) \quad \rho_{jt} = \lambda(L)\rho_{j,t-1} + \phi Z_{jt} + v_{jt},$$

where $\lambda(l)$ is a lag operator, Z_{jt} is a vector of exogenous variables, ϕ is a vector of unknown coefficients that are estimated and v_{jt} is a stochastic perturbation. In other words, current success is supposed to depend on lagged success and a set of exogenous variables. The fitted values of the dependent variable of this regression are a proxy for the values of the latent variable, that is expected profits at time t. We recover expected profits from our success measure by means of equation (5).

2.3 Barriers to entry

We need to construct variables that approximate the non–observable variable limit profits, b_j, or entry barriers. This is usually done by using information related to market structure, sunk costs, advertising or R & D.

Evidence from previous empirical studies show that limit profits are relatively high (in average 15 to 20 % over costs). Regarding the choice of variables, previous studies show that only capital requirements and sunk costs show the expected signs.

Our information allowed us to construct a series of variables related to possible entry barriers, but as we will see in later sections, only sunk costs, cost advantages by incumbents and firm age seemed to have any explanatory power.

3 A description of the Uruguayan industry

In Table 1 we present summary statistics for our sample of Uruguayan industrial firms. A more detailed description of the characteristics of this sample is presented in Appendix B. The average industry analyzed in this sample in 1988 had a clear export orientation and an intermediate degree of concentration (half of the sales is concentrated in the four biggest firms) [7].

Firms in the Uruguayan manufacturing sector have an average age of 15 years, and it can be said that most of them are quite young, despite the fact that there are some firms dating back to the nineteenth century. Their size is quite heterogeneous but the average size is small (the average value of gross production is around one million US dollars). Average capital/worker ratio is 13,000 US dollars.

Entry rates computed by the method suggested above show a striking similarity with studies for other countries. Entrants are usually smaller than existing firms, showing that penetration rates are smaller than net entry rates. On the other hand, profit rates for entrants are smaller than for incumbents, but they are also more variable.

In Table 2 we present the main characteristics of the Uruguayan manufacturing industries. This table enables as to trace a picture of the evolution of the Uruguayan industry while the economy was being gradually opened to international trade.

The first six industries with respect to its share in total Gross Value Added are 3111 (meat-processing industries), 3211 (textile), 3530 (oil refinery), 3116 (mill, rice), 3220 (clothing) and 3112 (milk industries). With the exception of petroleum refinery (a public monopoly) the rest are industries with a clear export orientation.

With respect to the age of firms in this set of industries where Uruguay has comparative advantages, it can be noticed that, at the milk and mill industries, firms are older than average and entry is lower.

There is another set of industries with export orientation and an intermediate importance in total Gross Value Added. These are 3121 (food), 3233 (leather), 3114 (sea products), 3521 (paint), 3240 (shoes) and 3213 (knittings). These are in general industries with younger firms than the previous group. Total number of firms and average size are also smaller in this group.

Industries were imports are important are 3843 (cars), 3522 (medicines), 3560 (plastics), 3512 (fertilizers and plaguicides), and 3511 (basic chemicals). These are older industries than industries in the previous group and with a greater variability of average sizes.

A third set of industries is formed by industries mainly oriented towards domestic markets and with small import competition. Industries in this group are 3117 (bread),

[7] The sample includes firms with more than five workers. These are the firms included in the 1988 Census of Manufacturers.

Table 1: Descriptive statistics for Uruguayan manufacturing industries (1988)

Variable	Mean	Coefficient of Variation	Minimum	Maximum
Average Size (thousand US $)	943	7.4	66	491,570
Productivity (thousand US $ of gross production per worker)	30	0.9	6	203
Capital/labor ratio	13	2.1	0.5	198.7
Commercial Specialization	-1	1.4	-6.6	0.7
C4 Index of Concentration (%)	55.5	0.5	12.4	100.0
Number of firms per industry	69	2.0	1	1084
Average age of firms (years)	15	0.4	5	61
Entry rate	0.052	1.0	0	0.25
Profit rate of Incumbents	0.16	0.4	0.02	0.36
Profit rate of Entrants	0.11	1.5	-0.12	0.98

Table 2: Description of the Uruguayan Industry

	Relative size		Entry		Age of firms	
Greater or equal to the average	>	<	>	<	>	<
Group 1: Main Exporters						
Competitive:						
Meat Processors	X		X			X
Textile	X		X		X	
Clothing		X		X		X
Concentrated:						
Rice Mill	X			X	X	
Leather	X		X		X	
Milk Products	X			X	X	
Group 2: Mid Exporters						
Competitive:						
Shoe, Knit		X	X			X
Concentrated:						
Food, Paint	X			X		X
Sea products		X	X			X
Group 3: Importers						
Competitive:						
Plastics		X		X		X
Medicine	X			X	X	
Concentrated:						
Plaguicides	X			X	X	
Car Industry	X			X		X
Group 4: Non-specialized						
Competitive:						
Printing, Electrical Machinery		X	X			X
Concentrated:						
Beverages, Paper Sugar, Beer	X			X	X	

3240 (publishers), 3134 (non alcohol beverages), 3411 (paper), 3819 (machinery), 3140 (tobacco), 3523 (cleaning products), 3552 (rubber), 3133 (beer) and 3118 (sugar).

In this group of non-specialized industries there are two types of industries. On the one hand one set of industries (beverages, paper, rubber, beer and sugar) with larger average size and older firms, with the highest concentration indices within the manufacturing sector. In these industries there is almost no entry. The second type shows a more competitive structure with more firms of smaller average size, less concentration and higher entry.

The rest of industries not considered in this description, with weights on total Gross Value Added smaller than 1 %, is characterized by fewer and younger firms and smaller average size. Firms in this group are also generally non specialized and face imports in their markets.

This general description allows us to trace a brief history of the Uruguayan industry. The largest firms belong to industries oriented to the domestic market and not facing high competition from imports. The most extreme examples are tobacco, the beer industry and non–alcoholic beverages. Even with the trade liberalization process going on, there are still strong protection mechanisms in place. Industries where imports are important have a smaller average size than the previous group. Several industries in this group can be traced to the period of import substitutions (decades of the 1940s and 1950s), with very limited entry in the last decades. These are also industries where the participation of foreign capital is important. Some of these industries have adopted an export orientation in certain production lines, for instance the car industry, basic chemicals, plastics and fertilizers.

Exporting industries can be divided in two groups. On the one hand there are industries that traditionally have had comparative advantages, such as textile, meat processing, milk, leather or rice. These are industries with a higher average size and younger firms if we compare them with the previous set of industries. The other group, sea products, ceramics, knit textiles, is composed by even younger firms of a smaller average size and clear export orientation.

4 The empirical model of entry

In this section we present the estimation of the model of entry. We start by estimating expected profits by means of the predicted values of a dynamic model of profitability for each industry. In a second step we estimate the model of entry using the expected profits estimated in the first step. In this second step we take into account that the value of the dependent variable, net entry rates, is left censored.

Table 3: Estimation of the profit equation. Dependent variable: ρ_t

Variable[a]	Estimate[b]
ρ_{t-1}	-0.209
	(0.047)
ρ_{t-2}	-0.249
	(0.043)
ρ_{t-3}	-0.224
	(0.040)
Participation of the industry	2.91
in total gross value of production	(1.38)
R^2 / Adjusted R^2	0.69 / 0.60
$F[79, 296]$	8.166

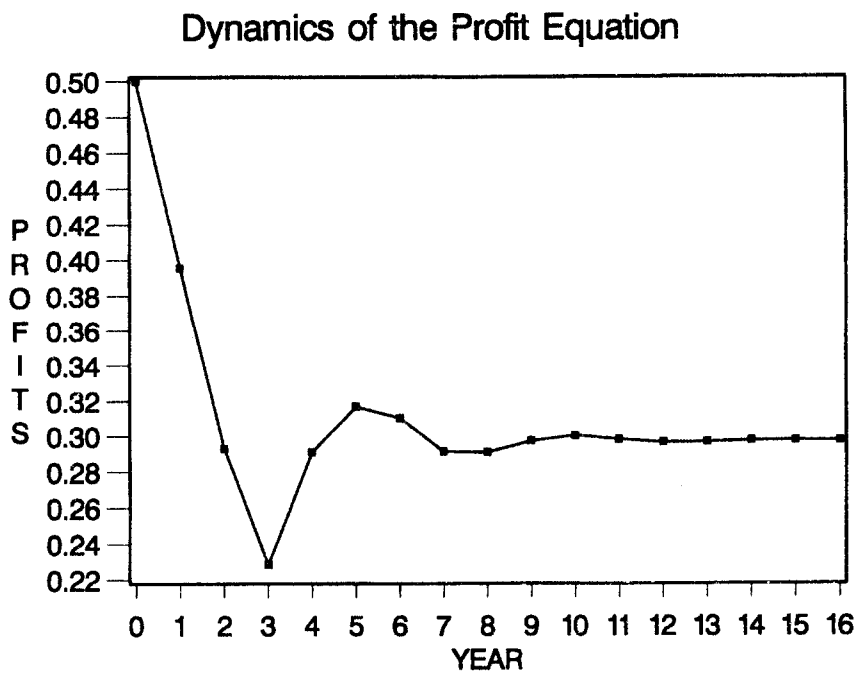
[a] A full set of 75 fixed effects were included in the regression. Most of them were significantly different from 0 at a 5 % level.

[b] Standard deviations are presented below in brackets. All variables are significantly different from 0 at a 5 % level.

4.1 Expected Profits

Using a panel data set with information about profits for the period 1981-1988 for all industries we estimate the reduced–form equation (6). We also include as an explanatory variable the participation of the industry in the total gross value of production of the period, as well as a full set of fixed effects. Given our time series span, we decided to truncate the lag structure for the success measure (ρ) at three periods. The estimated coefficients for the lagged value of profits are assumed to be the same across all industries, and therefore these coefficients have to be interpreted as an average elasticity of current success with respect to past success. This assumption would probably be too strong if we were trying to explain the persistence of profits, which is likely to be quite heterogeneous across industries, but recall that we are just trying to proxy expected profits for our entry equation. The results are presented in Table 3. The dynamics suggested by this equation is stationary. A simulation of this dynamic behavior can be obtained by assuming any level of the deviation from average profits. Suppose that this deviation is 0.50, and ignore the effect of the participation of the industry in total gross value of production of the period. In Figure 1 it is shown that profits will converge quite fast to their

Figure 1:



long–run level. In approximately eight years the deviation from the long–term level of profits is negligible.

4.2 Entry equation

In this section we present the estimation of our entry equation. As it is usual in this kind of models, there is an important proportion of the variability of entry that is not accounted by our proposed explanatory variables. There are a series of external factors influencing the entry decision that we are not taking into account, such as alternative profitable activities or government regulation. Nevertheless, our model is able to explain around 70 % of the variability of our entry measure, which represents a fairly high explanatory power compared to similar studies.

As an explanatory variable we use two measures of expected profits: a) the fitted values for the dependent variable in the profit equation, which would be equivalent to rational expectations by the entrants. b) average profits for 1981-1985, which would be equivalent to the assumption of adaptive expectations by entrants.

We include a series of variables as proxies for barriers to entry. These are the average age of the firms in the industry, export orientation of the industry, the ratio between non–machinery capital stock and total sales for incumbents and the

ratio between machinery capital stock and total sales also for incumbents. We also tried to include variables gathering information about structural differences between incumbents and entrants. A variable that turned out significantly different from zero in our model was a dummy variable constructed as follows: if the ratio of energy consumption over sales is smaller for incumbents than for entrants then it takes a value of one, otherwise it takes a value of zero. We interpret this variable as giving us information on cost advantages by incumbents with respect to entrants. We also included as an explanatory variable the standard deviation of profits for the period 1981–1988, trying to gather the effect of risk on the entry decision [8].

We found also four industries that were behaving as outliers in the proposed model. These (3312 wood containers and cane products, 3419 paper and cardboard products, 3691 clay products for construction and 3903 sporting products) are industries with a large dispersion in the number of firms, with a small average size of firms, with an important proportion of family or hand-craft businesses and a high degree of product differentiation.

We present the estimation by the ordinary least squares method and the Tobit procedure, as proposed in Tobin (1958). The latter is appropriate for the case of left truncation of the dependent variable, as in the case of our entry measure. The results are presented in Table 4. Expected profits have a significant and positive impact on entry, as we were expecting from economic theory. The coefficient for this variable can be interpreted as the speed of entry according to our specification. The value of the estimated coefficient is similar to the speed of entry estimated for industrialized countries, which range from 8 to 15 %. As in previous studies, the estimated coefficient of expected profits under the assumption of adaptive expectations is smaller than under rational expectations.

Average age of firms has a negative effect on entry. Older firms would be more apt to raise significant barriers to entry, may be taking advantage of their knowledge about existing regulatory mechanisms. This is also the group with the highest levels of foreign investment surviving from the period of import–substitution. It is also a group where patent protection, product differentiation, brand loyalties and scale economies are important.

Export orientation has a positive and significant effect on entry. We did not have an a priori expectation about the sign of this coefficient. Those industries which sell a significant proportion of their output in international markets raise smaller barriers to entry domestically. On the other hand, it has to be taken into account that there are strong expectations about a deepening of the trade liberalization process and increased economic integration [9]. This implies that industries which are more apt to compete regionally are more able to attract resources and therefore, show higher

[8] We tried to include other variables but they did not show any significant impact on entry, such as economies of scale, advertising, investment in R & D or royalties for the use of patents.

[9] On January 1st 1994 a custom union called MERCOSUR starts between Argentina, Brazil, Paraguay and Uruguay.

Table 4: Estimation of the entry equation. Dependent variable is entry rate

Variable[a]	Ordinary Least Squares		Maximum Likelihood (Tobit)	
Intercept	0.028	0.033	0.066	0.073
	(0.015)	(0.014)	(0.022)	(0.022)
Rational[b]	0.079		0.122	
Expectations	(0.038)		(0.053)	
Adaptive[c]		0.067		0.104
Expectations		(0.039)		(0.055)
Average	-0.002	-0.002	-0.006	-0.006
Age	(0.0004)	(0.0004)	(0.001)	(0.001)
Export	0.067	0.068	0.094	0.095
Orientation	(0.022)	(0.023)	(0.026)	(0.027)
Machinery/Sales	-0.004	-0.004	-0.003	-0.003
Ratio	(0.001)	(0.001)	(0.001)	(0.001)
Non–Machinery/Sales	0.060	0.059	0.071	0.070
Ratio	(0.015)	(0.015)	(0.017)	(0.017)
Risk	-0.079	-0.108	-0.203	-0.242
	(0.047)	(0.047)	(0.063)	(0.063)
Cost Advantage	0.047	0.047	0.063	0.063
Incumbents/Entrants	(0.011)	(0.011)	(0.013)	(0.013)
Dummies for Outliers:				
3312	0.183	0.187	0.211	0.216
	(0.037)	(0.037)	(0.041)	(0.042)
3419	0.188	0.191	0.194	0.198
	(0.037)	(0.038)	(0.041)	(0.042)
3691	0.092	0.096	0.135	0.142
	(0.036)	(0.036)	(0.040)	(0.041)
3903	0.091	0.092	0.076	0.076
	(0.037)	(0.038)	(0.042)	(0.043)
R^2/ Adjusted R^2	0.69/0.63	0.68/0.63		
$F[10, 65]$	12.7	12.3		
Log Likelihood		68.96	68.19	

[a]Standard deviations are presented in brackets below the estimated coefficients. All estimated coefficients are significantly different from zero at a 5 % level.

[b]Fitted values of the profit model.

[c]Average profits for the period 1981–1985.

entry rates.

It is interesting to compare the entry behavior of industries with old firms and high foreign capital participation, and young export oriented industries. The latter seem to present high profit opportunities and lower entry barriers.

Sunk costs are, according to economic theory, important sources of entry barriers. We tried to capture their importance by means of two measures of the weight of capital (machinery and non–machinery) on total sales. The ratio of machinery capital stock to total sales shows a positive effect on entry, while the ratio of non-machinery on total sales shows a negative and smaller effect. Investment in machinery has probably not the nature of a sunk investment, but of a recoverable fixed cost. Instead non–machinery investment may be gathering both recoverable and non–recoverable investment committed to entry.

Cost advantages by incumbents has the expected sign, showing that entry is more likely in those industries where these cost advantages are not present. This variable may be also giving information about new and improved technologies that entrants may be able to use, reducing therefore the advantage that incumbents may have, as they are committed to older or inferior technologies.

We included also a variable giving information about the uncertainty that potential entrants are facing in terms of the variability of profits. According to our estimation, the more variable is profits in previous periods the less likely is entry in the current period.

In short, out estimation shows that there exist a series of systematic forces that facilitate or impede entry, speeding up or delaying the response of potential entrants to the scope of excess profits in different industries. Old industries, in terms of the average age of the firms operating in them, show higher entry barriers, maybe indicating that old firms are able to reposition themselves in front of increased entry threats and raise significant obstacles to entrants. Export oriented industries seem also more akin to new profit opportunities, attracting significantly more entry than domestic oriented industries.

5 Concluding remarks

Traditional models of entry have shown that in industrialized countries the speed of entry is relatively small and most industries present important barriers to entry. In this paper we have estimated a model of entry to investigate the entry determinants in a small developing economy with increased international exposure.

The results obtained are of two types. First, our estimated coefficients for the speed of entry and the height of barriers to entry are very similar to equivalent estimations for developed countries. The age of incumbent firms, incumbent cost

advantages and sunk costs are negatively associated with entry, as expected. Second, we established that the degree of international exposure of industries is a relevant factor in determining the speed and value of entry. Export orientation of industries is positively associated with entry. Those industries still protected and not exposed to international competition, show a lower rate of entry and firm turnover. Furthermore, industries with larger cohorts of older firms, surviving from the import substitution period, and mainly oriented towards internal markets, seem to be industries with the highest barriers to entry. In these industries it seems that traditional firms have been repositioning themselves to be able to adopt credible entry deterring strategies and keep their market shares.

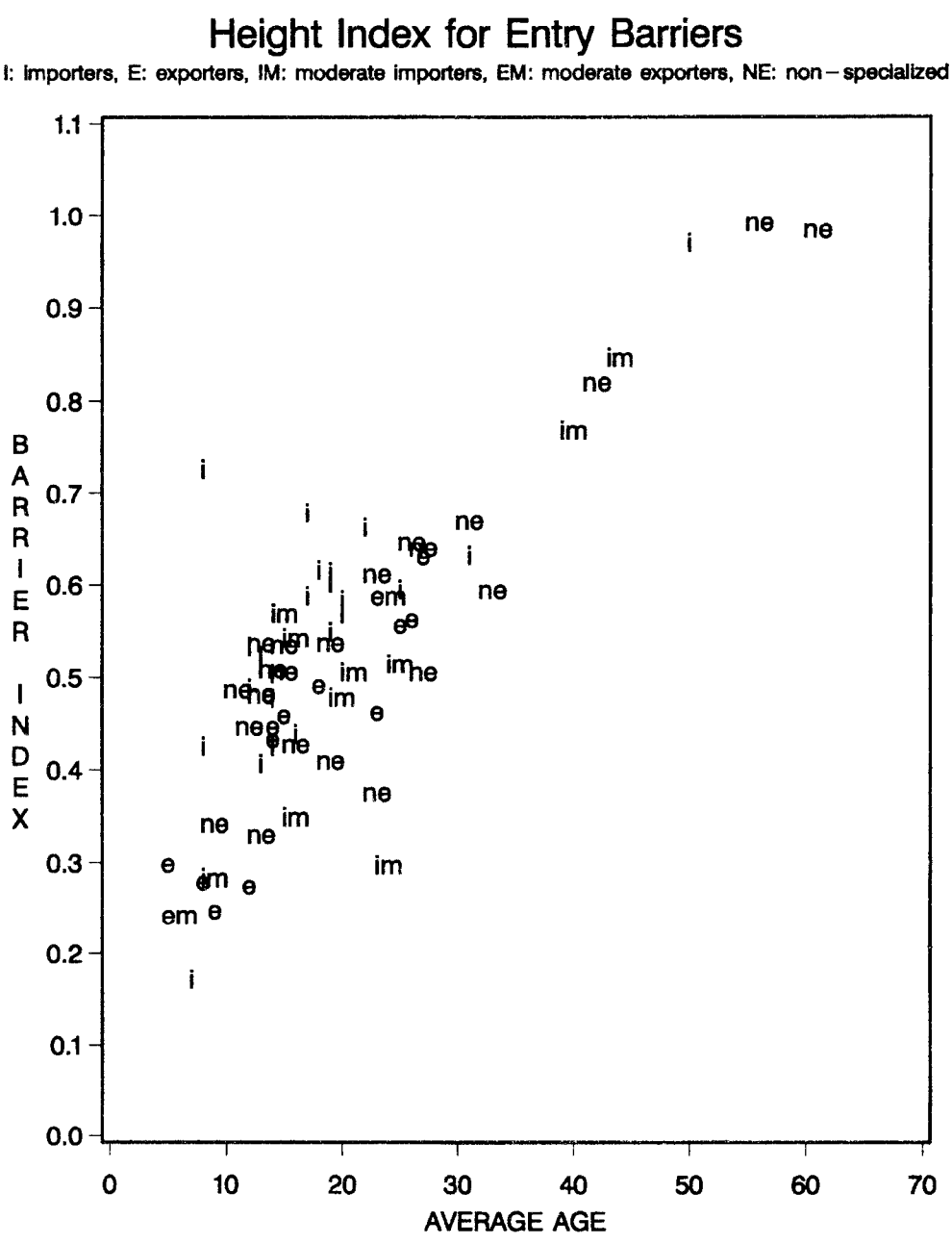
We conclude by presenting an index of barriers to entry and its relation to the different types of industries described in table 2. The index of barriers to entry is constructed by multiplying the estimated coefficients of the entry model by the value of the explanatory variables explaining long–run profit levels and normalizing this measure to lie between zero and one. We divide the industries in exporters, moderate exporters, importers, moderate importers and non–specialized. We plot the entry barriers index against average age. The results are shown in Figure 2.

We can observe two salient features from this figure. First, there is a high positive correlation between average age and barriers to entry. Older industries seem to be able to raise higher barriers to entry. Second, export oriented industries seem to show lower entry barriers than industries facing imports and non–specialized industries.

It is worth remarking that the oldest firms are also the firms with the highest participation of foreign capital. The industries where those firms participate show higher patent protection, product differentiation, brand loyalty or scale economies, explaining why these industries may be able to raise significant and credible entry barriers.

Summing up, the process of industrial restructuring caused by trade liberalization implies both a repositioning of traditional industries raising significant barriers to entry and a process of high turnover in the industries most exposed to the liberalization policies.

Figure 2:


Height Index for Entry Barriers
I: importers, E: exporters, IM: moderate importers, EM: moderate exporters, NE: non-specialized
BARRIER INDEX
AVERAGE AGE
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
0
10
20
30
40
50
60
70

References

DUNNE, T., M.J. ROBERTS, AND L. SAMUELSON (1988), "Patterns of firm entry and exit in United–States manufacturing–industries," *Rand Journal of Economics*, 19:495–515.

GEROSKI, P. A. (1988). "The interaction between domestic and foreign based entrants, " in Audretsch, D., L. Sleuwaegen, and H. Yamawaki, editors, *The convergence of international and domestic markets*. North–Holand, Amsterdam.

——— (1991a). "Domestic and foreign entry in the United Kingdom: 1983—1984, " in Geroski, P. and J. Schwalbach, editors, *Entry and Market Contestability: An International Comparison*, pages 63–88. Blackwell, Oxford, UK.

——— (1991b). *Market Dynamics and Entry*. Blackwell, Oxford.

GEROSKI, P. A. AND A. JACQUEMIN (1988), "The persistence of profits: a European comparison, " *The Economic Journal*, 98:375–389.

GEROSKI, P. A. AND J. SCHWALBACH (1991). *Entry and Market Contestability: An International Comparison*. Basil Blackwell, Oxford.

LAENS, S. AND R. OSIMANI (1992). *Itinerario de la apertura y condiciones macroeconómicas: El caso de Uruguay*. CINVE–BID, Montevideo.

LORENZO, F. AND S. LAENS (1988). *La especialización internacional en la industria manufacturera: una apicación del cluster analysis al caso uruguayo*. CINVE, Montevideo.

MACADAR, L. (1987). *La inserción subrregional del Uruguay and América Latina: evaluación del comercio negociado con Argentina y Brasil 1975–1984*. INTAL–BID, Buenos Aires.

ORR, D. (1974), "The determinants of entry: A study of the Canadian manufacturing industries, " *Review of Economics and Statistics*, 61:58–66.

TOBIN, J. (1958), "Estimation of relationships for limited dependent variables, " *Econometrica*, 26(1):24–36.

VAILLANT, M. AND A. CASSONI (1991), "Estrategias empresariales y desempeño exportador, " *Revista del Banco Central del Uruguay*, 6(1).

VAILLANT, M. AND E. MONTADO (1991). "Competitividad y patrón de crecimiento en la industria manufacturera uruguaya. una evaluación de los años ochenta, " Technical Report 6/91, Departamento de Economía, Montevideo.

Appendix

A The profit model

In this section we follow the model proposed by Geroski and Jacquemin (1988) for the persistence of profits. We model changes in success (ρ) as driven by systematic forces E (actual and potential entry) and unsystematic forces μ ("luck"). The equation proposed to explain changes in success, $\Delta\rho_t$ is the following:

$$(7) \quad \Delta\rho_t = \theta + \sum_{j=0}^{\infty} \beta_j E_{t-j} + \gamma\rho_{t-1} + \mu_t$$

For stationarity it is assumed that $-1 < \gamma < 0$. It is also expected that $\beta_j \leq 0$ for all j. E is also endogenous and can be modeled as:

$$(8) \quad E_t = \phi + \sum_{j=1}^{\infty} \alpha_j \rho_{t-j} + \epsilon_t$$

which corresponds to an error–correction model of entry. Past success attracts entry reducing the scope for excess profits. Furthermore, μ_t and ϵ_t are i.i.d. random variables with zero mean and constant and finite variance. Substituting (8) into (7) and restricting the lag structure to three periods, we obtain:

$$(9) \quad \rho_t = \lambda_0 + \lambda_1\rho_{t-1} + \lambda_2\rho_{t-2} + \lambda_3\rho_{t-3} + \nu_t$$

where,

$$\begin{aligned} \lambda_0 &= \theta + \sum_{j=0}^{3} \beta_j\phi \\ \lambda_1 &= 1 + \gamma + \beta_0\alpha_1 \\ \lambda_2 &= \alpha_1\beta_1 + \alpha_2\beta_0 \\ \lambda_3 &= \alpha_2\beta_2 + \alpha_3\beta_1 \end{aligned}$$

which is the reduced–form profit model that we estimate as equation (6).

B Description of the information

We use the Census of Manufacturers for the year 1988, surveyed by the DGEC (Dirección General de Estadísticas y Censos). The universe is all establishments with more than 5 workers. It corresponds to 1616 establishments belonging to 1382 firms, existing in 1988. To construct the time series of profits we used the Annual Survey of Industries from the DGEC.

Table 5 summarizes the main information about the sample. There are three definitions of production units from where the data is generated:

Table 5: Summary information of the sample

	Expanded Sample	Sample Data
Value Added	1864.9	1614.5
Employment	171.4	124.3
Establishments		
(Activity Class Unit)	5440.0	1616.0
Firms	6256	1382

Production plant: This is the physical place where production takes place. This variable is uniquely associated with geographical location. It can be formed by a set of establishments with different industrial activities.

Establishments: It is a firm or a part of a firm that independently engages only or mainly in an economic activity located or generated in a geographical site, and where value added can be computed.

Activity Class Unit: It is the aggregation of establishments of a single firm that share the same line of production (5-digit industry). This is the unit of observation of the Industrial Census.

Firm: It is the unit of observation and it is formed by a set of Activity Class Units.