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An Empirical Analysis of Mark-ups in the Argentine Manufacturing Sector

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Abstract

In this paper, we estimate mark-ups with plant level production data for Argentina from a structural model of cost-minimizing producers, as proposed by De Loecker and Warzynski (2012). We explore systematic differences across industries and plants. Our main findings are that mark-ups are higher in capital-intensive industries, and for plants that are more productive, larger, and more capital-intensive. Our findings are consistent with theories that predict larger mark-ups for more efficient firms and for higher quality products.

Keywords: Mark-ups, Productivity, Argentina.
JEL Codes: L1, L6

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1 Introduction

The aim of this paper is to estimate mark-ups for the Argentine manufacturing sector and to establish links between mark-ups and plant characteristics. Mark-ups are a key element in painting a picture of the competitiveness and profitability of an industry, as well as of the dispersion and inequality across plants. From a policy point of view, mark-ups help identify foci of entry barriers and reduced competition, as well as possibilities for firm growth and development.

We use the method of De Loecker and Warzynski (2012) to estimate mark-ups using plant-level production data on inputs and output for a panel of Argentine manufacturing firms over the period 1997-2001. The approach relies on a structural model of cost-minimizing producers, it is free of demand assumptions, and it does not require data on product attributes. It is based on the first order conditions of the cost minimization problem with respect to at least one variable input (labor in our case), which are exploited to establish a theoretical relation between unobserved plant-level mark-ups, the observed participation of the variable input in revenue, and the estimated output elasticity of the variable input. The estimation of the output elasticity is based on the control function approach of Olley and Pakes (1996) and extensions of Levinsohn and Petrin (2003) and Ackerberg, Caves and Frazer (2006), augmented to allow for both Cobb-Douglas and Translog production functions, as suggested by De Loecker and Warzynski (2012).

Results uncover estimated plant-level mark-ups that imply that prices in the Argentine manufacturing sector are on average 2 to 3 times higher than marginal costs, as well as significant dispersion across plants. We explore the systematic relation of mark-ups with plant characteristics, mainly total factor productivity (TFP) and plant size. We find a positive link between mark-ups, productivity and size, both for estimates based on the cross-section of plants, and for within estimators that control for plant fixed effects. While a causal relation cannot be established, the results suggest that efficiency is associated with higher mark-ups through competition effects, where more efficient firms enjoy higher market power, and that higher quality output, as evidenced by higher sales, is also associated with higher mark-ups.

We further find that mark-ups are higher in capital-intensive industries and in capital-intensive plants. Capital-intensive industries are associated with higher barriers to entry, which harbors niches of market power and high mark-ups. Capital-intensity at the plant level could reflect higher quality products, higher investment in cost-reducing technology (and therefore higher efficiency), and higher investment in product innovation. Additionally, we explore the link between mark-ups and foreign ownership. We find that plants that are fully-owned by foreign investors or firms enjoy mark-up advantages over domestic and joint foreign-domestic firms. The influnce of foreign ownership is increasing in productivity.

The paper is organized as follows. Section 2 describes the empirical model and methodology; Section 3 discusses the data and results; and Section 4 concludes.

2 Firm Model and Empirical Methodology

In this section we describe the structural model and empirical methodology in which the estimation of plant-level mark-ups is based. The model and estimation method follow De Loecker and Warzynski (2012) very closely.

The production function of firm j in industry i at time t is given by

$$Y_{jit} \quad = \quad F(L_{jit}, K_{jit}, \beta^i) \exp(\omega_{jit} + \eta_{jit}) \tag{1}$$

where output Y depends on two inputs, capital K and labor L, a vector of production technology parameters β^i, and a Hicks-neutral productivity term $\exp(\omega+\eta)$. The technology parameters β are indexed by i reflecting possible differences in technology across industries.[1] Technology is assumed to be the same across firms in a same industry, except for the Hicks-neutral productivity term. The Hicks-neutral productivity term has two components, one systematic component observed by the firm at the time of making input decisions (ω), which follows a known first-order Markov process, and one iid random shock, (η), which is

[1] Different specifications can be assumed for the function F, in the empirical section we work with two variants of F, Cobb-Douglas and Translog.

realized after the firm has made decisions on L and K. The distinction between the two productivity components is relevant in the estimation of the production function coefficients.

We assume that labor is a flexible input, that workers are homogeneous, and that labor markets are competitive. Capital, on the other hand, is subject to adjustment costs of investment and investment becomes operative in the following period, so that at any given time t, capital is a predetermined input.

Let Q denote the component of output that can be predicted by the firm for a given level of inputs, that is,

$$Q_{jit} = E(Y_{jit}|L_{jit}, K_{jit}, \beta^i, \omega_{jit}) = F(L_{jit}, K_{jit}, \beta^i)\exp(\omega_{jit}), \tag{2}$$

with $E(\exp(\eta_{jit})) = 1$. The minimum cost at which a given expected level of output Q can be produced is

$$C = \min_{L_{jit}, \lambda_{jit}} \left(w_{jit}L_{jit} + r_{jit}K_{jit} + \lambda_{jit}\left[Q_{jit} - F(L_{jit}, K_{jit}, \beta^i)\exp(\omega_{jit})\right]\right) \tag{3}$$

where w and r are wages and the capital rental rate, and λ is the marginal cost. The first order condition with respect to labor, the only variable input, is given by[2]

$$w_{jit} - \lambda_{jit}\frac{\partial F^i(.)}{\partial L_{jit}}\exp(\omega_{jit}) = 0. \tag{4}$$

Rearranging terms and multiplying by output Q and prices P yields the following expression for the mark-up

$$\mu_{jit} = \frac{P_{jit}Q_{jit}}{w_{jit}L_{jit}}\theta_{jit}. \tag{5}$$

In the expression above, the mark-up is defined as $\mu_{jit} = \frac{P_{jit}}{\lambda_{jit}}$, the ratio $\frac{P_{jit}Q_{jit}}{w_{jit}L_{jit}}$, is the inverse

[2]The cost minimization can be generalized to a context with several fixed and variable inputs, such as different types of labor, energy, and materials. With only one variable input the solution is trivial, since for a monotonic production function there is only one possible level of labor that yields the desired expected level of output. Writing the problem in terms of an optimal choice, however, lets us easily derive an expression for the marginal cost and for mark-ups.

of the share of labor in expected revenue, and θ_{jit} is the output elasticity of labor, defined by $\theta_{jit} = \frac{\partial F^i(.)}{\partial L_{jit}} \exp(\omega_{jit}) \frac{L}{Q}$.

The estimation of mark-ups is based on (5), data on revenue and labor costs, and estimates of the production technology (i.e. the output elasticity of labor). Recovering plant-level mark-ups thus requires estimating the production function (1). The production function parameters can be estimated from firm-level data on output and input use, using standard methods in the Industrial Organization literature, namely the seminal work of Olley and Pakes (1996) and extensions thereafter such as Levinsohn and Petrin (2003), and Ackerberg, Caves and Frazer (2006). Ackerberg, Benkard, Berry and Pakes (2007) provide a detailed overview and extensions to additional possible scenarios. These strategies to estimate production function parameters take into consideration endogeneity issues that arise because unobserved productivity is correlated with input use.[3]

Estimating equation (1) requires making parametric assumptions about its functional form. The usual assumption is that the production technology is Cobb-Douglas, that is, the log-production function can be written as

$$y_{jit} = \beta_l^i l_{jit} + \beta_k^i k_{jit} + \omega_{jit} + \eta_{jit} \tag{6}$$

where y, l and k are log-output, log-labor and log-capital. The Cobb-Douglas case is simple and can be interpreted as a first order approximation to more complex processes, and it is thus very popular in the productivity estimation literature. The Cobb-Douglas assumption, however, yields output elasticities given by $\theta_{jit} = \beta_l^i$, which are constant across firms in a same industry. For the purposes of mark-ups estimation this may excessively reduce the variance of mark-ups across firms. To address this issue it is possible to use more flexible specifications for the production function. De Loecker and Warzynski (2012) work with a

[3]Olley and Pakes (1996) develope an investment-proxy method in which investment is used to control for unobserved productivity shocks. In the same vein, Levinsohn and Petrin (2003) note that investment is often zero and develop a similar method based on a GMM estimator that uses intermediate inputs in place of investment. Finally, Ackerberg, Caves and Frazer (2006) cast doubt on the theoretical foundation of both methods by arguing that there may be significant collinearity problems in the first stages, where conditional on a nonparametric function in capital, materials, and other variables affecting input demand, identification of the labor coefficient is not plausible. They suggest an alternative estimation procedure which builds upon the ideas in the previous papers, but does not suffer from the collinearity problems.

translog specification given by

$$y_{jit} = \beta_l^i l_{jit} + \beta_{ll}^i l_{jit}^2 + \beta_k^i k_{jit} + \beta_{kk}^i k_{jit}^2 + \beta_{lk}^i l_{jit} k_{jit} + \omega_{jit} + \eta_{jit} \tag{7}$$

In the translog case, the output elasticity of labor is given by $\theta_{jit} = \beta_l^i + 2\beta_{ll}^i l_{jit} + \beta_{lk}^i k_{jit}$. See De Loecker and Warzynski (2012) for details of the simple extension of the Levinsohn and Petrin (2003) and Ackerberg, Caves and Frazer (2006) methods to the translog case.

Once the production function parameters are estimated, firm-level output elasticities can be computed and plugged into (5) to obtain the firm-level mark-ups. Finally, notice that in the data we observe the actual revenue, defined as $P_{jit}Y_{jit}$, whereas equation (5) refers to expected revenue $P_{jit}Q_{jit}$. Expected revenue can be easily computed from observed revenue as $P_{jit}Q_{jit} = P_{jit}Y_{jit}/\eta_{jit}$, where the non-systematic productivity component η_{jit} is estimated as a residual together with the production function parameters.

3 Mark-ups in the Argentine Manufacturing Sector

In this section, we estimate mark-ups at the plant-level for the Argentine manufacturing sector and their distribution according to plant characteristics. We study how mark-ups evolve according to plant-level productivity and size, capital intensity of firms and industries, and plant ownership status and age.

3.1 Data

We use plant-level data from Argentina's Annual Industrial Survey (EIA), collected by the Instituto Nacional de Estadística y Censos (Institute of Statistics and Census, INDEC). The EIA is a panel of manufacturing plants and provides information on sales, value added, input use, employment of production workers, employment of nonproduction workers, total wage bill, investment and several other expenditures; and broader information such as ownership structure, foreign capital participation, year in which activities began, and industry affiliation at the fourth-digit level of the International Standard Industrial Classification (ISIC)

Revision 3. We have access to the module of the survey that corresponds to the province of Buenos Aires spanning the period 1997-2001. The province of Buenos Aires, although not necessarily representative of other areas of the country, accounts for more than half of manufacturing employment and output in Argentina.

Table 1 reports basic summary statistics by 2-digit industries. The survey includes 7,023 plant-year observations. The largest 2-digit industry is Food and Beverages, followed by Chemicals. Together account for over 30 percent of employment in manufacturing and observations in the sample (Columns 2 and 3). Other large industries in terms of plants and employment are Textiles, Rubber, Plastics, Mineral Products, Metals, Machinery, Electrical Machinery, and Motor Vehicles.

Column (4) reports the average capital intensity of the industry, computed as the capital to labor ratio. Capital intensity varies greatly by industry. This is relevant for our analysis since differences in capital-labor ratio partly reflect differences in technology across industries, which in turn suggests that it is important to allow for differences in production function parameters as part of the procedure to estimate mark-ups. We further discuss this issue below.

3.2 Output Elasticities and Plant-Level Mark-ups

We now turn to the estimation of mark-ups. As described in Section 2, the computation of mark-ups requires estimates of the output elasticity of labor at the plant level. For robustness, we estimate the two specifications in equations (6) and (7), that is, Cobb-Douglas and Translog production functions. We use value added as left-hand side variable and labor and capital as right-hand side variables. To consider differences in quality or productivity, labor is computed in efficiency units, where physical units are normalized by the ratio between the plant average wage and the average industry wage. Capital is computed as the book value of plant physical assets. All variables are deflated using industry-level deflators.[4]

[4]The use of industry-level deflators raises the issue of the possibility that prices may vary across firms. Some estimation methods take this issue into consideration. De Loecker (2011) exploits demand shocks due to quota removals of the multifiber arrangement to overcome this issue using data from Belgian firms. De Loecker, Goldberg, Khandelwal and Pavcnik (2012) use firm-level prices to directly control for this issue using data from Indian firms. Our setting does not lend itself to these corrections, however, as argued by

Because our dataset is relatively small, we cannot let production function coefficients vary at the industry level. Instead, we adopt two different specifications. In the first specification coefficients are the same across industries. While in the second (preferred) specification, we define three industry groups according to the average capital intensity of the 2-digit industry (see Table 1), and we estimate three sets of coefficients, one for each group of industries.

Table 2 displays estimates of the output elasticities of labor and capital. Column (1) in Panel A, shows the estimates of the output elasticities in the case in which all industries share the same Cobb-Douglas technology. In the Cobb-Douglas case the output elasticity are the input coefficients in the production function, and thus the same across plants. The labor coefficient is 0.453, while the capital coefficient is 0.185. In columns (2) to (4) we let coefficients vary across three industry groups.[5] As expected the labor coefficient is decreasing in the capital intensity of the industry, whereas the capital coefficient follows the opposite pattern. The differences in coefficients across industries are, however, relatively modest. In Panel B of Table 2 we display estimates of the output elasticities from a Translog technology. In this case output elasticity varies across plants and we report the average. In general the average output elasticity is very close to the Cobb-Douglas case, except in the case of medium capital-labor ratio industries (column 3), in which the elasticities are not only different across Panels A and B, but also the implied capital intensity in column (3) is higher than in column (4) (for Panel B).

From output elasticities and data on labor costs and value added we can compute the mark-ups at the firm level. Figure 1 shows the distribution of mark-ups across firms and Table 3, Panel A, displays descriptive statistics. The average mark-up lies in the range of 2.7 to 3.4 across the four specifications (combinations of Cobb-Douglas or Translog, and same coefficients for all industries or coefficients that vary by industry group) and the

De Loecker and Warzynski (2012), while using industry-level deflators may affect the estimated level of mark-ups, it does not affect the ranking of mark-ups across firms.

[5] The three industry groups are as follows. Low K/L: Textiles, Apparel, Leather, Medical, precision and optical instruments, Other transport equipment, Furniture; Medium K/L: Wood, cork, and straw products, Publishing, printing and media, Rubber and plastic, Non-metallic mineral products, Fabricated metal products, Machinery and equipment, Office and computing machinery, Electrical machinery, Radio, TV and communication equipment; High K/L: Food products and Beverages, Tobacco products, Paper and paper products, Coke and refined petroleum products, Chemicals, Basic metals, Motor vehicles and trailers.

median mark-up lies between 2.1 and 2.4. These estimates suggests that in the Argentine manufacturing sector prices are at least twice as high as marginal cost. There is considerable variation across firms. The 25th percentile ranges from 1.2 to 1.7, and the 75th percentile ranges between 3.7 and 4.5. The correlations between mark-ups computed based on the Cobb-Douglas and Translog coefficients are high, at 0.967 and 0.914.[6] In Panel B we show average mark-ups by 2-digit industries. Mark-ups are high for Coke and petroleum, Food and beverages, Tobacco, Office equipment, Chemicals, and Leather. Figure 1 shows that dispersion across firms is high and that the distribution is highly skewed, with a large mass of firms on the left-end of the distribution and a long tail on the right of the distribution.

Table 3, Panel B, suggests that mark-ups may be on average higher for capital-intensive industries. We thus report in Table 4 descriptive statistics by industry groups. Panel A shows mark-ups based on Cobb-Douglas technology, and Panel B shows mark-ups based on Translog technology. In each case technology coefficients vary by industry groups, which is the preferred specification since it allows for more flexibility. Average mark-ups are 2.86 and 2.90 for low capital-labor ratio industries, 2.64 and 1.69 for medium capital-labor ratio industries, and 3.90 and 3.84 for high capital-labor ratio industries. We thus confirm that average mark-ups are higher for high capital-ratio industries. This ranking is displayed by other moments of the distribution as well. Higher capital intensity points towards higher barriers to entry, which in turn imply niches of market power and high mark-ups for established firms.

3.3 Mark-ups and Plant Characteristics

We now turn to exploring correlations between mark-ups and plant characteristics. We perform the analysis for the Cobb-Douglas specification of technology, and allow production function coefficients to vary by industry groups (low K/L, med K/L, and high K/L). Results are very similar when we use a Translog specification and are available in the Appendix.

We start by exploring the correlation between mark-ups and productivity. Our regression

[6] De Loecker and Warzynski (2012) estimate lower mark-ups for Slovenian manufacturing firms. They find median mark-ups of 1.17 and 1.28 for Cobb-Douglas and Translog specifications, with substantial variation across firms.

takes the form

$$\ln \mu_{jit} = \gamma_1 TFP_{jit} + x'_{jit}\gamma_2 + \phi_j + \phi_t + \epsilon_{it} \tag{8}$$

where μ is the plant-level mark-up, TFP is log-total factor productivity estimated together with the production function parameters, x are controls that vary across specifications, further described below, ϕ_j are plant fixed effects, ϕ_t are year effects that control for aggregate shocks, and ϵ is a random error term.

Results are in Table 5. We first run OLS regressions in which we include industry effects instead of plant fixed effects. Column (1) shows a positive and significant association between productivity and mark-ups. This result is consistent with the common intuition that more efficient firms usually charge higher mark-ups. As stressed by De Loecker and Warzynski (2012), theoretical models in industrial organization predict that firms with lower marginal costs are able to charge higher mark-ups. For example, in a model of Cournot competition, more productive firms have a higher market share and hence have higher mark-ups. Melitz and Ottaviano (2008) reach the same theoretical prediction with a model of monopolistic competition and quadratic utility. Another plausible channel is quality. Higher quality products are usually associated with higher mark-ups. In the quality literature, if productivity and quality are complements, as in Kugler and Verhoogen (2012), higher productivity firms produce higher quality products and charge higher mark-ups. To explore this avenue we add log sales as a control in column (2). For a given productivity level, higher sales imply higher perceived output quality. We find that the coefficients on both TFP and sales are positive and significant, although only at the 10 percent level for sales. These findings provide additional support to the efficiency-competition channel described above (through the still positive coefficient of TFP) and to the idea that higher quality firms charge higher mark-ups (through the positive coefficient on sales).[7]

In column (3) we further control for log labor and log capital. TFP and sales remain positively associated with mark-ups. The coefficients on inputs indicate that employment is associated with lower mark-ups and capital is associated with higher mark-ups. This

[7] Similar results are obtained by Lamorgese, Linarello and Warzynski (2013) for the case of Chile.

again could reflect differences in quality, if there is a complementarity between capital-labor ratio and quality production. It could also be due to the fact that firms with more market power are able to afford fixed costs of investment in product innovation and upgrading or in cost-reducing technology. Or it could reflect sunk costs at the plant level that provide an incumbent advantage over newer and smaller firms.

The previous results uncover relations in the cross-section of firms (OLS). In columns (4) to (6) we run fixed-effects regressions (FE) in which we control for plant level effects. These are within estimators that exploit variation in mark-ups, TFP, sales, labor and capital over time for a given firm. Interestingly, the FE estimates uncover the same story as the OLS estimates. This means that when a given firm becomes more productive, larger, or more capital intensive, its mark-up goes up. It is important to notice, however, that this is not necessarily a causal relation and that the positive association may be caused by time-varying unobserved heterogeneity across firms.

In light of our previous finding that mark-ups are considerably different for capital-intensive industries, we explore differences in the association between mark-ups, productivity and size for the three industry types. Results are in Table 6 and they are both qualitatively and quantitatively very similar to the previous table. In the three types of industries, higher mark-ups are associated with higher productivity, higher sales, and higher capital intensity. This result is observed both in the cross-section of firms (OLS regressions, columns 1 to 3) and within firms (FE regressions, columns 4 to 6).

We next turn to foreign ownership. In Table 7 we investigate whether there exist systematic differences in mark-ups between domestic and foreign plants. In Panel A we include a domestic dummy that is equal to one for plants that do not have any foreign participation in capital, as well as an interaction between the domestic dummy and TFP. The coefficients on the domestic variable are not statistically significant, while the interaction between domestic and productivity is negative and significant. Thus, on average, there are no differences in mark-ups between low-productivity domestic and foreign plants, whereas for high levels of productivity foreign plants have a market power advantage. These results suggest that differences between domestic and foreign plants arise as productivity increases, for example as foreign plants have better access to foreign inputs at a lower cost, or to sell their output in foreign markets, or have easier access to foreign technology and product innovation. Regarding imported inputs, foreign inputs could be associated with higher quality of output, which, as argued above, is related to higher mark-ups. Regarding exports, the mark-ups that we estimate are an average of mark-ups for domestic sales and sales abroad. Exports from developing countries are usually associated with higher mark-ups as well, through several channels such as price discrimination due to higher income in export destinations, higher valuation for quality, and quality selection via "shipping-the-good-apples-out" effects (Hummels and Skiba, 2004). Manova and Zhang (2012), for example, document that the average export price charged by Chinese firms is increasing in the income of the country of destination. Firm innovation is found by Cassiman and Vanormelingen (2013) to be related to higher mark-ups as well.

To further explore this idea, in Panel B we split foreign plants into plants of joint domestic and foreign ownership (1 to 99 percent of foreign participation in capital) and fully-foreign plants (100 percent of foreign ownership). The idea is that fully-foreign plants have more access to intermediate inputs and export a larger fraction of their product, via affiliate-parent trade. Results confirm that the effects are stronger for fully-foreign plants than for joint foreign plants, and that both groups of foreign plants charge higher mark-ups than domestic firms (the omitted category). Results for fully-foreign plants hold for fixed-effects regressions as well (columns 4 to 6), which means that as a fully-foreign plant becomes more productive, it tends to differentiate more from equally productive joint-foreign or domestic plants.

We next explore the evolution of mark-ups with plant age. The age of a plant is defined as the number of years since it entered the market. Age is commonly thought to be positively associated with mark-ups, due for example to a demand accumulation process such as building a customer base, as in Foster, Haltiwanger and Syverson (2013), or industry evolution models in which less efficient plants are selected out of the market as in Jovanovic (1982) and Dunne, Roberts and Samuelson (1988). Our empirical results, however, do not unequivocally support these ideas. We display results in Table 8. In column (1) we do not add any additional controls except for industry and year effects, and we obtain a negative and significant coefficient for age. This fiding is at odds with the ideas described above and could suggest that costs of labor and investment raise with age, due for example to increases in social security taxes and firing costs, or to the costs of financing capital.[8] To explore whether this issue is related to firm productivity, in column (2) we add TFP and an interaction of TFP and age as explanatory variables. The coefficient on age and age interacted with TFP are not significant. This finding supports the idea that newer firms may have lower variable costs. Results are qualitatively the same when we include sales (which controls for the customer base of Foster, Haltiwanger and Syverson (2013)) and input use in columns (3) and (4). In columns (5) to (7) we run FE regressions. Results are very similar to the OLS specifications. Results are reversed, however, when we use the Translog estimates of output elasticities, and we indeed find that when controlling for productivity mark-ups become increasing in age, as suggested by the customer-base and firm-selection theories (Table A4 in the Appendix).

4 Conclusions

In this paper we have estimated plant-level mark-ups for a panel of Argentine manufacturing plants. We find that average mark-ups are high and display high variance across plants and industries.

Mark-ups are systematically related to industry and plant characteristics. They are higher for capital-intensive industries as well as for productive, large, and capital-intensive plants. This is consistent with the idea that mark-ups increase with firm efficiency and output quality. The estimated mark-ups of fully-foreign plants are also higher than their domestic and joint foreign-domestic counterparts. This again could be due to differences in efficiency and quality explained by access to better technology and inputs, as well as less costly access to higher income export markets and the practice of price discrimination between domestic sales and exports. Plant age, on the other hand, does not appear to be consistently correlated to higher mark-ups, as suggested by customer-base and industry-selection theories.

[8]In developing countries new and small firms are more prone than established firms to hire workers outside of the social security system.

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Appendix

Tables 5 to 8 in the main text show correlations of mark-ups and plant characteristics in which mark-ups are computed from Cobb-Douglas estimates of the output elasticity of labor. For robustness purposes, the Appendix shows analogous correlations estimated from mark-ups that are computed from Translog estimates of the output elasticities. Results are in Tables A1 to A4.

Figure 1: Distribution of Mark-ups across Plants

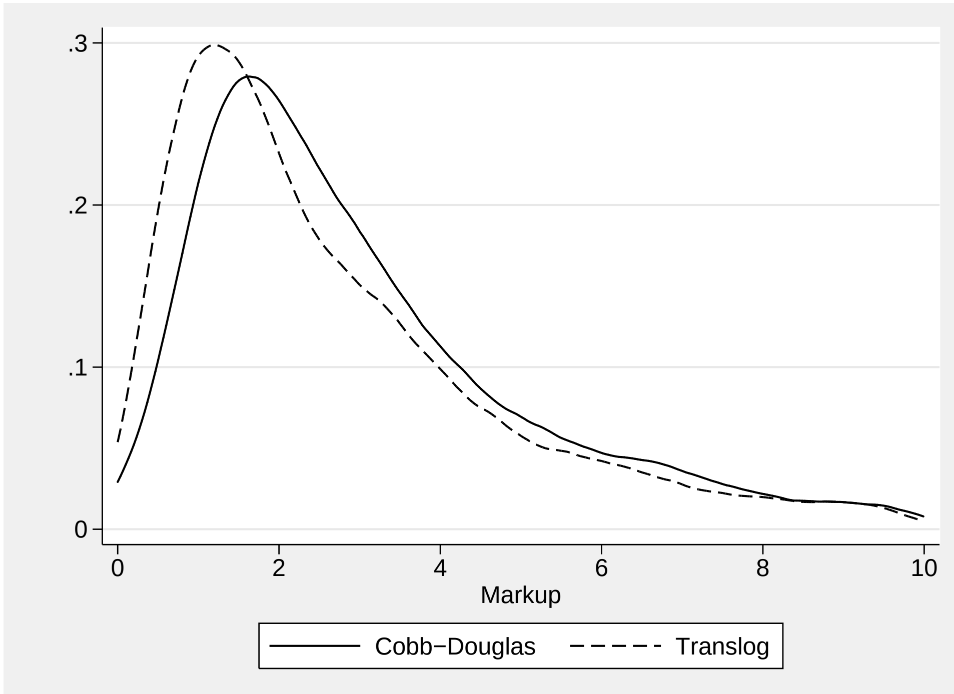

Table 1: Firms in the Encuesta Industrial Anual (EIA)

	ISIC (1)	Obs (2)	Employment (3)	K/L (4)
Food products and Beverages	15	1,353	0.23	4.1
Tobacco products	16	10	0.01	4.4
Textiles	17	497	0.05	1.8
Wearing apparel, dressing and dyeing of fur	18	151	0.01	0.5
Leather and leather products	19	214	0.05	1.3
Wood, cork, and straw products	20	121	0.01	1.4
Paper and paper products	21	224	0.04	3.6
Publishing, printing and media	22	163	0.02	2.6
Coke and refined petroleum products	23	67	0.02	13.6
Chemicals	24	828	0.12	5.2
Rubber and plastic	25	441	0.06	3.1
Non-metallic mineral products	26	407	0.06	3.2
Basic metals	27	279	0.08	3.4
Fabricated metal products	28	514	0.04	1.7
Machinery and equipment	29	504	0.04	2.4
Office, accounting and computing machinery	30	11	0.00	4.6
Electrical machinery and apparatus	31	356	0.03	2.1
Radio, TV and communication equipment	32	48	0.01	1.5
Medical, precision and optical instruments	33	95	0.01	0.9
Motor vehicles, trailers and semi-trailers	34	335	0.08	3.2
Other transport equipment	35	139	0.02	2.1
Furniture	36	266	0.02	1.3
Total		7,023	1.00	3.1

Notes: Source: Encuestra Industrial Anual (EIA), Province of Buenos Aires, 1997-2001. Column (1): 2-digit sector of Isic Rev. 3 classification. Column (2): number of plant-year observations in survey. Column (3): contribution of industry to total employment. Column (4): average capital-labor ratio in the industry.

Table 2: Estimated Output Elasticities

	Same coefficients	Varying coefficients		
		Low K/L	Med K/L	High K/L
	(1)	(2)	(3)	(4)
Panel A: Cobb-Douglas				
Labor	0.453***	0.459***	0.437***	0.411***
	(0.036)	(0.032)	(0.095)	(0.060)
Capital	0.185***	0.132**	0.182*	0.246***
	(0.040)	(0.047)	(0.101)	(0.063)
Observations	4,487	831	1,671	1,960
Panel B: Translog				
Labor	0.481***	0.481***	0.271***	0.422***
	(0.069)	(0.088)	(0.076)	(0.071)
Capital	0.166**	0.127	0.276***	0.247***
	(0.068)	(0.101)	(0.046)	(0.048)
Observations	4,487	831	1,671	1,960

Notes: Table reports output elasticities of capital and labor. Panel A: in the Cobb-Douglas case the output elasticities are the production function coefficients. Panel B: in the Translog case the output elasticity is computed for each firm from production function coefficients, output and input use, and averaged across firms. Column (1): production coefficients are the same for all industries. Columns (2)-(4): 3 sets of coefficients are estimated for 3 industry groups according to their capital intensity. S.E. in parentheses are clustered at the firm level. Significance at the 10, 5, and 1% levels are denoted by *, **, ***.

Table 3: Estimated Mark-ups

	Cobb-Douglas		Translog	
	Same Coefficients (1)	Varying Coefficients (2)	Same Coefficients (3)	Varying Coefficients (4)
Panel A: All industries				
Average	3.3	3.2	3.4	2.7
Std. Deviation	2.4	2.3	2.4	2.1
Percentil 25	1.6	1.5	1.7	1.2
Percentil 50	2.7	2.5	2.8	2.1
Percentil 75	4.3	4.1	4.5	3.7
Correlation			0.967	0.914
Observations	5,256	5,256	5,256	5,256
Panel B: By industry				
Food and Beverages	4.2	3.8	4.2	3.7
Tobacco	4.7	4.2	4.8	4.6
Textiles	2.8	2.8	2.9	2.7
Apparel	3.0	2.9	3.5	3.3
Leather	3.9	3.9	3.9	3.6
Wood, cork, and straw products	3.8	3.7	4.1	2.5
Paper and paper products	3.5	3.2	3.6	3.2
Publishing, printing and media	2.9	2.8	2.8	1.8
Coke and refined petroleum	6.2	5.7	5.4	4.9
Chemicals	4.1	3.7	4.0	3.6
Rubber and plastic	3.1	3.0	3.1	2.0
Non-metallic mineral products	3.1	3.0	3.2	2.0
Basic metals	3.2	3.0	3.5	3.1
Fabricated metal products	2.8	2.6	2.9	1.7
Machinery and equipment	2.9	2.8	3.0	1.8
Office and computing machinery	4.6	4.6	5.0	3.1
Electrical machinery	3.1	3.0	3.2	2.1
TV and communication equipment	2.1	2.0	2.3	1.3
Medical instruments	2.3	2.3	2.5	2.3
Motor vehicles	2.5	2.3	2.7	2.4
Other transport equipment	2.6	2.5	2.8	2.6
Furniture	3.3	3.3	3.5	3.3

Notes: Table displays descriptive statistics of plant-level mark-ups. Columns (1)-(2): output elasticities computed based on Cobb-Douglas estimates. Columns (3)-(4): output elasticities computed based on Translog estimates. Columns (1) and (3): production technology is restricted to be the same across industries. Columns (2) and (4): production technology is allowed to vary for the three industry groups (low K/L, medium K/L, large K/L).

Table 4: Mark-ups and Capital Intensity of the Industry

	Low K/L (1)	Med K/L (2)	High K/L (3)
Panel A: Cobb-Douglas			
Mean	2.86	2.64	3.90
Std. Deviation	1.92	1.64	3.09
Percentil 25	1.45	1.43	1.74
Percentil 50	2.33	2.22	2.94
Percentil 75	3.81	3.42	5.09
Panel B: Translog			
Mean	2.90	1.69	3.84
Std. Deviation	1.91	1.23	2.97
Percentil 25	1.54	0.79	1.75
Percentil 50	2.44	1.33	2.99
Percentil 75	3.76	2.25	4.96
Observations	965	2,040	2,250
Correlation	0.937	0.911	0.955

Notes: Table displays descriptive statistics of plant-level mark-ups. Columns (1), (2) and (3) correspond to Low K/L, Medium K/L and Large K/L industry groups. Panel A: output elasticities computed based on Cobb-Douglas estimates. Panel B: output elasticities computed based on Translog estimates. Production technology is allowed to vary by industry group.

Table 5: Mark-ups and Firm Characteristics
Productivity, Size, and Capital Intensity

	OLS			FE		
	(1)	(2)	(3)	(4)	(5)	(6)
TFP	2.203***	2.082***	0.897***	1.493***	1.273***	1.023***
	(0.093)	(0.089)	(0.286)	(0.094)	(0.094)	(0.108)
Sales		0.070*	0.529***		0.201***	0.358***
		(0.036)	(0.124)		(0.049)	(0.058)
Labor			-0.354***			-0.208***
			(0.049)			(0.030)
Capital			0.082**			0.148***
			(0.038)			(0.027)
Observations	5,533	5,533	5,533	5,533	5,533	5,533
Number of firms				1,604	1,604	1,604

Notes: Dependent variable: Log mark-up, Cobb-Douglas estimates with varying coefficients by 3 industry groups. Columns (1)-(3) include industry and year effects. Columns (4)-(6) include firm and year effects. SE in parentheses are clustered at the firm level. Significance at the 10, 5, and 1% levels are denoted by *, **, ***.

Table 6: Mark-ups and Firm Characteristics.
Capital Intensity of the Industry

	OLS			FE		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Low K/L						
TFP	2.373***	2.368***	0.914**	1.218***	1.041***	0.682***
	(0.190)	(0.190)	(0.341)	(0.207)	(0.215)	(0.238)
Sales		0.006	0.476***		0.188*	0.424***
		(0.030)	(0.105)		(0.099)	(0.106)
Labor			-0.324***			-0.295***
			(0.048)			(0.059)
Capital			0.047			0.154***
			(0.030)			(0.055)
Observations	1,016	1,016	1,016	1,016	1,016	1,016
Number of firms				285	285	285
Panel B: Medium K/L						
TFP	2.245***	2.246***	1.263***	1.668***	1.329***	1.203***
	(0.166)	(0.169)	(0.299)	(0.164)	(0.151)	(0.193)
Sales		-0.001	0.386***		0.249***	0.345***
		(0.024)	(0.126)		(0.082)	(0.103)
Labor			-0.312***			-0.148***
			(0.051)			(0.048)
Capital			0.114**			0.156***
			(0.045)			(0.042)
Observations	2,148	2,148	2,148	2,148	2,148	2,148
Number of firms				582	582	582
Panel C: High K/L						
TFP	2.227***	1.962***	0.820*	1.906***	1.762***	1.569***
	(0.134)	(0.127)	(0.452)	(0.150)	(0.162)	(0.192)
Sales		0.136**	0.580***		0.119	0.236**
		(0.063)	(0.195)		(0.077)	(0.102)
Labor			-0.367***			-0.190***
			(0.074)			(0.050)
Capital			0.087			0.207***
			(0.068)			(0.045)
Observations	2,369	2,369	2,369	2,369	2,369	2,369
Number of firms				756	756	756

Notes: Dependent variable: Log mark-up, Cobb-Douglas estimates with varying coefficients by 3 industry groups. Panels A, B, and C: Industries are split into Low, Medium and High Capital-Labor ratios at the industry level. Columns (1)-(3) include industry and year effects. Columns (4)-(6) include firm and year effects. SE in parentheses are clustered at the firm level. Significance at the 10, 5, and 1% levels are denoted by *, **, ***.

Table 7: Mark-ups and Firm Characteristics
Foreign Ownership

	OLS			FE		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A						
Domestic	-0.006	0.008	0.005			
	(0.069)	(0.070)	(0.063)			
TFP	2.256***	2.213***	1.467***	1.540***	1.356***	1.141***
	(0.124)	(0.119)	(0.216)	(0.123)	(0.122)	(0.136)
Domestic * TFP	-0.135	-0.167*	-0.202***	-0.012	-0.013	-0.032
	(0.086)	(0.085)	(0.075)	(0.068)	(0.066)	(0.063)
Sales		0.044**	0.354***		0.165***	0.313***
		(0.018)	(0.092)		(0.057)	(0.069)
Labor			-0.290***			-0.197***
			(0.038)			(0.037)
Capital			0.148***			0.158***
			(0.033)			(0.034)
Observations	4,290	4,290	4,290	4,290	4,290	4,290
Number of firms				1,456	1,456	1,456
Panel B						
Joint Foreign	0.089	0.084	0.038			
	(0.108)	(0.105)	(0.081)			
Fully Foreign	-0.058	-0.080	-0.039			
	(0.081)	(0.084)	(0.079)			
TFP	0.201	0.236*	0.244**	0.011	0.014	0.036
	(0.131)	(0.129)	(0.102)	(0.075)	(0.073)	(0.070)
Joint * TFP	0.082	0.114	0.166*	0.014	0.010	0.023
	(0.104)	(0.103)	(0.100)	(0.077)	(0.077)	(0.074)
Fully * TFP	2.120***	2.044***	1.267***	1.527***	1.343***	1.110***
	(0.096)	(0.091)	(0.199)	(0.105)	(0.107)	(0.123)
Sales		0.045**	0.353***		0.165***	0.313***
		(0.018)	(0.092)		(0.057)	(0.069)
Labor			-0.290***			-0.197***
			(0.037)			(0.037)
Capital			0.148***			0.158***
			(0.033)			(0.034)
Observations	4,290	4,290	4,290	4,290	4,290	4,290
Number of firms				1,456	1,456	1,456

Notes: Dependent variable: Log mark-up, Cobb-Douglas estimates with varying coefficients by 3 industry groups. Domestic is an indicator for firms that do not have any foreign participation in capital. Joint and Fully are indicators for firms with 1-99% and 100% of foreign ownership. Columns (1)-(3) include industry and year effects. Columns (4)-(6) include firm and year effects. SE in parentheses are clustered at the firm level. Significance at the 10, 5, and 1% levels are denoted by *, **, ***.

Table 8: Mark-ups and Firm Characteristics
Firm Age

	OLS				FE		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Age	-0.008***	-0.001	-0.002	-0.000			
	(0.001)	(0.002)	(0.002)	(0.002)			
TFP		2.126***	2.053***	1.218***	1.667***	1.446***	1.239***
		(0.099)	(0.094)	(0.179)	(0.137)	(0.135)	(0.149)
Age * TFP		0.002	0.002	0.002	-0.004	-0.006	-0.007*
		(0.002)	(0.002)	(0.002)	(0.004)	(0.004)	(0.004)
Sales			0.048**	0.382***		0.226***	0.368***
			(0.018)	(0.087)		(0.057)	(0.068)
Labor				-0.303***			-0.200***
				(0.037)			(0.034)
Capital				0.133***			0.163***
				(0.030)			(0.032)
Observations	4,424	4,424	4,424	4,424	4,424	4,424	4,424
Number of firms					1,063	1,063	1,063

Notes: Dependent variable: Log mark-up, Cobb-Douglas estimates with varying coefficients by 3 industry groups. Columns (1)-(4) include industry and year effects. Columns (5)-(7) include firm and year effects. SE in parentheses are clustered at the firm level. Significance at the 10, 5, and 1% levels are denoted by *, **, ***.

Table A1: Mark-ups and Firm Characteristics
Productivity, Size, and Capital Intensity
Translog Production Function

	OLS			FE		
	(1)	(2)	(3)	(4)	(5)	(6)
TFP	0.968***	0.782***	-0.139	1.023***	0.732***	0.599***
	(0.173)	(0.155)	(0.119)	(0.088)	(0.091)	(0.096)
Sales		0.077*	0.770***		0.257***	0.447***
		(0.046)	(0.062)		(0.050)	(0.052)
Labor			-0.420***			-0.258***
			(0.027)			(0.027)
Capital			-0.046*			0.077***
			(0.028)			(0.028)
Observations	5,533	5,533	5,533	5,533	5,533	5,533
Number of firms				1,604	1,604	1,604

Notes: Dependent variable: Log mark-up, Translog estimates with varying coefficients by 3 industry groups. Columns (1)-(3) include industry and year effects. Columns (4)-(6) include firm and year effects. SE in parentheses are clustered at the firm level. Significance at the 10, 5, and 1% levels are denoted by *, **, ***.

Table A2: Mark-ups and Firm Characteristics.
Capital Intensity of the Industry
Translog Production Function

	OLS			FE		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Low K/L						
TFP	1.675***	1.706***	0.758***	1.044***	0.846***	0.633***
	(0.165)	(0.130)	(0.158)	(0.169)	(0.165)	(0.200)
Sales		0.126***	0.513***		0.294***	0.438***
		(0.029)	(0.063)		(0.087)	(0.100)
Labor			-0.225***			-0.180***
			(0.028)			(0.058)
Capital			-0.064**			0.038
			(0.030)			(0.053)
Observations	1,016	1,016	1,016	1,016	1,016	1,016
Number of firms				285	285	285
Panel B: Medium K/L						
TFP	-0.104	0.500**	0.685***	0.739***	0.340*	0.837***
	(0.110)	(0.230)	(0.188)	(0.145)	(0.176)	(0.205)
Sales		-0.175***	0.523***		0.264**	0.406***
		(0.063)	(0.089)		(0.105)	(0.094)
Labor			-0.584***			-0.398***
			(0.029)			(0.053)
Capital			0.134***			0.200***
			(0.050)			(0.053)
Observations	2,148	2,148	2,148	2,148	2,148	2,148
Number of firms				582	582	582
Panel C: High K/L						
TFP	2.174***	1.730***	0.845*	1.809***	1.556***	1.455***
	(0.140)	(0.094)	(0.422)	(0.153)	(0.164)	(0.200)
Sales		0.209***	0.575***		0.202***	0.275***
		(0.057)	(0.188)		(0.073)	(0.101)
Labor			-0.264***			-0.117**
			(0.068)			(0.053)
Capital			0.016			0.114**
			(0.067)			(0.046)
Observations	2,369	2,369	2,369	2,369	2,369	2,369
Number of firms				756	756	756

Notes: Dependent variable: Log mark-up, Translog estimates with varying coefficients by 3 industry groups. Panels A, B, and C: Industries are split into Low, Medium and High Capital-Labor ratios at the industry level. Columns (1)-(3) include industry and year effects. Columns (4)-(6) include firm and year effects. SE in parentheses are clustered at the firm level. Significance at the 10, 5, and 1% levels are denoted by *, **, ***.

Table A3: Mark-ups and Firm Characteristics
Foreign Ownership
Translog Production Function

	OLS			FE		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A						
Domestic	0.275***	0.293***	0.147**			
	(0.083)	(0.084)	(0.059)			
TFP	1.046***	0.968***	0.225	0.982***	0.739***	0.653***
	(0.202)	(0.191)	(0.139)	(0.139)	(0.138)	(0.141)
Domestic * TFP	-0.086	-0.117	-0.213**	0.127	0.111	0.059
	(0.148)	(0.146)	(0.104)	(0.106)	(0.100)	(0.098)
Sales		0.046*	0.683***		0.215***	0.407***
		(0.026)	(0.053)		(0.060)	(0.062)
Labor			-0.401***			-0.260***
			(0.029)			(0.032)
Capital			0.004			0.081**
			(0.027)			(0.037)
Observations	4,290	4,290	4,290	4,290	4,290	4,290
Number of firms				1,456	1,456	1,456
Panel B						
Joint Foreign	-0.180*	-0.193*	-0.138*			
	(0.104)	(0.104)	(0.071)			
Fully Foreign	-0.345***	-0.367***	-0.153**			
	(0.101)	(0.103)	(0.073)			
TFP	0.196	0.226	0.238*	-0.092	-0.077	-0.028
	(0.196)	(0.196)	(0.130)	(0.116)	(0.110)	(0.110)
Joint * TFP	0.004	0.038	0.190	-0.186	-0.169	-0.112
	(0.168)	(0.161)	(0.131)	(0.123)	(0.117)	(0.112)
Fully * TFP	0.961***	0.851***	0.012	1.111***	0.852***	0.714***
	(0.160)	(0.132)	(0.112)	(0.098)	(0.106)	(0.111)
Sales		0.046*	0.683***		0.215***	0.407***
		(0.026)	(0.053)		(0.060)	(0.062)
Labor			-0.401***			-0.259***
			(0.029)			(0.032)
Capital			0.004			0.081**
			(0.028)			(0.037)
Observations	4,290	4,290	4,290	4,290	4,290	4,290
Number of firms				1,456	1,456	1,456

Notes: Dependent variable: Log mark-up, Translog estimates with varying coefficients by 3 industry groups. Domestic is an indicator for firms that do not have any foreign participation in capital. Joint and Fully are indicators for firms with 1-99% and 100% of foreign ownership. Columns (1)-(3) include industry and year effects. Columns (4)-(6) include firm and year effects. SE in parentheses are clustered at the firm level. Significance at the 10, 5, and 1% levels are denoted by *, **, ***.

Table A4: Mark-ups and Firm Characteristics
Firm Age
Translog Production Function

	OLS				FE		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Age	-0.008***	0.010***	0.010***	0.004*			
	(0.001)	(0.003)	(0.003)	(0.002)			
TFP		0.628***	0.537***	-0.075	0.767***	0.467***	0.489***
		(0.176)	(0.165)	(0.107)	(0.124)	(0.132)	(0.131)
Age*TFP		0.018***	0.018***	0.008***	0.012***	0.011***	0.004
		(0.003)	(0.003)	(0.002)	(0.004)	(0.004)	(0.004)
Sales			0.036	0.663***		0.276***	0.466***
			(0.028)	(0.054)		(0.061)	(0.061)
Labor				-0.397***			-0.264***
				(0.028)			(0.031)
Capital				-0.005			0.070**
				(0.026)			(0.034)
Observations	4,424	4,424	4,424	4,424	4,424	4,424	4,424
Number of firms					1,063	1,063	1,063

Notes: Dependent variable: Log mark-up, Translog estimates with varying coefficients by 3 industry groups. Columns (1)-(4) include industry and year effects. Columns (5)-(7) include firm and year effects. SE in parentheses are clustered at the firm level. Significance at the 10, 5, and 1% levels are denoted by *, **, ***.