The Relationship between Type of Contract and Firm Ownership Nationality: Evidence from Spain.*

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Abstract

This paper analyzes the differences on the proportion of temporary employees in the manufacturing sector according to firm ownership nationality. Using Spanish data from the ESSE for the period 1990 to 1999, the results show that there is a relationship between firms nationality and the labour conditions that firms offer even after controlling for a large number of observable firm characteristics. In particular, the share of temporary employees is significantly reduced in the case of foreign firms and the effect is smaller the larger the firm size. That may be due to differences in unobserved characteristics like the culture of every country that are reflected in the managerial style of each firm.

Keywords: Firm ownership nationality, fixed-term contracts, proportion of temporary employess.

JEL Classification Code: J23, C20, C24

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1 Introduction

Due to the high rate of unemployment in Spain at the beginning of the 80s, important changes were implemented in the Employment Protection Legislation (EPL), tending to the liberalization of fixed-term contracts (temporary employment). As a consequence, the proportion of temporary workers in total employment increased considerably up to the beginning of the 90s and kept relatively constant during all this decade.

The labour legislation was reformed again in 1994, 1997 and 2001. These reforms modified some conditions (basically the reduction of hiring and dismissal cost) of permanent contracts to make them less stringent and to restrict the use of temporary contracts, with the main objective of reducing the share of temporary workers through both the hiring of workers on a permanent basis and the conversion of contracts from temporary to permanent employment. Nevertheless, unemployment has remained about the same after fifteen years. Only since the end of the 90's the unemployment rate has started to decrease[1].

Considering that the proportion of temporary workers is twice greater for domestic firms, this paper analyzes if ownership nationality by itself can affect a firm's share of temporary employees, and thus the share of temporary employment in the host country, focusing on the Spanish manufacturing sector. Firms are classified as domestic or foreign according to their proportion of foreign capital.

Specifically, the objective of the paper is to answer if there is any relationship between firm nationality and the labor conditions firms offer, even after controlling for a large number of observable firm characteristics, and why the proportion of temporay workers is smaller for foreign firms than for

[1] Güell (2002) and Garibaldi & Mauro (2002), study these facts to many european countries, including Spain, and in general find a similar pattern in all countries.

domestic ones.

By answering these questions this work intends to identify whether the reasons for offering a different type of contract are associated with some observed firm's characteristics related to its productivity, such as activity, size, age, among others, or whether there are unobserved reasons, at least for the econometrician, related with firm nationality like the managerial style of every country.

Tobit and Double-Hurdle models are estimated to model the share of temporary employees using data from the Survey on Managerial Strategies (Encuesta sobre Estrategias Empresariales, ESEE) that includes a representative number of Spanish firms of the manufacturing sector, in the period 1990 to 1999.

The main finding of this paper is that there is strong evidence that foreign firms have a lower proportion of temporary workers than domestic firms in the Spanish manufacturing sector, after controlling for differences in firm's observed characteristics. This means that the large share of temporary employment may be due to unobserved characteristics like the culture of every country that are reflected in the managerial style of each firm.

The paper is organized as follows. The related literature is presented in Section 2, Section 3 shows some descriptive statistics to illustrate cross-country differences in permanent and temporary employment. The description and statistics of the sample used in the estimations are presented in Section 4 and Section 5 discusses the methodology to be employed. Finally, Section 6 presents the conclusions of the paper.

2 Related literature.

This paper relates to two main strands of literature. The first analyzes the determinants and consequences of the boom of temporary contracts, and

the second analyzes the differences in wages, productivity and worker skills among firms of different nationalities.

The consequences of temporary contracts on the Spanish labour market have been analyzed from different points of view in numerous papers. It is well known that permanent contracts are the standard way to offer incentives, but fixed-term contracts are cheaper. This generates a segmented labor market.

Spanish experience shows that together with the benefits of higher flexibility, there might be perverse effects on both efficiency and equity grounds. The existence of a segmented labour market has unexpected negative consequences such as lower investment in human capital, a more unequal distribution of unemployment duration**,** lower labour mobility and larger wage dispersion. Jobs in the segment of permanent contracts were characterized by greater job security resulting from high turnover costs and a strong unionism, while jobs in the segment of temporary contracts did not have such protections.

Güell (2002), points out that it is often argued that fixed-term contracts are "the price to pay to get full employment". But higher employment at the expense of segmentation of the labor market only arises if wages are very flexible. The idea is that perfect wage flexibility would be required in order for fixed-term contracts to eliminate the non-neutrality effect of firing costs, or else the two-tier system does not generate higher employment compared to the system with only permanent contracts. In addition, Güell found that the socially optimal renewal rate of fixed-term contracts into permanent contracts is larger than the private one. This means that the share of fixed-term contracts is too large from a social point of view.

Garibaldi & Mauro (2002) studied the differences of net employment growth across 21 OECD economies. They find that although a policy package (low taxation and low dismissal costs) is associated with high net em-

ployment growth and can account for a substantial share of cross-country differences, temporary jobs replace permanent jobs, with small net effects on net employment growth.

Blanchard & Landier (2002) argue that the main effect of allowing firms to hire workers on fixed–term contracts may be high job turnover and said that even if unemployment falls, workers may be worse off, going through spells of unemployment and entry–level jobs several times before obtaining a regular job.

The arguments against fixed-term contracts would loose importance if these become permanent as time elapses. Following this reasoning Güell & Petrongolo (2005) studied the rate of conversion of fixed-term contracts into permanent ones in Spain and found that conversion rates are generally below 10% and that they vary a little with tenure and with the legal possibility to retain the worker on a temporary contract. Amuedo-Dorantes (2002) finds that wage and dismissal cost reductions for permanent workers have virtually no impact on contract conversions, which primarily respond to employers' flexibility needs and unions' pressures for increased employment stability.

Amuedo-Dorantes (2002) also analyses the determinants of Spanish employers' reliance on temporary workers. She finds that the main determinants of the proportion of temporary workers are employment costs, specifically the wage-ratio between temporary and permanent workers and current firing costs. The collective bargaining and the short-run employment growth expectations are other relevant determinants of that proportion.

However, the reasons why the share of temporary workers continue to be so high in spite of the efforts of politics has not been studied in depth. From this point of view, Dolado, García-Serrano & Jimeno (2002) find that the policy reversal regarding EPL reforms does not reduce the proportion of temporary employees in the aggregate because this share in the public sector has increased more than the fall in the private sector.

On the other hand, there is a wide literature trying to explain the differences among firms of different nationalities with respect to productivity, wages and worker skills, but more studies are needed, specially for the Spanish case, where these topics have not been explored jet.

The general conclusions are that foreign firms have significantly higher labour productivity than domestic ones, that the proportion of skilled workers is higher in foreign firms, and that they pay higher wages for employees of similar skills.

Griffith & Simpson (2001) studied these facts for the British manufacturing sector over the period 1980 to 1996, and found that establishments that are always foreign-owned have significantly higher labour productivity than those that remain under domestic ownership. Additionaly, in foreign-owned establishments, labour productivity improves faster over time and with age, and the proportion of skilled workers and wages are higher in line with differences in labour productivity.

Conyon, Sourafel, Thompson & Wright (2002) provide a empirical analysis for the United Kingdom manufacturing industry for the period 1989 to 1994, the results show that foreign firms pay equivalent employees 3.4% more than domestic firms, attributable to their higher levels of productivity.

Zadia & Lidsey (1999) base their study in all economy sectors of the United States over the period 1987-1992 and find that foreing-owned establishments pay higher wages, and even though the difference is mainly related to industry composition, there are also differences within industries. For example, within manufacturing, the difference is due to establishment, state and industry characteristics, but in other industries the differences in average wages remain even when these other determinants are taken into account.

Görg, Strobl & Walsh (2002), using data of the manufacturing sector in Ghana in 1987 show that the foreign wage premium is only acquired by workers over time spent in the firm and only by those that receive on the job

training.

With respect to firms that change ownership nationality the conclusions are not all in the same direction. Huttunen (2005) finds, for Finnish firms, that foreign acquisition has a positive effect on wages many periods after the acquisition and that acquired plants reduce the share of highly educated workers in their employment. Griffith & Simson (2001) find for British firms, that firms that change of nationality do not seem to experience very large changes in labour productivity levels. Almeida, 2003 shows that Portuguese firms that are acquired are those with a more educated workforce and that are very similar to the group of existing foreign firms. Following the foreign acquisition, there are no significant changes in the workforce educational composition and the increases in wages are small. Sourafel (2003) performs a more detailed study for UK electronics and food industries over the period 1980 to 1994 and concludes that there is substantial heterogeneity in the post-acquisition wage effect depending on the nationality of the foreign acquirer, the industry in which the firms operate and the skill group of workers.

3 Employment Facts

This section shows labor market indicators for selected European countries and the United States. Its purpose is to compare Spain with other countries and to show some special characteristics of its labor market to understand why this is an interesting case.

Table I reports a set of indicators on the stringency of national legislation on EPL for some OECD countries normalized to range from 0 to 6, with higher scores representing stricter regulation.

The indicators show that Spain is one of the countries with stricter regulation since 1990 with respect to regular employment, while considering the temporary contracts Spain is one of the countries with weaker regulation.

The evolution of these indicators shows that the last labour market reforms provided a less stringent EPL for permanent contracts and considerable restrictions for the use of fixed-term contracts.

Table II reports the average employment and unemployment rates and the share of temporary employment in the 1980s, 1990s and from 2000 to 2004 for 26 OECD economies. It shows that Spain has relatively the worst performance. It has the smallest employment rate and the highest unemployment rate in the first two decades although the situation improved in the third period analyzed. Considering the proportion of temporary workers, Spain has the highest proportion in all periods. Moreover, in the second and third periods the share of temporary employment was approximately 10% higher than the in first period.

The proportion of temporary workers in total employment increased in the second half of the 1980s, exceeding 30% in 1991 and staying above this level until the current period. Thus, despite the labour market reforms the share of temporary employees has only marginally declined.

At the end of the 1990s the employment growth resurged in many European economies. Garibaldi & Mauro (2002) argue that this it is related to the acceleration of labour market reforms and they conclude that in Spain both temporary and permanent contracts have contributed to that resurgence.

4 Data description

4.1 *The sample*

The dataset used in this paper is the Survey on Managerial Strategies (Encuesta sobre Estrategias Empresariales, ESEE) designed by the Economic Research Program (Programa de Investigaciones Económicas) of the Foundation of Public Enterprise (Fundación de Empresa Pública). The sample

consists of an unbalanced panel of 3,151 firms belonging to the Spanish manufacturing sector in the period 1990 to 1999.

The sample is cleaned by droping all observations [corresponding to years] with missing values for some variable used in the regressions and by considering only firms with at least two consecutive observations. The cleaned sample has 2,448 firms and 14,810 observations.

The survey is national in scope and the sample is representative of the universe of manufacturing establishments with a certain size. The sample has been selected by crossing activity sectors and size intervals, where size is determined by the number of workers. Two subpopulations have been distinguished, one formed by firms with more than 200 workers, and the other by firms with 10 to 200 workers. For the first subpopulation the sample selection was exhaustive. For the second subpopulation, the sample was selected by random sampling of the crossing between 18 activities and four employment size intervals.

4.2 *Description of variables and sample statistics*

The dependent variable is the share of temporary employees in total employment. Temporary and full-time permanent workers are measured by the simple average of the quarterly number of temporary employees when there has been significant variation, or alternatively the number of employees at the end of the year when the firm reports that this number has not changed much. Part-time permanent workers are measured by the number of workers at the end of the year. Total employment is the sum of temporary workers, full-time permanent workers and one half of the part-time permanent workers.

The main explanatory variable is firm nationality. Firms are classified as domestic or foreign at each moment of time, depending on their proportion

of foreign capital, thus the firm nationality is a dummy variable that takes the value one if a firm is foreign and zero if a firm is domestic. A firm is considered foreign its proportion of foreign capital is greater or equal to 50%.

In an alternative exercise, the proportion of foreign capital is considered as the main explanatory variable, instead of the dummy variable. This allows to test the robustness of the results to the definition of nationality, since in this case the result does not depend on the limiting value of the proportion of foreign capital determining firm nationality.

Other explanatory variables used are firm activity, firm size, the region where the firm is located, firm age, the capital-labour ratio and the proportion of engineers and bachelors with respect to total employment. This last variable is reported only at the end of every fourth year. Activity is classified in 18 manufacturing sectors according to the 3-digit CNAE classification. The size of a firm is measured by the number of workers, 3 intervals of size are considered: 10 to 50, 51 to 200 and more than 200 workers. There are 17 regions that correspond to the autonomous communities of Spain. A firm's capital is measured by the net real capital in equipment goods.

Taking into account that each firm is classified as domestic or foreign in each year, a particular firm can change its nationality during the period it is observed and its behavior in a determined year could be influenced by its nationality in the previous year. Therefore to control for that effect additional explanatory variables are included: a dummy to identify the first two years after a firm changes its nationality from domestic to foreign and a dummy to identify the first two years after a firm changes its nationality from foreign to domestic.

Other variables are considered in a robustness analysis, like the proportion of owners and family of owners in the firm's management and administration (to control for the possible effect of family business on the type of contracts offered), and the annual cost of debt to financial institutions in the long-run

and in the short-run (to reflect the financial situation of a firm).

Table III shows the distribution of firms according to nationality. Of a total of 14810 observations, 81.90% represents domestic ownership, and 18.10% foreign ownership. Most of the 2448 firms in the sample (93%) never change nationality. Finally, firms that change nationality have more or less the same number of observations for each nationality.

Table IV shows the mean and standard deviation of the continuous variables used in the estimations. The most important observation is that the proportion of temporary employees (Pte) is nearly twice higher for domestic firms (26%) than for foreign firms (14%).

It is interesting to analyze these statistics for the firms that change nationality. Domestic firms that were foreign before have a lower Pte that the rest of domestic firms, and foreign firms that were domestic before have a higher Pte than the foreign firms that never changed nationality. This means that firms are influenced by their past nationality, reflecting that it takes time for them to adjust to their new structure.

Table V shows the distribution of firms according to size. Domestic firms are in general small firms (63% have less than 50 workers) and foreign firms are large (69% have more than 200 workers). For both type of firms, the proportion of temporary employees is decreasing in size. Finally, for each size, the proportion of temporary employees is larger for domestic firms than for foreign firms.

Table VI shows the distribution of firms according to their location. Independently of nationality, firms prefer to be located in regions like Catalunya or Madrid. Valencia is also a region chosen by a large proportion of domestic firms. We also observe that for nearly all regions the proportion of temporary employees is larger for domestic firms.

Finally, Table VII shows the distribution of firms according to their main activity. The first observation is that domestic and foreign firms dedicate to

different activities. Out of the activities with more than 8% of firms, only Food and tobacco is shared as a main activity by both type of firms. Domestic firms are mostly dedicated to textiles, metal products and food and tobacco, while foreign firms are mostly dedicated to chemical products, electronic and electrical equipment and vehicles, cars and motors. The second observation is that for all activities the proportion of temporary employees is higher for domestic firms than for foreign ones.

5 Methodology

Taking into account the differences in the proportion of temporary workers between foreign and domestic firms, previously shown, the main objective of the following empirical analysis is to determine if there is a causal relationship[2] between firm ownership nationality and the share of temporary employees, after controlling for observed characteristics.

5.1 Empirical models

Firms have to decide how many temporary and permanent contracts to offer depending on their optimum input decision arising from the profit maximization problem. The decision of the firm can be modelled in two alternative ways: (1) the firm analyzes the characteristics of each worker and, depending also on the firm characteristics, decides the optimal contract for this worker, and (2) depending on its characteristics, a firm decides how many contracts of each type it will offer and then looks for workers in the market to fill this demand.

The first modelling alternative leads to grouped data modelling. In this

[2] Causal relationship in the sense that we try to obtain the true exogenous effect of firm nationality on the proportion of temporary workers.

case, for each firm,j, the observed dependent variable is the proportion P of the n_j individuals with Y_{ij} equal to one, where Y_{ij} is sampled from a Bernoulli population and equals one if the individual has a temporary contract and zero otherwise. Under the second modelling alternative the proportion itself is considered as a single observation extracted randomly from a distribution of proportions.

5.1.1 Grouped data model

Let's consider a dummy variable Y, such that:

$$Y_{ij} = \begin{cases} 1 & \text{if worker } i \text{ has temporary contract} \\ 0 & \text{if worker } i \text{ has permanent contract} \end{cases}$$

where Y_{ij} is sampled from a Bernoulli population, $j = 1, ... N$, $i = 1, ... n_j$.

The type of contract the firm will offer to each worker depends on its own characteristics, x_j. Thus, the model can be written as follows:

$$Y_{ij} = \begin{cases} 1 & if \quad x_j'\beta + \varepsilon_{ij} \geq 0 \\ 0 & if \quad x_j'\beta + \varepsilon_{ij} < 0 \end{cases} \tag{1}$$

Where the ε_{ij}'s are independent and identically distributed errors with mean zero. $F(x_j'\beta)$ is the cummulative density function of ε_{ij}, where F could be the normal density function.

The proportion is constructed from the Y_{ij}, thus for each firm:

$$Pte_j = \frac{\sum_{i=1}^{n_j} Y_{ij}}{n_j} \tag{2}$$

$$\begin{aligned} E(Pte_j/x_j) &= E\left(\frac{\sum_{i=1}^{n_j} Y_{ij}}{n_j}/x_j\right) = \frac{\sum_{i=1}^{n_j} E(Y_{ij}/x_j)}{n_j} = E(Y_{ij}/x_j) \\ &= \Pr(Y_{ij} = 1/x_j) = \Pr(\varepsilon_{ij} < x_j'\beta/x_j) = F(x_j'\beta) \end{aligned} \tag{3}$$

Therefore, we can write the model like this:

$$Pte_j = F(x_j'\beta) + e_j \tag{4}$$

where

$$E(e_j/x_j) = 0 \tag{5}$$

and

$$V(e_j/x_j) = V\left(\frac{\sum_{i=1}^{n_j} Y_{ij}}{n_j}/x_j\right) = \frac{V(Y_{ij}/x_j)}{n_j} = \frac{F(x_j'\beta)[1 - F(x_j'\beta)]}{n_j} \tag{6}$$

The likelihood function of firm j is:

$$\begin{aligned} L_j &= \prod_{t=1}^{T} \left\{ F(x_j'\beta)^{\frac{\sum Y_{ij}}{n_j}} [1 - F(x_j'\beta)]^{\frac{nj - \sum Y_{ij}}{n_j}} \right\}^{n_j} \\ &= \prod_{t=1}^{T} \left\{ F(x_j'\beta)^{Pte_j} [1 - F(x_j'\beta)]^{1 - Pte_j} \right\}^{n_j} \end{aligned} \tag{7}$$

The log-likelihood function of N firms is:

$$\mathcal{L} = \sum_{j=1}^{N} \sum_{t=1}^{T} n_j \left\{ Pte_j \log F(x_j'\beta) + (1 - Pte_j) \log[1 - F(x_j'\beta)] \right\} \tag{8}$$

5.1.2 Proportion data model

If we think that the decision of the firm is about the proportion of temporary workers[3] we have to take into account that we face a corner solution problem

[3]Recall that the firm decides over the aggregate number of workers, not over an specific individual.

since the dependent variable lies between 0 and 100. In this case the models that can be applied are the Tobit model or the Hurdle model (also known as two-tier model).

In the standard Tobit model a single mechanism determines the choice between Pte_j equal zero and Pte_j greater than zero and the amount of Pte_j given that Pte_j is greater than zero. The Hurdle model allows the initial decision of entry or not into the market of temporary employees to be separated from the decision of how many temporary contracts to offer given that Pte_j is greater than zero.

The Tobit model that allows for both left and right censoring of Pte_j in the range [0,100] is:

$$Pte_j^* = x_j'\beta + \mu_j \tag{9}$$

where $\mu_j/x_j \sim Normal(0, \sigma^2 I_T)$, Pte_j^* is unobservable, what we observe is:

$$Pte_j = \begin{cases} 0 & if \quad Pte_j^* \leq 0 \\ Pte_j^* & if \quad 0 < Pte_j^* < 100 \\ 100 & if \quad Pte_j^* \geqslant 100 \end{cases} \tag{10}$$

The likelihood function of firm j is:

$$\begin{aligned} L_j \quad = \quad & \prod_{t=1}^{T} \left\{ \left[\frac{1}{\sigma} \phi \left(\frac{Pte_j - x_j'\beta}{\sigma} \right) \right]^{1[0<Pte_j<100]} \Phi \left(\frac{-x_j'\beta}{\sigma} \right)^{1[Pte_j=0]} \right. \\ & \left. \left[1 - \Phi \left(\frac{100 - x_j'\beta}{\sigma} \right)^{1[Pte_j=100]} \right] \right\} \end{aligned} \tag{11}$$

where ϕ is the standard normal density function and Φ the cumulative distribution function.

The log-likelihood function for N firms is:

$$\mathcal{L} = \sum_{j=1}^{N}\sum_{t=1}^{T}\left\{1[0<Pte_j<100]\log\left[\frac{1}{\sigma}\phi\left(\frac{Pte_j-x_j'\beta}{\sigma}\right)\right]+\right. \tag{12}$$
$$\left.+1[Pte_j=0]\log\Phi\left(\frac{-x_j'\beta}{\sigma}\right)+1[Pte_j=100]\log\left[1-\Phi\left(\frac{100-x_j'\beta}{\sigma}\right)\right]\right\}$$

It is important to recall that in corner solution applications we are interested in features of the distribution of Pte given x, such as $E(Pte/x)$and $P(Pte=0/x)$, thus:

$$E(Pte_j/x_j) = 100*\left[1-\Phi\left(\frac{100-x_j'\beta}{\sigma}\right)\right] \tag{13}$$
$$+ \left[\Phi\left(\frac{100-x_j'\beta}{\sigma}\right)-\Phi\left(\frac{-x_j'\beta}{\sigma}\right)\right]*\left[x_j'\beta+\sigma\frac{\phi\left(\frac{-x\prime_j\beta}{\sigma}\right)-\phi\left(\frac{100-x\prime_j\beta}{\sigma}\right)}{\Phi\left(\frac{100-x\prime_j\beta}{\sigma}\right)-\Phi\left(\frac{-x\prime_j\beta}{\sigma}\right)}\right]$$

A two-tier model for a corner solution variable is:

$$Pr(Pte_j=0/x_j)=1-\Phi\left(x_j'\delta\right) \tag{14}$$

$$log(Pte_j)/(x_j,Pte_j>0)\sim Normal(x_j'\beta,\sigma^2_{\log y}I_T) \tag{15}$$

The first equation (entry equation) determines the probability that Pte_j is zero and the second equation (level-of-use equation) says that, conditional on $Pte_j>0$, Pte_j/x_j follows a lognormal distribution.

The likelihood function of firm j is:

$$L_j=\prod_{t=1}^{T}\left[1-\Phi\left(x_j'\delta\right)\right]^{1[Pte_j=0]}\left\{\Phi\left(x_j'\delta\right)\frac{\phi\left[\frac{log(Pte_j)-x_j'\beta}{\sigma}\right]}{Pte_j\sigma}\right\}^{1[Pte_j>0]} \tag{16}$$

The log-likelihood function of N firms is:

$$\mathcal{L} = \sum_{j=1}^{N}\sum_{i=1}^{T}\left\{1[Pte_j=0]*log\left[1-\Phi\left(x_j'\delta\right)\right]+ \right. \tag{17}$$
$$\left. 1[Pte_j>0]\left[log\Phi\left(x_j'\delta\right)-log(Pte_j)-\frac{1}{2}log(\sigma^2)-\frac{1}{2}log(2\pi)-\frac{1}{2}\frac{\left[log(Pte_j)-x_j'\beta\right]^2}{\sigma^2}\right]\right\}$$

What is interesting in this case is the following:

$$E(Pte_j/x_j, Pte_j>0)=\exp\left(x_j'\beta+\frac{\sigma^2}{2}\right) \tag{18}$$

5.2 Estimation strategy

The grouped data approach is not useful because it has important drawbacks for our case. First, the assumption of i.i.d. Y_{ij} is hard to support because the type of contract offered to an individual may depend on what the firm offers to the rest of workers, and also because in this case n_j represents all the potential respondents in firm j rather than a random sample of respondents. Second, under this approach the unit of analysis would be the employee, but there are not employee-specific variables available in the sample to take advantage of this.

For these reasons I use the proportion data approach. Specifically, Tobit and Double-Hurdle model are estimated.

It can be thought that a better alternative to the hurdle model is the Heckman two-step model because it allows correlation between the two equations and a priory looks like a more general model.

To understand why in this case it is more appropriate or at least more reliable to use the hurdle model it is necessary to take into account that in the two-tiered model, the level-of-use equation models the conditional distribution of the actual outcome, while in the selection model the same

equation models the unconditional distribution of the potential outcome. This means that the Heckman model is more appropriate when the goal is to analyze an underlying regression model or to predict the value of the dependent variable that would be observed in the absence of selection, and the two-tiered model is usually the better choice when the goal is to predict an actual response. In other words, the coefficients for the two models are incomparable.

On the other hand, the selection model is not numerically well behaved, even when it is the true model, unless there are non-trivial exclusion restrictions. Moreover, if the explanatory variables are the same in both equations the coefficients are identified only due to the nonlinearity of the inverse Mills ratio. But if $x_j'\delta$ does not have much variation in the sample, then the estimated inverse Mills ratio can be approximated well by a linear function of x and this means that the regressors will be severely collinear. Thus, this model depends strongly on the model being correct and the two-tiered model is generally more stable in cases where the data are problematic (Manning, Duan and Rogers, 1987; Wooldridge, 1999)[4].

Taking into account the characteristics of the data used and the goal of this work, it is more appropriate to use the Hurdle model instead of the Heckman specification.

In conclusion, the Tobit and Hurdle models are estimated, in which the dependent variable is the share of temporary employees of each firm at each period of time denoted by Pte_{jt}, the main explanatory variable is the firm nationality (n_{jt}) and the others covariates are dummy variables such as change of nationality (cn_df_{it} and cn_fd_{it}), activity (a_{jt}), location (r_{jt}) and year

[4]Using a Monte Carlo analysis Manning, Duan and Rogers (1987) also find that if one knows the true specification but does not estimate the correlation, the predictions using a hurdle model are nearly unbiased on average and if one does not know the true specification, the overall prediction bias in the hurdle model is negligible.

(y_{jt}), and continuous variables as the capital-labour ratio (ik_{jt}), age (age_{jt}) and age squared (age^2_{jt}) and the proportion of engineers and bachelors (peb_{jt}).

As there are considerable differences among firms of different size, the estimations are performed individually by size interval to appreciate better the effect of firm nationality.

The estimated regression in the *Tobit* case is,

$$\begin{aligned} Pte_{jt} &= \beta_0+\beta_1 n_{jt}+\beta_2 cn\_df_{it}+\beta_3 cn\_fd_{it}+\beta_4 peb_{jt}+\beta_5 a_{jt}+ \\ &\quad +\beta_6 r_{jt}+\beta_7 y_{jt}+\beta_8 ik_{jt}+\beta_9 age_{jt}+\beta_{10} age^2_{jt}+\mu_{jt} \end{aligned} \tag{19}$$

where μ_{jt} are idiosyncratic disturbances (because these change across t as well as across j), $\mu_{jt}/x_{jt} \sim N(0,\sigma^2_\mu)$[5].

In the *Hurdle* case the MLE of δ is simply the Probit estimator using $w = 1[Pte_j > 0]$ as the binary response and the MLE of β is just the OLS estimator from the regression $log(Pte_j)$ on x_j using those observations for which $Pte_j > 0$, so the equations to be estimated are:

$$\begin{aligned} \Pr(w_{jt}=1/\mathrm{x}) = &\quad \delta_0+\delta_1 n_{jt}+\delta_2 cn\_df_{it}+\delta_3 cn\_fd_{it}+\delta_4 peb_{jt}+ \\ &+\delta_5 a_{jt}+\delta_6 r_{jt}+\delta_7 y_{jt}+\delta_8 ik_{jt}+\delta_9 age_{jt}+\delta_{10} age^2_{jt}+\epsilon_{jt} \end{aligned} \tag{20}$$

$$\begin{aligned} \ln Pte_{jt} &= \gamma_0+\gamma_1 n_{jt}+\gamma_2 cn\_df_{it}+\gamma_3 cn\_fd_{it}+\gamma_4 peb_{jt}+\gamma_5 a_{jt} \\ &\quad +\gamma_6 r_{jt}+\gamma_7 y_{jt}+\gamma_8 ik_{jt}+\gamma_9 age_{jt}+\gamma_{10} age^2_{jt}+\varepsilon_{jt} \quad \text{if} \quad Pte_{jt} > 0 \end{aligned} \tag{21}$$

where ε_{jt} and ϵ_{jt} are idiosyncratic disturbances, $\varepsilon_{jt}/x_{jt} \sim N(0,\sigma^2_{\log y})$ and $\epsilon_{jt}/x_{jt} \sim N(0,\sigma^2_\epsilon)$.

In principle it is assumed that there is not correlation between the errors and the covariates, x_{jt}, considered in equations *(19)*, *(20)* and *(21),* in other

[5]The $\{\mu_{jt} : t = 1,...T\}$ are allowed to be serially correlated and it is not necessary to assume strict exogeneity of x_{it}.

words, the x's are considered exogenous. Under this assumption the estimates obtained through pooled regressions will be consistent.

However, it is reasonable to think that there is a firm-specific time-invariant unobserved heterogeneity (η_j) correlated, at least, with the main variable of interest (n_{jt}). Then, there will be an endogeneity problem that would imply that those estimators will be biased.

In order to solve this endogeneity problem it is necessary to use fixed effects models. In a linear case, like equation *(21)*, is possible to obtain fixed-T consistent estimators, through the estimation of transformed models, like OLS in deviations with respect to the mean or GLS in the first difference model[6]. However, in the case of non-linear models, like equations *(19)* and *(20)*, to obtain fixed-T consistency many conditions are needed that are satisfied only in some specific cases, like the conditional MLE for the static panel logit model and Honoré and Kyriazidou's (2000) estimator for the dynamic panel logit model, therefore there are no general solutions.

It is also possible to apply correlated random effect approach, although it is more restrictive than the fixed effect approach in the sense that it is necessary to assume some distributional form of the unobserved component that relates the covariates with the unobserved component.

However, taking into account that in the dataset considered the main explanatory variable, both the dummy and the continuous specifications, has not much temporal variation, and that the same happens to the other covariates, the estimated coefficients through fixed or correlated random effects methods will not be accurate.

Another way of obtaining a causal effect of the covariates is by using the IV approach. This would allow us to control for the possible correlation between the covariates and the time-invariant component of the error term

[6]OLS in first difference models gives consistent estimates of the parameters, but not efficient because there will be correlation between the errors.

(η_j) but also between the covariates and the time-variant component of the error. The problem in this context is to find a suitable instrument to the firm's nationality.

Taking into account that it is impossible to obtain fixed-T consistent estimators, an attractive approach is to apply some method that corrects the MLE to reduce the bias from $O(T^{-1})$ to $O(T^{-2})$. A simple one is the numerical method called Panel Jackknife[7]. The jackknife estimator is:

$$\widetilde{\theta} = T\widehat{\theta} - (T-1)\frac{\sum_{t=1}^{T}\widehat{\theta}_{(t)}}{T} \tag{22}$$

Where $\widehat{\theta}_{(t)}$ is the fixed effect estimator based on the subsample excluding the observations of the tth period.

For these reasons, pooled regressions appear as the best estimation alternatives. In addition, jackknife estimators are calculated, to obtain estimators with lower bias in case there exists an unobservable firm specific component correlated with the firm's nationality.

A model selection test for non-nested models is performed to determine which model, Tobit or Hurdle, is more suitable for each size. This test was developed by Quang, Vuong (1989) and can be performed with the following statistic:

$$\Gamma = \frac{NT^{-1/2}\left[\mathcal{L}^{T}(\widehat{\beta}) - \mathcal{L}^{DH}(\widehat{\gamma})\right]}{\widehat{\omega}} \tag{23}$$

where $\widehat{\omega} = \left[\frac{1}{NT}\sum_{j=1}^{N}\sum_{t=1}^{T}\left(\ln L_{jt}^{T} - \ln L_{jt}^{DH}\right)^2 - \left[\frac{1}{NT}\sum_{j=1}^{N}\sum_{t=1}^{T}\left(\ln L_{jt}^{T} - \ln L_{jt}^{DH}\right)\right]^2\right]^{1/2}$, $\mathcal{L}^{T}(\widehat{\beta})$ is the log-likelihood of the Tobit model, $\mathcal{L}^{DH}(\widehat{\gamma})$ is the log-likelihood of the Double-Hurdle model and NT is the total number of observations.

[7] Quenouille (1949) first proposed the idea of the jackknife for estimation of bias, while Tukey (1958) gave it its name.

The null hypothesis (H_0) is that it is not possible to discriminate between the two competing models given the data. Under H_0, $\Gamma \xrightarrow{d} N(0,1)$. For a critical value "$z_\alpha$" for a some significance level, α, if the value of the statistic Γ is higher than z_α then one rejects the null hypothesis that the models are equivalent in favor of the Tobit being better than the Double-Hurdle model. If Γ is smaller than $-z_\alpha$ then one rejects the null hypothesis in favor of the Double-Hurdle model. Finally, if $|\Gamma| \leq z_\alpha$, then one cannot discriminate between the two models.

6 Results

The estimations are performed by size interval and the marginal effects are reported instead of the estimated coefficients. Table VIII reports the results of the estimation of Hurdle and Tobit models by firm size. The Tobit estimates of firm nationality are negative and significant at the 1% level for all size categories. The marginal effect of having foreign nationality is to decrease the share of temporary employees in 7.27% for small firms, 6.73% for medium firms and 2,87% for large firms. Therefore the effect is smaller the larger the size.

The effect of the change in nationality is positive although it is only significant for the largest firms and when the change is from domestic to foreign. The effect of the change in nationality during the first two years following the change is to increase 4.36% the share of temporary workers. This is larger than the effect of nationality, meaning that the latter effect is cancelled for firms that change nationality. Therefore, the foreign firms that were domestic one or two years ago have a greater proportion of temporary workers than the firms that never changed nationality. Possibly this firms are strongly affected by their past nationality, and need time to adjust to their new needs or customs.

With respect to the Hurdle model, the results of the entry equation show that being a foreign firm decreases the probability of entering the fixed-term contracts market in 0.93% for small firms and in 0,69% for medium firms. The effect for large firms is not significant, thus ownership nationality has no effect in the decision to offer temporary contracts or not. Nevertheless, the change of nationality from domestic to foreign is significant for this group, a foreign firm that was domestic before has a 0.36% higher probability of entering the temporary market.

The level-of-use estimates of firm nationality are also negative and significant at the 1% level for all sizes, and the effect is also smaller the larger the size. In this case the marginal effect of having foreign nationality is to decrease the share of temporary employees in 11.11% for small firms, 7.86% for medium firms and 2,06% for large firms, therefore, the effect is greater than the previous case for the first two size categories and smaller for the third.

The effect of the change nationality is similar than for the Tobit case.

Other interesting results are that the effect of capital intensity is negative and significant but small for medium and large firms, and the effect of the proportion of engineers and bachelors is also negative but significant only for the largest firms in the Tobit case and for the small and medium firms in the level-of-use equation of the Hurdle model The entry equation, on the other hand, determines that when this last proportion increases, the probability of entry also increases.

In conclusion, the estimations by both Tobit and Two-tiered regressions, show that the estimated coefficient on nationality is negative and strongly significant, supporting, at least under the assumptions of these models, the hypothesis that there is a causal relationship between the firm's ownership nationality and its share of temporary employees.

Although, the results are preliminary, the jackknife estimators are very

similar to the other estimators, being in the most cases slightly larger a bit greater, for both the discrete and continuous specifications of firm nationality. For example, in the discrete case, the tobit coefficients are -9.93, -8.57 and 3.50 for small, medium and large firms respectively, while the jackknife coefficients are -10.73, -8.66 and -3.50. In the double-hurdle model, the entry equation coefficients are -0.28, -0.31, and -0.1, while the jackknife coefficients are -0.31 for small and medium firms and -0.1 for large firms. For the level of use equation the coefficients for small, medium and large firms are respectively -0.36, -0.38, and -0.11, while the jackknife are -0.39, -0.38 and -0.11.

Model selection tests described in Section 5.2, determine that the Double-Hurdle model is better for medium or large firms and the Tobit model is better for small firms. The test statistics are $\Gamma_S = 4$, 57 for small firms, Γ_M = -2.78 for medium-size firms and Γ_L = -2.79 for large firms, thus the null hyphoteses are rejected in all cases at the 1% level of significance, but in the first case it is rejected in favour of the Tobit model, while in the other cases it is rejected in favour of the Double-Hurdle model.

6.1 Robustness of the Estimation

As stated in section 3.2, similar regressions were estimated using as explanatory variable the proportion of foreign capital (pfk). The results reinforce previous evidence. In the Tobit model, an increase in the proportion of foreign capital of 10% implies an estimated decrease in the share of temporary workers of 0.61% for small firms, 0.71% for medium firms and 0.26% for large firms. For the level-of-use equation of the Hurdle model, these figures amount to 1.33% for small firms, 0.96% for medium firms and 0.19% for large firms. This means that the results are robust to the definition of nationality.

The robustness of the estimations has been tested further by adding new

variables: the proportion of owners and family of owners in the firm´s management and administration (*pown*) and the annual cost of debt to financial institutions in the Long-run (*cdlr*) and in the Short-run (*cdsr*). The results are included in Table IX in the appendix. The inclusion of these variables in both models, and under the two alternative specifications for the main explanatory variable (ownership nationality), lead to similar conclusions than before.

In the Tobit case the effect of firm nationality is to decrease the share of temporary workers in 6.85%, 6% and 1.86% for small, medium and large firms , and in the level-of-use equation these effects are 10.42% and 6.18% for small and medium firms respectively, and 1,29% for large firms with a level of significance of 10%. The effect of pown is significant and positive except for small firms in the Tobit case, where is small and negative.

In addition, the effect of the cost of debt in the long-run is generally positive for both models. However, the effect of the cost of debt in the short-run is positive for the smallest firms and negative for the largest ones.

With respect to the entry equation, the probability of entering the temporary contracts market is only negatively affected by foreign nationality for small firms. The probability of entry for large and medium firms is not affected by any of the included variables (except for a small positive effect of cdlr in large firms). The probability of entry for small firms is affected negatively by pown and positively by cdlr and cdsr.

7 Conclusions

This paper uses Tobit and Hurdle models to analyze the effect of firm nationality on the share of temporary employees, controlling by a large number of covariates representing firm characteristics like age, region, activity and financial situation, among others.

The results obtained show that there is a significant relationship between the firm's ownership nationality and the labour conditions that firms offer. In particular, a firm's share of temporary employees is significantly reduced in the case of foreign firms. This effect is larger for small and medium firms. The largest firms are affected also by the change of nationality: foreign firms that were domestic one or two years before the change have a greater proportion of temporary workers than foreign firms that never changed nationality. This results are robust to the definition of nationality.

Therefore, there is evidence in favour of the hypothesis that the lower proportion of temporary contracts observed in foreign firms is not caused by firm and industry characteristics such as activity, size or region, but on the managerial style of the home country, that affects the way in which each firm organizes its structure; or anyelse unobservable characteristic, at least to the econometricians.

To understand what we mean by managerial style, we can think that Spanish employers and managers, could be more risk averse and for this reason want to adapt faster to fluctuations in demand or productivity. This may be why Spanish firms want more flexibility in the labor contracts (hiring of workers).

There is evidence supporting this hypothesis. First, Amuedo-Dorantes (2002) finds that a determinant for employers to hire temporary workers is the need to adapt to fluctuations in the workload due to market factors, vacancies, leaves, and special tasks. Second, foreign and domestic firms have a similar total number of hours per worker, but the composition of these hours is different: foreign firms have less regular hours and more overtime hours. This means that foreign firms prefer to adapt to fluctuations using the permanent workers more, while domestic ones prefer to adjust through the use of temporary workers.

Another difference in the managerial style could be reflected by differences

in the intertemporal discount rate or in the time horizon that firms take into account to make decisions.

These are the reasons why domestic firms prefer the flexibility of temporary contracts and foreign firms the greater productivity or experience of permanent contracts.

Finally, it would be interesting to control for the presence of an unobservable component correlated with firm nationality, but the nature of the explanatory variables and the lack of suitable instruments makes this very difficult. One way to continue research in this aspect would be to use methods aimed at reducing the bias due to the presence of an unobservable, instead to elimating this unobservable to obtain consistency.

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TABLE I: The strictness of employment protection legislation

Country	Regular Contracts			Fixed-Term Contracts		
	1990	1998	2003	1990	1998	2003
Australia	1	1.5	1.5	1.3	1.3	1.3
Austria	2.6	2.9	2.4	1.8	1.8	1.8
Belgium	1.5	1.7	1.7	5.3	1.5	1.5
Canada	0.9	1.3	1.3	0	0	0
Denmark	1.6	1.5	1.5	1.3	2.3	2.3
Finland	2.7	2.3	2.2	3.3	3.3	3.3
France	2.3	2.3	2.5	3.5	4	4
Germany	2.7	2.7	2.7	3.5	1.8	1.8
Greece	2.5	2.3	2.4	4	4	4.5
Ireland	1.6	1.6	1.6	0	0	0.8
Italy	2.8	1.8	1.8	5.3	4	2.5
Japan	2.7	2.4	2.4	1	0.5	0.5
Korea		2.4	2.4		0.8	0.8
Netherlands	3.1	3.1	3.1	1.5	0.8	0.8
New Zealand		1.4	1.7		0.3	1.5
Norway	2.4	2.3	2.3	3.3	3.3	3.3
Poland		2.2	2.2		1	0
Portugal	4.8	4.3	4.2	2.3	2.3	1.8
Spain	**3.9**	**2.6**	**2.6**	**1.5**	**2.5**	**3**
Sweden	2.8	2.9	2.9	2.7	1.8	1.8
Switzerland	1.2	1.2	1.2	1.3	1.3	1.3
Turkey		2.6	2.6		4.3	4.3
United Kingdom	0.8	0.9	1.1	0	0	0.3
United States	0.2	0.2	0.2	0	0	0

Data Source: OECD

TABLE II: Labour Market Indicators

Country	AVERAGE EMPLOYMENT RATE			AVERAGE UNEMPLOYMENT RATE			AVERAGE SHARE OF TEMPORARY EMPLOYMENT		
	1980/9	1990/9	2000/3	1980/9	1990/9	2000/3	1980/9	1990/9	2000/4
Australia	65.66	67.70	70.48	7.25	8.55	6.05			
Austria	63.85	67.72	68.95	3.3	3.82	3.85		6.96	7.88
Belgium	55.42	56.83		11.12	11.36		5.90	6.11	8.54
Canada	66.9	68.19	71.73	9.32	9.50	7.30		11.70	12.68
Denmark	75.01	75.14	76.08	8.09	7.60	4.90	11.45	11.11	9.58
Finland	73.58	65.74	68.53	4.82	11.74	9.18		17.60	16.32
France	60.94	59.97	63.33	9.05	10.98	9.23	5.87	11.90	13.84
Germany	63.6	65.67	65.65	6.06	7.76	8.38	10.87	11.02	12.33
Greece	54.97	54.19	57.13	6.64	9.64	10.30	17.99	12.01	12.30
Iceland	78.02	81.55	84.77		3.64	2.63		12.44	10.57
Ireland	53.79	56.06	66.10	13.99	12.10	4.15	7.81	8.58	4.43
Italy	54.48	53.69	56.03	9.93	11.10	9.43	5.50	7.26	10.18
Japan	70.54	74.18	74.28	2.49	3.06	5.10	10.08	10.72	13.30
Korea	57.55	62.40	64.05	3.8	3.27	3.60			
Luxembourg	64.35	77.23	94.70	1.34	1.95	2.00	3.81	2.94	3.83
Netherlands	54.81	65.60	72.83	9.78	6.11	3.03	7.98	10.49	14.36
New Zealand	65.97	67.93	72.15	4.53	7.90	5.28			
Norway	75.52	74.67	77.28	2.75	4.81	3.85		11.45	9.56
Poland	71.17	59.81	53.28		11.61	18.43			17.30
Portugal	65.01	68.34	72.73	7.33	5.54	4.85	16.98	13.37	20.56
Spain	**48.29**	**49.55**	**57.38**	**17.42**	**19.60**	**11.75**	**21.53**	**32.92**	**31.18**
Sweden	79.48	73.09	73.23	2.77	7.53	5.50		15.33	14.92
Switzerland	76.71	84.04	84.58	0.63	3.00	3.03		12.33	12.06
Turkey	60.14	54.09	48.93	7.58	7.61	8.75	17.55	19.02	16.98
United Kingdom	66.98	69.40	71.73	9.68	8.08	5.05	6.20	6.38	6.20
United States	69.03	73.5	73.13	7.15	5.68	4.80		4.73	4.00
Europe							8.23	11.74	12.26
G7 countries							8.71	9.13	9.76
OECD countries							9.14	11.06	11.80

Data Source: OECD

Table III: Firm Distribution in the Sample

	Observations		Firms	
	Nº	%	Nº	%
Nationality				
Domestic	12,129	81.90	-	-
Foreign	2,681	18.10	-	-
Total	14,810	100	2,448	
Change Nationality				
Don't Change	13,595	91.80	2,275	92.93
Change	1,215	8.20	173	7.07
Total	14,810	100	2,448	100
Don't Change				
Domestic	11,562	85.05	1,929	84.80
Foreign	2,033	14.95	346	15.20
Total	13,595	100	2,275	100
Change				
Domestic	567	46.67	-	-
Foreign	648	53.33	-	-
Total	1,215	100	173	

Data Source: ESEE

Table IV: Means of Continuous Variables

Variable	Nationality: Domestic		Nationality: Foreign		Total	
	Mean	Std.Dev	Mean	St.Dev	Mean	St.Dev
Pte	26.259	26.528	14.060	15.383	24.051	25.322
ik	302,862	1,257,635	612,757	662,087	358,961	1,178,506
age	21.728	21.063	31.581	24.987	23.512	22.152
peb	2.813	5.358	6.519	7.182	3.483	5.906
pown	4.006	6.420	0.096	0.718	3.295	6.008
cdlr	2.066	4.344	1.434	3.667	1.951	4.236
cdsr	5.116	5.462	5.816	5.013	5.241	5.391

	Don't Change Nationality: Domestic		Foreign	
	Mean	St.Dev	Mean	St.Dev
Pte	26.662	26.702	13.516	14.856
ik	287,866	1,278,490	599,500	644,472
age	21.338	21.021	32.178	26.133
peb	2.706	5.256	6.844	7.386
pown	4.164	6.518	0.051	0.354
cdlr	2.070	4.349	1.359	3.626
cdsr	5.076	5.463	5.763	5.017

	Change Nationality: Domestic		Foreign	
	Mean	St.Dev	Mean	St.Dev
Pte	18.041	21.083	15.768	16.829
ik	608,662	637,063	654,349	713,466
age	29.691	20.358	29.708	20.896
peb	4.982	6.769	5.497	6.398
pown	0.725	1.944	0.232	1.294
cdlr	1.980	4.239	1.671	3.788
cdsr	5.913	5.384	5.979	5.005

Data Source: ESEE

Table V: Firm Size

Activity	Domestic		Foreign	
	Obs. (%)	Mean Pte	Obs. (%)	Mean Pte
1: [10, 50]	62.709	30.035	7.497	17.225
2: [51, 200]	15.772	23.306	23.909	13.525
3: > 200	21.519	17.420	68.594	13.901
Total	12,129		2,681	

Data Source: ESEE

Table VI: Firm Location

Activity	Domestic		Foreign	
	Obs. (%)	Mean Pte	Obs. (%)	Mean Pte
1:Andalucia	8.311	39.253	4.103	13.110
2:Aragon	3.422	30.991	5.147	17.147
3:Asturias	2.432	20.010	0.858	10.113
4:Baleares	1.929	25.667	0.075	13.246
5:Canarias	1.583	22.456	1.082	9.149
6:Cantabria	0.989	13.401	1.678	18.054
7:Castilla-Leon	3.636	26.686	4.551	11.084
8:Castilla-La Mancha	4.592	36.378	1.305	20.509
9:Catalunya	22.500	21.453	33.197	13.632
10:Extremadura	0.602	30.565	0.448	27.373
11:Galicia	5.656	32.628	2.051	24.479
12:Madrid	15.146	20.023	26.520	11.433
13:Murcia	2.919	40.909	0.634	50.896
14:Navarra	1.748	21.235	3.655	16.055
15:Pais Vasco	6.926	13.002	7.646	11.246
16:Rioja	1.270	22.335	0.597	33.369
17:Valencia	16.341	31.745	6.453	18.878
Total	12,129		2,681	

Data Source: ESEE

Table VII: Firm Activity

Activity	Domestic		Foreign	
	Obs. (%)	Mean Pte	Obs. (%)	Mean Pte
1: Ferrous and nonferrous metals	2.300	17.517	2.723	10.607
2: Non-metallic mineral products	7.321	24.269	5.371	10.399
3: Chemical products	4.930	13.662	14.323	7.783
4: Metal products	11.914	26.460	5.968	15.685
5: Industrial and agricultural machinery	5.714	19.499	6.975	11.354
6: Office and data processing machinery	0.693	21.267	1.678	17.543
7: Electronic and electrical equipment	6.249	26.603	17.158	14.757
8: Vehicles, cars and motors	2.828	21.337	12.533	14.060
9: Other transport equipment	2.391	19.847	1.790	16.141
10: Meet industry	3.405	34.662	1.567	17.099
11: Food and tobacco	10.660	34.579	8.840	21.969
12: Beverages	2.193	15.757	1.940	8.902
13: Textile industry	12.351	26.375	4.812	14.674
14: Leather and footwear	4.147	40.679	0.075	0.141
15: Timber and furniture	7.231	34.681	0.858	22.644
16: Paper and printing products	8.006	18.681	3.693	8.117
17: Rubber and plastic products	5.318	28.372	8.579	20.778
18: Other manufacturing industries	2.350	24.803	1.119	11.395
Total	12,129		2,681	

Data Source: ESEE

Table VIII: Estimation Results

	Tobit Model		Hurdle Model			
			Entry Equation		Level-of-use Equation	
Size 1: 10 - 50						
Variables [1]	**Mg. Eff.**	**Std. Err.**	**Mg. Eff.**	**Std. Err.**	**Mg. Eff.**	**Std. Err.[2]**
n	-7,2733 *	1,8499	-0,0933 **	0,0366	-11,1152 *	2,660
cn_df	6,7051	5,6335	0,1058 ***	0,0564	5,2721	5,861
cn_ff	-1,3563	6,0001	0,0142	0,0992	-2,0764	6,823
peb	-0,0920	0,0623	-0,0010	0,0010	-0,2009 *	0,071
ik	-5,57E-08	0,0000	1,51E-09	0,0000	-1,71E-07	1,92E-07
age	-1,0010 *	0,0407	-0,0064 *	0,0007	-1,1484 *	0,049
age_sq	0,0063 *	0,0004	3,92E-05 *	1,00E-05	0,0067 *	0,001
Observations	7807		7807		5986	
Size 2: 51- 200						
Variables [1]	**Mg. Eff.**	**Std. Err.**	**Mg. Eff.**	**Std. Err.**	**Mg. Eff.**	**Std. Err.[2]**
n	-6,7303 *	0,8409	-0,0688 *	0,0192	-7,8603 *	1,4975
cn_df	1,9208	2,5275	0,0342	0,0371	3,6512	3,4138
cn_ff	-2,7953	2,5394	0,0240	0,0475	-5,5436 ***	3,7560
peb	-0,1259	0,0772	0,0026 ***	0,0016	-0,2606 **	0,1069
ik	-7,65E-06 *	0,0000	-5,20E-08 *	0,0000	-1,05E-05 *	1,20E-06
age	-0,3985 *	0,0373	-0,0019 *	0,0007	-0,4937 *	0,0531
age_sq	0,0022 *	0,0003	1,05E-05 ***	1,00E-05	0,0029 *	0,0005
Observations	2554		2545		2197	
Size 3: > 200						
Variables [1]	**Mg. Eff.**	**Std. Err.**	**Mg. Eff.**	**Std. Err.**	**Mg. Eff.**	**Std. Err.[2]**
n	-2,8720 *	0,4668	-0,016	0,0104	-2,0591 *	0,8346
cn_df	4,3650 *	1,2595	0,037 ***	0,0198	4,3382 **	1,8924
cn_ff	-1,8109	1,3317	0,012	0,0315	-1,5931	2,2833
peb	-0,1076 *	0,0356	0,002 ***	0,0008	-0,0704	0,0587
ik	-1,58E-06 *	0,0000	-9,78E-09	0,0000	-2,40E-06 *	5,81E-07
age	-0,1591 *	0,0170	-0,001	0,0004	-0,1914 *	0,0286
age_sq	0,0007 *	0,0001	5,75E-06	0,0000	0,0007 *	0,0002
Observations	4449		4434		3986	

*, ** and *** denote 1%, 5% and 10% level of significance, respectively

(1) Dummy variables of year, activity and region are included in the estimations

(2) These standard errors are calculated using delta method

Table IX: Estimation Results

	Tobit Model		Hurdle Model			
			Entry Equation		Level-of-use Equation	
Size 1: 10 - 50						
Variables [1]	**Mg. Eff.**	**Std. Err.**	**Mg. Eff.**	**Std. Err.**	**Mg. Eff.**	**Std. Err.[2]**
pfk	-0,0609 *	0,0219	-0,0006 ***	0,0003	-0,1333 *	0,0270
peb	-0,1041 ***	0,0620	-0,0012	0,0010	-0,2191 *	0,0745
ik	-6,16E-08	0,0000	1,35E-09	0,0000	-1,82E-07	2,03E-07
age	-1,0011 *	0,0407	-0,0064 *	0,0007	-1,2141 *	0,0497
age_sq	0,0063 *	0,0004	3,94E-05 *	1,00E-05	0,0071 *	0,0005
Observations	7807		7807		5986	
Size 2: 51- 200						
Variables [1]	**Mg. Eff.**	**Std. Err.**	**Mg. Eff.**	**Std. Err.**	**Mg. Eff.**	**Std. Err.[2]**
pfk	-0,0713 *	0,0097	-0,0006 *	0,0002	-0,0958 *	0,0161
peb	-0,1261	0,0773	0,0026 ***	0,0016	-0,2562 **	0,1046
ik	-7,62E-06 *	0,0000	-5,16E-08 *	0,0000	0,0000 *	1,18E-06
age	-0,3970 *	0,0373	-0,0019 *	0,0007	-0,4805 *	0,0519
age_sq	0,0022 *	0,0003	1,03E-05 ***	1,00E-05	0,0028 *	0,0005
Observations	2554		2545		2197	
Size 3: > 200						
Variables [1]	**Mg. Eff.**	**Std. Err.**	**Mg. Eff.**	**Std. Err.**	**Mg. Eff.**	**Std. Err.[2]**
pfk	-0,0264 *	0,0049	-0,0001	0,0001	-0,0190 **	0,0086
peb	-0,1067 *	0,0357	0,0015 ***	0,0008	-0,0681	0,0576
ik	-1,55E-06 *	0,0000	-9,33E-09	0,0000	-2,32E-06 *	5,68E-07
age	-0,1570 *	0,0170	-0,0007	0,0004	-0,1846 *	0,0276
age_sq	0,0007 *	0,0001	5,48E-06	0,0000	0,0006 *	0,0002
Observations	4449	4434			3986	

*, ** and *** denote 1%, 5% and 10% level of significance, respectively

(1) Dummy variables of year, activity and region are included in the estimations

(2) These standard errors are calculated using delta method

Table X: Estimation Results

	Tobit Model		Hurdle Model			
			Entry Equation		Level-of-use Equation	
Size 1: 10 - 50						
Variables [1]	**Mg. Eff.**	**Std. Err.**	**Mg. Eff.**	**Std. Err.**	**Mg. Eff.**	**Std. Err.[2]**
n	-6,8476 *	1,9876	-0,1058 *	0,0405	-10,4197 *	2,8484
cn_df	4,5936	5,8365	0,0819	0,0673	4,6515	6,2769
cn_ff	-1,5097	6,6650	0,0409	0,1062	-2,9887	7,6061
peb	-0,1416 **	0,0663	-0,0021 **	0,0010	-0,1849 *	0,0769
ik	-7,30E-08	0,0000	9,36E-10	0,0000	-1,52E-07	1,91E-07
age	-0,9888 *	0,0435	-0,0068 *	0,0007	-1,1045 *	0,0524
age_sq	0,0062 *	0,0005	4,32E-05 *	1,00E-05	0,0063 *	0,0005
pown	-0,1032 **	0,0450	-0,0055 *	0,0007	0,2634 *	0,0533
cdlr	0,1877 **	0,0778	0,0041 *	0,0014	0,0879	0,0861
cdlr	0,1863 *	0,0619	0,0050 *	0,0011	0,0118	0,0696
Observations	6495		6495		4963	
Size 2: 51- 200						
Variables [1]	**Mg. Eff.**	**Std. Err.**	**Mg. Eff.**	**Std. Err.**	**Mg. Eff.**	**Std. Err.[2]**
n	-6,0092 *	0,9141	-0,0784 *	0,0210	-6,1820 *	1,5324
cn_df	5,7090 **	2,9110	0,1001 *	0,0184	7,2039 **	3,4949
cn_ff	-0,3006	2,8392	0,0332	0,0518	-3,2642	3,7924
peb	-0,1140	0,0789	0,0028 ***	0,0016	-0,2510 **	0,1062
ik	-7,23E-06 *	0,0000	-5,04E-08 *	0,0000	-1,02E-05 *	1,23E-06
age	-0,3685 *	0,0432	-0,0017 **	0,0008	-0,4423 *	0,0605
age_sq	0,0022 *	0,0004	0,0000	0,0000	0,0028 *	0,0006
pown	2,2333 *	0,3259	0,0067	0,0064	2,6328 *	0,4498
cdlr	0,2656 **	0,1047	0,0026	0,0021	0,3338 **	0,1416
cdlr	-0,1058	0,0891	0,0001	0,0017	-0,1442	0,1224
Observations	2126		2120		1837	
Size 3: > 200						
Variables [1]	**Mg. Eff.**	**Std. Err.**	**Mg. Eff.**	**Std. Err.**	**Mg. Eff.**	**Std. Err.[2]**
n	-1,8614 *	0,5385	-0,0015	0,0112	-1,2943 ***	0,9076
cn_df	3,4201 **	1,4427	0,0114	0,0273	3,5955 **	2,1429
cn_ff	-1,0950	1,4274	0,0258	0,0264	-0,8518	2,3333
peb	-0,1152 *	0,0388	0,0013	0,0008	-0,0683	0,0623
ik	-2,26E-06 *	0,0000	-2,21E-08 *	0,0000	-2,74E-06 *	6,71E-07
age	-0,1406 *	0,0192	-0,0005	0,0005	-0,1736 *	0,0313
age_sq	0,0006 *	0,0001	0,0000	0,0000	0,0006 *	0,0002
pown	1,6158 ***	0,8536	-0,0162	0,0172	3,5056 *	1,3761
cdlr	0,2654 *	0,0605	0,0042 *	0,0013	0,1846 **	0,0964
cdlr	-0,1043 ***	0,0563	0,0002	0,0011	-0,1991 **	0,0917
Observations	3389		3368		3062	

*, ** and *** denote 1%, 5% and 10% level of significance, respectively

(1) Dummy variables of year, activity and region are included in the estimations

(2) These standard errors are calculated using delta method