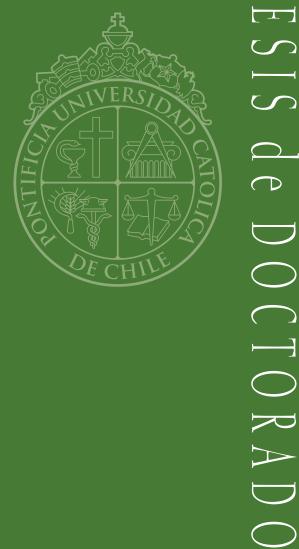
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Essays on Firm Heterogeneity and Employment Protection Legislation

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por

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Abstract

Essays on Firm Heterogeneity and Employment Protection Legislation

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This thesis analyzes the effects of Employment Protection Legislation (EPL) on firms' labor decisions. The first chapter presents an empirical evaluation of the legislation concerning EPL in the labor demand of heterogeneous firms. The overall effect of EPL on the demand for labor has been a subject of debate, because no clear answer has been found on the total labor demand. In this chapter I find that EPL negatively affects the demand for labor, specially the demand for unskilled workers. Thus, in presence of increasing firing costs, heterogeneous firms have heterogeneous responses in their labor demand. The second chapter The second chapter the impact of stringent EPL (employment protection legislation) in the propensity to downsize, exploiting the heterogeneity of productivity levels of firms within each sector. Using a simple theoretical model and an empirical application, the evidence presented in this chapter strongly supports the idea that when firing costs are higher the probability of doing downsizing will decrease but heterogeneously. The differences arise from sectors price growth rates, firm productivity and labor wedge.

Resumen

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Esta tesis analiza los efectos de las leyes de protección al empleo (LPE) sobre las decisiones laborales de las empresas. El primer capítulo presenta una evaluación empírica del efecto de aumentos en la LPE sobre la demanda por trabajo de firmas heterogéneas. El efecto de la LPE sobre la demanda por trabajo ha sido tema de discusión en la literatura. En este capítulo se observa que aumentos en los costos de despido disminuye la demanda por trabajo de largo plazo, en presencia de costos de despido crecientes, las empresas heterogéneas tienen respuestas sobre la demanda por trabajo heterogéneas. En el segundo capítulo se analiza el efecto de las leyes de protección al empleo sobre la decisión de downsizing de las firmas, tomando en consideración la heterogeneidad en los niveles de productividad de las empresas dentro de cada sector. A través de un modelo teórico simple y una aplicación empírica, presentamos evidencia de que cuando los costes de despido son más altos, las probabilidades de hacer downsizing se reducirá pero heterogéneamente. Las diferencias surgen del crecimiento de los precios en el sector, la productividad de la empresa y la brecha entre el trabajo deseado y el real.

To my family

Table of Contents

Chapter 1: Heterogenous firms labor demand and employment protection legislation	1
1.1 Introduction	1
1.2 Evolution of EPL in Chile	4
1.3 Data	7
1.3.1 Data description	7
1.3.2 Constructing a sectoral EPL index	8
1.4 The econometric model	12
1.4.1 Estimating the main equation	13
1.4.2 Estimation methodology	15
1.5 Empirical Results	17
1.5.1 Results using GMM	17
1.5.2 Results including sample selection	20
1.6 Conclusions	22
1.7 References	23
Appendix1: Variable description	26
Appendix2: Heterogeneity Variables	28
Appendix3: Variables in the Participation equation	29
Appendix4: Dynamic Labor Demand Estimation	30
Appendix5: Dynamic Labor Demand Estimation; using sectoral index	31
Chapter 2: Downsizing and emplloyment protection legislation	32
2.1 Introduction	32
2.2 The Model	35
2.2.1 Framework	35
2.2.2 Decisions made by firms	36
2.2.3 Numerical example and implications of the model	37
2.3 Empirical Model	40
2.3.1 Institutional Background	40
2.3.2 Data	42
2.3.3 Analyzing Downsizing	43
2.3.4 Baseline Regression	47
2.4 Results	49
2.5 Conclusions	55
2.6 References	56
Appendix1: Variable description	58
Appendix2: Job Security Protection index	60

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CHAPTER 1

Heterogeneous firms labor demand and employment protection legislation

1.1 Introduction

From an empirical and a theoretical point of view, employment protection legislation (EPL)¹, unambiguously reduces job destruction and job creation². Therefore, the overall effect of dismissal costs in job levels is uncertain. Specifically theory suggests that dismissal costs may have ambiguous effects on demand for labor and the employment levels. A deeper empirical analysis is necessary to elucidate the real consequences of EPL on labor demand composition and employment levels³. A way to pursuit this is to study closely the firms' labor decision problem, considering their heterogeneity. This document studies the response of firms that face the same legal modification, to understand the channels through which EPL affects firms' individual labor demand. The idea is that EPL could be the same for all sectors, but the effective restrictions imposed on specific sectors and/or firms' could vary due to market or technological characteristics of the industries.

In this paper I study the mechanism through which EPL affect the dynamics of labor demand. Firms of all sectors face the same employment protection legislation, but they respond differently to changes in the EPL. The reason for this hinges on the fact that firms are heterogeneous. More precisely I look for the relevant sources of heterogeneity that explains the response of labor demand to changes in the EPL.

¹ Also called firing costs, layoff costs or employment protection legislation (EPL).

² See for example:Mortensen and Pissarides(2004), Bertola (1992), Blanchard and Portugal (2001), Kugler et al (2003), Bentolila and Bertola (1990).

³ See Bertola, Blau and Kahn(2002), Bertola (1992), Montenegro and Pagés (2004), Almeida and Carneiro (2009).

First of all this paper estimates a dynamic labor demand equation for Chile using an unbalanced panel data of manufacturing firms⁴. The estimation will take into account the effect of EPL on firms labor demand, considering firm and sectoral heterogeneity sources. The estimation considers important econometric issues like the dynamic structure of the problem that affects the consistency of the parameters estimated and the selection bias since the econometrician observed only those firms that stay in the market. The method employed here is a semiparametric GMM estimator proposed by Kyriadizou (2001) to estimate dynamic panel data with sample selection models, where the firms' participation decision serves as the selection equation⁵.

The Chilean manufacturing industry provides an interesting dataset to study the firms' labor adjustment process to tighter EPL, because between 1981 and 1994 this economy experienced changes in job security legislation that tended to increase the cost of adjustment to all sectors of the economy, which helps in the identification of the firms' reaction towards stricter labor market regulation. Chilean EPL is high compared across countries, Heckman and Pagés (2000) construct an index of job security at the end of the 90s, classifying Chile as number 29 in a ranking of 36 countries⁶.

To capture the changes of the EPL I construct a measure of the expected cost of dismissing a worker at the time of hiring. The baseline measure is the index proposed by Heckman and Pagés (2000), which captures changes in the legislation in time, but in this case I include sectoral heterogeneity due the intrinsic sectoral variability. Bertola (1992) claims that one of the main sources of heterogeneity is intrinsic sector volatility faced by the firm. Firms operating in a sector that has higher turnover rates will suffer dismissal costs more often, so higher adjustment costs imposed by the EPL are more binding for these firms. I use the proposed new index in the estimation of the demand for labor to explore what sources of heterogeneity may accentuate or attenuate the effects of EPL over the demand for labor. Besides sector volatility, the additional three sources of heterogeneity explored here arise from the existing literature.

The first one is the degree of competition in a more competitive product market, where firm are price takers, any shift in cost or demand has to be absorbed by larger fluctuations in output and employment (Weiss, 1998), therefore higher firing costs will affect more the

⁴ The dataset comes from the National Annual Industrial Survey (ENIA according to its Spanish acronym)

⁵ This is a recently used estimator, the first published implementation of this estimator was done by Guvenen(2007)

⁶ This ranking can be found in Heckman and Pages (2000): table 1, page 11.

firms in that industry than others. In a similar vein, Amable and Gatti (2004) argue that the presence of real wage rigidities, make firms more sensitive to higher costs, since firms are forced to adjust to shocks through employment rather than through price adjustments.

The second source of heterogeneity is the composition of the skill to unskilled worker employed in the firm. The average cost of dismissing an employee increases with the skill of the worker, because they have higher wages and longer tenures, and severance payment is increasing in tenure and wages. For the opposite reason EPL has a bigger impact in the demand for unskilled workers, because it's less expensive the adjustment in that way (lower tenure and wages). This is a stylized fact found in the data by Hammermesh and Pfann (1996), among other authors.

The third source is the size of the firm. EPL has a bigger relative impact in small rather than large firms. One of the explications in the literature, for why an increase in EPL affects firms heterogeneously in relation to size has to do with the fact that small firms are more likely to face financial constraints. For instance, Bennett (2011) shows that smaller firms have less access to liquid assets, and firing helps to hold on to them; firing costs reduce "labor liquidity service", and firms reduce their value added, therefore labor demand. In the same line Davis et al (1996) argue that, an establishments' access to capital funds can greatly affect its costs and ability to adjust, therefore small size firms with less access to capital funds will have to adjust trough employment when firing costs increase.

Empirically this paper relates to the paper of Micco and Pagés (2006), which also find that stricter EPL reduces the industrials sectors value added and employment, based on the theoretical result that EPL should be more binding in industries that are intrinsically characterized by higher volatility in demand or supply shocks. The main difference with this paper is that I present more disaggregated data (they use country and two digit sector level), getting inside the firms decisions and exploiting sectoral and time variability. And contribute to this line of literature disentangling the heterogeneity sources that drive the different responses towards changes in the EPL legislation.

I find that the demand for skilled workers is reduced in 2% in the long run, the demand for unskilled workers is reduced in almost 12% when the EPL costs increase in one point, an increase of the EPL index of this magnitude is similar to the raise in EPL that took place in Chile in 1991. Another important finding is that firms of bigger size relative to their sector,

are less affected by increases in the firing costs. Therefore an unskilled worker of a small firm in a highly volatile sector, will probably lose his job when firing costs rise.

The rest of the paper is organized as follows. Section 2 briefly reviews the evolution of EPL in Chile. In section 3 I summarize the data characteristics and construct a measure for EPL. Section 4 gives an insight of the empirical approach, section 5 presents the main results and robustness checks. Finally, in section 6 I state the conclusions.

1.2 Evolution of EPL in Chile

In this section I describe the evolution of EPL in Chile, with special emphasis in the period of study (1981-1994). Giving a brief institutional framework that discusses the milestones in the Labor Code, related to firing costs.

The Chilean Labor Code was enacted in 1931 and regulates the labor market with the exception of state jobs (Statute Administrative Law 18.834). Title V of the Labor Code is the chapter dedicated to the termination of job contracts and labor stability. In general terms EPL give rise to costs of two kinds; the severance payments that are transfers made from the firm to the workers and administrative costs with no monetary transfers, like for example the advanced notice period.

This chapter can be divided in three regimens between 1981 and 1994, which are different because of changes in the legislation governing EPL. The changes are described in detail in the following paragraphs.

Before 1981, the employer could claim economic difficulties of the firm as a justified cause of dismissal and the compensation in the case of unjustified dismissal had no maximum limit. In 1981, law 18.618 was introduced which stipulated a maximum equivalent to a dismissal compensation of five months of salary but this limit applied only to workers hired after August, 1981.

Then, in 1984, law 18.732 eliminated a firm's economic difficulties as a just cause for dismissal. This narrows the dismissals that are considered justified, (that do not have associated a severance payment), and therefore if firms face economic difficulties and has for this reason to dismiss workers has to pay severance payment.

Finally in 1990, law 19.010 turned back the prior decision and the economic difficulties of a firm were again allowed to be a justified cause according to the law, but the maximum amount payable was raised to eleven months of salary. If a court of law resolved that the dismissal of an employee was unjustified, the employer would have to pay a compensation of 1.5 months of salary per year worked, see Table 1.

Table1: Summarizes the changes in the legislation, just explained, that took place between 1981 and 1994.

Year	Law N°	Prior Notice Period	Change	Compensation for dismissal in case of just cause	Limit	Min Compensation	Max Compensation
1981	18.618	l 1 month	Maximum limit introduced	non	5 months	1 month per year	1 month per year
1984	18.372	1 month	Economic needs not considered just cause	non	5 months	1 month per year	1 month per year
1990	19.010	1 month	needs where	Economic reasons: 1 month per year	11 months	1 month per year	1.5 month per year

Information taken from Chilean labor code

Chilean EPL is high compared across countries, Heckman and Pagés⁷ (2000) construct an index of job security at the end of the 90s, and classify Chile N°29 in a ranking of 36 countries. In the first position the United States has the lower job security index (0 in monthly wages). Between the Latin American countries Chile has the 12th position from a total of 16 countries, see Table 2.

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⁷ Heckman and Pagés (2000) will be abbreviated as HP from hereon.

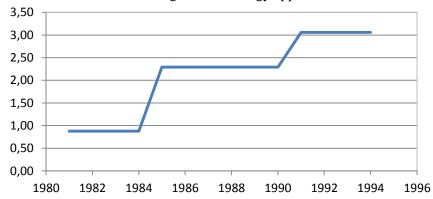
Table 2: Chile presents a high Job Security Index, when compared to other LAC, the calculations where made using the situation of the end of the 90s.

	Country	Job Security Index (Monthly Wages)
1	Brazil	1.8
2	Paraguay	2.2
3	Uruguay	2.2
4	Nicaragua	2.6
5	Panama	2.7
6	Dominican Republic	2.8
7	Venezuela	3.0
8	Argentina	3.0
9	Costa Rica	3.1
10	Mexico	3.1
11	El Salvador	3.1
12	Chile	3.4
13	Colombia	3.5
14	Peru	3.8
15	Ecuador	4.0
16	Bolivia	4.8

Data from Heckman and Pagés (2000)

In this paper I am interested in the evolution of EPL in Chile between 1981 and 1994. Therefore to visualize the evolution of EPL I construct a job security protection index, based on the methodology of PM (2000) and using the legal modifications of the law summarized in Table1. Figure 1 shows, that the changes in the EPL legislation turned out to increase the job security index from an initial period of 0.88 month wage to 3.05 month wage after 1991. This means that in a 14 year period, the job security index in Chile raised almost three times its initial value, for all the firms in the economy.

Figure 1: Job security index evolution, constructed using the Heckman - Pagés methodology applied for Chile



1.3 Data

To estimate the effect of increasing firing costs, I use firm level panel data of Chilean manufacturing firms. The unbalanced panel used recorded, employment decisions of firms in the National Annual Industrial Survey (ENIA, according to its Spanish acronym). I will briefly analyze the data used in this paper and construct a sectoral EPL index, following the HP methodology but letting the index vary across sectors and in time.

1.3.1 Data description

The empirical analysis is based on statistical information from the National Annual Industrial Survey (ENIA), implemented by the National Institute of Statistics. The goal of the ENIA is to gather information annually from all manufacturing establishments of Chile at the end of every year, and includes firms with at least 10 employees.

Observations of the cross-section data sets are matched over time to form a plant level panel data set, the unbalanced structure of the panel arises from the traditional firms dynamic performance (firms enter and others exit the market).

The ENIA was taken between 1979 and 2007, but the INE changed plants' identification number. I have been working on matching plant identification number to construct the entire time series 1979-2007, but the results have been unsatisfactory in terms of plant coverage, there are a significant number of plants for which the matching is imperfect, so I will concentrate in the period between 1981 and 1994. The reason for using this period is that three EPL regimens are present, and all firms face the same legal modifications. By the other side between 1995 and 2007 only one change was made to firing costs (in 2001).

The data consist of 64,486 observations on individual firms. The first filter used is to eliminate the firms that do not report employment keeping 48,697 observations, then I eliminated those firms that entered and left more than one time in the sample since they correspond to errors in the measurement or they lower the threshold of 10 employees. After eliminating these, I have a total of 43,931 observations. The last filter used in an effort to make following the companies by sector more manageable, was that I restricted the analysis to twelve 3-digits sectors, in order to concentrate the analysis on sectors characterized by competition and representation in terms of the number of observations. Table 3 shows the selected sectors and the percentage that each sector represents out of the

total. It can be seen that the Food sector is the largest (311) and that all twenty sectors⁸ selected represent more than 95% of the total sample, thus, the sectors that are not considered are very small. The base that I worked with in the end was comprised of 41,888 observations.

The firm level data is observed annually, and in this paper I use mainly data on employment (total, skilled and unskilled), real wages, real value added (output) and interest rate. Some of these variables are obtained directly from the survey and others needed to be constructed for our analysis. A data description is available in Appendix 1, but in general terms an average firm from the sample is 5 years old, has 47 workers 80% of them are unskilled and 20% skilled.

Table 3: The 12 selected sectors represent more than 65% of the total sample

	CIIU2	N° obs	Ac. Freq
Food	311-312	10,694	22%
Metal	381	3,241	29%
Wearing Apparel	322	3,127	36%
Wood	331	2,749	41%
Textiles	321	2,440	46%
Printing and Publishing	342	1,701	50%
Machinery	382	1,573	53%
Transport Equipment	384	1,308	56%
Non-metallic mineral products	369	1,085	58%
Furniture and Fixtures	332	874	60%
Electrical machinery	383	871	62%
Industrial chemicals	351	523	63%
Rubber products	355	499	64%
Paper and paper products	341	456	65%
Leather and leather products	323	445	66%

1.3.2 Constructing a sectoral EPL index

Firms of all sectors face the same employment protection legislation, but they respond differently to changes in the EPL. The evolution of EPL in Chile can be seen in figure 1, but a source of heterogeneity can be introduced in this EPL measure, and capture the

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⁸⁸ From a universe of 29 ISIC three digit sectors.

variability of EPL across sectors, that arises from their intrinsic employment characteristics.

The sectoral EPL index is constructed using the methodology of PM (2000), that computes an EPL index combining information on notice periods, compensation for dismissal, the likelihood that a firm's economic difficulties argument is considered as a justified cause of dismissal and the severance pay that is due in that event. The formula used for the cost of job security in period t is:

$$Index_{t} = \sum_{i=1}^{T} \beta^{i} (\delta^{i-1}) (1 - \delta) \left[b_{t} + a_{t} S P_{t+i}^{jc} + (1 - a_{t}) S P_{t+i}^{uc} \right]$$
 (1)

Where δ is the probability of remaining in a job, $(\delta^{i-1})(1-\delta)$ is the probability of dismissal after i periods at the firm and is the annual discount factor. In addition, b denotes the cost of advance notice, a is the probability that the economic difficulties of a firm are considered a justified cause of dismissal⁹, SP^{jc} is the mandated severance pay in the event the dismissal is justified and the worker has a tenure of i years at the firm and finally, SP^{uc} denotes the payment to be awarded to a worker with tenure i in case of unjustified dismissal.

The constructed index measures the expected cost (in monthly wages) at the time of hiring, of dismissing a worker in the future and captures the whole profile of severance pay. High values of the index indicate periods of relatively high EPL, whereas low values characterize periods in which dismissals were less expensive. The parameters used by the authors to fill in the equation are shown in Table 4.

Table 4: Parameters used in equation of EPL index constructed by PM(2000)

Period	β	δ	b	а	Sp_just	Sp_unj
1981-1984	0.92	0.88	1	0.8	0	(1)
1985-1990	0.92	0.88	1	0.0	0	(1)
1991-1999	0.92	0.88	1	0.9	(2)	(3)

The maximum tenure is of 25 years (1) is a payment of one month per year with an upper limit of 5 months per year (2) one month per year with an upper limit of 11 months (3)1.2 -1.5 months per year worked with an upper 11 months

⁹ a was constructed based on two pieces of information: (i) whether a firms' economic difficulties are considered a justified cause for dismissal according to the labor codes and (ii) information on the stand of labor courts in each period, taken from casual observation and conversations with labor judges.

The parameter δ is the probability of remaining in a job and it is assumed to be a constant, it takes the value generated by Davis and Haltiwanger (1992) who estimate that U.S. job destruction rates average 12% a year. 10 The assumption of considering an exogenous probability, is based on the idea that due US has the low firing costs, therefore it is an exogenous measure. But this assumption restricts the heterogeneous behavior of firms from different sectors in the manufacturing industry, job destruction rates vary along different sectors that's why I use for each sector it's corresponding δ .

These probabilities (δ) are calculated and then introduced in the index equation (1), so each sector will have a unique measure of job security protection, which lets me study the variability of the index between sectors. I am also able to adjust the delta through time, but I would be over estimating firing costs. For example, if the compensation for years of service increases (SP^{uc}) the index would increase simultaneously in two ways. First, it would increase directly through the increase in SP^{uc} and second, it would increase indirectly because the probability of getting fired $(1 - \delta)$.

The probability of firing by sector is reported in Figure 2, these probabilities where constructed using DH (1992) methodology. It can be seen that the probability of being fired is, on average, less than that used by PM (12%). The average value of the probability of firing for manufacturing sectors in Chile is 9%, between the years 1981-1994. The sector with the highest probability is the manufacture of wood and wood products, including furniture (331) while the sectors with the greatest labor stability are manufacture of paper and paper products (341) and manufacture of chemical products (352). The wood sector presents a skilled to unskilled ratio (0.46) lower than average (0.58), while chemical (0.95) and paper products (0.68) are above average.

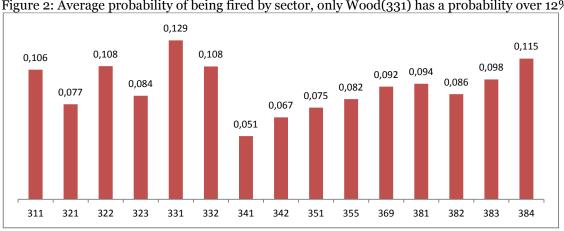


Figure 2: Average probability of being fired by sector, only Wood(331) has a probability over 12%

10 Davis and Haltiwanger (1992) will be abbreviated as DH from here on in.

Previously I mentioned the argument given by PM of considering the US probability as an exogenous measure, but they use a fix delta for all the sectors. DH (1992), also reports for 15 US manufacturing sectors. In table 5 I report the probability of being fired by sector previously calculated with the ENIA and by DH). Two important features can be noticed: in the first place, there is dispersion in delta between the sectors in the US data, indeed the standard deviation of the probability is of o.o24 while the dispersion of the ENIA calculations is of o.o19 and secondly the highest and lowest probabilities are present in the same sectors as in my own calculations, the wood and the paper manufacturers.

Once the probabilities are calculated, they are introduced in the index equation 1. Due this procedure I obtain three measures of employment protection legislation, the index calculated by PM, the index that varies through sectors due the different average probability of being fired taken from the data and finally the same index but using the US sector probability. All these three measures are resumed in table 6, the first column reports the average for the entire sample period. The other columns represent a period where the labor legislation stayed unaltered, this is more evident in the index constructed by PM that doesn't vary within each time period. While the other two measures have variation within time period, such variation arises from the sectoral average probability of being fired. A slightly higher standard deviation is seen using the US sector probability.

Table 5: Probability of being fired calculated with the ENIA data compared to DH calculations, only 15 sectors are comparable. The wood and paper product sectors represent the higher and lower probability in both calculations.

CIIU2_3	Probability of being	Probability of being
CHU2_3	fired ENIA (delta)	fired DH (delta_h)
Food	0.106	0.100
Textiles	0.077	0.110
Wearing Apparel	0.108	0.160
Leather and leather products	0.084	0.140
Wood	0.129	0.160
Furniture and Fixtures	0.108	0.120
Paper and paper products	0.051	0.080
Printing and Publishing	0.067	0.090
Industrial chemicals	0.075	0.080
Rubber products	0.082	0.120
Non-metallic mineral products	0.092	0.120
Metal	0.094	0.110
Machinery	0.086	0.120
Electrical machinery	0.098	0.110
Transport Equipment	0.115	0.090
max	0.129	0.160
min	0.051	0.080

Table 6: Average of the different EPL index measures, taking into consideration 15 sectors in order to make them comparable. The standard deviations are reported in parenthesis.

EPL index measures	All	1981-1984	1985-1990	1991-1994
index PM (average probability US)	2.11	0.88	2.29	3.06
	(0.842)	(0.000)	(0.000)	(0.000)
index (sector average probability ENIA)	2.16	0.84	2.25	3.33
	(0.962)	(0.087)	(0.205)	(0.218)
index (sector average probability USA)	2.30	0.92	2.42	3.48
	(0.980)	(0.071)	(0.147)	(0.103)

1.4 The Econometric Model

To study the mechanism through which EPL affect the dynamics of labor demand and search for the relevant sources of heterogeneity that explain the reaction of labor demand to changes in the EPL, I present in this section a dynamic labor demand equation that is

estimated for Chile using an unbalanced panel data of manufacturing firms. Due the characteristics of the panel I also explain the empirical methodology used.

1.4.1 Estimating the main equation

The impact of firing costs in labor demand, must be analyzed from a dynamic point of view, this is mainly because firms only incur in EPL costs when workers are fired. The spirit of the traditional estimating models (see Nickell (1986), Arellano and Bond (1991), Fajnzylber and Maloney (2005)), is preserved but EPL costs are included:

$$L_{i,t} = \alpha_1 L_{i,t-1} + \alpha_2 X_{i,t} + \alpha_3 Index_{st} + \alpha_4 Index_{st} * Z + \lambda_t + \eta_i + v_{it}$$
(2)

The variable of interest is $Index_{st}$, which measures the relative rigidity of Chilean labor codes over the years¹¹. The dependent variable $L_{i,t}$ is the logarithm of the average annual employment of firm i at time t, the vector $X_{i,t}$ contains firm level control variables¹². The specification also contains λ_t time effects related to calendar years that do not change among firms, η_i that captures unobserved heterogeneity in production technologies and v_{it} a random error term.

Equation 2 considers the direct effect of the $Index_{st}$ on the firm's demand for labor (α_3) and the indirect effect of EPL (α_4) . The interactions of sectors characteristics and EPL explain labor demand responses considering heterogeneity in firms and sectors, these characteristics are represented by the vector Z. This functional form was first used by Rajan and Zingales (1998) to test whether industrial sectors that are relatively more dependent on external financing develop faster in countries with better developed financial markets.

The vector Z includes four sources of heterogeneity, the first three are associated to sectoral characteristics and the fourth is firm size heterogeneity. The analysis of these four sources of heterogeneity arises from arguments described in previous literature¹³:

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¹¹ The EPL index used in these regressions, was calculated in the previous section with the USA average manufacturing industry probability of keeping the job.

¹² At a firm level, the controls that are included in $X_{i,t}$ are associated with the components of the conventional labor demand function: wages, real added value of the firms as a measure of production and interest rate as the price of the substitute factor. Details about the variables used in Appendix 1.

¹³ Information about the sources of Z and its basic statistics are included in Appendix 2.

- (1) Sector intrinsic volatility (SUM): Bertola (1992) claims that one of the main sources of heterogeneity is intrinsic sector volatility faced by the firm. Firms operating in a sector that has higher turnover rates will have to pay dismissal costs more often, so higher adjustment costs imposed by the EPL are more binding for these firms. This is also supported empirically by Micco and Pages (2006).
- (2) Product market competition (MARK): in more competitive product market sectors, higher firing costs make firms adjust through employment. The effect of EPL, over labor demand relies on a partial equilibrium analysis, where no adjustment takes place through prices. Weiss (1998) suggest that when exogenous demand and cost shifts do not affect prices, they have to be absorbed by larger fluctuations in output and employment. In the same line of analysis Amable and Gatti (2004) due to the presence of real wage rigidities, as product market competition increases firms are increasingly forced to adjust to shocks through employment rather than through price adjustments.
- (3) Human capital intensity (SKU): the average cost to adjust rises with the skill of the worker, usually because they have higher wages and longer tenures, and severance payment is increasing in tenure and wages (Hammermesh and Pfann (1996)). Increases in EPL has a bigger impact in the demand for unskilled workers, because it's cheaper to adjust in that way (less tenure and wages).
- (4) Firm size (SIZE): higher EPL has a bigger relative impact in small rather than big firms. One of the explications in the literature, for why an increase in EPL affects firms heterogeneously in relation to size has to do with the fact that small firms are more likely to face financial constraints. This is how Bennet (2009) shows that smaller firms have less access to liquid assets, and firing helps to hold on to them; firing costs reduce "labor liquidity service", and firms reduce their value added, therefore labor demand. In the same line Davis et al (1996) argue that, an establishments' access to capital funds can greatly affect its costs and ability to adjust, therefore small size firms with less access to capital funds will have to adjust trough employment when firing costs increase.

1.4.2 Estimation Methodology

The estimation of equation 2, given the Chilean manufacturing firms' panel data, faces two important econometric issues: the dynamic structure of the model and the unbalancedness of the panel.

First, the traditional fixed effect estimation applied to a dynamic panel data model is not consistent for T fixed and N large, this is precisely the case of this panel. Nickell (1981), shows that the estimator (FE) of a dynamic panel data model is biased even in large samples where the number of time periods (T) is fixed and the number of cross sectional data (N) is large. The FE approach performs well only when the time dimension of the panel is large. Judson and Owen (1997), solve the problem of how big T should be before the bias can be ignored, performing a Monte Carlo approach to investigate the performance of different methods. They find the bias in the case of performing FE, can be significant even with a large time dimension (T=3o). The authors point out that for sufficiently large N and T, the differences in efficiency and bias of different techniques becomes quite small.

Secondly, the unbalanced nature of the panel comes from the firms' extensive margin. Firms enter and leave the sample in different years. Therefore there might be sample selection because; I only observe labor demand decisions if the firm is involved in production, which means the dependent variable in equation (2) is only observed when d_{it} of equation (4) takes the value of 1. The number of firms present in the panel is of 5.341 (N) with an average presence of \overline{T} =7.5. Unbalancedness is an important issue in this panel, as evidence from the computation of Ahrens and Pincus index¹⁴ of unbalancedness is 0.45, with 0<w≤1; where if w=1 the panel is balanced (see Bruno (2005)). Firing costs might impact both the extensive and the intensive margin, and due my interest is estimating the effects of firing costs in the firms' demand for labor (intensive margin), when estimating the model I should take into consideration the sample selection problems.

To take care of the previous issues¹⁵ I use the methodology proposed by Kyriazidou (2001), that corrects for sample selection as in Kyriazidou (1997) but in a dynamic environment¹⁶.

¹⁴Ahrens and Pincus index: $w = N / \left[\overline{T} \sum_{i=1}^{N} \left(\frac{1}{T_i} \right) \right]$, where N=5.341; \overline{T} =7.5

¹⁵ Semykina and Wooldridge(2010), also propose a self selection dynamic panel model estimation method. But one of the conditions for using it is to have all the initial observations the first year, condition I do not comply.

The methodology is a semi parametric two step estimation procedure, which "differences out" sample selection and unobservable fixed effects from the equation (2). The first implementation of this estimation method was first done by Guvenen (2007), who studied the extend of risk sharing among stockholders. The households had each period to decide whether they wanted to participate in the stock market, therefore as the author says in his paper: "...due to this endogenous entry decision, the testable implications of perfect risk-sharing take the form of a sample selection model, which we estimate and test using a semi-parametric GMM estimator proposed by Kyriazidou (2001)".

The first step is to estimate the participation equation (3), which is related to the firms' probability of being involved in production. Equation (4) is estimated using a logit estimation, where g_{st} includes the firing cost index and other variables used in the traditional IO literature that study plant survival such as: Herfindahl Index that is a concentration index within a sector and the minimum efficient scale that measures the median plant size in terms of employment calculated for each sector ¹⁷, the sectors minimum efficient scale . In order to control for environmental factor I include the sectors growth rate, and time dummy variables ¹⁸. The firing costs (index), should also be included in this regression, due de impact of this costs might have in the extensive margin (firm dynamics).

$$d^*_{it} = g_{st}\gamma + \mu_i + \nu_{it} \tag{3}$$

$$d_{it} = 1(g_{st}\gamma + \mu_i + \nu_{it} \ge 0) \tag{4}$$

Once the parameter $\hat{\gamma}$ is obtained, Kyriazidou (2001) proposed to weight the moments restrictions, giving more importance to observations where $g_{st}\hat{\gamma}$ and $g_{s\tau}\hat{\gamma}$, $\tau\neq t$, are close. The weights are constructed using a Kernel normal density: $\Psi=\frac{1}{h_n}K\left(\frac{\Delta g\hat{\gamma}}{h_n}\right)$, that declines to zero as $|\Delta g|$ increases. In the second stage equation (2) is estimated using the kernel-weighted GMM estimator that solves:

$$\widehat{a_n} = \arg\min \widehat{G}_n(\alpha)' A'_n A_n \widehat{G}_n(\alpha)$$
(5)

¹⁶ Kyriadizou (1997) methodology is used by Cerda and Saravia(2010), Dustmann and Rochina-Barrachina (2007), Charlier et al (2001).

¹⁷ This variables are used in Gorg and Stobl(2005), Cerda and Saravia (2009)

¹⁸ Information about the sources of g_{st} and its basic statistics are included in Appendix 3.

where A_n is a stochastic matrix that converges in probability to a finite non-stochastic limit A_0 , and $\hat{G}_n(\alpha)$ is the vector of stacked sample moments with rows of the form (see further details in Kyriazidou 2001, case 2):

$$\frac{1}{n}\sum_{i=1}^{n}\frac{1}{h_{n}}K\left(\frac{\Delta g\hat{\gamma}}{h_{n}}\right)m_{it}(\alpha) \tag{6}$$

1.5 Empirical Results

In this section I will present two sets of results the first using GMM model and the second using weighted GMM.

1.5.1 Results using GMM

In this section I report the results of the estimates obtained using the regular GMM, which does not correct for selection, but takes care of lagged dependent variable endogeneity. Table 7 shows these results, the first column presents the regular labor demand estimation, the second column includes the index variable that captures the changes in the firing costs and the third column includes the interaction terms that let me identify the sources of heterogeneity. As expected, the estimate for the employment protection legislation index is negative and significant. In column 2 it can be seen that an increase of one point in the index (as the one experimented in the Chilean economy in 1991), is associated to a long run labor demand reduction of 4% (reported here and throughout the paper at the bottom of each table).

In the following column, the long run EPL index effect is calculated taking into consideration the heterogeneity variables in their median values. The negative effect of the index is increased, now one more point in the EPL makes the long run labor demand decrease in 7.5%.

The decline in labor demand is larger in firms operating in higher turnover rates. However, in firms that belong to higher human capital intensive sectors or that are small relative to their sector, the effect of the EPL index stays negative but smaller. This interactions, help to understand that the final effect on labor demand depend on firm and sectoral characteristics.

Understanding skilled and unskilled workers are different kinds of production factors; in this section I estimate separately labor demand for these two kinds of workers. The results are reported in Table 8 and Table 9 respectively.

Table 7: Dynamic labor demand estimation, GMM

	(1)	(2)	(3)		
VARIABLES	$ln(employ)_{i,t}$	$ln(employ)_{i,t}$	$ln(employ)_{i,t}$		
$ln(emp loy ment)_{i,t-1}$	0.486 ***	0.483 ***	0.484 ***		
	(0.0262)	(0.0262)	(0.0257)		
ln(av real wage) _{i,t}	-0.295 ***	-0.298 ***	-0.256 ***		
	(0.0077)	(0.0077)	(0.0061)		
ln(capital) _{i,t}	0.081 ***	0.081 ***	0.091 ***		
	(0.0043)	(0.0036)	(0.0077)		
ln(real value added) _{i,t}	0.077 ***	0.077 ***	0.071 ***		
	(0.0359)	(0.0036)	(0.0037)		
av ln(value added) _{s,t}	0.072 ***	0.077 ***	-0.030 ***		
	(0.0140)	(0.0036)	(0.0048)		
Index _t		-0.021 ***	0.0198 ***		
		(0.0049)	(0.0032)		
Index*SUM			-0.780 *		
			(0.0951)		
Index*M ARK			0.101 *		
mack within			(0.0523)		
Index*SKU			0.115 **		
muex SKU			(0.0623)		
T 1 4 4			` ′		
Index*size			0.015 *		
	0.105	0.174	(0.0080)		
trade	-0.105 ***	-0.174 ***	-0.17 ***		
124	(0.0239)	(0.0288)	(0.0288)		
credit	-0.004 ***	-0.005 ***	-0.005 ***		
growth	(0.0004) 0.356 ***	(0.0006) 0.484 ***	(0.0006) 0.476 ***		
giowiii	(0.0421)	(0.0513)	(0.0514)		
	(0.0421)	(0.0313)	(0.0314)		
Index long run effect, other va	riables				
evaluated in median values		-0.041 ***	-0.075 ***		
Year fixed effects	yes	yes	yes		
N° of observations	22606	22606	22606		
Sargan test p-value	0.45	0.51	0.53		
Standard errors in parenthesis	. *** p<0.01,** p<0.0	5, *p<0.1			

In both cases an increase of one point in the EPL index, generates a negative effect in the long run labor demand. But the magnitude is different, while the demand for skilled workers is reduced in 5.7% in the long run, the demand for unskilled workers is reduced in almost 10%. This has important distributive implications, the negative effect of higher employment protection legislation in firm level employment is bigger for the less skilled

workers. Indeed, the demand for unskilled workers in small firms is reduced in 10% when the EPL index increases in one point, while in large firms the impact in unskilled labor demand around 7%.

Table 8: Dynamic labor demand for skilled workers estimation, GMM

	(1)	(2)	(3)
VARIABLES	` '	` '	
VARIABLES	ln(employ_skill) _{i,t}	ln(employ_skill) _{i,t}	ln(employ_skill) _{i,t}
1	0.227 ***	0.206 ***	0.016 ***
ln(employ_skill) _{i,t-1}	0.227 ***	0.206 ***	0.216 ***
1.7.1.1.190	(0.0235)	(0.0235)	(0.0231)
ln(real wage_skill) _{i,t}	-0.390 ***	-0.390 ***	-0.391 ***
	(0.0075)	(0.0067)	(0.0075)
ln(real wage_unskill) _{i,t}	0.065 ***	0.061 ***	0.061 ***
	(0.0103)	(0.0100)	(0.1020)
$ln(capital)_{i,t}$	0.0658 ***	0.0675 ***	0.0674 ***
	(0.0071)	(0.0071)	(0.0071)
ln(real value added) _{i,t}	0.073 ***	0.073 ***	0.073 ***
	(0.0055)	(0.0055)	(0.0056)
av ln(value added) _{s,t}	0.121 ***	0.095 ***	0.095
	(0.0234)	(0.0236)	(0.0236)
Index _t		-0.050 ***	0.096
		(0.0314)	(0.0329)
Index*SUM			-0.149 *
much ben't			(0.1580)
Index*MARK			-0.020
muca WAKK			(0.0850)
T 1 -007777			
Index*SKU			0.164
			(0.1020)
Index*size			0.010 **
			(0.0128)
trade	-0.255 ***	-0.408 ***	-0.403 ***
	(0.0403)	(0.0474)	(0.0478)
credit	-0.008 ***	-0.012 ***	-0.012 ***
	(0.0004)	(0.0009)	(0.0009)
growth	0.117	0.392 ***	0.381 ***
	(0.0723)	(0.0852)	(0.0859)
Index long run effect, oth	er variables		
evaluated in median value		-0.036	-0.057
Year fixed effects	yes	yes	yes
N° of observations	21,214	21,214	21,214
Sargan test p-value	0.12	0.12	0.15
Standard errors in parent	hesis. *** p<0.01,** p	<0.05, *p<0.1	

Table 9: Dynamic labor demand for unskilled workers estimation, GMM

		(2)					
	(1)	(2)	(3)				
VARIABLES	ln(employ_unskill) _{i,t}	ln(employ_unskill) _{i,t}	$ln(employ_unskill)_{i,t}$				
ln(employ_unskill) _{i,t-1}	0.440 ***	0.446 ***	0.446 ***				
	(0.0317)	(0.0318)	0.0315				
ln(real wage_unskill) _{i,t}	-0.278 ***	-0.280 ***	-0.281 ***				
	(0.0082)	(0.0083)	(0.0082)				
ln(real wage_skill) _{i,t}	0.037 ***	0.036 ***	0.036 ***				
	(0.0052)	(0.0052)	(0.0052)				
$ln(capital)_{i,t}$	0.0847 ***	0.0853 ***	0.0852 ***				
	(0.0053)	(0.0053)	(0.0053)				
ln(real value added) _{i,t}	0.077 ***	0.077 ***	0.0769 ***				
	(0.0044)	(0.0044)	(0.0044)				
av ln(value added) _{s,t}	0.059 ***	0.048 ***	-0.052 ***				
	(0.0172)	(0.0172)	(0.0178)				
Index _t		-0.016 ***	0.034				
		(0.0222)	(0.0233)				
Index*SUM			0.004				
			(0.1170)				
Index*M ARK			-0.139 **				
			(0.0633)				
Index*SKU			0.172 **				
			(0.0760)				
Index*size			0.017 *				
			(0.0098)				
trade	-0.03255	-0.0833 ***	-0.0783 ***				
	(0.0294)	(0.0351)	(0.0351)				
credit	-0.003 ***	-0.004 ***	-0.004 ***				
	(0.0004)	(0.0007)	(0.0007)				
growth	0.427 ***	0.527 ***	0.517 ***				
	(0.0522)	(0.0642)	(0.0642)				
Index long run effect, oth	ner variables						
evaluated in median valu		-0.030	-0.095				
Year fixed effects	yes	yes	-0.093 yes				
N° of observations	21389	21389	21389				
Sargan test p-value	0.11	0.13	0.21				
Standard errors in parent			0.21				
parent	p total, p total, p total						

1.5.2 Results including Sample Selection

The results obtained using Kyriazidou (1997), are resumed in Table 10 (the complete estimation results are shown in Appendix 4.

The results of incorporating the participation equation estimates in the dynamic labor demand equation (details in section 4.2), are shown in columns 1-3. The long run effect of an increase in firing costs, affects more the demand for unskilled workers. The results are quiet similar to the ones obtained in the GMM estimations shown before, but the long run impact of EPL index are smaller. This arises from the correction of the sample selection, therefore this methodology gives a better understanding of the effects of an increase of EPL in firm level labor demand decisions.

Table 10: Dynamic labor demand estimation, Kyriazidou.

	(1)	(2)	(3)	[logit regression]
VARIABLES	$ln(emp loy)_{i,t}$	$ln(employ_sk)_{i,t}$	$ln(employ_unsk)_{i,t}$	Particip 1(in)
Index _t long run total effect	-0.072	-0.011	-0.061	-0.360 ***
				(0.0158)
Lagged dependent variable	0.362 ***	0.312 ***	0.363 ***	
	(0.0534)	(0.0359)	(0.0470)	
Age	0.017 ***	0.024 ***	0.015 ***	0.313 ***
	(0.00242)	(0.00429)	(0.00292)	(0.0042)
ННІ				-0.039 ***
				(0.0093)
CREC				-0.116 ***
				(0.0412)
EME				-0.154 **
				(0.0606)
Index*SUM	-0.059 *	-0.762 *	0.177	
	(0.227)	(0.415)	(0.285)	
Index*M ARK	-0.106 *	-0.130 *	-0.116 **	
	(0.0614)	(0.111)	(0.0760)	
Index*SKU	0.127 *	0.293 *	0.132 **	
	(0.0785)	(0.142)	(0.0976)	
Index*size	0.0105 *	0.000758 *	0.0124 *	
	(0.00782)	(0.0142)	(0.00970)	
N° of observations	27474	25919	25919	27474

Standard errors in parenthesis. *** p<0.01,** p<0.05, *p<0.1

Index long run effect, other variables evaluated in median values

Some control variables of the labor demand equations are not reported in this table. The last column represents the selection equation

An increase of one point in the EPL index decreases the probability of participating in the market (extensive market) in 0.39 percentual points.

The estimates of the participation equation show that the impacts of the Herfindahl index and the Minimum efficient scale index have a negative impact on firms' participation equation. These results imply that for the potential entrants it's harder to get in the market, because there is high concentration and the necessary size to operate in the sector is high. The sectors growth variable is positive and significant, which indicates that firms are more willing to participate when they face better economic conditions. Also older firms, have a higher probability of staying in the market.

In regards to the EPL index, it has significant and negative effect over the firms' participation decision, higher firing costs, has a negative effect in the extensive market.

1.6 Conclusions

This paper has investigated the impact of stringent employment legislation (EPL) on the firms' dynamic labor demand. This document studied the response of firms that face the same legal modification, to understand the channels through which EPL affects firms' individual labor demand. The idea is that EPL could be the same for all sectors, but the effective restrictions imposed are heterogeneous as a function of: firms size, sectors reallocation rate and skilled dependence.

One of the findings is that the effect of EPL index, affects differently the demand for skilled and unskilled workers. In general the first approach is to study the effect on overall labor, but higher firing costs reduce the labor demand for skilled labor in almost 6% while the same increase of the firing costs affects almost 10% the demand for unskilled workers.

Another important contribution that arises from this paper, is that the extensive margin is also affected by firing costs. Firing costs make less firms enter the market and more firms exit the market, one interpretation is that firms simply exit the market, but it can also mean that small firms go to the informal sector.

Therefore when studying the effects of EPL on labor demand, in order to avoid sample selection I used a weighted GMM methodology proposed by Kyriazidou(2001), which attenuates the final effect of EPL index in all the labor demand estimations.

Finally I also presented a new measure of employment protection that incorporates the sectors intrinsic variability, empirical results using this new measure are in Appendix 5. The overall effect of EPL index is higher in magnitude but keep the same size and significance, because it captures more sectoral variability. This gives insights about the

different reactions of sectors to a same legal modification. . Sectors with higher reallocation rate, incur more often in labor adjustments, therefore firing costs are more relevant.

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Appendix 1: Variable description.

Employment

The employment level of firms in the manufacturing sector has evolved in time, during the first years of the sample Chile experienced an economic recession this is seen in the reduction of the number of workers in all the firms' size distribution. Firms report their employment yearly and can be divided between skilled and unskilled workers, in this sample hire more unskilled than skilled workers.

Firm labor demand evolution by percentile.

year	Total Employment			Unskilled Employment			Skilled Employment		
,	p25	p50	p75	p25	p50	p75	p25	p50	p75
1981	20	33	72	17	26	55	3	7	17
1982	19	31	67	15	24	49	3	7	16
1983	19	30	68	15	24	49	3	7	16
1984	20	34	72	16	26	54	3	7	17
1985	21	36	77	17	28	58	4	7	17
1986	22	39	84	18	30	64	4	8	20
1987	23	39	89	18	30	65	4	8	22
1988	23	43	95	18	32	70	4	9	23
1989	24	45	104	19	34	76	4	10	24
1990	24	43	101	20	34	75	4	9	24
1991	24	44	100	19	33	74	4	9	23
1992	23	43	101	19	34	76	4	9	23
1993	22	41	102	18	34	73	4	9	24
1994	22	39	89	17	32	73	4	9	23

Average real wage, real value added and capital.

In the ENIA, firms report the total wage bill per year. The average real wage is calculated as the wage bill divided by the number of workers. The measure of output I use is real value added defined as gross output less the total costs of intermediate goods and services plus the net change in inventories (this data is directly reported in the ENIA each year). The nominal wages and value added were converted to 1992 pesos using industry-level price deflators at three-digit ISIC codes.

The methodology used to construct capital is based on the work by Cerda and Saravia (2009), which I describe below.

It is prepared with capital stock information only between 1992 and 1994. Thus, for all other years, the capital stock numbers were reconstructed in the following manner:

For those companies with a continual presence until 1992 (being the first year that capital stock is registered), this dynamic equation was used:

$$K_{a,t-1} = K_{at} - I_{at} + d_{at}$$

where K_{at} is type a capital stock (machinery, vehicles, buildings) in the time t, I corresponds to the gross addition of fixed capital and d is the depreciation of the reported fiscal years. If K has a negative value, it is left as a missing value.

For those companies with a non-continuous presence, and thus have missing values, the following regression model was used:

$$K_{iat} = \beta_0 + \beta_1 V A_{it} + \beta_2 L_{it} + e_{iat}$$

This is a reduced form of a Cobb-Douglas production function. VA_{it} corresponds to the firms value added and L_{it} the total employment. The model was used for each one of the 3 types of capital (a) and by firm (i). The pre-stated values replaced the missing values mentioned previously.

The following table shows some basic statistics about the previous variables, these values are presented in logarithms and are aggregated values for the period 1981-1994. This variables are the ones contained in the vectors: L_{it} , L_{it-1} and X_{it} , used in equation 2.

Statistics	Real	Av Real	Av Real	Av Real	Capital	Total	Skilled	Unskilled
	Value Added	Wage	Wage Unsk	Wage Skill	Stock	Employ	Employ	Employ
25th percentil	10.85	7.41	7.24	7.80	10.26	3.09	1.39	2.83
50th percentil	11.93	7.83	7.58	8.45	11.42	3.66	2.08	3.40
75th percentil	13.18	8.30	7.94	9.02	12.78	4.48	3.04	4.19
Stand. Deviation	1.66	0.64	0.56	0.81	1.86	0.99	1.29	0.98

All variables in natural logarithms, for the period of analysis $% \left\{ 1,2,...,n\right\}$

Appendix 2: Heterogeneity Variables, sources and statistics.

Vector Z include the sectors (Z_s) and firm level (Z_i) characteristics that used to explain the heterogeneous labor demand responses towards increasing firing costs.

The sector level characteristics are:

- Sector intrinsic volatility (SUM): average job reallocation rate for US manufacturing sectors, used as a measure of intrinsic volatility of the sector.
- Product market competition (MARK): Estimated sector mark ups for US manufacturing sectors (Roegers' method)
- Human capital intensity (SKU): Human capital intensity is associated with the technology intensity of the sector. The OECD classifies the industries according to their technology intensity "global technological intensity". [source Hatzichronoglou (1997)]

The firm level characteristic is firms' size relative to the sector, the measure of size usually used in the literature is the average number of workers, I also use as a robustness check the firms' average real value added:

- Size1 takes value 1 when the average firm employment is bigger than the sectors average employment, and takes the value 0 in the case it's smaller.
- Size2 takes value 1 when the average firm value added is bigger than the sectors average value added and takes the value 0 in the case it's smaller.

The following table shows some basic statistics about the previous variables, This variables are the ones contained in the vectors: Z used in equation 2.

Descriptive statistics of Souces of Heterogeneity (Z)

Statistics		Zs		Zi
Statistics	SUM	MARK	SKU	size
25th percentil	0.17	1.07	0.30	0.00
50th percentil	0.23	1.09	0.30	0.00
75th percentil	0.25	1.22	0.70	1.00
Stand. Deviation	0.05	0.10	1.45	0.45

SUM: Sector intrinsic volatility, MARK: Product market competition, SKU: Human capital intensity, size: dichotomic variable takes value 1 if the median firms value added is higher than the median from it's sector and 0 otherwise

Appendix 3: Variables in the participation equation.

- The participation variable (PART) takes the value of 1 if firms are producing and 0 if they are not producing.
- The explanatory variables are included in vector G:
 - HHI: Herfindahl index is defined as the sum of the squares of the market share within the sector, where the market shares are expressed as fractions, the result is proportional to the average market share. It can range from o to 1, increases in the Herfindahl index generally indicate a decrease in competition and an increase of market power, whereas decreases indicate the opposite.
 - o CREC: Sectors growth rate measured as the sectors median value added growth rate.
 - EME: Median plant size in terms of employment, calculated for each sector at the 3 digits ISIC classification.
 - o Index: EPL index constructed in section 3.2

Appendix 4: Dynamic Labor Demand Estimation, Kyriazidou

(0.0534) (0.00)	(3)
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$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	0.406 ***	* 0.0369 ***
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	816)	(0.00441)
In(capital) _{i,t} 0.076 *** 0.000 (0.000 (0.0000 (0.00000 (0.000000 (0.0000000 (0.0000000 (0.0000000 (0.00000000	0.053 ***	-0.276 ***
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(0.00302) (0.00000000000000000000000000000000000	715)	(0.00491)
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(0.0166) (0.00000000000000000000000000000000000	(555)	(0.00380)
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(0.219) (0.219) (0.219) (0.219) (0.219) (0.227) (0.2	291)	(0.0206)
Index*SUM -0.059 * -0.059 (0.227) (0.00000000000000000000000000000000000	0.628	-0.108
(0.227) (0.227) (0.227) (0.227) (0.227)	.400)	(0.274)
Index*MARK -0.106 * -0.00 (0.0614) (0.00 Index*SKU 0.127 ** 0.00 (0.0785) (0.00 Index*size 0.0105 * 0.00 (0.00782) (0.00 Age 0.017 *** 0.00 (0.00242) (0.00).762 *	0.177
(0.0614) (0.0614) (0.0614) (0.0614) (0.0614) (0.0614) (0.0614) (0.0614) (0.0785) (0.0614) (0.0785) (0.0614) (.415)	(0.285)
Index*SKU 0.127 ** 0.00 (0.0785) (0.00042) (0.00242) (0.00042)	0.130	-0.116 **
(0.0785) (0.00000000000000000000000000000000000	.111)	(0.0760)
Index*size 0.0105 * 0.000 (0.00782) (0.00 Age 0.017 *** 0.000 (0.00242) (0.00).293 **	0.132 **
Age (0.00782) (0.00 (0.0	.142)	(0.0976)
Age 0.017 *** 0 (0.00242) (0.00	0758 *	0.0124 *
(0.00242) (0.00	142)	(0.00970)
(0.00242) (0.00	0.024 ***	* 0.015 ***
	1429)	(0.00292)
$Index_{st} long run total effect -0.072 -0$	0.011	-0.061

Appendix 5: Results of final estimation equation using sectoral index, that varies with the US average probability of being fired.

	(1)	(2)	(3)	[logit regression]
VARIABLES	$ln(employ)_{i,t}$	$ln(employ_sk)_{i,t}$	$ln(employ_unsk)_{i,t}$	Particip 1(in)
Index _{st} long run total effect	-0.105	-0.020	-0.128	-0.399 ***
				(0.0106)
Lagged dependent variable	0.418 ***	0.393 ***	0.426 ***	
	(0.0595)	(0.0419)	(0.0513)	
Age	0.103 ***	0.026	0.118 ***	0.476 ***
	(0.0240)	(0.0442)	(0.0305)	(0.0715)
ННІ				-0.111 **
				(0.0160)
CREC				-0.120 ***
				(0.0100)
EME				-0.020 **
				(0.0090)
Index*SUM	-0.016 *	0.082	-0.019 *	
	(0.0119)	(0.0217)	(0.0340)	
Index*MARK	0.001	0.003	0.004	
	(0.0052)	(0.0094)	(0.0065)	
Index*SKU	0.012 **	0.003 **	0.014 **	
	(0.0049)	(0.0049)	(0.0062)	
Index*s2	0.002 ***	0.004 **	0.001	
	(0.0010)	(0.0018)	(0.0012)	
N° of observations	27474	25919	25919	27474

Standard errors in parenthesis. *** p<0.01,** p<0.05, *p<0.1

Index long run effect, other variables evaluated in median values

Some control variables of the labor demand equations are not reported in this table. The last column represents the selection equation

CHAPTER 2

Downsizing and employment protection legislation

2.1 Introduction

Downsizing is defined as "an intentional event involving a range of organizational policies and actions undertaken to improve firm performance through reduction in employees" ¹⁹. The main purpose of this practice is to reduce costs associated with employment and improve productivity²⁰. One of the restrictions faced by firms to do so is the employment protection legislation (EPL). The essence of this regulation is to increase the stability of employment, generating firing costs to firms in the form of severance payment. Autor, Kerr and Kugler (2007) empirically argue that "...dismissal protections altered short-run production choices and caused employers to retain unproductive workers, leading to a reduction in technical efficiency".

Therefore, due to the presence of EPL, firms face a tradeoff between productivity gains from workforce reorganization and firing costs. The firm will downsize if the productivity gains associated to this practice compensates the firing costs.

This paper takes a closer look at the impact of EPL in the propensity to downsize, exploiting the heterogeneity of productivity levels of firms and their labor wedge within each sector. The mechanism is the following, given a distribution of productivity across firms, an increase in the firing cost will lower the cutoff productivity level that makes downsizing profitable. In other words, firms with higher average productivity levels will tend to keep excess employment and only firms with a low level of productivity will pursue downsizing. The inclusion of firms labor wedge in the analysis is to measure firms' unproductive workers accumulation, previous to the decision of doing downsizing.

I will firstly present a simple theoretical model, to develop a framework that will guide the empirical work and will also provide a number of simple insights to understand the

¹⁹ This definition presented by Datta et al (2010) which reviews the studies associated to downsizing in all disciplines (eg economics, finance, organizational behavior, organization theory, human resources and sociology)

²⁰ Cameron and Freeman (1993)

changes in the propensity of downsizing practices, in a world with heterogeneous levels of productivity and different firing costs scenarios. A numerical exercise that simulates a price reduction of 15%, shows that in the case of no firing costs all firms downsize in almost 36% their workforce independent of the productivity level they had. If downsizing is defined as a reduction of more than 20% of the firms workforce then, the probability of doing downsizing is 1 in that scenario. In the presence of low firing costs (Chile 1985), firms reduce the magnitude of job reduction to 14% on average, but the effect of a price reduction for a firm in the 10th percentile in TFP distribution, is a decline of 24.7% of its workforce. Therefore these firms do downsizing, while higher productivity firms (with productivity levels over the 90th percentile of the TFP distribution), dismiss 2.8% of their workforce which means they do not downsize. Furthermore, in an economy with high firing costs (Chile 1991), none of the firms, independent of their productivity levels will do downsizing, according to this exercise.

The main features that can be taken from the simple model, that will guide the empirical work is that, firms' likelihood of doing downsizing will depend on external factors such as demand or market shocks and internal factors like the firm productivity level and labor wedge. When firing costs are higher, the probability of doing downsizing will decrease but heterogeneously, as a function of the previous factors.

The implications that arise from the model motivate the empirical exercise conducted afterwards. For doing so, I will use a panel data of manufacturing plants in Chile. The dataset covers a 14 year time period, from 1980-1994, and 20 sectors at three digit level of the Industrial Classification. Chilean manufacturing sector is interesting to study because job security protection turned more stringent during the period under analysis and also because the empirical literature on downsizing such as Coucke et al (2007) for the Belgian firms and Budros (2002) in the US, suggest that downsizing is more prevalent in the manufacturing firms than those in other sectors. Moreover Chile, experienced three legal modifications affected in two dimensions firing costs. The first has to do with the compensation that the worker receives per years of service. Before 1981, in order to fire an employee who had been with the company for 15 years, the compensation for years of service corresponded to 15 month salary. Between 1981 and 1990, this same employee would have received 5 month salary. Lastly, if this person had been fired in 1991, he would have received 11 month salary. The second is related to the definition of justified firing and the position of the court as mediator between the employee and the firm. Before 1990,

firms did not pay compensation if the firing was unjustified, but after 1990 the economic reasons of the firm were considered a justified reason for firing although the firm needed to pay 1 month for each year worked with a maximum of 11 years.

I find evidence that an increase in the EPL index of one point reduces on average the probability of doing downsizing in 0.24 percentual points. This effect can be attenuated by the previous level of productivity of the firm, in line with idea of changing the cutoff point that makes downsizing profitable. An increase of one point in the EPL index, make firms in the lower part of the productivity distribution 25th percentile reduce the effect of the index in the probability of downsizing to 0.14 percentual points. While, firms in the 75th percentile of the TFP distribution that face an increase in firing costs, reduce the probability of doing downsizing in 0.33 percentual points. Therefore firms with higher productivity will keep more excess of employment in presence of higher firing costs.

I find a similar effect in the case of labor wedges, as the distance between the desired and the actual level of employment increases, the marginal effect of an increase in the EPL index is magnified.

The research on downsizing has focused either on the causes or on the effects of downsizing in firm's performance. This paper belongs to the former branch of the literature, specifically to the one that emphasizes environmental factors, such as: demand's stability and growth, industry concentration, technological and capital intensity and organizational factors (firm's governance, reputation and managerial strategy). The main contribution of this work is the analysis of how the interaction between increasing EPL and firm's attributes affects the downsizing decision, issue that, to my knowledge, has not been addressed by the literature so far. By doing so, this work expands the current understanding of employment protection legislation and the effects in firm practices like downsizing in an emerging economy.

This paper is organized as follows: section 2 presents a basic theoretical model; section 3 presents the empirical model and section 4 analyzes the econometric results. Section 5 concludes.

2.2 The Model

In this section I present a traditional partial equilibrium model, where firms with different technological characteristics face a negative output price shock, and optimally must adjust their production decisions. The firms' problem is presented firstly in an economy with no firing costs and the second scenario is in the presence of higher firing costs. The purpose here is not to present a complex comprehensive model, but rather to develop an organizing framework for the empirical work and also provide some insights to understand the changes in the propensity of downsizing in the context of heterogeneous levels of productivity and the presence of firing costs.

2.2.1 Framework

I assume that firms are price takers in the product and input markets, facing a wage w per unit of labor and a price of p per unit of output. The profit maximizing firm uses labor as the only production input, this leaves aside the possibility of doing downsizing due changes in the technology process. Moreover, it prevents the possibility of substituting labor by other factors of production (capital deepening), as documented by Acemoglu and Finkelstein(2006) in firms-level response to changes in the labour costs in the US hospital industry and by Autor, Kerr and Kugler (2007) in US firms due the adoption of wrongful-discharge protection.

Suppose that the output of firm i with productivity level A_i is given by: $x_{it} = A_i l_{it}^{\alpha}$, where l_{it} is the labor input and $\alpha < 1$ reflects decreasing returns to the factor. If the firm i, employs l_{it} workers in period t, when output price is p_t , it's profit function in t is:

$$\pi[A_i, p_t] = p_t A_i l_{it}^{\alpha} - w l_{it}$$

The wage rate, the product price and the technology are given exogenously. The firm heterogeneity arises from firm-specific productivity (A_i), which is drawn from a steady state normal distribution. Despite some firms have high technology and others low levels of technology, but a of them are willing to offer x_{it} (no firms are exiting the market).

The timing of the firms' decision is as follows: at the beginning of time t (t=o) the firm observes its profitability and decides the level of employment (l_0). At the end of t (t=t), the product market suffers a demand shock, this causes the prices to adjust downwards; they will have to take adjustment decisions in the presence of firing costs.

2.2.2 Decisions made by the firm

In t = 0, firm i solves a traditional profit maximization problem, the idea is to produce a given output at the lowest possible cost, the firms optimal choice of labor equates revenue with marginal cost:

$$l_{i0}^* = \left(\frac{p_0 \alpha A_i}{w}\right)^{1/1 - \alpha}$$

In time t=1, the firm faces a negative price shock, the new price the firm faces is p_1 . The firms' new marginal revenue is smaller than the firms' marginal cost:

$$p_1 \alpha A_i l_{i0}^{\alpha-1} < w$$

This implies in this simple model that the a new optimal production level is $x_{i1}^* < x_{i0}^*$. This analysis is made in the case of no firing costs. The firm reduces labor until its marginal revenue is equal to the marginal cost.

In the presence of firing costs, a negative price shock leads also to employment adjustment, but in this case the wage rate will be equal to the revenue minus the shadow value of the firing constraint (see Bertola (1999)). I will assume that variations in the level of employment are accompanied by an adjustment cost represented by the following quadratic function²¹:

$$C_f = \begin{cases} \tau w \frac{(l_1 - l_0)^2}{2} & \text{if } (l_1 - l_0) < 0 \\ 0 & \text{if } (l_1 - l_0) \ge 0 \end{cases}$$

therefore the firms' new profit maximization function in t=1, is given by:

$$\pi[A_i, l_0, p_1] = p_1 x(A_i, l_1) - w l_1 - C_f$$

Then the firm chooses the new optimal amount of labor for period t=1 due to the negative shock in the final product price. The first order condition of this maximization problem is:

$$p_1 \alpha A_i l_1^{\alpha - 1} = w - \tau w (l_0 - l_1)$$

²¹ I will use quadratic costs because of the advantage of its simplicity, and because it introduces certain a dynamic dependence in the labor firing decision(also used by Lafontaine and Sivadasan (2009)). I do not introduce hiring costs due the characteristics of the shock I introduce (negative in price). For a further discussion in the adjustment cost structure see chapter 4 of Cahuc and Zylberberg (2004).

In the presence of firing costs, firms subject to the same negative demand shock will reduce labor hiring less than in the case were there are no such firing costs. In the next section I present a numerical example to determine the magnitude of the effects of firing costs on labor demand.

2.2.3 Numerical examples and implications of the model

For the empirical exercise I will normalize the initial price (p_0) and wage rate (w_0) to be equal to unity²². Hence firing costs must adjust to this parameters, if the severance payment is as in 1985 of 1 month per year with an upper limit of 5 months, and assuming the average length of work is 6 years, the value of τ is 0.4. If severance payment is as today, 1 month per year with an upper limit of 11 months τ will be 0.5 (more details about EPLs evolution are shown in section 3.1). The parameter α is equal to labors share of total revenue; it is set in 0.64, which is the value used by Hopenhayn and Rogerson (1993), recalling that this value has been used in most of real business cycle literature. All the parameters used in this numerical exercise are shown in Table 1.

Table 1: parameters used for the numerical exercise

Parameters	Values
$\overline{p0}$	1.00
w0	1.00
low firing costs	0.40
high firing costs	0.50
α	0.64

I first calibrate the model to the parameter values that reflect the average firms size distribution taken from the data. Therefore given the parameters of Table 1 and the firms optimal labor decision (taken from the data), the productivity level can be obtained for each firm (results shown in Table 2 and Figure 1).

From the Chilean manufacturing data between 1979-1994, I calculate the evolution of prices with the sectoral deflators. The largest price reduction took place in 1982 and was of 20% while the average price reduction in the sample period was of 10%. Therefore, given the calibrated economy productivity and size distribution in t=0, I will assume all firms face a price reduction of 15%; which means that the new price (p_1) will be $p_1=0.85$.

 $^{^{\}rm 22}$ Hopenhayn and Rogerson (1993) used the same method to solve their equilibrium.

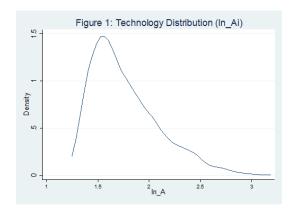


Table 2: Calibrated TFP levels, given size distribution

Employees	Size distribution	Calibrated ln(A)
10-19	0.18	1.50
20-99	0.61	1.91
100-499	0.19	2.47
500+	0.02	3.13
Average firm size	55.86	_

The firms' behavior in t=1, is analyzed in three scenarios: no firing costs, low firing costs and high firing costs²³. Because of the final products price decline, in an economy with no firing costs, all firms would adjust labor in order to equal the marginal revenue to the marginal cost of production. This can be seen in the first column of Table 3, all firms reduce their labor force around a 36%. If downsizing is defined as a reduction of at least 20% of a firms workforce²⁴, all firms would be doing downsizing, in this scenario.

If the economy had adjustment costs (low firing costs), the percentage of workforce reduction varies across firms. In the second column of Table 3, it can be seen that firms with higher productivity levels, adjust less their workforce due the costs associated to firing. The effect of a price reduction for a firm in the 10th percentile in TFP distribution, is a decline of 24.7% of its workforce. Therefore these firms do downsizing, while higher productivity firms (with productivity levels over the 90th percentile of the TFP distribution), dismiss 2.8% of their workforce which means they do not downsize.

²³ The values of the firing costs are in Table 1.

²⁴ The precise way to define downsizing will be described in the further sections, in this section I will assume downsizing is a reduction in the workforce of 20%.

Table 3: % of workforce reduction in firms of different productivity levels, that face the same price reduction, in three firing costs scenarios

	no firing	low firing	high firing
	costs	costs	costs
<pre><perc 10<="" pre=""></perc></pre>	36.2%	24.7%	12.80%
perc 10 - 50	36.3%	19.5%	7.90%
perc 50 - 90	36.3%	10.2%	3.50%
> perc 90	35.8%	2.8%	0.81%
average	36%	14%	6%

In an economy with high firing costs, none of the firms, independent of their productivity levels will do downsizing. But they will have small reductions in their workforce; in column 3 it can be seen that the percentage change in labor due the 15% price reduction is decreasing as the firms' productivity is higher.

Table 4: % of firms that do downsizing, taking into consideration three definitions of downsizing and different firing costs

	firing more than	firing more than	firing more than
	10% of the	15% of the	20% of the
	workforce	workforce	workforce
no firing costs	1.00	1.00	1.00
	-	-	-
low firing costs	0.72	0.51	0.29
	(7.40)	(6.00)	(4.97)
high firing costs	0.18	0.00	0.00
	(4.70)	(4.00)	-

^{*} productivity cuttof level in parenthesis, below that productivity level firms will do downsizing.

Table 4 shows the impact of EPL in the propensity to do downsizing, in this exercise I use three different definitions of downsizing. For all of the definitions, the presence of higher firing costs reduces the probability of doing downsizing, when firms face a negative price shock. Given the distribution of productivity across firms, an increase in the firing cost will lower the cutoff productivity level that makes downsizing profitable in almost 50%. This can be seen also in Table 4, firms with higher average productivity levels will tend to keep excess employment and only firms with a low level of productivity will pursue downsizing.

This theoretical exercise does not represent fully the Chilean case, in firms with the same level of employment have different TFP levels, and this is due the firing costs aren't zero at

the beginning of the period. So some firms face differences between their desired level of employment and their real level of employment. Different gaps that determine their initial situation that will affect their downsizing decisions, the main conclusion in the case of Chile is that history matters, firms that have accumulated a lot of FAT might be willing to pay higher firing costs, because it turns profitable to do so.

The main features that can be taken from this simple model, that will guide the empirical work is that, firms' likelihood of doing downsizing will depend on external factors such as demand or market shocks and internal factors like the firm productivity level and labor wedge. When firing costs are higher, the probability of doing downsizing will decrease but heterogeneously, as a function of the previous factors.

2.3 Empirical Model

This section presents the empirical evidence on the effects of firing costs on downsizing and how it is related to the firms' initial productivity level, using data of the manufacturing plants in Chile. The dataset covers a 14 year time period, from 1980-1994, and twelve sectors at three digit level of the Industrial Classification. Chile is an interesting case to study as job security legislation has experienced discrete changes over time, which makes easier to identify the effect of EPL on downsizing. In this section I will firstly describe the evolution of EPL in Chile, then I will present and analyze the Chilean data and finally give insights about the empirical methodology that is going to be used.

2.3.1 Institutional Background

The Chilean Labor Code was enacted in 1931 and regulates the labor market with the exception of state jobs (Statute Administrative Law 18.834). Title V of the Labor Code is the chapter dedicated to the termination of job contracts and labor stability. In general terms, EPL imposes two kinds of firing costs; the severance payments that are transfers made from the firm to the workers and administrative costs with no monetary transfers, for instance the advanced notification period.

There are three different regimes imposed by the legislation governing EPL between 1981 and 1994. The changes are described in detail in the following paragraphs.

Before 1981, the employer could claim economic difficulties of the firm as a justified cause of dismissal and the compensation in the case of unjustified dismissal had no maximum limit. In 1981, law 18.618 was introduced which stipulated a maximum equivalent to a dismissal compensation of five months of salary but this limit applied only to workers hired after August, 1981.

Then, in 1984, law 18.732 eliminated a firm's economic difficulties as a justified cause for dismissal. This narrows the dismissals that are considered justified, (that do not have associated a severance payment), and therefore if firms face economic difficulties and have to, for this reason, dismiss workers, they need to incur in severance payment.

Finally, in 1990, law 19.010 reverted the prior decision and the economic difficulties of a firm were considered again as a justified cause, but the maximum amount payable was raised to eleven months of salary. If a court of law resolved that the dismissal of an employee was unjustified, the employer would have to pay a compensation of 1.5 months of salary per year worked, Table 5 summarizes all these modifications to the law.

Table5: Summarizes the changes in the legislation, just explained, that took place between 1981 and 1994.

Year	Law N°	Prior Notice Period	Change	Compensation for dismissal in case of just cause	Limit	Min Compensation	Max Compensation
1981	18.618	1 month	Maximum limit introduced	non	5 months	1 month per year	1 month per year
1984	18.372	1 month	Economic needs not considered just cause	non	5 months	1 month per year	1 month per year
1990	19.010	1 month	Economic needs where considered just cause	Economic reasons: 1 month per year	11 months	1 month per year	1.5 month per year

Information taken from Chilean labor code

These three legal modifications directly affected firing costs. The first way they affected firing costs is regarding the compensation that the worker receives per years of service. Before 1981, in order to fire an employee who had been with the company for 15 years, the compensation for years of service corresponded to 15 month salary. Between 1981 and 1990, this same employee would have received 5 month salary. Lastly, if this person had been fired in 1991, he would have received 11 month salary. The second is related to the definition of justified firing and the position of the court as mediator between the employee

and the firm. Before 1990, firms did not pay compensation if the firing was unjustified, but after 1990 the economic reasons of the firm were considered a justified reason for firing although the firm needed to pay 1 month for each year worked with a maximum of 11 years.

2.3.2 Data

The empirical analysis is based on statistical information from the National Annual Industrial Survey (ENIA), implemented by the National Institute of Statistics (INE according to its Spanish acronym). The goal of the ENIA is to gather information annually from all manufacturing establishments in Chile that have 10 or more employees. Using these surveys, firms can be followed over time. These surveys include companies that come into the sample and then also leave the sample, during the period of time studied, and thus, it is an unbalanced panel of companies.

In this paper, the relevant period of study is between 1980 and 1994 and this is mainly due to data availability. The ENIA was conducted between 1979 and 2007, but the INE changed plants' identification numbers. I have been working on matching plant identification number to construct the entire time series 1979-2007, but the results have been unsatisfactory in terms of plant coverage. There are a significant number of plants for which the matching is imperfect. I decided to use the first period since during these years, three changes were made to employment protection laws and in the period between 1995-2007 only one change was made that affects firing costs (in 2001).

The size of the panel is 53,274 observations. I eliminated those firms that entered and left more than one time in the sample since they correspond to errors in the measurement or they are below the threshold of 10 employees. After eliminating these, I have a total of 43,838 observations. I restricted the analysis to twelve 3-digits sectors, in order to concentrate the analysis on sectors characterized by competition and representation in terms of the number of observations. Table 6 shows the selected sectors and the percentage that each sector represents out of the total. It can be seen that the Food sector is by far the largest (311) and that all twelve sectors selected represent 82% of the total sample. Thus, the sectors that are not considered have a small number of firms. The final database has 35,860 observations²⁵.

²⁵ More details on the data construction and statistics in Appendix 1

One of the aims of this paper is to analyze the firms downsizing decisions, which are not the same as the death of a firm. The downsizing practices are not the regular layoffs made by firms before exiting the market, but a practice that firms do to improve their efficiency. Therefore the main empirical analysis will only consider firms that do not exit the sample, which represent more than 62% of the observations, in section XX I will enlarge the sample (using all firms) in order to contrast the results.

The firms that exit the sample are smaller than the continuing firms (31 vs 40 employees) and also have a median TFP²⁶ that is 5.7% smaller than the continuing firms.

Table 6: The 12 selected sectors represent more than 82% of the total sample

	CIIU2	N° obs	Ac. Freq
Food	311	11796	0.27
Metal	381	3798	0.36
Textiles	321	3347	0.43
Wood	331	3203	0.51
Wearing Apparel	322	2979	0.57
Plastic	356	1908	0.62
Chemical Products	352	1861	0.66
Printing and Publishing	342	1675	0.70
Machinery	382	1635	0.73
Footwear	324	1429	0.77
Beverages	313	1146	0.79
Non-metallic mineral products	369	1083	0.82

2.3.3 Analyzing Downsizing

A distinctive feature that characterizes downsizing is that is an intentional practice driven by firms to improve its efficiency or productivity. The main difference between regular layoffs and downsizing is that downsizing is a voluntary big reduction in the number of permanent workers, that doesn't end up in the firms' death but in productivity improvements. Baily et al (1996), tried to see the effects of downsizing in firms productivity growth using plant level data for the US, and found that downsizing firms had only a slight improvement in its productivity, however the authors defined downsizing

²⁶ The information provided by the ENIA allows the estimation of TFP at firm-level data using the methodology developed by Olley and Pakes (1996) and extended by Levinsohn and Petrin (2003), as it has been made previously for the Chilean manufacturing industry by Bergoeing et al (2006) and Alvarez and Fuentes (2011)

firms as those that reduced their employment (giving the same importance to firms that cut 1 or 100 workers), which is regular job reduction and it is not the concept of downsizing used in the literature²⁷.

The precise way to measure downsizing is not a clear issue in the literature; most of the researchers use a numerical cutoff of employment reduction (θ). Guthrie and Datta (2008), make reference to the existing literature and conclude that the most common value for θ is a 5% reduction, which represents a significant event and likely an intentional reduction in employment. But these researchers use employment data of the Compustat database, where firms are relatively big compared to the Chilean manufacturing firms, an employment reduction of 10% in a firm with 12 employees is not the same as the same reduction in a firm with 5000 employees. Therefore I will use higher θ values in order to make sure the phenomenon is downsizing and not a regular layoff, downsizing of firm i at time t is calculated as:

$$Down(\theta)_{i,t} = 1 \quad if \quad \left[\frac{\left|empl_{it} - empl_{i,t-1}\right|}{empl_{i,t-1}} \geq \theta \right] and \quad \left(empl_{i,t} - empl_{i,t-1}\right) < 0$$

where $empl_{it}$ is the employment level of firm i at time t and θ is the cutoff value.

Table 7: Porcentage of firms doing downsizing, considering only the firms that do not exit the sample

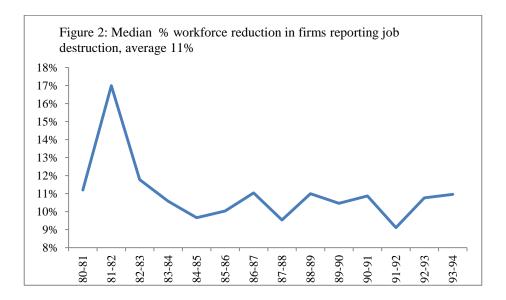
	(1)	(2)	(3)	(4)
year	% of firms that reduce it's	% of firms in (1) that reduce more	% of firms in (1) that reduce more	% of firms in (1) that reduce more
	workforce in t	than 10% of it's	than 20% of it's	than 20% of it's
		workforce	workforce	max size
1981	39%	57%	28%	13%
1982	59%	69%	44%	20%
1983	43%	58%	30%	9%
1984	26%	52%	23%	11%
1985	27%	49%	26%	11%
1986	25%	50%	24%	11%
1987	23%	54%	29%	16%
1988	27%	49%	22%	14%
1989	30%	53%	29%	19%
1990	36%	51%	27%	17%
1991	34%	53%	29%	20%
1992	33%	47%	24%	16%
1993	36%	52%	27%	20%
1994	39%	54%	27%	18%
Average	34%	53%	28%	15%

 $^{^{27}}$ Baily et al (1996) calculate downsizing as the reduction of the number of workers over a 10 year period; Muñoz et al (2008) define downsizing in the same way but during a year span.

Table 7 shows the frequency with which firms do downsizing, Column (1) presents the percentage of firms that reduces its workforce, 1987 presents the lower level and the highest is present in 1982. The average percentage of firms reporting some job elimination is 34%, which is lower than the 44% reported by the AMA(American Management Association) for the same period of study in the US²⁸. Column (2) and (3) show the percentage of firms that do downsizing using a θ =0.1 and θ =0.2 (from the total number of firms that reduce the workforce that period), respectively. It can be seen from comparing this two columns that assuming a higher cutoff level, the proportion of firms that do downsizing is reduced. The last column presents the measure of downsizing used by Abowd et al (2009), this is a stricter measure of downsizing, that depends on the maximum size the firm achieves during the sample period. Abowd et al (2009) report for three states in the US in 1992 that 25% of the surviving firms did downsizing in my sample this probability is on average a 15%.

$$Down_abw_{it} = 1 \ if \ \left[\frac{\left| empl_{it} - empl_{i,t-1} \right|}{\max(empl)_i} \ge 0.2 \right] and \ \left(empl_{i,t} - empl_{i,t-1} \right) < 0$$

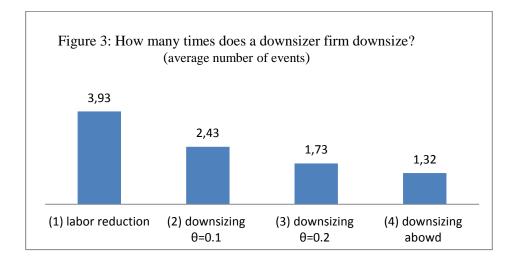
The pattern of employment reduction of the Chilean manufacturing plants in the sample period can be seen in Figure 2. Half of the firms reduce 11% of the total employment, in the period 81-82 the median workforce reduction in firing firms, was of 17%.



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²⁸ Source: Table 2.2 Baumol, Blinder and Wolff (2003)

Taking into consideration that firms are 7 years on average present in the sample, job destruction is a relatively frequent practice: half of the firms reduce the number of workers at least 5 times. But downsizing is a less frequent practice, as shown in Figure 3 the stricter the definition of downsizing, the average number of times a firm downsizes decreases, when analyzing the continuing firms.



Downsizing firms had on average before doing downsizing: 48 employees and with a productivity almost 10% lower than the non-downsizing firms. Table 8 shows the average change of the firms' employment between the two periods before doing downsizing and the two immediate periods after downsizing is done. The same is done with the variables real value added and firm level productivity, which shows an increase of 8%.

Table 8: Average percentual change before and after firms do downsizing, using different definitions of downsizing

Variable	downsizing θ=0.1	downsizing θ=0.2	downsizing abowd
Employment	-19.5%	-27.0%	-37.1%
Real value added	-6.0%	-9.5%	-18.5%
TFP	7.0%	8.0%	8.0%

Firms present in the data exhibit that for the same level of productivity, they have different employment levels. Analyzing firms that belong to a same sector, this continue happening, therefore some firms are being less efficient. After firms do downsizing, it can be seen that they increase on average their TFP level²⁹.

2.3.4 Baseline Regression

In order to study the characteristics that predict downsizing I use a traditional fixed effect logit regression, where the dependent variable is the downsizing event, that takes value 1 if done by firm i at time t. The probability of downsizing is modeled as a function of two sets of variables30; firm level characteristics ($Firm_{i,t-1}$) and environmental factors ($Environ_{t-1}$), all of them prior to downsizing:

$$Pr_{it} = \Phi[\alpha' Firm_{i,t-1} + \beta' Environ_{t-1} + \mu_i + \varepsilon_{it}]$$

where μ_i are the unobserved firm characteristics. In order to avoid potential endogeneity problems, all variables are included as one-year lags. Firm characteristics include:

- Firms size in relation to the average sectors size (RFS_{it}), downsizing has been described as a practice that is more likely to happen in big firms (Baily et al (1996) and Ahmadijan et al (2001)). One of the reasons is that larger firms have higher visibility, therefore if a firm announces a downsizing practice aiming efficiency reasons, it will give a positive signal to the market. Another reason is that downsizing in the presence of firing costs make firms pay out at once a big amount of money, bigger firms have a better access to liquidity from financial institutions.
- 2 Productivity level (TFP_{it}), it is expected that firms engage in downsizing strategies when they have low productivity (Marquez (2011), Abowd et al (2009), Ahmadjian et al (2001) and Love(2005)). Using downsizing as a mechanism to increase efficiency, eliminate redundancies and therefore increase productivity.
- 3 Labor share cost (LSC_{it}), it is expected that higher wages relative to sales lead to higher cost savings as labor is fired (Boone (2000) and Baily et al (1996)).
- 4 Human capital dependence (high_skill_{it}) is the ratio of high skilled to low skilled employees at firm i in time t, this variable should affect negatively the likelihood of downsizing because of two mechanisms: firstly it is more expensive to fire workers

²⁹ In an exercise done for firms from the Food sector (311) which has the higher number of firms. It can be seen that firms that did downsizing in 1988 increased their TFP the next couple of years (this period was chosen because it was macroeconomically stable).

³⁰ Details on the construction of variables in Appendix 1

that receive higher incomes because the firing costs are associated to their wages and also because retraining high skilled employees is also expensive (Hammermesh and Pfann (1996)). Secondly, the variation in the workforce is an important instrument to change output and production in low skilled dependent firms, so downsizing would be a more cost effective practice in this firms (Pfann and Verspagen (1989)).

Labor Gap (GAP_{it}) is the difference between the desired and the real level of employment of firm *i* at time *t*. The methodology to construct this variable is based on Petrin and Sivadasan (2011), and explained in detail in Appendix 1. The incorporation of this variable follows the concept of "wedge" minted by Caballero, Engel and Micco (2004). The bigger the GAP_{it} the bigger the probability of adjusting labor in the presence of a shock, in this case the probability of downsizing increases with the GAP.

The variables included in environmental factors are linked to changes in the macroeconomic conditions or changes in industry specific characteristics (Datta et al (2010)). Time dummy variables are included in order to capture changes in the macroeconomic conditions that affect all firms simultaneously. The variable of interest included in the environmental factors is the job security protection index (Index_t), which measures a firms firing costs³¹, it is expected that high firing costs "alter short run production choices and cause employers to retain unproductive workers" (Autor et al (2007)).

The last variable included is related to changes in the industry specific demand characteristics, relative sector price growth (RPG_{st}), which is calculated as the growth rate of the relative price between the manufacturing sectors 3-digit ISIC³² deflators and the industrial price index. RPG_{st} is calculated for each sector between 1980 and 1994, a negative demand shock represents a reduction in the sectors relative price³³. In the previous model the downsizing decision of firms, came from a reduction in the final product price. Indeed employee downsizing has been linked to demand declines, with firms seeking to reduce labor costs (Cameron et al (1993), Budros (2002) and Datta et al(2010)).

³¹ Appendix 2 shows the way the variable is calculated.

³² The deflators where calculated for the Chilean manufacturing firms by Andrea Repetto, who gently made them available to me.

³³ More details about the construction of this variable and its evolution by sectors in Appendix 1.

2.4 Results

In Table 9 the first column presents the estimates of the probability of a job reduction in firm *i* at time *t*, independent of the number of workers been laid off (DRC) the second column presents the estimates of the probability of doing downsizing (DRC_20). I present this table in order to identify some differences between these two practices.

Table 9: Probability of reducing workforce, logit estimation marginal effects reported. All the explanatory variables used are from t-1

	(1)	(2)
Dependent variable	DCR	Down_20
RPG	-0.527 ***	-0.168
	(0.207)	(0.333)
TFP	-0.079 ***	-0.231 ***
	(0.023)	(0.038)
RFS	-0.174 ***	-0.47 ***
	(0.019)	(0.040)
High_skilled	0.416 ***	0.799 ***
	(0.082)	(0.145)
LSC	0.0446 *	-0.0629
	(0.024)	(0.038)
GAP	0.116 ***	0.229 ***
	(0.012)	(0.023)
EPL Index	-0.070 ***	-0.269 ***
	(0.019)	(0.031)
Year fixed effects	yes	yes
Sector fixed effects	yes	yes
Observations	21377	21377

DCR: takes value 1 if the firm reduces it's workforce in period t, Down_20: takes value 1 if the firm does downsizing of more o the 20% of it's workforce in period t, RPG:sectors price growth rate, TFP:firms total factor productivity, RFS: Relative firms size, High_skilled: ratio of skilled workforce, LSC: Labor share cost, GAP: wedge between actual and desired labor in absolute value, EPL Index: employment protection legislation index. Standard errors in parenthesis. *** p<0.01,** p<0.05, *p<0.1

It can be seen that if the sectors prices grow, the probability of reducing jobs decreases. This is associated to better demand conditions, nevertheless they do not explain changes in the probability of downsizing. The firms TFP level is a more relevant variable in the downsizing decision rather than in regular dismissal. Something similar happens in the

case of the wedge between desired and real labor, as the wedge increases the probability of regular dismissals and downsizing also increase.

These preliminary findings are consistent with the idea that downsizing is a practice that differs from regular dismissals. Regular dismissals are basically driven by external market conditions, while downsizing depends on firms particular long term characteristics, linked to productivity and efficiency.

In regards to the EPL index, which measures how stringent the firing costs legislation is, it can be seen that if the EPL index increases in one point, as in the Chilean economy the year 1984, the impact in the downsizing decision is bigger than in a regular job reduction. With a decrease in the likelihood of downsizing, 0.26 and 0.07 percentual points respectively. This is not a surprising result, because a firms' total firing cost expenditure increases with the number of workers being fired.

In order to take a closer look to the impact of EPL in the propensity to downsize, exploiting the heterogeneity between firms and sectors, column 1 of table 10 includes interaction between EPL index and other explanatory variables.

It can be seen that an increase of one point in the index, implies a decrease of 0.32 percentual points in the likelihood of downsizing. Because the variables are expressed in deviations with respect to their means, the impact of the EPL index is evaluated in all the other variables mean.

Three interaction terms, affect the effect of EPL index: the relation with the price growth rate (RPG) which means that an increase in the sectors prices lowers the negative impact of EPL; also for firms with higher levels of TFP the impact of an increase of the EPL in the probability of doing downsizing is even lower; finally firms with bigger labor gaps (GAP) when facing an increase in the index it's negative effect in the probability will be attenuated.

In general the literature about downsizing is focused in big firms, because this practice is associated to large US corporations. As pointed out by Baumol (2003) many corporations in the US where paternalistic towards their workers and where characterized as "fat and mean". To study downsizing in large and small firms, in a context of a developing country, I divide the sample in two groups small firms (with an average of less than 100 workers) and big firms (with an average of more of 100 workers).

Column 2 and 3 of table 10 show these results, in small and big firms the downsizing likelihood is affected negatively by raises in the EPL index. The negative effect is slightly smaller in big firms.

Table 10: Probability of downsizing, logit estimation marginal effects reported. All the explanatory variables used are from t-1 and are deviations from their means.

	(1)	(2)	(3)
	Continuing	Small Firms	Big Firms
Dependent variable	Down_20	Down_20	Down_20
RPG	-0.708 *	-0.880 *	-0.145
	(0.373)	(0.427)	(0.729)
TFP	-0.249 ***	-0.295 ***	-0.417 ***
	(0.038)	(0.042)	(0.070)
RFS	-0.466 ***		
	(0.040)		
High_skilled	0.779 ***	-0.16	-0.196
	(0.145)	(0.138)	(0.416)
LSC	-0.0664 *	-0.0844 **	-0.126 *
	(0.039)	(0.004)	(0.072)
GAP	0.236 ***	0.211 ***	0.245 ***
	(0.023)	(0.026)	(0.043)
EPL Index	-0.323 ***	-0.291 ***	-0.227 **
	(0.004)	(0.039)	(0.089)
index*RPG	-1.585 ***	-1.167 **	-2.445 ***
	(0.463)	(0.531)	(0.934)
index*TFP	-0.178 ***	-0.220 ***	-0.123 **
	(0.045)	(0.051)	(0.055)
index*RFS	-0.0271		
	(0.038)		
index*High_skilled	-0.201	-0.183	-0.791 *
	(0.163)	(0.162)	(0.479)
index*LCS	-0.0689	-0.0879 *	-0.0113
	(0.045)	(0.053)	(0.086)
index*GAP	0.062 **	0.038	0.109 **
	(0.026)	(0.031)	(0.047)
Observations	21360	16035	5325
Number of padron	2371	1847	524

Down_20: takes value 1 if the firm does downsizing of more o the 20% of it's workforce in period t, **RPG**:sectors price growth rate, **TFP**:firms total factor productivity, **RFS**: Relative firms size, **High_skilled**: ratio of skilled workforce, **LSC**: Labor share cost, **GAP**: wedge between actual and desired labor in absolute value, **EPL Index**: employment protection legislation index. Standard errors in parenthesis. *** p<0.01,*** p<0.05, *p<0.1

It is interesting to see that likelihood of doing downsizing in small firms is highly driven by changes in the prices (demand shocks) while big firms likelihood of doing downsizing relies strongly in their productivity level. Both samples in the presence of higher wedges in their desired and real labor (GAP) increase the likelihood of doing downsizing, this means history matters in the sense that "fat" accumulation gets to a point where downsizing needs to be done.

Table 11: Adittional interactions and their impact in the effect of EPL index in the probability of downsizing (Down_20)

Dependent variable	(1) Continuing Down_20	(2) Small Firms Down_20	(3) Big Firms Down_20	
EPL Index total effect	-0.237	-0.393	-0.338	
index*RPG	-1.523 ***	-1.219 **	-2.104 **	
	(0.460)	(0.525)	(0.925)	
index*TFP	-0.177 ***	-0.207 ***	-0.136 *	
	(0.044)	(0.051)	(0.080)	
index*RFS	0.00384 *			
	(0.002)			
index*High_skilled	-0.211	-0.136	-0.725	
	(0.160)	(0.160)	(0.463)	
index*LCS	-0.0378	-0.056	0.017	
	(0.045)	(0.052)	(0.084)	
index*GAP	0.0589 **	0.033	0.103 **	
	(0.026)	(0.030)	(0.045)	
index*trade	-2.853 ***	-2.433 ***	-4.116 ***	
	(0.364)	(0.414)	(0.729)	
index*RZ*credit	-0.00588 *	-0.006 *	-0.013 *	
	(0.003)	(0.003)	(0.007)	
index*durable*growth	-3.508 ***	-3.857 ***	-2.330 ***	
	(0.481)	(0.541)	(0.978)	
Observations	21360	16035	5325	
Number of padron	2371	1847	524	

Only interactions are reported, and the Index total effect is calculated evaluating the interacted variables in their mean values. Down_20: takes value 1 if the firm does downsizing of more o the 20% of it's workforce in period t, RPG:sectors price growth rate, TFP:firms total factor productivity, RFS: Relative firms size, High_skilled: ratio of skilled workforce, LSC: Labor share cost, GAP: wedge between actual and desired labor in absolute value, trade: trade opennes indicator, RZ: sectors financial dependence indicator, credit: financial development indicator, durable: takes value 1 if the sector produces durable goods, growth: output gap, EPL Index: employment protection legislation index. Standard errors in parenthesis. **** p<0.01, *** p<0.05, *p<0.1

During the study period, not only the EPL index varied. Chile experienced in this period trade openness, higher financial and economic growth. Therefore in Table 11, I also implement some additional regressions adding controls and interactions (such as trade openness, business cycle and financial development³⁴). The idea is to check if the results

³⁴ Characteristics of this variables included in Appendix 1

concerning employment legislation and downsizing are stable. In order to analyze the quantitative importance of the interactions of the EPL index with the variables of interest (sectors relative price growth, TFP and labor wedge). I present in Table 12 the effect in the probability of downsizing of changes in the EPL index when moving the variables of interest from the 75th to the 25th percentile, leaving the rest of the variables in there median values³⁵.

Table 12: Effect of EPL index in the probability of doing downsizing, when moving relevant interaction variables from the 75th to the 25th percentile distribution

	(1) Continuing Down_20	(2) Small Firms Down_20	(3) Big Firms Down_20
Relative price growth (RPG)	0.10	0.45	0.13
Total Factor Productivity	0.19	0.21	0.14
(TFP) Labor Wedge (GAP)	-0.08	-	-0.18

Some interesting conclusions can be learned from this exercise; in the first place a negative demand shock that can be reflected in a reduction of the final goods prices attenuates the negative effect of an increase in the firing costs. The attenuation effect is stronger in the case of small firms when moving through the relative price growth distribution.

Another similar result happens when we move in the distribution of firms TFP, when the firms TFP level decreases, the negative impact of an increasing EPL index is attenuated.

Finally, when firms reduce their labor GAP becoming more "slim" the effect of an increase in the labor costs is magnified. Looking it from an opposite side, firms that have more accumulated "fat" reduce less the likelihood of doing downsizing when firing costs increase.

The previous results consider only the firms that did not exit the sample, which represented more than 62% of the observations. This was done to isolate downsizing

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 $^{^{35}}$ This is done incorporating the additional interactions shown in Table 11 in order to avoid identification problems.

decisions (that improve firms' efficiency) from regular layoffs made by firms before exiting the market.

In order to analyze the differences in the results that arise from selecting a smaller sample, I perform the main regressions to all the firms (continuing and exiting firms) this sample will be named as "enlarged sample". The results are reported in Table 13, the negative effect of EPL index in downsizing is bigger in the enlarged sample when evaluating the interaction variables in there median values, this is consistent with the idea of capturing more downsizing episodes.

Table 13: Adittional interactions and their impact in the effect of EPL index in the probability of downsizing (Down_20). Using "continuing" and "enlarged" sample.

Dependent variable	(1) Continuing Sample	(2) Enlarged Sample
EPL Index total effect	-0.237	-0.312
index*RPG	-1.523 ***	-1.592 ***
	(0.460)	(0.379)
index*TFP	-0.177 ***	-0.167 ***
	(0.044)	(0.036)
index*RFS	0.00384 *	-0.0017
	(0.002)	(0.032)
index*High_skilled	-0.211	-0.279 **
	(0.160)	(0.132)
index*LCS	-0.0378	-0.0441
	(0.045)	(0.036)
index*GAP	0.0589 **	0.0591 ***
	(0.026)	(0.022)
index*trade	-2.853 ***	-2.441 ***
	(0.364)	(0.321)
index*RZ*credit	-0.00588 *	-0.00217 *
	(0.003)	(0.003)
index*durable*growth	-3.508 ***	-3.182 ***
	(0.481)	(0.406)
Observations	21360	25985
Number of padron	2371	3390

Only interactions are reported, and the Index total effect is calculated evaluating the interacted variables in their mean values. Down_20: takes value 1 if the firm does downsizing of more o the 20% of it's workforce in period t, RPG:sectors price growth rate, TFP:firms total factor productivity, RFS: Relative firms size, High_skilled: ratio of skilled workforce, LSC: Labor share cost, GAP: wedge between actual and desired labor in absolute value, trade: trade opennes indicator, RZ: sectors financial dependence indicator, credit: financial development indicator, durable: takes value 1 if the sector produces durable goods, growth: output gap, EPL Index: employment protection legislation index. Standard errors in parenthesis. **** p<0.01, *** p<0.05, *p<0.1

Comparing column 1 and 2 of table 13, it can be seen that the relative firm size does not affect the impact of EPL index in the downsizing probability in the case of the enlarged sample. But instead, the sectors skilled dependence turns out to be relevant, this is because increases in firing costs are related directly to the wages of the workers. More skilled workers, make the downsizing decision even more expensive when EPL increases.

2.5 Conclusions

This paper has investigated the impact of stringent employment legislation (EPL) on the firms' decision of downsizing. I presented a simple partial equilibrium framework to emphasize how the different firing costs regimes, may affect heterogeneously the firms optimal downsizing strategy. Then I tested empirically the impact of higher firing costs in the manufacturing plants in Chile.

Consistent with the theoretical framework developed, higher firing costs increase the "price" of downsizing, and this practice is done less frequently. Although firms that have a low productivity performance have a higher probability of downsizing when facing a negative demand shock (environmental factor). Considering that a firm in the 25th percentile TFP distribution, reduces the probability of downsizing in 0.23 percentage points while a firm in the 75th percentile reduces the probability of downsizing in 0.43 percentage points, after facing the same increase of 1 point in the EPL index.

One of the caveats of this simple model is that it does not represent fully the Chilean case, where firms with the same level of employment have different TFP levels, and this is due the firing costs are not zero at the beginning of the period. So some firms face differences between their desired level of employment and their real level of employment (labor wedge). The different gaps determine the firms' initial situation, affecting their downsizing decisions. The main conclusion in the case of Chile is that history matters, firms that have accumulated a lot of FAT might be willing to pay higher firing costs, because it turns profitable to do so.

The evidence presented in this paper strongly supports the idea that when firing costs are higher the probability of doing downsizing will decrease but heterogeneously. The differences arise from sectors price growth rates, firm productivity and labor wedge. The first two channels attenuate the effect of EPL index while labor wage magnifies the effect.

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Appendix 1: Variable description

Relative price growth (RPG)

If the sectoral relative prices have a negative growth rate, it means that the firms that belong to that sector face a negative demand shock.

Sectoral relative price (p_{st}) is constructed as the rate between the sectors deflator in t and the industrial price index for that period:

$$p_{st} = \left(\frac{defl_{st}}{IPM_t}\right)_{base\ year1992}$$

The following figure shows the evolution of the sectoral relative price growth rate $\left(\frac{p_{st}-p_{st-1}}{p_{st-1}}\right)$, between 1980 and 1994. Considering all sectors the average relative price growth rate, reaches its lower value in 1983 (-13%). The biggest negative demand shock took place in 1983 in the beverages sector (-31%).

Total Factor Productivity

In order to estimate a firm-level TFP, I use the Olley and Pakes (1996) methodology. Based in the estimation of a Cobb Douglas production function, the estimation takes care of potential simultaneity issues³⁶. This methodology is also implemented by other studies that work with the ENIA like Pavcnik(2002), Alvarez et al (2004) and Bergoeing et al (2006).

Relative firms size (RFS)

Firms i size at time t, relative to sectors s size in time t. This ratio represents how big in terms of the number of workers is a firm, controlling for the sectors size.

Skill dependence (High_skilled)

It's the ratio of high skilled workers over total employment, in firm i at time t. The classification between skilled and unskilled workers arises from the information present in ENIA about the kind of jobs they do. I do not have information about the educational level of the workers.

Labor share costs (LSC)

³⁶ Details about this methodology is extensively explained in Alvarez et al (2004)

Is defined as: $lsc_{it} = \left(\frac{wage\ bill_{it}}{value\ added_{it}}\right)$; both variables are reported in ENIA by firm and year.

Percentile	LSC		
25th	0.465		
50th	0.712		
75th	1.008		

Firm labor wedge (Gap)

This variable is created based in Petrin and Sivadasan (2011), where given the values of the production function (previously estimated for TFP) and the observed labor levels, the value of the marginal product of labor is:

$$VMP = \beta_L \left(\frac{PX_{it}}{L_{it}} \right)$$

The absolute value labor GAP (G_{it}), given the wage bill reported in ENIA will then be the absolute difference between the marginal revenue of product and the marginal input price, that in this case is the wage:

$$G_{it} = |VMP_{it} - w_{it}|$$

Other variables used for robustness checks:

- Trade openness: Country level variable calculated for each year as exports and imports over GDP.
- 2. *Financial development*: Country level variable calculated for each year as private credit over GDP.
- 3. *Financial dependence*: 3-ISIC digit level variable developed by Rajan and Zingales (2008) for the US industries in the manufacturing sector.
- 4. *Durable goods sector*: variable that takes value of one if the firm belongs to an industry that produces durable goods and zero otherwise. The durable goods classification is defined as a variant NAICS.

Appendix 2: Job security protection index

Pagés and Montenegro (1999,2007) constructed a measure of job security cost, which is an index used in the estimations presented in this paper. Their goal was to elaborate a synthetic index that measures the relative rigidity of Chilean codes over the years. The authors approach was to compute an index combining information on notice periods, compensation for dismissal, the likelihood that a firm's economic difficulties argument is considered as justified cause of dismissal, and the severance pay that is due in that event. The equation to compute the cost of job security in period t is the following:

Index_t =
$$\sum_{i=1}^{T} \beta^{i} (\delta^{i-1}) (1 - \delta) [b + aSP_{t+i}^{jc} + (1 - a)SP_{t+i}^{uc}]$$

where δ is the probability of remaining in a job, $(\delta^{i-1})(1-\delta)$ is the probability of dismissal after i periods at the firm and β is the annual discount factor. In addition, b denotes the cost of advance notice, a is the probability that the economic difficulties of a firm are considered a justified cause of dismissal³⁷, SP_{t+i}^{jc} is the mandated severance payment in the event the dismissal is justified and the worker has a tenure of i years at the firm, and finally, SP_{t+i}^{uc} denotes the payment to be awarded to a worker with tenure i in case of unjustified dismissal.

The constructed index measures the expected cost (in monthly wages), at the time the hiring, of dismissing a worker in the future. The advantage of this measure is that it captures the whole profile of severance payment. The assumption is that firms evaluate future costs based on current labor law. Higher values of the index indicate periods of relatively high EPL, whereas lower values characterize periods in which dismissals were less expensive.

The parameters used by the authors to fill in the equation are resumed in Table A . The parameter δ is the probability of remaining in a job and is assumed to be a constant. It takes the value generated by Davis and Haltiwanger (1992) who estimated that U.S. job destruction rates average 12% a year. This assumption of considering an exogenous probability restricts the heterogeneous behavior of firms from different sector in the

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 $^{^{37}}$ a was constructed with two pieces of information: (1) whether a firms' economic difficulties are considered a justified cause for dismissal according to the labor codes and (2) information on the stand of labor courts in each period

manufacturing industry. Finally, Pages and Montenegro (1999) compute the discount rate based on the fact that Chilean real interest rates averaged 8.4% during the 1960-1998 period.

Table A

Period	Index	β	δ	b	а	SP ^{jc}	SP^{uc}
1981-1984	0.88	0.92	0.88	1	0.8	0	(1)
1985-1990	2.29	0.92	0.88	1	0	0	(1)
1991-1999	3.06	0.92	0.88	1	0.9	(2)	(3)

The maximum tenure is of 25 years (1) is a payment of one month per year with an upper limit of 5 months per year (2) one month per year with an upper limit of 11 months (3)1.2 -1.5 months per year worked with an upper 11 months

Firing costs, according to the index, were low - close to *o.8* months of wages before 1984, after that year job security raised significantly and then again after the 1991 law. At the end of the period studied, the average firing costs raised to approximately 3 months of wages.