THE COSTS OF NET LABOR ADJUSTMENTS

IN ROMANIA

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Submitted to
Central European University
Department of Economics

In partial fulfilment of the requirements for the degree of Master

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Budapest, Hungary
2010

Abstract

The downsizing in the large manufacturing plants and the growth of the private sector during the transition in Romania were both accompanied by reorganizations and large adjustments in the labor force. This paper attempts to estimate the size and structure of the labor adjustment costs at firm level, by assuming a model of the labor adjustment similar with the “q” models of investments with adjustment costs. The first order conditions of the model that show the optimal level of downward and upward adjustments are estimated with the Heckman correction to take into account the sample bias induced by the firm-year observations that do not make any change in the number of employees. The adjustment cost function comprises different fixed, linear and quadratic parameters for the upward and downward adjustment and the results are estimated separately for 9 manufacturing sectors between 1994 and 2001. The findings show that the only relevant parameter for the upward adjustment is the linear one, while in the case of the downward adjustment all the parameters are statistically significant, but the estimated linear parameter is negative in all the industries. However, compared with the yearly wage bill, the estimated adjustment costs (benefits) are negligible, suggesting that the rigidity of the Romanian transition does not lie in the labor market.

Acknowledgements

I would like to thank my supervisor John S. Earle for his full support and to Labor Project members Álmos Telegdy and Ruxandra Ștefan for providing me the data.

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INTRODUCTION

The 1990s have been a period of active restructuring in the Romanian manufacturing sector, which was over-sized by market economy standards. As shown in Table A1, the employment in manufacturing decreased continuously between 1994 and 2001, even more sharply than the overall employment, which during this period fell with about 28%. Based on Labor Force Survey data, John Earle (1998) finds that, despite the large decrease of employment in industry, between 1993 and 1995 the inflows into this sector are significant, suggesting "some dynamism and not a mere collapse" (1998, p. 9). Moreover, as I will show, between 1994 and 2001 the large Romanian manufacturing firms were making major, mostly downward, adjustments in their labour force, while the small firms were making small and mostly upward adjustments.

It seems thus that the restructuring process was not a homogenous and blunt down-sizing, but rather it was associated with large changes and reorganizations of the labor force. The aim of this paper is to estimate the structure and magnitude of the labour adjustment costs that accompanied the restructuring process. In a period when massive transformation in the industrial outlook was needed, a flexible labor market with low adjustment costs would have been a catalyst to the transition process, but on the other hand it would have been likely to offer less protection to the employees. Estimating the precise size and shape of the adjustment cost as a function of the size of the adjustment would offer a clear image of the role played by these costs in the response of firm's demand for labor inputs. This would constitute a necessary contribution to the better understanding of the mechanisms underlying the Romanian transition, especially since, to my knowledge, no such study exists yet.

Most of the costs associated with changes in the number of employees are not observable and measurable – for example there is no data on the costs associated with the disruption that a new worker causes in the production process, or the costs of dismissing a worker, or the searching costs (advertising the job opening, human resource personnel to handle the selection process, etc.) that a company incurs when looking for a new worker. But these costs do affect the decisions taken by firms with respect to the changes they make in their labor input, so this is why it is important to estimate them, in order to uncover the adjustment paths that firms make in response to shocks.

Since the Romanian transition is much skewed towards downsizing, there is little reason to assume symmetric costs of increasing and decreasing the labor force; in consequence, I estimate separate functions for the upward and downward movements in the labor force. Also, since the production functions are very different across industries in manufacturing, I estimate these costs separately for 9 manufacturing industries that have the largest number of firm-year observations between 1994 and 2001. Table A1 shows that a significant share of the employees in manufacturing are hired in the 9 sectors included in the sample – this share ranging from 34% in 1994 to 61% in 2000 – confirming thus that the industries with the largest number of firm-year observations throughout this period also employ a large share of the labor force in manufacturing.

The most important findings of the literature on labor adjustment costs up to 1996 are well presented in Daniel Hamermesh and Gerard Pfann's review. One of the points that they stress in this paper is the difference between net and gross costs of adjustment. Net adjustment takes into account only the difference in the number of employees from one period to another (like snapshot images) and disregards the inflows and outflows of employees that led to those specific modifications (Hammermesh and Pfann, 1996, p. 1266). Since the data set that I use does not provide any information on the flows of workers at plant level, I focus on the net costs of adjustment.

Temporal aggregation

The frequency of observations is critical in analysing the costs of labor adjustment. In the absence of information on the gross flows, low frequency data may fail to reveal any change in the labor force if the outflow of workers is equal to the inflow, or it may reveal a small net change that actually hides large but comparable gross changes in both directions – which can actually incur substantial adjustment costs.

Knowing the time intervals between firms' decisions about whether or not to alter their factor demand and estimating the adjustment costs on data of that specific frequency would be the first best approach. Unfortunately, information on the timing of decisions can only be obtained in extensive interviews with human resource managers. But, as Hamermesh and Pfann suggest, in most for-profit firms, especially in the large ones that make more refined projections of future demand, plans are likely to be revised more frequently than once a year (1996, p. 1277). This implies that quarterly or even monthly data is better suited in the analysis of adjustment costs.

Low frequency data biases the results against lumpy costs. The intuition behind this statement is that large fixed costs of adjustments induce companies to make large and infrequent changes, which are not well captured by data points at long time intervals. As Jose Varejao and Pedro Portugal point out, "temporal aggregation is expected to bias the estimates against non-linear models because it implies that all activity that is, partly or fully, reversed within the course of one year is missed by annual data." (2007, p. 15)

For example, for a firm that incurs lumpy costs for both the negative and the positive adjustments, and makes a large negative adjustment at the beginning of the year, followed by a large positive adjustment at the end of the year, the net adjustment from one year to another will appear to be very small, and this small adjustment will erroneously appear to be the result of convex costs. But if the firm makes adjustments only in one direction (either in a lumpy fashion or in small steps), the yearly adjustment appears to be large and is thus more likely to be linked to the lumpy costs. As I will show, the autocorrelation in the yearly change in the number of employees for the Romanian firms is positive, which suggests that indeed there is a trend in the pattern of adjustment of each firm (i.e. there are firms that systematically expand and firms that systematically contract) and thus the temporal aggregation problem is mitigated in the sample that I use.

Spatial aggregation

As I have showed, temporal aggregation can induce bias in the estimation; spatial (cross-sectional) aggregation also leads to the same types of problems. As Hamermesh and Pfann (1996) point out, observing smooth adjustment based on data describing industries or higher aggregates over time is uninformative about firms' structures of adjustment. If in each period some fraction of firms adjust their labor force and the others do not, the aggregate image of adjustment will look smooth, while each firm actually changes its labor force in a lumpy and infrequent fashion. The findings in the literature agree on the necessity of estimating the adjustment costs at plant level and then aggregating over these plant-level patterns in order to obtain the macro image (Hamermesh, 1989).

To sum up, the findings in the literature suggest that high-frequency data at firm level is the best for estimating the size and structure of the labor adjustment costs. In this paper I am using a panel of yearly data at firm level, which, admittedly not the best, is the only frequency available for the Romanian firms. But, as pointed earlier, the fact that there is constancy in the direction of adjustment at firm level mitigates the problem of simultaneous positive and negative gross flows within a year being hidden by small observed movements in employment.

Previous research

If there is a wide agreement on the necessity of estimating the adjustment costs on high frequency plant data, this is not the case with respect to the methods of estimation and results obtained. One of the main problems in dealing with adjustment costs is that these costs are not directly observed. Anderson (1993) circumvents this problem by using data in 6 states that have "experience rated unemployment insurance systems" in which the unemployment benefits are paid from a common pool at which each firm contributes. The future contribution of each firm is determined as a function of the unemployment benefits that are currently paid to the former employees of the firm; thus an important share of the expected costs of further firings are observable and measurable. She estimates that in the retailing sector (a sector with high and predictable seasonal component) at the end of the 70's and beginning of the 80's, a 10 percent increase in the expected costs associated with firings tax costs produces a 1.3 percent increase in the probability the firm will take no action towards decreasing its workforce.

Bentolila and Bertola (1989) derive a model of labor adjustment inspired from financial models of asset pricing. More specifically, they consider the marginal worker as a dividend-paying asset, with the dividend equal to the (positive or negative) excess of their marginal productivity over the wage received, until the worker quits. "When a worker is hired at the margin, the value of such an asset should equal the out-of-pocket cost, plus the value of the (forsaken) call option to delay the hiring decision, minus the value of the newly acquired put option to fire him/her" (p. 385). Their aim is to explain the sclerotic European labor market that followed the two oil shocks. The findings indicate that after the shocks, firms became more reluctant to hire, and in the same time the quit rate decreased.

Cooper et al. (2003) and Lapatinas (2009) follow very similar approaches in estimating the costs of labor adjustments. Their methodology is to set the dynamic programming problem of the firm that in each period chooses whether to change (and incur the adjustment costs) or not its employment (and in the first case also how much to alter the employment level) in order to maximize the sum of future discounted profits. The function of adjustment costs is symmetric and includes convex, fixed and disruption parameters which are estimated through the method of simulated moments. The only difference in the two models is that Cooper et al. also take into account the adjustment in the number of hours, as information on the number of hours worked is available in the quarterly data on US manufacturing plants between 1972-1980 that they use, while Lapatinas uses yearly data between 1998 and 2004 in the Greek manufacturing sector, where information on hours worked is not available. In the first paper the estimated costs of labor adjustment are only 0.24% of profits, while in the second paper the results show an amazingly high fixed cost of 29% of a yearly wage for each worker that is being hired or fired, even though the Greek author uses a yearly balanced panel, excluding thus the firms that exit the market in the analyzed period, which potentially induces a downward bias in the estimated costs of adjustments, since the exit probability could be correlated with the level of adjustment costs.

The model that I am using is inspired by Tobin's q models of investment with adjustment costs, where an investment is made only if its shadow value is larger than its cost. In the same fashion, in this model the firms are assumed to make adjustments in their labor force only if the costs of these adjustments are less than the benefits. Allowing for fixed, linear and convex costs, in the first step, I estimate an ordered probit equation to determine the probabilities of the three types of adjustment (negative, positive or non-adjustment) for each firm-year observation. In the second step, I estimate the first order conditions that show the optimal level of downward and respectively upward adjustment, adding the inverse Mills' ratios as regressors, in order to take into account the sample bias introduced by those firm-year observations which do not adjust at all. Two auxiliary regressions and the estimation of the FOCs allow retrieving estimates of the parameters of the cost function.

Applying a very similar version of this model on Norwegian yearly plant data between 1986 and 1995, Nielsen et al. (2007) find that the cost of downward adjustment is larger than the costs of upward adjustment (the fixed component is significant only for labor contractions) and moreover that "for large plants the quadratic components are the dominant ones" (2003, p.22).

The wide gamut of results obtained in the literature on labor adjustment costs, leaves open the range of expectations for adjusting costs on the Romanian labor market. Large estimated costs of adjustment would complete the image of the slow Romanian transition being a consequence of the rigidities in the labor market, but on the other hand small costs of adjustments would not be surprising either, in a context of large unemployment rates that insure a large pool of easily available potential employees, that decreases the expansion costs and in the context of low awareness of the employment protection legislation among employees, which limits the contraction costs.

The paper is organised as follows: the first chapter describes the process of cleaning the data and presents the representative statistics of the firm-year observations from which the adjustment costs are estimated. Chapter 2 presents the theoretical model and the empirical strategy associated with the model, while Chapter 3 presents the results of the main regressions and the estimated parameters of the adjustment cost function, as well as their economic significance. Moreover, this chapter relates the estimated adjustment costs to the employment protection legislation and to the unemployment rate, which were characteristic to the Romanian transition, as robustness checks for the findings on the adjustment costs. The Conclusion develops further paths of research that can be followed in the light of the results presented in this paper.

CHAPTER 1 – THE DATA

The data is an unbalanced panel extracted from the annual balance sheet that the firms have to submit at the Romanian Ministry of Finance, therefore, it contains yearly information on operating income, wages and the number of employees of 40,705 firms in 9 manufacturing sectors across 8 years, from 1994 to 2001 – 188,857 firm-year observations in total.

In order to ensure comparability across years, the operating income and the wages were adjusted by the Consumer Price Index reported by the National Institute of Statistics, thus all the prices are expressed in 1997 Romanian lei.

Data cleaning

Observations contain data on the two-digit industry code of each firm. Since there were cases when the industry was not consistent across years, the industry variable had to be cleaned. In the dataset that comprised all the firms in all the industries, when there was just an outlying year, I ignored it and inferred the industry from the other years (for example when a firm appeared to be in textiles for only one year and in apparel industry for the rest of the years, I considered the industry to be apparel). When there was just one switch, I considered that the firm changed industry and consequently considered the firm in a certain industry for the first period and in another industry for the second period. Then I picked from this database the year-firm observations in the 9 industries that I analyze.

Thus, out of the 40,705 firms in the sample, 17,866 (i.e. approximately 43.9%) did not display any change in industry; 17,056 (or 41.9%) had some outlying year in which the industry was different from the rest of the years; the rest – 5783 (or around 14.2%) had more than an outlying year. These firms in the last category either appear in the sample as belonging to different industries in different years (if the industries between which they switch are among the 9 industries which I analyze), or appear in the sample only in those years when they were in one of the analyzed industries. This cleaning process lead to the following outcome: 86.5% of the firms in the sample appear just in one industry, 12.3% appear in 2 industries and only 1.2% appear in 3 or 4 industries. When there are more frequent switches between industries i.e. when the firm appears in less than 4 consecutive years in an industry, or less than 4 consecutive years in the sample, the firm is automatically dropped from the analysis of the adjustment costs, since I run each regression separately for each industry and for the first regression I use data on 4 consecutive years.

As the paper focuses on the costs of labour adjustment, I excluded from the analysis those observations with outliers in the change of labor force. Defining the outliers only in absolute terms, or only in relative terms would not have been proper, since the small and large firms have different patterns of adjustment. For example, a firm that increases the number of employees from 1 to 2 (i.e. with 100%) cannot be considered an outlier, while a firm that increases the number of employees from 10.000 with 100% within a year definitely is an outlier.

In order to better spot the outliers, I plotted two types of scatter diagrams: in the first I plotted the absolute vs. relative change in employment ($\frac{L_t - L_{t-1}}{L_{t-1}}$) from one year to another and in the second I plotted the absolute change in employment vs. change in employment as a share of the existing (current) employment ($\frac{L_t - L_{t-1}}{L_t}$). The second is more useful in detecting the outliers in negative adjustments. Figure B1 shows the first type of scatter plot on the left column and the second type on the right column, progressively zoomed in; the last figures in each column show the data that I am actually using in the estimation. Even after removing the obvious outliers, the data points in the bottom figures still look scattered, reflecting either the active restructuring in the 9 manufacturing sectors that I analyze, or errors in the data, which are quite plausible since panels are more sensitive to data errors (for example the number of employees reported with error in a certain year induces errors in the data on labor adjustment both in the current and consequent year). 210 outliers were excluded based on this visual representation. I also plotted average cost per worker (salary and associated taxes) and average future operating income per current number of workers and eliminated further 70 visible outliers. In the end out of the 40,705 firms and 188,857 firm-year observations, 40,701 firms and 188,577 firm-year observations remained.

Descriptive statistics

Since smaller firms are likely to have different patterns of adjustment than large firms, I divided the firms into 4 size classes according to the average number of employees that they had across time. The first class comprises micro firms, which had an average number of employees between 1 and 10; the second class comprises small firms with an average number of employees between 10 and 50; firms with an average employment between 50 and 250 are considered medium, while firms that had on average more than 250 employees are considered large. Figure C1 shows that the data set is dominated by micro firms (67%), followed by small firms (22.2%) and then medium (7.3%) and large firms (3.5%).

Table C1 presents statistics regarding the number of employees (L) and the difference in the number of employees from one year to another (ΔL) across size classes. While the micro and small firms had on average positive and small adjustments, the average change in employment of the medium firms was negative and quite small (-0.31) and the average change in employment of the large firms was large in absolute terms and negative (-59.9). The large standard deviations, as well as the large differences between the median and the mean value of the change in employment point to the irregular patterns of adjustment, that still comprise outliers even after the data was cleaned.

Further differences in the pattern of adjustments between different size classes are presented in Table C2. While the micro firms are almost as likely to reduce/ keep constant / expand their employment, the larger the firm, the more likely it is to make a negative adjustment. Thus, only 27.3% of the micro firms have a negative ΔL, while 34% of the small, 48.1% of the medium and almost 70% of the large firms make negative adjustments. Consequently, larger firms are less likely to keep their employment unchanged. But considering that very small fluctuations in the labor force of large firms cannot be directly linked to the costs of adjustment, in the empirical analysis I consider the employment to remain unchanged even if it fluctuates with less than ±1%. Table C3 shows the types of adjustments over size classes under this rule. As expected, for the micro and small firms the distribution remains the same, while the number of non-adjustments increases from 449 to 602 for the medium firms (or from 4.1% to 5.5%) and from 88 to 467 (or from 1.4% to 7.6%) for the large firms. At the level of the whole sample, in 38.3% of the firm year-observations there is an upward adjustment, in 28.7% there is non-adjustment and in 33% of the observations there is contraction in the labor force from one year to another, reflecting the balanced distribution of the firm-year data points across contraction, non-adjustment and expansion. It is also important to notice that in 52.9% of the total firm-year observations of small the firms there are positive adjustments – these type of firms having a small but steady increase in the labor force.

As Tables C2 and C3 showed the differences in adjustment among size classes in absolute terms, Table C4 presents these differences as relative adjustments: %ΔL $= \frac{L_t - L_{t-1}}{L_{t-1}}$. This table shows that approximately 69.5% of the large firms have negative adjustments, while approximately 45.7% of the small firms have relative adjustments greater than 10%, reflecting again the downsizing of the large companies that is accompanied by the growth of the small ones.

The autocorrelation of ΔL is positive but rather small in all class sizes, except micro where it is negative and small – as can be noticed from Table C5. But as the autocorrelation takes into account the size of the adjustment, it is not the most relevant indicator of the existence of a trend. For example if firms make large negative adjustments in the odd years and low negative adjustments in the even years, the autocorrelation will appear negative, even though firms make only negative adjustments. For this reason, in Table C5, I included the absolute number and the share of negative adjustments that are followed by negative adjustments, negative adjustments that are followed by positive adjustments, and so on. The table reveals that in 35.3% of the firm-year observations a negative or positive adjustment is followed by the same type of adjustment, while only in 23% of the firm-year observations two consecutive adjustments have different signs. The rest of 41.6% of the observations have one of the two consecutive adjustments equal to 0. Even though the findings in this table do not provide any insight on the pattern of adjustment within years, the message that they convey is that in many cases, within firms, there is a trend in the pattern of adjustment from one year to another, pointing to the that systematic adjustments in one direction or another at firm level.

The differences across years in the pattern of adjustments are shown in Figure C21. The bars represent the share of positive (I – from increase), negative (D – decrease) and zero-adjustments (C – constant) in each year. Even though the differences between years do not seem to reveal any particular pattern, the graph shows that in the early years most of the adjustments made by the firms in the sample were upward; also, the share of non-adjustments was increasing from 1995 to 1999, and then decreasing again in 2000 and 2001. But, as showed previously, as 67% of the firms in the data set are micro, most these adjustments take place within the micro firms. Figure C22 shows this pattern more clearly: in each year and in each category (I/C/D) most of the adjustments are made by the micro firms, followed by the small firms. Figure C22 also shows the relative large share of negative adjustments in large firms in 1995.

The foods and drinks industry is the best represented in the sample with 46,336 firm-year observations, while the industry with the fewest observations is leather (8,526). Table C6 shows the distribution of the industries across size classes. Again, in each industry, most of the firm-year observations comprise micro firms, even though in the leather industry only 55.9% of the observations are micro, while in the rubber and plastic industry 77.5% of the observations are micro. In all the industries the fewest firm-year observations are for the large firms, the most extreme case being the typography industry, where there are only 103 firm-year observations for large firms. This table shows that there are no large differences in the distributions of firms across size classes in the 9 industries.

Table C7 shows the average adjustment (ΔL) in each industry. With the exception of the apparel industry, where the average adjustment in the large firms is close to 0, but still positive, in all the other industries, the average adjustment is negative for large the firms. Also, the average adjustment is positive for the small firms in all industries. Even though among industries the average adjustment in the large firms ranges from -144 in typography to almost 1 in the apparel industry, this uniformity suggests that firms in the same size class tend to have similar adjustment patterns, regardless of their industry.

As shown in Table C8, the average adjustment was negative in all the industries in 1995, and in 1998 and 1999 it was negative for all the industries except apparel. Also, 1995 was the year with the smallest average adjustment in all the industries, save for rubber and plastic and furniture. The broader economic conditions seem thus to have similar effects at industry level.

It is known that state companies can be used as a means of keeping low levels of unemployment; therefore the pattern of adjustment of state firms could be different from that of private firms. In this sample I created 3 dummies to account for this effect. The first, *state* is 1 for all those firms where state ownership remained equal or larger than 50% between 1995 and 2000 and 0 otherwise; *privatised* is 1 for the firms which became entirely or more than 50% private in this period, and 0 otherwise; and *private* is 1 for the firms where the state had had less than 50% ownership throughout the period. I choose 2000 as the last year of reference for the ownership form, since in the regressions I use forward values over two periods as regressors, so the last year with available dependent variable in the dataset is 1999.

Private firms are considerably smaller than state or privatised firms in all industries – as shown in Table C9. The industries with the largest private firms are textile, apparel and leather. In some sectors (food and drinks, textiles, apparel and rubber and plastic) the average number of employees of the companies that became private is larger than the average number of employees of the firms that remained in state's ownership. Also, as presented in Table C10, the private firms have positive average adjustments in all industries, with the exception of metal. In all industries, with the exception of the rubber and plastic industry, the average adjustment is more negative in the state firms, than in the privatised firms. Since the previous table shows that in several industries state firms are larger than the privatised ones, it is possible that the larger negative adjustment in the state firms reflects just the difference in sizes. In order to account for this possibility, Table C10 presents also the relative adjustment for each type of industry accross the ownership forms. The relative adjustment is also larger in absolute value in the state firms, with the exception of typography where the average relative adjustment is -9.19% in the state sector and -10% for the firms that became private; moreover, for the privatised firms in the apparel industry, even though the average of the absolute adjustment is negative, the average of the relative adjustment is positive. To sum up, the rough statistics presented in Table C10, do not support the hypothesis of state firms being more inclined to hoard labor.

Finally, Table C11 gives an account of the inflow and outflow pattern of the firms in the sample. It presents the number of firms that entered the sample each year and how many years they remained in the sample. Out of the 13,284 that were in the sample in the first year, 8,298 (i.e. about 62%) survived until the last year of the sample. 1995 and 1997 appear to be the years with the largest inflow of new entrants, while 2000 and 2001 represent the years associated with very small number of new entrants. It is important to notice that 15,041 firms (i.e. almos 37% of the total number of firms) appear in less than 4 years in the sample so they are excluded from the estimation of the adjustment costs, as in the regressions I use data on 4 consecutive years. The large exit rate is also important in the sense that it is likely to cause bias, since firms that expect to exit the market appear to no longer behave as profit maximizers; for example, a firm that exits in two years, may already have liquidity problems in the current period and thus be forced to sell its output below the market price, or it may already fire a large number of workers, regardless of the adjustment costs incurred. While for those firms that are in the sample from the early years one can check whether they exit or not and control for this aspect, for the firms that appear later in the sample, the exit represents a more serious problem, since the last year of observation is 2001 and one cannot check their exit.

The broad image presented in the descriptive statistics is that of a dynamic restructuring, with similar patterns across the 9 manufacturing industries. Large decreases in the labor force of the larger, mainly state owned firms, is counterbalanced by the growth of the small private businesses. Firms also appear to be consistent over time with respect to the direction of their adjustments, given the small proportion of consecutive adjustments that have opposite signs.

CHAPTER 2 – THEORETICAL MODEL AND EMPIRICAL STRATEGY

The Model

The theoretical model used to investigate the costs generated by adjustments in the labour force is based on the assumption that in each period j the firm chooses the adjustment in its labour force such that this choice maximises the future stream of profits.

$$\max_{\Delta L_{t+j}} E_t \sum_{j=0}^{\infty} \beta^j \left\{ F(A_{t+j} L_{t+j}) - w_{t+j} L_{t+j} - G(\Delta L_{t+j}, L_{t+j-1}) \right\}$$

s.t.

$$L_{t+j} = \Delta L_{t+j} + L_{t+j-1}$$

β represents the discount factor; F is the production function, which in this model is assumed to depend only on the productivity shock and on the number of employees; w is the average wage and G is the adjustment cost function, which depends on the existing number of employees (L_{t+j-1}) and on the size of the adjustment of the labor force (ΔL_{t+j}). The specification of this function allows estimating different costs in the case of upward and downward adjustments. Thus D^+ is a dummy that takes value 1 if ΔL is positive and 0 otherwise and D^- is a dummy that takes value 1 if ΔL is negative and 0 otherwise. In each case, the adjustment cost function comprises fixed, linear and convex elements.

$$G(\Delta L_{t+j}, L_{t+j-1}) = D^+ \left[a_0^+ + a_1^+ L_{t+j-1} + b^+ \Delta L_{t+j} + \frac{c^+}{2} \left(\frac{\Delta L_{t+j}}{L_{t+j-1}} \right)^2 L_{t+j-1} \right] +$$

$$D^- \left[a_0^- + a_1^- L_{t+j-1} - b^- \Delta L_{t+j} + \frac{c^-}{2} \left(\frac{\Delta L_{t+j}}{L_{t+j-1}} \right)^2 L_{t+j-1} \right]$$

The choice variable is the adjustment in the number of employees - ΔL_{t+j} and implicitly the new number of employees L_{t+j}.

The Lagrangean of the problem can be written in the following way:

$$L=\sum_{j=0}^{\infty}\beta^{j}\left\{F(A_{t+j}L_{t+j})-w_{t+j}L_{t+j}-G(\Delta L_{t+j},L_{t+j-1})+q_{t+j}\left(\Delta L_{t+j}+L_{t+j-1}-L_{t+j}\right)\right\}$$

The first order conditions with respect to ΔL_{t+j} in the two cases (expansion and contraction) – equations (1) and (1') below – imply that the only relevant variable that determines the size of the adjustment is q – i.e. the shadow value of employment.

$$\frac{\Delta L_{t+j}}{L_{t+j-1}}=\frac{1}{c^{+}}\left(q_{t+j}-b^{+}\right) \quad \textbf{(1)} \quad \text{for expansion}$$

$$\frac{\Delta L_{t+j}}{L_{t+j-1}}=\frac{1}{c^{-}}\left(q_{t+j}+b^{-}\right) \quad \textbf{(1')} \quad \text{for contraction}$$

The first order condition with respect to L_{t+j} – equation (2) – can be rewritten to obtain a relevant expression for q_t – equation (3).

$$F'(A_{t+j,}L_{t+j})-w_{t+j}-q_{t+j}+\beta\left[-a_1+c\left(\frac{\Delta L_{t+j+1}}{L_{t+j}}\right)\cdot\frac{\Delta L_{t+j+1}}{L_{t+j}}-\frac{c}{2}\cdot\left(\frac{\Delta L_{t+j+1}}{L_{t+j}}\right)^2+q_{t+j+1}\right]=0 \ \textbf{(2)}$$

$$q_t=E_t\sum_{j=0}^{\infty}\beta^{j}\left[F'(A_{t+j},L_{t+j})-w_{t+j}-\beta\cdot G_L(L_{t+j},\Delta L_{t+j+1})\right] \ \textbf{(3)}$$

Equation (3) is useful in that is shows that q_t represents the present value of the marginal product of labour, net of adjustment costs, minus the flow of wage costs associated with the marginal worker. Assuming a Cobb Douglas production function, the marginal productivity of labour can be written as the ratio of sales or operating income to employment – both the numerator and the denominator being observed.

The condition to hire more workers is that their shadow value is larger than the positive adjustment costs, and the condition to lay off workers is that their shadow value is less than the cost of dismissing them. These conditions are reflected in equations (4) and (4'). Combining these equations with the FOCs (1) and (1'), one obtains threshold values of the shadow value of employment beyond which upward or downward adjustments are worth – equations (5) and (5').

$$q_t^+ \cdot \Delta L_t - a_0^+ - a_1^+ L_{t-1} - b^+ \Delta L_t - \frac{c^+}{2}\left(\frac{\Delta L_t}{L_{t-1}}\right)^2 L_{t-1} \geq 0 \quad (4)$$

$$q_t^- \cdot \Delta L_t - a_0^- - a_1^- L_{t-1} + b^- \Delta L_t - \frac{c^-}{2}\left(\frac{\Delta L_t}{L_{t-1}}\right)^2 L_{t-1} \leq 0 \quad (4')$$

$$q_t^+ \geq \sqrt{2c^+ \cdot \left(\frac{a_0^+}{L_{t-1}} + a_1^+\right)} + b^+ \quad (5)$$

$$q_t^- \leq \sqrt{2c^- \cdot \left(\frac{a_0^-}{L_{t-1}} + a_1^-\right)} - b^- \quad (5')$$

Empirical strategy

The aim of this paper is to pin down the estimates of the parameters of the cost adjustment function: a_0^-, a_1^-, b^-, c^-, a_0^+, a_1^+, b^+ and c^+. In order to achieve this, first I estimate an order probit regression for the probabilities of downward adjustment, non-adjustment and upward adjustment; then, using these estimated probabilities and the estimated value of the shadow value employment, I run two auxiliary regressions to obtain estimates of $c^-a_0^-$, $c^-a_1^-$, b^- and $c^+a_0^+$, $c^+a_1^+$, b^+.

Last but not least, I estimate the FOCs using the Heckit method to correct the sample selection. This correction is needed since negative or positive adjustments are observed only for those firms for which the benefits of adjustments are greater than the costs, thus $\frac{\Delta L_t}{L_{t-1}}$ is observed only for a subset of the population. These two last regressions that estimate the FOCs allow retrieving estimates of b^-/c^- and $-b^+/c^+$, which actually represent the intercepts, according to equations (1) and (1'). Knowing these ratios and the estimated b^- and b^+ from the two auxiliary regressions, by bootstrapping one can obtain estimates of c^- and c^+. Further on, retrieving from the auxiliary regressions the means and standard deviations of $c^-a_0^-$, $c^-a_1^-$, $c^+a_0^+$, $c^+a_1^+$ on one hand, and having the means and standard deviations of c^- and c^+ on the other hand, one can use bootstrapping again to obtain estimates of a_0^-, a_1^- and a_0^+, a_1^+, pinning thus down estimates for all the parameters of the adjustment cost function.

As equation (3) shows, the shadow value of employment is determined by the expected marginal productivity and expected future wages. In this paper I assume that firms have perfect foresight and use the actual future values of these variables as the expected values. Pfann and Palm (1992), also substitute the realised values of period t+1 for the unobserved expectations of one-period-ahead employment, but they also add a vector of forecast errors of mean zero.

Considering a Cobb Douglas production function, the marginal productivity of employment can be written as the ratio of operating income over the number of employees. I use the operating income instead of the total sales of the firm, because it reflects better the income obtained from productive activities, as opposed to selling assets for example. Thus, in equation (6), the array of regressors includes logarithm of future wages for the next two periods, the logarithm of future operating income to current employment, the logarithm of the operating income over two periods to future employment, and controls such as year dummies and size class dummies.

$$q_{it} = \gamma_1 \cdot \ln(\text{average\_wages}_{\text{i,t+1}}) + \gamma_1 \cdot \ln\left(\frac{\text{sales}_{\text{i,t+1}}}{\text{employees}_{\text{i,t}}}\right) + \gamma_3 \cdot \ln(\text{average\_wages}_{\text{i,t+2}}) + \gamma_4 \cdot \ln\left(\frac{\text{sales}_{\text{i,t+2}}}{\text{emplyees}_{\text{i,t+1}}}\right)$$
$$+ \text{Year\_dummies} + \text{Size\_class\_dummies} + \varepsilon_{it} \quad (6)$$

Equation (6) is thus the empirical equivalent of equation (3) in a horizon of two years; the expected future wages are considered to be equal with the realised future wages and the expected marginal productivity of labor is considered to equal the ratio between future sales and the current employment; moreover, equation (6) contains time dummies and size class dummies as controls. Since the shadow value of employment cannot be observed and measured, equation (6) cannot be estimated as such.

Instead, equations (5) and (5') show that for each firm there are two threshold values of q_t that determine the type of adjustment that is made: downward, no adjustment or upward adjustment. Therefore I estimate an ordered probit model in order to determine the probabilities of q_{it} being below the first threshold (i.e. the probability of contraction) - P_c, the probability of q_{it} being between the two thresholds (no adjustment) – P_0 and, the probability of q_{it} being larger than the second threshold (expansion) - P_e. It is necessary to assume that ε_i is normally distributed with a 0 mean.

$$P_{ci} = \Pr(\gamma_1^{'} Z_i + \varepsilon_i < \sqrt{2c^- \cdot \left(\frac{a_0^-}{L_{i,t-1}} + a_1^- \right)} - b^-) = 1 - \Phi\left(\gamma_1^{'} Z_i + b^- - \sqrt{2c^- \cdot \left(\frac{a_0^-}{L_{i,t-1}} + a_1^- \right)} \right) \quad (7)$$

$$\begin{aligned} P_{0i} &= \Pr(\sqrt{2c^- \cdot \left(\frac{a_0^-}{L_{t-1}} + a_1^- \right)} - b^- < \gamma_1^{'} Z_i + \varepsilon_i < \sqrt{2c^+ \cdot \left(\frac{a_0^+}{L_{t-1}} + a_1^+ \right)} + b^+) = \\ &= \Phi\left(\gamma_1^{'} Z_i + b^- - \sqrt{2c^- \cdot \left(\frac{a_0^-}{L_{i,t-1}} + a_1^- \right)} \right) - \Phi\left(\gamma_1^{'} Z_i - b^+ - \sqrt{2c^+ \cdot \left(\frac{a_0^+}{L_{i,t-1}} + a_1^+ \right)} \right) \end{aligned} \quad (8)$$

$$P_{ei} = \Pr(\gamma_1^{'} Z_i + \varepsilon_i > \sqrt{2c^+ \cdot \left(\frac{a_0^+}{L_{t-1}} + a_1^+ \right)} + b^+) = \Phi\left(\gamma_1^{'} Z_i - b^+ - \sqrt{2c^+ \cdot \left(\frac{a_0^+}{L_{i,t-1}} + a_1^+ \right)} \right) (9)$$

Apart from the variables that determine q_{it} in equations (6) – which in equations (7), (8) and (9) are denoted by Z_i – in the ordered probit model the lagged number of employees appears as an independent variable. This is important because the lagged employment represents the exclusion restriction that allows estimating the FOCs with sample correction for those firms that do not adjust. Equations (7), (8) and (9) show that the lagged employment is relevant for the probability of the firm making one type of adjustment or another, while equations (1) and (1') show that this variable is not relevant in determining the size of the adjustment. Intuitively is not obvious why the lagged number of employees is relevant for the direction of the adjustment, but not for its size; one explanation is that the size of adjustment is measured relative to the lagged number of employees.

The coefficients from the ordered probit regressions allow constructing proxies for the shadow value of employment of each firm in the sample: $\hat{q}_{it} = \hat{\gamma}_1^{'} Z_{it}$

Thus, from (7):

$$b^- - \sqrt{2c^- \cdot \left(\frac{a_0^-}{L_{i,t-1}} + a_1^- \right)} = \Phi^{-1}(1 - P_{ci}) - \hat{q}_{it} \qquad (10)$$

And from (9)

$$-b^+ - \sqrt{2c^+ \cdot \left(\frac{a_0^+}{L_{i,t-1}} + a_1^+ \right)} = \Phi^{-1}(P_{ei}) - \hat{q}_{it} \qquad (10')$$

Using the notations $t_{1,i} = \Phi^{-1}(1 - P_{ci}) - \hat{q}_{it}$, and $t_{2,i} = \Phi^{-1}(P_{ei}) - \hat{q}_{it}$, equations (10) and (10') can be rewritten as following:

$$\frac{2c^- a_0^-}{L_{i,t-1}} + 2c^- a_1^- + 2b^- t_{1,i} - (b^-)^2 = t_{1,i}^2 \qquad (11)$$

$$\frac{2c^+ a_0^+}{L_{i,t-1}} + 2c^+ a_1^+ - 2b^+ t_{2,i} - (b^+)^2 = t_{2,i}^2 \qquad (11')$$

Running a simple OLS of t^2 on the inverse of the number of employees in the previous period and on t, one obtains estimates of $c^- a_0^-$, b^-, $2c^- a_1^- - (b^-)^2$ and $c^+ a_0^+$, b^+, $2c^+ a_1^+ - (b^+)^2$.

The last step is to estimate the FOCs with the sample correction; equation (12) is the first order condition for the firm-year observations that have negative adjustments and (12') is the condition for those observations with positive adjustments. The inverse Mill's ratio is a non linear function of both Z_{it} and $L_{i,t-1}$, but it can still be approximated by a linear function of these variables. Therefore, if $L_{i,t-1}$ appeared as a regressor in equations (12) and (12'), the explanatory variables would have been highly correlated leading to multicollinearity and consequently high estimated standard errors. But the fact that the lagged employment affects selection into the group of firms that make either a positive or a negative adjustment, but not the size of this adjustment, provides the exclusion restriction that is necessary to estimate the first order conditions with sample selection.

$$\frac{\Delta L_{it}}{L_{i,t-1}} = \frac{1}{c^-}\cdot\left(b^- + \gamma_1' Z_{it}\right) + \lambda^- \frac{\phi\left(\gamma_1' Z_{it} + \gamma_0 + b^- - \sqrt{2c^-\cdot\left(\frac{a_0^-}{L_{i,t-1}} + a_1^-\right)}\right)}{1-\Phi\left(\gamma_1' Z_{it} + \gamma_0 + b^- - \sqrt{2c^-\cdot\left(\frac{a_0^-}{L_{i,t-1}} + a_1^-\right)}\right)} + v_{it} \tag{12}$$

$$\frac{\Delta L_{it}}{L_{i,t-1}} = \frac{1}{c^+}\cdot\left(-b^+ + \gamma_1' Z_{it}\right) + \lambda^+ \frac{\phi\left(\gamma_1' Z_{it} + \gamma_0 - b^+ - \sqrt{2c^+\cdot\left(\frac{a_0^+}{L_{i,t-1}} + a_1^+\right)}\right)}{\Phi\left(\gamma_1' Z_{it} + \gamma_0 - b^+ - \sqrt{2c^+\cdot\left(\frac{a_0^+}{L_{i,t-1}} + a_1^+\right)}\right)} + v_{it} \tag{12'}$$

The constant term in equation (12) represents the ratio of b^- and c^- and the constant in equation (12') represents the ratio of $-b^+$ and c^+. In order to determine the mean and variance of each parameter of the adjustment cost function, I use bootstrapping. For example, to obtain an estimate of c^+ I generate 1000 random variables according to the distribution of b^+ (retrieved from equation 11') and 1000 random variables according to the distribution of $\frac{b^+}{c^+}$ (from equation 12'); the distribution of c^+ is obtained by dividing the numbers in the first distribution to the numbers of the second distribution.

The main advantage of this model is that it allows retrieving the estimates of the adjustment cost function using relatively few variables that are easily available, without imposing symmetry for the upward and downward adjustments. It also exploits cleverly the existence of the two thresholds in the unobservable shadow value of employment which determine the 3 types of action that are observable: downward adjustment, non-adjustment or upward adjustment, solving thus the problem of dealing with the unobservable variables. However, the main disadvantage is given by the rigidity of the adjustment cost function, which cannon be altered or specified differently because this would result in more complicated forms of equations (10) and (10’) which would not allow retrieving the parameters of interest any longer. For example, dropping the fixed component out of the adjustment cost function would result in losing the lagged number of employees form equations (10) and (10’) and thus losing the exclusion restriction that allows estimating the first order conditions with the necessary Heckman correction.

CHAPTER 3 – THE RESULTS

This section presents the results of the main regressions of the model, namely the ordered probit equation and the two first order conditions for the downward and upward adjustments. It also presents the bootstraping estimates of the adjustment cost function and discusses the economic impact of the estimated costs. Last but not least, it relates the estimated upward costs with the unemployment rate and the estimated downward costs with the employment protection legislation, as a robustness check.

The estimated equations

The Probit Model

The results of the ordered probit model are shown in Table D1. The dependent variable has three values associated with the 3 possible actions that firms can take: 1 – decrease their labor force; 2 – keep it constant; or 3 – hire more employees. As mentioned earlier, I consider a non-adjustment in the labor force those adjustments that altered the number of employees with less than ±1%, since very small changes in the labor input of large firms can be attributed to random factors or data errors.

Similarly to the probit models, the estimated results of the ordered probit model do not have a quantitative interpretation, but only their sign and statistical significance are relevant; therefore I will confine my comments to these two aspects. The expected average wage in the next period is statistically insignificant in most of the industries, with the exception of textiles, where it has the expected negative sign and is significant at 5% confidence level in the specification without controls for the ownership form, and rubber and plastic industry — where it is negative and statistically significant at 5% in the specifications without controls and at 10% in the specification with controls. In the metal and apparel industries, in the second specification the coefficient on the next period's average wage is statistically significant but it has a positive sign. The expected wage over two periods is negative and statistically significant only in the food and drinks industry, while in the apparel and rubber and plastic industries it is positive, and in all the other industries it is statistically insignificant.

These poor results could reflect the use of the actual average wages in each firm in the next periods as expected wages; it may well be the case that management's expectations, upon which they act in the current period, differ from the realised values. In this case there is a measurement error in these two explanatory variables. It is known that in an OLS regression, such errors, if uncorrelated with the true, unobserved expectations on wages would bias the estimates towards 0; even though I could not find any theoretical discussion of the implication of classical error in variables (CEV) on the results of an ordered probit regression, it is reasonable to assume that such errors cause bias in an ordered probit model as well.

The other explanation of the poor results of the estimated coefficients on future wages comes from the simultaneity problem. Establishing a causality relationship between wages and employment is always a difficult task in lack of adequate instrumental variables. In the context of this paper, the unexpected positive correlation between future wages and employment can be accounted by the fact expanding firms could have increased both their level of employment and their wages, while firms in a trough could have decreased both the number of employees and the wages; in the absence of a competitive labor market, as seems to be the case with Romania in the 1990s, this hypothesis cannot be easily refuted.

With the exception of leather and the wood industry in the second specification, in all the other 6 industries, the expected future sales to the current number of employees are highly statistically significant and have the expected positive sign. The expected sales over two periods to the future number of employees is statistically significant in 6 out of the 9 industries, namely food and drinks, leather, wood, typography metal and furniture. Again the error in measuring expectations may play some role in rendering insignificant estimates. Moreover, I assumed that the input of an employee that is hired in the current period is translated into sales one period later (this is why I consider the future marginal productivity as the ratio of future sales to current employees) but this assumption depends crucially on the inventory turnover which is different among industries, so here is another possible source of error.

It seems thus that the variables used as proxy for the shadow value of employment are not always statistically significant and sometimes have the wrong sign. On the other hand, the lagged number of employees is always negative and statistically significant, implying that in all the analysed industries firms with larger inherited number of employees are more likely to adjust downwards, which is consistent with the observations in the descriptive statistics.

For most of the industries the class size dummies are statistically significant; the firms with an average number of employees between 10 and 50 throughout the period are more likely to make an upward adjustment than the micro-firms in each industry with the exception of metal industry; also the coefficient on the *medium* dummy is positive and statistically significant, with some exceptions: in the rubber and plastic industry, the textiles and the furniture industries (the specifications without controls), it is insignificant, while in the metal industry it is negative, and in the food and drinks industry it changes signs between the specification without controls for the ownership form and the specification with controls. If smaller firms in different industries seem to behave similarly, there is more heterogeneity among large firms at industry level: in apparel, leather and typography the coefficient on the *large* dummy is positive and statistically significant; in the rubber and plastic and metal industries it is negative and statistically significant, while in the other industries it changes the sign and/or the significance level between the specification with controls for the ownership form and the specification without such controls. Also, most of the year dummies are statistically significant, and all of them are positive, suggesting that the basis year (1999) was mostly associated with downward adjustments.

In the second specification I control for the ownership form using three dummies: as mentioned in the previous chapter, *private* is 1 if the company was private and remained so throughout the period, and 0 otherwise; *privatised* is 1 if the firm was state-owned and at some point within the analyzed period it became private; and the basis category is *state* which is 1 for all those firms that remained in state's ownership. As mentioned, I introduced dummies for the ownership form of the company in the idea that state-owned companies could be more reluctant to shed the labor force, so I expected negative signs on the *private* dummy. The results show that *private* is not negative and statistically significant in any of the industries; on the contrary, with the exception of apparel and leather, in all the other industries it is positive and statistically significant. These findings reflect the steady expansion of the private sector in the 1990s. But the coefficient on *privatised* is insignificant in most of the industries (with the exception of food and drinks and wood, where it is positive and significant only at 10% level), suggesting that the firms that became private in this period are not statistically different form the firms that remained in state's ownership, with regard to their propensity to make positive or negative adjustments in the labor force. The *privatised* dummy that I use is not specific enough to capture the different behaviours before and after the privatisation, i.e. to show whether throughout the period the privatised firms do not differ at all from the state ones, or if there are significant adjustments of opposite sign before and after the privatisation.

Based on this regression, I calculated for each firm-year observation the probabilities of downward adjustment, non-adjustment and upward adjustment, which served for estimating equations (11) and (11') and obtaining estimates of $c^+a_0^+$, b^+, $2c^+a_1^+-(b^+)^2$ and $c^-a_0^-$,

b^-, $2c^-a_1^- - (b^-)^2$. Since these estimates are not relevant in themselves, I do not present the results here. Instead I focus on the results of equations (12) and (12'). These are the first order conditions for the firms that adjust negatively and positively, with the sample correction to account for those firms which do not adjust.

Downward adjustment equation

The results of the first order condition for the firm-year observations with downward adjustments and correction for the sample selection are presented in Table D2. The dependent variable in the regression is the relative adjustment in the labor force. In most of the industries the expected wage in the next year is statistically significant and positive, the only exceptions being the textiles, the rubber and plastic and the furniture industries where it is insignificant. These results imply that higher expected wages are associated with smaller decreases in the labor force – a finding that is difficult to explain in a market economy. As stated earlier, it may be the case that expectations are not adequately measured by the realized average wages or that firms with dim perspectives simultaneously decreased their labor force and the wages paid to the remaining employees – a situation which can only occur in a non-competitive labor market. The expected wage over two periods is again positive and significant for the foods and drinks, apparel, wood, typography, rubber and plastic and metal industries; for the textiles, leather and furniture industries it is insignificant. The fact that the expected average wage over two periods has again the unexpected positive sign seems to give some support to the hypothesis that the frictions that allowed firms to pay uncompetitive wages in the shorter run, persist over two years as well.

Looking at the coefficients on the expected marginal productivity, measured as future sales to the current employment, these are positive and statistically significant at 10% level in the specification with less controls and at 5% level in the specification with controls for ownership, only in the rubber and plastic industry; otherwise the coefficients are statistically insignificant in textiles, metal and furniture, and negative in the other industries, implying that expected higher marginal productivities are associated with larger downward adjustments. This puzzling result can be accounted by the problematic way of measuring the marginal productivity: again the expectations of the management may be different from the realised sales or simply, if the production function is not Cobb Douglas – as I have assumed, the marginal productivity cannot be computed as the ratio of sales to employment. The marginal productivity over two periods is positive and statistically significant, save typography and the rubber and plastic industry, where it is insignificant.

The inverse Mill's ratios are not statistically significant in all the industries; namely they are insignificant in apparel, leather, typography and furniture, suggesting that in these industries there is no sample selection problem.

The coefficients on the *private* and *privatised* dummies are either positive – suggesting that the private and privatised firms make smaller negative adjustments than the state firms, either statistically insignificant – suggesting that the private and privatised firms are not statistically different from the state firms with respect to the size of their average negative adjustment. In leather and typography industries, the ownership dummies do not capture any difference between the behaviour of the firms in each of the three categories; and in the metal industry only the *privatised* dummy is statistically 0. These results contradict again the initial assumption that the state firms are more reluctant to make large negative adjustments than the private firms, but it can be explained by the fact that the private sector was growing rapidly in the analyzed period.

Upward adjustment equation

The estimated coefficients of the first order condition for the upward adjustments are presented in Table D3. The future average wages have the expected negative sign and are significant at 1% level only in the metal industry and at 10% level in the typography industry. Otherwise the coefficients on this variable are statistically insignificant, or even positive for textiles, in the more parsimonious specification. The wages over two periods have the expected negative sign and are statistically significant in the typography, textiles and apparel industries; in the leather industry, and in the food and drinks industry (the specification with less controls) the coefficients on the wage over two periods are positive, while in the rest of the industries these are statistically insignificant.

The expected future marginal productivity, measured as before, is positive and highly significant in the food and drinks sector and marginally significant in the typography sector; in the other industries it is non-significant. The expected marginal productivity over two periods is positive and marginally significant only in the rubber and plastic industry; in food and drinks, textiles and furniture industries it is negative, while in the other industries it is not significant. The negative signs of the coefficients on $\ln(sales_{i,t+2}/employees_{i,t+1})$ are most probably related to the difference between the real expectations of management and the realised value of sales to employment.

For the dummies controlling for size class differences or different years, there is no clear pattern regarding the sign or the statistical significance. But both dummies accounting for different ownership forms are statistically insignificant in all the industries, suggesting that there are no differences among firms in different ownership forms with respect to the size of their relative positive adjustment.

The inverses Mill's ratios are negative and statistically significant in all industries and specifications, save for the rubber and plastic and metal industries, where there seems to be no selection bias.

Model discussion

In all the three regressions discussed above, many of the coefficients are either statistically insignificant, or have the wrong sign. Also, the R squared of the two OLS regressions are low, especially for the upward adjustment equation, where in the best case the chosen variables explain only 9.4% of the variation of the upward movements in the labor force.

Moreover, in the first order condition estimated for the firm-year observations with downward adjustments, the variables that should have been a proxy for the shadow value of employment have the wrong sign in most of the industries. The bad performance of the model in this particular equation can be linked to the fact that I do not control for exit. Those firms that exit the market will behave differently even before doing so; thus, for a firm that is forced to exit, higher future sales to the current number of employees may actually represent stock liquidations; this possibility would explain the negative coefficient on $\ln(sales_{i,t+1}/employees_{i,t})$ in foods and drinks, apparel, leather, wood and typography industries. As showed in the descriptive statistics and as noticed by Eric Bartelsman et al. (2004, p.26) high exit rates represent indeed a specific feature of the Romanian firms:

> *Romania is obviously an outlier amongst transition economies: not only are failure rates higher than in the other countries, but even successful entrants have more limited opportunities of expanding.*

As stated before, these unconvincing results could be the consequence of the inadequate measurement of the explanatory variables that include expectations. But it may also be the case that this model is not well suited for the economic context in which it was applied. One of the reasons is that between 1994 and 2002 in Romania the inflation rate had unusually high levels (Table A2 shows the consumer price indices as reported by the National Institute of Statistics). It is known that such high levels of inflation induce uncertainty in the business sector and thus for the management of each company it becomes more difficult to elaborate accurate and reliable forecasts. So, apart from the difficulty that arises in measuring expectations adequately, there is the additional problem of the model assuming that the management uses such expectations in taking decisions; given the unreliability of expectations about monetary wages and sales in such an inflationary environment, it is likely that the decisions regarding adjustments in the labor force are taken on other grounds, like perspectives of privatisation if the firm is state-owned, specific long-term contracts (or the absence of such contracts) that guarantee a certain steady demand, or local conditions in the labor market – more specifically, for example, the disadvantaged region status granted to several regions which offer better opportunities for developing businesses.

Adjustment function parameters

Statistical significance

From the estimated parameters of the two first order condition regressions and of the other two auxiliary regressions, I estimate the parameters of the labor adjustment cost function by bootstrapping. But given the relative poor performance of the model in capturing the dynamics of the adjustment, these estimated parameters should be regarded cautiously, especially in the case of downward adjustments.

The results are presented in Table D4. The most striking fact is that the results are qualitatively the same across all industries – i.e. in each industry and specification, the different components of the adjustment costs have the same sign and statistical significance. The other unexpected fact is that the estimated linear component of the downward adjustment cost is negative and statistically significant at 1% level, implying that on average, firms have a linear benefit in decreasing their employment; this benefit appears to be greater in the specification with more controls – i.e. b^- is more negative in the second specification – in all industries, save for leather. But c^- (the convex component) is always higher than b^- and always statistically significant, so when plotting the cost of adjustment as a function of the absolute size of the adjustment, most of the firms appear to have costs of downward adjustment near 0; c^- is smaller in the second specification in apparel, rubber and plastic, metal and furniture, and larger in the other industries.

While a_0^- and a_1^- are positive and statistically significant but low in absolute value, a_0^+ and a_1^+ are not significant. Moreover, c^+ is also not significant in any of the industries. Thus, for the upward adjustment, the only statistically significant component is the linear one, b^+ being always positive and highly statistically significant.

Comparing industries among each other, the typography seems to incur the largest adjustment costs, as the estimated a_0^-, a_1^-, c^- and b^+ are the largest in this industry; but also the estimated b^- is among the lowest in typography. On the other hand, in the food and drinks, textiles and rubber and plastic, all the elements of the adjustment costs are among the lowest.

The structure of the adjustment costs is important in determining the path of adjustment of the labor force. As discussed by Hammermesh (1996, p. 1268-1275), in the presence of significant fixed costs, the adjustment proceeds in jumps (i.e. there are large and infrequent modifications of the number of employees); in the case of linear costs, the marginal cost of adjustment is constant and so the larger the linear costs, the longer the periods of inaction in response to shocks; quadratic costs imply that the marginal cost increases with the size of the adjustment, so in the presence of such costs, the optimal strategy for the firm is to adjust continually and in small quantities.

The fact that only the linear component of the cost function is significant for the upward adjustment implies that the marginal cost of adjustment is equal with b^+ at all the levels of adjustment, which suggests that firms have some flexibility in making their adjustments as each upward adjustment is made as long as its benefit offsets b^+. In the case of downward adjustment, even though the fixed component is statistically significant, it has such low estimated values that it can be considered insignificant from the economic perspective; a larger fixed cost would have deterred firms to make any adjustment, unless the benefits of this adjustment were large enough to offset the fixed cost. The fact that both b^- and c^- are significant, but have different signs literally implies that there are linear *benefits* and simultaneous quadratic *costs* of downward adjustment; moreover, as these estimated components are of comparable size, it is hard to predict the path of adjustment in the case of downward adjustments.

Economic impact

Figure E1 plots the estimated adjustment costs obtained in the specification with more controls for the firms in the sample in all the 4 size classes as a function of the absolute adjustment, separately for each industry. Since the only parameter that is statistically significant for the upward adjustment is b^+ – the linear component – all the estimated upward costs are lined up. The steepest slope is in typography (6.29), while the flattest slope is in textiles (3.189); as all the prices are in thousands of 1997 Romanian Lei, and the average exchange rate in 1997 was 7,167.94 ROL for an USD this implies that even in the industry with the highest upward adjustment cost, this cost is less than $1 for each additional worker that is hired.

As for the downward adjustment, the plots reflect the more inconclusive shapes of the cost function, with most of the observations bulking around 0, especially for smaller adjustments. Even though it is highly statistically significant, the fixed component has very small values, ranging from 0.0035 in the rubber and plastic industry to 0.0859 in typography, and is thus economically insignificant; a_1^- has also small values from 0.0324 in the rubber and plastic industry to 0.1855 in the leather industry, but since this term is multiplied with the existing number of employees, it can have some impact on the cost of adjustment in the large firms. The estimated b^- ranges from -3.92 in typography to -2.49 in the rubber and plastic industry; interestingly, the industry with the most negative b^-, has the largest estimate of the quadratic cost (9.397) and the industry with the estimated b^- closest to 0, has the lowest estimate of the quadratic cost (2.844).

The distribution of firms according to the share of their adjustment costs in the yearly wage bill is shown in Figure E2, separately for downward (left column) and upward (right column) adjustments for each industry. The figure shows that all the firms in the apparel, rubber and plastic and metal industries have only benefits from downward adjustment (i.e. the downward adjustment costs are negative), but these benefits, are extremely small – less than 0.05% of the yearly wage bill for most of the firms. In the other industries, most of the firms have negative costs for decreasing their labor force (i.e. benefits), but there are also firms with positive costs. Again, most of these costs and benefits are very close to 0 when compared to the firms' wage bill. The figure also shows that the upward costs are very small in each industry, most of the firms incurring upward adjustment costs that are less than 0.1% of the yearly labor expenses.

Employment protection legislation and unemployment rate

The results presented above lead to the conclusion that between 1995 and 1999 (the years actually used in estimating the adjustment costs), there are no adjustment costs on the Romanian labor market. But, given the poor performance of the model in capturing the dynamics of the labor adjustment, this conclusion should be regarded cautiously. In order to shed more light on these results, I consider the strictness of the employment protection legislation as an indicator of the size of the downward adjustment costs and the unemployment rates as an indicator of the upward adjustment costs.

In the World Bank's 2005 report entitled "Enhancing Job Opportunities – Eastern Europe and Former Soviet Union", Romania is ranked the first in the top of countries with the strongest employment legislation in the region, having the strongest regulations for temporary employment and the second strongest regulations (after Ukraine) for the regular employment (Figure 6.6B, p. 214). The same report labels Romania as a country with very rigid EPL and intermediate enforcement (Table 6.1, p. 215). This evidence seems to support the idea that the chosen model was inadequate and the conclusions derived from it are not trustworthy. But, the same report points out to the "the differences between the legislative difficulty of hiring and firing and the ease of both reported by employers" (2005, p.212) that are specific to the Romanian labor market. Moreover, these conclusions are based on the labor code adopted in 2003. The law that was valid in the period of my analysis is the labor code dating from 1972, with some amendments, that did not insure such a high level of protection for employees. Accoring to Vasile Ciucă and Luise Malden, in the 2003 code the "employees' information and consultation rights have been greatly improved" (2009, p. 2); the same authors mention that this code proved to be particularly rigid and therefore was modified in 2005 and 2006 in order to insure a greater flexibility of the labor market.

Another argument that supports the hypothesis of a lax EPL that induces low costs of labor adjustments can be found in the previous study of Juan Botero et al. (2004), which ranks Romania on the 20th place out of 85 countries with respect to the flexibility of their employment laws. Their employment law index measures the protection of labor taking into account 4 aspects: alternative employment contracts, the cost of increasing hours worked, the cost of firing workers and the dismissal procedures. Romania's index of 0.3272, places it in the quarter of the countries with the lowest protection, the 25th percentile being 0.3433 and the average 0.488. Unfortunately, the online appendix provided by the authors, that should contain information on the exact source of the data in each country, cannot be accessed, but given the fact that the paper was published in 2004, it is likely that the data for Romania refers to the older labor code, that which was valid during the 90s and which is relevant for my analysis. This would also explain the discrepancy between the evaluation of the Romanian EPL in this article and the evaluation in the World Bank's report.

As for the extremely low estimates of the upward adjustment cost, one explanation could reside in the large levels of unemployment that were characteristic in Romania for this period. In order to test if the large pool of unemployed people lowered the costs associated with searching new workers, I estimated the costs of upward adjustment separately for each year and each industry. Since only the linear component turned out to be significant, Table D5 presents the unemployment level in each year and the estimated b^+ separately for each year and industry. 1996 – the year with the lowest unemployment rate is also the year with the lowest estimated costs in the in textiles and wood industries and in all the industries the estimated marginal costs of adjustment between 1995 and 1996 are smaller than the estimated costs for the whole period. Moreover, in 1999 (the year with the highest rate of unemployment), in all industries the estimated b^+ is larger than the estimated b^+ for the whole period. Thus, it seems that in the presence of high unemployment rates, the adjustment costs are also higher and consequently the low estimates for the upward costs of adjustment cannot be explained by the high rates of unemployment that were characteristic to Romania in that period.

But there are two problems in using the rate of unemployment at country level in order to explain the size of the estimated upward adjustment costs: the first one is that the unemployment rate is a rough measure that does not provide any clue about the local conditions of each firm, which are more relevant for its search costs. And the second problem comes from two possible simultaneous causality relations: on the one hand more firms making larger upward adjustments results in lower estimated costs of adjustment; and on the other hand more firms making larger upward adjustments results in decreased levels of unemployment. Therefore the causality relation between the unemployment rate and the cost of adjustment is shadowed by the increased upward adjustments determining simultaneously lower levels of unemployment and lower estimated costs of upward adjustment.

Conclusion And Further Paths of Research

The poor performance of the model shades doubt on the estimated parameters of the adjustment cost function. Moreover, the analysis of the unemployment rate and of the EPL does not provide conclusive arguments to sustain these results. And since one cannot test simultaneously the performance of a model and the accuracy of the results it produces for a particular set of data, more research is needed in both directions, i.e. in improving this theoretical model and also in using other models to measure the size and structure of the labor adjustment costs during the Romanian transition. Also, the theoretical framework that I used ignores several important aspects of the labor adjustment that were previously emphasised in the literature.

For example, one possibility that is worth investigating in the future is whether the expected firing costs have any impact on hiring, interplaying thus with the hiring costs to determine the optimal level of upward adjustment. Intuitively, higher separation costs should make the firm more reluctant to hire. On the other hand, as Bentolila and Bertola (1989) point, "the larger the fixed cost of separation, the longer is tenure and the closer to zero is the expected discount factor multiplying this cost" (1990, p 391). In the same paper, by calibrating their model with realistic parameter values, they find that actually firing costs do not have large effects on hiring decisions, nor do high firing costs reduce the average level of employment, and they explain these results by the role of discounting and labor attrition in the firms's dynamic optimization problem. Similarly, Anderson (1993) finds that the theoretical possibility that high firing costs prevent increases in employment is not supported empirically. Based on these results, in my model I did not allow the firing costs to influence the decision regarding hires, but this possibility cannot be totally excluded.

There is empirical evidence that the voluntary turnover rate affects the labor adjustment costs Burgess (1988). Thus, incorporating attrition in the model of labor adjustment would make it more realistic and would allow retrieving better estimates of the adjustment costs. On one hand attrition allows firms to reduce their labor force without incurring the associated costs of downward adjustment – which is beneficial for a firm in a trough, but on the other hand, attrition increases the upward adjustment costs, since the firm has to hire more workers to replace those who quit or retire. More importantly, the quit rate is tightly related to the tightness of the labor market, which in turns affects the adjustment costs. A tight labor market, with high levels of unemployment is likely to lower the upward adjustment costs, and in the same time decrease the quit rate. As I showed, in the analyzed period, in Romania the unemployment rate was high, which implies a low quit rate, and thus not taking into account the quit rate is not likely to have affected much the results.

Another direction in which estimation could be improved is by taking into account the adjustment costs in employment generated by changes in the amount of capital. As Alonso-Borrego (1998) shows, it is plausible that the decisions of investment and labour demand are interrelated, and more specifically, as shown by Cooper and Willis, "the presence of lumpy capital adjustment could induce lumpy labor adjustment even without non-convex costs of adjusting the stock of workers." (2009, p. 645) In this case, the approach that considers the amount of capital as fixed and given (as it is considered in most of the literature) should be replaced with an approach where the adjustment cost function includes an interaction term between labor and capital inputs.

Even the costs associated with changes in different types of labor can be considered separately. It is reasonable to expect hiring costs to be larger the higher the skill of workers, since training costs are expected to be lower for unskilled labor. "Furthermore, since severance pay depends on the worker's earnings, and they depend on his skill, firing costs will increase with worker's skill." (Alonso-Borrego, 1998, p.476) A particular labor input will thus be adjusted more slowly than others if its adjustment costs are larger. Using data for manufacturing in Netherlands between 1971(I) and 1984(IV) and for manufacturing in UK between 1955 and 1986, Pfann and Palm (1992), find that hiring costs exceed firing costs of production workers, whereas firing costs exceed hiring costs of non-production workers.

Moreover, a potentially fruitful approach would be to take into account the influence of the adjustment of one type of labor on the adjustment of the other types. Alonso-Borrego follows this track and, using data on 1080 Spanish manufacturing firms between 1986 and 1991, tries to show the pattern of interactions between adjustments of permanent nonproduction/ permanent production and temporary workforce. The results show that "there is a positive cross-adjustment effect between nonproduction and production labor inputs (…); this implies that, at the margin, the costs of hiring permanent nonproduction employment may be lowered if the firm dismisses permanent production employees at the same time." (1998, p. 492). This result could actually be the expression of the skill biased technological change that occurred during that period. But in order to test this hypothesis, capital should have also been considered as the 4th type of input.

Focusing on the adjustment on the number of employees, it is important not to disparage the adjustment in the numbers of hours worked. Empirical studies show that this is a more flexible mechanism of adjustment, and is thus being used intensively by firms. For example Hamermesh's study on monthly plant-level data shows that increases in demand are met by combinations of greater effort and increased hours per worker, and only "with very large changes in product demand, though, firms respond by non-marginal changes in employment" (1989, p. 683). Also, Cooper et al. point to the fact that "at the plant-level, there is about equal adjustment in hours per worker and employees" (2003, p. 2). Labor unions are also known to have a considerable effect on the costs of labor adjustments through their influence on the rate of dismissal payments and the duration of application terms for dismissals (Pfann and Verspagen, 1989).

Unfortunately, the data set that I use does not contain information on union coverage, neither on the voluntary turnover rate, or on the number of employees with different skills, or on the number of hours worked. Thus, most of the limitations of this study are intrinsically linked to the limitations of the data.

The findings of this paper support the hypothesis of the Romanian transition not being hampered by any type of labor adjustment costs. However it is important to be cautious about this statement and not to disparage the shortcomings of the model through which these estimates were obtained, that were outlined throughout the paper. The absence of adjustment costs should have constituted an effective catalyst for the transition. Therefore, in the light of this paper, the fact that Romania fell behind in its speed of adjustment to the market economy, compared to other countries in the region can only be explained by the existence of larger rigidities in other fields. A multi-disciplinary investigation of the rigidities in these other fields would help building a clear and exhaustive image of the Romanian transition.

APPENDIX A – MACROECEONOMIC CONTEXT

Table A1 - Evolution of the total number of employees in all activities, in manufacturing and in the sample

	1994	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
Total number of employees (thousands)	6,438	6,160	5,939	5,597	5,369	4,761	4,623	4,619
Annual change		-4.32%	-3.59%	-5.76%	-4.07%	-11.32%	-2.90%	-0.09%
Employees in manufacturing industry (thousands)	2,426	2,192	2,148	2,032	1,907	1,660	1,560	1,590
Annual change		-9.65%	-2.01%	-5.40%	-6.15%	-12.95%	-6.02%	1.92%
Employees in the sample (thousands)	831	1,087	1,124	1,207	1,109	1,004	955	674
Share of employees in manufacturing	37.68%	35.58%	36.17%	36.31%	35.52%	34.87%	33.74%	34.42%
Share of manufacturing employees in the sample	34.25%	49.59%	52.33%	59.40%	58.15%	60.48%	61.22%	42.39%

Table A2 - Consumer price indices
Previous year=100

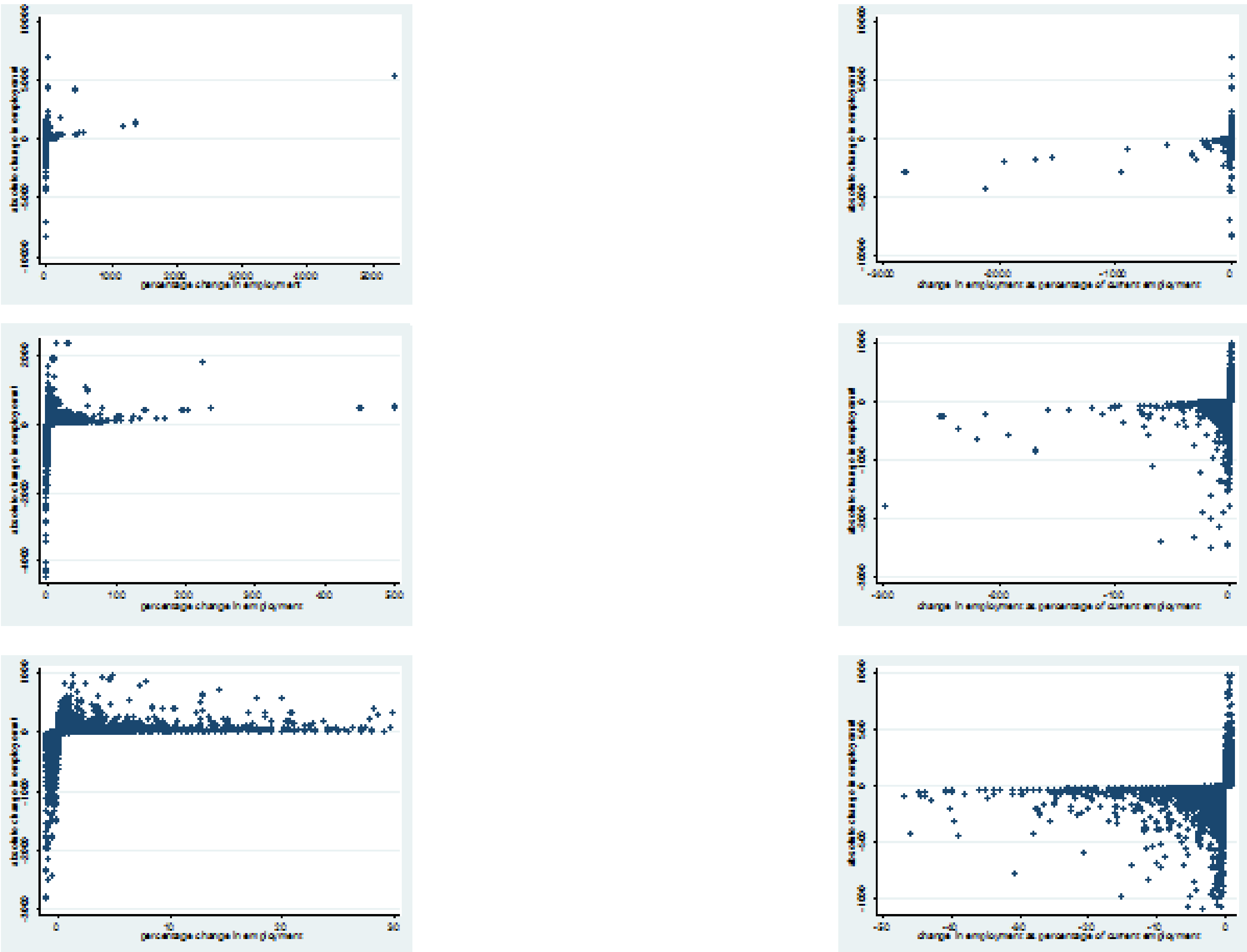
1994	236.7
1995	132.3
1996	138.8
1997	254.8
1998	159.1
1999	145.8
2000	145.7
2001	134.5
2002	122.5

APPENDIX B – DATA CLEANING

Figure B1

Percentage change vs. absolute change in employment (left column)

Change in employment as percentage of the current number of employees vs. absolute change (right column)



APPENDIX C – DESCRIPTIVE STATISTICS

Figure C1– The share of micro, small and medium firms

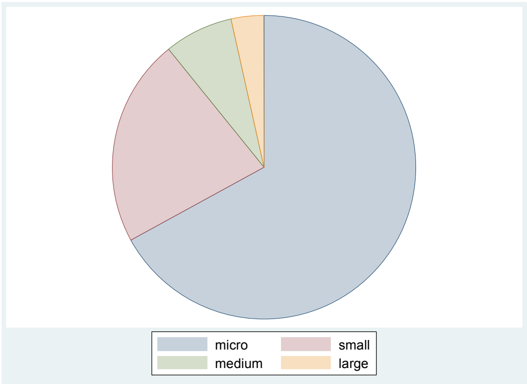


Table C1 – The mean, median and standard deviation of the number of employees and of the yearly change in the number of employyes by size class

Size Class	**Mean (ΔL)**	**Median (ΔL)**	**St. Dev. (ΔL)**	**Mean (L)**	**Median (L)**	**St. Dev. (L)**
micro	0.15	0	2.56	4.07	3	3.28
small	1.67	1	11.79	21.32	17	15.81
medium	-0.31	0	52.97	112.02	93	80.28
large	-59.89	-33	162.35	754.71	524	757.24
Total	-2.66	0	43.35	54.44	6	232.91

Table C2 – The absolute number and share of the firm-year observations that contract, do not adjust and respectively expand the labor force, by size class

	Size Class				
	micro	**small**	**medium**	**large**	**Total**
contraction	18,643	10,558	5,286	4,280	38,767
	27.28%	33.99%	48.13%	69.57%	33.26%
non adjustment	28,331	4,074	449	88	32,942
	41.45%	13.12%	4.09%	1.43%	28.27%
expansion	21,374	16,426	5,248	1,784	44,832
	31.27%	52.89%	47.78%	29.00%	38.47%
Total	68,348	31,058	10,983	6,152	116,541
	100.00%	100.00%	100.00%	100.00%	100.00%

Table C3 – The absolute number and share of the firm-year observations that contract, do not adjust and respectively expand the labor force, considering non-adjustment any change in employment that is smaller than ±1%, by size class

	Size Class				
	micro	**small**	**medium**	**large**	**Total**
contraction	18,643	10,558	5,212	4,078	38,491
	27.28%	33.99%	47.46%	66.29%	33.03%
non adjustment	28,331	4,074	602	467	33,474
	41.45%	13.12%	5.48%	7.59%	28.72%
expansion	21,374	16,426	5,169	1,607	44,576
	31.27%	52.89%	47.06%	26.12%	38.25%
Total	68,348	31,058	10,983	6,152	116,541
	100.00%	100.00%	100.00%	100.00%	100.00%

Table C4 – The absolute number and share of firm-year observations with relative adjustments ($\%\Delta L = \frac{L_t - L_{t-1}}{L_{t-1}}$) in different intervals, by size class

	Size Class				
	micro	**small**	**medium**	**large**	**Total**
% ΔL <=-.3	11,963	3,968	1,391	677	17,999
	17.50%	12.78%	12.67%	11.00%	15.44%
-.3<% ΔL <=-.1	6,372	4,371	2,166	1,615	14,524
	9.32%	14.07%	19.72%	26.25%	12.46%
-.1<% ΔL <0	308	2,219	1,729	1,988	6,244
	0.45%	7.14%	15.74%	32.31%	5.36%
% ΔL =0	28,331	4,074	449	88	32,942
	41.45%	13.12%	4.09%	1.43%	28.27%
0<% ΔL <=.1	181	2,224	1,365	972	4,742
	0.26%	7.16%	12.43%	15.80%	4.07%
.1<% ΔL <=.3	4,516	4,751	1,535	446	11,248
	6.61%	15.30%	13.98%	7.25%	9.65%
% ΔL >.3	16,677	9,451	2,348	366	28,842
	24.40%	30.43%	21.38%	5.95%	24.75%
Total	68,348	31,058	10,983	6,152	116,541
	100.00%	100.00%	100.00%	100.00%	100.00%

Table C5 – The absolute number and share of two consecutive adjustments that are both negative (first column), positive followed by negative (second column), both positive (third column), negative followed by positive (fourth column), non-adjustment followed or preceded by negative or positive adjustment (fifth column), as well as the autocorrelation of the absolute change in employment (last column), by size class

	$\Delta L_t<0$; $\Delta L_{t-1}<0$	$\Delta L_t<0$; $\Delta L_{t-1}>0$	$\Delta L_t>0$; $\Delta L_{t-1}>0$	$\Delta L_t>0$; $\Delta L_{t-1}<0$	$\Delta L_t=0$ or $\Delta L_{t-1}=0$	**Total**	**ΔL autocorrelation**
micro	4004	5969	5474	3428	29074	47949	-0.093
	8.35%	12.45%	11.42%	7.15%	60.64%	100.00%	
small	3754	4017	7717	2607	5735	23830	0.055
	15.75%	16.86%	32.38%	10.94%	24.07%	100.00%	
medium	2819	1413	2737	1040	672	8681	0.0816
	32.47%	16.28%	31.53%	11.98%	7.74%	100.00%	
large	2869	639	829	597	132	5066	0.2392
	56.63%	12.61%	16.36%	11.78%	2.61%	100.00%	
total	13446	12038	16757	7672	35613	85526	0.2782
	15.72%	14.08%	19.59%	8.97%	41.64%	100.00%	

Figure C21 The frequency of positive adjustments (I), non-adjustments (C) and negative adjustments (D), by year

Figure C22 The frequency of positive adjustments (I), non-adjustments (C) and negative adjustments (D), by year and class size

Figure C21

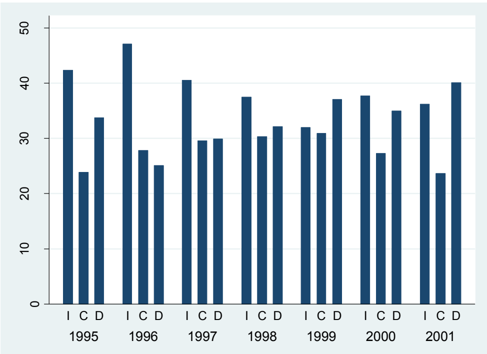


Figure C22

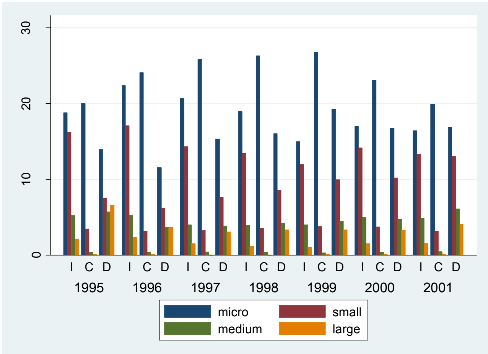


Table C6 – The absolute number and share of firm-year observations in each industry by size-class

Industry	Size Class micro	small	medium	large	Total
food and drinks	28,698	12,673	3,201	1,764	46,336
	61.93%	27.35%	6.91%	3.81%	100.00%
textiles	8,352	2,697	1,649	1,541	14,239
	58.66%	18.94%	11.58%	10.82%	100.00%
apparel	12,135	4,346	2,421	1,004	19,906
	60.96%	21.83%	12.16%	5.04%	100.00%
leather	4,769	2,001	1,216	540	8,526
	55.93%	23.47%	14.26%	6.33%	100.00%
wood	21,490	6,247	1,474	533	29,744
	72.25%	21.00%	4.96%	1.79%	100.00%
typography	9,001	3,037	634	103	12,775
	70.46%	23.77%	4.96%	0.81%	100.00%
rubber and plastic	7,693	1,634	373	226	9,926
	77.50%	16.46%	3.76%	2.28%	100.00%
metal	9,595	4,392	1,445	886	16,318
	58.80%	26.92%	8.86%	5.43%	100.00%
furniture	8,561	2,490	913	466	12,430
	68.87%	20.03%	7.35%	3.75%	100.00%
Total	110,294	39,517	13,326	7,063	170,200
	64.80%	23.22%	7.83%	4.15%	100.00%

Table C7 – The average absolute adjustment by industry and size class

Average ΔL				
Industry	Size Class			
	micro	**small**	**medium**	**large**
food and drinks	0.19	1.54	-7.55	-53.59
textiles	-0.02	1.38	0.12	-67.99
apparel	0.12	2.02	5.29	0.94
leather	-0.03	2.32	11.75	-42.04
wood	0.17	1.99	4.78	-104.4
typography	0.21	1.19	-4.36	-144.16
rubber and plastic	0.04	2.07	1.08	-97.03
metal	0.2	0.93	-6.17	-80.82
furniture	0.2	2.4	-1.28	-78.44

Table C8 – The average absolute adjustment by industry and year

Average ΔL							
industry	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
food and drinks	-7.67	1.26	-1.9	-2.78	-3.38	-2.66	-2.47
textiles	-32.82	-7.77	-4.8	-7.28	-9.66	-3.44	-6.28
apparel	-1.26	0.52	4.19	1.45	0.41	1.74	1.49
leather	-8.85	-0.53	3.55	-4.72	-2.23	3.91	0.02
wood	-8.28	1.35	-0.89	-2.82	-1.27	-0.1	-2.15
typography	-2.58	1.04	-0.92	-3.08	-2.58	-0.16	-0.9
rubber and plastic	-2.92	-0.42	-1.83	-4.23	-4.64	-1.13	-1.54
metal	-9.54	0.44	-5.67	-9.17	-9.52	-4.36	-1.9
furniture	-4.97	-0.97	-2.2	-6.86	-3.94	-2.14	-1.03

Table C9 – The average number of employees by industry and ownership form

Average L			
	ownership form		
industry	**state**	**privatised**	**private**
food and drinks	208.61	322.52	19.62
textiles	457.23	586.92	43.04
apparel	204.09	950.48	47.43
leather	2401.84	964.58	47.17
wood	1013.93	706.29	15.49
typography	359.71	116.77	15.01
rubber and plastic	269.99	589.75	16.71
metal	949.97	390.14	22.66
furniture	541.42	496.64	27.95

Table C10 – The average absolute (ΔL) and average relative (%ΔL) adjustment by industry and ownership form

	state		**privatised**		**private**	
industry	**Av (ΔL)**	**Av (%ΔL)**	**Av (ΔL)**	**Av (%ΔL)**	**Av (ΔL)**	**Av (%ΔL)**
food and drinks	-46.77	-18.14%	-38.59	-10.66%	0.9	31.35%
textiles	-92.54	-19.75%	-63.28	-9.63%	1.76	30.98%
apparel	-93.3	-17.24%	-37.12	0.88%	2.47	29.98%
leather	-196.06	-16.89%	-80.16	-7.88%	3.31	30.60%
wood	-126.67	-21.00%	-75.98	-8.30%	1.11	31.17%
typography	-68.14	-9.19%	-25.51	-10.00%	0.08	22.60%
rubber and plastic	-39.12	-13.47%	-57.14	-10.23%	0.51	23.84%
metal	-95.58	-12.13%	-38.57	-7.91%	-0.31	28.15%
furniture	-120.4	-25.17%	-55.77	-7.24%	0.49	33.00%

Table C11 – The number of firms that enter in the sample each year and the number of years they appear in the sample

year of entry	number of years the firm appears in the sample 1	2	3	4	5	6	7	8	Total
1994	407	664	696	774	714	796	935	8,298	13,284
1995	560	1,072	1,204	1,029	1,024	2,172	1,749		8,810
1996	402	647	460	696	593	1,171			3,969
1997	821	904	2,686	2,890	1,331				8,632
1998	377	540	321	1,488					2,726
1999	818	488	1,209						2,515
2000	429	245							674
2001	91								91
Total	3,905	4,560	6,576	6,877	3,662	4,139	2,684	8,298	40,701

APPENDIX D – ESTIMATED RESULTS

Table D1 – Results of the Probit Model

$$action_{it} = \gamma_1 \cdot \ln(\text{average\_wages}_{\text{i,t+1}}) + \gamma_1 \cdot \ln\left(\frac{\text{sales}_{\text{i,t+1}}}{\text{employees}_{\text{i,t}}}\right) + \gamma_3 \cdot \ln(\text{average\_wages}_{\text{i,t+2}}) + \gamma_4 \cdot \ln\left(\frac{\text{sales}_{\text{i,t+2}}}{\text{emplyees}_{\text{i,t+1}}}\right) +$$
$$+ \text{Year\_dummies} + S\text{ize\_class\_dummies} + \varepsilon_{it}$$

Table D2 – Results of the First Order Condition for the observations with downward adjustments

$$\frac{\Delta L_{ti}}{L_{t-1,i}} = \frac{1}{c^-} \cdot \left(b^- + \gamma_1^{'} Z_{it}\right) + \lambda^- \frac{\phi\left(\gamma_1^{'} Z_{ti} + \gamma_0 + b^- - \sqrt{2c^- \cdot \left(\frac{a_0^-}{L_{ti}} + a_1^-\right)}\right)}{1 - \Phi\left(\gamma_1^{'} Z_{ti} + \gamma_0 + b^- - \sqrt{2c^- \cdot \left(\frac{a_0^-}{L_{ti}} + a_1^-\right)}\right)} + v_{it}$$

Table D3 - Results of the First Order Condition for the observations with downward adjustments

$$\frac{\Delta L_{ti}}{L_{t-1,i}} = \frac{1}{c^+} \cdot \left(-b^+ + \gamma_1^{'} Z_{it}\right) + \lambda^+ \frac{\phi\left(\gamma_1^{'} Z_{ti} + \gamma_0 - b^+ - \sqrt{2c^+ \cdot \left(\frac{a_0^+}{L_{t-1i}} + a_1^+\right)}\right)}{\Phi\left(\gamma_1^{'} Z_{ti} + \gamma_0 - b^+ - \sqrt{2c^+ \cdot \left(\frac{a_0^+}{L_{t-1i}} + a_1^+\right)}\right)} + v_{it}$$

Table D1 – Ordered Probit Results

	foods & drinks		textiles		apparel		leather		wood		typography		rubber & plastic		metal		furniture	
ln(average_ wage,t+1)	-0.0322	0.0052	-0.0859**	-0.0471	0.0574	0.0656*	0.0511	0.0505	0.0025	0.0111	0.0181	0.0320	-0.0891**	-0.0809*	0.0584	0.0674*	-0.0139	-0.0099
	(0.0217)	(0.0219)	(0.0430)	(0.0434)	(0.0357)	(0.0358)	(0.0563)	(0.0564)	(0.0273)	(0.0274)	(0.0407)	(0.0408)	(0.0443)	(0.0444)	(0.0369)	(0.0370)	(0.0479)	(0.0479)
ln(sales,t+1/ employees,t)	0.0783***	0.0545***	0.108***	0.0848***	0.0869***	0.0843***	0.0131	0.0203	0.0309**	0.0193	0.0933***	0.0814***	0.146***	0.133***	0.146***	0.131***	0.0949***	0.0817***
	(0.0118)	(0.0120)	(0.0232)	(0.0235)	(0.0201)	(0.0202)	(0.0313)	(0.0314)	(0.0152)	(0.0152)	(0.0261)	(0.0262)	(0.0262)	(0.0263)	(0.0207)	(0.0209)	(0.0289)	(0.0291)
ln(average_ wage,t+2)	-0.0557***	-0.0241	0.0208	0.0488	0.0708**	0.0729**	-0.0259	-0.0233	0.0287	0.0381	0.0165	0.0272	0.0886**	0.0958**	0.0228	0.0318	0.0011	0.0076
	(0.0203)	(0.0205)	(0.0381)	(0.0385)	(0.0323)	(0.0323)	(0.0526)	(0.0527)	(0.0261)	(0.0262)	(0.0381)	(0.0383)	(0.0422)	(0.0422)	(0.0355)	(0.0356)	(0.0447)	(0.0448)
ln(sales,t+2/ employees,t+1)	0.0843***	0.0679***	0.0380*	0.0221	0.0283	0.0286	0.125***	0.123***	0.0585***	0.0541***	0.0559**	0.0558**	-0.0009	-0.0056	0.0601***	0.0520***	0.0737***	0.0635**
	(0.0109)	(0.0110)	(0.0212)	(0.0215)	(0.0186)	(0.0186)	(0.0298)	(0.0299)	(0.0142)	(0.0143)	(0.0239)	(0.0239)	(0.0248)	(0.0249)	(0.0195)	(0.0196)	(0.0277)	(0.0278)
L,t-1	-0.00162***	-0.00134***	-0.000778***	-0.000636***	-0.000836***	-0.000698***	-0.00169***	-0.00146***	-0.00103***	-0.000923***	-0.0144***	-0.0135***	-0.000358**	-0.000291*	-0.000408***	-0.000360***	-0.000754***	-0.000597***
	(0.000119)	(0.000119)	(9.74e-05)	(9.82e-05)	(9.17e-05)	(9.91e-05)	(0.000165)	(0.000195)	(0.000134)	(0.000150)	(0.00110)	(0.00112)	(0.000158)	(0.000152)	(0.000107)	(0.000110)	(0.000143)	(0.000145)
small	0.172***	0.191***	0.287***	0.314***	0.244***	0.245***	0.290***	0.283***	0.239***	0.256***	0.315***	0.308***	0.286***	0.353***	-0.0151	0.0032	0.257***	0.280***
	(0.0219)	(0.0220)	(0.0486)	(0.0488)	(0.0376)	(0.0376)	(0.0537)	(0.0538)	(0.0308)	(0.0309)	(0.0467)	(0.0469)	(0.0550)	(0.0560)	(0.0378)	(0.0379)	(0.0528)	(0.0531)
medium	-0.176***	0.165***	0.0725	0.369***	0.232***	0.234***	0.414***	0.417***	0.159***	0.272***	1.083***	1.104***	-0.1260	0.1030	-0.484***	-0.321***	-0.0320	0.162**
	(0.0387)	(0.0434)	(0.0594)	(0.0638)	(0.0495)	(0.0497)	(0.0705)	(0.0709)	(0.0551)	(0.0567)	(0.131)	(0.132)	(0.0994)	(0.108)	(0.0558)	(0.0602)	(0.0753)	(0.0814)
large	0.0498	0.499***	-0.235**	0.305***	0.588***	0.660***	0.863***	0.899***	-0.0972	0.646***	2.787***	2.880***	-0.984***	-0.439*	-0.850***	-0.467***	-0.262*	-0.0981
	(0.0803)	(0.0864)	(0.0945)	(0.104)	(0.100)	(0.103)	(0.141)	(0.142)	(0.144)	(0.168)	(0.411)	(0.430)	(0.218)	(0.237)	(0.113)	(0.128)	(0.142)	(0.150)
year 1995	0.271***	0.304***	0.0240	0.1050	0.0693	0.0706	0.173**	0.180**	0.189***	0.207***	0.0076	0.0219	0.311***	0.344***	0.273***	0.286***	0.203**	0.223**
	(0.0377)	(0.0380)	(0.0700)	(0.0712)	(0.0558)	(0.0560)	(0.0797)	(0.0798)	(0.0491)	(0.0493)	(0.0712)	(0.0714)	(0.0780)	(0.0784)	(0.0594)	(0.0597)	(0.0863)	(0.0868)
year 1996	0.407***	0.436***	0.363***	0.428***	0.234***	0.237***	0.445***	0.449***	0.400***	0.402***	0.284***	0.292***	0.430***	0.443***	0.514***	0.525***	0.451***	0.462***
	(0.0310)	(0.0313)	(0.0633)	(0.0643)	(0.0495)	(0.0496)	(0.0700)	(0.0702)	(0.0416)	(0.0417)	(0.0609)	(0.0611)	(0.0679)	(0.0681)	(0.0518)	(0.0520)	(0.0734)	(0.0737)
year 1997	0.235***	0.252***	0.292***	0.277***	0.208***	0.214***	0.316***	0.317***	0.155***	0.163***	0.0979*	0.0946*	0.263***	0.263***	0.264***	0.266***	0.338***	0.349***
	(0.0275)	(0.0277)	(0.0539)	(0.0545)	(0.0457)	(0.0459)	(0.0644)	(0.0646)	(0.0366)	(0.0367)	(0.0550)	(0.0551)	(0.0623)	(0.0624)	(0.0474)	(0.0475)	(0.0616)	(0.0619)
year 1998	0.187***	0.196***	0.0926	0.0956	0.169***	0.171***	0.1030	0.108*	0.108***	0.115***	0.0322	0.0302	0.261***	0.260***	0.158***	0.156***	0.223***	0.225***
	(0.0280)	(0.0282)	(0.0586)	(0.0593)	(0.0465)	(0.0467)	(0.0649)	(0.0651)	(0.0374)	(0.0375)	(0.0561)	(0.0562)	(0.0634)	(0.0636)	(0.0486)	(0.0487)	(0.0652)	(0.0654)
Cut 1	0.632***	1.776***	0.727**	0.0102	1.833***	-0.1360	1.372***	-0.9820	0.718***	0.497*	1.416***	-0.2990	1.226***	0.0511	2.625***	0.0826	1.340***	-0.0550
	(0.165)	(0.184)	(0.292)	(0.117)	(0.272)	(0.419)	(0.387)	(0.623)	(0.214)	(0.266)	(0.293)	(0.262)	(0.310)	(0.266)	(0.269)	(0.147)	(0.350)	(0.297)
Cut 2	1.289***	2.431***	1.365***	0.993***	2.558***	0.4970	2.036***	-0.5370	1.513***	1.665***	2.202***	0.436*	2.151***	0.878***	3.270***	0.602***	2.069***	0.631**
	(0.165)	(0.184)	(0.292)	(0.116)	(0.273)	(0.405)	(0.388)	(0.641)	(0.214)	(0.260)	(0.294)	(0.246)	(0.311)	(0.254)	(0.270)	(0.148)	(0.351)	(0.293)
privatised		0.134*		0.0102		-0.1360		-0.9820		0.497*		-0.2990		0.0511		0.0826		-0.0550
		(0.0798)		(0.117)		(0.419)		(0.623)		(0.266)		(0.262)		(0.266)		(0.147)		(0.297)
private		0.982***		0.993***		0.4970		-0.5370		1.665***		0.436*		0.878***		0.602***		0.631**
		(0.0780)		(0.116)		(0.405)		(0.641)		(0.260)		(0.246)		(0.254)		(0.148)		(0.293)
Observations	16,162	16,150	4,417	4,417	6,047	6,047	3,023	3,018	8,762	8,758	3,954	3,954	3,140	3,140	5,581	5,576	3,147	3,146

Table D2 – FOC for decreasing the number of employees

	foods & drinks		textiles		apparel		leather		wood		typography		rubber & plastic		metal		furniture	
ln(average_wage,t+1)	0.0189***	0.0229***	-0.0014	0.0070	0.0235**	0.0250**	0.0361**	0.0375**	0.0176**	0.0204**	0.0321***	0.0307***	-0.0172	-0.0201	0.0300***	0.0361***	0.0163	0.0146
	(0.00611)	(0.00606)	(0.0114)	(0.0112)	(0.0105)	(0.0107)	(0.0153)	(0.0153)	(0.00824)	(0.00823)	(0.0106)	(0.0107)	(0.0139)	(0.0136)	(0.0102)	(0.0104)	(0.0122)	(0.0122)
ln(sales,t+1/employees,t)	-0.0177***	-0.0201***	0.0059	0.0040	-0.0353***	-0.0358***	-0.0467***	-0.0468***	-0.0277***	-0.0296***	-0.0352***	-0.0353***	0.0241*	0.0232**	0.0093	0.0127	-0.0049	-0.0056
	(0.00345)	(0.00334)	(0.00591)	(0.00577)	(0.00652)	(0.00678)	(0.00800)	(0.00804)	(0.00450)	(0.00446)	(0.00700)	(0.00699)	(0.0127)	(0.0116)	(0.00811)	(0.00809)	(0.00742)	(0.00761)
ln(average_wage,t+2)	0.00942*	0.0145***	0.0058	0.0128	0.0250**	0.0255**	-0.0086	-0.0097	0.0218***	0.0246***	0.0253***	0.0246**	0.0580***	0.0646***	0.0153*	0.0183**	0.0022	0.0047
	(0.00546)	(0.00538)	(0.00981)	(0.00980)	(0.00988)	(0.0100)	(0.0142)	(0.0142)	(0.00797)	(0.00803)	(0.00978)	(0.00978)	(0.0124)	(0.0126)	(0.00918)	(0.00925)	(0.0111)	(0.0110)
ln(sales,t+2/employees,t+1)	0.0213***	0.0186***	0.0152***	0.00999**	0.0121**	0.0120**	0.0225***	0.0234***	0.0174***	0.0173***	0.0009	0.0008	-0.0085	-0.0095	0.0196***	0.0206***	0.0145**	0.0141**
	(0.00304)	(0.00297)	(0.00505)	(0.00502)	(0.00550)	(0.00553)	(0.00791)	(0.00807)	(0.00441)	(0.00450)	(0.00634)	(0.00634)	(0.00617)	(0.00610)	(0.00524)	(0.00521)	(0.00682)	(0.00696)
small	0.0898***	0.0971***	0.138***	0.158***	0.0601***	0.0583***	0.102***	0.104***	0.111***	0.121***	0.126***	0.126***	0.180***	0.212***	0.0836***	0.0873***	0.108***	0.121***
	(0.00703)	(0.00732)	(0.0155)	(0.0166)	(0.0137)	(0.0148)	(0.0157)	(0.0161)	(0.0113)	(0.0129)	(0.0115)	(0.0115)	(0.0263)	(0.0297)	(0.0105)	(0.0104)	(0.0168)	(0.0196)
medium	0.0862***	0.128***	0.139***	0.206***	0.125***	0.124***	0.152***	0.154***	0.136***	0.164***	0.171***	0.165***	0.156***	0.223***	0.0579**	0.0744***	0.158***	0.184***
	(0.0112)	(0.0104)	(0.0146)	(0.0175)	(0.0143)	(0.0149)	(0.0177)	(0.0183)	(0.0140)	(0.0159)	(0.0180)	(0.0178)	(0.0242)	(0.0229)	(0.0260)	(0.0221)	(0.0175)	(0.0183)
large	0.123***	0.167***	0.121***	0.219***	0.178***	0.182***	0.201***	0.203***	0.0978***	0.218***	0.109**	0.0838*	-0.0750	0.0593	-0.0111	0.0382	0.191***	0.221***
	(0.0171)	(0.0132)	(0.0240)	(0.0172)	(0.0192)	(0.0221)	(0.0226)	(0.0253)	(0.0338)	(0.0242)	(0.0427)	(0.0434)	(0.0881)	(0.0484)	(0.0479)	(0.0368)	(0.0354)	(0.0323)
Year 95	-0.0057	0.0087	0.0287*	0.0467***	-0.0213	-0.0214	-0.0367*	-0.0352*	-0.0466***	-0.0386**	-0.0162	-0.0161	0.0586**	0.0831***	0.0563***	0.0686***	-0.0331	-0.0244
	(0.0104)	(0.0108)	(0.0152)	(0.0151)	(0.0165)	(0.0165)	(0.0200)	(0.0202)	(0.0152)	(0.0158)	(0.0180)	(0.0180)	(0.0286)	(0.0297)	(0.0171)	(0.0182)	(0.0208)	(0.0217)
Year 96	0.0622***	0.0757***	0.127***	0.150***	0.0029	0.0025	0.0060	0.0096	0.0103	0.0208	-0.0154	-0.0176	0.112***	0.130***	0.151***	0.175***	0.0218	0.0344
	(0.0105)	(0.0113)	(0.0166)	(0.0178)	(0.0162)	(0.0171)	(0.0199)	(0.0208)	(0.0173)	(0.0192)	(0.0171)	(0.0172)	(0.0349)	(0.0349)	(0.0248)	(0.0273)	(0.0249)	(0.0285)
Year 97	0.0262***	0.0344***	0.114***	0.121***	0.0016	0.0010	0.0097	0.0114	-0.0054	0.0001	0.0118	0.0120	0.0828***	0.0942***	0.0948***	0.106***	0.0031	0.0156
	(0.00810)	(0.00843)	(0.0138)	(0.0140)	(0.0147)	(0.0154)	(0.0175)	(0.0181)	(0.0115)	(0.0120)	(0.0144)	(0.0144)	(0.0246)	(0.0241)	(0.0151)	(0.0161)	(0.0196)	(0.0227)
Year 98	0.0281***	0.0345***	0.0763***	0.0804***	0.0113	0.0110	-0.0093	-0.0094	-0.0006	0.0037	-0.0034	-0.0030	0.0761***	0.0849***	0.0554***	0.0609***	0.0161	0.0228
	(0.00791)	(0.00807)	(0.0134)	(0.0133)	(0.0143)	(0.0148)	(0.0159)	(0.0161)	(0.0113)	(0.0115)	(0.0149)	(0.0149)	(0.0243)	(0.0239)	(0.0128)	(0.0131)	(0.0174)	(0.0187)
Inv Mill	-0.0532**	-0.0814***	-0.155***	-0.208***	0.0345	0.0388	0.0012	-0.0107	-0.110***	-0.142***	0.0221	0.0330	-0.320***	-0.364***	-0.283***	-0.354***	-0.0493	-0.0893
	(0.0236)	(0.0267)	(0.0372)	(0.0436)	(0.0393)	(0.0503)	(0.0265)	(0.0320)	(0.0400)	(0.0496)	(0.0232)	(0.0252)	(0.103)	(0.100)	(0.0637)	(0.0713)	(0.0537)	(0.0700)
privatised		0.0973***		0.0633***		0.171**		0.0944		0.111***		-0.0287		0.157***		0.0338		0.0930**
		(0.0126)		(0.0169)		(0.0861)		(0.0793)		(0.0333)		(0.0423)		(0.0401)		(0.0208)		(0.0414)
private		0.169***		0.231***		0.177**		0.1030		0.270***		-0.0640		0.359***		0.150***		0.172***
		(0.0211)		(0.0329)		(0.0860)		(0.0808)		(0.0580)		(0.0420)		(0.0671)		(0.0357)		(0.0471)
Constant	-0.573***	-0.737***	-0.538***	-0.779***	-0.552***	-0.743***	-0.327***	-0.429***	-0.446***	-0.708***	-0.511***	-0.438***	-0.560***	-0.888***	-0.803***	-1.007***	-0.545***	-0.676***
	(0.0486)	(0.0502)	(0.0779)	(0.0799)	(0.0856)	(0.132)	(0.102)	(0.130)	(0.0684)	(0.0828)	(0.0847)	(0.0971)	(0.0871)	(0.108)	(0.0923)	(0.117)	(0.0888)	(0.0967)
Observations	4,883	4,874	1,773	1,773	1,655	1,655	957	953	2,306	2,303	1,167	1,167	915	915	1,999	1,994	977	976
R-squared	0.15	0.16	0.22	0.24	0.19	0.19	0.23	0.23	0.16	0.17	0.23	0.24	0.27	0.29	0.21	0.22	0.25	0.26

Table D3 – FOC for increasing the number of employees

	foods & drinks		textiles		apparel		leather		wood		typography		rubber & plastic		metal		furniture	
ln(average_ wage,t+1)	-0.0486	-0.0608	0.281*	0.2440	-0.1210	-0.1400	-0.1380	-0.1520	-0.0041	-0.0123	-0.127*	-0.133*	-0.2020	-0.2870	-0.317***	-0.300***	0.1710	0.1610
	(0.0569)	(0.0566)	(0.166)	(0.164)	(0.108)	(0.109)	(0.214)	(0.214)	(0.0741)	(0.0741)	(0.0721)	(0.0721)	(0.183)	(0.186)	(0.105)	(0.110)	(0.153)	(0.153)
ln(sales,t+1/ employees,t)	0.133***	0.141***	0.1100	0.1470	0.0425	0.0280	-0.0574	-0.0710	-0.0244	-0.0151	0.0952*	0.0969**	-0.0308	0.1090	0.1280	0.1740	0.0646	0.0738
	(0.0341)	(0.0335)	(0.0994)	(0.0986)	(0.0660)	(0.0677)	(0.118)	(0.119)	(0.0441)	(0.0438)	(0.0491)	(0.0490)	(0.214)	(0.223)	(0.113)	(0.115)	(0.103)	(0.104)
ln(average_ wage,t+2)	0.0969*	0.0880	-0.307**	-0.324**	-0.193*	-0.209*	0.443**	0.445**	0.0146	0.0092	-0.263***	-0.269***	-0.0058	0.1180	-0.0009	0.0092	-0.0440	-0.0448
	(0.0554)	(0.0551)	(0.145)	(0.148)	(0.106)	(0.107)	(0.214)	(0.215)	(0.0709)	(0.0717)	(0.0672)	(0.0672)	(0.182)	(0.202)	(0.0974)	(0.0997)	(0.151)	(0.152)
ln(sales,t+2/ employees,t+1)	-0.141***	-0.132***	-0.207**	-0.183**	-0.0843	-0.0910	0.0231	-0.0061	-0.0090	-0.0051	0.0233	0.0204	0.152**	0.143*	-0.0773	-0.0594	-0.193**	-0.186*
	(0.0320)	(0.0319)	(0.0806)	(0.0797)	(0.0583)	(0.0586)	(0.120)	(0.125)	(0.0428)	(0.0434)	(0.0434)	(0.0435)	(0.0776)	(0.0778)	(0.0655)	(0.0650)	(0.0967)	(0.0973)
small	-0.159***	-0.157***	-0.1140	-0.0779	0.1060	0.0542	-0.2620	-0.3340	-0.1370	-0.1480	-0.184***	-0.192***	0.1370	0.5650	-0.0782	-0.0868	0.0277	0.0167
	(0.0550)	(0.0593)	(0.186)	(0.218)	(0.114)	(0.124)	(0.189)	(0.207)	(0.0897)	(0.102)	(0.0656)	(0.0659)	(0.394)	(0.549)	(0.0846)	(0.0833)	(0.176)	(0.203)
medium	0.0797	-0.0850	0.370**	0.1660	0.1460	0.0982	0.0137	-0.0940	-0.254**	-0.345**	-0.0504	-0.0930	0.697**	0.970***	0.2130	0.0486	0.0701	-0.0532
	(0.0990)	(0.0935)	(0.182)	(0.261)	(0.132)	(0.139)	(0.227)	(0.251)	(0.117)	(0.134)	(0.116)	(0.116)	(0.313)	(0.280)	(0.390)	(0.309)	(0.206)	(0.227)
large	-0.2270	-0.419***	0.3110	-0.2110	-0.1450	-0.3310	-0.3610	-0.6160	0.3910	-0.2340	-0.0924	-0.1320	-0.4360	-0.6450	0.2480	-0.0156	0.4350	0.3140
	(0.188)	(0.159)	(0.419)	(0.276)	(0.178)	(0.208)	(0.301)	(0.381)	(0.360)	(0.315)	(0.490)	(0.565)	(2.212)	(1.604)	(0.919)	(0.687)	(0.487)	(0.449)
Year 95	0.280***	0.281***	0.3130	0.2750	0.2150	0.2010	0.2880	0.2260	0.299**	0.290**	0.1120	0.1110	0.4900	0.9460	0.1460	0.2390	0.510*	0.503*
	(0.100)	(0.107)	(0.247)	(0.256)	(0.156)	(0.158)	(0.272)	(0.281)	(0.131)	(0.138)	(0.115)	(0.115)	(0.480)	(0.589)	(0.237)	(0.272)	(0.267)	(0.279)
Year 96	0.261***	0.281***	-0.1420	-0.0861	0.1670	0.1180	-0.1480	-0.2790	0.254*	0.260*	0.1190	0.1070	0.5360	1.0760	0.2290	0.3980	0.1450	0.1460
	(0.0944)	(0.108)	(0.256)	(0.310)	(0.146)	(0.155)	(0.257)	(0.296)	(0.141)	(0.156)	(0.0993)	(0.101)	(0.618)	(0.726)	(0.368)	(0.429)	(0.286)	(0.328)
Year 97	0.183**	0.190**	-0.3550	-0.2800	-0.0700	-0.1170	-0.1190	-0.2150	0.1330	0.1310	-0.0591	-0.0619	0.3430	0.6560	0.1290	0.2150	0.1490	0.1470
	(0.0791)	(0.0847)	(0.224)	(0.238)	(0.136)	(0.144)	(0.232)	(0.253)	(0.103)	(0.107)	(0.0914)	(0.0915)	(0.409)	(0.462)	(0.219)	(0.245)	(0.237)	(0.266)
Year 98	-0.0272	-0.0245	-0.354*	-0.3380	-0.223*	-0.258*	-0.1700	-0.2070	-0.0489	-0.0519	-0.0422	-0.0442	0.1010	0.4010	0.0884	0.1430	0.1960	0.2010
	(0.0785)	(0.0818)	(0.213)	(0.216)	(0.135)	(0.140)	(0.228)	(0.231)	(0.101)	(0.103)	(0.0948)	(0.0949)	(0.404)	(0.455)	(0.165)	(0.176)	(0.226)	(0.239)
Inv Mill	-1.311***	-1.227***	-1.822***	-1.505*	-1.409***	-1.731***	-1.556***	-2.000***	-1.454***	-1.434***	-0.993***	-1.059***	-0.2830	1.4550	-1.3250	-0.8210	-1.575**	-1.554*
	(0.222)	(0.279)	(0.635)	(0.808)	(0.385)	(0.493)	(0.436)	(0.650)	(0.395)	(0.476)	(0.145)	(0.158)	(1.998)	(2.333)	(1.049)	(1.215)	(0.633)	(0.810)
privatised		-0.2380		-0.5630		0.5660		-0.8810		-0.0624		0.1820		-0.5040		-0.1460		0.1090
		(0.274)		(0.525)		(1.106)		(2.602)		(1.001)		(0.603)		(0.923)		(0.518)		(1.172)
private		-0.3350		-0.9500		-0.2100		-1.6680		-0.9250		-0.0792		1.6750		0.0363		-0.2030
		(0.348)		(0.885)		(1.066)		(2.703)		(1.134)		(0.578)		(1.626)		(0.844)		(1.306)
Constant	1.711***	1.950**	4.103***	4.541*	5.173***	6.211***	0.1670	2.8510	2.568***	3.455*	3.957***	4.222***	1.4300	-4.0970	4.2940	2.8040	2.4960	2.6120
	(0.553)	(0.868)	(1.500)	(2.449)	(1.217)	(1.918)	(1.627)	(3.672)	(0.901)	(1.827)	(0.586)	(0.908)	(4.591)	(6.637)	(3.159)	(4.248)	(1.746)	(2.760)
Observations	7,530	7,528	1,658	1,658	2,809	2,809	1,354	1,354	3,932	3,932	1,655	1,655	1,182	1,182	2,311	2,311	1,347	1,347
R-squared	0.03	0.04	0.04	0.04	0.02	0.02	0.03	0.03	0.02	0.02	0.09	0.09	0.03	0.04	0.04	0.04	0.03	0.03

Table D4 – Parameters of the cost adjustment function

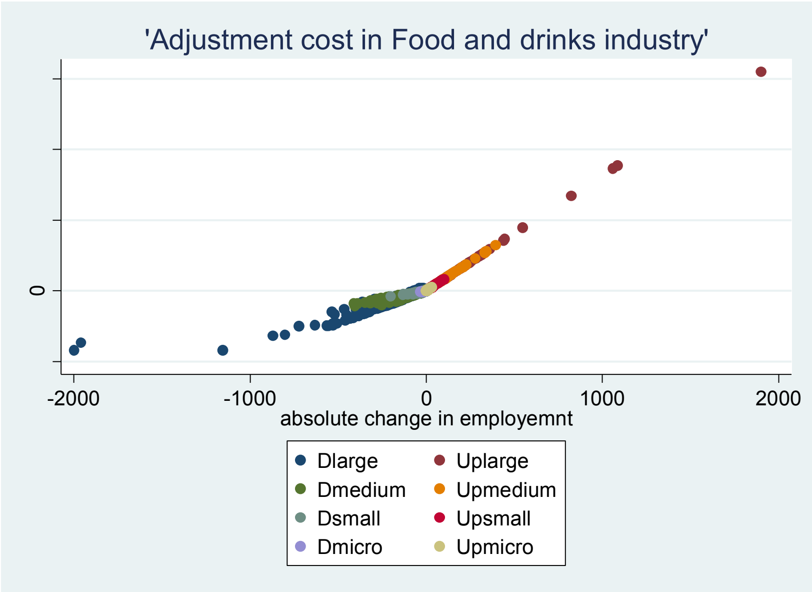
a_0^-	0.04541 (0.00413)	0.02504 (0.00192)	0.04161 (0.00672)	0.02444 (0.00291)	0.01378 (0.00230)	0.01114 (0.00206)	0.03801 (0.01227)	0.05027 (0.01594)	0.01777 (0.00284)	0.01303 (0.00177)	0.12640 (0.02120)	0.08590 (0.01952)	0.00479 (0.00092)	0.00353 (0.00055)	0.01028 (0.00145)	0.00872 (0.00120)	0.01998 (0.00376)	0.01369 (0.00222)
a_1^-	0.14700 (0.01310)	0.08151 (0.00611)	0.08667 (0.01340)	0.05050 (0.00733)	0.05724 (0.00927)	0.04643 (0.00868)	0.13299 (0.04388)	0.18551 (0.05489)	0.19530 (0.03085)	0.18028 (0.02182)	0.23716 (0.03935)	0.16115 (0.03645)	0.04386 (0.00743)	0.03237 (0.00554)	0.04861 (0.00801)	0.04172 (0.00863)	0.09348 (0.01617)	0.06423 (0.01125)
b^-	-1.62950 (0.00419)	-2.60400 (0.00348)	-1.52950 (0.0066)	-2.54750 (0.0054)	-2.62300 (0.00459)	-3.05850 (0.00383)	-3.09650 (0.0128)	-2.49500 (0.0127)	-2.11400 (0.0067)	-3.63650 (0.006)	-3.54350 (0.0172)	-3.91950 (0.0161)	-1.77100 (0.00447)	-2.49050 (0.00362)	-3.30050 (0.0061)	-3.73400 (0.0054)	-2.28050 (0.00915)	-2.57600 (0.00725)
c^-	2.87851 (0.25039)	3.54848 (0.25326)	2.90463 (0.45710)	3.29722 (0.34160)	4.87112 (0.79649)	4.23611 (0.84275)	11.10654 (8.85792)	6.66836 (5.91468)	4.84248 (0.77762)	5.21944 (0.61621)	7.15267 (1.27339)	9.39748 (2.52001)	3.22252 (0.54621)	2.84435 (0.37209)	4.16770 (0.48001)	3.72408 (0.44383)	4.25184 (0.74261)	3.89185 (0.59484)
a_0^+	0.11568 (0.41535)	-0.00785 (0.28649)	0.44419 (1.06493)	0.22640 (1.21769)	0.01521 (0.27700)	-0.00368 (0.15446)	-0.66321 (2.14642)	-5.09060 (4.72723)	0.11827 (0.31234)	-0.01945 (0.54059)	-2.74842 (2.01083)	-1.51391 (3.38302)	0.19474 (0.20150)	0.01227 (0.16365)	-0.03394 (0.81428)	0.20383 (0.25343)	-0.43156 (1.05087)	-0.64827 (0.91077)
a_1^+	-0.38247 (1.34186)	-0.87240 (0.64251)	0.44415 (1.40803)	1.08995 (2.40725)	-0.22037 (1.55589)	-0.56615 (0.92384)	-8.63729 (8.95111)	9.52135 (21.8814)	-1.15731 (2.20069)	-3.50694 (2.72752)	-5.32148 (3.63326)	0.39879 (6.69278)	2.81311 (2.27728)	-1.46987 (2.78086)	0.17079 (1.20179)	0.65487 (1.60460)	-2.48129 (3.60722)	3.89588 (2.79127)
b^+	2.28650 (0.00419)	3.25900 (0.00348)	2.16700 (0.0066)	3.18900 (0.0054)	3.34800 (0.00459)	3.77250 (0.00383)	3.85500 (0.01465)	3.98450 (0.03515)	2.90950 (0.0067)	4.43200 (0.006)	5.53500 (0.0332)	6.29000 (0.03635)	2.69550 (0.00447)	3.41850 (0.00362)	3.94550 (0.0061)	4.37650 (0.0054)	3.01000 (0.00915)	3.30350 (0.00725)
c^+	0.43906 (12.0602)	-0.15039 (7.03087)	-0.80386 (16.5821)	0.15737 (4.85739)	-0.33103 (38.3838)	0.00995 (3.31334)	-0.37400 (2.53413)	-0.48980 (14.6991)	-1.71691 (47.5004)	-0.35220 (3.52059)	-1.67318 (13.9142)	0.55300 (11.0133)	0.01536 (1.76696)	0.06606 (2.82094)	0.21935 (8.24822)	-2.63868 (51.1190)	0.08863 (4.15048)	0.19676 (3.66532)

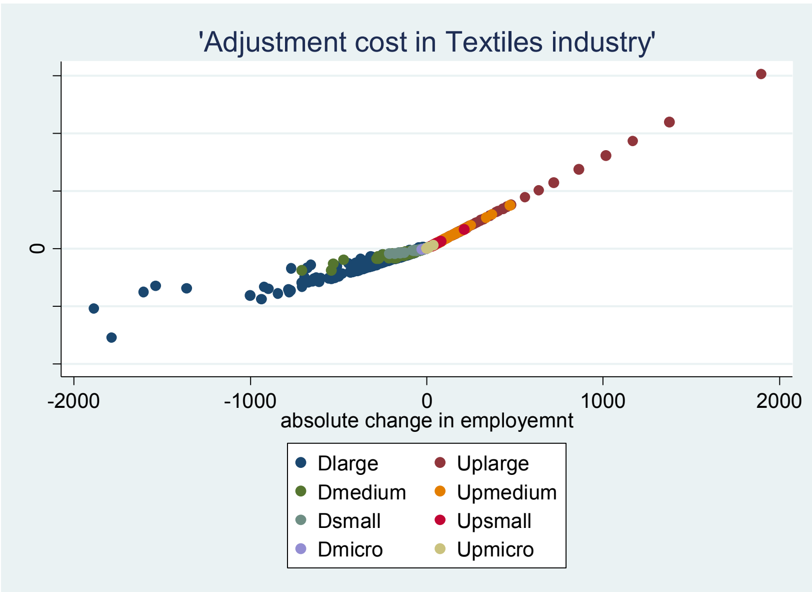
Table D5 – The estimated upward linear adjustment cost by year

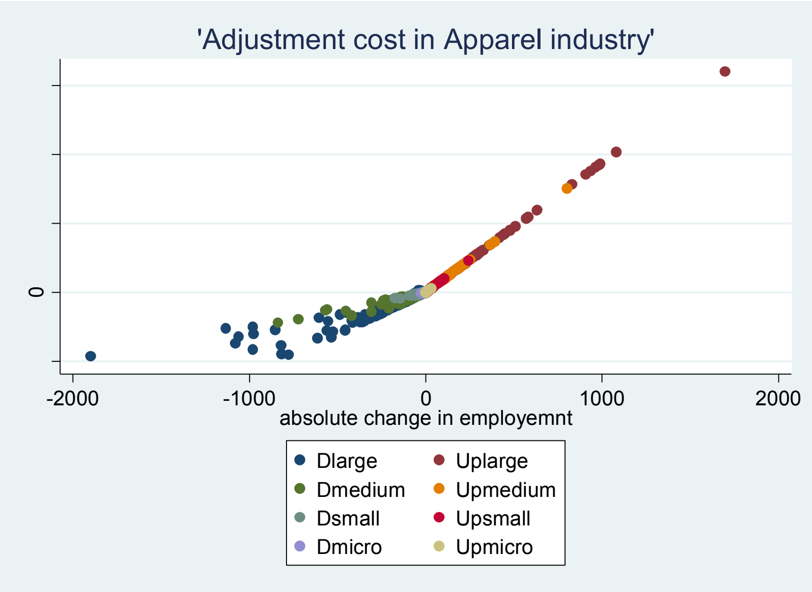
	unemployment rate	b+								
		food & drinks	textiles	apparel	leather	wood	typography	rubber & plastic	metal	furniture
1995	9.50%	2.28 (0.0138)	3.81 (0.0317)	2.32 (0.01875)		3.68 (0.02315)	8.5 (0.1255)	2.73 (0.148)	4.96 (0.0369)	2.52 (0.0056)
1996	6.60%	2.53 (0.0074)	1.2 (0.01385)	2.62 (0.0076)		3.17 (0.0068)	6.14 (0.0665)	2.79 (0.0133)	3.62 (0.01385)	2.76 (0.01405)
1997	8.90%	2.64 (0.00870)	1.61 (0.0118)	2.61 (0.0120)	1.17 (0.0325)	4.67 (0.0098)	4.63 (0.0681)	3 (0.0099)	4.18 (0.0117)	2.22 (0.0215)
1998	10.40%	3.23 (0.00931)	3.01 (0.0116)	3.63 (0.0117)	1.61 (0.0245)	5.17 (0.0243)	6.64 (0.116))	3.09 (0.00125)	4.08 (0.00801)	2.85 (0.0144)
1999	11.80%	3.96 (0.0157)	4.38 (0.0141)			4.58 (0.0301)	7.3 (0.0741)	3.55 (0.0256)	5.32 (0.0523)	
All years		3.26 (0.00348)	3.20 (0.0054)	3.77 (0.00383)	3.98 (0.03515)	4.43 (0.006)	6.29 (0.03635)	3.42 (0.00362)	4.38 (0.0054)	3.30 (0.00725)

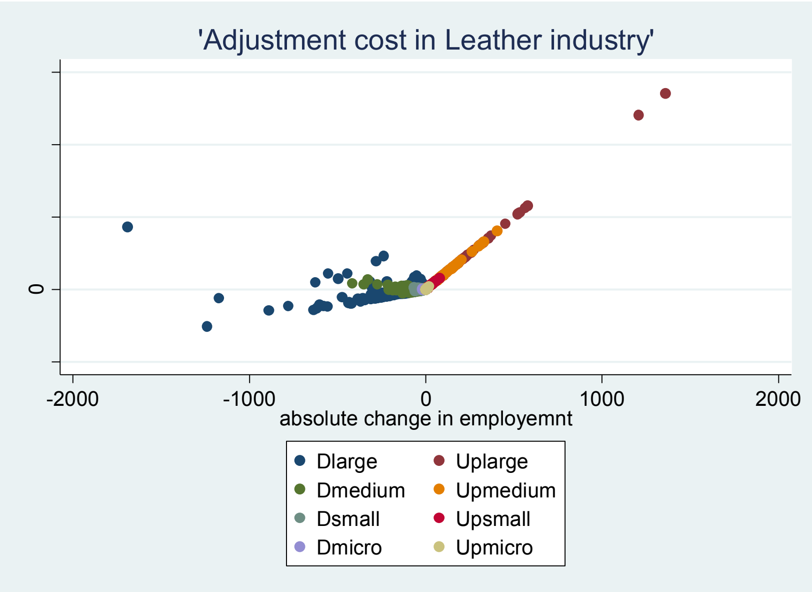
APPENDIX E – SHAPE AND SIZE OF THE ADJUSTMENT COSTS

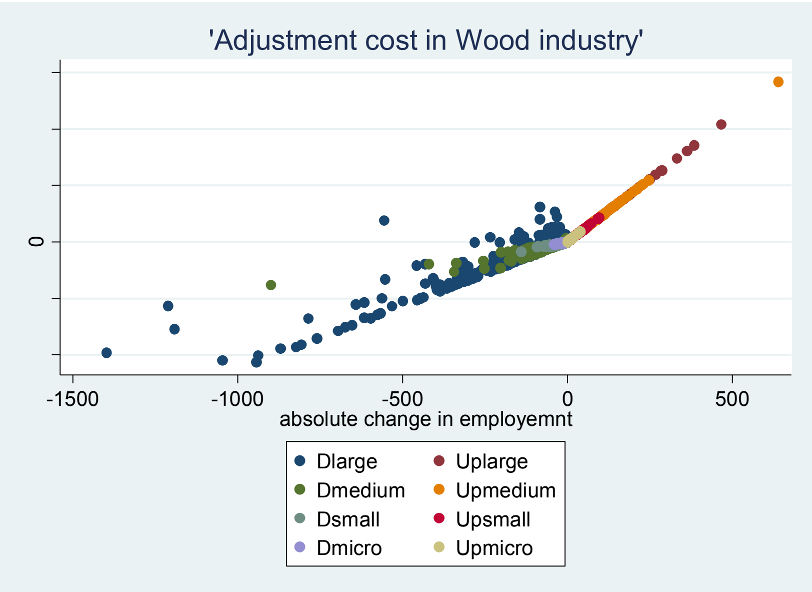
Figure E1 – The estimated adjustment cost for the firms in the sample as a function of the absolute adjustment, by industry and size class

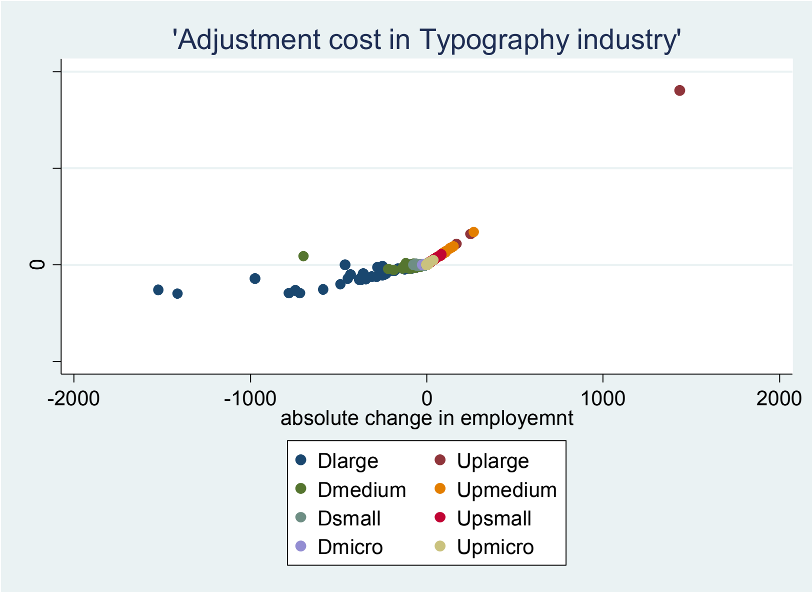


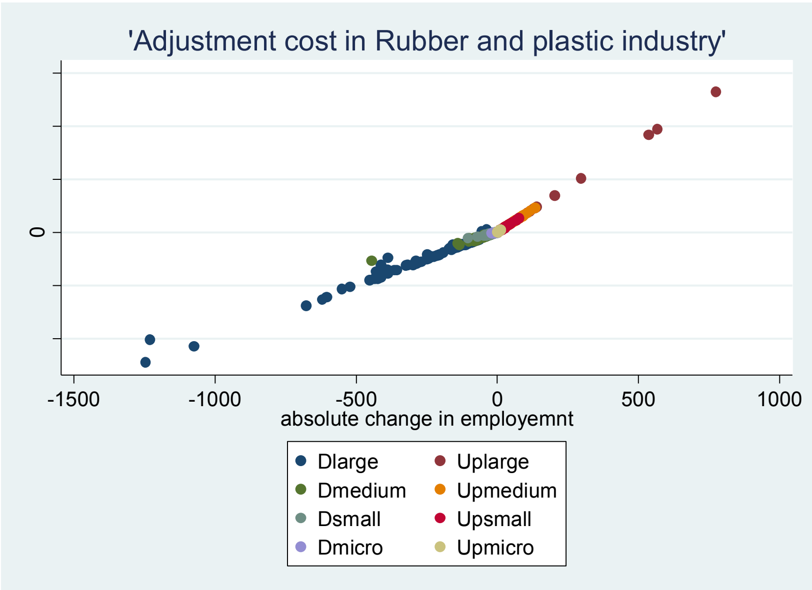


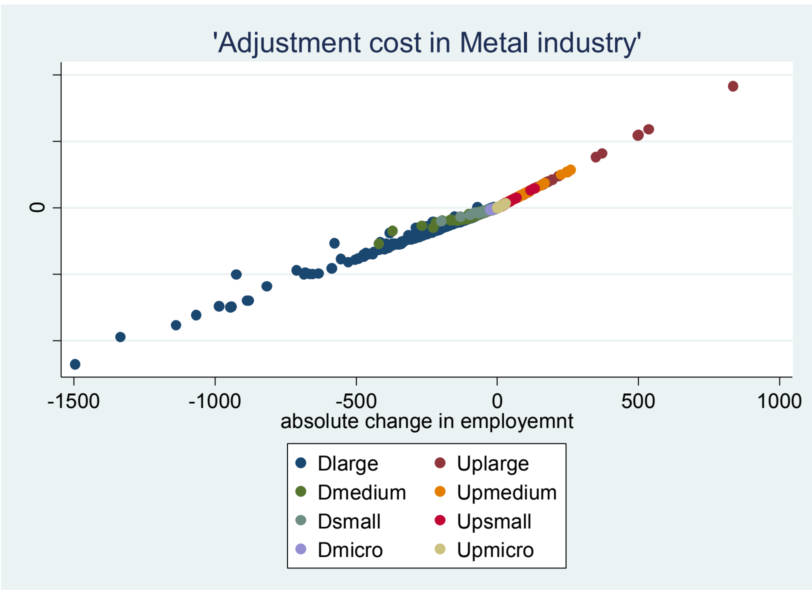

'Adjustment cost in Apparel industry'
0
-2000
-1000
0
1000
2000
absolute change in employemnt
Dlarge
Dmedium
Dsmall
Dmicro
Uplarge
Upmedium
Upsmall
Upmicro


'Adjustment cost in Leather industry'
0
-2000
-1000
0
1000
2000
absolute change in employemnt
Dlarge
Dmedium
Dsmall
Dmicro
Uplarge
Upmedium
Upsmall
Upmicro


'Adjustment cost in Wood industry'
0
-1500
-1000
-500
0
500
absolute change in employemnt
Dlarge
Dmedium
Dsmall
Dmicro
Uplarge
Upmedium
Upsmall
Upmicro


'Adjustment cost in Typography industry'
0
-2000
-1000
0
1000
2000
absolute change in employemnt
Dlarge
Uplarge
Dmedium
Upmedium
Dsmall
Upsmall
Dmicro
Upmicro


'Adjustment cost in Rubber and plastic industry'
0
-1500
-1000
-500
0
500
1000
absolute change in employemnt
Dlarge
Uplarge
Dmedium
Upmedium
Dsmall
Upsmall
Dmicro
Upmicro


'Adjustment cost in Metal industry'
0
-1500
-1000
-500
0
500
1000
absolute change in employemnt
Dlarge
Uplarge
Dmedium
Upmedium
Dsmall
Upsmall
Dmicro
Upmicro

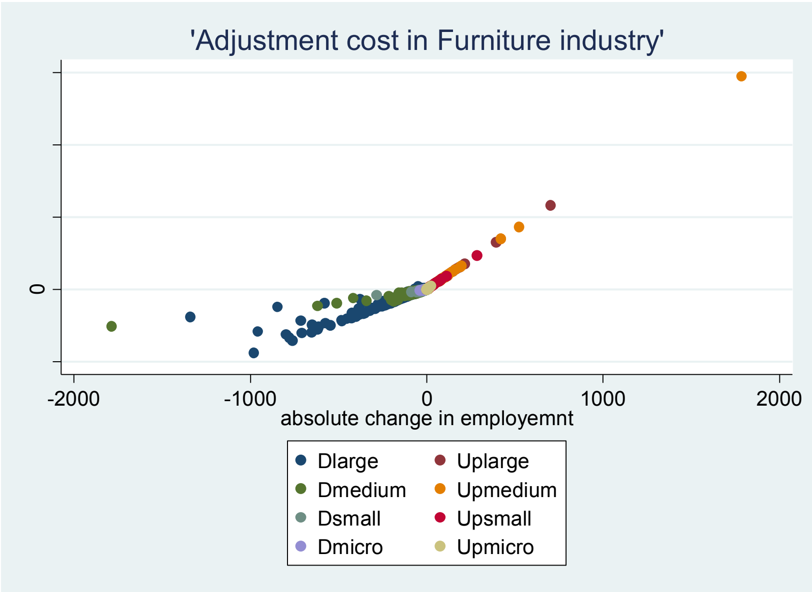
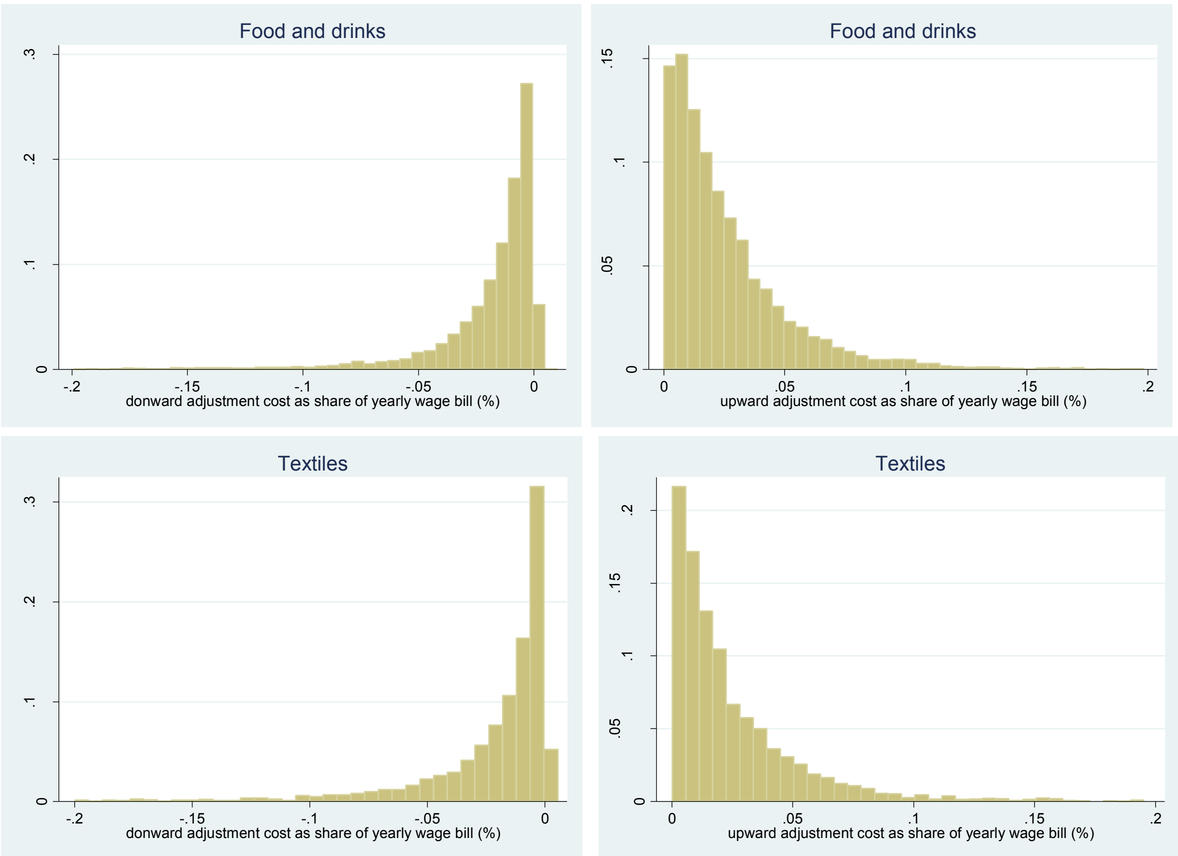
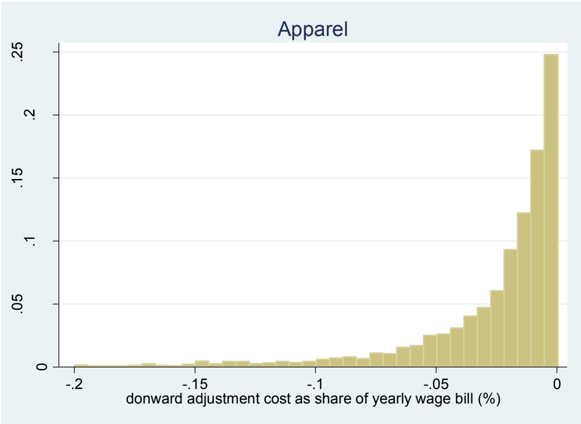
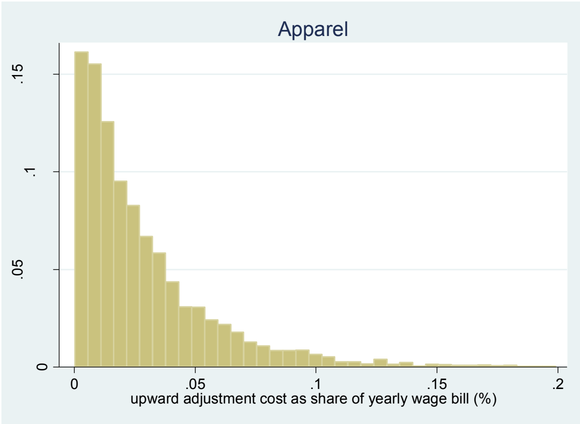
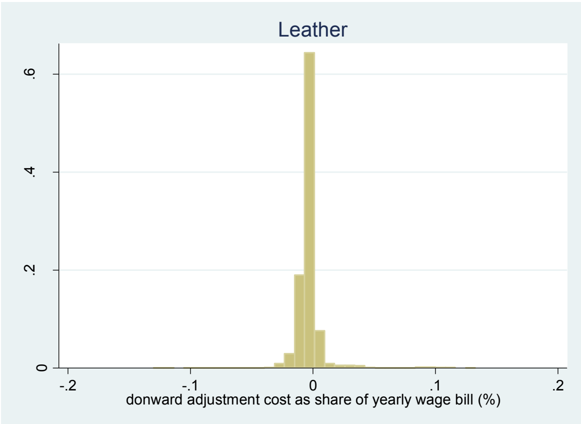


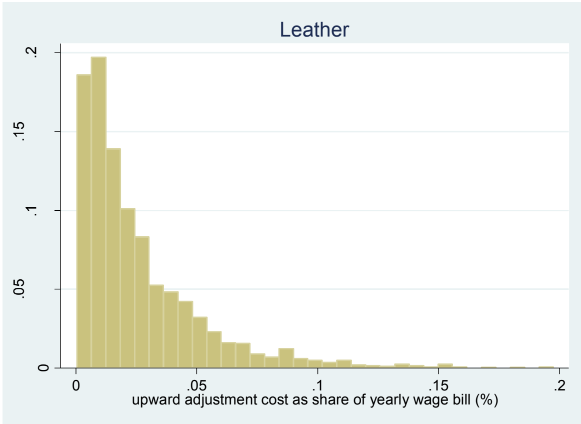
Figure E2 – The distribution of firms in the sample according to the share of their yearly downward adjustment cost (left column) and upward yearly adjustment cost (right column) in the yearly wage bill

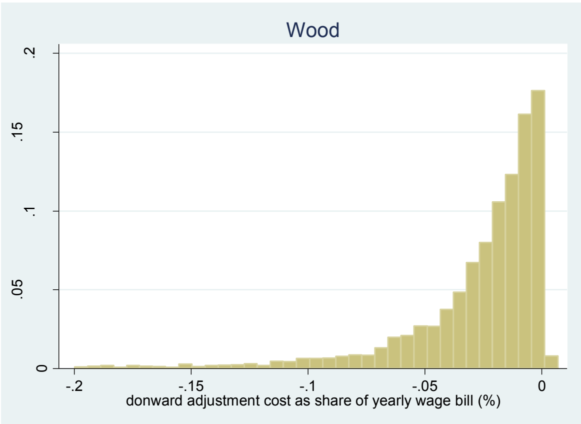



Apparel
0
.05
.1
.15
.2
.25
-.2
-.15
-.1
-.05
0
donward adjustment cost as share of yearly wage bill (%)

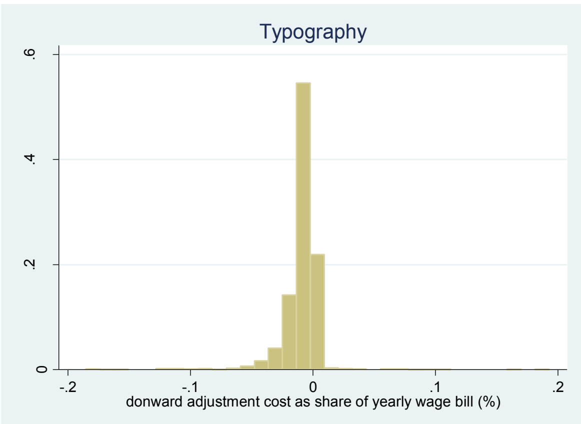

Apparel
0
.05
.1
.15
0
.05
.1
.15
.2
upward adjustment cost as share of yearly wage bill (%)

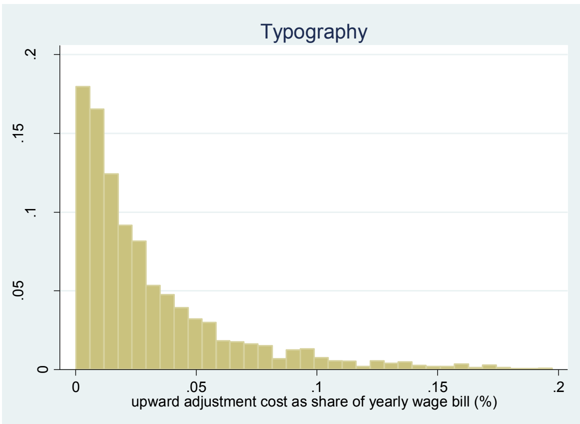

Leather
0
.2
.4
.6
-.2
-.1
0
.1
.2
donward adjustment cost as share of yearly wage bill (%)

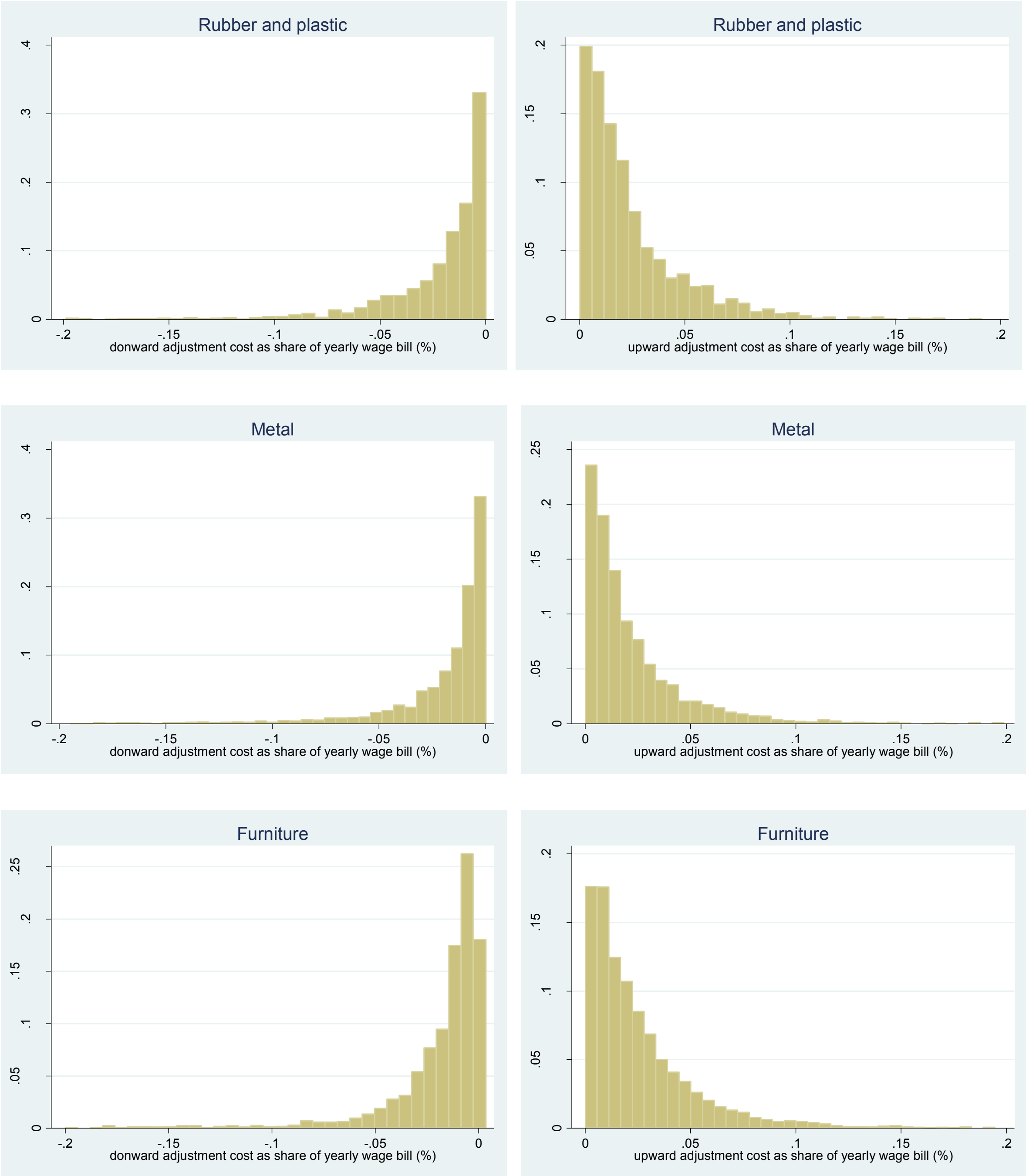

Leather
0
.05
.1
.15
.2
0
.05
.1
.15
.2
upward adjustment cost as share of yearly wage bill (%)


Wood
0
.05
.1
.15
.2
-.2
-.15
-.1
-.05
0
donward adjustment cost as share of yearly wage bill (%)


Wood
0
.05
.1
.15
0
.05
.1
.15
.2
upward adjustment cost as share of yearly wage bill (%)


Typography
0
.2
.4
.6
-.2
-.1
0
.1
.2
donward adjustment cost as share of yearly wage bill (%)


Typography
0
.05
.1
.15
.2
0
.05
.1
.15
.2
upward adjustment cost as share of yearly wage bill (%)


Rubber and plastic
donward adjustment cost as share of yearly wage bill (%)
Rubber and plastic
upward adjustment cost as share of yearly wage bill (%)
Metal
donward adjustment cost as share of yearly wage bill (%)
Metal
upward adjustment cost as share of yearly wage bill (%)
Furniture
donward adjustment cost as share of yearly wage bill (%)
Furniture
upward adjustment cost as share of yearly wage bill (%)

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