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Identifying Adjustment Costs of Net and Gross Employment Changes

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Identifying Adjustment Costs of Net and Gross Employment Changes

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Abstract

A relatively unexplored question in dynamic labour demand regards the source of adjustment costs, whether they depend on net or gross changes in employment. We estimate a structural model of dynamic labour demand where the firm faces adjustment costs related to gross and net changes in its workforce. We focus on matching quarterly moments of hiring and of net changes in employment from a panel of establishments. The main component of adjustment costs in our panel is quadratic adjustment costs to gross changes in employment. We also estimate that adjustment costs have a large economic cost, roughly cutting the value of our establishments in half.

JEL Classification: C33, C41, E24, J23

Keywords: Employment, adjustment costs, establishment level data, structural estimation.

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1 Introduction

In recent years there has been renewed interest in labour demand at the firm and plant level. A largely unexplored question in this area regards the source of adjustment costs, whether they depend on net or gross changes in employment. Thus, despite existing empirical work documenting a variety of different adjustment costs, it is unclear how the dynamics of employment at the firm and plant level are affected by a mix of the various adjustment costs. It is evident that in most firms there is a constant worker turnover, such that worker flows in and out of a firm are bigger than the flows caused by job creation and job destruction. Furthermore, adjustment costs and their structures are likely to differ significantly depending on whether a firm is adjusting its actual number of workplaces, or whether worker flows are due to turnover. For instance, employment protection affects gross changes, i.e. worker turnover, while taxes and subsidies affect net labour demand, i.e. total number of workplaces. In addition training costs impact on worker turnover, while production disruption is likely to be more significant when changing the number of workers.routines. Thus, understanding the source of adjustment costs is of great importance for understanding the response of firms to exogenous shocks.

This paper studies the impact of adjustment cost structures using establishment level data. Our dynamic optimization problem incorporates different types of adjustment costs of net and gross changes in employment, including nonconvex costs. We use a minimum (weighted) distance method to recover the structural parameters of the adjustment cost function. It should be noted that with the existence of nonconvex costs, there is no simple analytical solution linking the marginal cost of additional labour today with future marginal benefits. Thus, a structural model is appropriate for the dynamic optimization problem. By using this structural approach we hope to get a better understanding of the temporal path of labour demand.

The literature on net adjustment costs is vast, going back to Oi (1962) who used sectoral employment data. Most literature has assumed convex adjustment costs.[1] In micro level data the observed inaction in employment adjustments is consistent with non-convexities in adjustment costs (see for instance Caballero and Engel (1993), Caballero et al. (1997) and King and Thomas (2006). Rota (2004) finds large fixed net adjustment costs for Italian firms, and Nilsen et al. (2007) find also that fixed costs are important components of net adjustment costs for Norwegian plants particularly smaller plants with less than 25 employees when reducing the labour stock.

The empirical literature on gross flows is scarce.[2] Abowd and Kramarz (2003) analyze the costs of gross employment changes using a cross section of French manufacturing firms. They find fixed costs to be large and statistically significant, and about three times larger for separations than for hires. Hiring costs for skilled employees have both a fixed and a concave component, while hiring costs for unskilled workers are largely fixed. Interestingly, in a follow-up study with panel data Michaud and Kramarz (2004) find that fixed costs are negligible, but that there are still concavities in the adjustment costs functions. Thus, it seems that the estimated significance and magnitude of fixed adjustment costs depend crucially on the econometric model and structure of the dataset.

One of the few papers to study adjustment costs of both gross and net employment changes simultaneously is Hamermesh and Pfann (1996b). Using US quarterly data for the manufacturing industry, they find that quits do not matter much for explaining employment movements after allowing for asymmetries.

There are a few recent studies which use structural estimation techniques. Most of these models include net employment changes only, not gross flows. Rota (2004) estimates a model of net employment adjustment with only fixed costs, but scaled with employment in the beginning of each year and finds an amazing fixed cost of 15 monthly wages. Cooper et al. (2004) use a model which includes fixed and convex adjustment costs as well as

[1] See Nickell (1986), Hamermesh and Pfann (1996a) for surveys of dynamic labour demand models including non-convexities in the adjustment costs function.

[2] Except for Hamermesh (1989, 1992, 1995). The data used in these latter studies are based on a sample of very few units only

disruption costs. They find that nonconvex rather than quadratic adjustment costs are needed to match plant-level observations. Contreras (2006) models adjustment costs to employment in the spirit of investment and similarly to Rota (2004) he scales these by lagged employment. Unlike most other authors, he rejects the existence of fixed costs when estimating his model on data for Colombian manufacturing firms. Bloom (2007) attaches "fixed" costs to gross employment changes, but they are measured as fractions of output, and so are really disruption costs in the spirit of Cooper et al. (2004). Another paper is Vermeulen (2006) who finds fixed cost to be negligible even with quite substantial non-adjustment frequencies in French manufacturing firms.

In our paper we focus on nonconvexities in the adjustment costs technology using establishment level data. Different from most other studies, we allow for nonconvexities for both net employment changes and gross employment changes. As already pointed out, the number of studies trying to identify net and gross adjustment costs simultaneously is very limited. In our model a firm with homogeneous labour incurs adjustment costs associated with both net and gross employment flows. In our model the firm, assumed to have homogenous labour, experiences stochastic demand such that its revenues fluctuate over time, and simultaneously faces stochastic voluntary quits. Initially we simulate a calibrated version of the model, under different cost structures, to explore a set of selected moments which identifies the various adjustment costs components in the real data. Having identified proper moments we use the simulated method of moments to estimate the structural parameters of interest on actual data. In the end we also allow for heterogeneity among the firms. Such heterogeneity might reflect unobserved sectoral- and firm-specific differences. This might also reflect a gap between the frictionless and actual employment, a gap that affects firms' propensity to adjust (the extensive margin).

The data is a cut from a panel containing quarterly establishment level information for Portugal with information on employment stocks, entry and exit. These data are a subsample of the sample used by Varejão and Portugal (2007). We focus on medium sized establishments with 20-100 workers employed. We strongly believe that the answer to our question requires appropriate micro level data. Unless we understand individual firms' or establishments' response to external shocks, we cannot understand the aggregate effects of the same shocks. This is especially true if the adjustment costs are nonconvex such that the responses to shocks are nonlinear. These nonlinearities imply that some units will adjust their labour input in a lumpy fashion, while other units' demand is unchanged in response to the same external shock. As already mentioned, our data are quarterly, not annual as in many other studies. Aggregation over time might hide adjustments, especially worker turnover. For instance, observing zero net employment changes may say very little about the turnover in the background. It is also less likely that zero net employment changes are caused by zero hiring and zero separations when using annual data when compared to quarterly data. As we will see later on, one important difference between quarterly and annual frequencies is that at quarterly level most inaction is due to the absence of entry and exit from the establishment. Thus temporal aggregation blurs the picture of labour adjustment. In doing so, the importance of nonlinear adjustment costs might seem less important than what is actually true, and this might affect our understanding of micro units' response to external shocks.

Our estimation results indicate that establishments in our dataset face mainly quadratic and linear costs of both net and gross adjustments, with an emphasis on quadratic costs of gross adjustment. Fixed costs are one order of magnitude smaller but nevertheless have a significant impact on flows, although less so on the value of the establishment. On the other hand, it turns out that the quadratic and linear gross adjustment costs decrease the value of the establishment by around 50% relative to a frictionless case (i.e. no adjustment costs).

The paper continues as follows. In Section 2 we describe the data and some institutional settings. Section 3 describes the model, while we in Section 4 discuss identification. In Section 5 we present the empirical results. Section 6 gives the concluding remarks.

2 Data

The data we use in our estimation exercise comes from a Portuguese panel study called "Inquérito ao Emprego Estruturado". The information is collected at the establishment level and is compulsory reporting for every establishment in Portugal. The dataset consists of a sample of establishments with less than one hundred employees, and the universe of establishments with more than one hundred employees. It contains quarterly information about the stock of employment at the end of the period (number of workers), and the entry and exit flows during the period (number of workers entering the establishment and number of workers leaving the establishment). A detailed description of this dataset can be found in Varejão (2003) and Varejão and Portugal (2007). As pointed out by these authors, the sample is statistically representative for the industries, region and size class.

The Portuguese labour market is the most regulated in Europe in all existing rankings of indexes of employment protection (e.g., OECD, 1999 and 2004).[3] Costly collective dismissal rules apply to the dismissal of as few as two or five employees depending on the size of the establishment. These rules result in high firing costs.[4]

We work with a sample of establishments where initial employment (number of workers in the first reported period) is bigger than or equal to 21 and smaller than or equal to 100. We choose to eliminate establishments with less than 20 workers in their initial report because inference regarding different types of adjustment costs is harder for small sizes due to the discrete nature of our employment data: one worker is a large adjustment for a small establishment. Very large establishments are left out of the sample because they increase our numerical burden disproportionately.

We limit our sample to the balanced panel of those establishments that report the complete time series of 20 quarters from 1991 to 1995. Also, since the flows of entry

[3] See also www.doingbusiness.org.

[4] As pointed out by Blanchard and Portugal (2001), the high employment protection leads to lower worker flows in Portugal compared to the United States. These authors find that "worker outflows barely exceed job destruction" in Portugal.

and exit match the change in the stocks of employment from one period to the next, we actually have 21 quarters of information on the stock, and 20 quarters of information on the flows. This gives us 501 establishments and around 10 thousand observations.[5] If we use an unbalanced panel of the establishments in our size class that report eleven or more consecutive periods we have 1215 establishments and 20271 observations, but qualitatively that sample is identical to the one we use. One other important feature of our data is that its patterns are pervasive across the entire panel, whether in smaller or larger establishments.

Given the main question in this paper, a significant emphasis is put in contrasting the behavior of gross flows (entry and exit) with that of net flows (differences in the stock of employment). In Figure 1 we show the distribution of the rate of net employment changes, $\Delta L_t/L_{t-1}$, i.e. the changes in number of workers over a quarter, normalized with the number of workers in the beginning of the quarter. We see that, much like in Rota's Italian data, there is a mass point at zero. As much as 36.7% of observations have zero net employment changes.[6] This is suggestive of the fact that changing the number of workers, even with a small amount induces significant costs. On the other hand, while we expect to find fat tails if there are noncovexities associated with changing the number of workers, we don't see them in the data. It is also interesting to see that the distribution is quite symmetric, indicating that the asymmetry found in many other studies of employment changes is not present in our data. The fact that very small net employment changes are not that frequent is suggestive of nonconvexity in the adjustment costs function, but actually it is due to indivisibility: given that establishments have mostly less than one hundred workers, we do not see positive changes of less than one percent. This indivisibility is explicit in our structural model which avoids inference problems from

[5] We start with 3060 establishments. We drop establishments with inconsistent reports of stocks and flows. Then establishments with over 200 workers at any moment are dropped. This step eliminates two units, one that grows slowly over the 20 quarters from 54 to 208 workers in the final observation, and another which jumps up by 150 workers in a single quarter.

[6] The mean of $\Delta L/L$ is -0.006.

traditional econometric models based on net employment change rates.

[Figure 1: "Quarterly Net Employment Change Rates" about here]

We also look at the entry and exit rates, EN_t/L_{t-1} and EX_t/L_{t-1}, defined as the number of new workers joining an establishment during the quarter, and the number of individuals leaving an establishment during the quarter, both normalized by the stock of individuals in the establishment in the beginning of the quarter. These rates are shown in Figure 2. The entry rate has a mass point at zero with 52.9% of the observations. Again this suggests the presence of significant fixed or linear costs related to gross changes. And similarly to the patterns shown in Figure, 1, there are no fat tails. The dip in the curves, close to zero is due to indivisibility.

[Figure 2: "Quarterly Hiring Rates and Exit Rates" about here]

So far we have seen that there are significant levels of inaction, defined by establishments having the same number of workers in consecutive periods, or by having no entry and/or exit during the quarter. Indeed, at quarterly frequencies, the magnitude of job flows in Portugal is much less than in other countries. Identification of what exactly lies beneath this inaction is fundamental for the understanding of labour market rigidity. This translates into the identification of the parameters of a structural model of the employment decision of the establishment. To put it simply, a establishment may decide not to change its labour force because its demand does not fluctuate, or because even though demand fluctuates, it has large costs associated with hiring and firing.

Our data also have the property that exits take place even when establishments are increasing their labour stock, and that establishments hire even in periods when their overall employment shrinks. In Figure 3 we show entry and exit rates as functions of the net employment rate, using annualized data for ease of comparison with other studies.[7]

[7] Entry rates are the sum of entry over four quarters divided by employment in the beginning of the year. Net employment changes are variations from fourth quarter to fourth quarter in employment levels.

[Figure 3: "Hiring and Exit Rates by Net Employment Rates" about here]

The entry and exit rates at zero net changes in employment are around 8.5%. This is much smaller than reported in Abowd et al. (1999, Figure 1) for France and confirms that the worker flows in Portugal are lower compared to other EU countries. The quarterly frequency version of this picture has exactly the same qualitative features.[8] An interesting observation when holding together annual and quarterly data points to the importance of time aggregation. When we observe zero net employment changes, $L_t = L_{t-1}$, at annual frequency, 32% of these zero net changes have zero entry and zero exit, $EN_t = EX_t = 0$. This latter fraction rises to 77% when we use quarterly frequencies.[9]

3 Model

Consider a model of a firm that decides on the optimal employment of homogeneous labour.[10] Capital and other inputs are assumed to be maximized away, and the only decision taken by the firm is that of employment.[11] The profit function of the firm is given by

$$\Pi_t \left(A_t, Q_t, L_t, L_{t-1}\right) = R_t - wL_t - AC\left(.\right)$$

where $R_t = A_t L_t^{\alpha}$ is the revenue function, and L_t is the employment level used in production in period t. A_t is a profitability shock reflecting variations in demand or technology. We assume that profits are possible: R_t is concave in labour, $0 < \alpha < 1$, and α reflects both labour's share in the production function as well as the elasticity of the demand curve when the firm has market power. The wage rate per worker, w, is an exogenous

For visual clarity we show only net employment rates in the interval -0.2 to 0.2. This interval covers 90.0% of all net employment observations.

[8] See Hamermesh et al. (1996, Figures 2a and 2b) and Davis et al. (2006, Figure 6) for similar pictures of flows conditional on net employment changes.

[9] The frequency of zero net employment changes is 15.25% in annual data and 36.7% in quarterly data.

[10] In the subsequent parts we will use firm and establishment synonymously.

[11] Capital is not explicit in the model, as we assume that either it is not costly to adjust or its adjustment costs are additively separable from those of labour. We have no reliable data on capital for our establishments.

constant. We assume that new hires become productive immediately.

The function $AC(.)$ is the general adjustment cost function which depends on both net, ΔL_t, and gross employment changes defined as $M_t = H_t - F_t$. Net employment changes, ΔL_t, hiring H_t, and separations, $F_t + Q_t$ follow:

$$\Delta L_t = L_t - L_{t-1} = H_t - (F_t + Q_t)$$

where F_t and Q_t denotes firings and quits (voluntary separations), respectively. The gross employment changes, M_t, can be positive (hires) or negative (fires). In the model hiring and firing cannot occur in the same period. This matches the fact that, according to most countries's labour employment legislation, one cannot hire and fire at the same time unless in case of serious misconduct. More explicitly, gross employment changes are defined as:

$$M_t = H_t - F_t = \begin{cases} H_t; & F_t = 0 \text{ if } H_t > 0 \\ -F_t; & H_t = 0 \text{ if } F_t > 0 \end{cases}$$

Furthermore, we define entry and exit as

$$EN_t = M_t \times I(M_t > 0)$$
$$EX_t = Q_t - M_t \times I(M_t < 0)$$

where $I(.)$ is an indicator function taking the value one if the condition in brackets is satisfied and zero otherwise.

We use the following specification for the adjustment cost function:

$$\begin{aligned}
AC(.) &= C^n(\Delta L_t) + C^g(M_t) \\
C^n(\Delta L_t) &= \frac{\gamma^n}{2}\frac{\Delta L_t^2}{L_{t-1}+1} \\
&\quad +\phi^n \times abs(\Delta L_t) \\
&\quad +[F^n \times L_{t-1}] \times I(\Delta L_t \neq 0) \\
C^g(M_t) &= \frac{\gamma^g}{2}\frac{M_t^2}{L_{t-1}+1} \\
&\quad +\phi^g \times abs(M_t) \\
&\quad +[F^g \times L_{t-1}] \times I(M_t \neq 0)
\end{aligned} \tag{1}$$

where $I(.)$ is an indicator function, and "abs" indicates the absolute value function. This specification includes quadratic, linear, and fixed costs, and all types of costs have gross flows (M_t) and net flows (ΔL_t) components.[12]

The parameters of interest are $(\gamma^n, \gamma^g, \phi^n, \phi^g, F^n, F^g)$.[13] For simplicity these functions are symmetric with respect to upward and downward adjustment which is consistent with our data.[14]

Finally, the firm observes (A_t, Q_t, L_{t-1}), and then decides on its current labour force L_t. The dynamic programming problem is

$$V(A_t, Q_t, L_{t-1}) = \max_{L_t} \Pi_t(A_t, Q_t, L_t, L_{t-1}) + \beta E_t V(A_{t+1}, Q_{t+1}, L_t) \tag{2}$$

where $V(A_t, Q_t, L_{t-1})$ is the value of entering the period with L_{t-1} workers and facing Q_t quits and state of technology A_t. The expectation operator contains both random variables, and β is the discount factor.

[12] Note, the denominator of the quadratic costs is $L_{t-1}+1$ instead of the standard in the literature, L_{t-1}. This is done to avoid potential problems of a zero denominator during the simulations.

[13] We explore fixed costs with and without the scaling by L_{t-1}.

[14] Quits do not *directly* induce adjustment costs. Indirectly, net adjustment costs result if quits are not replaced, and gross adjustment costs result if replacement takes place.

4 Identification

Our first exercise is to simulate a calibrated version of the model under different cost structures to observe the behavior of selected moments. We focus on features of net (ΔL_t), and gross (M_t), changes in employment, since they relate directly to the different cost functions used and also to the question at hand. We use mainly moments of entry because exit is more directly affected by the exogenous quit process, and study in particular standard deviations and first order serial correlations because these are key moments that characterize the behavior of the objects of study. These moments also have good identification properties as we explain below. Finally, to take account of heterogeneity our moments are constructed in rates rather than levels.

The state space for L is the set of integers including zero up to a reasonable upper bound and we choose to center the model at $\bar{L} = 42$ which is the median employment in our data. The mean level of the shocks is then determined by the first order condition of the frictionless model: $\bar{A} = \frac{w}{\alpha}\left(\bar{L}\right)^{1-\alpha}$. The value of α is 0.66 as in King and Thomas (2006), and is the labour share in the frictionless model. For convenience, we normalize the wage to equal the curvature of the revenue function, $w = \alpha$. The discount factor $\beta = 1/(1+r)$ contains a 1.5% interest rate, which corresponds to 6.1% annual interest rate. Quits have a minimal structure. They consist of an iid quit shock, z, defined with a nine point support on the set of integers $z \in [0, 1, 2, .., 8]$, which is assumed to be uncorrelated with either the employment level or the technology shock.[15] The discrete density probabilities $p(z)$ are given by the empirical distribution of exit given positive entry for all firms (which according to the model must be quits).

In our experiments adjustment cost parameters are set for each case so that, given employment at $\bar{L}$, the adjustment of one worker has costs equal to 1/1000 of quarterly revenues, except for fixed costs where this fraction is 1/100. Finally, the demand/technology

[15] We experimented with a random fraction δ_t multiplied with L_{t-1}, with the *realization* of this product ($\delta_t L_{t-1}$) rounded to the nearest integer. This generated too much correlation between current exit and lagged employment compared to the data and so we dropped it.

shock A_t is assumed to have a log normal distribution. More formally;

$$\begin{aligned} A_t &= \overline{A}e^{a_t} \\ a_t &= \rho a_{t-1} + \varepsilon_t \\ \varepsilon_t &\sim N(0, \sigma). \end{aligned} \tag{3}$$

The process for a_t is discretized into a first order Markov process with 31 elements in its support by applying the gaussian quadrature method of Tauchen (1986), with persistence and standard deviation values ($\rho = 0.50, \sigma(\varepsilon) = 0.2$). Later we need to estimate these parameters simultaneously with the adjustment cost parameters because we lack separate information on profitability which would allow a direct estimation of (ρ, σ). In this sense, imposing the AR1 form on the shock process is a maintained identifying assumption.

We generate artificial data for 2000 firms and 21 quarters. All firms have initially 50 workers. The only thing that distinguishes these firms is the realization of the shocks. For each cost structure, allowing only one adjustment cost parameter to be different from zero at the time, we use the optimal decision functions from the dynamic programming problem to generate 121 periods of firm level data. After eliminating the first 100 periods we describe the behavior of the firms by a set of moments. Note that for all of the various cost structures we keep the same realizations of shocks.

The moments following the simulation are presented in the appendix, Table A1. Here we give a brief description only. We find that when we increase the impact of quadratic costs (by increasing γ) we reduce the standard deviation, $s(.)$, and increase the first order serial correlation, $r(.)$, of the variable affected. Said differently, high quadratic costs of net changes (and low quadratic costs of gross flows) imply high serial correlation and low standard deviation of net employment change rates, $\Delta L_t/L_{t-1}$, and low serial correlation and high standard deviation of entry rates, EN_t/L_{t-1}. Correspondingly for a case with high gross adjustment costs and low net adjustment costs. Thus, relative movements in these four moments, $s(\Delta L_t/L_{t-1})$, $r(\Delta L_t/L_{t-1})$, $s(EN_t/L_{t-1})$, and $r(EN_t/L_{t-1})$, identify variations between the two convex cost parameters, γ^n and γ^g.[16]

The fraction of zeros of entry conditional on positive exit, $\%EN = 0|EX > 0$, is very different depending on whether fixed costs are associated with net or gross flows. If fixed costs are associated with gross flows, hiring is costly in itself, and the firm will not counteract exits with immediate hiring, but will rather wait and hire several workers when hiring takes place. If, on the other hand, fixed costs are associated with net changes, the firm will immediately counteract exits by hiring and we should see a lot less zeros in entry. Therefore $\%EN = 0|EX > 0$ helps in identifying fixed costs of gross versus net changes, F^n vs F^g. This moment is also useful to identify the effects of net vs. gross linear costs, ϕ^n vs ϕ^g.

Following several studies in the literature, we include one measure of the tail of our distributions. We pick the 10% tail of the entry rate, i.e. $\%(EN_t/L_{t-1} > 0.1)$. We find that the density beyond the 10% cut-off is very responsive to the presence of large quadratic costs; high quadratic costs lead to small tails. The tail is less responsive to fixed or linear costs, suggesting that measures of tails or spikes identify convex, rather than nonconvex costs. We include also the average entry rate, $\mu(EN_t/L_{t-1})$, in our set of moments. This moment is a location statistic with different information from the standard deviation and serial correlation of the entry rate. It turns out that this moment is very different for the quadratic costs models and the other ones.

5 Estimation

We estimate the model using the simulated method of moments (see Lee and Ingram (1991)). We generate a series of k simulated panels conditional on a vector of parameters

[16]Linear costs and fixed costs affect serial correlations and standard deviations, but are unable to provide identifying variation between gross and net flows.

θ.[17] The vector of simulated moments for each of the k artificial sets of data is denoted $Y_j(\theta)$. The vector of moments in the actual data is denoted X. The estimation procedure seeks to minimize the distance between the moments predicted by the model and by the actual data, i.e. the procedure chooses the value θ^* that minimizes the following quadratic form $J(\theta)$:

$$J(\theta) = \left(\frac{1}{k}\sum_{j=1}^{k} Y_j(\theta) - X\right)' W^{-1} \left(\frac{1}{k}\sum_{j=1}^{k} Y_j(\theta) - X\right)$$

where W denotes a weighting matrix.[18] The J statistic has a chi-squared distribution with degrees of freedom given by the difference between the number of moments and the number of parameters.

Table 1 shows parameter estimates for various models by column: quadratic costs (Q), linear costs (L), fixed costs (F), fixed costs with scaling by L_{t-1} (FS), quadratic and linear costs (Q+L), quadratic and fixed costs (Q+F), and finally quadratic and fixed costs with scaling (Q+FS). Based on the results presented in the previous section it should be noted that it is hard from the chosen moments to disentangle between the truly fixed costs, F, and fixed costs with scaling, FS. Thus, we estimate both specifications [19] In the first four columns the J statistic has three degrees of freedom while in columns five through seven it has one degree of freedom.[20]

[Table 1 "Parameter Estimates" about here]

Starting with a broad look at this table we see that quadratic costs of gross adjustment dominate in size and significance. We also see that the shock process parameters, ρ and σ, are generally significant and display low persistence. The first four columns show that the adjustment cost parameters are not very precisely estimated in these simplified

[17] Each of the k panels has the same size as our actual data, 501 firms with 21 periods. We set $k = 10$. We generate a matrix of standard normal shocks for 5010 firms and 121 periods, and this matrix is used in every run of the model for every parameter vector. We then eliminate the first 100 periods of data.

[18] The weigthing matrix is defined as $W = (1 + 1/k)\,V$, where V denotes the covariance matrix obtained by resampling the 501 firms in the actual data panel one thousand times with replacement. This provides us with one thousand draws of every moment we are interested in.

[19] In estimation, starting values for net and gross parameters are always identical.

[20] We use seven moments described in Section 4.

models, even if they all include both net and gross components. The J statistics for the four same columns show that the model with quadratic costs performs better than any of the others.[21] This induces the choice of extending the quadratic model by adding linear or fixed costs to it, reported in the last three columns of the table. For the model where both quadratic and linear components are combined, Q+L, we find that only the quadratic gross adjustment parameter, together with the parameters describing the shock process, is statistically significant. This is also true for the Q+F model.[22,23]

The J statistic hides the performance of the models in terms of the individual moments. In Table 2 we show the set of moments used in estimation for the combined models, first generated by the estimated models, $Y(\theta^*)$, and in the last column the corresponding values from the data, X. All models (and especially Q+L and Q+FS) come within an order of magnitude for all moments with one notable exception. None of the models are able to simultaneously match the serial correlation moments, $r(\Delta L_t/L_{t-1})$ and $r(EN_t/L_{t-1})$.

[Table 2 "Moments Used: Model and Actual Data" about here]

We also want our model to deliver a distribution of flows similar to what we see in the data. A good approximation to the number of zeros and ones is an important feature of the model, since the former is an important measure of inaction and the latter is an important measure of action with fundamental implications for fixed costs. To motivate the importance of zeros and ones it is helpful to point out the difference between fixed and quadratic costs: quadratic costs generate a bell shape with high probability mass around zero, while fixed costs induce a mass of probability at zero. The higher fixed costs are, the higher the mass at zero and the lower the mass around zero.[24]

[21] The J statistic rejects the model - $\chi^2_{df=2} = 5.99$ - but common sense suggests that if J has a lower value we must be closer to the "truth".

[22] The Q+FS model has the lowest J-statistic, but none of its adjustment cost parameters is significant.

[23] For all the "combined" models, we find γ^g to be bigger than γ^n. This is true even when using other sets of moments to estimate the model and is a very robust feature.

[24] Given the discrete nature of our data (number of employees) this distinction between at zero and around zero can be blurred for smaller firms. Partly for that reason firms with less than 20 workers are not in our panel

Table 3 shows how the estimated models perform on zeros and ones. We see that our models fail in either the number of zeros, the number of ones, or both. For instance, the linear costs model matches zeros reasonably well but is unable to match the ones. Fixed costs are more successful at generating zeros, but they empty the density around zero. More importantly, our experiments show also that this density is shifted mostly to zero and very little to the tails, suggesting the density at the tail of the distribution is not an identifier of fixed costs. Also note that the scaling of fixed costs matters. A fixed cost that is truly fixed is eroded by growth. Scaling destroys this possibility and implies it is hard for firms to hire single workers. We see that the Q+FS model does quite well on the zeros but poorly on the ones, whereas for the Q+F model the better performance on the ones comes at the cost of a worse performance on the zeros.[25] Overall, the best model here is the Q+L model. This model performs better on the ones, but loses some of the fit on the zeros of the linear model alone. The bottom line of Table 3 shows the average of the absolute value deviations in these four reported moments, $Qabs$, for each case, and we see that the Q+L model is on average 24% away.

[Table 3 "Percentage of Zeros and Ones" about here]

As a robustness check we have also estimated a frictionless model. Doing so we get an estimate of σ which is very small, delivering a small standard deviation for the A_t shock. This is required to have a chance of fitting the moments. The small σ states that the model without adjustment costs implies excessive sensitivity of employment changes to variations in profitability. The models with adjustment costs, on the other hand, allow the shock to have a much bigger standard deviation. Doing this exercise, the results reported in the appendix, Table A2, we find that in general are all the moments further away from the actual data, than any of the combined models (see Table 2). The Qabs measure for this frictionless model is 0.411, compared to 0.237, 0.346 and 0.395 for the Q+L, Q+F, and Q+FS models respectively. Thus, fit of the simulated data for the frictionless

[25] It faces the same trade off as the linear costs model in this respect.

model, and therefore employment dynamics, is very different from the other models where employment adjustments are costly.

So far it is evident that the fixed costs are small and mainly statistically insignificant. For example, in the Q+F model the value of $F^N = 0.017$ is about 7.8% of one monthly wage, while the value of 0.0034 in the Q+FS model is somewhat higher - when evaluated at median employment (42 workers) it comes to 65% of one monthly wage. However, calculations based on the parameter values alone do not allow us to properly gauge the economic impact of adjustment costs, fixed or otherwise. To do this we compute the value of the firm in the Q+FS model, as this is the one with the lowest value of the J statistic.[26] For each observation in the sample we compute the value function $V(A_t, Q_t, L_{t-1})$, eq. (2) and then take its average over the panel. Taking the estimated model to be the "truth", we shut down some of the cost parameters and run the model again - with the same shocks and all other parameters as estimated - to obtain a counterfactual measure of the gain of eliminating these costs. Shutting down fixed costs has a relatively small economic impact: setting $F^n = F^g = 0$ increases the value of the firm by 0.93%. The reason for this small impact of fixed costs is because they only affect flows of zeros and ones while the median size of the firm is 42. Eliminating quadratic costs associated with gross flows has, as expected, a large impact on the value of the firm: setting $\gamma^g = 0$ increases the value of the firm by 20.7%. Interestingly, setting $\gamma^n = 0$ has a negligible impact on the firm, increasing its value by only 0.45%. The message from this experiment is clear: adjustment costs are large, and largely associated with quadratic costs of gross flows.

5.1 Matching zeros and ones

Given our discussion of zeros and ones, we try to match them explicitly in a new set of estimations. Yielding largely the same results, the new estimates serve also as robustness checks to our previous exercises. Using levels of zeros and ones may be seen as introducing

[26] Similar results come out from an exercise based on the Q+L model and the Q+F model.

heterogeneity. As in King and Thomas (2006) and in Khan and Thomas (2008), we note that size is persistent. Of the 247 establishments in our sample that are below median size in the first quarter, 211 of them (85%) are still below median size five years later in the twentieth quarter. Furthermore, we also find that the number of zeros of ΔL and of entry are negatively correlated with firm size (for a similar pattern see Nilsen et al. 2007). One possible explanation may be the existence of a pure fixed component associated with labour adjustments. Such fixed component is a bigger relative burden for smaller firms and may induce more infrequent adjustments for such firms.

To take care of firm specific heterogeneity, we add a quasi fixed effect to the shock process in the form of a very persistent shock. Now we model the shock process as follows;

$$A_{it} = e^{b_{it}} e^{a_{it}}$$

As before, the shock $\exp(a_{it})$ has unconditional expectation equal to one. Now the term $\exp(b_{it})$ has unconditional expectation equal to median employment. This shock is implemented as a Markov process and has three points in its support.[27] As previously there is a single unconditional mean, but in fact, due to the extremely high persistence in the new shock, the model has three conditional expectations implied by the values of employment at the first, second and third quartiles of the employment distribution, respectively 27, 42, and 65 workers. The support for $\exp(b_{it})$ shock is obtained by inverting the first order condition of the frictionless model at these points.

In addition to the introduced heterogeneity in our model, we add four new moments to our estimation exercise: the fraction of zeros and ones of net and gross changes. In this way we make the model consistent again, i.e. heterogeneity both in the model and the matched moments. At the same time as we add these new moments we drop the serial correlation of $\Delta L_t/L_{t-1}$, which is posing a problem for the optimization algorithm

[27] The transition matrix has 0.992 in the main diagonal and an equal split outside it, making this a quasi fixed effect. This implies 0.992^{20}=0.85 which is the percentage of small firms, defined as below the median size, in the initial period which are small also in the last period.

because of its difference with the serial correlation of the entry rate.[28] We have then ten moments and six parameters: The new parameter estimates are reported in Table 4.

[Table 4 "Estimation Results: High Persistency in the Shocks" about here]

Now we see that all of the adjustment cost parameters are statistically significant, with the exception of the fixed gross components, F^g. We also see that γ^g is always much bigger than γ^n, and $\phi^g > \phi^n$. This pattern we also saw in Table 1, only that there the results were not statistically significant. Our J statistics have in general increased comparable to the ones reported in Table 1 and are not very satisfactory. Still, the estimation exercise in this section is faced with much bigger challenges than before given that we have ten moments to match. Furthermore, it seems reasonable to point out that a high J statistics tells that it is generally difficult to predict individual behavior. Still, the significance of the adjustment cost parameters tells that the effect of each adjustment cost component is reliable. When we find that only the net part of the *fixed* adjustment costs, F^n, are statistically significant this is plausible since increasing the number of workplaces instead of only replacing workers requires more machinery and equipment. These latter capital adjustments are more related to changes in workplaces than to changes of workers.

The moments implied by the model with fixed effects are reported in Table 5. For ease of comparison, we add the corresponding moments from Tables 2 and 3.[29] The numbers in brackets are moments not used for estimation in one of these sets of models.

[Table 5 "Moments Used: High Persistency in the Shocks" about here]

The figures in Table 5 show a moderate improvement in a major part of the moments relative to the same models estimated without the fixed effect. In the Q+F model we see an improvement on both the zeros and ones of ΔL, and on the ones of entry, EN. The

[28]We sacrifice this particular moment because it is also the one where the ratio of mean to its (bootstrapped) standard deviation is lowest in the data, making it the least reliable. Given that our adjustment cost structures have both net and gross components, we had no a priori reason to think it would be so hard to match these different serial correlations.

[29]Note that these models were estimated against a different set of moments.

Q+FS model sees a marked reduction in the number of zeros for a very small improvement in the number of ones of ΔL. Furthermore, zeros and ones remain hard to reproduce. In their investment model, Khan and Thomas (2008) allow for zero costs of small adjustments relative to current capital, which may help with matching zeros and ones. A different way of dealing with this is the approach of Gourio and Kashyap (2007) who directly assume heterogeneity in fixed costs. With the appropriate level of heterogeneity in this parameter we can partially relieve the model in its task of matching the distributions of interest.

The exercise in this section does generate similar results to what we had obtained before. Nevertheless, adding the zeros and ones to the set of moments increases the significance of our estimated parameters and, more importantly, clearly identifies the model with quadratic and linear costs as the best one.

To see the magnitude of the new estimates of fixed costs in the same perspective as with the earlier models, we find that the fixed cost of $F^n = 0.022$ of the Q+F model amounts to 9.8% of one monthly wage, while with $\gamma^g = 6.793$ the gross quadratic cost of adjusting one worker at median employment is 36% of one monthly wage. Fixed costs have a negligible impact on the value of the firm. In the Q+F model, setting $F^n = F^g = 0$ increases the value of the firm, eq. (2), by 0.12% only, while setting $\gamma^g = 0$ increases the value of the firm by 9.4%.[30]

More interesting is to examine the contribution of the different cost components to the value of the firm based on the Q+L model; the model with the smallest J statistic. The results of this exercise are reported in Table 6.

[Table 6 "Welfare calculations based on Q+L model result" about here]

Table 6 shows the value of the firm when we shut downs all or parts of the cost structure for the Q+L model. The first striking outcome is that adjustment costs have a huge impact, more than halving the value of the firm. The elimination of all adjustment costs increases the value of the firm by 111.4%, which implies that their presence reduces

[30]Setting $\gamma^n = 0$ increases the value of the firm by only 0.7%.

the value of the firm by 52.7%. The second outcome is that quadratic costs are still the bigger ones, and finally, the last significant fact is that costs of gross flows have a much bigger impact than costs of net flows.

It should be noted that all our results are partial equilibrium results and not general equilibrium outcomes. Thus, in the counterfactual experiments where we set a subset of the estimated adjustment costs parameters equal to zero, prices and aggregate employment are unaffected. To endogenise firms' output and therefore prices in the output market, wages, together with a labour supply that responds to price- and wage changes is beyond the scope of this paper. Nevertheless, the lesson to be drawn is that adjustment costs are very large.

While Table 6 shows us the full extent of the economic impact of adjustment costs by accounting for the value of the actions not taken, actual incurred costs as a fraction of profits, $AC(.)/(R_t - wL_t - AC(.))$, are much smaller at about 6.2% in the estimated model. As with the value function measure, this number averages all observations in all simulated panels.

It is useful to end with the calculations based on the estimated parameter values. We use the estimates for the Q+L model with persistent shocks, and evaluate the effects at median employment. In our data the average entry rate equals 0.0316, implying one hire every quarter. If we assume employment stays constant, $\Delta L = 0$, total adjustment costs due to turnover amount to 1.7 monthly wages, and the linear part is the dominant one. For quadratic costs to dominate, turnover must exceed four workers. Let us now assume that the median firm increases its labour force by one worker, i.e. $\Delta L = 1$. Given that even in growing firms there are separations we assume additionally that this firm has to hire at least 2 workers to get a net increase of 1.[31] Then total adjustment costs for this extra worker amount to 4.3 monthly wages. Note however, the quadratic adjustment costs increase these costs significantly when larger employment changes takes place.

[31] This is a conservative estimate since conditional on positive hiring, which occurs in 1/4 of the observations, average hiring in our data is of 3.9 workers.

These last numbers may seem in line with other estimates in the literature. However, we know that adjustment costs have a large economic impact on the firm by affecting employment dynamics, cutting its value by more than half. Calculations based only on the parameter values or on observed costs give an incomplete view since they do not include the incidence of shocks, and therefore the frequency of adjustment. This is fundamental to get a complete picture of the full economic impact of adjustment costs.

6 Conclusion

This paper has given attention to whether employment adjustment costs are related to net or gross employment changes, or both. We are able to do this because we have a rich dataset with quarterly information on employment stocks as well as on entry and exit flows which allows us to distinguish between gross and net flows. We use a structural model of the dynamic employment decision of the firm to allow for nonconvexities in the adjustment costs function. With the existence of nonconvexities there is no simple analytical solution in which the marginal cost of additional labour today is linked with future marginal benefits since it is no guarantee that this plant will be adjusting its labour stock in the next period. Our findings indicate that the cost structure consist of both a convex and a linear part, while fixed costs are small. This is a significant outcome because it raises an issue of what we really see in the data. Our data has similar patterns to data used by other authors, in particular it displays a high frequency of inactivity. Despite this, our estimated model does not point us in the direction of large fixed costs, neither for net nor gross employment changes. The reason is that the high frequency of zeros in the data, is coupled with an also high frequency of entries and exits of workers in low numbers. The coexistence of these two properties of the data makes it hard for large fixed costs to be part of the explanation. Furthermore, our experiments show that fixed costs have no impact on the density of the tails of the distribution of adjustment, a moment often used to identify fixed costs in the investment and employment literatures.

This tail is often selected to isolate infrequent (and large) events, and exactly because of that low frequency characteristic it is unlikely to be a good identifier of nonconvexities in adjustment. We believe this is a general result that points to the use of densities around zero as the proper identifiers of fixed costs.

Our estimates show that eliminating adjustment costs would more than double the value of the establishment, and that the single most important component of adjustment costs is the quadratic cost of gross changes in employment. This is an enormous economic cost which drives home the notion that Portugal has a heavily regulated labour market. Nevertheless, a quick look at the estimated parameters suggests a direct adjustment cost of around four monthly wages for an increase of one worker in the establishments's labour force. While this seems to be either smaller or in line with estimates obtained elsewhere in the literature and for other countries, such calculations fail to incorporate the dynamic nature of the problem, and may give a misleading picture of the true size of the problem, and of the true extent of the gains from deregulation.

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Table 1: Parameter Estimates

	Q	L	F	FS	Q+L	Q+F	Q+FS
γ^n	2.092				1.545	2.251	1.159
	(1.428)				(1.324)	(2.669)	(1.786)
γ^g	8.298*				6.235*	9.092*	9.509
	(1.373)				(2.418)	(2.593)	(5.026)
φ^n		0.246			0.020		
		(0.132)			(0.093)		
φ^g		0.310			0.288		
		(0.358)			(0.289)		
F^n			0.026*			0.017	
			(0.001)			(0.176)	
F^g			0.024*			0.005	
			(0.003)			(0.129)	
F^n				0.011*			0.003
				(0.001)			(0.021)
F^g				0.011*			0.001
				(0.001)			(0.008)
ρ	0.190*	0.299*	0.299*	0.405*	0.179*	0.127*	0.179
	(0.037)	(0.102)	(0.058)	(0.064)	(0.040)	(0.045)	(0.211)
σ	0.692*	0.355*	0.018*	0.059*	0.580*	0.727*	0.738*
	(0.027)	(0.081)	(0.001)	(0.003)	(0.044)	(0.117)	(0.110)
J	185	269	1016	519	89	143	76

Notes: Each column reports the results of the various model specifications; quadratic costs (Q), linear costs (L), fixed costs (F), fixed costs with scaling (FS), quadratic and linear costs (Q+L), quadratic and fixed costs (Q+F), and quadratic and fixed costs with scaling (Q+FS).
ρ and σ describe the demand/technology shock, see eq. (3)
* denotes significant at 5% level.

Table 2: Moments Used - Model and Actual Data

	Model							Data
	Q	L	F	FS	Q+L	Q+F	Q+FS	
s(ΔL/L)	0.048	0.079	0.039	0.085	0.044	0.044	0.048	0.082
r(ΔL/L)	0.067	0.000	-0.255	-0.118	0.027	0.023	0.048	-0.010
μ(EN/L)	0.030	0.041	0.047	0.052	0.029	0.028	0.029	0.032
s(EN/L)	0.040	0.084	0.061	0.095	0.039	0.037	0.040	0.067
r(EN/L)	0.079	0.022	-0.076	-0.053	0.101	0.041	0.064	0.164
%EN/L>0.1	0.076	0.134	0.184	0.166	0.076	0.063	0.075	0.079
%EN=0|EX>0	0.479	0.416	0.230	0.308	0.409	0.454	0.396	0.437

Notes: $s(.)$ denotes the standard deviation, r(.) denotes the first order serial correlation, $\mu(.)$ denotes the mean, $\%EN_t/L_{t-1}>0.1$ denotes the 10% tail of the entry rate, and $\%EN_t=0|EX_t>0$ denotes the fraction of zeros of entry conditional on positive exits.

Table 3: Percentage of Zeros and Ones

	Model							Data
	Q	L	F	FS	Q+L	Q+F	Q+FS	
ΔL=0	0.107	0.596	0.732	0.732	0.268	0.140	0.387	0.367
ΔL=1	0.092	0.007	0.000	0.000	0.082	0.084	0.000	0.114
EN=0	0.414	0.576	0.457	0.529	0.463	0.413	0.459	0.529
EN=1	0.123	0.113	0.121	0.129	0.131	0.129	0.109	0.180
Q abs	0.359	0.505	0.615	0.569	0.237	0.346	0.395	

Notes: *Q* abs shows the average of the absolute value deviations in these four reported moments.

Table 4: Estimation Results - High Persistency in the Shocks

	Q+L	Q+F	Q+FS
γ^n	1.589*	1.558*	1.562*
	(0.591)	(0.299)	(0.756)
γ^g	6.525*	6.793*	9.534*
	(0.604)	(0.288)	(0.894)
φ^n	0.020*		
	(0.008)		
φ^g	0.301*		
	(0.057)		
F^n		0.022*	
		(0.011)	
F^g		0.011	
		(0.017)	
F^n			0.001*
			(5.0-E04)
F^g			0.001
			(0.001)
ρ	0.171*	0.187*	0.226*
	(0.033)	(0.032)	(0.025)
σ	0.557*	0.537*	0.633*
	(0.013)	(0.011)	(0.019)
J	461	1013	1374

Notes: See notes to Table 1.

Table 5: Moments Used - High Persistency in the Shocks

	Extended model			Earlier model			Data
	Q+L	Q+F	Q+FS	Q+L	Q+F	Q+FS	
s(ΔL/L)	0.045	0.051	0.059	0.044	0.044	0.048	0.082
r(ΔL/L)	(0.110)	(0.102)	(0.107)	0.027	0.023	0.048	-0.010
μ(EN/L)	0.032	0.037	0.035	0.029	0.028	0.029	0.032
s(EN/L)	0.041	0.042	0.049	0.039	0.037	0.040	0.067
r(EN/L)	0.261	0.202	0.130	0.101	0.041	0.064	0.164
%EN/L>0.1	0.076	0.091	0.109	0.076	0.063	0.075	0.079
%EN=0|EX>0	0.377	0.389	0.474	0.409	0.454	0.396	0.437
%ΔL=0	0.256	0.171	0.272	(0.268)	(0.140)	(0.387)	0.366
%ΔL=1	0.100	0.096	0.017	(0.082)	(0.084)	(0.000)	0.114
%EN=0	0.423	0.364	0.483	(0.463)	(0.413)	(0.459)	0.528
%EN=1	0.147	0.140	0.072	(0.131)	(0.129)	(0.109)	0.180
Q abs	0.201	0.306	0.448	0.236	0.345	0.396	

Notes: The numbers in brackets are moments not used for estimation for the given model
Q abs shows the average of the absolute value deviations in the four last reported moments.
See also notes to Table 2.

Table 6: Welfare calculations based on Q+L model result

	Estimated model	Keeping the following adjustment costs: none	quadratic	linear	quad. net.	quad. gross	lin. net	lin. gross
γ^{n}	1.589	0	1.589	0	1.589	0	0	0
γ^{g}	6.525	0	6.525	0	0	6.525	0	0
φ^{n}	0.020	0	0	0.020	0	0	0.020	0
φ^{g}	0.301	0	0	0.301	0	0	0	0.301
V_0	208.0	439.8	214.7	236.0	234.3	216.2	408.7	239.9
$V_{increase}$	0 %	111.4 %	3.2 %	13.4 %	12.6 %	3.9 %	96.4 %	15.3 %

Notes: V_0 denotes the value of the firm, based on eq. (2) in the text

$V_{increase}$ denotes the increased value (%) with alternative adjustment costs structures.

Figure 1: Quarterly Net Employment Change Rates

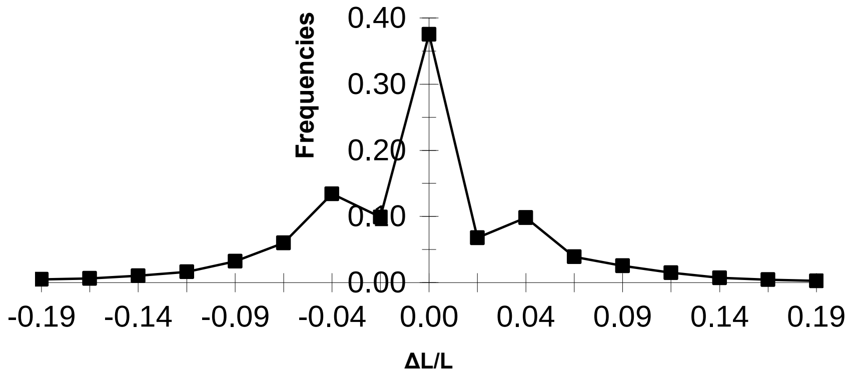


Figure 2: Quarterly Hiring Rates and Exit Rates

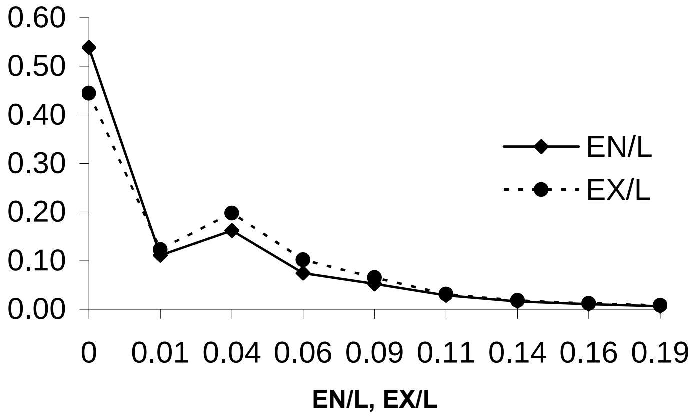
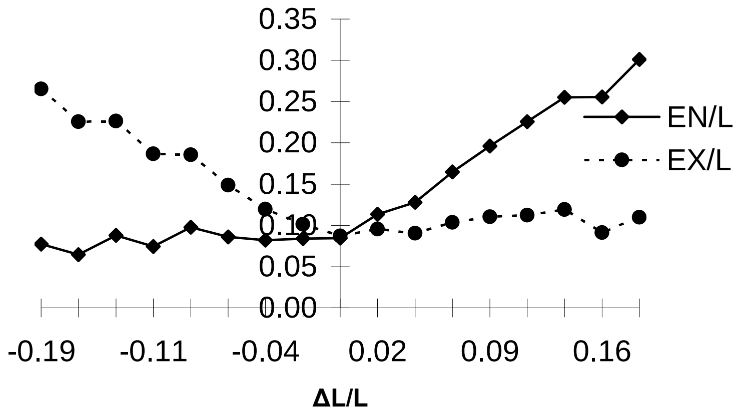


Figure 3: Hiring and Exit Rates by Net Employment Rates



Note: The entry and exit rates are annualized for ease of comparison with other studies.

Table A1: Simulated Moments: 40.000 observations

	Quadratic		Linear		Fixed		Fixed Scaled			
	γ^n	γ^g	φ^n	φ^g	F^n	F^g	F^n	F^g	No AC	Data
s(ΔL/L)	0.050	0.061	0.569	0.583	0.929	0.932	0.903	0.903	0.945	0.082
r(ΔL/L)	0.315	0.164	-0.121	-0.117	-0.194	-0.194	-0.218	-0.213	-0.207	-0.011
μ(EN/L)	0.052	0.048	0.269	0.269	0.444	0.437	0.437	0.432	0.470	0.032
s(EN/L)	0.058	0.046	0.500	0.519	0.844	0.851	0.822	0.823	0.850	0.067
r(EN/L)	0.141	0.356	-0.086	-0.084	-0.134	-0.137	-0.151	-0.147	-0.148	0.164
%EN/L>0.1	0.195	0.144	0.393	0.366	0.404	0.365	0.380	0.364	0.446	0.079
%EN=0|EX>0	0.368	0.322	0.430	0.595	0.425	0.673	0.410	0.669	0.516	0.437
%ΔL=0	0.163	0.148	0.325	0.159	0.334	0.111	0.362	0.119	0.164	0.366
%ΔL=1	0.141	0.136	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.114
%EN=0	0.353	0.287	0.443	0.569	0.442	0.634	0.437	0.636	0.470	0.529
%EN=1	0.128	0.154	0.074	0.029	0.074	0.000	0.080	0.000	0.038	0.180

Notes: We generate data for a panel of 2000 firms, all initialized at 50 workers. Data for these firms are generated for 121 periods, eliminating the first 100 periods when calculating the moments. In the experiments adjustment cost parameters are set for each case so that the adjustment of one worker with employment around median L, has costs equal to 1/1000 of quarterly revenues, except for fixed costs where this fraction is 1/100.
For each cost structure we keep the same realizations of the random variables.

Table A2: Frictionless Model: Parameter Estimates and Moments

Parameter estimates

ρ	0.918*
	(0.025)
σ	0.008*
	(0.001)
J	936.7

Notes: See notes to Table 1.

Moments

	Frictionless Model	Data
s(ΔL/L)	0.027	0.082
r(ΔL/L)	-0.097	-0.011
μ(EN/L)	0.049	0.032
s(EN/L)	0.052	0.067
r(EN/L)	-0.018	0.164
%EN/L>0.1	0.155	0.079
%EN=0|EX>0	0.246	0.437
%ΔL=0	(0.360)	0.366
%ΔL=1	(0.238)	0.114
%EN=0	(0.309)	0.529
%EN=1	(0.202)	0.180
Q abs	0.411	

Notes: See notes to Table 2.
The numbers in brackets are moments not used for estimation for the given model
Q abs shows the average of the absolute value deviations in the four last reported moments.

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