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Worker Churning and Firms' Wage Policies

by

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Abstract: If a random firm were to increase its wages, would that decrease the firm's churning ("excessive" worker reallocation)? Although the trade-off between wage and churning costs has received attention in both the labour and HRM literatures, there seems to be no evidence about the *causal* impact of wages upon churning. This paper seeks to fill that gap by considering detailed Portuguese matched employer-employee panel data and different identification methods. After presenting comprehensive evidence about job and worker flows and churning, we find that even models based on within-firm time differences do still generate the negative association between wages and turnover found in most research. However, that result no longer holds when we consider instrumental variables based on minimum wages determined by collective bargaining arrangements. One possible interpretation of our finding is that workers' effort may not be sufficiently sensitive to wages: employers may replace workers priced out of the labour market with more skilled individuals, so that churning does not fall.

Keywords: Worker Turnover, Endogeneity, Personnel Economics, Efficiency Wages.

JEL codes: J31, J50, J63, M50.

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1. Introduction

One of the several striking stylised facts that has emerged from the literature on job flows (Davis et al, 1996) is the large extent of worker churning (the excess of worker reallocation with respect to job reallocation). Contrary to what one may expect, even firms that exhibit stable levels of employment typically display high levels of hires and separations. Moreover, firms that are increasing the size of their workforce also generally exhibit a considerable number of separations, while hirings also tend to coexist with separations in firms that are cutting employment.

For instance, in a well-known study, Burgess et al (2000) document substantial levels of worker churning, at 12.1% in manufacturing and 22.8% in non-manufacturing. These churning levels represent, respectively, 61.9% and 70.4% of total worker flows, implying that most hirings and separations that occur within firms do not translate into changes in firm size (Hamermesh et al., 1996, Albaek and Sorensen, 1998, Abowd et al., 1999, Burgess et al., 2001, and Ilmakunnas and Maliranta, 2005, present additional evidence of churning).[1]

The importance of churning in most firms' employment policies raises important questions about the quality of the matching between employers and employees achieved by the labour market. For instance, since hirings or separations entail costs for both employers and employees, and low average tenure levels are typically detrimental to the acquisition of productivity-enhancing firm-specific skills, one may expect that the market would adjust in such a way that churning would be a less sizeable phenomenon. For instance, as firms age, they could improve the selection of candidates for their vacancies and their retention practices, in order to minimise churning.

In any case, it is important to acknowledge the role of wages upon the amount of churning in the labour market. For instance, one of the mechanisms that may generate efficiency wages (Akerlof and Yellen, 1986) is about the reduction in turnover costs achieved by increasing pay. However, little is known in both the labour and HRM literatures about the specific trade-offs between wage and churning costs faced by firms. More specifically, there is no evidence about whether a random firm that were to increase its wages would typically achieve a reduction in churning. Indeed, while there is plenty of evidence about the association between different HRM variables and different

[1] See also Martins (2006b) for evidence that churning does not only correspond to "replacement hiring", the most common interpretation in the literature: events involving "job upgrading" or "job downgrading" (i.e. firms changing the profile of their workforces in terms of skills and/or occupations) also explain part of the "excessive" worker turnover (with respect to job flows).

firm performance indicators, there is a disappointing lack of evidence about causal relationships (Guest et al, 2003, Lazear, 1995, Bandiera et al., 2005).

This paper seeks to fill a part of such large gap in our understanding of the causal impact of personnel policies by focusing specifically on the relationship between churning and pay (see also Barth and Dale-Olsen, 1999, and Dale-Olsen, 2006). Our analysis is implemented by considering long and detailed Portuguese matched employer-employee panel data and different identification methods, including instrumental variables. After describing evidence about job and worker flows and churning for the entire economy (including the services sector, unlike many earlier papers), we present regression results that explain the role of wages upon the variability of churning levels across and within firms over time.

As in other studies, we find, at first, that churning is negatively related to wages. This result still holds when considering only within-firm time variation. However, because the wages paid by firms are, at least to some extent, a choice variable, such estimates cannot necessarily be interpreted as causal parameters. Once we consider that, we obtain our main result: when instrumenting wages by using variation in wages driven by factors outside the control of firms (wages determined by collective bargaining contracts, in our case) we find that the relationship between wages and churning is actually non-negative: either significantly or insignificantly positive, depending on the estimates.

Section 2 presents the data and some statistics about job and worker flows. Section 3 describes the results, based on different estimation methods and samples. Finally, Section 4 offers a short summary.

2. Data and Descriptive Statistics

We employ the "Quadros de Pessoal" (Personnel Records) data set, an annual census of all firms based in Portugal that have at least one employee. The census, conducted by the Ministry of Employment, requires that each firm provides detailed information about itself (size, industry, region, age, sales, etc) and also each one of its employees (gender, age, schooling, tenure, wages, etc). Moreover, each firm and each employee is assigned a unique identifier, allowing one to follow them over time. In this paper, we use data from all years from 1986 to 2000 (except 1990, when only firm-level data are available).

"Quadros de Pessoal" can thus be characterised as a matched employer-employee panel data set covering a very large share of the entire labour market over a relatively long period. (The groups of workers not covered are the unemployed, the civil servants, the self-employed and the informal workers.) The data used here includes information about 2.4 million firms-year and almost 30 million workers-year. Moreover, because the main goals of the census are to check compliance with employment law and provide statistical evidence about the labour market, great care is placed on data quality.[2]

All flow variables are defined in the way that has become standard in the literature, as described in Davis et al (1996). Each rate is constructed by dividing a given flow (job creation, for instance) by the average employment of the firm over the two periods analysed. For instance, the job creation rate is defined as $JC = \frac{L_t - L_{t-1}}{0.5(L_t + L_{t-1})}$, if $L_t > L_{t-1}$, or 0, if $L_t < L_{t-1}$, in which L_t stands for the firm size in period t. Similarly, the job destruction rate is defined as $JD = \frac{L_{t-1} - L_t}{0.5(L_t + L_{t-1})}$ if $L_t < L_{t-1}$, or 0, if $L_t > L_{t-1}$, while the net job creation rate corresponds to JC – JD and the job reallocation rate is JC + JD. The hiring rate is $H = \frac{Hirings_{t,t-1}}{0.5(L_t + L_{t-1})}$, in which $Hirings_{t,t-1}$ denotes the number of workers present in the firm in period t but not in period t-1, while the separation rate is $S = \frac{Separations_{t,t-1}}{0.5(L_t + L_{t-1})}$, in which $Separations_{t,t-1}$ denotes the number of workers present in the firm in period t-1 but not in period t. Finally, the worker reallocation rate is H + S, and the churning rate is defined as CR = WR – JR.

All descriptive statistics and regression results are carried out by weighting each firm-level observation by its average employment.

We follow Blanchard and Portugal (2001) (see also Varejão, 2003) in the computation of worker flows and classify as (new) hirings all workers whose date of hiring was subsequent to the census date of the previous period (March, up to 1993, and October, from 1994 onwards). Since $\Delta L \equiv H - S$, in which L is firm size, H is hirings and S separations, the number of separations can be defined

[2] Although we do believe data quality is indeed of high standards, there are inevitably some missing or incorrect observations, particularly for smaller firms and/or in the earlier years of the census, when computers were not so widespread.

as H – ΔL, the difference between the total number of hirings in that firm-year and the change in firm size.[3]

Table 1 presents some descriptive statistics. Given that they refer to the entire population of Portuguese firms with at least one employee, they may deserve some particular attention. The first two columns refer to all firms in all years (a total of 2.899.846 firms-year, including interpolations[4]). The remaining four columns refer to 1987 and 2000 (given that 1986 is the first year in our data, it is not possible to compute job and worker flows variables for that year), which include, respectively, 128.754 and 301.607 firms.

Average firm size is 1,032 – in other words, given that our statistics are weighted by firm size, an average worker has 1,031 colleagues in her firm. 3% of all firms-year are new firms, while 5% are in their last year in the data. About 9% of firms are foreign owned (defined as when at least 50% of the equity of the firm is held by foreign investors). 39% of the workforce is female and their average schooling attainment is 6.7 years. They have 24 years of experience and almost 100 months of tenure, while their last promotion occurred, on average, 56 months before the date of the census.

Average job creation rate is 14%, while job destruction rate is 12%, resulting in a net job creation rate of 2%. Hiring and separation rates are almost twice that, at 23% and 22%. It is also noticeable all four rates increase significantly from 1987 to 2000, particularly the job destruction and the separation rates (from 9% to 18% and from 17% to 27%, respectively).

Figure 1 presents the distribution of net job creation rates in 2000 (similar figures could be presented for the remaining years). As documented in other studies, we find a large concentration around zero, the modal category, and at the two spikes at -2 and 2 (firm deaths and births, respectively). Except for those two extreme cases, very few firms (almost none) exhibit changes in employment of less than (greater than) the smaller spikes at -2/3 (2/3).

Coming back to Table 1, one can calculate churning rates at an average of about 20%, corresponding therefore to almost half of the worker reallocation rate. Moreover, we also find that the distribution of the churning rates is highly skewed. Out of the 2.3 million firms-year for which

[3] One problem with this approach is that any underestimation of H (for instance, because of missing or incorrect hiring dates) will also lead to the underestimation of S. However, from a more detailed analysis of this issue – see Martins (2006a) –, we believe this problem is not particularly relevant in our study.

[4] A closer inspection of the data indicated that some firms do not report their information in some years. In order to avoid biases in terms of the artificial definition of too many new and closing firms, the firm size of those firm-years (less than 10% of the firms-year used) was interpolated.

churning can be calculated, churning is greater than zero in only about 26% of the cases (not weighting by size). From Figure 2, which presents the distribution of churning rates in 2000, we can also see that only a very limited number of firms exhibit churning rates above 50%.

Moreover, gross monthly pay is on average €738 (2004 prices), ranging from €595 in 1987 to €814 in 2000. Hourly pay also increases, at a slightly higher rate. The last row refers to the variable that will be used as an instrument later in the paper. The variable is the percentage of workers in each firm that earn a base wage that is the modal wage in the workers' occupation (defined at the four-digit level). On average, about 18% of workers in each firm (again, weighted by firm size) earn those modal wages.

Table 2 presents more detailed results about the flows of jobs and workers across firms. In the first table, the firms are divided into their sector of activity (agriculture, manufacturing and services).[5] As in other studies, the services sector exhibits much higher rates of job creation and destruction and of worker hirings and separations – and therefore the services sector also exhibits higher rates of job and worker reallocation. For instance, worker reallocation is 51.5% in services and only 39.2% in manufacturing. However, we find that the agriculture sector is characterised by even higher job and worker reallocation rates. Finally, another important result is that, while churning is much higher in services than in manufacturing, its share in total worker reallocation is very similar in the two sectors, at about 50%.[6]

3. Results

In this section we present the main results of the paper. These results involve the estimation of a simple reduced-form linear equation that relates the churning rate of a firm in a given year with the average wage paid by that firm to its workers plus a number of controls. These controls include different measures of firm heterogeneity that may help explaining churning rates, including firm and time fixed effects. The equation is as follows:

$$(1) \qquad C_{it} = \beta W_{it} + X_{it}'\delta + \gamma_i + \delta_t + \varepsilon_{it}$$

[5] Electricity and Gas, and Construction have been included in the Services sector. The agriculture sector also includes Forestry and Fishing.
[6] See also the Appendix for a more detailed analysis of differences in these variables across industries.

C_{it} is the churning rate of firm i in period t, W_{it} is the average wage, and X_{it} are firm-year characteristics (the percentage of women in the workforce, average education and average experience of the workers, the levels of sales and of equity and log firm size), γ and δ are firm and time fixed effects, respectively. As suggested above, the firm fixed effects are of particular importance, as otherwise one would have to assume that the wage policy of the firm is chosen randomly in order to interpret the β coefficient as the causal impact of wages upon churning.

The estimation method also deserves some discussion. Given the large number of zeros in the dependent variable, a tobit model would be appropriate. However, to the best of our knowledge, an estimator for this model with fixed effects has not yet been developed. We are also not aware of tobit models, even with random effects, that could incorporate instrumental variables.

Given such technical constraints, our approach is to conduct our analysis first by employing a random effects tobit model instead. We then adopt a standard OLS model, first excluding firm fixed effects, and then including them. Finally, given that we are also concerned about the endogeneity of the within-firm time variation of wages, we also consider a model in which we instrument the change in wages. As a robustness test, we also replicate the previous models considering only firms that have a positive level of churning, including with a specification based on log churning and log wages.

Our instrument is the share of workers being paid collective bargaining contractual wages (henceforth SWCW). The choice of this variable is motivated by the very interesting work by Cardoso and Portugal (2005), who study the implications of collective wage bargaining upon wage determination. In order to derive their results, Cardoso and Portugal (2005) assume that bargained wages – basically an industry/occupation specific minimum wage – can be defined as the modal wage for each worker's job category, an assumption that receives support from the sample of jobs for which they collect wage information from collective agreements.

Our specific approach underpinning our adoption of the instrument involves arguing first that the greater the SWCW, the lower the average wages paid by the firm. This is straightforward because those contractual wages are wage floors – firms are free to pay above those agreed levels and most workers do indeed earn more). More important, we also argue that the SWCW does not affect directly the level of churning of the firm. In other words, it is not the share of workers that determines their mobility decisions, it is instead the wages themselves. This assumption corresponds to the exclusion restriction.

To sum it up, all the effect from SWCW upon churning in each firm is assumed to take place through the wages paid by the firm; the share is only a predictor, which is also influenced by factors outside the control of the firm, namely the bargaining process that takes place between different employers association and different unions. Moreover, as suggested before, we also expect the relationship between the instrument and wages to be negative: controlling for other variables, the greater the SWCW, the lower the average wage paid by the firm.

Table 3 presents the first set of results. All equations consider all firms (including those with zero churning rates). The first column is based on a tobit model with random effects. We find the expected significantly negative relationship between average pay and churning rates. The following three columns are based on OLS. Column 2 ignores the possible endogeneity of wages across firms while column 3 ignores the possible endogeneity of wage differences within firms, over time. In both cases, we again obtain very significant, negative coefficients of wages. For instance, the result of column 3 indicates that for each €1,000 extra that each worker earns per month, there is a decline of 1.7pp in that firm's churning rate. This negative relationship is consistent with the pattern documented in Figure 3, that depicts the level of churning and average pay across all industries in 2004: the fitted line, weighted by industry size, is clearly downward sloping.

However, in column 4, when we instrument wage differences with the shares of workers that are paid collective bargaining wages, we find that the coefficient remains statistically significant, but it is now positive. At 0.32, the coefficient indicates that there is an increase of 32pp in a firm's churning rate for each €1,000 increase of average pay. Although the contribution of the instrument in the first stage is not particularly strong (a partial R^2 of 0.0022), the instrument is significantly negative, as expected from our discussion above.

Overall, the result suggests that, contrary to previous findings, if firms pay higher wages (because of exogenous reasons), then churning may actually increase. Roughly speaking, a doubling of wages would lead to the doubling of churning.

In order to test the robustness of this (surprising) result, we repeat the analysis of the three last columns of Table 3 but considering only firms-year in which churning is positive (see Table 4). This selection of the sample is motivated by the fact that, as mentioned before, a considerable number of firms does not exhibit churning. In any case, we still find that the same pattern of results emerges, with significantly negative coefficients in the first two specifications (those without

instruments) and a positive coefficient (although now insignificant) when wages are instrumented. Finally, we consider the same sample of firms-years (those with positive levels of churning) but now adopting a log-log specification. The same pattern emerges again, with negative elasticities for the first two specifications and an insignificant, but also positive coefficient when wages are instrumented. In both cases, the instruments are significantly negative in the first-stage equations.

3.1 Interpretation

Our finding of a non-negative causal relationship between wages and churning (which is even significantly positive in some specifications) may at first seem counterintuitive. Presumably, if a firm were to increase the wages paid to its workers due to forces outside the firm's control, then workers would be less interested in leaving their jobs. Therefore, churning – understood as "replacement hiring" –, would fall. This would then generate a negative relationship between pay and churning.

In our view, one aspect that may be missing in this interpretation concerns the behaviour of firms once their workers become better paid due to exogenous forces. According to some efficiency wage models, such wage increases may pay for themselves, but only if workers' effort increase more than proportionately. However, if that were the case, one would presumably expect that firms would be keen to implement those pay rises in the first place, before being forced to do so by virtue of the increase in collective bargaining contractual wages. Moreover, as the outside options of workers earning the minimum wage would also increase (i.e. the minimum wage in other firms has also increased, by virtue of the collective nature of the bargaining), then the incentive for those workers to put in more effort will in fact be relatively weak.

Our explanation for the non-negative relationship between wages and churning is therefore that workers' effort may not be sufficiently responsive to wage increases, particularly in the firms most affected by our instrument (a local average treatment effect). Such firms are those that are paying lower wages, so that their wage bill goes up significantly when collective bargaining increases minimum wages. If effort then does not increase at least in a commensurate way to the increase in pay, then employers will prefer to dismiss or, more generally, promote the separations of those workers whose wages exceed their productivity and replace them with more skilled workers. To the

extent that not all dimensions of skill are captured in our regression controls, this process of replacement can easily prevent worker churning rates from falling, thus explaining the non-negative association between wages and churning documented in our study, when using instrumental variables.

Of course, it would be desirable to present additional empirical evidence about this interpretation in future research. One possible way of achieving that would be to follow the individuals whose pay is most affected by collective bargaining (i.e. those workers that earn the industry/occupation minimum wage). One could then examine whether such workers are also more likely to leave their jobs once their wages are increased by virtue of new collective bargaining agreements, as suggested by our interpretation of our findings.

4. Summary

Our study examined the relationship between churning and wages, using matched data covering the entire population of Portuguese firms between 1986 and 2000. We believe this relationship deserves attention from the points of view of both labour economics and human resource management. While economists may be concerned about the waste of resources that surrounds the constant replacement of workers in firms, HRM experts will find it helpful to draw on stronger quantitative evidence about how firms may ensure that employer-employee matches are long-lasting.

Given that we are interested in the causal relationship between the two variables, we used within-firm time variation (an improvement upon studies that focus on cross-section variation only). Moreover, we also exploit what we argue is a source of exogenous variation in wages: the share of workers in each firm being paid collective bargaining wages. Using that instrument, we find that the standard negative correlations between wages and churning become a non-negative causal link. We also argue that this finding may be explained by a relatively weak responsiveness of effort to wages in the firms affected by the instrument and the consequent replacement by employers of priced-out workers by more skilled new hires in such a way that churning does not fall with wages.

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Tables and Figures

Table 1 - Descriptive Statistics

	All Firms		1987		2000	
Variable	**Mean**	**Std. Dev**	**Mean**	**Std. Dev**	**Mean**	**Std. Dev**
Firm Size	1,032.0	3521.0	1,715.5	5,155.3	688.5	2,285.8
First Year	0.03	0.18	0.04	0.19	0.04	0.19
Last Year	0.05	0.21	0.04	0.19	0.00	0.00
Foreign Firm	0.09	0.29	0.09	0.28	0.11	0.31
Female	0.39	0.31	0.34	0.29	0.42	0.32
Schooling	6.70	2.38	5.81	1.92	7.57	2.64
Experience	24.08	7.03	24.99	6.44	23.55	7.43
Tenure	99.65	71.20	111.24	66.57	89.46	69.32
Months since Last Promotion	56.30	49.19	56.34	41.19	58.22	50.18
Job Creation Rate	0.14	0.37	0.13	0.38	0.15	0.39
Job Destruction Rate	0.12	0.34	0.09	0.31	0.18	0.49
Net Job Creation Rate	0.02	0.54	0.04	0.51	-0.03	0.67
Hiring Rate	0.23	0.40	0.21	0.40	0.26	0.41
Separation Rate	0.22	0.36	0.17	0.32	0.27	0.44
Worker Reallocation Rate	0.46	0.52	0.38	0.49	0.52	0.57
Monthly Pay	738.22	446.55	595.45	309.45	813.95	490.96
Hourly Pay	4.54	3.40	3.56	2.14	5.10	3.29
Binding Wages	0.18	0.23	0.19	0.21	0.18	0.25

Notes: Author's calculations based on "Quadros de Pessoal" data. "Firm size" refers to the number of workers in each firm; "first year" and "last year" are dummy variables taking value one when the firm appears for the first or last time in the data, respectively; "foreign firm" is a dummy variable taking value one if at least 50% of the equity of the firm is held by foreign investors; "schooling" refers to the years of schooling attained by each worker; "tenure" is measured in months; "monthly" and "hourly pay" are measured in 2004 euros; "binding wages" refer to the percentage of the workforce in each firm that is paid the wage determined by collective bargaining (this is measured following the approach of Cardoso and Portugal, 2005), considering only the worker's occupation or his/her occupation and industry (see main text for more details). Job and worker flow rates follow the standard definition in the literature (more details in the main text).

Table 2 - Job and Worker Flows Rates, 1986-2000, by Sector

Sector	Job Creation	Job Destruction	Net Job Creation	Job Reallocation
Agriculture	0.198	0.194	0.005	0.392
Manufacturing	0.109	0.113	-0.004	0.222
Services	0.166	0.123	0.044	0.289

Sector	Hiring	Separation	Worker Reallocation	Worker Churning	W. Churning / W. Reallocation
Agriculture	0.340	0.351	0.691	0.265	0.439
Manufacturing	0.188	0.203	0.392	0.163	0.518
Services	0.275	0.241	0.515	0.218	0.502

Notes: Job and worker flow rates follow the standard definition in the literature (more details in the main text).

Table 3 - Impact of Wages on Churning, Different Models
Dependent variable: Churning Rate; Years used: 1987-2000, except 1990

	1 RE Tobit	2 Pooled OLS	3 FE	4 FE-IV
Avg pay	-0.029*** [0.000]	-.076*** [0.000]	-.017*** [0.000]	.320*** [0.000]
Fixed Effects			X	X
IV				X
R-squared		0.119	0.571	-0.022
No. obs	931093	931093	931093	931093

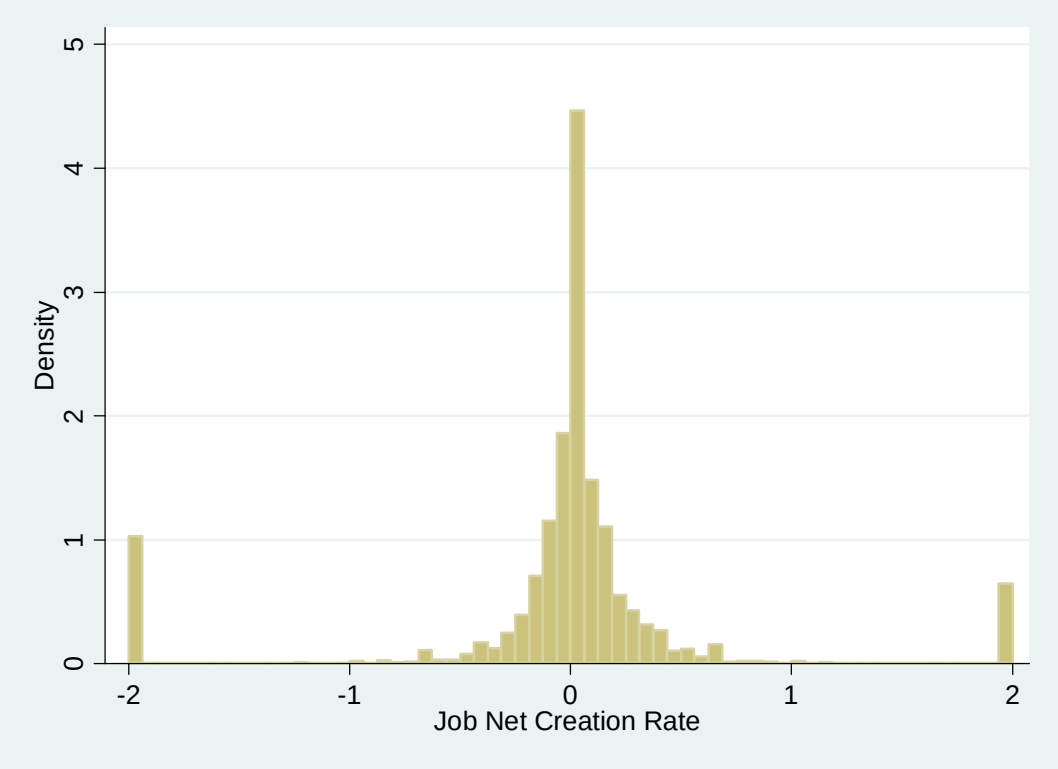
Notes: The coefficient of the instrumental variable in the first-stage equation is -.067 (t-ratio: -9.44), with a partial R2 of 0.0022 and an F-statistic of 89.05. Controls used in all regressions: year dummies, percentage of women, average education, average experience, sales, equity and log firm size. The explanatory variable is measured in thousands of euros(2004 prices). Only firms present three or more years over 1987-2000 are included in the analysis. Robust standard errors. * p<0.05, ** p<0.01, *** p<0.001.

Table 4 - Impact of Wages on Churning, Different Models
Dependent variable: Churning Rate or Log Churning Rate; Years used: 1987-2000, except 1990

	1 Pooled OLS	2 FE	3 FE-IV	4 Pooled OLS	5 FE	6 FE-IV
Avg pay	-0.106*** [0.006]	-0.025*** [0.005]	0.164 [0.123]			
Log avg pay				-0.511*** [0.027]	-0.120** [0.038]	0.167 [0.845]
Fixed Effects		X	X		X	X
IV			X			X
R-squared	0.186	0.694	0.057	0.312	0.710	0.104
No. obs	413246	413246	387468	413246	413246	387468

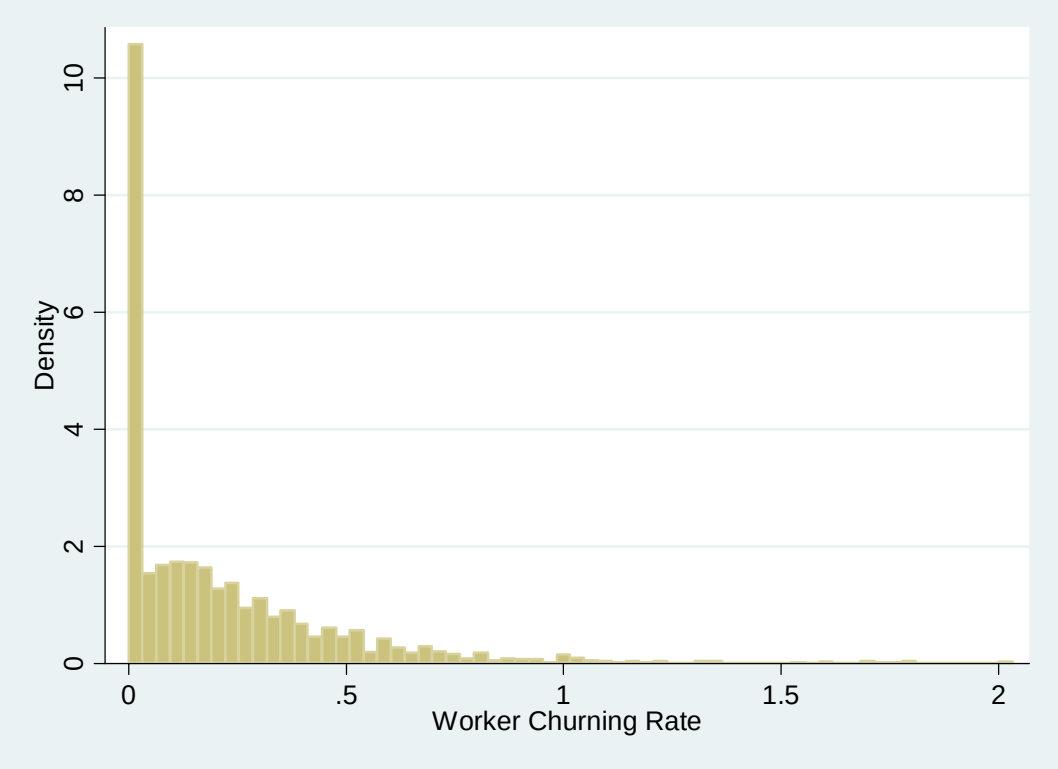
Notes: The coefficient of the instrumental variable in the first-stage equation of column 3 is -.064 (t-ratio: -5.59), with a partial R2 of 0.0017 and an F-statistic of 31.26. For column 6, the instrumental variable in the first-stage equation coefficient is -.055 (t-ratio: -6.72), with a partial R2 of 0.0016 and an F-statistic of 45.09. Controls used in all regressions: year dummies, percentage of women, average education, average experience, sales, equity and log firm size. The explanatory variable is measured in thousands of euros (2004 prices). Only firms present three or more years over 1987-2000 are included in the analysis. Robust standard errors. * p<0.05, ** p<0.01, *** p<0.001

Figure 1 – Distribution of Net Job Creation Rates, 2000, All Firms



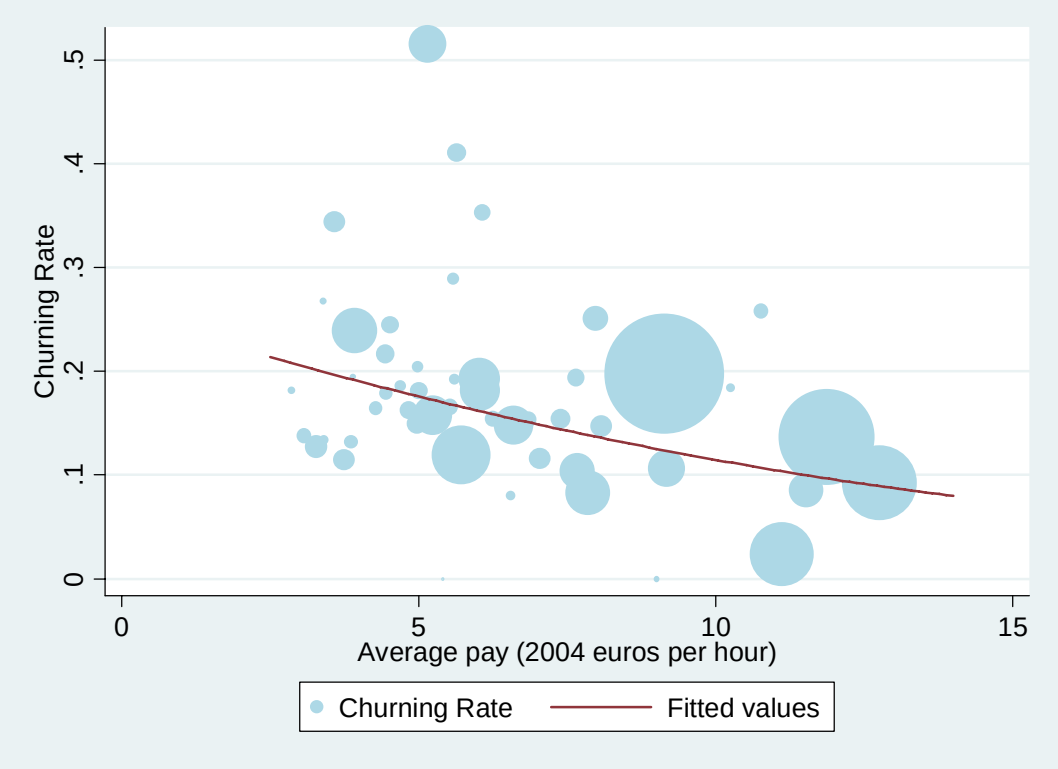
Source: Author's calculation based on "Quadros de Pessoal" data.

Figure 2 – Distribution of Churning Rates, 2000, All Firms



Source: Author's calculation based on "Quadros de Pessoal" data.

Figure 3 – Churning Rates and Average Pay per Industry, 2000



Source: Author's calculation based on "Quadros de Pessoal" data.
Note: The size of each industry in the Figure is proportional to its size, as measured in terms of employment.

Appendix

Table A1 decomposes information about job and worker flows and churning rates into two-digit industries for all three sectors. The results below support the findings of considerable heterogeneity in job flows, an important result of Davis et al (1996). For instance, while net job creation rates in manufacturing are negative over the 1986-2000 period (although at only -0.4%), specific industries can exhibit very different patterns.

On the one extreme, firms in the 'Petroleum and Natural Gas' industry have employment declines of 103%, and those in 'Coke and Refined Petroleum' see their number of jobs falling by 12.2%; on the other extreme, the 'Recycling' and 'Motor Vehicles' industries increase their jobs by 10.5% and 3.2%. Moreover, job reallocation rates also tend to be high although, again, they vary considerably across industries. These results are further evidence of the dynamic nature of labour markets and the constant reshuffling of jobs across firms, within or not the same industries.

Table A1 - Job and Worker Flows Rates, 1986-2000, by Industry

Industry	Job Creation	Job Destruction	Net Job Creation	Job Reallocation
Agriculture	0.204	0.194	0.010	0.398
Forestry	0.244	0.208	0.036	0.452
Fishing	0.124	0.181	-0.057	0.306
Mining	0.015	1.529	-1.513	1.544
Petroleum and Natural Gas	0.000	1.029	-1.029	1.029
Mining of Uranium	0.082	0.054	0.029	0.136
Mining of Metal Ores	0.062	0.153	-0.091	0.215
Other Mining and Quarrying	0.142	0.118	0.025	0.260
Food Products and Beverages	0.098	0.112	-0.014	0.210
Tobacco Products	0.029	0.066	-0.038	0.095
Textiles	0.070	0.106	-0.036	0.176
Wearing Apparel	0.144	0.127	0.017	0.271
Leather, Luggage, and Footwear	0.120	0.109	0.011	0.228
Wood and Products of Wood and Cork	0.122	0.133	-0.011	0.255
Paper and Paper Products	0.070	0.104	-0.034	0.173
Publishing, Printing	0.112	0.097	0.015	0.209
Coke, Refined Petroleum	0.003	0.125	-0.122	0.129
Chemicals	0.072	0.115	-0.043	0.186
Rubber and Plastics Products	0.101	0.100	0.001	0.201
Other Non-Metallic Mineral Products	0.103	0.101	0.002	0.204
Basic Metals	0.072	0.129	-0.058	0.201
Fabricated Metal Products	0.136	0.119	0.017	0.255
Machinery and Equipment	0.103	0.105	-0.002	0.208
Office, Accounting and Computing Machine	0.215	0.215	0.000	0.430
Electrical Machinery	0.132	0.102	0.029	0.234
Radio, Television, Communication Equipme	0.134	0.136	-0.002	0.270
Medical, Precision, Optical Instruments	0.080	0.079	0.001	0.159
Motor Vehicles	0.121	0.090	0.032	0.211
other Transport Equipment	0.081	0.125	-0.044	0.206
Furniture	0.126	0.115	0.012	0.241
Recycling	0.217	0.112	0.105	0.329
Electricity, Gas	0.091	0.128	-0.037	0.219
Water	0.039	0.042	-0.002	0.081
Construction	0.202	0.152	0.049	0.354
Sale, Maintenance of Vehicles; Fuel	0.141	0.111	0.030	0.252

Wholesale Trade	0.152	0.120	0.031	0.272
Retail Trade	0.194	0.136	0.058	0.329
Hotels and Restaurants	0.192	0.141	0.050	0.333
Land Transport	0.103	0.092	0.011	0.194
Water Transport	0.089	0.133	-0.044	0.222
Air Transport	0.042	0.030	0.013	0.072
Auxiliary Transport; Travel Agencies	0.125	0.117	0.008	0.242
Post and Telecommunications	0.110	0.120	-0.010	0.230
Financial Intermediation	0.059	0.062	-0.003	0.121
Insurance and Pension Funding	0.075	0.083	-0.009	0.158
Activities auxiliary to Finance	0.215	0.117	0.097	0.332
Real Estate	0.284	0.176	0.108	0.460
Renting of Machinery and Equipment	0.185	0.112	0.074	0.297
Computer and related activities	0.294	0.127	0.167	0.421
Research and Development	0.178	0.110	0.068	0.287
Other Business activities	0.241	0.134	0.107	0.374
Public Administration and Defence	0.156	0.098	0.058	0.255
Education	0.139	0.088	0.051	0.227
Health and Social Work	0.144	0.074	0.069	0.218
Sewage and Refuse Disposal, Sanitation	0.343	0.067	0.275	0.410
Activities of Membership Organizations	0.119	0.109	0.010	0.227
Recreational and Sporting activities	0.128	0.100	0.028	0.227
Other Service activities	0.210	0.160	0.050	0.370
Extra-Territorial Organizations	0.146	0.149	-0.002	0.295

Table A2 presents worker flows across all two-digit industries, over the 1986-2000 period. A striking result from this table is the considerable dispersion of worker reallocation rates across industries. They range between 171% and 162% for 'Petroleum and Natural Gas' and 'Mining' to as little as 13.1% and 16.9% in 'Water' and 'Financial Intermediation', respectively.

Churning rates also vary considerably across industries. They range from 0% and 3.1% in 'Petroleum and Natural Gas' and 'Mining' to as much as 43.1% and 39.5% in 'Fishing' and 'Other Business Activities' (which includes, for instance, 'Cleaning Services' firms), respectively. However, as suggested before, in the comparison between the manufacturing and the services sectors, there is much less dispersion across industries in the ratios between churning and worker reallocation rates (the coefficient of variation drops to about half), indicating that the two rates are positively correlated (an unweighted Pearson correlation of 18%).

Table A2 - Worker Flows Rates, 1986-2000, by Industry

Industry	Hiring	Separation	Worker Realloc.	Worker Churning	W.Churn. / W.Realloc.
Agriculture	0.338	0.342	0.680	0.247	0.423
Forestry	0.366	0.339	0.705	0.218	0.336
Fishing	0.340	0.421	0.761	0.431	0.609
Mining	0.032	1.592	1.624	0.031	0.036
Petroleum and Natural Gas	0.000	1.714	1.714	0.000	0.000
Mining of Uranium	0.076	0.114	0.190	0.054	0.071
Mining of Metal Ores	0.117	0.211	0.328	0.115	0.539
Other Mining and Quarrying	0.247	0.236	0.483	0.216	0.484
Food Products and Beverages	0.199	0.227	0.426	0.213	0.579
Tobacco Products	0.083	0.120	0.202	0.108	0.507
Textiles	0.126	0.171	0.297	0.119	0.512

Wearing Apparel	0.233	0.222	0.455	0.168	0.526
Leather, Luggage, and Footwear	0.207	0.204	0.411	0.172	0.556
Wood and Products of Wood and Cork	0.204	0.226	0.430	0.164	0.478
Paper and Paper Products	0.126	0.171	0.297	0.121	0.517
Publishing, Printing	0.195	0.191	0.386	0.172	0.529
Coke, Refined Petroleum	0.024	0.149	0.173	0.040	0.400
Chemicals	0.122	0.183	0.305	0.119	0.475
Rubber and Plastics Products	0.187	0.196	0.382	0.176	0.548
Other Non-Metallic Mineral Products	0.188	0.196	0.384	0.177	0.545
Basic Metals	0.130	0.196	0.326	0.120	0.437
Fabricated Metal Products	0.234	0.224	0.458	0.194	0.507
Machinery and Equipment	0.184	0.194	0.377	0.168	0.515
Office, Accounting & Computing Machines	0.276	0.288	0.564	0.113	0.339
Electrical Machinery	0.222	0.210	0.432	0.193	0.509
Radio, Television, Communication Equip.	0.187	0.223	0.409	0.123	0.421
Medical, Precision, Optical Instruments	0.146	0.148	0.294	0.135	0.553
Motor Vehicles	0.181	0.169	0.350	0.143	0.510
other Transport Equipment	0.131	0.181	0.312	0.102	0.407
Furniture	0.215	0.209	0.424	0.163	0.481
Recycling	0.308	0.212	0.519	0.181	0.459
Electricity, Gas	0.129	0.100	0.229	0.031	0.370
Water	0.062	0.068	0.131	0.054	0.535
Construction	0.358	0.313	0.671	0.301	0.517
Sale, Maintenance of Vehicles; Fuel	0.231	0.211	0.442	0.178	0.496
Wholesale Trade	0.242	0.225	0.467	0.189	0.496
Retail Trade	0.291	0.248	0.539	0.194	0.432
Hotels and Restaurants	0.359	0.312	0.671	0.318	0.552
Land Transport	0.153	0.156	0.309	0.119	0.507
Water Transport	0.189	0.249	0.438	0.211	0.599
Air Transport	0.101	0.097	0.198	0.127	0.693
Auxiliary Transport; Travel Agencies	0.187	0.196	0.383	0.143	0.314
Post and Telecommunications	0.159	0.171	0.330	0.100	0.594
Financial Intermediation	0.075	0.094	0.169	0.064	0.518
Insurance and Pension Funding	0.085	0.127	0.213	0.074	0.395
Activities auxiliary to Finance	0.289	0.202	0.491	0.137	0.317
Real Estate	0.399	0.286	0.685	0.193	0.372
Renting of Machinery and Equipment	0.317	0.254	0.571	0.259	0.514
Computer and related activities	0.412	0.247	0.659	0.222	0.425
Research and Development	0.284	0.231	0.516	0.224	0.527
Other Business activities	0.440	0.348	0.788	0.395	0.543
Public Administration and Defence	0.255	0.199	0.455	0.171	0.522
Education	0.233	0.195	0.429	0.196	0.548
Health and Social Work	0.216	0.154	0.370	0.148	0.512
Sewage and Refuse Disposal, Sanitation	0.504	0.224	0.728	0.302	0.497
Activities of Membership Organizations	0.171	0.180	0.351	0.121	0.395
Recreational and Sporting activities	0.226	0.212	0.438	0.205	0.551
Other Service activities	0.318	0.268	0.586	0.181	0.374
Extra-Territorial Organizations	0.202	0.193	0.395	0.068	0.308

This relationship between churning and worker reallocation rates can also be inferred from Figure A1, which plots job and worker reallocation rates by industry in 2000. Since churning is difference between the two, it can be seen that churning increases with worker reallocation.

Figure A1 – Job Reallocation and Worker Reallocation, by Industry, 2000