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Abstract

This paper examines the long-term earnings losses of displaced workers in Portugal, using a nationally representative longitudinal linked employer-employee data set. The results show that four years after displacement the earnings of displaced workers remain around 9% (women) to 12% (men) below their counterfactual expected levels. The post-displacement earnings losses are mainly associated with the loss of tenure within the firm and, to a lesser extent, to the loss of sector-specific features. Furthermore, workers who experienced a spell of nonemployment are the most affected by job displacement. Finally, this study points to the importance of controlling for employers' characteristics in this type of wages-dynamic analysis, since there are systematic differences in earnings between displaced and non-displaced workers that stem from differences in firm characteristics. Ignoring them may confound the evaluation of the earnings losses.

JEL classification: J31; J63; J65
Keywords: displacement; earnings losses determinants; firm characteristics

1 Introduction

Worker displacement has been the subject of an extensive and growing literature.[1] The costs of job loss in terms of unemployment (incidence and duration) and earnings-changes (magnitude and persistence) have been the most studied aspects of job displacement.

During the 1980s a number of empirical studies emerged analyzing workers' post-displacement wages and unemployment in the U.S. [(see, for instance, Podgursky and Swaim (1987), Kruse (1988), Addison and Portugal (1989), Kletzer (1989, 1991)].[2] Basically, these studies provide a snapshot view of short-term earnings losses, defined as the difference between pre- and post-displacement earnings of displaced workers. This literature established a basic stylized fact - high-tenure workers suffered the greatest losses in terms of subsequent wages and time employed.

However, this type of analysis, focusing solely on workers who have been displaced, is likely to underestimate the magnitude of wage losses, since it does not account for the earnings growth that would have occurred in the absence of job loss. A simple comparison of pre- with post-separation earnings for displaced workers is insufficient. The methodology used by Jacobson *et al.* (1993) introduced a different approach on the study of worker displacement and earnings losses. Basically, their methodology consists in comparing the earnings changes of displaced workers over a long-term period with the earnings changes that would have occurred if the displaced had not lost their jobs. Since this latter variable is not observable, a comparison group of non-displaced workers is used. The emphasis in worker displacement research has shifted from short-term wage losses to long-term dynamics. In fact, in recent years the existence of suitable longitudinal data sets in the U.S. and Europe that match workers and firms enables the comparison of wage patterns for displaced and identical non-displaced workers.

For a variety of data sets and methodologies the studies for the U.S. have established that displaced American workers usually experience short spells of unemployment, but substantial and persistent reductions in earnings, on the order of 10-25% (Ruhm, 1991; Jacobson *et al.,* 1993; Stevens, 1997). Furthermore, these losses begin to occur at least one year before displacement. For Europe the evidence is less clear-cut. Some studies have concluded for the existence of large earnings losses, while others have concluded for the existence of reduced wage losses. In one point, however, these studies seem to be in agreement. A displaced worker who takes more than a year to find a new job suffers a large penalty on earnings (Bender *et al.*, 1999; Gregory and Jukes, 2001; Lehmann *et al.*, 2002).

Few of these studies, however, attempted to decompose the earnings gap between displaced and non-displaced workers into its main determinants. To our

[1] According to previous research, displacement is usually defined as the permanent and involuntary separation of workers from their jobs without cause (i. e. for economic reasons). Displacements occur when a firm closes or downsizes.

[2] See Hamermesh (1989), Fallick (1996) and Kletzer (1998) for surveys.

knowledge the only exception is the study of Lefranc (2003), who analyzed the sources of wage losses of displaced workers in France and the U.S. using micro-data from labor force surveys. He showed that while the magnitude of the wage losses are very similar in the two countries (around 10-15%), the sources of wage adjustment differ considerably. In France, most of the earnings losses result from the loss of accumulated firm-specific human capital, while in the U.S., earnings losses mostly stem from the loss of search rents on the displacement job.

It is to be expected that reemployment wages of displaced workers be lower than the wages of those workers that remain employed. As mentioned by Fallick (1996), there are at least four reasons that can explain this pattern. First, the lost of human capital specific to the firm or industry. To the extent that these skills are non-transferable, their contribution to worker's productivity is permanently lost when a job loss occurs. Second, payments by seniority in order to provide incentives not to shirk may delay higher earnings to the latter part of the career. In this case, a permanent separation reduces lifetime earnings. Third, there is the loss of a high quality job match between the worker and the firm. In fact, some authors claim that standard estimates of the return to job-specific training are biased upward by job match and individual unobserved heterogeneity.[3] A long job tenure may signal a high quality match between the firm and the worker and/or a high ability worker, because more able workers and workers in good jobs are less likely to separate. In this line of research, Addison and Portugal (1989) and Kletzer (1989, 1991) showed that tenure in the pre-displacement job is positively associated with post-displacement earnings, reflecting heterogeneity in worker ability and the transferability of skills. Fourth, to the extent that firm's and/or industry characteristics also play a role in the process of wage determination, a displaced worker may lose some wage premium that he was previously receiving such as insider rents, union premiums or efficiency wage differentials.

Finally, a fifth reason should be added if a displaced worker experiences some period of unemployment. It is widely argued that a spell of unemployment causes the depreciation of general or transferable worker skills and that prolonged unemployment accelerates the process of depreciation of human capital (Phelps, 1972; Pissarides, 1992). On the other side, some authors also argue that a period of unemployment may signal an individual as a low productivity worker, leading employers to pay, at least initially, less than his marginal productivity (Lockwood, 1991).

The main goal in this study is to analyze the costs of worker displacement in terms of earnings losses. Do displaced workers in Portugal suffer pre- and post-displacement wage losses? If so, what are the magnitude and persistence of these losses? What are the main sources of earnings losses?

Two main objectives will drive the investigation. The first objective is to analyze the long-term impact of a displacement on the earnings evolution of displaced workers in Portugal. For this purpose a rich data set that links employers

[3] See, among others, the studies of Abraham and Farber (1987, 1988), Altonji and Shakotko (1987), Topel (1991) and Dustmann and Meghir (1999).

and employees will be exploited. The recent empirical research on this issue has been based on individual or household data sets with little information on the employers in which the individuals work. The possibility to link workers with their employers constitutes a tremendous advantage of this data set, reinforced by the fact that recent empirical work on wage determination has been showing that employers' characteristics are an important determinant of workers' wages (see, for example, Nickell and Wadhawani, 1990; Blanchflower *et al.*, 1990; Hildreth and Oswald, 1997). At this point, a quantile regression analysis will be used in order to determine if earnings evolution varies significantly according to the worker's position in the wage distribution. The second objective is to decompose the earnings losses according to their sources/causes.

The plan of the paper is as follows. In Section 2 the longitudinal data are described. Section 3 presents the econometric model. The empirical results are reported in Section 4 and conclusions are outlined in Section 5.

2 The data

2.1 Description

The data set of this study comes from *Quadros de Pessoal (QP)* survey and includes all workers that lost their jobs in 1994, 1995 or 1996 due to firm closure and were present in the *QP* registers at least in one of the three years that preceded the displacement event. Indeed, for reasons of completeness we also included in the sample those workers that left the firm (voluntarily or involuntarily) before closing. Most of the previous studies usually use a sample of displaced workers that remain in the firm until the closing down. Because some workers may leave the firm in anticipation to its shutdown we decided to include also the early-leavers in order to avoid a potential problem of sample selection bias.

QP is an annual mandatory employment survey collected by the Portuguese Ministry of Employment, and covers virtually all firms employing paid labor in Portugal.[4] The data set includes both firm-specific information (such as location, industry (SIC codes), legal setting, foreign ownership, employment, sales, ownership type) and workforce characteristics (labor earnings, worker qualifications, gender, age, tenure, hours of work, etc.).

Moreover, the survey has a longitudinal dimension which makes it particularly well suited for analyzing the issues of firms' entry and exit. Each firm entering the database is assigned a unique identifying number and the Ministry implements several checks to ensure that a firm that has already reported to the database is not assigned a different identification number. Using this identifier it is possible to pinpoint all firms that have entered and exited economic activity. In particular, an exit from the database should signal a firm that has ceased

[4] Hence, this source does not cover operated family businesses without wage-earning employees and self-employment. Public administration is also excluded.

its activity.[5] To ensure that we are in the presence of firms' true closures and not mergers or acquisitions, we also excluded from the sample those workers that appeared in the database in the period after displacement with a year of admission in the new job less than the year of displacement minus one.[6] These exclusions reduced the sample size by around 20%.

It is worth noting that workers also have an identification number based on a (scrambling) transformation of his/her social security number which allows us to follow them over the years and to match workers and their firms.

There are three reasons that make this survey an appropriate source for analyzing the effects of job displacement on earnings. The first is its representativeness. Each year, every establishment with wage earners is legally obliged to file a standardized questionnaire, which, by law, is posted at the workplace. Indeed, the administrative nature of the data and their public availability imply a high degree of coverage and reliability. The second results from its longitudinal dimension which enables us to identify firm closings and to follow workers and firms over the years.[7] The third advantage is the richness of information at both worker and firm levels and the possibility of matching workers with their employers. Indeed, almost all available empirical research on job displacement and wages has been based on individual or household data sets with little information on the employers for which the individuals work.

Of course, this data set also has disadvantages. The most important is that it is impossible to know if a worker is really in a situation of nonemployment when he does not appear in the *QP* registers. In fact, workers who exit the *QP* database, besides being unemployed or out of the labor force, may have a new job as self-employed or civil servant. To construct an indicator for the existence of a nonemployment spell we have used the information on the year of admission in the first job after the displacement as a criterion to classify the workers. Thus, a worker is classified as having experienced a positive spell of nonemployment if he is employed in year t (the year when the firm shut down) and is not subsequently reemployed in year $t+1$.

2.2 Sample construction - experimental group

As mentioned above, to be included in the sample a worker must be present in the *QP* registers at least in one of the three years that precedes the displacement.

[5] This criteria, however, is not entirely accurate, due to the fact that some of the firms may temporarily exit the database. A temporary exit may occur for a number of reasons other than cessation of activity, a very likely reason being that the survey form was not received in the Ministry of Employment before the date when the recording operations were closed. Almost all of these temporary exits last less than two years, but can still cause an identification problem if they occur in the terminal years. In order to account for this problem, the information on the last two years after displacement was used solely to control for temporary exits in the intermediate years. Thus, a firm is classified as an exiting firm in year t if it is present in year $t-1$, but absent in t, $t+1$ and $t+2$.

[6] If, for example, a worker's displacement year is 1994 and he (she) appears in the database in the post-displacement period with a year of admission in the new job of 1992 or less, he (she) is excluded from the sample.

[7] Eight spells of *QP*, from 1991 to 1998, were used for this study.

Additionally, and in order to ensure that all workers are employed with the same employer three years before separation, the year of admission in the pre-displacement job should be equal to or less than the year of displacement minus three. We also decided to include solely workers employed full-time in the period before separation. In the period after displacement the individual may be reemployed in a part-time job. We also limited the sample to workers aged between 18 and 59 in the year prior to the firm closing. We have also excluded those observations for which some explanatory variable was not available for a particular year and the extreme values for wages and sales (0.1% top and bottom observations). After these exclusions, we obtained a treatment group composed by 106,549 workers that were displaced between 1994-96 due to firm closing.

2.3 Sample construction - control group

The control group includes three sub-samples and was constructed in the following way. For each year prior to the displacement year we obtained a random sample of around 300,000 workers who were employed in firms that did not close.[8] These individuals were followed in the three years before displacement and in the years after displacement until 1998. The control group of the 1994 displacements includes a sample of workers employed in 1993 in firms that did not close in 1994. These workers were followed over the 1991-98 period if they remained with the same employer over that period. The control group of the 1995 displacements includes a sample of workers employed in 1994 in firms that did not close in 1995. These workers were followed over the 1992-98 period. Finally, the control group of the 1996 displacements includes a sample of workers employed in 1995 in firms that did not close in 1996. These workers were followed over the 1993-98 period if they remained with the same employer over that period. To be included in the sample a worker must be present in the *QP* files at least in the year that precedes the displacement and in the year of displacement. In order to guarantee that the worker was employed with the same employer three years before separation, we control for worker's admission year in the firm. In the year prior to displacement the worker must have at least two years of tenure with the employer. It should be noted that we do not restrict our control group only to continuously employed workers over the entire period of analysis, avoiding the potential selection of better than average workers in the control group that a longer time span may induce (e. g. Jovanovic, 1979). The sample of non-displaced individuals includes all workers continuously employed in the time span of interest, but also workers that were employed with the same employer until the displacement year but absent from the *QP* files in the post-displacement years (or at least in part of that period).

This sub-sample was also limited to full-time workers in the pre-displacement period aged between 18-59 in the year prior to displacement. After excluding

[8] The sample was drawn employing a random number generator.

those observations with missing values in the explanatory variables and the extreme values in wages and sales, we obtained a control group composed by 172,624 non-displaced workers.

2.4 A bird's eye view

Table 1 presents the evolution of the average real hourly earnings of displaced workers around the year of displacement. The pattern of average hourly earnings is shown for all these periods, separately for men and women. Comparable figures for non-displaced workers are also reported. In columns 5 (for men) and 10 (for women) the ratio of average hourly earnings of displaced and non-displaced workers is reported.

As can be seen in Table 1, displaced workers earn, on average, significantly lower wages than non-displaced workers. This gap is more pronounced for male workers. Moreover, the earnings differential between displaced and non-displaced workers tends to increase with the approximation of the displacement event. The wage loss further deepens until two years after displacement, when a recovery pattern appears to emerge. This analysis seems to reveal that a displacement event tends to wide the earnings gap between displaced and non-displaced workers. However, it can always be argued that displaced workers would have had a slow earnings growth even without being displaced. A multivariate analysis will be required in order to control for observed individual and firm characteristics and to be able to determine the wage growth that displaced workers would have experienced if they had not been displaced.

Tables 2 and 3 present the descriptive statistics for the samples of displaced and non-displaced workers in the time before and after displacement, for men and women respectively. Displaced workers are slightly younger, with fewer years of education and tenure, and are employed smaller and less productive firms (measured by sales per worker) in comparison with their non-displaced counterparts.

Other additional considerations should be made concerning the composition of the sample of displaced workers. First, it should be observed that of the total number of displaced workers, 47% left the firm one or two years prior to the displacement year (see Table 4). Of the total number of workers that left the firm one year before displacement, 30% were reemployed. This rate is only 22% for workers who left their firms two years before displacement. These results seem to suggest that early leavers have lower reemployment rates. It would be interesting to know if these workers left the firm voluntarily or because they were laid off. In this data set, unfortunately, it is not possible to know the reason for the worker separations.

Second, of the total number of reemployments, 58% experience a positive spell of nonemployment and only 4% two or more spells (see Table 5). Furthermore, 35% of the reemployed individuals changed industry.[9] After being

[9] Here industry is defined at the one-digit level. According to the Portuguese Classification

reemployed, 22% of the reemployed individuals changed job again (19% one time and 3% two or more times). Finally, of the total number of reemployments, 44% were immediately reemployed in the displacement year, 26% one year after, 17% two years after, 9% three years after and the remaining 4% only four years after the displacement occurred (see Table 6).

Third, the total number of workers that were displaced between 1994 and 1996, only 45% were reemployed until the end of the observation period.[10] This low rate of reemployment may, in part, be justified by the generosity of the Portuguese unemployment insurance system where unemployment benefits may be collected for up to four years (Addison and Portugal, 2003).[11]

Nonetheless, small reemployment rates may raise a potential sampling problem. A self-selection issue may arise when we analyze the earnings losses of only those displaced workers that reenter employment. In fact, for an individual's wage to be observed in the post-displacement period he must be employed and registered in the QP files at least one time over that period. Whereas this requirement may misrepresent the behavior of the population of displaced workers, it still conveys an adequate picture of the experience of reemployed displaced workers.[12]

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of Economic Activities (CAE), at the one-digit level there are nine sectors. We decided to define the industry at the one-digit level in order to avoid measurement errors, since in 1995 the CAE codes were altered.

[10] Because the last available survey is for 1998, displaced workers can only be followed for up to 5, 4, and 3 years, depending on the year of displacement.

Notice also that even though the reemployment rate is 45%, the total number of reemployments represents solely one third of the sample of displaced workers. This is due to the fact that observations with missing values for the explanatory variables in the post-displacement period were dropped.

[11] In Portugal the unemployment benefit represents approximately 65 per cent of the wages that an individual expects to obtain in the labor market. The duration of this benefit varies from a maximum of 10 months for individuals under 25 years of age to a maximum of 30 months for those aged 55 or over. After the exhaustion of the unemployment benefits proper, unemployed workers may apply to unemployment assistance subsidies which may last for up to 15 months.

[12] Conventional correction procedures for self-selectivity are ill-suited for the problem at hand, not least because this problem does not appear to conform with a standard friction problem where observations are missing at random (Wooldridge, 2002). In any case, if we assume that the conditions for the use of a standard Heckman procedure are verified, and estimate an Heckit, the use of this correction does not point to any serious inconsistency.

Table 1
Average real hourly earnings before and after displacement

	Men					Women				
	Displaced		Non-displaced		Ratio	Displaced		Non-displaced		Ratio
Years before/after	AHE	Obs.	AHE	Obs.	(1)/(3)	AHE	Obs.	AHE	Obs.	(6)/(8)
displacement	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
3 years before	421.1	38850	561.0	75954	0.751	322.2	28845	399.8	45459	0.806
2 years before	435.3	37441	583.7	89110	0.746	332.9	28829	419.9	55330	0.793
1 year before	430.8	31276	597.0	105506	0.722	337.7	25411	431.7	67118	0.782
Displacement year	448.3	6442	623.2	105506	0.719	348.3	4433	451.0	67118	0.772
1 year after	445.1	10302	646.3	88994	0.689	346.1	7660	465.1	55325	0.744
2 years after	460.7	12077	675.6	83548	0.682	356.1	8897	485.6	51790	0.733
3 years after	475.0	9422	682.0	49626	0.697	368.2	7168	485.8	29924	0.758
4 years after	500.7	5679	694.3	23371	0.721	379.4	4510	497.8	13677	0.762

AHE is average real hourly earnings [PTE (escudo): 1 EUR≡200.482 PTE]. CPI deflator (base=1991).
Obs. denotes number of observations.

Table 2
Basic characteristics of the sample before and after displacement (means and standard deviations): men

	Before displacement				After displacement			
	Displaced		Non-displaced		Displaced		Non-displaced	
Variable	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.
Age (in years)	35.526	10.961	37.968	10.279	36.518	9.969	40.858	10.277
Education (in years)	5.738	2.800	6.180	3.116	6.718	2.924	6.433	3.196
Tenure (in years)	7.308	7.793	10.736	8.580	1.263	1.242	13.751	8.565
Part-time job	0.000		0.000		0.062		0.030	
Out of employment	0.000		0.000		0.520		0.000	
Changed job after reemployed	0.000		0.000		0.146		0.000	
Changed industry	0.000		0.000		0.359		0.000	
Size (in logs)	3.321	1.611	4.892	2.104	3.521	1.847	4.849	2.100
Sales per worker (in logs)	8.446	1.193	8.923	1.036	8.574	1.165	8.982	1.054
Average real hourly earnings (in logs)	5.919	0.473	6.193	0.549	6.019	0.435	6.307	0.554
Number of observations	107567		270570		43922		351045	

Table 3
Basic characteristics of the sample before and after displacement (means and standard deviations): women

	Before displacement				After displacement			
	Displaced		Non-displaced		Displaced		Non-displaced	
Variable	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.
Age (in years)	32.760	9.853	34.212	9.607	33.403	8.687	37.249	9.592
Education (in years)	5.955	2.807	6.373	3.056	6.943	2.838	6.643	3.156
Tenure (in years)	6.930	7.279	9.212	7.907	1.290	1.243	12.306	7.989
Part-time job (%)	0.000		0.000		0.080		0.043	
Out of employment (%)	0.000		0.000		0.517		0.000	
Changed job after reemployed (%)	0.000		0.000		0.127		0.000	
Changed industry (%)	0.000		0.000		0.287		0.000	
Size (in logs)	3.417	1.660	4.583	1.963	3.612	1.927	4.591	1.992
Sales per worker (in logs)	8.103	1.146	8.527	1.080	8.086	1.229	8.579	1.083
Average real hourly earnings (in logs)	5.692	0.396	5.881	0.497	5.787	0.373	5.993	0.507
Number of observations	83085		167907		32668		217834	

Table 4
Early-leavers: timing and frequency

Displaced workers [N=106549]			
Early-leavers [N=49862 (47%)]			
2 years before [N=23304 (47%)]		1 year before [N=26558 (53%)]	
Reemp.	Non reemp.	Reemp.	Non reemp.
5235 (22%)	18069 (78%)	7942 (30%)	18616 (70%)

Table 5
Reemployments: some basic characteristics

Displaced workers [N=106549]				
Reemployed [N=34825]				
Out of employment		Changed job after reemp.		Changed
1 spell	2 or more	1 time	2 or more	industry
20311 (58%)	1221 (4%)	6641 (19%)	1016 (3%)	12155 (35%)

Table 6
Reemployments by years since displacement

Displaced workers [N=106549]				
Reemployed [N=34825]				
Disp. year	1 year after	2 years after	3 years after	4 years after
15263 (44%)	8896 (26%)	6057 (17%)	3257 (9%)	1352 (4%)

3 The Econometric Model

The empirical model is drawn from Jacobson *et al.* (1993) and Margolis (1999). An equation capturing the difference in earnings across the displaced and comparable non-displaced workers in the sample can be written as:

$$\ln W_{it} = \beta_1 X_{it} + \beta_2 Z_{ijt} + \sum_{k=-3}^{4} D_{it}^{k} \delta_k + \varphi \sum_{\iota=1}^{4} OE_{i\iota} + \gamma_t + \varepsilon_{it} \qquad (1),$$

where $\ln W_{it}$ is the natural log of average real hourly earnings for individual i at period t. Average hourly earnings are defined as the ratio between total regular labor earnings and the total number of usual hours worked.[13] Average hourly earnings were deflated using the Consumer Price Index (CPI; base=1991). X_{it} is a vector of individual characteristics such as education and age. Z_{ijt} includes a set of characteristics from the firm in which the individual works such as size and sales per worker.

D_{it}^{k} is a dummy variable that takes the value one if at time t worker i is k years after separation or -k years before separation. The δ_k parameters reflect the difference in earnings k years before or after separation between displaced workers and the corresponding reference group. Hereinafter, we will refer to these dummies as displacement dummies. The variable $OE_{i\iota}$ takes the value one in the after-separation period for those individuals who experience at least one spell of nonemployment (zero otherwise). The parameter φ captures a negative permanent effect on earnings for those individuals who experienced a nonemployment spell. γ_t is a set of time dummies that control for year-specific effects. ε_{it} is a disturbance term which is assumed to have zero mean and constant variance.

Equation (1) will be estimated by weighted least squares (WLS) separately for the samples of male and female workers.[14] The validity of this estimation method relies on the assumption that the included independent variables control for all the individual heterogeneity that could be correlated with the occurrence of a displacement. In this study the fact that job displacement occurs for exogenous reasons (firm closing) makes this assumption reasonable. If unobserved permanent individual heterogeneity affects the probability of displacement and is correlated with wage determinants, WLS estimates of equation (1) will be biased. In this sense we are assuming that firm closure can be use as a quasi-experiment.

If unobserved individual heterogeneity correlated with the covariates is of concern, the regression coefficients could be estimated using panel data estimators based on the within or first-difference transformations. The problem, of course, is that such estimators do not allow us to identify the coefficients of the

[13] Total regular payroll includes base wages, seniority payments and regular benefits.

[14] Since the experiment group corresponds to the population of displaced workers through firm closing between 1994 and 1996 and the corresponding control group to a random sample of non-displaced workers, we decided to use the weighted least squares method of estimation. Thus, each observation was weighted by its representativeness in the population.

time-invariant variables, invalidating, namely, the decomposition of the worker and firm effects in earnings of displaced and non-displaced workers.

4 Empirical results

4.1 Pre- and post-displacement earnings losses - WLS regressions

In Tables 7 and 8 the WLS regression results of model (1) are presented for men and women, respectively. Column 1 of Tables 7 and 8 provides results for a parsimonious specification in which average real hourly earnings depend on the displacement dummies ($Disp_{it}$) and a set of individual characteristics that do not change with the job, such as age (and its square) and education. Education is defined as the number of years of schooling completed. Two dummy variables were added to the model. One that takes the value one if the worker has a part-time job in the post-displacement period (zero otherwise), and the other that takes the value one for displaced workers who left the firm one or two years before closing - the early-leavers (zero otherwise). A set of time dummies is also included in order to account for aggregate shocks.

As can be shown in column 1 of Table 7, men that will be displaced in year zero earn, three years before separation, 11.8% less than their non-displaced counterparts, conditional on age, education, and macroeconomic conditions.[15] In these same conditions women earn 8.3% less (see column 1 of Table 8). This gap increases for both male and female with the approximation of the displacement event. Two years after the displacement year, Portuguese men earn 22.0% less than their non-displaced counterparts, and women earn 17.5% less. Only in the latter years does a slower recovery in earnings seems to emerge. In any event, three years after displacement men's earnings differential has risen by around 11 percentage points (p.p.) and women's differential by around 8 p.p., when compared to the earnings differential three years before displacement.[16] This pattern is, in general, consistent with Table 1. However, the introduction of a control for worker characteristics considerably decreases the earnings differential, suggesting that differences in worker characteristics between the two groups explain a sizable part of the wage gap between displaced and non-displaced workers.

The coefficient estimates of the early-leaver dummy variable are negative but not statistically different from zero. Even though early-leavers represent almost

[15] To calculate the discrete percentage change in y induced by $\triangle x$ the mathematical transformation $\exp(\delta) - 1$ is employed.

[16] In Table A.1 of Appendix A this same parsimonious specification was estimated with individual-specific fixed effects. It shoud be noted that the fixed effects estimates of the coefficients of the displacement dummies do not have a straightforward interpretation in terms of earnings changes of displaced workers relative to non-displaced workers, since the coefficients represent within-individual earnings changes. Nevertheless, the fixed effects estimates also exhibit significant and negative effects of past displacement on hourly earnings.

half of the sample of displaced workers, the pattern of earnings losses for these workers does not differ substantially from the pattern of earnings losses of those workers who remain in the firm until the closing down.[17]

Differences in earnings between displaced and similar non-displaced workers may be explained by differences in employer characteristics where the individuals work. It is well established that closing firms have some characteristics (such as size and age) that are systematically different from those that remain in activity. It is also well known that differences in employer's performance may affect wages. In order to analyze to what extent the earnings gap between displaced and non-displaced workers is determined by differences in employer characteristics, a set of controls for employers observing heterogeneity was included in column 2 of Tables 7 and 8. The first variable is size, which is measured as the natural log of total employment in the firm. Sales per worker is defined as the ratio of annual real sales and total employment (in logs). Finally, eight industry (one-digit level) and six regional dummies were added to the model.

The effects of size and sales per worker on average hourly earnings are positive and highly significant. The results reveal that a large part of the relative annual earnings differential may be explained by differences in employers observed characteristics. Three years before separation the earnings gap between displaced workers and the reference group is almost negligible and not statistically different from zero (+1.1% for men and +1.2% for women). Indeed, after controlling for firms' characteristics, it is still possible to observe a very similar pattern on earnings evolution over the entire period of analysis. A pre-displacement dip in earnings is observed, followed by a drop in earnings in the displacement year (see column 2 of Tables 7 and 8). Not surprisingly, three years after displacement the relative earnings differential has risen by around 12 p.p. for men and 10 p.p. for women (only slightly higher than the one obtained in specification 1).

These results point to the importance of controlling for observed employers' characteristics when analyzing the effects of a displacement event on earnings. In fact, firms' characteristics such as size and sales per worker have a significant impact on earnings, and not controlling for them may confound the evaluation of the earnings losses.

[17] The same regressions presented in Tables 7 and 8 were re-estimated for a subsample of workers in which early-leavers were excluded. The results are quite similar to those obtained for the overall sample, and are not recapitulated here (available upon request).

Table 7
Weighted least squares regressions: men

N=773104	(1)		(2)		(3)		(4)	
Independent variable	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
$Disp_{-3}$	-0.126	(-14.0)	0.011*	(1.5)	0.004*	(0.5)	0.010*	(1.3)
$Disp_{-2}$	-0.151	(-17.7)	-0.006*	(-0.9)	-0.012*	(-1.7)	-0.007*	(-1.0)
$Disp_{-1}$	-0.193	(-22.9)	-0.029	(-4.1)	-0.029	(-4.0)	-0.026	(-3.8)
$Disp_0$	-0.203	(-10.8)	-0.073	(-4.6)	-0.039*	(-2.3)	0.010*	(0.6)
$Disp_1$	-0.234	(-15.6)	-0.087	(-7.0)	-0.042	(-3.0)	0.008*	(0.6)
$Disp_2$	-0.248	(-17.8)	-0.109	(-9.4)	-0.052	(-3.7)	0.0002*	(0.0)
$Disp_3$	-0.254	(-16.2)	-0.114	(-8.7)	-0.052	(-3.3)	0.002*	(0.1)
$Disp_4$	-0.252	(-12.6)	-0.113	(-6.7)	-0.046*	(-2.4)	0.009*	(0.4)
Age	0.066	(195.3)	0.046	(161.8)	0.046	(161.8)	0.043	(144.4)
Age squared[a]	-0.059	(-141.1)	-0.042	(-120.1)	-0.042	(-120.1)	-0.042	(-114.0)
Education	0.103	(679.4)	0.069	(479.1)	0.069	(479.1)	0.071	(488.6)
Part-time job	0.101	(27.7)	0.091	(29.9)	0.091	(30.0)	0.092	(30.4)
Early-leaver	-0.012*	(-1.4)	-0.025	(-3.4)	-0.011*	(-1.5)	-0.009*	(-1.2)
Size			0.063	(254.5)	0.063	(254.5)	0.057	(226.2)
Sales per worker			0.113	(254.9)	0.113	(254.9)	0.114	(258.2)
OE (out of employment)					-0.066	(-5.2)	-0.060	(-4.7)
JC (job changes)					-0.012*	(-0.7)	-0.011*	(-0.6)
CIND (changed industry)					-0.062	(-4.9)	-0.066	(-5.3)
Tenure							0.006	(35.6)
Tenure squared[a]							-0.001*	(-2.5)
Constant	3.970	(604.1)	3.399	(521.1)	3.399	(521.2)	3.443	(522.7)
$\overline{R}^2$	0.44		0.61		0.61		0.62	

Dependent variable: log of average real hourly earnings. All specifications include a set of time dummies.
Specifications (2), (3) and (4) include a set of industry and regional dummies.
[a] variables divided by 100. All estimates are significant at 1%, except those with an *.

Table 8
Weighted least squares regressions: women

N=501494	(1)		(2)		(3)		(4)	
Independent variable	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
Disp_{-3}	-0.087	(-9.7)	0.012*	(1.7)	0.006*	(0.7)	0.016*	(2.1)
Disp_{-2}	-0.103	(-12.2)	0.004*	(0.6)	-0.001*	(-0.2)	0.008*	(1.1)
Disp_{-1}	-0.130	(-15.8)	-0.006*	(-0.9)	-0.006*	(-0.9)	-0.003*	(-0.4)
Disp_0	-0.151	(-7.5)	-0.044	(-2.7)	-0.001*	(-0.1)	0.068	(4.1)
Disp_1	-0.174	(-11.4)	-0.056	(-4.5)	-0.005*	(-0.4)	0.064	(4.7)
Disp_2	-0.192	(-13.5)	-0.084	(-7.2)	-0.022*	(-1.6)	0.047	(3.5)
Disp_3	-0.191	(-12.1)	-0.089	(-6.9)	-0.018*	(-1.2)	0.051	(3.3)
Disp_4	-0.185	(-9.4)	-0.083	(-5.1)	-0.011*	(-0.6)	0.057	(3.0)
Age	0.040	(108.2)	0.026	(85.8)	0.026	(85.8)	0.019	(57.6)
Age squared[a]	-0.031	(-63.4)	-0.020	(-50.2)	-0.020	(-50.2)	-0.014	(-32.5)
Education	0.102	(587.8)	0.069	(408.4)	0.069	(408.4)	0.070	(417.4)
Part-time job	0.144	(41.8)	0.108	(38.0)	0.108	(38.2)	0.110	(39.1)
Early-leaver	-0.011*	(-1.2)	-0.026	(-3.5)	-0.012*	(-1.5)	-0.009*	(-1.1)
Size			0.059	(231.3)	0.059	(231.4)	0.054	(209.3)
Sales per worker			0.098	(200.4)	0.097	(200.4)	0.095	(196.1)
OE (out of employment)					-0.049	(-3.8)	-0.034	(-2.6)
JC (job changes)					-0.018*	(-1.0)	-0.011*	(-0.6)
CIND (changed industry)					-0.131	(-9.7)	-0.132	(-9.9)
Tenure							0.013	(63.6)
Tenure squared[a]							-0.025	(-38.0)
Constant	4.239	(622.6)	3.713	(555.3)	3.713	(555.4)	3.850	(566.1)
$\overline{R}^2$	0.46		0.63		0.63		0.64	

See notes to Table 7.

In column 3 of Tables 7 and 8 controls for time spent out of employment and for post-displacement turnover were added to specification 2. The variable OE takes on the value one in all the years following the displacement if the individual experienced one or more spells of nonemployment. As mentioned before, a worker experiences a positive spell of nonemployment if he is employed in year t and is not immediately reemployed in year $t+1$.[18]

Since our sample includes displaced workers that may change job several times after being reemployed, a variable that controls for the effects of changing a job on subsequent wages was also included in equation (1). An individual experiences a job change if the identification number of his recent employer is different from the identification number of his previous employer. The variable JC takes the value one in all the years after a job change has occurred, if the individual changed job again after being reemployed. Two categories were defined: 1 or more job changes and no job change (the omitted category). Finally, a dummy variable for industry changers was also included in column 3. The variable CIND takes the value one in the post-displacement period for reemployed displaced workers who changed industry (at the one-digit level).

The results reported in column 3 of Tables 7 and 8 show that workers who experienced one or more spells of nonemployment are seriously affected by displacement. In fact, once a control for time spent out of employment is included, the displacement dummies reflect the difference in average hourly earnings between the control group and those displaced workers who do not experience any spell of nonemployment. For the latter, the annual earnings gap three years after displacement increased by 6 and 3 p.p. for men and women, respectively. Male workers who experienced at least one spell of nonemployment have an additional penalty on hourly earnings of 6.6 p.p. and female workers of 4.9 p.p.

This result seems to suggest that earnings losses for displaced workers in Portugal reflect a major difference between those who find a new job quickly and those who do not. This empirical evidence is in line with that obtained by Bender *et al.* (1999) and Margolis (1999) for displaced workers in Germany and France.

Furthermore, the results reveal that workers reemployed in the same one-digit industry suffered lower post-displacement earnings losses. In fact, displaced male workers who changed industry earn 6.2% less and displaced women 13.1% less. These results are in line with those obtained by Addison and Portugal (1989), Jacobson *et al.* (1993), Carrington (1993) and Stevens (1997), who showed that industry changers in the U.S experience larger earnings losses. Finally, the coefficient estimates of the variable JC are negative but not statistically different from zero.

Post-displacement earnings losses may stem from the loss of accumulated firm-specific human capital and/or a "good" job match. In column 4 of Tables 7 and 8 a control for worker's tenure was added to specification 3. Tenure is measured as the total number of years with the employer. The inclusion of

[18] Note that we are also controlling for subsequent separations after the first displacement through firm closing.

a control for the returns to accumulated tenure will enable us to determine the extent to which post-displacement earnings losses result from the loss of firm-specific capital and/or a high quality match.

The results reveal that tenure has an important impact on the magnitude of the relative annual earnings differential. As expected, the post-separation earnings differentials are much smaller (by around 5 to 7 p.p.) when a control for job tenure is included in the model. According to column 4, once losses of firm tenure are accounted for, no negative annual earnings differential is observed over the post-displacement period for either male or female workers. These results suggest that the loss of match-specific characteristics has a significant impact on earnings, deepening the average hourly earnings gap between displaced and their similar non-displaced counterparts.

In sum, we can decompose the earnings losses of displaced workers relative to non-displaced workers into three main components: (i) the loss that stems from the loss of job tenure; (ii) the loss associated with nonemployment duration; and (iii) the loss related with industry changing. In order to determine the weights attached to each of these sources we consider the basic specification of column (2) of Tables 7 and 8 (including the JC variable) and analyzed how the earnings losses three years after displacement changed as the controls for tenure (and its square), out of employment (OE) and changed industry (CIND) were added separately to the model. Table 9 presents the percentages that each of these sources of earnings loss accounts for.[19]

Table 9
Sources of Earnings Losses

	Men	Women
Job Tenure	40-46%	45-52%
Joblessness	33-43%	16-34%
Industry Changing	14-24%	16-31%

Overall, the results for the male sample reveal that the increase (three years after displacement) in the earnings gap of 12 p.p. is mainly due to the loss of tenure in the job and to joblessness. According to our calculations, tenure accounts for around 40-46% to the deepening in the earnings gap and joblessness for around 33-43%. Changing industry explains only 14 to 24% of the increase in the earnings gap. For female workers, the increase in the earnings gap of 10 p.p. is mainly due to the loss of accumulated returns to tenure (45-52%), joblessness accounts for 16 to 34% of that increase and changing industry accounts for 16-31%.

[19] As these percentages change according to the order that the variables are included in the basic specification, the results reported in Table 9 correspond to the lower and upper limits. In Appendix B we report the results of the earnings losses three years after displacement according to the various possible specifications and the corresponding percentages that each source of earnings loss accounts for.

4.2 Pre- and post-displacement earnings losses: quantile regressions

In this Section we use quantile regression techniques in order to examine if displacement effects on wages vary along the wage distribution. Unlike the conditional mean regression, the quantile regression analysis allows us to determine the effect of each of the covariates along the whole distribution of hourly wages and to examine to what extent the marginal effect of displacement on wages depends on the point of the conditional wage distribution where the individual is located.

Table 10 presents the quantile regressions estimates for male workers according to specifications 2 and 4 of Table 7. Table 11 presents the same estimates for female workers. The selected quantiles are 10-th, 50-th and 90-th. The estimated coefficients measure the impact of each covariate on wages for each specific quantile.

According to column 1 of Tables 10 and 11, even though the effect of each displacement dummy differs across quantiles, the earnings gap between displaced and similar non-displaced workers increased over the period by almost the same amount at the top, median and bottom of the wage distribution. Indeed, three years after displacement, and compared to the earnings gap three years before displacement, the annual earnings differential between displaced male workers and their counterparts has increased by 11 p.p. at the first and ninth decile and by 10 p.p. at the median. For female workers, the same earnings gap increased by 8 p.p. at the first decile, by 7 p.p. at the median and by 9 p.p. at the top decile. These results seem to suggest that the magnitude of the full effect of displacement on earnings is fairly similar across the whole wage distribution. Yet, once controls for job tenure and for time spent out of employment are included in the model, some differences across quantiles seem to emerge, namely for male workers.

According to column 2 of Table 10, once losses of accumulated returns to tenure and loss of sector-specific factors are accounted for, no negative post-displacement earnings differential appears to exist between displaced and similar non-displaced male workers at the 10-th and 50-th quantile. A dip in earnings is observed only in the pre-displacement period. At the 90-th decile, however, male workers seem to suffer post-displacement earnings losses even after controlling for job tenure and industry changing.[20] This might be justified by the fact that the returns to tenure decrease for higher quantiles, suggesting that tenure is more valued at relatively low paid jobs. On the contrary, the returns to education are higher for the top quantiles.[21]

In sum, the results for the sample of male workers seem to suggest that even though the magnitude of the global effect of displacement on wages is quite similar across quantiles, the sources of these losses seem to differ along

[20] According to column 6 of Table 10 only the coefficient of the displacement dummy two years after displacement is statistically different from zero at the 5% level of significance.

[21] See Machado and Mata (1998) for a detailed description of the conditional wage distribution for Portugal and its evolution from 1982 to 1994.

the wage distribution. While for low paid male workers, tenure within the firm and industry changing explain most of the earnings losses experienced by these workers, for high paid male workers there are other (unobserved) factors beyond tenure/industry changing that account for a non-negligible amount of these losses. Changing industry imposes a larger penalty on male earnings at the bottom than at the top quantiles. For low and high paid male workers the effects of being out of employment are quite similar, even though weaker for the former.

For the sample of female workers, as before, once the returns to accumulated tenure are accounted for, a positive earnings differential between displaced (immediately reemployed) and non-displaced workers is observed in the post-displacement period. In this case, and contrary to the sample of male workers, the displacement effects are quite similar across all the selected quantiles (see Table 11).

Overall, the regression quantile results reinforce the WLS results obtained in the previous Section, showing that the full effect of displacement on earnings is quite similar across quantiles. Low and high paid workers seem to be equally affected, in terms of magnitude and persistence, by job displacement. The only exception concerns the different sources of wage adjustment. For female and low paid male workers who find a new job quickly, the main source of earnings adjustment stems from the loss of accumulated returns to tenure. For high paid male workers, and since tenure on the job is less valued than for low paid workers, there are other unobserved sources of earnings losses. One possibility is that these latter losses may stem from the loss of search rents earned on the job lost.

Table 10
Quantile regressions: men

	(1)						(2)					
N=773104	Q=0.1		Q=0.5		Q=0.9		Q=0.1		Q=0.5		Q=0.9	
Independent variable	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
$Disp_{-3}$	-0.012*	(-1.4)	0.002*	(0.9)	0.014*	(1.5)	-0.010*	(-1.2)	0.003*	(1.6)	0.011*	(1.2)
$Disp_{-2}$	-0.025	(-3.2)	-0.015	(-9.0)	-0.004*	(-0.4)	-0.022	(-2.8)	-0.013	(-7.9)	-0.004*	(-0.5)
$Disp_{-1}$	-0.042	(-5.5)	-0.035	(-22.3)	-0.017*	(-2.0)	-0.038	(-5.0)	-0.032	(-20.5)	-0.017*	(-2.0)
$Disp_0$	-0.089	(-5.5)	-0.076	(-22.8)	-0.062	(-3.4)	0.033*	(1.9)	0.016	(4.4)	-0.014*	(-0.7)
$Disp_1$	-0.103	(-7.9)	-0.082	(-30.9)	-0.070	(-4.8)	0.036*	(2.5)	0.018	(6.0)	-0.020*	(-1.2)
$Disp_2$	-0.115	(-9.5)	-0.100	(-40.1)	-0.106	(-7.8)	0.040	(2.8)	0.011	(3.8)	-0.034*	(-2.0)
$Disp_3$	-0.124	(-9.1)	-0.102	(-36.3)	-0.103	(-6.7)	0.035*	(2.2)	0.014	(4.2)	-0.029*	(-1.5)
$Disp_4$	-0.120	(-6.9)	-0.104	(-28.9)	-0.106	(-5.4)	0.040*	(2.0)	0.016	(4.0)	-0.030*	(-1.3)
Age	0.038	(37.7)	0.044	(213.1)	0.053	(46.9)	0.032	(31.0)	0.041	(189.6)	0.054	(45.5)
Age squared[a]	-0.037	(-29.8)	-0.042	(-161.3)	-0.047	(-33.4)	-0.034	(-26.1)	-0.041	(-152.4)	-0.051	(34.3)
Education	0.042	(79.6)	0.063	(581.6)	0.091	(153.4)	0.043	(82.4)	0.064	(594.1)	0.093	(155.6)
Part-time job	-0.0003*	(-0.0)	0.044	(19.5)	0.251	(20.2)	0.005*	(0.4)	0.045	(20.1)	0.260	(21.0)
Early-leaver	-0.050	(-6.8)	-0.035	(-23.2)	0.008*	(1.0)	-0.025	(-3.4)	-0.021	(-13.1)	0.021*	(2.5)
Size	0.059	(67.2)	0.063	(347.6)	0.061	(60.7)	0.053	(59.4)	0.057	(306.9)	0.056	(55.0)
Sales per worker	0.107	(69.9)	0.104	(329.8)	0.092	(53.7)	0.107	(71.1)	0.105	(335.9)	0.093	(54.1)
OE (out of employment)							-0.051	(-4.0)	-0.050	(-19.1)	-0.065	(-4.4)
JC (job changes)							-0.037*	(-2.2)	-0.015	(-4.3)	0.009*	(0.4)
CIND (changed industry)							-0.090	(-7.2)	-0.059	(-22.8)	-0.044	(-3.1)
Tenure							0.012	(19.5)	0.008	(60.5)	0.001*	(1.6)
Tenure squared[a]							-0.016	(-8.7)	-0.005	(-13.4)	0.011	(5.0)
Constant	3.462	(152.0)	3.545	(754.9)	3.708	(144.5)	3.537	(155.9)	3.590	(762.2)	3.705	(143.4)
$\overline{R}^2$	0.58		0.59		0.58		0.58		0.60		0.59	

Dependent variable: log of average real hourly earnings. All specifications include a set of industry, regional and time dummies.

[a] variables divided by 100. All estimates are significant at 1%, except those with an *.

Table 11
Quantile regressions: women

	(1)						(2)					
N=501494	Q=0.1		Q=0.5		Q=0.9		Q=0.1		Q=0.5		Q=0.9	
Independent variable	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
$Disp_{-3}$	-0.003*	(-0.3)	0.005	(2.8)	0.012*	(1.3)	0.001*	(0.2)	0.007	(4.2)	0.016*	(1.7)
$Disp_{-2}$	0.003*	(0.5)	-0.004	(-2.9)	0.002*	(0.3)	0.009*	(1.2)	-0.002*	(-1.1)	0.007*	(0.8)
$Disp_{-1}$	-0.014*	(-2.0)	-0.014	(-9.5)	0.002*	(0.3)	-0.010*	(-1.5)	-0.013	(-9.0)	0.009*	(1.1)
$Disp_0$	-0.057	(-3.6)	-0.038	(-11.6)	-0.023*	(-1.2)	0.043	(2.7)	0.066	(19.4)	0.049	(2.6)
$Disp_1$	-0.066	(-5.5)	-0.045	(-17.7)	-0.034*	(-2.4)	0.044	(3.3)	0.066	(23.7)	0.051	(3.3)
$Disp_2$	-0.083	(-7.3)	-0.066	(-27.8)	-0.072	(-5.4)	0.032*	(2.4)	0.052	(18.7)	0.023*	(1.5)
$Disp_3$	-0.091	(-7.2)	-0.077	(-29.0)	-0.076	(-5.2)	0.029*	(1.9)	0.054	(16.9)	0.023*	(1.3)
$Disp_4$	-0.082	(-5.2)	-0.062	(-18.6)	-0.073	(-3.9)	0.038*	(2.1)	0.063	(16.4)	0.030*	(1.4)
Age	0.022	(22.0)	0.021	(98.9)	0.024	(20.8)	0.016	(15.5)	0.015	(69.0)	0.021	(17.4)
Age squared[a]	-0.023	(-17.3)	-0.017	(-58.7)	-0.013	(-8.2)	-0.017	(-12.2)	-0.012	(-41.0)	-0.013	(-8.1)
Education	0.032	(56.8)	0.060	(502.0)	0.092	(139.0)	0.033	(58.1)	0.061	(512.6)	0.094	(143.1)
Part-time job	-0.011*	(-1.2)	0.039	(19.8)	0.256	(23.1)	-0.003*	(-0.4)	0.051	(25.6)	0.264	(24.1)
Early-leaver	-0.029	(-4.2)	-0.025	(-17.3)	-0.009*	(-1.1)	-0.017*	(-2.4)	-0.009	(-6.2)	0.005*	(0.6)
Size	0.050	(59.7)	0.054	(305.3)	0.055	(56.0)	0.049	(57.8)	0.050	(278.8)	0.050	(50.9)
Sales per worker	0.061	(39.4)	0.082	(252.6)	0.090	(50.1)	0.060	(39.6)	0.079	(245.7)	0.087	(48.8)
OE (out of employment)							-0.029*	(-2.4)	-0.028	(-11.1)	-0.032*	(-2.3)
JC (Job changes)							-0.024*	(-1.4)	-0.015	(-4.3)	0.016*	(0.8)
CIND (changed industry)							-0.124	(-9.8)	-0.143	(-54.0)	-0.109	(-7.4)
Tenure							0.012	(17.7)	0.013	(86.0)	0.009	(10.9)
Tenure squared[a]							-0.031	(-14.0)	-0.023	(-50.7)	-0.006*	(-2.5)
Constant	4.131	(190.6)	4.012	(878.9)	3.977	(157.3)	4.192	(191.2)	4.110	(895.7)	4.046	(159.0)
$\overline{R}^2$	0.58		0.60		0.60		0.59		0.61		0.60	

See notes to Table 10.

5 Conclusions

In this study we have analyzed the long-term earnings costs of displacement for Portuguese displaced workers through firm closing. For this purpose a large representative data set that links employers and its employees was used.

The findings of this research suggest four primary conclusions. First, we find that the effects of displacement on earnings are considerable in magnitude and quite persistent. Three years after displacement the average hourly earnings differential of displaced workers relative to non-displaced workers has increased by around 10 and 12 percentage points for women and men respectively. A slight recovery in earnings is observed only in the last year. These estimates are near the lower bound for the U.S.

Second, the empirical results revealed that the deepening in the earnings differential between displaced and non-displaced workers is in large part due to the loss of tenure within the firm and, to a lesser extent, to industry changing, suggesting that job displacement leads to the destruction of firm (industry)-specific features that positively influence wages.

Third, aside from the losses that stem from the loss of job tenure, workers who take a long time to find a new job suffer an additional penalty on earnings that is directly related with time spent out of employment. Indeed, workers who experienced a spell of nonemployment have an additional annual penalty on average hourly earnings of 3 to 6 percentage points.

In sum, the results revealed that for male workers the loss of tenure on the job explains about 40-46% of the increase in the post-displacement earnings gap relative to non-displaced workers; joblessness accounts for 33-43% of that increase; and the remaining 14-24% is explained by the loss of sector-specific features. As for female workers, the loss of accumulated returns to tenure account for 45-52% of the increase in the earnings differential; joblessness accounts for around 16-34%; and the loss of sector-specific features explains the remaining 16-31%.

Fourth, this study points to the importance of controlling for employer characteristics when estimating the earnings differential between displaced and similar non-displaced workers, since a gap in earnings exists even before displacement due to systematic differences in firm characteristics for the two groups of workers. Ignoring them may overestimate largely (more than 10 p.p.) the annual earnings differential between displaced and non-displaced workers.

APPENDIX A

Table A.1
Fixed effects results

	Men (N=773104)		Women (N=501494)	
Independent variable	Coef.	t-ratio	Coef.	t-ratio
$Disp_{-3}$	0.010*	(1.8)	0.007*	(1.1)
$Disp_{-2}$	-0.004*	(-0.7)	-0.003*	(-0.4)
$Disp_{-1}$	-0.029	(-5.1)	-0.017	(-2.6)
$Disp_0$	-0.043	(-6.8)	-0.029	(-4.0)
$Disp_1$	-0.045	(-7.4)	-0.031	(-4.6)
$Disp_2$	-0.050	(-8.3)	-0.036	(-5.3)
$Disp_3$	-0.059	(-9.6)	-0.039	(-5.7)
$Disp_4$	-0.068	(-10.6)	-0.037	(-5.2)
Age squared[a]	-0.049	(-82.6)	-0.036	(-46.3)
Education	0.004	(8.6)	0.006	(12.0)
Part-time job	0.126	(65.7)	0.125	(62.8)
Early-leaver	0.024*	(1.7)	-0.013*	(-0.8)
$\overline{R}^2$	0.88		0.86	

Dependent variable: log of average real hourly earnings. A set of time dummies is included in the specification. [a] variables divided by 100. All estimates are significant at 1%, except those with an *.

APPENDIX B

Table B.1: Decomposing the Sources of Earnings Losses

	Earnings Losses 3 years after displacement				
	Basic Specification	Controlling for Tenure	Controlling for OE	Controlling for CIND	Total Loss
Men	-0.115	-0.069	-0.026	-0.008	-0.107
%		43%	40.2%	16.8%	100%
Women	-0.092	-0.029	+0.009	+0.036	-0.128
%		49.2%	29.7%	21.1%	100%

Table B.2: Decomposing the Sources of Earnings Losses

	Earnings Losses 3 years after displacement				
	Basic Specification	Controlling for Tenure	Controlling for CIND	Controlling for OE	Total Loss
Men	-0.115	-0.069	-0.043	-0.008	-0.107
%		43%	24.3%	32.7%	100%
Women	-0.092	-0.029	+0.015	+0.036	-0.128
%		49.2%	16.4%	34.4%	100%

Table B.3: Decomposing the Sources of Earnings Losses

	Earnings Losses 3 years after displacement				
	Basic Specification	Controlling for OE	Controlling for Tenure	Controlling for CIND	Total Loss
Men	-0.115	-0.069	-0.026	-0.008	-0.107
%		43%	40.2%	16.8%	100%
Women	-0.092	-0.048	+0.009	+0.036	-0.128
%		34.4%	44.5%	21.1%	100%

Table B.4: Decomposing the Sources of Earnings Losses

	Earnings Losses 3 years after displacement				
	Basic Specification	Controlling for OE	Controlling for CIND	Controlling for Tenure	Total Loss
Men	-0.115	-0.069	-0.054	-0.008	-0.107
%		43%	14%	43%	100%
Women	-0.092	-0.048	-0.023	+0.036	-0.128
%		34.4%	19.5%	46.1%	100%

Table B.5: Decomposing the Sources of Earnings Losses

	Earnings Losses 3 years after displacement				
	Basic Specification	Controlling for CIND	Controlling for Tenure	Controlling for OE	Total Loss
Men	-0.115	-0.092	-0.043	-0.008	-0.107
%		21.5%	45.8%	32.7%	100%
Women	-0.092	-0.052	+0.015	+0.036	-0.128
%		31.3%	52.3%	16.4%	100%

Table B.6: Decomposing the Sources of Earnings Losses

	Earnings Losses 3 years after displacement				
	Basic Specification	Controlling for CIND	Controlling for OE	Controlling for Tenure	Total Loss
Men	-0.115	-0.092	-0.054	-0.008	-0.107
%		21.5%	35.5%	43%	100%
Women	-0.092	-0.052	-0.023	+0.036	-0.128
%		30.5%	23.4%	46.1%	100%

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