

Too Many Changes? Post-Displacement Job Mobility and Wages: an Analysis of Displaced Workers in Portugal

NEC Research Project Final Report

Abstract: The research project aims to investigate the impact of job mobility on wage dynamics for displaced workers in the Portuguese labor market. The study utilizes a nationally representative matched employer-employee dataset and a multi-dimensional fixed effects event study model to estimate the differences in wage trajectories for workers who experience post-displacement job mobility compared to those who do not. The findings reveal that changes in job title significantly impact wage trajectories, with workers experiencing occupational mobility facing significantly worse outcomes even five to six years after displacement. Geographical mobility also shows negative effects, particularly for women. However, no significant differences are found for workers who move from one industry to another. This study contributes to the existing literature on factors impacting wage dynamics and provides insights valuable for individual career choices and governmental policy-making.

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I. Introduction

After the mass layoff wave that came with the COVID-19 pandemic, increasing literature has directed its concern with workers' displacement, either be it unemployment (Cortes and Forsythe, 2023; Chetty *et al.*, 2024) or workers' individual losses (Bertheau *et al.*, 2023; Schmieder, Wachter and Heining, 2023), however there is still a relatively shortage of evidence of some of the causes of this wage loss, with the major "common sense" arguments related to the pandemic prevailing in the general narratives.

Yet, displacement is a phenomenon that occurred long before the pandemic - with waves of lower and higher intensity - and that shaped labour market outcomes. Not only employment is affected by layoffs and mass displacement but also workers' career progress - specially wages, which take huge hits after displacement (Jacobson, LaRonde and Sullivan, 1993; Lachowska, Mas and Woodbury, 2020).

This project aims to connect the dots and find some of the causes for wage loss in the context of the Portuguese labour market. Raposo, Portugal and Carneiro (2021) tackle this issue - the authors find that changes in the job title (in this report it is referred to as "*occupational mobility*") account for a big part of wage losses and argue that job title plays a part in three major areas crucial in wage setting - job-specific human capital, bargaining power and loss in the "hierarchical standings" related to that occupational category/firm. Nevertheless, we investigate whether the story is completely told by studying three types of post-displacement job mobility - occupational mobility, geographical mobility (i.e. if a worker moves from one region to another) and industrial mobility (i.e. if a worker moves from one industry to another) - and answering the question **"Does post-displacement job mobility impact displaced workers' wage dynamics?"**. This study will then deconstruct the possibility of heterogeneous effects for men and women. The insights gained from this research will not only provide valuable guidance to individuals when making career choices, but they will also be instrumental at the governmental level. Understanding whether specific demographic groups are more profoundly affected by these wage fluctuations will help in shaping policies aimed at mitigating the resulting effects. In summary, our study aims to shed light on how job mobility impacts wage progression, with a focus on the comparison of outcomes of the displaced workers that do and do not choose/experience post-displacement job mobility.

Using a nationally representative matched employer-employee dataset with extensive information on workers, firms and the worker-firm connection, Quadros de Pessoa (QP), and a multi-dimensional fixed effects event study model we estimate the differences between workers who move from one region to another (*geographical mobility*), one industry to another (*industrial mobility*) or from one occupation/job title to another (*occupational mobility*) in the post-displacement period comparative to their displaced peers who did

not undergo these movements. We find, in line with Raposo, Portugal and Carneiro (2021), that changes to the job title significantly impact wage trajectories of displaced workers - whilst prior to displacement these workers' wage trajectories are not (statistically) significantly different, in the post-displacement period workers who experience *occupational mobility* experience significantly worse outcomes which persist even 5/6 years later (point estimates of around 1.5%). Furthermore, we find that workers who move from one region to another are also worse off, at or near the threshold of significance at the 5% level (significant in the second and fourth years after moving). We argue that we may attribute this to what is called a '*disruption effect*', specially for women (Contreras, Sanchez and Soria, 2016), whose negative effects are significantly more highlightable. Finally, we find no significant differences between workers who move from one industry to another and those who don't.

Concerning literature contributions, this study contributes firstly to the long-lasting literature on the factors that impact wage dynamics (Mincer, 1974; Mincer and Jovanovic, 1981) and also to more recent literature not only on the relationship between displacement and wages (Lachowska, Mas and Woodbury, 2020; Bertheau *et al.*, 2023; Schmieder, Wachter and Heining, 2023) but in addition to the context of the studies on displacement in the Portuguese labor market (Raposo, Portugal and Carneiro, 2021).

The report is structured as follows: Section II provides a brief literature review on wage dynamics - firstly on its relationship with displacement and then on its relationship with job mobility, Section III provides an extensive overview of the data and the intricacies of the sample, Section IV presents the econometric framework for the analysis, Section V presents the results and Section VI closes with some concluding remarks and policy implications.

II. Literature Review

1. Displacement and Wage Dynamics

Addison and Portugal (1989) provide a foundation for the study of the impact of displacement on workers' wage changes. In this foundational research the authors break down the conventional Mincerian equation (Mincer and Jovanovic, 1981) by arguing that the broken down version of the equation is more likely to provide richer insights into worker investment profiles, job-matching strategies, job-search behavior, and unemployment effects on wages than the original equation ¹. Using specialized data from the CPS on displaced workers, the article then delves into examining the wage implications of job displacement, doing so within the framework that highlights the impact of previous

1. The original equation compounds the effects of previous job durations and previous unemployment durations in a single coefficient, whereas the equation used by the authors divides these two effects.

job tenures and periods of unemployment on wages after displacement. It is found that although displacement deeply declines earning prospects, increased unemployment duration strongly reduces subsequent earnings meaning that the conventional path to this determination overstated results in previous attempts to do so.

Jacobsen, LaRonde and Sullivan (1993) then use the model developed by Addison and Portugal (1989)² and leveraging extensive administrative data that combines workers' earnings histories with firm-specific information, aim to quantify the extent and temporal trends of earnings reductions among displaced workers, revealing in their quest to do so that individuals with substantial job tenures who depart from financially distressed firms experience enduring income decreases averaging 25 percent annually. Moreover, their findings indicate that these earnings declines commence prior to their separations, are minimally influenced by age and gender, are more sensitive to local labor market conditions and previous industry affiliations, affect workers across various sectors, and persist even among those securing new positions in similar firms.

As for more recent literature on displacement, Bertheau *et al.* (2023) examine the impacts of job loss across various nations by employing a unified research framework across seven comparable employer-employee databases through an harmonized research design. Among these countries, it is found that Denmark and Sweden demonstrate the least reduction in earnings post-job displacement, while Italy, Spain, and Portugal witness earnings declines threefold higher. French and Austrian employees encounter losses falling somewhere in the middle. These variations stem from the lower likelihood of reemployment among workers in Southern European countries. Furthermore, the decline in employer-specific wage premiums accounts for a significant portion of wage decreases across all studied nations.

Finally, with regards to the main contextual reference of this investigation, we turn to the paper **"The Sources of the Wage Losses of Displaced Workers"** (Raposo, Portugal and Carneiro, 2021). This paper applies the previous models of displacement research in the Portuguese labor market, using the *Quadros de Pessoal* dataset, which will also be used in this research project. The authors analyze the factors behind wage reductions by examining the influence of firm characteristics, match quality, and job title stability and find that the predominant factor contributing to the monthly wage decrease among displaced workers is the transition to lower-paying job titles, constituting 37% of the total average monthly wage decline, compared to 31% attributed to firm effects and 32% to match effects. In terms of hourly wage decreases, job title effects play a more significant role, accounting for 46% of the total loss, while firm and match effects each contribute 27%. In this research project we also seek to understand if the importance

2. The model also benefited from later contributions of Kletzer (1989), Topel (1991) and Swaim and Podgursky (1991).

of the job title effect in comparison to regional and industrial effects (which could be considered matching effects) is consistent with the findings of this paper.

2. Job Mobility and Wage Dynamics

Addison, Portugal and Raposo (2023) extend the conventional Mincerian wage equation by incorporating worker's job histories to distinguish the returns to experience and tenure over the sequence of jobs. Using a rich Portuguese linked employer-employee dataset, *Quadros de Pessoal*, the authors advance the traditional analysis by accounting for the possibility that wage change may occur with each job switch. Their findings report that job mobility are important drivers of wage growth, particularly during the early stage of the worker. Additionally, the authors investigate the heterogeneity in job matches and its effect on the returns to mobility, experience, and tenure. The study reveals that returns to job mobility could be indicative of sorting into better job matches and that more productive workers to be more experienced, potentially biasing estimated returns to experience upward.

On the same thematic, however focusing on the cyclicity of wages within the British context, Hart (2006) explores the relationship between wage cyclicity and job mobility from 1980 to 2001. The author distinguishes between job stayers and movers, with movers defined by changes within and between companies. Hart's findings indicate significant wage cyclicity, particularly among job movers. Furthermore, he uncovers that long-term job stayers experience wage cyclicity, especially in later years of tenure.

Topel (1991, 1992) proposes a dynamic model where wages rise with job seniority, challenging previous claims that wages are independent of tenure once unobserved worker heterogeneity is controlled for. By analysing longitudinal data and employing a two-stage estimation approach, Topel's findings show a robust relationship between job tenure and wages increases, suggesting that workers accumulate job-specific human capital over time. Moreover, Topel's research argues that high separation rates from jobs with longer tenures suggest substantial losses in job-specific human capital upon job displacement.

As for the gender implications of these dynamics, Contreras, Sánchez and Soria (2016), by utilizing the stochastic frontier technique, they quantify the gap between potential and actual wages. The study focuses on a cohort of young workers who have sustained employment for at least seven consecutive years. Findings from this paper reveal that, contrary to the author's expectations, job mobility does not uniformly enhance wage efficiency. Particularly, Spanish and Italian women, despite exhibiting higher mobility rates, encounter a widened gap between potential and actual wages. This mobility apparently fails to translate into expected wage benefits, especially for women, indicating systemic inefficiencies or barriers in the labor market's recognition.

Regarding the impact of institutions on wage levels, Cardoso (2006) tackles the relationship between labour market institutions and wage mobility. The authors focus on Portugal, one of Europe’s most regulated labour markets and perform some comparisons with the United Kingdom, known for its flexibility. The study reveals remarkable similarities in mobility trends between the two countries, suggesting that rigid institutional frameworks do not necessarily impede individual wage mobility. In other words, despite Portugal’s regulated environment, firm-specific conditions play a crucial role in shaping wage mobility.

As mentioned in the introduction, the aim of our paper is also to analyse the effects of different types of mobility on the wage dynamics. Within this context, Hervé (2023) analyses the impact of industrial specialization on job mobility and earnings for American workers in low- and middle-wage occupations. It is introduced the concept of “industry specificity”, using the constructed index of industrial concentration of employment (CEI) at the occupation-state-year level. The author first examines the relationship between the CEI and workers’ wages, and second, explores the mechanisms driving this relationship. This study reveals that moving from the first to the third quartile of industry specificity results in a decrease in wages, suggesting that industry specificity is a potential obstacle to workers’ cross-industry mobility. It also provides evidence that industry-specific occupations may make workers more susceptible to industry-wide wage shocks.

Furthermore, Contreras, Sánchez and Soria (2016) examine the impact of geographical mobility on the potential and actual wages of individuals within the labor markets of Germany, the United Kingdom, Italy and Spain. This research employs the stochastic frontier technique to measure the gap between potential and actual wages. The authors find that geographical mobility brings men closer to their potential wage, whereas for women, mobility – particularly due to household factors or personal reasons – tends to distance them from their potential wage. Focusing on Portugal, Vieira and Madruga (2005) examine the impact of regions on low wage incidence and mobility. According to their conclusions, the probability of leaving low-pay jobs is higher in Lisbon than in other regions, as well as for males and individuals with higher education following diminishing marginal returns along with the individual’s age.

III. Data

1. *Quadros de Pessoal*

For this project, a longitudinal data from a matched employer-employee-job title dataset known as *Quadros de Pessoal* (*QP, Lists of Personnel*) will be used, in the period spanning from 2010 to 2021. Compiled annually by the Portuguese Ministry of Employ-

ment, this dataset is sourced from a survey mandated by law for every establishment with at least one employee receiving wages. It includes information on the firm, establishment, and individual workers. Currently, QP encompasses data from over 300,000 firms and approximately three million workers. The compulsory nature of the survey, coupled with its comprehensive coverage of all private sector wage earners in Portugal, minimizes common panel data issues such as attrition. Worker information reporting reduces measurement errors, particularly regarding earnings. Each firm in the database is assigned a unique identifier, and the Ministry employs various validation measures to ensure data accuracy.

By looking at the firm identifier, we can precisely identify all firms that have either commenced or terminated economic operations. An exit from the database should identify the cessation of a firm's activity. The firm data comprises comprehensive details such as industry, geographical region, ownership structure, and size. Worker identification numbers are linked to their respective social security numbers. This dataset facilitates the correlation of firms with their employees, enabling us to establish the worker-firm relationships.

Information concerning workers encompasses gender, age, educational attainment, and comprehensive details regarding monthly earnings. This includes base wages, regular benefits (e.g., seniority bonuses), irregular benefits (such as profit shares and premiums), overtime compensations, and hours worked (both standard and overtime). Our primary findings rely on the hourly wage, which is computed as the total sum of regular (base wage and regular benefits) and irregular payroll (irregular benefits and overtime payments) for the reference hours worked.

2. Sample Construction

2.1. Displaced Workers

For the sample construction of displaced workers between 2010 and 2021 the same restrictions and procedure of Raposo, Portugal and Carneiro (2021) were imposed. Displaced workers are defined as workers who lost their job due to firm closure and include, in our sample, workers who suffered displacement between 2010 and 2021. A firm is classified as an exiting firm in year $t + 1$ if it is present in the QP files in year t , but absent in $t + 1$, $t + 2$, and all of the subsequent years. During the reference period, some individuals encounter consecutive closures of distinct firms. To accurately determine the time to displacement, we utilized only the data from the first firm closure within the reference period.

To be included in the sample, a worker must report positive earnings and have at least two years of tenure in the year immediately preceding the displacement event. Additionally, the worker must report positive earnings at least once afterward. The sample was limited to full-time wage earners in the private, non-farm sector, aged 16-64 years, employed at firms with at least 20 employees, and earning base wages above 80 percent of the mandatory minimum wage. Further restrictions included: (i) removing observations with missing values in the covariates and (ii) excluding singleton observations (groups reduced to a single observation that do not affect the coefficient estimates in the fixed-effects model, particularly the coefficients of interest).

Table 1 presents the sample composition of the displaced workers comparative to the total number of workers in each year and Table 2 descriptive statistics for these workers.

	Non-Displaced	Displaced
N	18,057,711 (80.6%)	4,351,528 (19.4%)
Year of Reference		
2010	1,513,325	447,462
2011	1,489,149	428,102
2012	1,390,535	369,299
2013	1,373,954	358,925
2014	1,400,692	367,482
2015	1,433,595	372,549
2016	1,475,650	370,919
2017	1,530,480	372,495
2018	1,587,463	370,334
2019	1,619,998	348,533
2020	1,566,697	321,467
2021	1,676,173	223,961

Table 1: Displaced Workers by year of displacement

	Non-Displaced	Displaced
N	18,057,711 (80.6%)	4,351,528 (19.4%)
Gender		
Male	9,732,272 (53.9%)	2,395,693 (55.1%)
Female	8,325,439 (46.1%)	1,955,835 (44.9%)
Age (in years)	40.402 (10.945)	40.473 (10.303)
Education (in years)	10.196 (3.924)	9.776 (3.812)
NUTS II Region where the establishment is located (October 31st)		
North Region	6,665,825 (36.9%)	1,680,584 (38.6%)
Algarve	776,785 (4.3%)	197,326 (4.5%)
Centre Region	3,877,946 (21.5%)	842,385 (19.4%)
Lisbon Metropolitan Area	5,116,699 (28.3%)	1,203,458 (27.7%)
Alentejo	949,722 (5.3%)	232,515 (5.3%)
Azores	287,087 (1.6%)	91,017 (2.1%)
Madeira	374,448 (2.1%)	102,292 (2.4%)
Outside of Portugal	9,199 (0.1%)	1,951 (0.0%)
Log of Real Hourly Total Remuneration (in 2012 Euros)	1.792 (0.541)	1.671 (0.492)
Turnover (Euros)	228,895,110.482 (858,966,645.493)	58,261,899.410 (351,900,294.819)
Tenure (in years)	9.426 (9.286)	6.953 (7.893)

Table 2: Descriptive Statistics of Displaced and Non-Displaced Workers

Note: For the total number of workers, gender and region (NUTS II) variables the % of workers in each of the categorical distinctions is shown in the parenthesis. For the age, education, wage, turnover and tenure variables the parenthesis show the standard deviation of the variable.

2.2. Movers and Stayers

However, as the main focus of the paper is not to look at wage loss but instead compare mobility effects in earnings outcomes, we define the treatment and control groups as *movers* and *stayers*, within each mobility type. To delve into the effects of post-displacement occupational mobility we look into workers who, as mentioned in Raposo, Portugal and Carneiro (2021), either experience ‘a switch in the occupational category code within the same collective agreement, a switch in the collective agreement or a switch in the hierarchical standing within the same collective agreement/occupational category’. The stayers are defined as displaced workers who experience neither of these events. Descriptive statistics for these two groups are depicted in Table 3.

	Occupational Mobility	
	Stayers	Movers
N	4,144,773 (95.2%)	206,755 (4.8%)
Gender		
Male	2,285,550 (55.1%)	110,143 (53.3%)
Female	1,859,223 (44.9%)	96,612 (46.7%)
Age (in years)	40.473 (10.315)	40.471 (10.061)
Education (in years)	9.760 (3.812)	10.009 (3.797)
Portuguese Classification of Occupations (2-digits)		
Representatives of the legislature and executive bodies, senior leaders of the Public Administration, specialized organizations, directors and managers of companies	24,680 (0.6%)	2,764 (1.3%)
Directors of administrative and commercial services	57,037 (1.4%)	4,900 (2.4%)
Production and specialist service managers	37,060 (0.9%)	3,564 (1.7%)
Hotel, catering, retail and other service managers	63,138 (1.5%)	5,234 (2.5%)
Specialists in the physical, mathematical, engineering and related technical sciences	80,990 (2.0%)	3,200 (1.6%)
Health Professionals	41,539 (1.0%)	1,626 (0.8%)
Teachers	32,144 (0.8%)	754 (0.4%)
Specialists in finance, accounting, administrative organization, public relations, and commercial (specialists)	85,184 (2.1%)	5,904 (2.9%)
Information and Communication Technology (ICT) Specialists	52,626 (1.3%)	2,148 (1.0%)
Experts in legal, social, artistic and cultural affairs	34,547 (0.8%)	1,096 (0.5%)
Technicians and professions in science and engineering, intermediate level	144,899 (3.5%)	11,492 (5.6%)
Technicians and professionals, intermediate level of health	51,776 (1.2%)	2,888 (1.4%)
Intermediate level technicians from the financial, administrative and business areas	163,549 (3.9%)	14,358 (7.0%)
Intermediate level technicians in legal, social, sporting, cultural and similar services	17,078 (0.4%)	1,522 (0.7%)
Information and communication technology technicians	34,951 (0.8%)	1,707 (0.8%)
Office workers, general secretaries, and data processing operators	238,082 (5.7%)	10,388 (5.0%)
Direct customer support staff	100,490 (2.4%)	4,519 (2.2%)
Data, accounting, statistical, financial services and related operators registration	155,034 (3.7%)	9,494 (4.6%)
Other administrative support staff	51,818 (1.3%)	5,168 (2.5%)
Personal service workers	286,958 (6.9%)	11,506 (5.6%)
Sellers	464,216 (11.2%)	13,974 (6.8%)
Personal care and similar workers	77,412 (1.9%)	3,842 (1.9%)
Safety and security services personnel	68,757 (1.7%)	574 (0.3%)
Farmers and skilled workers in agriculture and animal production, oriented towards the market	15,829 (0.4%)	543 (0.3%)
Skilled market-oriented forestry, fishing and hunting workers	3,720 (0.1%)	184 (0.1%)
Skilled construction and similar workers, except electricians	265,741 (6.4%)	8,799 (4.3%)
Skilled workers in metallurgy, metalworking and the like	199,472 (4.8%)	5,583 (2.7%)
Skilled workers in printing, precision instrument manufacturing, jewellers, craftsmen and the like	34,009 (0.8%)	2,325 (1.1%)
Skilled electrical and electronics workers	66,931 (1.6%)	2,853 (1.4%)
Workers in food processing, wood, clothing and other industries, and handicrafts	251,040 (6.1%)	13,909 (6.7%)
Fixed plant and machine operators	273,917 (6.6%)	14,142 (6.9%)
Assembling Workers	31,043 (0.7%)	1,906 (0.9%)
Vehicle drivers and mobile equipment operators	197,159 (4.8%)	3,858 (1.9%)
Cleaning Workers	135,362 (3.3%)	3,964 (1.9%)
Unskilled workers in agriculture, animal husbandry, fisheries and forestry	9,095 (0.2%)	453 (0.2%)
Unskilled workers in mining, construction, manufacturing and Transport	133,995 (3.2%)	9,379 (4.5%)
Meal preparation assistants	51,923 (1.3%)	3,799 (1.8%)
Street vendors (except food vendors) and street service providers	5,292 (0.1%)	673 (0.3%)
Workers in waste and other basic services	104,624 (2.5%)	11,375 (5.5%)
Log of Real Hourly Total Remuneration (in 2012 Euros)	1.670 (0.491)	1.691 (0.514)
Turnover (Euros)	57,894,604.552 (349,030,416.969)	65,623,865.722 (405,089,396.816)
Tenure (in years)	7.015 (7.917)	5.710 (7.293)

Table 3: Descriptive Statistics for Displaced Occupational *Stayers* and *Movers*

Note: For the total number of workers, gender and occupation (CPP) variables the % of workers in each of the categorical distinctions is shown in the parenthesis. For the age, education, wage, turnover and tenure variables the parenthesis show the standard deviation of the variable.

To explore the impacts of geographical transition following displacement we define as *movers* the displaced workers who change region ³ in their next employment reference following their displacement and *stayers* those who do not experience this change. Table 4 displays descriptive statistics for both cohorts.

3. The Eurostat-based NUTS system subdivides the nation into three region levels: NUTS I, NUTS II and NUTS III. The *Quadros de Pessoal* dataset offers insight concerning workers’ NUTS II location, which will be used as the region determinant in this study.

	Geographical Mobility	
	<i>Stayers</i>	<i>Movers</i>
N	4,318,279 (99.2%)	33,249 (0.8%)
Gender		
Male	2,373,171 (55.0%)	22,522 (67.7%)
Female	1,945,108 (45.0%)	10,727 (32.3%)
Age (in years)	40.474 (10.303)	40.336 (10.362)
Education (in years)	9.776 (3.811)	9.672 (3.948)
NUTS II Region where the establishment is located (October 31st)		
North Region	1,671,056 (38.7%)	9,528 (28.7%)
Algarve	195,613 (4.5%)	1,713 (5.2%)
Centre Region	835,099 (19.3%)	7,286 (21.9%)
Lisbon Metropolitan Area	1,192,550 (27.6%)	10,908 (32.8%)
Alentejo	229,874 (5.3%)	2,641 (7.9%)
Azores	90,727 (2.1%)	290 (0.9%)
Madeira	101,720 (2.4%)	572 (1.7%)
Outside of Portugal	1,640 (0.0%)	311 (0.9%)
Log of Real Hourly Total Remuneration (in 2012 Euros)	1.670 (0.491)	1.809 (0.550)
Turnover (Euros)	58,087,715.629 (352,045,132.763)	80,863,685.164 (331,801,854.191)
Tenure (in years)	6.967 (7.899)	5.182 (6.825)

Table 4: Descriptive Statistics for Displaced Geographical *Stayers* and *Movers*

Note: For the total number of workers, gender and region (NUTS II) variables the % of workers in each of the categorical distinctions is shown in the parenthesis. For the age, education, wage, turnover and tenure variables the parenthesis show the standard deviation of the variable.

	Industrial Mobility	
	<i>Stayers</i>	<i>Movers</i>
N	4,188,862 (96.3%)	162,666 (3.7%)
Gender		
Male	2,303,032 (55.0%)	92,661 (57.0%)
Female	1,885,830 (45.0%)	70,005 (43.0%)
Age (in years)	40.487 (10.308)	40.115 (10.166)
Education (in years)	9.762 (3.813)	10.123 (3.767)
Firm's Harmonized Sector of Economic Activity		
Mining and Quarrying of Energy Producing Materials	1 (0.0%)	1 (0.0%)
Mining and Quarrying, Except of Energy Producing Materials	15,612 (0.4%)	515 (0.3%)
Manufacture of Food Products, Beverages and Tobacco	161,761 (3.9%)	5,249 (3.2%)
Manufacture of Textiles and Textile Products	297,375 (7.1%)	5,950 (3.7%)
Manufacture of Leather and Leather Products	96,026 (2.3%)	1,115 (0.7%)
Manufacture of Wood and Wood Products	40,865 (1.0%)	1,252 (0.8%)
Manufacture of Pulp, Paper and Paper Products, Publishing and Printing	71,468 (1.7%)	1,373 (0.8%)
Manufacture of Coke, Refined Petroleum Products and Nuclear Fuel	229 (0.0%)	18 (0.0%)
Manufacture of Chemicals, Chemical Products and Man-Made Fibers	17,860 (0.4%)	780 (0.5%)
Manufacture of Rubber and Plastic Products	26,914 (0.6%)	959 (0.6%)
Manufacture of Other Non-Metallic Mineral Products	47,286 (1.1%)	1,115 (0.7%)
Manufacture of Basic Metals and Fabricated Metal Products	118,486 (2.8%)	6,179 (3.8%)
Manufacture of Machinery and Equipment n.e.c.	65,627 (1.6%)	3,720 (2.3%)
Manufacture of Electrical and Optical Equipment	26,313 (0.6%)	1,053 (0.6%)
Manufacture of Transport Equipment	27,410 (0.7%)	1,526 (0.9%)
Manufacturing n.e.c.	80,437 (1.9%)	2,162 (1.3%)
Electricity, Gas and Water Supply	9,963 (0.2%)	379 (0.2%)
Construction	457,390 (10.9%)	22,371 (13.8%)
Wholesale and Retail Trade, Repair of Motor Vehicles, Motorcycles and Personal and Household Goods	932,514 (22.3%)	38,387 (23.6%)
Hotels and Restaurants	377,699 (9.0%)	15,164 (9.3%)
Transport, Storage and Communications	182,139 (4.4%)	6,545 (4.0%)
Financial Intermediation	98,099 (2.3%)	3,893 (2.4%)
Real Estate, Renting and Business Activities	587,942 (14.1%)	25,475 (15.7%)
Public Administration and Defense, Compulsory Social Security	10,681 (0.3%)	65 (0.0%)
Education	63,199 (1.5%)	3,028 (1.9%)
Health and Social Work	209,942 (5.0%)	9,718 (6.0%)
Other Community, Social and Personal Service Activities	159,158 (3.8%)	4,506 (2.8%)
Extra-Territorial Organizations and Bodies	62 (0.0%)	0 (0.0%)
Log of Real Hourly Total Remuneration (in 2012 Euros)	1.669 (0.492)	1.716 (0.487)
Turnover (Euros)	57,279,227.646 (347,926,305.847)	83,543,259.736 (441,271,930.323)
Tenure (in years)	7.082 (7.913)	3.641 (6.535)

Table 5: Descriptive Statistics for Displaced Industrial *Stayers* and *Movers*

Note: For the total number of workers, gender and industry (CAE) variables the % of workers in each of the categorical distinctions is shown in the parenthesis. For the age, education, wage, turnover and tenure variables the parenthesis show the standard deviation of the variable.

Finally, to investigate the effects of transitioning industries after displacement we classify displaced workers who relocate to a different industry ⁴ in their subsequent employment reference as "movers," and those who do not make this change as "stayers." Table 5 provides descriptive statistics for both groups.

IV. Econometric Framework

To investigate the losses of post-displacement job mobility, we use the difference between *movers*' and *stayers*' remunerations (w_{it}) as the outcome variable. As mentioned in Section III. 2, we use the logarithm of the real hourly wage ⁵ of both groups to make this comparison.

Then, we apply an event study model similar to that of Bertheau *et. al* (2023) taking into consideration the findings of Raposo, Portugal and Carneiro (2021):

$$w_{it} = \alpha_i + \lambda_t + \phi_{iF(i,t)} + \psi_{F(i,t)} + \sum_{k=-5}^{k=5} \gamma_k \mathbf{1}\{t = t_i^* + k\} + \sum_{k=-5}^{k=5} \theta_k \mathbf{1}\{t = t_i^* + k\} \times Mob_i + X'_{it}\beta + \epsilon_{it} \quad (1)$$

Where α_i depicts worker fixed effects, λ_t illustrates calendar year (time) fixed effects, $\phi_{iF(i,t)}$ represents match quality fixed effects which measure the returns to time-invariant characteristics of the worker–firm match, $\psi_{F(i,t)}$ are firm fixed effects that account for the permanent characteristics of the firm, Mob_i is an indicator variable equal to one for treated workers (*movers*) and zero for the control workers (*stayers*) and X_{it} is a vector of control variables which includes age squared and, for occupational mobility, the occupational tenure of the worker at the time of displacement (to account for occupation specific capital losses as these might be heterogeneous between *movers* and *stayers*). Under the assumption of parallel trends between the treated and control units, the coefficients of interest, θ_k , capture the causal effect of moving at event time k . The coefficients are normalized relative to θ_{-1} and standard errors clustered at the worker level.

To conduct the gender analysis, specification (1) will be used to calculate differences for both men and women (using the dummy variable *female* (derived from the variable *sexo* (gender) in the original dataset). Finally, Figures 10, 11 and 12 in the appendix argue for the usage/non-usage of the fixed effects/control variables in this analysis.

4. We use the portuguese CAE (Classificação Portuguesa de Actividades Económicas) to define the different industries and use the 3-digit denomination of the CAE to define an industry.

5. Values of Logarithm Real Hourly Remuneration are in 2012 Euros accounting for the CPI values of the corresponding year.

V. Results

1. Geographical Mobility

In this section we present results regarding the impact of geographical mobility on wages by comparing the outcomes of displaced workers who moved or did not move from one region to another in the post-displacement period.

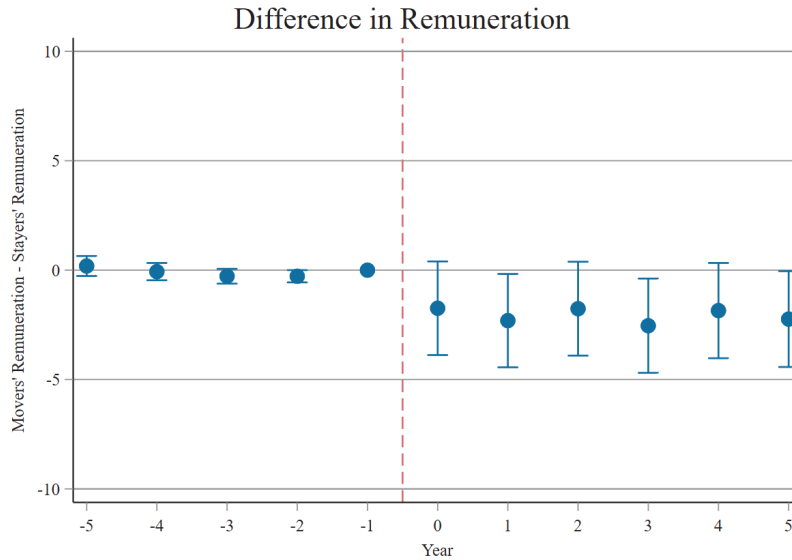


Figure 1: Wage Differences between (Geographic) *Movers* and *Stayers*

Note: The coefficients of interest θ_k are represented by the point estimates of the graph. The coefficients are in percentage units (i.e. difference in % between both groups' earnings). The confidence intervals are represented at the 95% confidence level.

Figure 1 displays the previously mentioned wage gaps across time. Firstly, we can observe that the assumption of parallel trends between the treated and control units holds and, thus, the coefficients of interest capture causal effect of moving at event time k . Geographical *movers*, despite not differing significantly from *stayers* before displacement, are worse off after the displacement - though not significantly worse off for the majority of the years (except in the second and fourth years post-displacement).

However, we can look into the outcome of women and men to find out why both of these results (I. *Movers* worse off; II. Statistically insignificant results in the majority of years) hold. Figures 2 and 3 (below) depict the '*mobility*' wage gap for displaced women and men, respectively.

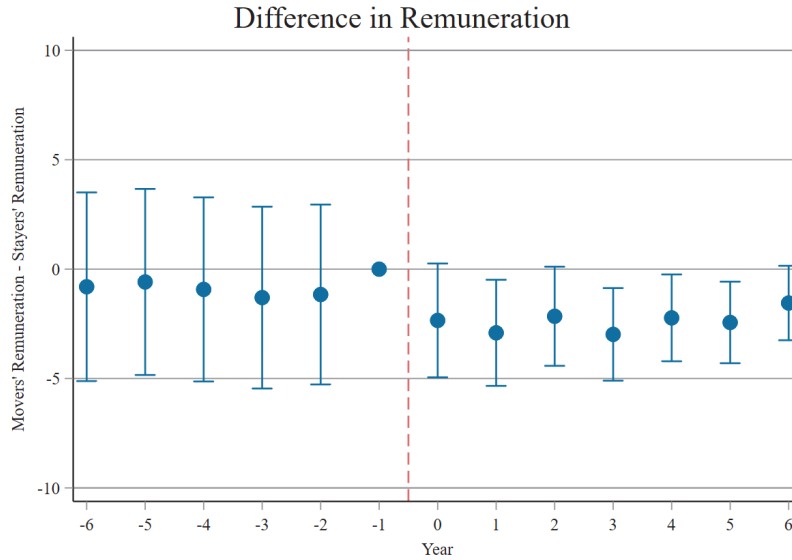


Figure 2: Wage Differences between (Geographic) *Movers* and *Stayers* for women

Note: The coefficients of interest θ_k are represented by the point estimates of the graph. The coefficients are in percentage units (i.e. difference in % between both groups' earnings). The confidence intervals are represented at the 95% confidence level.

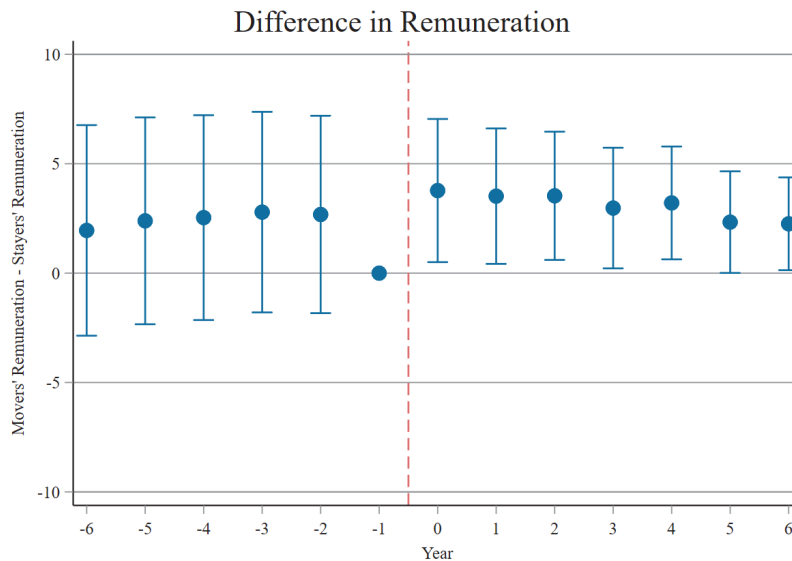


Figure 3: Wage Differences between (Geographic) *Movers* and *Stayers* for men

Note: The coefficients of interest θ_k are represented by the point estimates of the graph. The coefficients are in percentage units (i.e. difference in % between both groups' earnings). The confidence intervals are represented at the 95% confidence level.

In line with the findings of Contreras, Sánchez and Soria (2016) we also observe very distinct outcomes for men and women who move from one region to another - whilst women who choose/are obliged to move after displacement are, in general, worse off compared to their counterparts who did not choose/were not obliged to do so, men who move are actually significantly better off compared to those who do not. These findings

have severe policy implications which will be discussed in Section VI. To conclude the results on geographical mobility, Figure 10 in the appendix shows the outlook of the Figure 1 graph if no controls were included and the arguments for and against the inclusion of the control variables and fixed effects.

2. Industrial Mobility

Next, we put forward the results of our analysis on the impact of industrial mobility on wages. Specifically, we compare the outcomes of displaced workers who either transitioned to a different industry or remained in the same industry during the post-displacement period.

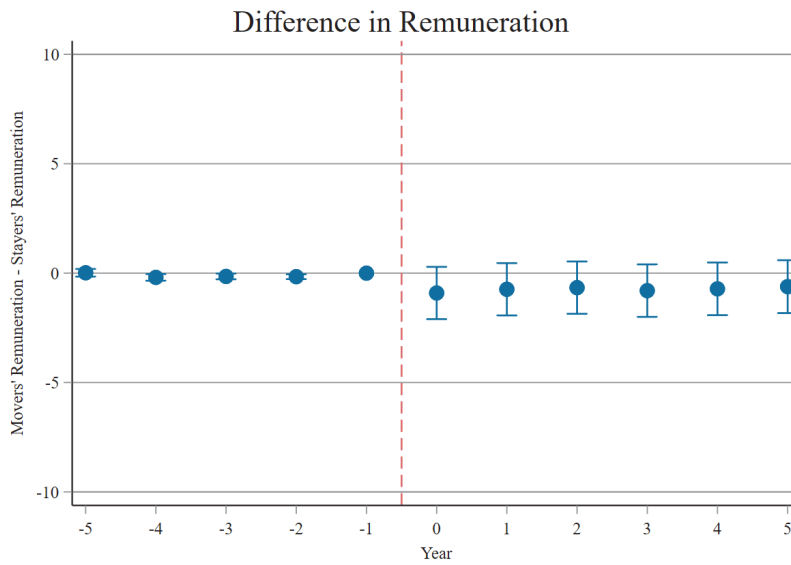


Figure 4: Wage Differences between (Industrial) *Movers* and *Stayers*

Note: The coefficients of interest θ_k are represented by the point estimates of the graph. The coefficients are in percentage units (i.e. difference in % between both groups' earnings). The confidence intervals are represented at the 95% confidence level.

Figure 4 shows the aforementioned wage gaps over time. Firstly, we observe that the assumption of parallel trends between the treated and control units holds true, indicating that the coefficients of interest accurately capture the causal effect of moving at event time k . Secondly, it can be observed that after displacement there is still no significant difference from those who move to another industry after displacement and those who do not. This holds true for both men (Figure 5) and women (Figure 6), thus meaning that moving industries in the post-displacement period does not affect significantly the wage trajectories of those who do so compared to those who do not. To finalize the findings on industrial mobility, Figure 11 in the appendix illustrates how the graph in Figure 4 would appear without the inclusion of control variables. It also presents the arguments for and against incorporating these control variables and fixed effects.

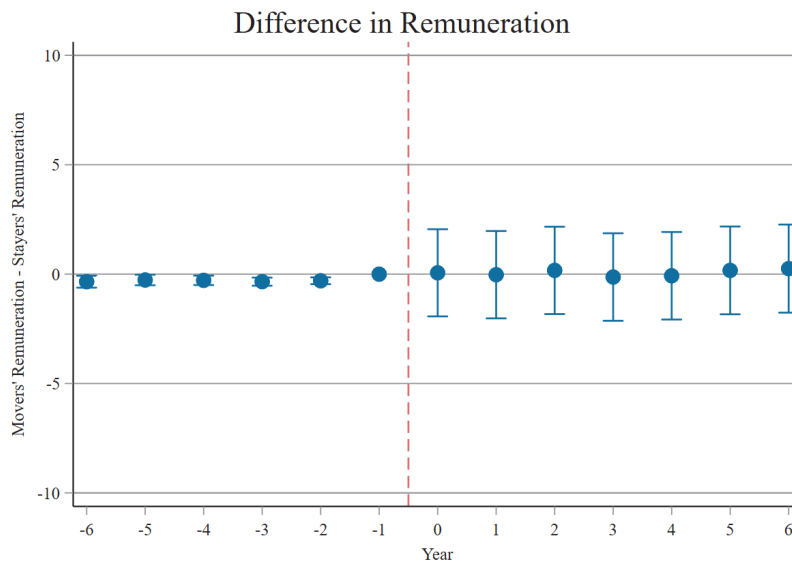


Figure 5: Wage Differences between (Industrial) *Movers* and *Stayers* for men

Note: The coefficients of interest θ_k are represented by the point estimates of the graph. The coefficients are in percentage units (i.e. difference in % between both groups' earnings). The confidence intervals are represented at the 95% confidence level.

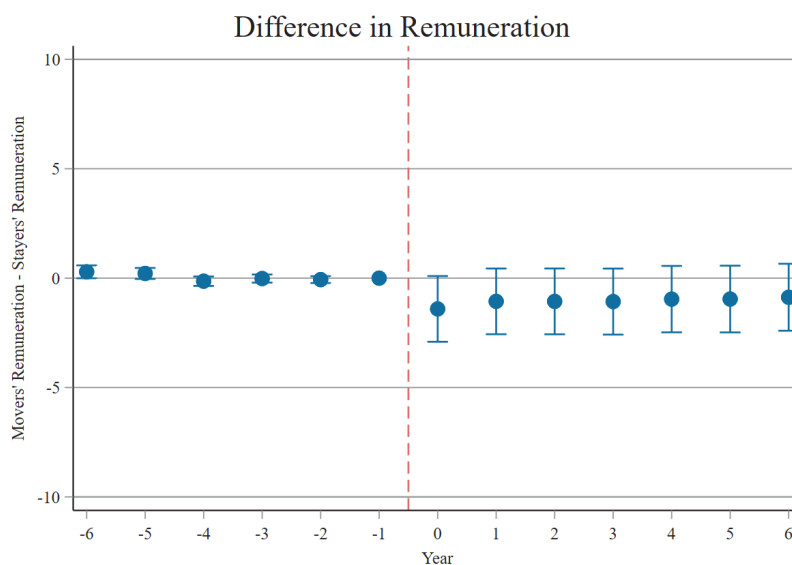


Figure 6: Wage Differences between (Industrial) *Movers* and *Stayers* for women

Note: The coefficients of interest θ_k are represented by the point estimates of the graph. The coefficients are in percentage units (i.e. difference in % between both groups' earnings). The confidence intervals are represented at the 95% confidence level.

3. Occupational Mobility

Finally, we carry out an analysis related to how changes in occupation after a situation of worker displacement affect wage dynamics.

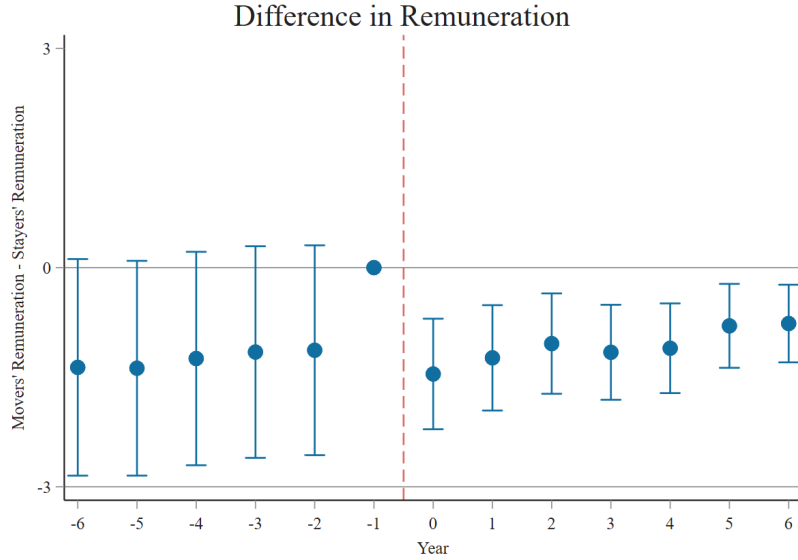


Figure 7: Wage Differences between (Occupational) *Movers* and *Stayers*

Note: The coefficients of interest θ_k are represented by the point estimates of the graph. The coefficients are in percentage units (i.e. difference in % between both groups' earnings). The confidence intervals are represented at the 95% confidence level.

Figure 7 displays the wage gap over time between (occupational) *movers* and *stayers*. Under the parallel pre-trends assumption, which holds true in this case, the point estimates represented depict the causal effect of changes in occupation on post-displacement wages (compared to non-movers). Workers who experience occupational mobility earn (statistically) significantly less than workers who do not in the post-displacement period. This disparity can reach up to 1.5% (point estimate, statistically significantly different from 0 at the 5% level as shown by the confidence intervals) and persists throughout the period analysed of 5-6 years. This result is in line with the findings of Raposo, Portugal and Carneiro (2021) which conclude that this change ends up being the most significant change in workers post-displacement wage trajectories, which is indeed true in this case (for the whole sample of workers, occupational mobility is the only factor where movers earn persistently (statistically) significantly less over the post-displacement period in analysis).

Turning our attention to gender disparities, Figures 8 and 9 focus on differences for men and women, respectively. By examining these pictures, we can see that women are also the most affected by the loss of occupation specific capital or other factors related to occupational mobility - for men, though movers are worse off, the point estimates are not statistically significant, whereas for women these point estimates, which indicate that

the movers may earn up to 2% less than their female stayer and displaced peers, are statistically significantly different from 0 at the 5% level as demonstrated by the confidence intervals. Concluding the findings on occupational mobility, Figure 12 in the appendix presents the scenario depicted in Figure 7 without any controls. It also discusses the pros and cons of including control variables and fixed effects.

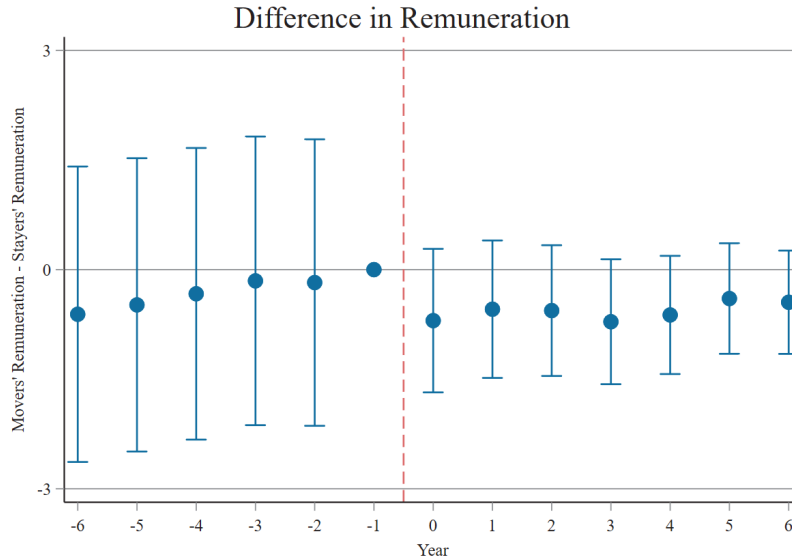


Figure 8: Wage Differences between (Occupational) *Movers* and *Stayers* for men

Note: The coefficients of interest θ_k are represented by the point estimates of the graph. The coefficients are in percentage units (i.e. difference in % between both groups' earnings). The confidence intervals are represented at the 95% confidence level.

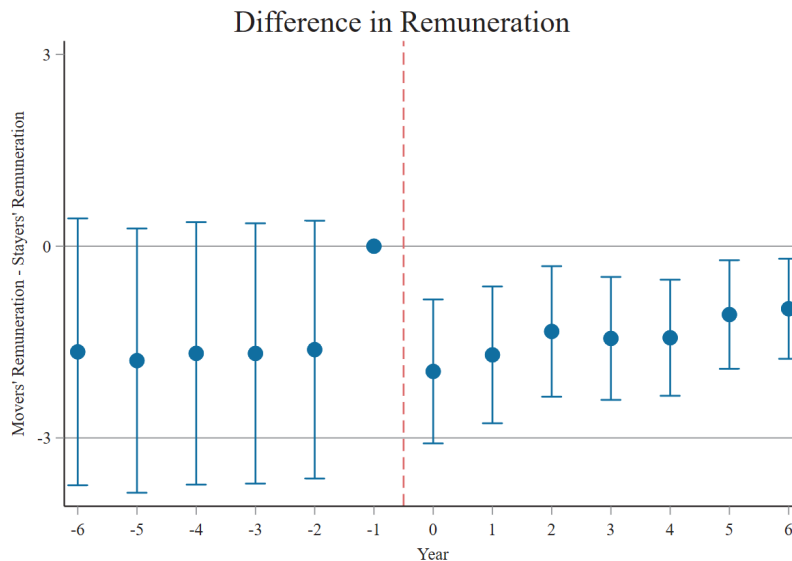


Figure 9: Wage Differences between (Occupational) *Movers* and *Stayers* for women

Note: The coefficients of interest θ_k are represented by the point estimates of the graph. The coefficients are in percentage units (i.e. difference in % between both groups' earnings). The confidence intervals are represented at the 95% confidence level.

VI. Discussion, Policy Implications and Conclusion

First, it is crucial to discuss the methodology and research implemented - though made possible by the use of complete framework and dataset, it is important to acknowledge that this project is still far from a citable\referenceable scientific source for the field of labor economics. As students of the researching world we are aware of the weaknesses of our work - for example, the control variable choice, the chosen regression command/s-strategy and the initial data cleaning process, which, though referring back to Raposo, Portugal and Carneiro (2021), might have been misinterpreted/misimplemented. These are all issues which need to be discussed to address the validity of our results.

Nevertheless, looking at our conclusions, the results obtained by Contreras, Sánchez and Soria (2016) and Raposo, Portugal and Carneiro (2021) are re-highlighted: (1) **Geographical Mobility is a huge barrier for (displaced) women's "natural" wage progression** and (2) **Changes in occupation account not only for a big part of displacement losses but also are the biggest driving force of persistent differences in remuneration.**

For policy implications of the latter, we cite the important prescriptive conclusion of Raposo, Portugal and Carneiro (2021): *'Severe losses in the returns to the job title may be due to depreciation of (occupation) specific human capital or to the difficulty of finding a new job requiring skills similar to those acquired in the predisplacement job. Here, **retraining programs** may be of some help.'* Moreover, not only retraining programs can contribute to overcome the losses - *on-the-job training*, improved *job matching services* (both at the local and central levels), providing early access to *potential employment(professional) networks* and promoting a *lifelong learning culture* are all aspects where governments, either by direct intervention or by ways of subsidies, grants and other tools, can intervene to cushion the wage losses of displaced workers.

To discuss the policy implications of the former however, we must first acknowledge some of the reasons why the barrier of (women's) geographic mobility might exist according to previous literature. The first potentially crucial determinant of the barrier might be related to the housing market, in two different fronts: (1) Literature has shown that French women have a higher priority order in their wage reservation preferences for lower commute time/distance than men (Barbanchon *et. al*, 2021) and, thus, trade off lower commuting times for lower wages, i.e. accepting worse job-housing offers in trade for lower commuting times (shorter mobility distances). To test if this hypotheses could be valid for Portuguese women, further research on the (internal) migration patterns of women vs men post-displacement would have to be conducted in addition to an analysis of the home-work commuting times for these people. In Portugal, this could be an issue because of the correlation between the concentration of the housing market and best

transportation networks around the biggest cities, especially around the Metropolitan Area of Lisbon (AML), which could see women struggling to strike a balance between commuting time and housing stability. (2) There might be an argument for women discrimination in the housing market which leads women to lower housing stability and the acceptance of worse job offers in return for higher stability. Voldman (2020) and the National Women's Law Center (US, NWLC) (2021) relate labor and housing market outcomes whilst arguing that (french and american) women's discrimination in one of these markets leads to inequalities in the other. Landlord biases, credit biases or even contract duration biases could all be leading causes of these issues, though no investigation has been conducted on these potential problems in the Portuguese housing market.

The second potentially crucial determinant, and most relevant in the case of Portuguese women, is the impact of network effects (losses) and its relation with childcare responsibilities. According to Torres (2008), whereas the majority of men in Portugal turn to their (female) partners as their primary social network for childcare, the majority of women turn to their family, particularly to their mothers (grandmother of the children). Moreover, the ability to mobilize these primary social networks increases with financial capacity (Torres, 2008) and, therefore, individuals with the least access to support networks are the ones who require them the most. This goes along with the findings of Collischon and Eberl (2021) who find that in the UK as much as 15% of the overall gender wage gap is explained by network structure differences. This means that it is probable that the results found by Torres (2008) are just a small indicator of a result that can be translated into other social networks - women struggle to 'find their feet' and establish new networks/mobilize old networks when moving, which plays a big part in explaining the gender wage gap increase for those who move from one region to another. To mitigate the losses from network disruptions local and central governments need to both invest in resilient infrastructure (both digital (e.g. internet access for all) and physical infrastructure (e.g. transportation and communication networks)) which allows for easier network maintenance and in tools which help people establish new networks at their current location (e.g. providing subsidies or grants for the creation of organizations which help with integration (for example, for motherhood, one crucial element of integration is to connect with other mothers which could be trustful for childcare networks)).

Finally, we would like to conclude by addressing a direction for future research - given that there is still little research in Portugal about the consequences/results of the before mentioned *retraining programs* or regarding the gender disparities of *geographical mobility*, we think that, since the results on both topics are already established in previous literature it could be the next logical step to study these issues.

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Appendix

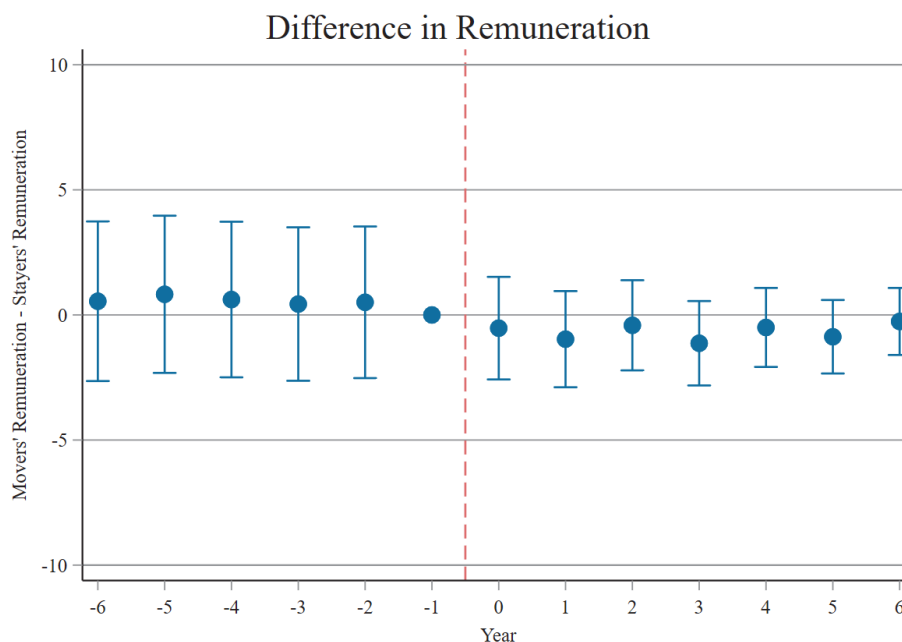


Figure 10: Wage Differences between (Geographic) *Movers* and *Stayers* Without Controls

Note: The coefficients of interest θ_k are represented by the point estimates of the graph. The coefficients are in percentage units (i.e. difference in % between both groups' earnings). The confidence intervals are represented at the 95% confidence level. As observable, the non-inclusion of the control variables vector does not change the outcome of the investigation, though we feel that it is important to include the vector of control variables in accordance with the literature on the topic. The fixed effects are necessary to control for individual and time-specific characteristics of the workers, firm characteristics and match quality effects.

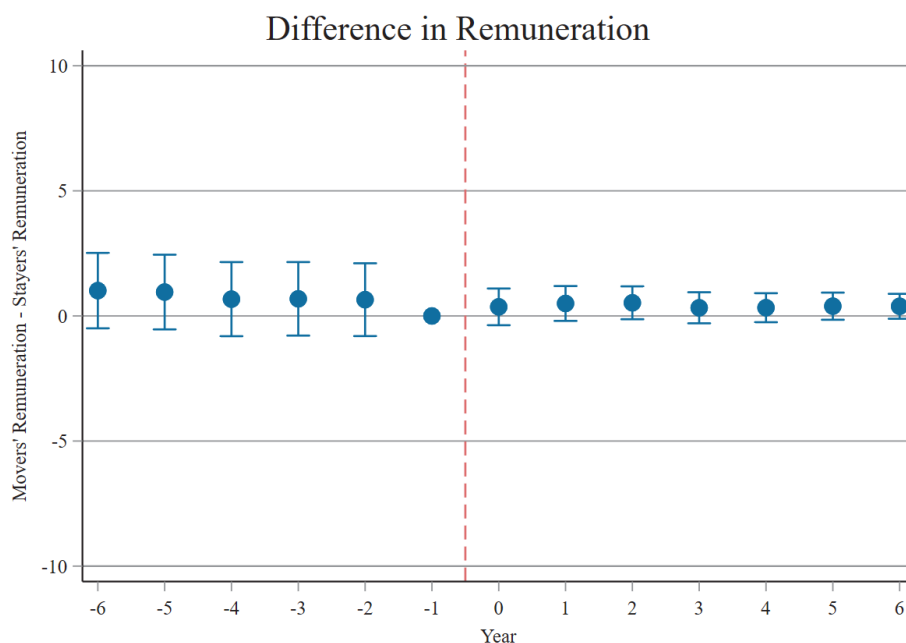


Figure 11: Wage Differences between (Industrial) *Movers* and *Stayers* Without Controls

Note: The coefficients of interest θ_k are represented by the point estimates of the graph. The coefficients are in percentage units (i.e. difference in % between both groups' earnings). The confidence intervals are represented at the 95% confidence level. As observable, the non-inclusion of the control variables vector does not change the outcome of the investigation, though we feel that it is important to include the vector of control variables in accordance with the literature on the topic. The fixed effects are necessary to control for individual and time-specific characteristics of the workers, firm characteristics and match quality effects.

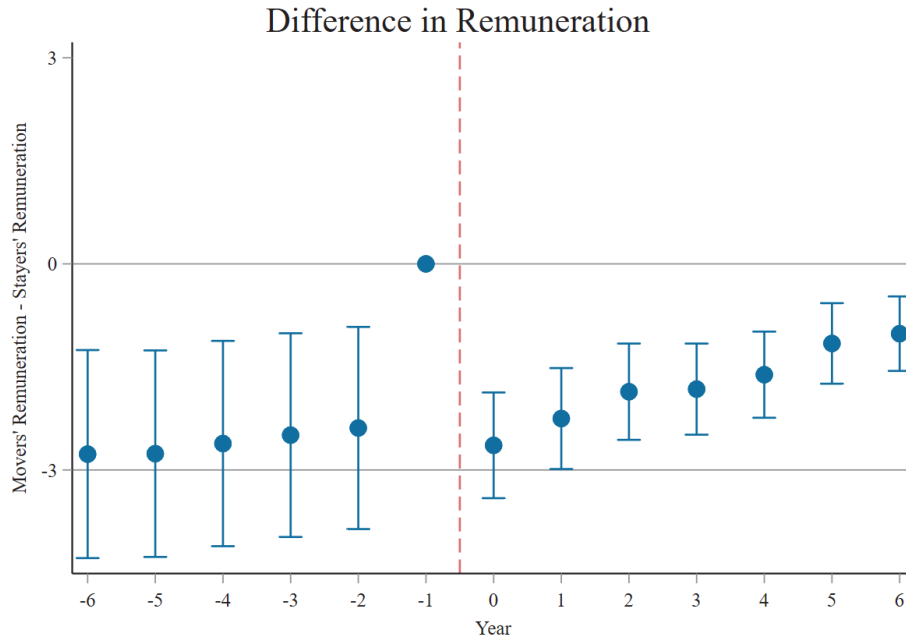


Figure 12: Wage Differences between (Occupational) *Movers* and *Stayers* Without Controls

Note: The coefficients of interest θ_k are represented by the point estimates of the graph. The coefficients are in percentage units (i.e. difference in % between both groups' earnings). The confidence intervals are represented at the 95% confidence level. Regarding occupational mobility, we can see that the inclusion of the control variables are key to the results - if not for their inclusion, the parallel pre-trends assumption would be violated and, therefore, preclude any causal inference on the effect of occupational mobility. Furthermore, we argue even further - we believe that there might be other variables unaccounted for, given the point estimates for the remuneration difference pre-displacement seen in 7. Because we are unsure which control(s) we are missing, we have decided to not include variables in a "trial and error" fashion, though we admit that this could be investigated further and is a major weakness of the report. The fixed effects are necessary to control for individual and time-specific characteristics of the workers, firm characteristics and match quality effects and also contribute to the failure of the pre-trends assumption.