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The Impact of Early Retirement Reform on Firms' Employment Adjustment

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Abstract

Facing low participation rates of old workers and an increase in life expectancy, in the last two decades many developed countries have reformed their social security systems to improve their long-term financial sustainability. In Europe, the starting point for the policy maker has been the increase in the statutory retirement age and the gradual phase-out of early retirement schemes. Against the common trend, the Portuguese legislator approved in 1999 an early retirement reform, allowing older workers to flexibilize their retirement decision. In this paper I analyze the effects of the 1999 reform on the retirement decision of the workers and the firms' employment adjustment. I find that after the reform workers retire earlier, and that the reform resulted in a job destruction process as firms do not replace old workers with young and prime age ones. I conclude that the reform failed to stimulate young employment and by allowing workers to retire earlier posed risks to the long-term sustainability of the Portuguese social security system.

Keywords: Social security, early retirement, labor force, net job creation

1 Introduction

The unsustainable debt dynamics of many advanced economies have stimulated a debate amongst policy-makers and academics worldwide on how to reach a structural budget balance, especially lately in troubled Euro zone periphery. Given the large share of social security expenditures in total public spending in

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the developed world, reforming the social security system has been the starting point for many policy-makers.

In Europe social security systems are suffering from two main phenomena: low participation rates especially in the extremes of the age spectrum (younger and older cohorts) and population ageing. If the latter is not matched with an increase in the participation rates of the elderly, overall participation rate will come down bringing with it an increase in the old-age dependency ratio, a widely-used measure for the burden of social security spending on the workforce.¹ Low labor force participation of older cohorts coupled with population ageing and excessive social security benefits have forced the European Union (EU) policy-makers to keep track of the population trends underlying the increase in social security spending. Back in 2009 the Economic and Financial Affairs (ECOFIN) Council gave a mandate to the Economic Policy Committee (EPC) to develop projections for social security-related public spending based on population projections from the Eurostat. The EPC created a working group, the Ageing Working Group (AWG), to deal with the issue. The figures emerging from the latest report (2011) are quite worrying: the old-age dependency ratio is likely to increase and almost double from 27.6 in 2011 to 53.3 in 2060, due to an increase in life expectancy coupled with a low birth rate in almost every European country. The latest available EPC's projections on public pension expenditures show an average Euro Area (EA) increase in pension-related public spending from 11% to 13.8% of GDP by 2060.² Thus, to reform their social safety nets and make them sustainable over time the EU policy makers have to deal with the problem of population ageing unmatched with an increase in the labor force participation of older cohorts.

To stimulate elderly participation in the labor force and thus improve the fiscal sustainability of social programs and reduce their burden on the labor force, in the last ten to fifteen years almost every European country has reformed its social security system. Measures range from fundamental reforms such as the shift to defined contribution schemes to parametric reforms and changes in the early retirement schemes. The most common pension reform in the last two decades has been the increase in the legal retirement age. In Austria, the 2003 reform gradually increased the legal retirement age to 65 and 60 for men and women, respectively. Amongst the countries that implemented fundamental reforms, Italy introduced in 1995 a gradual shift from the generous defined-benefit scheme to a notional defined-contribution scheme, which offers strong financial incentives for late retirement. In Portugal, to link the benefit stream to the average life expectancy at retirement, the policy makers introduced in 2007 a "sustainability factor" that corresponds to a penalty for early retirement. According to the EPC-AWG's projections, the implementation of these reforms should bring an increase in the labor force participation of people aged 55-64 by around 9.2pp by 2020, 14.8pp by 2040 and 15.5pp by 2060. For a country that

¹Old-age dependency ratio = People aged 65 or more/People aged 15-64.

²Estimates are dated 2009. In the latest report, "[...] the EPC decided that it would be preferable if projections of pension expenditure were carried out by the Member States using national models."

modified the structure of the system (fundamental reform) such as Italy, the increase in elderly participation is expected to be as high as 22.1pp by 2060. In Portugal, on the other hand, the implementation of a non-fundamental reform will deliver only an 8pp increase in the elderly participation rate by 2060.³ These projections should promote the implementation of fundamental reforms as they naturally increase the tax-benefit links of pension systems and create incentives for a longer working life.

Even though population ageing and deterioration in public finances stemming from excessive pension-related spending is nowadays a consolidated issue in the European and worldwide debate, back in the early 1980s the position of the reforming policy maker was quite the opposite, especially in Europe. In 1982 the European Union approved a recommendation to the Member States in which it defended the right to a flexible retirement age.⁴ According to the European Directive, Member States had to reform their social security system to allow workers to choose freely their retirement age and avoid imposing excessive penalties for early retirement. Up until the 2000s, some countries welcomed this guidance and reformed their social security system to facilitate early retirement, also moved by the possibility of freeing up jobs for younger cohorts. The experiment resulted to be a failure, especially in Germany, as documented by Jackson (2003). Portugal have first facilitated the access to early retirement schemes to curb the problem of long-term unemployment (1993), to then extend the flexibility in retirement age (with a penalty for early retirement) to all the workers aged 55-65 with at least 30 years of contributions to the system (1999).

Studying the Portuguese reform and its outcome can help understanding why some social security systems in Europe are destined to grow unsustainably. More concretely, one should be interested in understanding if the implementation of such a reform creates incentives for early retirement, even though a penalty was embedded in the design of the reform. If early retirement is not coupled with the creation of jobs for younger cohorts, social security spending is likely to increase, creating an excessive burden on the reduced workforce. In addition, analyzing the outcome of the reform at the aggregate level could reveal the main trends in the labor creation process in Portugal. In this paper I am interested in estimating the impact of the early retirement reform on the hazard of leaving the labor force for male workers in Portugal. I exclude female workers to avoid mixing the impact of two different reforms that affected the Portuguese labor market during the 1990s: one is the reform under analysis, while the other is the increase of the female legal retirement age by 1999 (the reform was approved in 1993 with a gradual phase-in ended in 1999). Given that workers, in the post-1999 period, have the possibility to retire earlier, they might effectively decide to leave the labor market before 65 years old and, on the other hand, firms might decide not to substitute them with younger or prime-age workers. In other words, I am interested in the job creation and destruction process in the post-reform period in Portugal. The main questions I want to address are: Does

³See the EPC and EC Report (2011) on population ageing for a detailed description of the reforms included in the projections exercise for each country.

⁴EU Council Directive 82/857/CEE.

the early retirement scheme introduced in 1999 increase the hazard of leaving the labor market before statutory retirement age for male workers? Are firms willing to substitute these early-retiring older workers with young or prime-age ones? Has Portugal, *ceteris paribus*, created or destructed jobs as a consequence of the 1999 reform?

The paper is organized as follows. Section 2 discusses the main findings of the literature on early retirement and offers an overview of the main stylized facts on older workers' participation rates. Section 3 presents the institutional framework in Portugal for both the pre- and post-reform periods. I discuss methodology and data in section 4. Section 5 analyses the retirement decisions of the workers and the employment adjustment of the firms after the 1999 reform and presents the estimation results. Section 6 concludes and presents the main findings and policy implication for the future of the European policy debate.

2 Literature review and stylized facts on early retirement

Given the overwhelming evidence of the decrease in the elderly participation rates since the early 1970s (especially for male workers aged 55-64), previous literature has been focused on investigating the reasons of such trend (Table 1). Diamond (2005) finds that the increase in real earnings has played a central role in this phenomenon. He argues that higher real earnings allows for higher consumption patterns even without an increase in the working life, which seemed natural considering the increase in the average life expectancy.⁵ From a perspective of income and substitution effects, the income effect prevails and higher consumption is consistent with an increase in leisure. Blöndal and Scarpetta (1998) observe that much of this early withdrawal resides in the financial disincentives to work longer. They argue that working one extra year after the statutory retirement age corresponds to an implicit tax on continued work, as the drop in old-age pension wealth amounts to 50-80% of gross income, thus removing incentives to work longer.⁶ Given that one-extra year of work corresponds to both foregone benefits and paid contributions, eligible workers prefer to retire earlier if the penalty for early retirement doesn't offset the drop in pension wealth. Finally, Blöndal and Scarpetta (1998) estimate using pooled cross-country and time series data for 15 countries an econometric model for the labor supply of older workers, including incentives for early retirement and other factors that might explain the retirement decision (such as the prime-age workers unemployment rate, the level of wage rigidities and others).⁷ They find evidence that the removal of disincentives to work for the 55-64 year-olds could

⁵Diamond (2005) also refers to the decrease in the physically demanding labor.

⁶Pension wealth is defined as the future value of the stream of pension benefits minus pension contributions.

⁷Prime-age workers unemployment rate could retain unemployed older workers from actively searching for a job, as it acts as a discouragement factor.

increase their participation rates by 4-8%, depending on the generosity of such income support programs.

Table 1. Labor force participation rate, men 55-64, selected OECD countries

Country	Labor force participation, males, 55-64					Change 2000-2011
	1970	1980	1990	2000	2011	
Australia	85.11	69.02	62.83	60.79	71.65	10.86
Belgium	..	..	35.41	36.31	47.82	11.51
Canada	..	74.48	64.00	60.70	68.46	7.77
France	..	..	39.35	35.35	47.08	11.73
Germany	80.24	67.33	55.94	52.41	71.68	19.26
Greece	..	..	59.46	57.34	57.28	-0.07
Ireland	..	..	65.02	64.91	65.48	0.57
Italy	48.20	39.60	53.04	42.75	50.67	7.92
Japan	86.65	85.36	83.26	84.14	83.14	-1.00
Netherlands	..	63.15	45.67	50.94	68.61	17.66
Portugal	..	74.62	66.48	64.43	61.64	-2.79
Spain	..	75.87	62.48	60.46	63.66	3.19
Sweden	85.41	78.81	75.49	72.64	80.05	7.41
United Kingdom	..	..	68.14	63.22	68.62	5.40
United States	82.96	72.11	67.77	67.30	69.30	2.05
EU 15	67.07	65.77	55.43	51.50	61.20	9.70
Europe	67.07	66.21	56.25	51.28	59.38	8.10
G7	80.52	72.94	65.69	63.50	68.78	5.28
North America	82.96	72.32	67.37	68.67	70.54	1.88
OECD	79.01	73.03	64.84	62.53	67.61	5.08

Source: OECD Labor Force Statistics (online)

Gruber and Wise (2002) calculate the amount of the implicit tax on continued work after retirement is possible. They base their calculations on the missed benefits when postponing retirement and the existence of a pension premium for late retirement. The implicit tax can be seen as the decrease in the expected discounted lifetime income for a worker who decides to continue working after the statutory retirement age (or after the first available age of retirement where early pensions are available). They conducted their analysis on a sample of 11 countries and found that the higher the “tax force” the lower the participation rates of elderly workers. Thus many social security systems include a penalty for late retirement, and usually individuals prefer to retire as soon as they are eligible for retirement in order to avoid losing income.⁸

⁸In principle, statutory and early retirement age should not per se affect retirement decision. According to the lifecycle hypothesis, forward-looking individuals can choose the retirement age that maximizes their welfare by borrowing or lending in the capital markets (Duval, 2003). However, even the most detailed microeconomic models failed to explain the large jump in retirement rates at the early and statutory retirement ages.

Gruber and Wise (2002) conclude, after running a simulation on the selected 11 countries, that delaying benefit eligibility by 3 years could increase the participation rates for men aged 56-65 from 23% to 36%, offering empirical support against the application of the life-cycle theory in this context.

Given the evidence of widespread use of early retirement schemes, it is useful to take a closer look to the characteristics of those who leave the labor market earlier than the statutory retirement age. Blöndal and Scarpetta (1998) show using data from the European Union Labor Force Survey of 1995 that different educational attainment are related to different participation rates in the labor force. In Portugal, for instance, the share of retirees among male workers aged 55-64 with vocational education is almost double than for those with tertiary education (Table 2). I find evidence that the conditional probability for male workers of leaving the labor force earlier (hazard ratio) is higher for low-skilled workers in Portugal (see section 5 for more details). The common explanation of these patterns is that lower education is usually related to lower incomes and lower job stability, thus making more attractive for low-educated workers to retire earlier.

Table 2. Share of retirees among male workers 55-64 by educational attainment in 1995, selected EU countries

Country	No further education (%)	Vocational education (%)	Tertiary education (%)
Belgium	53.40	57.60	36.90
Denmark	32.50	24.10	15.10
Finland	35.00	43.60	30.20
France	51.10	47.60	28.90
Germany	29.20	28.50	21.60
Greece	29.60	38.60	35.40
Italy	44.70	47.40	22.20
Luxembourg	74.50	62.50	28.40
Netherlands	56.80	48.20	40.80
Portugal	28.20	40.00	20.80
Spain	24.90	26.90	21.60
United Kingdom	24.10	20.60	21.40

Source: Blöndal and Scarpetta (1998)

Early retirement have complemented the problem of ageing population and have resulted in an increase of the old-age dependency ratio, which in turn is considered the crucial problem to the financial sustainability of the unfunded pension schemes (PAYG). The obvious question then is why the majority of voters in many OECD countries supported such early retirement schemes. An interesting politico-economic explanation of this issue is offered by Conde-Ruiz and Galasso (2003). Using an overlapping generation model they argue that the political support for generous early retirement schemes hinges on two conditions: first, the existence of a large number of redundant and unemployed

elderly workers with incomplete working history, the case of many European countries. Second, the early retirement scheme has to include an element of intragenerational redistribution via the utility from leisure.⁹ If the first condition ensures the creation of early retirement schemes, the second one is needed in order to ensure its political sustainability over time. The majority of voters who support the scheme is composed by redundant or unemployed elderly workers and by low-ability young workers who expect to retire early.¹⁰

One of the main issues for policy makers in Europe and around the world in the last two decades has been how to increase labor force participation and offset the deterioration in public finances stemming from early retirement and ageing population. The obvious and at the same time controversial choice has been to reform the social security systems to remove or at least reduce the implicit tax on continued work. The pension reforms approved by these policy makers can be used as "policy experiments" to gauge the impact of the reforms on labor market participation rates, especially of the elderly. Arpaia, Dibzack and Pierini (2009) analyze the short-term impact of pension reforms on labor participation rates for male and female workers in the 50-64-age range. Using a sample of 27 countries over the period 1990-2006 and a difference-in-differences approach controlling for the economic cycle, they found that fundamental reforms increase the participation rates of older men in the EU and EMU by about 2/3 and 1/2 percentage points within 2 years, respectively. Non-fundamental reforms mostly affect female participation rates, while for men the effect is insignificant. What is more interesting for our purposes, early retirement reforms affect men participation rates only in the EMU and for the 60-64 age group. The authors find that after such a reform the increase in the participation rate for this subgroup is about 3pp within 2 years.¹¹

Given that the focus of my analysis is Portugal, it is worth taking a closer look to the main findings related to the retirement patterns in this country. Albuquerque, Arcanjo and Escaria (2009) use the Eurostat European Community Household Panel (ECHP) to investigate the main characteristics of the early retirees in Portugal. Using both hazard rates and probit estimates, they find that health status positively affects the early retirement decisions, while family size has the opposite effect. Surprisingly, they find that educational outcome does not influence participation rates of elderly workers. If evidence of the effect of health on early retirement is extensive, also education seems to play a role (Table

⁹If leisure is valued indifferently among individuals, those with higher incomes find less convenient to retire earlier, as the increase in utility coming from leisure might not offset the loss in utility from the foregone income. Thus, the early retirement scheme is mostly used by low-income individuals and de facto represents an intragenerational redistribution scheme. Empirical evidence of this fact is found in Blöndal and Scarpetta (1998).

¹⁰Low ability is usually associated with lower educational attainment, which is in turn related with lower incomes. See Spence (1973) and Becker and Chiswick (1966).

¹¹Arpaia, Dibzack and Pierini (2009) define fundamental reforms as those which change the first pillar from a defined benefit to a notional defined contribution scheme, transfer public pension savings to privately funded schemes or change the eligibility conditions (increase in statutory retirement age, etc.); non-fundamental reforms as those which change the tax regime of contributions and pension benefits, gradually introduce second and third pillar or change the indexation rules; the last group comprises reforms that phase-out early retirement schemes.

2).¹² Albuquerque, Arcanjo and Escaria (2009) also investigate the relationship between income and retirement choices. If personal income affects negatively the decision of early retirement, capital income does not seem to play any role in labor supply choices. This is somewhat in contrast with what the life-cycle theory predicts: as Diamond (2005) argues, the increase in real earnings should have deterred older workers to continue to supply labor as the income effect could have ensured higher consumption and higher leisure. What seems to be the case is that the opportunity cost of leaving the workforce is higher when labor income is higher, thus making it more expensive for high-income workers to retire earlier.

My analysis differs from that of Albuquerque, Arcanjo and Escaria (2009) in two important dimensions: first, I use a different dataset, the *Quadros de Pessoal* (QdP), a Portuguese dataset that includes information on workers and firms that is collected every year from 1986 to 2009.¹³ Second, although I also estimate hazard rates and investigate the characteristics of the early retirees, the final aim of my work is to understand if an early retirement reform has, *ceteris paribus*, an impact on the overall process of job creation in Portugal. My analysis is conducted at the firm level using a difference-in-differences approach to evaluate the impact of the early retirement reform approved by the Portuguese policy maker in January 1999 on the worker flows. Specifically, I am interested in understanding whether firms effectively replaced early retirees with prime-age and young workers, thus supporting the policy from an across-cohorts labor creation standpoint.

3 Institutional Framework

In this section I discuss the institutional framework in which the analysis is conducted. I start with an overview of the social security system in Portugal to then discuss the reforms implemented by the Portuguese legislator in the period between 1993 and 2012.

3.1 Social security system in Portugal

At the beginning of the 1990s, the Portuguese public social security system was composed by three pillars: the insurance-based subsystem, the non-contributory subsystem and the social action subsystem. The most important of the three is the insurance-based one, which is divided in a general scheme and a small voluntary insurance component and provides earnings-related benefits. The system

¹²Sickles and Taubman (1986), for instance, find that health and education, among other factors, influence the retirement decision. Their results are quite consistent as they are generated by structural estimation of a joint health-retirement model to account for error dependencies and other factors. They also argue that health might be endogenous because it could be affected by the occupational choice of the individuals, typically in the unskilled professions.

¹³With the exception of 1990 and 2001.

covers all the workers in the private sector (both employees and self-employed) and offers protection against a decrease in earnings due to unemployment, occupational disease, sickness, employment injury, disability, old-age and death. The system is run on a PAYG basis and it is funded by contributions of workers (11%), self-employed (until 1998 23%-28% of the reference income, after 25.4%-32%) and employers (23.5%). Before 1993 the pension was calculated using as reference earnings the average of the highest 5 annual labor earnings over the last 10. Full pension was released with at least 36 years of contributions and the formula used was $P = W \times 2.2\% \times N$, where P is the pension, W reference nominal earnings, N the number of contribution years and 2.2% the benefit accrual rate. The statutory retirement age was 65 for men and 62 for women.¹⁴

3.2 Towards the early retirement reform

Back in 1982, in the document EU 82/857/CEE, the European Council recommended a flexible retirement policy, allowing workers to postpone or bring forward their retirement age. In other words, retirement age was not seen as mandatory. In addition, member States should not penalize excessively those who decide to retire early, and the penalty on pension benefits should not prevent those who are entitled to exercise their early retirement rights.

The Portuguese policy maker was not the leader in introducing the aforementioned principles in the national legislation. The introduction of the first proper early retirement scheme dates back in 1993, with the approval of the Decree-Law 329/1993. The entitled were the long-term unemployed with at least 55 years of age and 30 years of contributions to the social security scheme.¹⁵ The legislator introduced a penalty for early retirement corresponding to 4.5% of the value of the benefits for each year the pension was received below the statutory retirement age (65 years old). The penalty was reduced by one year for every 3 extra years of contributions above the minimum 30 years to be eligible. For instance, a worker with 33 years of contributions in the situation of long-term unemployed could have claimed retirement benefits at the age of 64 without incurring into a penalty for early retirement. In addition, the 1993 reform increased gradually the statutory retirement age for women from 62 to 65, by 6 months every year in the 1994-1999 period, increased the window over which reference earnings are calculated and changed the pension formation formula.¹⁶ The new pension was calculated using the formula $P = W_R \times 2\% \times N$, where P is the pension, W_R the real reference earnings, calculated as the average of the 10 highest annual labor earnings in the last 15, N the number of years of

¹⁴Given that until 2009 the system did not apply to workers employed in the financial sector, I exclude them from the sample. The Decree Law 54/2009 determined the unification of the two systems. Today, workers employed in the financial sector are covered by the insurance-based subsystem.

¹⁵According to the Portuguese legislation, long-term unemployed are those who have been actively searching for a job for more than 12 months.

¹⁶For an extensive analysis on the effect of the increase in the legal retirement age for women on the labor market flows and firms' performance see Martins, Novo and Portugal (2009).

contributions and 2% the accrual rate. Substantially, the 1993 reform aimed at strengthening the tax-benefit link of the social security system.

With the approval of the Decree-Law 9/99 in January 1999 the Portuguese legislator, inspired by the aforementioned EU principles on flexible retirement, extended the early retirement scheme to all workers with at least 55 years of age and 30 years of contributions to the system, with the same penalty structure as in the 1993 reform. The reform was aimed at improving labor market conditions (possibly to free-up jobs for younger workers) and at allowing workers with complete working lives to retire earlier.

The latter reform represents a policy experiment through which analyze the retirement decisions of the workers and assess the overall effect of such a reform on the worker flows in Portugal. More concretely, I am interested in understanding whether elderly workers effectively take on the early retirement opportunity and which are the characteristics of the early retirees. As I showed in Tables 1 and 2, Portugal is one of the few countries in which participation rates for elderly workers dropped in the 2000s' decade. In addition, participation rates are much lower for elderly uneducated workers. Thus, one must shed some light on who finds more convenient to retire early. The issue is puzzling: on the one hand, one might think that if income is high, the income effect prevails on the substitution effect and higher consumption is possible even with fewer working hours. Thus, high-income individuals retire earlier. On the other, high labor income might retain workers from retiring earlier as the opportunity cost would be too high. Finally, the implicit tax on continued work plays a great role in the retirement decision.

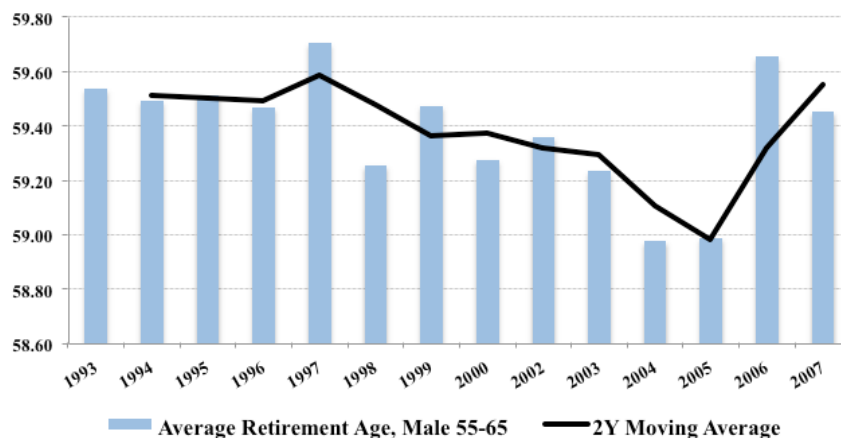
We can also analyze the effect of the 1999 reform from the labor demand perspective. Older workers are typically less productive, and might be costlier for firms than young individuals. Firms could take advantage of the early retirement scheme to dismiss older workers and replace them with younger and more productive ones. If this is the case, then the 1999 reform can be deemed as a success, in the sense that stimulated young employment while flexibilizing the retirement decision of workers with a complete working path. If the reform instead reduced the participation of older workers without stimulating young employment, then it is more of a failure in the sense that it created a burden on the social security system by posing risks to its long term sustainability.

The time horizon of my analysis goes from 1993, when the early retirement scheme was firstly introduced, to 2005, when the scheme was suspended until December 31, 2006.¹⁷ By 2005 it was clear to the Portuguese legislator that the penalty for early retirement was insufficient to maintain the financial sustainability of the social security system in the long run. In addition, the demographic evolution of the population added to the accumulation of deficits in the insurance-based subsystem. A system that incentivized early retirement with the levy of an implicit tax on continued work was not consistent with the need of promoting longer working careers, and thus reformed. Using the *Quadros de Pessoal* dataset, which I describe in the next section, I can show that for those

¹⁷Decree-Law 125/2005, August 3, 2005.

individuals in the 55-65-age range the average retirement age decreased after 1999, to only increase again after 2005, when the early retirement scheme was suspended (Chart 1). In 2007 the legislator, after conducting a study on the sustainability of the pension system, reintroduced the early retirement scheme with an increase in the penalty for early retirement (6% of the value of the benefits for every year the pension is received in advance of the 65 years old statutory retirement age). Lately this year, the Government temporarily suspended the scheme again under recommendation of the official sector (European Central Bank, European Commission and the International Monetary Fund, so-called Troika) in the mark of the Economic Adjustment Program.

Chart 1. Average retirement age, male workers 55-65, 1993-2005¹⁸



Source: *Quadros de Pessoal* (QdP) and author's calculations

4 Data and methodology

4.1 Data

To conduct my analysis I use *Quadros de Pessoal* (QdP), a longitudinal dataset matching employers and employees in Portugal. The dataset is collected every year from 1986 to 2009 in the reference month (March up to 1993, October since 1994) by the Ministry of Employment and Social Security based on a census of firms employing at least one worker.¹⁹ Civil servant, self-employed and domestic workers are excluded from the sample. Coverage of agriculture is not extensive given the low share of wage earners in the sector. Personnel on

¹⁸Workers with a working life below 30 years were excluded from the sample. Data were not collected in 2001.

¹⁹Data was not collected in 1990 and 2001.

short-term leave, such as sickness or maternity, are included, while those in long-term leave, such as military service, are not. Workers and firms entering the database are assigned a unique identification number (social security number in the case of the workers), which ensures they can be followed over time.

The dataset is very rich in details: firms' reported data include location, industry, legal setting, the share of public/private and domestic/foreign ownership and employment, while for workers it reports characteristics such as gender, age, skill and education level, hiring date, occupation, tenure, earnings, hours worked and so on.

There are multiple advantages when using such a dataset. First of all, the survey is mandatory and thus has a very high response rate. Secondly, employer-reported data are known to be less subject to measurement error than worker-reported data, such as those coming from the unemployment survey. Last and most important, given the mandatory nature of the survey, well-known problems of panel data such as panel attrition are considerably attenuated.

The main disadvantage of using the QdP is that one cannot tell whether a worker is unemployed, left the labor force or has opted for retirement when he/she leaves the dataset. In the next subsection I discuss in detail the definition of retirement used and comment on the modifications to the dataset prior to the empirical estimation.

4.2 Methodology

I overcome the aforementioned problem related to the QdP by defining as retirement year the maximum year in which a worker is present in the sample. Retirement age is defined as the age in the retirement year. Given that some individuals may drop from the sample at very early stages, I restrict the observations to those individuals aged 45-75, i.e., 10 years before legal retirement is possible and 10 years after the statutory retirement age. The choice related to the first possible retirement age is based on previous literature. For instance, Latulippe (1996) estimates the average retirement age for OECD countries in the period 1950-1990 and defines 45 years old as the minimum retirement age. Given that the 1993 and 1999 reforms only allow for early retirement if a worker has contributed for at least 30 years to the system, I include in the sample only workers with at least 30 years work experience.

In my analysis I only cover workers in the secondary and tertiary sectors, while I drop primary sector's workers. I also exclude financial sector's workers as until 2009 they were not covered by the public social security system.

The labor market effects of the 1993 reform, which gradually increased the legal retirement age for women from 62 to 65 in the 1994-1999 period, are likely to interfere with the impact of the 1999 reform and for this reason I remove female workers from the sample.

The time span of my analysis goes from 1993, when the first early retirement reform was approved, to 2005, when early retirement was suspended.

In the next two subsections I present, respectively, the methodology used for the survival analysis and for the difference in difference estimates implemented to analyze the process of job creation in Portugal after the 1999 reform.

4.2.1 Survival analysis

The first step I take in the estimation of the hazard and survival function is the non-parametric approach, widely used for descriptive purposes. From the QdP we have $t_1 < \dots < t_j < \dots < t_{30}$ observed discrete failure times of the spells, from 45 to 75 years old. These correspond to the different possible ages of exit from the labor market (retirement). At the end of period j we have d_j individuals who dropped from the sample. To account for right censoring, we define c_j as the censored spell in the time interval $[t_j, t_{j+1})$. Given the way I defined retirement, right censoring only occurs for those individuals who are still in the sample at the end of 2005. For these spells, we only know that the failure time is greater than t_j . The number of spells at risk just before t_j , denoted r_j , is then composed by those who have not yet failed and those who are censored, that is, $r_j = (d_j + c_j) + (d_{j+1} + c_{j+1}) + \dots + (d_{30} + c_{30})$. In the first period the number of individual at risk is the entire sample.

The hazard rate is the probability of exiting from the labor market at the end of period j conditional on being active until t_j . In other words, $h_j = \Pr[T = t_j | T \geq t_j]$, where h_j is the hazard rate. An easy way to estimate the non-parametric hazard rate is then:

$$\hat{h}_j = \frac{d_j}{r_j} \quad (1)$$

which is the number of spells ending at time j divided by the number of spells at risk at time j .

The product limit estimator of the survivor function, also known as the Kaplan-Meier estimator, is given by:

$$\hat{S}(t) = \prod_{j|t_j \leq t} \frac{r_j - d_j}{r_j} = \prod_{j|t_j \leq t} (1 - \hat{h}_j) \quad (2)$$

which is the multiplication over the j time intervals of the proportion of individuals surviving over the spells at risk.

To estimate consistently fully parametric model for single-spell duration data I use a proportional hazard model, in which the conditional hazard rate of the form $h(t|X) = h_0(t, \alpha)\phi(X, \beta)$ is factored into separate functions, one of time and a time parameter alone, $h_0(t, \alpha)$, and the other of the x covariates. The typical form chosen for the latter is the exponential one, $\phi(X, \beta) = \exp(\beta'X)$. This form makes the interpretation of coefficient easier, as a unitary change in the z^{th} explanatory variable increases the hazard rate by $\exp(\beta_z)$. Given the discrete nature of the dataset, in which failure times are essentially discrete, it might not be accurate to use continuous-time models such as the Cox PH specification

to estimate the effect of the reform on the hazard rate of exiting the labor market. Discrete-time hazard models can be estimated using the complementary log-log specification (*cloglog*), but this method requires the specification of a functional form for the baseline hazard. I use a piecewise constant specification for the baseline hazard, which consists of six intervals, one for every group of five years from 45 to 75 years old.

The discrete-time interval hazard function $h_j(X, \beta)$ is:

$$h_j(X, \beta) = \frac{S(a_{j-1}, X) - S(a_j, X)}{S(a_{j-1}, X)} = 1 - \exp[\exp(\beta' X) \cdot (H_{j-1} - H_j)] \quad (3)$$

The log-log denomination comes from the fact that taking the log of (3) twice we get:

$$\log(-\log[1 - h_j(X)]) = \beta' X + \log(H_{j-1} - H_j) \quad (4)$$

The baseline hazard for interval j is defined as $\log(-\log[1 - h_0(X)]) = \log(H_{j-1} - H_j) = \gamma_j$, and its functional form needs to be specified (piecewise constant in my case).

In the discrete-time duration model the interpretation of the coefficients of the covariates is the same as in the Cox PH model. After defining the “reform” variable as a dummy that takes value 1 in 1999 and after and 0 before the reform was implemented, the cloglog model tells us that in the post-reform period the hazard rate increased by $\exp(\beta_{post})$.

Another important issue that has to be taken into account is the unobserved heterogeneity (frailty). When analyzing retirement choices of individuals some factors might be omitted either because i) data is not available or ii) characteristics are intrinsically unobservable. In addition, there might be some measurement errors in the observed characteristics of the covariates, although I have already discussed in subsection 4.1 that using the QdP considerably reduces the chances of such errors. If unobserved heterogeneity is ignored in the model, one can get underestimation of the positive duration dependence in the hazard rate. Another issue when ignoring the unobserved heterogeneity is that one gets an underestimation of the true change in the hazard rate from a unitary change in the z^{th} regressor (β_z). Thus, controlling for the frailty is also important for the correct interpretation of the parameters of the covariates.

In my analysis, instead of assuming a continuous distribution for the frailty component, I follow a non-parametric approach proposed by Heckman and Singer (1984). The idea is to use a discrete mixing distribution instead of a continuous one, and to fit the discrete distribution through a series of parameters. These parameters are a number of mass points and the probabilities of a worker being located at each mass point. The duration dependence is now different for individuals pertaining to different groups (mass points). Of course the choice of the number of mass points is not obvious, but in my analysis I will assume there are two types of individuals, the early and late exiters. The hazard rate will be of the form:

$$h_j(j|X) = 1 - \exp[-\exp(\mu_m + \beta'X + \gamma_j)], \text{ for } m = 1, 2 \quad (5)$$

Using this approach we have two hazard functions, one for each group of individuals. In my case, $\mu_1 > \mu_2$, where μ_1 is the intercept for the early exiters, for whom the hazard rate is higher. The contribution to the sample log-likelihood for each individual with spell length j is the probability-weighted sum of the contributions for both groups.

4.2.2 Difference-in-differences approach and worker flows at the firm level

In this subsection I discuss the methodology used to estimate the impact of the 1999 reform on the worker flows at the firm level in Portugal. The following discussion is based on a review of the difference-in-differences methodology offered by Blundell and Costa-Dias (2008). For illustration purposes, I apply the discussion of the methodology to the net job creation of firms, which is the difference in the number of workers in the pre- and post-reform periods.²⁰

Defining the treatment and control groups is a key step in any valid policy evaluation method, especially when dealing with a natural experiment. In fact, in a non-experimental setting assignment to the treatment group is almost always not random. Consider the following specification for the employment of firm i in year t (L_{it}):

$$L_{it} = c + \alpha_i d_i + \beta' X_{it} + u_{it} \quad (6)$$

where c is the intercept, d the treatment dummy variable, X a vector of covariates with their respective coefficients and u a variable that collects unobservable characteristics of the firm. The parameter α_i is the effect of the reform on the employment of treated firm i . Randomization essentially corresponds to two assumptions:

$$A1 : E[u_i | d_i = 1] = E[u_i | d_i = 0] = [u_i] \quad (7)$$

$$A2 : E[\alpha_i | d_i = 1] = E[\alpha_i | d_i = 0] = [\alpha_i] \quad (8)$$

These assumptions state that there is no selection bias on the untreated outcome, i.e., there is no selection in the treatment group (A1), and that there is no selection bias on the expected outcome of the reform (A2). In my case, a firm is selected in the treated group if it hires at least one worker aged 55-65 with a minimum of 30 years work experience, thus the assumptions A1 and A2 do not hold, the latter because some firm may decide to be in the treatment group as it can be influenced to a greater extent by the reform.

²⁰The same methodology applies to the analysis of hirings, separations and hirings of young workers (aged 15-24).

If in principle one should be interested in the average treatment effect, in practice when leaving the aforementioned assumptions one can only identify the average treatment on the treated (*ATT*), which will be the parameter of interest in my analysis. The idea behind the *ATT* is that each firm experiences a different effect due to the treatment, and therefore each parameter associated to the treatment variable is different: the estimate of this parameter will be the average of all the different parameters across the treated units. The *ATT* tells us what is the average effect of the early retirement reform in 1999 on the net job creation process in treated firms.

Given that the framework of the analysis is a quasi-natural experiment, I can recreate partial randomization by using the difference-in-differences estimation strategy (*DID*), which consists in differencing the outcomes for the treated and non-treated before and after the change in policy takes place, assuming that there are firm-specific fixed effects included in the error term of (7). The treatment group is composed by firms that employ at least one worker aged 55-65 with a minimum of 30 years work experience.

A common problem of these non-experimental settings is that the control group may differ from the treated group up to some observable characteristics. To make the estimate of the *ATT* more precise, we then need to choose appropriately the units to include in the control group. This analysis is known as matching. The basic idea behind matching is that it recreates the treatment characteristics among the non-treated units, thus recreating the experimental setting that is missing in non-experimental settings. Correctly choosing the control group assures that the only difference between this and the treatment group is due to program participation.

The key assumption of the matching procedure is the conditional independence assumption (CIA):

$$L_i^0, L_i^1 \perp d_i | X_i \tag{9}$$

$$E[u_i | d_i, X_i] = E[u_i | X_i] \tag{10}$$

The assumption at (10) states that after controlling for a sufficient number of covariates the participation is independent on the treated and non-treated outcomes. The assumption at (11) is a direct consequence of (10), and states that the conditional mean of the error term is independent from the decision of participation. If CIA holds, then we can say that there is no selection bias on the unobservables.

The implication of the CIA is that treated and non-treated units are comparable with respect to the untreated outcome after controlling for characteristics included in the vector X . For each L^1 we have to find some L^0 with the same X (in term of firm's characteristics) and use L^0 as the counterfactual for L^1 . This, of course, implies that the variables contained in X do not determine exactly participation, otherwise we will not be able to find any counterfactual with the same X . This is the second important assumption of matching, the support

condition, which basically says that the probability of participating given X is not trivial. More formally:

$$\Pr[d_i = 1|X_i] < 1 \tag{11}$$

Another delicate issue when applying matching estimator is that we have to choose which variables to include in the X vector: too many variables would imply the failure of the common support condition, while too little set of variables would imply the failure of CIA. So in applying matching one should be careful at the moment of selecting variables. The problems that arise here can be addressed using matching on a function of X : this is usually modeled as the probability of being treated and it is called propensity score. More formally, it is defined as follows:

$$P(X) = \Pr(d = 1|X) \tag{12}$$

Rosenbaum and Rubin (1983) demonstrated that if the CIA is valid for X then it is also valid for the propensity score $P(X)$. There is an important advantage in using $P(X)$ instead of X , and is that we reduce the matching problem to a single dimension (the probability of being treated). Given that the nature of the treatment is not binary but discrete, I choose a slightly different approach. To estimate the propensity score I choose a Poisson model and use as dependent variable the number of workers aged 55-65 with at least 30 years work experience. The resulting propensity score is the expected number of workers with the aforementioned characteristics that a firm is likely to employ, given a set of covariates (X). The control group is chosen according to some pre-defined criteria, such as the proximity between the propensity score of the treatment and control group. In other words, firms are matched based on the expected number of 55-65 workers with at least 30 years work experience they are likely to hire given their characteristics.

Once we have a set of comparisons for the treated units we have to choose the weights to associate the selected set of non-treated observations to each treated observation. There are several methods to do that: I opt for kernel matching, which assigns a greater weight to the untreated units whose propensity score is closer to the propensity score of the treated units. The kernel matching uses a weighting function, which is decreasing in the distance from the propensity score of the treated (more distant is the untreated propensity to the treated propensity score, less weight it receives in the matching procedure). In any case, the types of weights one decides to use do not affect how the matching estimator is obtained.

When facing a quasi-natural experiment can be very suitable to combine *DID* and the matching estimator to obtain the so-called *MDID* estimator. Using this estimator we can relax the assumptions posed by the matching estimator. The basic problem surges with the CIA: usually the information included in X is not enough to guarantee that the decision whether to participate or not is independent on the untreated outcome up to a vector X . So using *DID* we can eliminate the effect on the decision of the unobserved variables as long

as they are constant over time (firm-specific fixed effects). In other words, we can adapt the CIA in (10) using the *A1* randomization assumption for the DID estimator:

$$A1 - DID : E[u_{it_1} - u_{it_0} | d_i = 1] = [u_{it_1} - u_{it_0} | d_i = 0] = [u_{it_1} - u_{it_0}] \quad (13)$$

The revised CIA is:

$$(u_{it_1} - u_{it_0}) \perp d_{it_1} | X_i \quad (14)$$

The matching hypotheses discussed above hold but now in term of the difference between before and after the treatment instead of levels: this means that the suitable units to be used as control groups are those who have evolved in the same way as the treated units if the latter had not received the treatment.

Given that we are working with a longitudinal dataset, the resulting matching estimator is:

$$\hat{\alpha}^{ATT} = \sum_{i \in T} \left\{ [L_{it_1} - L_{it_0}] - \sum_{j \in C} \tilde{w}_{ij} [L_{jt_1} - L_{jt_0}] \right\} w_i \quad (15)$$

where T and C refer to the treatment and control group and \tilde{w}_{ij} to the weights assigned by kernel matching when comparing the untreated firm j with the correspondent treated firm.

5 Results

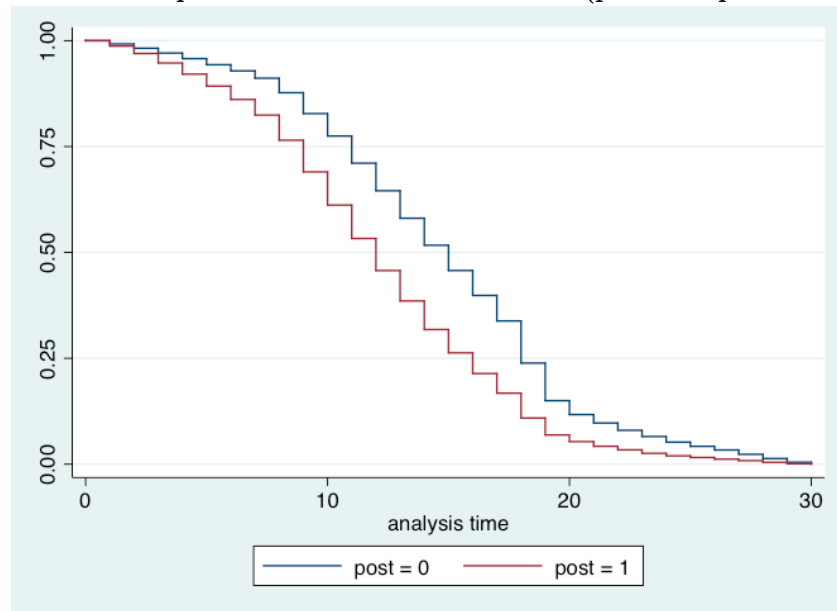
5.1 Worker level analysis

The 1999 reform introduced early retirement to workers with 30 years of contributions to the social security system and a 55-65-age range, and had a non-negligible impact on the retirement decision of Portuguese workers. As showed in Chart 1, the average retirement age for individuals aged 55-65 decreased from 59.47 in 1999 to 58.99 in 2005, to then increase back to 59.45 after the early retirement scheme was suspended in 2005. In what follows, I include in the dataset workers in the 45-75-age range with at least 30 years work experience. As discussed before, I exclude women and workers in the financial sector from the sample.

Chart 2 shows the Kaplan-Meier survival function for the pre- and post-reform period. The survivor function is decreasing with time more rapidly in the post-reform period, with the difference being statistically significant at the 1% level. Chart 3 shows the smoothed hazard rates for the pre- and post-reform period. Given that the construction is speculative to the survivor function, the hazard rate of leaving the labor market is higher in the post-reform period.

Given the discrete nature of the dataset, I use a complementary log-log model (*clog-log*) with piecewise constant baseline hazard to estimate the hazard rate. Given that only workers aged 55-65 are affected by the reform, I am interested in the interaction between the reform dummy and a treatment dummy that takes value one if the individual is in the 55-65-age range, and zero otherwise. As discussed in the previous section, the estimates of the model might be affected by unobserved factors. After accounting for unobserved heterogeneity using the mass-point distribution approach proposed by Heckman and Singer (1984), I obtain that in the post-reform period the hazard rate increases by 18.7% (see Table 3).²¹

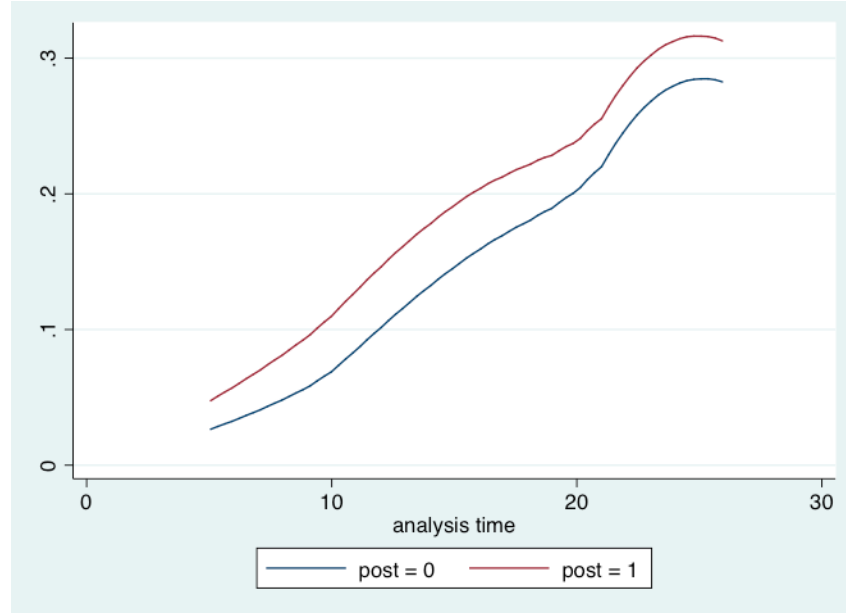
Chart 2. Kaplan-Meier Survivor Function (pre- and post-reform)



The heterogeneity follows a discrete distribution across two groups of individuals, the early and late exiters. Only 12.7% of the workers are of the former type, and for this group the baseline hazard rate is considerably higher. The results are as expected: the baseline hazard is increasing with age (positive duration dependence in the hazard rate) and the education level has a great impact on the hazard of leaving the labor market. For instance, holding an undergraduate degree decreases the hazard rate by 40,96%.

²¹Non-reported controls include the log of the size and the education level of the workers (from below primary to undergraduate degree).

Chart 3: Smoothed hazard estimates (pre- and post-reform)



The analysis supports the hypothesis that the 1999 reform caused a reduction in the working lives of Portuguese workers, as it did not set the adequate penalties for early retirement. If the education level determines at least in part income, results also indicate that the opportunity cost of leaving the labor market might be higher for high-income individuals.

Given the issues discussed above, flexible retirement age uncoupled with the financial incentives to work longer could represent a weight on the working class and finally on the sustainability of the social security system itself. The latter essentially depends on the ability of the economy to generate enough jobs to replace the early retirees and to keep the shape of the population pyramid. If the demographic trend does not support the latter hypothesis, I can test whether Portuguese firms have indeed replaced older workers who chose early retirement with young and prime-age ones. Particularly, if the reform was aimed at generating vacancies for younger workers, did it have the desired effect? In the next subsection I answer this question using a difference-in-differences analysis applied to Portuguese firms.

5.2 Firm level analysis

After organizing the dataset by firm and removing the units with more than 100 workers, I define net job creation in year t as the difference in the employment of firm i in year t and year $t - j$, where j is the base year. Given that I am interested in the cumulative effect of the reform on the net job creation in year

t , I use as the base year 1998, which is the last year before the approval of the early retirement reform. For instance, net job creation in 1999 is the difference in the number of employees in 1999 compared with 1998. Net job creation is computed for 1999, 2000 and 2002. Secondly, I define the treatment variable as one if a firm employs at least one worker in the 55-65-age range and a minimum of 30 years work experience, and zero otherwise. Given the discrete nature of the treatment, to estimate the propensity score assigned to each treated and untreated unit I use a Poisson specification with the number of workers in the 55-65-age range as the dependent variable, and the log of the sales, the share of public and foreign capital, the sector where the firm operates, dummies for firm size, the square and cubic of the number of workers employed, the log of the total remuneration (defined as the average remuneration times the number of workers in each firm) and the square and cubic of the log of the total remuneration as covariates.

Table 3. *clog-log* model with unobserved heterogeneity

Dependent variable: Exit = {0,1}		
Variables	Coefficient	Standard error
[45, 50)	0.701***	0.085
[50, 55)	1.772***	0.082
[55, 60)	2.305***	0.082
[60, 65)	2.857***	0.082
[65, 70)	3.080***	0.083
[70, 75]	3.365***	0.087
post-reform	0.119***	0.014
post-reform × treatment	0.171***	0.016
log(size)	0.074***	0.002
primary education	-0.085***	0.016
secondary education	-0.221***	0.025
vocational education	-0.404***	0.152
college	-0.527***	0.033
constant	-4.06***	0.080
constant _{Type E}	3.404***	0.040
Prob. Type E	12.7%	0.002
Prob. Type L	87.3%	0.002
Observations		377,854

E = early exiter; L = late exiter

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

After obtaining the propensity score, I match firms using the propensity score matching technique described in section 4.2.2, using the Poisson propensity scores and the Epachenikov kernel function (with bandwidth parameter $h = 0.2$) to choose the appropriate controls for the treated units. Results are shown in

table 4. Using the Poisson model to calculate the propensity scores, I find that the treated firms have created, on average, 1.16, 2.22 and 3.84 less jobs than their untreated counterparts in the period from 1998 to 1999, 2000 and 2002, respectively, with the results being statistically significant at the 1% level.

To better understand to what extent the net job creation process comes from less hirings, more separations or a combination of both, I calculate, using the same methodology, the effect of the 1999 early retirement reform on hirings and separations of Portuguese firms in the selected cumulated periods. Hirings are calculated as the number of workers hired in year t from year $t - j$, where j is the base year (1998), while separations as the difference between hirings and net job creation. Using the Poisson specification I find that treated firms hired, on average, 1.02, 1.49 and 1.43 workers less than their untreated counterparts from 1998 to 1999, 2000 and 2002, respectively. Regarding separations, treated firms lost, on average, 0.52, 1.10 and 2.23 workers more than their untreated counterparts from 1998 to 1999, 2000 and 2002, respectively. Results on hirings and separations are statistically significant at the 1% level.

Table 4. ATT: Kernel Matching - Poisson Propensity Score

Base Year = 1998	Cumulative until		
	1999	2000	2002
Net job creation	-1.156*** (0.119)	-2.219*** (0.148)	-3.845*** (0.209)
Hirings (Total)	-1.027*** (0.066)	-1.492*** (0.134)	-1.433*** (0.193)
Separations	0.525*** (0.102)	1.102*** (0.158)	2.226*** (0.255)
Hirings (aged 15-24)	-0.522*** (0.029)	-0.861*** (0.051)	-0.890*** (0.074)
Treated (%)	2.587%	2.967%	3.429%
Untreated (%)	97.413%	97.033%	96.571%
Total	138,797	117,243	89,275

Standard errors in parenthesis

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Analyzing the labor demand of firms by cohort is helpful in understanding whether flexible retirement schemes have, on the one hand, facilitated the early exit from the labor market, and on the other created opportunities for younger workers. After dividing workers by cohort, I calculate the hirings of workers aged 15-24 for firm i . Treated units have, on average, hired 0.52, 0.86 and 0.89 less young workers than the untreated units in the 1998-1999, 2000 and 2002 periods, respectively, with the results being statistically significant at the 1% level.

Given the nature of the reform, one would expect that the net job creation

process should be largely driven by separations. Although in the first two years the effect of the reform on hirings is higher than its effect on separations (in absolute value), in the 1998-2002 period treated firms have, on average, dismissed around two more workers than their untreated counterparts, while they have hired only around one worker less than the untreated firms. As expected, separations became the main determinant of net job creation from a cumulative standpoint. The reasons why firms should dismiss older workers with complete working paths could be various: first of all, workers' productivity. Lazear (1979) argues that retirement is mandatory because at an old age the wage level of the workers tends to exceed their productivity level. Thus, firms might find costlier to retain old workers.

Another reason could be the age structure of the firm. A firm with an old age structure is largely composed of workers whose skills are obsolete, especially during a period of skilled-biased technological change. Such a firm might facilitate early retirement. On the other hand, it is not clear why firms do not substitute old with prime-age and younger workers. Older workers may be less productive than younger ones, and a firm might be willing to renew its personnel structure by dismissing obsolete workers. This does not seem to be the case of Portugal, as treated units have, on average, hired around one less young worker than their untreated counterparts in the 1998-2002 period, thus not supporting the aforementioned hypothesis. The production structure could play an important role: a firm with an obsolete production structure might find it difficult to attract young individuals with an up-to-date formation. What seems to be the case for Portugal is that young workers are not suitable substitutes of older workers, and, perhaps, the physical capital structure of firms is not complementary with the skills of the emerging labor force.

The issue remains puzzling. What seems clear is that the reform failed to achieve its objective: if, on the one hand, it flexibilized the retirement decision of older workers, on the other it failed to stimulate employment of younger workers, posing risks to the sustainability of the first pillar of the social security system.

6 Conclusion

This paper investigates the effects of the reform approved by the Portuguese legislator in 1999 on the worker flows. The reform extended early retirement to every worker aged 55-65 with at least 30 years work experience. Following the EU Council Directive of 1982, the Portuguese policy maker reformed the social security system by rendering flexible the retirement decision of workers with a complete working path. Amongst the motivations of the early retirement reform, the policy maker was moved by the possibility of improving labor market conditions for the youngest cohorts. In other words, by allowing older workers to retire earlier, the legislator hoped for the possibility of freeing up jobs for young workers.

I analyze the effect of the reform from two perspectives: labor supply (worker level analysis) and labor demand (firm level analysis). Using discrete-time models for survival analysis, I find that the reform had a strong impact on the retirement decisions of older workers: the hazard rate of leaving the labor market increased by around 19% in the post-reform period. Thus, even though early retirement implies the payment of a penalty on pension benefits, workers anticipate their retirement decision. Previous literature investigates the reasons why workers should retire before the statutory retirement age. Diamond (2005) argues that the increase in real incomes allows for higher consumption even with fewer working hours. Thus, high-income individuals should find convenient to retire earlier. However, investigating the characteristics of early retirees, I find that the individuals who opt for early retirement are the less educated ones. If education determines, at least in part, the income level, it might be the case that for high-income individuals the opportunity cost of leaving the labor market is high, thus making it less attractive to retire earlier. Also Blöndal and Scarpetta (1998) find that in the EU early retirees are, on average, the less educated ones.

I also analyze the effect of the 1999 reform on firms' employment adjustment. Using a difference-in-differences matching estimator, I find that firms that employ at least one worker aged 55-65 with a minimum of 30 years work experience (treated units) create, on average, 2 less jobs in the 1998-2002 period than firms that do not employ such workers. Instead of stimulating job creation, the reform has resulted in a job destruction process. Investigating the dynamics of the job creation process, I find that it is largely driven by separations. In other words, treated units have dismissed more workers than their untreated counterparts in the 1998-2002 period. Firms could dismiss older workers because they are less productive, and they might replace them with younger ones. This does not seem to be case for Portugal, according to the findings discussed above. In fact, investigating the hirings of young workers I find that treated firms employ around one less worker aged 15-24 than the untreated units in the 1998-2002 period. Thus, the reform failed to stimulate young employment. Also the age and production structure could play a role: a firm with an old age structure is usually composed of older and obsolete workers, and might facilitate early retirement. At the same time, if the firm has an obsolete production structure, it might fail to attract young workers with an up-to-date formation. Such firms destroy employment as a consequence of the reform.

As in many other European countries, the Portuguese social security system is suffering from a low participation rate of older and young workers. By allowing workers to retire earlier and failing to stimulate young employment, the 1999 reform deteriorated the financial sustainability of the insurance-based subsystem, given the increase in life expectancy and the resulting higher old-age dependency ratio.

The policy implications of my analysis are various. First of all, policy makers should take into account that education is an important determinant of early retirement when reforming the social security system. They should design programs aimed at encouraging less educated workers to remain on the workplace and increase penalties for early retirement. In addition, they should improve the

information channel on the consequences of early retirement, especially for less educated workers who might find difficult to fully understand the decrease in their pension wealth. Another important fact policy makers should not overlook is that younger workers are not perfect substitutes for older ones, as they might differ in terms of experience and position held within a firm. As I showed, young employment did not offset the increase in separations of workers aged 55-65, posing risks to the sustainability of the social security system.

Further research is needed to investigate the reasons why firms dismiss old workers without replacing them with younger ones. More concretely, looking at the breakdown of hirings and separations by education or qualification of older workers might provide some insights on the dynamics underlying the net job creation process. Firms might be willing to dismiss old and low-educated workers and retain the more productive and educated ones. If this is the case, early retirement reforms should be complemented by job training programs addressed at improving the qualification and the education level of workers that are more likely to retire earlier.

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