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# Dangerous Flexibility –
## Retirement Reforms Reconsidered

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**Abstract**
Flexible retirement is supposed to increase labor supply of older workers without touching the third rail of pension politics, the highly unpopular increase of the retirement age. While this may have intuitive appeal, this paper shows that it might be wishful thinking. Economic theory tells us that flexible retirement policies can have a zero or positive effect on labor force participation while the effect on hours worked can be positive or negative depending on the distribution of leisure preferences. Thus, the overall effect is *ex ante* unclear. Empirical results from nine OECD countries show that the effect on labor force participation is *ex post* small and positive while the effect on hours worked is negative. Overall, there is no evidence of the desired positive effect on total labor supply. We conclude that the flexibility reforms enacted so far have failed to increase old-age labor supply and delineate several alternative options to achieve this aim.

## 1. INTRODUCTION

In the face of ageing societies, there is an on-going debate in many countries around the world on how to make pension systems more sustainable. The combination of rising life expectancy and low fertility rates, as well as the retirement of the baby boomers are putting pressure on pension systems. In order to ease the burden of demographic change, a common objective in many developed economies is to tap better into the pool of older workers. Against this backdrop, various governments have responded to the development by increasing the statutory retirement ages in the last years. Later retirement has two effects which help to stabilize the financial situation of pension systems: it reduces the volume of pension benefits to be paid and it increases the total labor volume that constitutes the tax and contribution base to finance the pension system.

Increasing the retirement age, however, is not a very popular policy. Politicians often consider reforms which are designed to make pension systems more sustainable and resilient against population aging as the "third rail in politics", referring to the high-voltage rail in the subway which gives a fatal jolt to those who touch it (Safire 2007, Lynch and Myrskyl 2009). Increasing the retirement age appears to carry a particularly high voltage.

Politicians therefore have invented a new kid in the town of retirement policies called "flexibility reforms". They are designed to allow workers to retire more "flexibly", "gradually" or "partially" as an elegant way to increase older workers' labor supply by relaxing constraints such as mandatory retirement, earnings tests which effectively impose maximum hours constraints and minimum hours constraints, and by introducing partial retirement, a combination of part-time work and pension benefit receipt.

While these measures may have intuitive appeal to policy makers and the populace in general, this paper argues that the labor market effects may be more wishful thinking than reality because flexible retirement policies may exert counteracting incentives when they are applied to the currently existing public pension systems. We show that it is *ex ante* unclear whether the goal of increasing older workers' labor supply can be achieved through flexible retirement. While some workers who retire early without the availability of the part-time option might extend their working lives on a part-time schedule, others might opt for part-time work instead of full-time work and thus reduce their total hours worked. It is therefore an empirical question whether flexible retirement can be a successful policy alternative to a later statutory retirement age when the aim is to increase the total labor volume supplied by older workers in order to strengthen the financial base of pension systems.

There is not much research on this issue. Previous research focuses on the effect of a particular reform in a specific country (see, e.g., Graf et al. 2011 for evidence on Austria, Huber et al. 2013 for evidence on Germany, Ilmakunnas and Ilmakunnas 2006 for evidence on Finland, and Brinch et al. 2015 for evidence on Norway). Gustman and Steinmeier (1983) study the presence and rationale for minimum hours constraints and cite empirical evidence that this is particularly salient for the US. They show that a minimum hours constraint changes retirement behavior since older workers may prefer part-time but are forced to decide between full-time work and full-time retirement. The dynamic programming model by Gustman and Steinmeier (1984, 1986, 2004) predicts that the typical minimum hours constraint in the US generates earlier retirement than in the case of unrestricted hours. There are also restrictions on the maximum amount of labor that households may supply. The most prominent examples are earnings tests, which distort labor supply at older ages in many countries (Börsch-Supan et al. 2017). There are also studies which show that older workers would prefer to reduce their working hours towards their retirement as an alternative to fully retiring (Gielen 2009, Büsch et al. 2010, Cihlar et al. 2014 for evidence on Germany).

This paper employs an international view to study the effect of flexibility reforms. It collects evidence of different reform measures taken in various countries and compares those policy measures. Due to the cross-national variance in pension rules, this should reliably identify the effectiveness of the partial retirement reforms in increasing the total labor supply of older workers. We use aggregate time series data from the OECD's employment database for a subsample of nine OECD countries which introduced partial retirement reforms in the past, namely Australia, Austria, Belgium, Denmark, Finland, France, Germany, The Netherlands and Sweden. Using this sample, we first estimate the effect of flexible retirement on labor force participation (extensive margin) and then on working hours of older workers (intensive margin). Our distinction between the intensive and the extensive margin is an important feature of this paper. So far most of the studies evaluating the effects of flexibility reforms on labor supply focus on the extensive margin. We will show that more flexibility is likely to increase the overall labor force participation (extensive margin). At the same time, however, more flexibility could potentially decrease the average hours worked (intensive margin). Since total labor volume – the financial base of pension systems – is the product of the intensive and the extensive margin, it is important to look at both margins when evaluating the success of flexible retirement reforms.

The paper is structured as follows and offers the following main results: Section 2 sets the stage by presenting stylized facts about labor force participation of older workers in the

countries under investigation. Key here is to show that, while there are already many pathways to retirement which allow for some flexibility in the decision when to retire, most countries still feature a rather sudden decline in labor force participation at and even before the statutory retirement age.

Section 3 summarizes the characteristics of the flexible retirement schemes, which have been introduced in those countries that are relevant to our empirical work.

Section 4 provides the theoretical reasoning and shows that things are not as straight forward as many politicians make believe. Indeed, economic theory contradicts the popular belief that "more flexibility is always better" if "better" refers to the financial base of the pension system. Rather, the overall effect of a reform allowing for more flexible transitions to retirement on total labor supply is *ex ante* unclear and depends crucially on the workers' preferences for leisure which is likely to increase with age. We show that if workers have a moderate or low preference for leisure there will be no effect on labor force participation. Moreover, the effect on total hours worked can be positive or negative depending on the distribution of leisure preferences and thus age in the population. This theoretical result is important as an underpinning of our empirical results, especially, as it contradicts the popular wisdom.

The empirical analysis in Section 5 shows that the potentially unpleasant effects predicted by the theoretical analysis have indeed happened in many countries. We analyze the effects of the flexibility reforms described in Section 3 on labor force participation of older workers and the hours worked by those who participate in the labor force. We then calculate the effect on total labor supply. We show that, on average, flexibility reforms introduced in OECD countries since the 1990s have increased labor force participation rates of older men aged 55-64 while they have decreased their weekly working hours, creating a zero to negative effect on total labor supply. Our empirical results are in line with the hypotheses derived in the theoretical model.

We therefore conclude in Section 6 that the flexibility reforms enacted so far have failed to be an effective policy to increase the labor supply of older workers. In our conclusions, we delineate several alternative options.

## 2. LABOR SUPPLY AND RETIREMENT PATTERNS

The statutory retirement age – more precisely named the statutory eligibility age (SEA) as it defines the age at which workers are eligible for full pension benefits independent of any

other qualification – sends a strong signal to older workers to leave the labor force. This is shown in Figure 1.[2] Most workers have left the labor force when they have reached the statutory eligibility age, and the average exit age (AEA) from the labor force is considerably lower than the statutory eligibility age. This pattern is similar among the European countries. Only for males in Sweden, the average exit age is later than the statutory eligibility age. In all countries, the labor force profiles exhibit a rather steep slope during the period shortly before the statutory retirement age.

From an economist‘s perspective, the existence of a fixed and universal retirement age needs explanation since preferences for leisure differ between individuals and over age, health at older ages varies widely and family circumstances such as the need to take care of parents or a partner differ across households especially at older ages. Moreover, there is no economic reason why claiming a pension must imply leaving the labor force. When to claim a contributory pension should depend on actuarial rules while when to exit the labor force should depend on the preference for leisure. Hence, the exit from the labor force could occur earlier, at the same time or later than claiming a pension. However, in many cases, this flexibility is restricted by a combination of constraints and incentives imposed by employers, unions and governments. Flexibility reforms try to reduce these constraints.

First, in many sectors of European countries the statutory eligibility age is effectively a mandatory retirement age. This is usually not a legal constraint but determined in labor agreements between the social parties. Unions have traditionally pursued a policy of pushing for an early retirement age and justified this by protecting workers with declining health and (misleadingly so) by freeing up jobs for younger workers. Employers, as pointed out already very early by Gustman and Steinmeier (1983), like to impose a lower limit on the hours worked since part-time jobs and flexible hours incur additional fixed costs of work.[3] As a consequence and in contrast to standard labor market theory, many workers are not free to choose their working hours, in this case to reduce their working hours when they become older but must choose between working full-time or retiring fully.

Second, many pension systems impose earnings tests which limit the amount of earnings that can be received by an individual who receives pension benefits. They usually concern the

[2] The paper concentrates on the labor supply of men age 55 and over. In most countries considered, female labor force participation of the equivalent cohorts has been low with a large share of part time work at younger ages, making these women ineligible for most of the reforms considered later in this paper.

[3] Fixed costs of employment and team production are some of the reasons why minimum hours constraints exist. See Gustman and Steinmeier (1983) and Hurd (1996) for other possible reasons.

time period before reaching the statutory eligibility age. Again, this is an impediment for flexible retirement since earnings tests impose a maximum hours constraint for a given wage. As Table 1 shows, the maximum permissible earnings are relatively low and in many cases (e.g. in Austria, Belgium and Germany) are substantially below a half-time job. In combination with a minimum hours constraint imposed by the employers this may restrict labor supply choices to a very narrow range of hours or, in the extreme, to full work or no work at all.

After the statutory eligibility age, many countries do not limit the combination of work income and pension benefits. Nevertheless, this is rather unpopular. The main reason is most likely the inflexible regulation prior to the standard eligibility age since decisions to exit the labor market are normally not revised – only few employees pick up work after having reached the standard eligibility age.

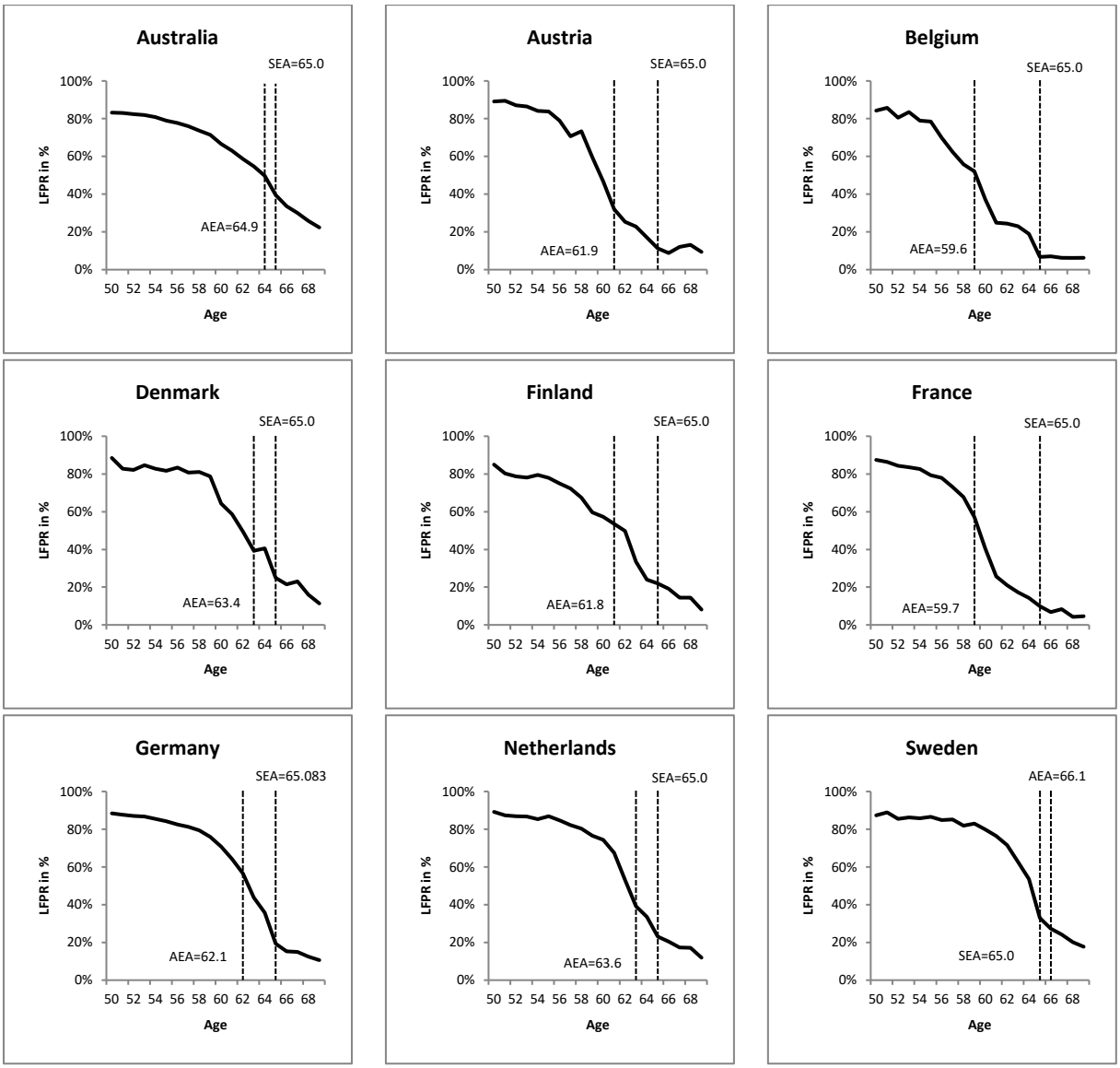
Third, most European countries have allowed and sometimes even encouraged alternative forms of exiting the labor force before reaching eligibility for an old-age pension. Typical forms are incentives set by specific pre-retirement schemes, unemployment and/or disability benefits or early retirement pensions. In many countries these pathways into early retirement are very attractive since pension benefits are not calculated in an actuarially neutral way. This means that there exists an implicit tax on working longer once individuals have reached the early eligibility age, thus encouraging them to claim their pensions as early as possible (Gruber and Wise 1999, 2002).

The combination of these constrains and incentives tend to induce workers to both claim the pension and exit the labor force at the earliest possible time. The two events then occur simultaneously. This is reflected in the rapid and early decline in labor force participation in Figure 1. The differences in the slopes reflect different preferences for leisure as well as differences in early retirement incentives provided by the pension systems in each country and the other impediments to flexibility that disrupt the bridge between exiting the labor force and eligibility for a pension.

Institutional arrangements also influence the demand for labor at older ages: it might be optimal for employers to discharge older workers when their productivity does not increase anymore but labor contracts still impose rising wages. Moreover, in many countries it is much cheaper to dismiss older rather than younger workers when a company is forced to restructure because severance payments to older workers are effectively subsidized by early retirement and disability benefits (Börsch-Supan et al. 2009). These mechanisms have also shaped the

slopes visible in Figure 1. We will, however, focus on the supply side in the sequel of the paper.

**Figure 1: Labor Force Participation Rate (LFPR) in % by single years of age, Statutory Eligibility Age (SEA) and Average Exit Age (AEA) by Country, 2012, Males**




Notes: The statutory eligibility age (SEA) is defined as the age at which workers are eligible for full pension benefits independent of any other qualification. The most salient other qualifications for a full pension is the number of working years with the effect that the normal retirement age is effectively the earliest eligibility age, e.g. age 62 in Belgium and France. The labor force participation data for Australia are those of 2011 (2011 Census data).
Source: Australian Bureau of Statistics (2016), OECD (2013a), OECD (2015a).

## 3. FLEXIBILITY REFORMS

In the last two decades, most OECD countries have attempted a shift away from the different early retirement policies mentioned in the previous section and moved towards a strategy of more active aging and longer working lives. Many countries have undertaken substantial pension reforms which have included flexible retirement schemes. The primary goals of these

flexible retirement schemes are, on the one hand, to enable employees to gradually reduce their working hours with increasing age in order to facilitate the transition from full-time employment to full retirement. On the other hand, older workers are encouraged to remain in the labor market as long as possible, preferably beyond the statutory eligibility age. Since very often the minimum hours constraints by the employers restrict the labor supply of older workers, in some countries the flexibility reforms targeted firms and set incentives for them to offer part-time schemes to older workers by subsidizing the wages of those workers under certain conditions. Table 1 gives an overview of the flexibility reforms that will be analyzed in Section 4 and summarizes their key parameters[4].

A particularly interesting case is **Sweden**. With the 2000 pension reform that introduced the now famous notional defined contribution system (Palmer 2000), Sweden also introduced a much more flexible scheme regarding flexible retirement. Since then, there is no formal retirement age any more. In the new system, pensions can be drawn from age 61 onwards, without an upper age limit. Pension entitlements accrue on individual notional accounts if the person earns pensionable income, regardless of his or her age and irrespective whether the individual already gets a pension. Pension payments are calculated by dividing the notional account balance by a cohort-specific annuity divisor. The annuity divisor is linked to the retirement age and the life expectancy of each cohort. The pension payment increases with the age of retirement because of the resulting shorter period over which a pension is paid. Since 2000 it is also possible to combine an old-age pension with work income without any financial restrictions and without any earnings test; all years during which an income from work or through other types of pension earnings has been earned count for pension entitlements (Lindecke et al. 2007). Over time, an increasing number of Swedes has begun to claim a pension at the age 61. While 3.9% of the 1939 cohort received a pension with 61, the proportion increased to 5.9% in the 1949 cohort and 7.8% in the 1953 cohort. The persistent trend to claim pension benefits as early as possible led to a debate in Sweden with the plan to raise the minimum eligibility age from 61 to 63 (Statens Offentliga Utredningar 2013).

Already in 1992, **Germany** introduced a partial pension system. In compliance with certain supplementary income limits, individuals could reduce their working hours by working part-time and compensate the resulting income loss by drawing a partial pension. The pension contributions payed on the reduced labor income led to higher pension entitlements later on.

[4] Norway, the UK and the US have also recently introduced flexibility reforms. Since the reforms in these countries were very recent, however, they do not provide a sufficient number of post-reform observations for the empirical analysis and are therefore not described here.

Eligibility for the partial pension depended on being entitled to an old-age pension. The partial pension could only be drawn for certain proportions of the split between work and retirement: either one third, one half, or two thirds. In between, no further gradations were possible. The earning limits were calculated individually based on the labor income of the last three years before drawing the partial pension. This system of partial pensions, however, was not a success and only very few individuals took it up. In 1993, the number of new partial pensioners was around 1,100; approaching 3,000 at the end of the 1990s. Afterwards, the number declined in the 2000s. Throughout the period since the introduction in 1992, the proportion of new pensioners claiming a partial pension was below 0.5% in each year (Börsch-Supan et al. 2015). The rigid earnings limits were slightly increased in 2008 and finally substituted by a more flexible limit in 2016, coming into force in July 2017. Within the new system, each additional earned Euro in excess of 6,300€ per year is only counted by 40% towards the pension. The employee can retain 60%. With the new regulation the German government tries to encourage partial pensioners to extend their labor supply.

## Table 1: Overview of Flexible Retirement Options, Earnings Tests and Mandatory Retirement Regulations across Countries

| | **Year of Introduc-tion**[a] | **Statutory Eligibility Age (SEA) for public pensions**[b] | **Start of the flexible retirement window**[c] | **Working Hours** (i.e. extent to which the working time must be reduced within the flexible retirement option) | **Compensation of Income Loss** | **Earnings Tests**[d] (i.e. limit of additional earnings for recipients of public pension benefits) | **Mandatory retirement**[e] |
|---|---|---|---|---|---|---|---|
| **Australia** | 2005 | 65 men, 63 women | 55 | full flexibility | via superannuation | before Statutory Eligibility Age (SEA): no Age Pension claiming possible;<br><br>after SEA: the Age Pension benefits are reduced if the annual income exceed the so-called "income free area" of 168€ per month | mandatory retirement age for certain groups (e.g. 70 for federal judges, 60 and 65 for Australian Defence Force personnel and reservists respectively) |
| **Austria** | 2000 | 65 men, 60 women | 55 men, 50 women | bilateral agreement between employer and employee on a working time reduction of between 40% and 60% | via governmental subsidies | before SEA: when earnings are above a ceiling of 290€ per month, the pension is fully withdrawn;<br><br>after SEA: no limit | mandatory retirement age for certain groups (e.g. 70 for notaries) |
| **Belgium** | 2002 | 65 men, 62 women | 50 | reduction of working hours by 20% or 50% | via governmental subsidies | before SEA: when annual earnings are above 7,793€ (single) or 11,689€ (dependent child) per year, the pension is reduced by the amount that exceeds the limit. If annual earnings are 25% above the limit, the pension is fully withdrawn for as long as the additional income is higher than the ceiling;<br>after SEA: when earnings are above 22,509€ (single) or 27,379€ (dependent child) per year, the pension is reduced by the amount that exceeds the limit. If annual earnings are 25% above the limit, the pension is fully withdrawn for as long as the additional income is higher than the ceiling. For a retiree older than 65 with at least 42 years of contribution, the ceiling is lifted entirely | mandatory retirement age is 65 for most civil servants |
| **Denmark** | 1995 | 67 men, 67 women | 60 | working hours reduction by at least 25%, but the remaining working time has to be at least twelve hours per week (18.5 hours per week for self-employed) | via fixed payment of unemployment insurance fund | before SEA: no public pension receipt possible, therefore no conflict between public pension benefits and additional income;<br><br>after SEA: full basic pension (795€ per month or 9,540€ per year, which is equivalent to around 17% of average earnings) is reduced at a rate of 30% against earned income, if work income exceeds 40,518€ per year (approx. ¾ of average earnings) | mandatory retirement age is 70 for public servants; for certain groups via collective agreement |
| **Finland** | 2005 | 65 men, 65 women | 63 | full flexibility | via public pension benefits | no limit | mandatory retirement age is 67 for some public servants (e.g. university professors, judges); employment relationship ends automatically at the end of month when the employee turns 68, unless employer and employee agree otherwise |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **France** | 1993 | 65 men,<br>65 women | 55 | reduction of working hours by an average of 50% over the five year gradual retirement period | via governmental subsidies | no limit for full pension recipients; workers are eligible for full public pension benefits if they fulfil either both a minimum contributory record (in 2014: 41.25 years for people born in 1953) and the minimum legal pension age (61 years and two months) or the age of 66 years and two months. | mandatory retirement age is 70 for private-sector workers. For public-sector workers, there is a full pension age limit (67 in 2017), with exceptions |
| **Germany** | 1992 | 65 men,<br>65 women | 63 men, 60 women | reduction of working hours determines the level of the partial pension. Partial pension benefits can be drawn either to one third, one half, or two thirds of the full pension entitlements, depending on the additional work income | via public partial pensions | before SEA: for drawing full pension payments the limit is one-seventh of the reference base (i.e. 3,060€ per year or 255€ per month respectively); for drawing a partial pension the ceiling is dependent of the partial pension level, i.e. 1,483€ per month (1/3 partial pension), 1,112€ per month (1/2 partial pension), 741€ per month (2/3 partial pension), multiplied with the individual earnings points in the year before pension claiming<br><br>after SEA: no limit | mandatory retirement age for certain groups (e.g. 75 for professors; 70 for attorneys, notaries; 67 judges, 65 for pilots, mayors) |
| **Netherlands** | 2006 | 65 men,<br>65 women | 55 to 60, varies across pension funds | reduction of working hours is dependent on employer agreement and required to draw pension fund payments | via occupational pension funds | before SEA: no public pension receipt possible, therefore no conflict between public pension benefits and additional income;<br><br>after SEA: no ceiling on additional earnings for public pension recipients | mandatory retirement age of 65 in the public sector was abolished in 2008 |
| **Sweden** | 2000 | 65 men,<br>65 women | 61 | full flexibility | via public pension benefits | no limit | none |

Notes: a) The information refer to the regulations in the respective years of the introduction of the flexible retirement option, except the information about earnings tests and mandatory retirement.
b) The statutory eligibility age (SEA) is defined as the age at which workers are eligible for full pension benefits independent of any other qualification. See note to Figure 1.
c) The flexible retirement window may start earlier than the earliest eligibility age if the income loss is compensated by sources other than the state pension.
d) The information about earnings tests refers to the following years: Belgium (2015 regulation), Denmark (2015 regulation), France (2016 regulation) and The Netherlands (2016 regulation).
e) The information about the mandatory retirement regulations are those of 2016.
Sources: Bloemen et al. (2014), Börsch-Supan (2005), Börsch-Supan et al. (2015), Devisscher and Sanders (2008), Eurofound (2012), European Commission (2011), Graf et al. (2011), Ilmakunnas and Ilmakunnas (2006), Lindecke et al. (2007), OECD (2005a), OECD (2014), OECD (2015b, 2015c), Reday-Mulvey (2000), Warren (2008).

In the early 1990s, but especially with the 1993 reform, the **French** government attempted to reverse the previously widespread early retirement trend by promoting gradual retirement through governmental subsidies. The partial retirement scheme was especially designed for employees from age 55 to 65. Within the system, employees could earn income based on their part-time work. In the time before full retirement, employees would receive a governmental income supplement equal to about 30% of the daily reference wage (up to a ceiling), provided that the firm hired a new employee for the vacant part-time position. At the end of the 1990s, about 45,000 private-sector workers were benefitting from the governmental subsidies within this partial retirement scheme. The scheme was abolished in 2004 (Reday-Mulvey 2000, OECD 2005b).

With the 1995 reform in **Denmark**, the government tried to encourage gradual retirement by replacing the full early retirement system with a part-time work scheme. The system required that the employee was aged between 60 and 66 years, was entitled to unemployment benefits and was a member of an unemployment insurance fund for at least 20 out of the last 25 years. Within the scheme, working time had to be reduced by at least 25% (or by 18.5 hours per week for self-employed), but the remaining working time should be at least twelve hours a week. The income loss was compensated by a fixed payment of the unemployment insurance fund which was in 1995 7.67€ per hour of working time reduction (2016: 12.32€). The unemployment insurance fund administered the scheme (European Commission 1995, Delsen 1996, Eurofound 2016). Hansen (2001) states that the scheme never attracted many participants in the late 1990s, only around 1,000 per year. The scheme is being phased out and applies only for workers born in 1959 or before (OECD 2011a).

In **Austria**, a subsidized old-age part-time scheme was introduced in 2000. The scheme is based on a bilateral agreement between the employer and the employee and requires a reduction of working hours between 40% and 60%. Working time can be distributed in two distinctly different ways: Either the employee reduces his working hours for the whole period of 6.5 years by half or the so-called “block model” option can be chosen. In this option the employee continues working without any reduction in working hours for the first part of the period (first block), while for the second part (second block), the employee stops working completely. Employees must have had a full-time employment with working hours at least 80% of a regular full-time employment, before they are entitled to the subsidized scheme. 50% of the income loss is compensated by governmental subsidies, up to 75% of the former gross wage. Pension contributions have to be paid at the same amount as before the working time reduction. In the regime of 2000, the lower age limit of the flexible retirement window

was 50 for women and 55 for men. In 2005, this age was increased to 52 for women and 57 for men, and further raised to 55 and 60 in 2013. In 2001, 5,274 people were part of the scheme. The number grew to 17,411 in 2002, 31,387 in 2003 and 39,859 in 2004. Subsequently the number of participants slightly declined (Graf et al. 2008, Graf et al. 2011).

In 2002, the **Belgian** government introduced a system of partial interruption of the working career. In the new time credit system, the employees can take time credit for reducing their working hours fully or by half for up to one year or they can reduce their working hours by one fifth for a maximum of five years; this scheme requires that the employee worked full-time before. The idea of the scheme was to give people time for themselves or their family at some point of their working career, so that they will stay longer in the labor force. Especially for employees aged 50 or older the time credit scheme provided extra possibilities. The scheme was named as end-of-career-scheme. If older workers have had an employment career of at least 20 years and were employed at the same employer for at least three years, they were eligible to reduce their number of working hours by half or one fifth until their retirement. The employees are partially compensated for their income loss by governmental flat-rate benefits, depending on the reduction of working time (Devisscher and Sanders 2008). While being part of the scheme, the employees acquire the same amount of pension entitlements as before the working time reduction. The number of participants grew steadily from 8,700 in 2002, to 88,000 in 2011. In 2012, the lower age limit of the flexible retirement window was raised to 55 years and will gradually increase to 60 starting from 2015 until 2019 (Albanese at al. 2015). Moreover, the government has announced to further lift the earnings test restrictions after the statutory eligibility age (OECD 2015b).

The **Australian** pension system with its fully funded "superannuation" scheme introduced flexible retirement in 2005 with the aim to encourage older workers to remain in the workforce. This program is called "transition-to-retirement-pension". Since then, people who have reached the superannuation preservation age are allowed to access their superannuation as an additional income stream. The preservation age is not the same as the statutory eligibility age. While the statutory eligibility age is 65, the current preservation age is 55 for people born before 1960, gradually being increased to 60 by 2025. Those who want to remain in the workforce but reduce their working hours in the period between the preservation age and the statutory eligibility age are allowed to supplement their work income with benefits of their superannuation. The amount that can be taken from the superannuation as income compensation is limited to 10% of the person's superannuation balance in the respective year.

Access to the full superannuation benefits is permitted with reaching age 65 (Australian Government 2004, Warren 2008).

As in Australia, a major reform in the **Finnish** pension system came into effect in 2005. The reform was a substantial step towards improving the earnings-related part of the Finnish pension system. Regarding a flexible transition from work to retirement, Finland introduced a window of flexible retirement age between the ages 63 and 68 (plus an early retirement option at age 62). Thus, the former fixed retirement age has become flexible. Within the new system, employees who have turned 63 can decide their individual date of retirement themselves: an employee may retire on an old-age pension within the window of flexible retirement. For giving incentives to the employees to postpone their withdrawal from the labor force, there is a sharp increase in the pension accrual rate at the age of 63 (from 1.9% to 4.5%). Besides, there is no cap of the replacement rate under the new regulation (in the old system the pension could not exceed 60% of the highest wage). Employment beyond age 63 is also encouraged by making it more attractive to combine an old-age pension with income from work. An employee drawing old-age pension benefits may work and have earnings without any financial restrictions. Furthermore, new pension entitlements accrue up to the age 68, the accrual rate being 1.5% (instead of 4.5%). The additional pension rights are added up to the former old-age pension entitlements at the age of 68 (Börsch-Supan 2005, Ilmakunnas and Ilmakunnas 2006). The early eligibility age will be raised from 63 to 65 by 2027 (Finnish Centre for Pensions 2014).

Until the revision in 2006, important facilities for gradual retirement in **The Netherlands** were tax-supported saving plans. But in order to increase the labor force participation, all tax facilities for gradual (or early) retirement schemes were abolished. As a consequence of that policy change, the Dutch (occupational) pension funds were obliged to offer part-time pensions. Part-time retirement requires that the insurant reduces his or her working hours, while simultaneously drawing pension benefits out of the pension fund. The lower age limit of the flexible retirement window for retiring part-time varies across the pension funds, starting from age 55 or 60. Besides the different eligibility ages, there is much variety regarding the generosity of pension benefits, and whether pension benefits are based on the average or the final income (Bloemen et al. 2014).

## 4. ECONOMIC THEORY: MORE FLEXIBILITY DOES NOT NECESSARILY INCREASE LABOR SUPPLY

In this section, we build a simple model to show that a flexibility reform is likely to increase labor force participation among older workers but may decrease their working hours such that the reform has an ambiguous effect on total labor supply. We also characterize the conditions under which a flexibility reform is likely to be counterproductive by decreasing labor supply. Subsection 4.1 provides a very simple model of a stylized flexibility reform while Subsection 4.2 adds various extensions.

### 4.1. A SIMPLE MODEL OF A STYLIZED FLEXIBILITY REFORM

Our model has two scenarios. The "constrained scenario" is the inflexible status quo described in Section 2. It deviates from standard labor market theory in so far as workers cannot flexibly choose their working hours as they wish, especially when they get older and would like to reduce working hours. Rather, the labor market imposes a combination of a minimum hours constraint with a fixed mandatory retirement age. The second scenario ("unconstrained scenario") abolishes both constraints.[5]

In a nut-shell, the model works as follows. In the absence of the constraints, workers will gradually reduce their working hours as they age and their preference for leisure increases. They will remain in the labor market until it is too costly for them to drive to work. If employers impose a minimum hours constraint, however, which may be half-time or even higher, workers can reduce their work hours only slightly until they reach that employer-imposed constraint. They then work for a while more hours than they would have preferred without the constraint but only until the loss in preferred leisure is so large that they retire fully. Our model assumes, following the logic in Section 2, that the social partners have acknowledged this mechanism and have chosen this age as the statutory retirement age which is thus effectively a mandatory retirement age.[6]

Hence, while abolishing the constraints will induce workers to work more *past* the former retirement age, workers who have worked full-time with the constraints imposed will now reduce their working hours *before* the former retirement age. The overall effect of a flexibility

[5] We are only modelling the complete abolishment of a minimum hours constraint, although many of the reforms listed in section 3 still require some minimum hours of work. However, the principle mechanism of our model works in the same way if the minimum hours constraint is relaxed partially or completely.

[6] Using the definitions explained later in the formal model, the mandatory retirement age is the age in which $\alpha$ reaches $\alpha$''.

reform on total labor volume is therefore *ex ante* unclear and depends on the distribution of age-related leisure preferences in the population.

We provide a rigorous formal treatment in Subsection 4.2 and only show the results in graphical form. We assume that individuals value consumption ($c$) and leisure ($1-l$) according to a very simple additively separable utility function given by

$u = \ln c + \alpha \ln(1-l)$

where $l$ denotes working hours and $\alpha$ represents the importance of leisure relative to consumption during the second period. In this very simple version of the model, we assume that $\alpha$ increases monotonically with age and is the same for all workers of a given age, so $\alpha$ also represents the birth cohort of an individual. $\alpha$ is the key behavioral parameter in our model since it directly relates to whether the minimum hours constraint is binding or not. It may not only reflect preferences but also other circumstances, e.g., the need to take care of a relative or the influence of health on the utility of consumption and the disutility of work.

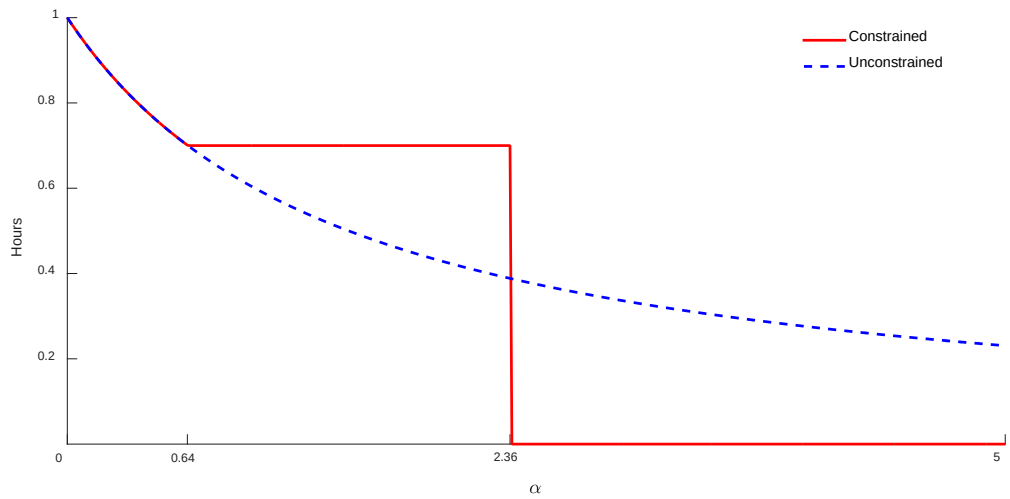
Figure 2 shows the optimal labor supply with and without the constraints. The red solid lines correspond to the optimal decisions in the constrained scenario while the dashed blue lines correspond to the unconstrained textbook scenario. We are particularly interested how labor supply in the two scenarios relates to the age-dependent preferences for leisure, described by the parameter α in the utility function. α is therefore shown on the x-axis in Figure 2. The importance of leisure relative to consumption increases as we move to the right as does the age of the individuals.

We first discuss the constrained case in which labor supply faces a minimum hours constraint. It is defined by $\overline{l}$ which we set to 0.7. Individuals must choose between working $l \geq \overline{l}$ hours or retiring completely from the labor market, in which case $l$=0. Younger individuals with a very low preference for leisure like to work more than the minimum number of hours; they are thus unconstrained. As they get older and α increases, however, there is an $\alpha$' where the constraint becomes binding ($\alpha$'=0.64 in our parametrization and $l = \overline{l}$). To the right of $\alpha$', individuals continue to work although they work more hours than they would have preferred without the constraint. Increasing age and thus $\alpha$ even further, we reach an $\alpha$'' where labor supply changes qualitatively ($\alpha$''=2.36 in our parametrization). This corresponds to the retirement age. Beyond this age, individuals have a sufficiently high preference for leisure, $\alpha > \alpha''$, to retire fully and thus work fewer hours than they would have preferred without the constraint.

After a flexibility reform which removes the constraints, individuals will follow the path of labor supply represented by the dashed line in Figure 2. Nothing changes for the youngest individuals with a very low $\alpha<\alpha'$. Moderate-α individuals with $\alpha'<\alpha<\alpha''$, however, reduce their labor supply to a more desirable level in the unconstrained scenario. This produces a negative effect on total hours worked while leaving labor force participation unchanged. The oldest individuals with a high preference for leisure ($\alpha>\alpha''$) increase their working hours to the desired level rather than retire early. This creates a positive effect on total hours worked and labor force participation.

Our model therefore predicts an unambiguously positive effect of a flexibility reform on labor force participation but generates opposing effects on total labor supply. Whether the positive effect on labor supply of those younger than the former mandatory retirement age dominates the negative effect on labor supply of those older than the former mandatory retirement age depends on the distribution of $\alpha$ representing the age-dependent preferences for leisure and thus the size of the underlying birth cohorts.[7] A flexibility reform put into place when the baby boomers are still relatively young is therefore most likely to reduce total labor supply.

**Figure 2: Number of Hours Worked when Middle-aged**




Source: Authors' own calculations

[7] Age, as pointed out, also represents birth cohorts, and we interpret the model as if it were based on a stationary population.

## 4.2. MODEL EXTENSIONS AND PENSION POLICY

The point of the preceding subsection was to show that even in a very simple model of labor supply more flexibility does not necessarily mean more labor volume, using the combination of a mandatory retirement age and a minimum hours constraint as an example for inflexibility.

In a richer model, there will be additional effects. Moreover, pension policies may shift the cut-off point $\alpha''$ in Figure 2. This section provides examples which show that the basic insights of the simple model are robust.

First, we may want to loosen the strict link between age and the preference for leisure and introduce heterogeneity of preference within a given birth cohort. The simple model of Subsection 4.1 can then be re-interpreted by replacing the single representative individual for each birth cohort by the median individual. The mandatory retirement age becomes binding for all individuals who reach this age and (still) have a lower preference for leisure than the median individual. Success and failure of a flexibility reforms does not only depend on the relative size of birth cohorts but also on the distribution of leisure preferences within each cohort. Increasing flexibility means more labor supply for individuals with a high preference for consumption while it means less labor supply for individuals with a high preference for leisure.

Second, there may be repercussions of the constraints on labor supply at younger ages. We therefore expand our simple model to a three period model (young, retirement window and old). Individuals work during the first two periods. The retirement decision is taken in the second period. All individuals are retired in the third period. They supply $l_1$ and $l_2$ hours of labor and receive an hourly wage of $w$ in return. The remaining hours are dedicated to leisure. For convenience, the total number of hours in a period is normalized to 1 ($l_t<1$ for t=1,2,3).

The individuals' period utility increases in consumption ($c_t$) and leisure ($1-l_t$) and is given by the same additively separable utility function as in our simple model:

$$u_t = \ln c_t + \alpha \ln\left(1-l_t\right).$$

Individuals choose a sequence $\{c_t, l_t, t=1...3\}$ to maximize their lifetime utility, U, where:

$$U = \sum_{t=1}^{3} u_t$$

subject to the lifetime budget constraint:

$$\sum_{t=1}^{3} wl_t = \sum_{t=1}^{3} c_t$$

where we set the price of the consumption good to one and the time preference and interest rates to zero.[8] In the third period all workers are retired, $l_3$=0. Consumption in retirement is financed by saving or an equivalent actuarial pension implicit in the budget constraint of our model.

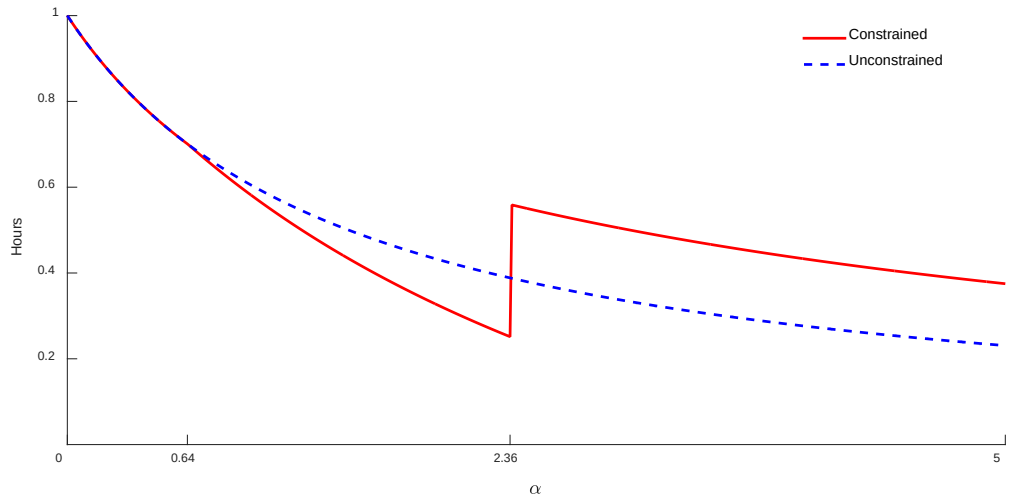
The focus of the simple model in Subsection 4.1 was on the second period. The equations for $\alpha$' at which the minimum hours constraint starts to be binding and $\alpha$'' at which individuals are forced to retire fully are given in Appendix A. This appendix also shows the number of working hours gained by a flexibility reform for all individuals with $\alpha>\alpha$'' and the number of working hours lost by a flexibility reform for all individuals with $\alpha<\alpha$''.

Due to the symmetry of the model, $l_1 = l_2$ if there is no minimum hours constraint. If the constraint is binding, however, labor supply decisions in the second period have repercussions on the labor supply in the first period.[9] This is shown in Figure 3. As in Figure 2, $\alpha$ indexes the leisure preferences in the second period. Since moderate-$\alpha$ individuals work shorter hours in the second period when labor supply is unconstrained, they earn less and therefore want to work more in the first period to maintain their old consumption levels. The opposite is the case for the high-$\alpha$ individuals.

[8] We make these simplifying assumptions to ease exposition. Introducing impatience or positive interest rates would not qualitatively change our results. Note that saving or an equivalent actuarial pension cancel from the lifetime budget constraint.

[9] We did not model another minimum hours constraint for the first period for clarity and simplicity of exposition. The effect of having a minimum hours constraint in both periods is qualitatively similar: abolishing the constraint in both or one of the two periods will increase labor supply for some workers and decrease it for others, with the total effect depending on the distribution of $\alpha$.

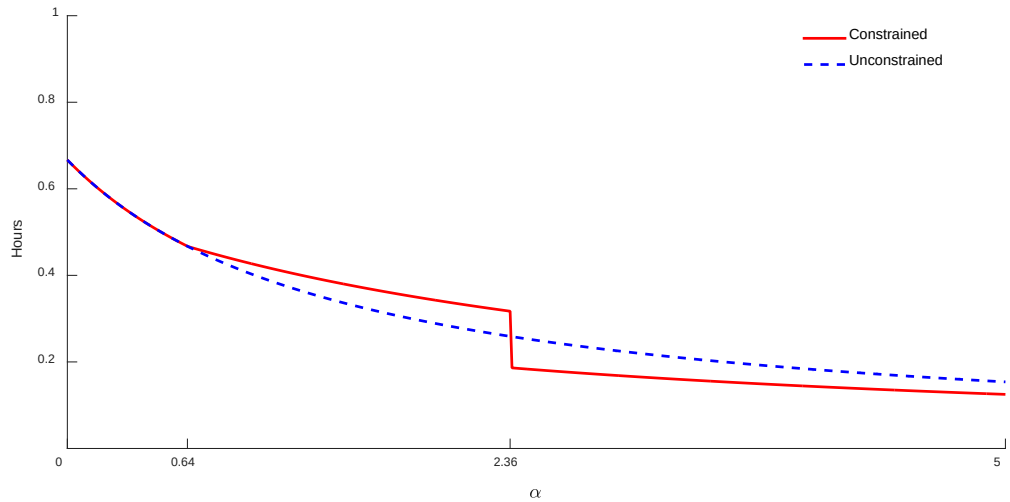
**Figure 3: Number of Hours Worked when Young**




Source: Authors' own calculations

Note that the moderating effect in Figure 3 is substantially smaller than the original effect in Figure 2. The extended model therefore delivers the same qualitative result as the simpler specification in Subsection 4.1 did. This is shown in Figure 4 which displays life-time labor supply. For individuals with moderate $\alpha$ the overall effect of the reform on total life-time labor supply is negative, while high-$\alpha$ individuals increase their labor supply after the reform.

**Figure 4: Total Number of Life-time Hours Worked**




Source: Authors' own calculations

A third extension of our model involves pension policies. The separability of leisure and consumption in the simple utility function implies that income changes affect consumption but not the choice between work and leisure. In a technical sense, it makes life very easy because we can ignore how pension income is provided. In a richer model, however, pension

policies may shift the cut-off point $\alpha''$ in Figures 2 through 4. This mechanism explains how differences in leisure preferences and pension policies across countries generate the different retirement patterns which have been shown in Figure 1. We provide two examples:

**Generosity of the pension system**: As discussed in Section 2, the generosity of the pension system especially in the years before the statutory retirement age crucially determines the retirement decisions of workers. The more generous (early) pensions are, the higher the incentives to retire early. This relationship has been extensively discussed in the literature and is supported by the empirical evidence (see e.g. Gruber and Wise 2002).

To be precise, "generous" refers to an (early) retirement benefit that is larger than actuarially fair. This is the case in most of the countries in our sample (Queisser and Whitehouse 2006, OECD 2015b). With a non-separable utility function, a higher income will increase consumption as well as leisure, hence the cut-off point $\alpha''$ in Figures 2 through 4 will shift to the left, increasing the number of individuals who will retire fully when a minimum hours constraint is in place. Lifting this constraint has therefore more likely a positive effect on total labor supply in an actuarial unfair system which is generous to the early retirees relative to our baseline model. The total effect, however, remains ambiguous.

**Maximum hours constraints generated by earnings tests**: In Section 2 we also discussed that in many countries earnings tests limit the amount of labor income individuals can earn while receiving a pension. In this sense, the earnings test is equivalent to a maximum hours constraint in the second period. We discuss two cases. First, if the earnings limit is very low, see Table 1, the combination of minimum and maximum hours effectively prohibits work and forces individuals to retire early even if their preferred hours were exceeding the minimum hours constraint. Making the earnings test less incisive then unambiguously increases labor supply. Second, plugging a maximum hours constraint into our model in t=2 reveals that, in this case, individuals would try to compensate the earnings lost due to the constraint by increasing their labor supply in t=1. Relaxing a maximum hours constraint in our framework would thus reduce the hours worked in t=1 and increase the hours worked in t=2. In our simple model, total labor supply thus remains unchanged; in a more complex model with age-dependent preferences for leisure, the total effect is likely to be negative since the preference for leisure is supposedly larger in older age.

Börsch-Supan et al. (2017) show that the combination of early retirement incentives and earnings tests can create distinct patterns of labor force exit and pension claiming age. If earnings tests are lifted (i.e. maximum hours constraints are abolished) in the presence of non-

actuarial adjustment factors, this can lead to very early pensions claiming. This means that an increase in labor force participation happens at the cost of the pension system since individuals have an incentive to claim their pension as early as possible and continue to work according to their leisure preferences.

It is possible to merge all these extensions into a single structural model of saving and retirement. This has been done by Gustman and Steinmeyer (1986, 2004) for the U.S. institutional environment and results in a very complex dynamic programming model that has to be solved numerically. Their model allows for preferences for leisure which are age-dependent such that leisure becomes more attractive with increasing age. In addition, they model different family structures, different health status over time and different job characteristics such as the difficulty and the stress of the job which might influence the individual retirement decision. Their model also embeds the complex rules of the U.S. Social Security system in great detail. Based on this complex model, Gustman and Steinmeyer (1986) show that the presence of the minimum hours constraint is responsible for the corner solutions in their set up, meaning that if a minimum hours constraint is present, individuals will immediately move from full-time work to full retirement. This is the same qualitative result as derived from our simple model. Gustman and Steinmeyer (2004) also provide quantitative estimates of the effects of relaxing constraints and changing several Social Security policies.

# 5. EMPIRICAL ANALYSIS

## 5.1. METHODOLOGY

The objective of our empirical analysis is to estimate the effect of the flexibility reforms described in Section 3 on total labor supply. We first estimate the effects on labor force participation (extensive margin), then the effect on total hours worked for those who participate in the labor market (intensive margin) and finally the effect on total labor supply.

After describing our data (Section 5.2), we employ two different estimation methods. The first method is a pooled Ordinary Least Squares (OLS) regression which captures the reform effect by a dummy variable indicating that the reform is in effect (Section 5.3). This method combines cross-sectional data on N countries and T time periods to produce a dataset of NxT observations. In our analysis we combine time series data for nine countries which adopted a flexibility reform in the past as described in Section 3. The advantage of the pooled OLS method is that combining time series with cross sections yields larger samples than using only

cross sections or time series. We obtain an average effect of the flexibility reforms over all countries and time periods. The disadvantage of pooled OLS is that the estimated effects may have no causal interpretation if the reforms were driven by unobserved time varying factors which also affect labor force participation and/or working hours. Additionally, it might be interesting to evaluate the heterogeneity of the reforms by country given the differences in the country circumstances and the reform specifics as described in Section 3.

We therefore use as a second method the synthetic control method (SCM) proposed by Abadie and Gardeazabal (2003) and extended in Abadie et al. (2010, 2015) for each country individually (Section 5.4). This means that for each treated country we construct a synthetic control from a weighted average of untreated countries. The synthetic control country should approximate the treated country without the reform as closely as possible. We use a set of non-treated OECD countries for this purpose. The weights for the control countries are set in such a way that the pre-reform trends in labor force participation and working hours, respectively, match the treated countries. The treatment effect is then estimated by taking the difference between the outcome variable (labor force participation or working hours) in the treated country and in its synthetic counterpart after the reform – similar to a conventional difference-in-difference estimator, permitting us to evaluate the effects of the flexibility reforms at the country level. Additionally, endogeneity stemming from omitted variable bias is treated by allowing the existence of unobserved time-varying variables in the estimation. A disadvantage of the synthetic control method is that we need long time series of the outcome and the control variables not only for the treated but also for untreated countries. By employing two different empirical approaches – pooled OLS and SCM – with, as we will see, rather similar results, we intend to increase the validity of our empirical findings.

## 5.2. DATA

The empirical analyses require a large amount of data; especially the synthetic control method requires time series data for at least ten years before a flexibility reform came into effect in order to construct the synthetic control country. In particular time series data on working hours for older workers are hard to obtain; they are only available for more recent years restricting our analysis depending on the year of the reform.

**Dependent variables.** Our main dependent variables are **labor force participation** and **working hours** for the age groups 55-64 and 65+.[10] Annual time series data on labor force participation and working hours are obtained from different sources: the OECD's Employment database, Eurostat, Eurofound, the International Labour Organization (ILO) and from several national statistical agencies (Australian Bureau of Statistics, Statistics Canada, Statistics Finland, Statistics Japan, Central Bureau of Statistics of Norway, Statistics Portugal, Statistics Sweden, U.K. Data Service, U.S. Bureau of Labor Statistics). In order to obtain the **total labor supply,** we multiply labor force participation rates and working hours at the country and year level.

**Control variables**. The **labor market participation** rates and **working hours of younger workers** at ages 25-54 are included in the estimations to capture country-specific labor market trends over time. These data are obtained from the same sources as the dependent variables. We additionally control for the **statutory eligibility age** at which a person becomes eligible for full (state) pension benefits, and the **early eligibility age**, when early retirement (mostly with reduced benefits) is possible.[11] Those data are obtained from the Social Security Administration's "Social Security Programs Throughout the World" (1985-2014), OECD's 'Pensions at a Glance' (OECD 2011a, 2013b) and Duval (2003). **Average years of total schooling**[12] are taken from Barro and Lee (2013). **GDP per capita** and **life expectancy at birth** are obtained from the OECD (OECD 2016a, OECD 2016b). Summary statistics for all variables are presented in Annex 6.

**Treated countries**. Our basic estimation sample includes nine countries: Australia, Austria, Belgium, Denmark, Finland, France, Germany[13], The Netherlands and Sweden. The periods covered in the OLS estimation are: 1983-2013 for Australia, Belgium, Denmark, France and Germany, 1989-2013 for Finland, 1990-2013 for Sweden and 1995-2013 for Austria and The Netherlands, resulting in an unbalanced panel of 242 observations for men. Due to the unavailability of the data on working hours for the age group 65+, Sweden is not part of this

[10] For the labor force participation and the working hours we follow the OECD definition. The labor force participation rate is defined as the ratio of the labor force to the working-age population, broken down by age group. Working hours are defined as average weekly working hours of people who are employed and work full-time or part-time.

[11] For the construction of some of the synthetic control countries we also used the years of early retirement, i.e. the difference between the statutory and the early eligibility age.

[12] The data on schooling are available in five-year increments and therefore, converted to annual frequency by means of linear interpolation.

[13] Annual data on the labor force at the OECD are averages of monthly estimates supplied by the German authorities. From 1991 onwards, data for unified Germany are available.

analysis. As a result, the number of observations drops to 218 for the older age group. The treatment dummy is constructed according to the reform year as indicated in Table 1.

**Control countries**. In the synthetic control method potential comparison countries for each treated country are the OECD member countries which have not adopted a flexibility reform during the observation period. The set of comparison countries and the observation periods may differ for each treated country since the reform years are different in each country. Additionally, the availability of the time series determines the observation periods. More precisely, a comparison country is included in the estimation if a sufficiently long time series of the outcome variable before the reform (usually around ten years) is available and it has stayed untreated for a sufficiently long time period after the reform took place in the treated country (here around seven years).[14] The set of a specific treated country and the comparison countries constitutes a balanced panel. Tables A1 and A2 in the Appendix show the set of comparison countries for each treated country including the weight of each comparison country in the synthetic control and the time periods covered in the estimation.

### 5.3. POOLED OLS

In the following, we first run pooled Ordinary Least Squares (OLS) regressions of labor force participation and working hours.

More specifically, we estimate the following equation separately for men aged 55-64 and 65+ where these two age ranges roughly correspond to the age bands to the right and left of $\alpha$'' in our theoretical model:

$$Y_{it} = \beta_0 POSTREFORM_{it} + \beta_1 X_{it} + \delta_i + u_{it} \qquad (1)$$

where Y is the dependent variable. It is alternatively labor force participation (LFP), working hours (WH), or the multiplication of the two, i.e. total labor supply (TLS). *i* and *t* are country and time suffices. POSTREFORM is a dummy variable which is equal to one in the year of the reform (as shown in Table 1) and in the subsequent years of the reform and is equal to zero otherwise. $\delta_i$ is a set of country fixed effects, $u_{it}$ is the error term. $X_{it}$ is a set of control variables including the labor force participation, the hours worked or total labor supply of the young (25 to 54 year olds) depending on the specification and the statutory and early pension eligibility ages in order to capture the generosity of the pension systems. Standard errors are

[14] Some treated countries which had flexibility reforms rather late have also been included among the untreated countries for the construction of the synthetic control group of countries that were treated early (e.g., Belgium, Finland, The Netherlands, and Sweden).

clustered at the country level in order to account for potential serial correlation in the LFP and hours worked time series.

The main explanatory variable of interest is the post reform dummy. According to the hypotheses developed in Section 3, the estimated coefficient on the post reform dummy in the labor force participation equation can be positive or zero. Working hours can increase or decrease after the reform which is determined by the extent to which workers value leisure relative to consumption. Thus, the combined effect of the reform on total labor force participation is unclear *ex ante*.

**Table 2: Effect of Flexibility Reforms on Labor Force Participation (LFP), Working Hours (WH) and Total Labor Supply (TLS)**

| | (1) LFP 55-64 | (2) LFP 65+ | (3) WH 55-64 | (4) WH 65+ | (5) TLS 55-64 | (6) TLS 65+ |
|---|---|---|---|---|---|---|
| Post reform | 0.038** | 0.008 | -0.753* | -5.350** | 0.860 | -0.088 |
| | (0.016) | (0.013) | (0.381) | (1.867) | (0.800) | (0.362) |
| LFP aged 25-54 | 0.452 | 0.288 | | | | |
| | (0.428) | (0.383) | | | | |
| WH aged 25-54 | | | 0.779*** | 0.376 | | |
| | | | (0.086) | (0.393) | | |
| TLS aged 25-54 | | | | | 0.282 | 0.085 |
| | | | | | (0.407) | (0.152) |
| Statutory eligibility age | 0.005 | 0.003 | 0.171 | -0.165 | 0.257 | 0.106 |
| | (0.004) | (0.004) | (0.127) | (0.328) | (0.156) | (0.125) |
| Early eligibility age | 0.028*** | 0.008 | 0.016 | 0.474 | 1.175*** | 0.206 |
| | (0.006) | (0.005) | (0.133) | (0.871) | (0.241) | (0.111) |
| Constant | -2.033*** | -0.924* | -0.692 | 7.098 | -80.280*** | -21.218*** |
| | (0.442) | (0.405) | (9.531) | (40.308) | (15.539) | (5.223) |
| Country dummies included | Yes | Yes | Yes | Yes | Yes | Yes |
| *N* | 242 | 242 | 242 | 218 | 242 | 218 |

Notes: Clustered standard errors in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. The periods covered are: 1983-2013 for Australia, Belgium, Denmark, France and Germany, 1989-2013 for Finland, 1990-2013 for Sweden and 1995-2013 for Austria and The Netherlands. Due to the unavailability of the data on working hours for the age group 65+, Sweden is not part of that analysis.
Source: Authors' own calculations.

Our results show that labor force participation of men between age 55 and 64 has on average increased after the introduction of the flexibility reforms (see Table 2). The mean of the labor force participation of men in the age group 55-64 was 53% in the years before the reforms. LFP of men in that age group increased on average by 3.8% after the introduction of the flexible retirement reforms (Table 2, column 1). The effect for the age group 65+ is small and

insignificant (Table 2, column 2). Labor Force participation remained at around 7% before and after the flexibility reforms for this age group. This is in line with the hypothesis derived from the theoretical model that the effects of flexibility reforms on labor force participation can be positive or zero depending on the distribution of leisure preferences in the population and the cohorts affected. The fact that not many individuals increased participation in the labor market in the older age group despite the increased flexibility reflects their lower preferences for leisure. Our empirical results based on the OLS regressions give a first indication that the effect on LFP is positive.

Regarding the control variables, we find that there are no effects of the LFP of the young on the LFP of those aged 55-64 and 65+ or the standard eligibility age after controlling for country fixed effects. However, the early eligibility age has a positive and significant effect on LFP for those aged 55-64 but not on those age 65+. This is intuitive since the early eligibility age falls into the age window 55-64 in all countries allowing workers to leave the labor force. After age 65 individuals have reached the statutory retirement age in all countries except Denmark and the early eligibility age is not relevant for the decision to leave the workforce anymore.

The effect of the reform on working hours of older workers is shown in columns 3 and 4. There is a statistically significant decline in the number of hours worked by workers older than 55. Due to the reform, men aged 55-64 work 0.75 hours less per week than before the reform (Table 2, column 3). Average weekly hours worked decrease from 40.6 before the reforms to 39.8 after the reforms. The effects for workers aged 65 and above are larger. Their average weekly working hours decrease from 33.6 to 28.3. In other words, they work more than 5 hours less after the reforms (Table 2, column 4). This is also in line with the hypotheses derived before where we suggested that the effects on working hours could be positive or negative. Our evidence here indicates that the average effect is negative both for workers before and after the statutory eligibility age.

We are ultimately interested in the overall effect of the flexibility reforms on total labor supply. We therefore multiply the LFP and WH variables in order to obtain an unconditional measure of the total labor supply and run the regressions with the same explanatory variables as before. Results are presented in Table 2, columns 5 and 6. The post-reform dummy is neither significant for the total labor force participation of men aged 55-64 nor for those aged 65+. This means that overall the reforms do not seem to have had any effect on the total labor supply of older male works. The positive effect on labor force participation is offset by the

negative effect on hours worked, so that overall there is no measurable effect of the flexibility reforms on total labor supply across the nine countries included in the analysis.

## 5.4. SYNTHETIC CONTROL METHOD

### 5.4.1. The Model

As already explained, the OLS results cannot be interpreted causally if one suspects that there are unobserved time trends which could confound the analysis. Another disadvantage of the OLS method is that we pooled reforms across countries and time and thus obtain an average measure of the effects of the reforms described in Section 3. These reforms are, however, quite heterogeneous. We therefore apply the synthetic control method separately to those countries that introduced a flexibility reform in the past. The model that we adopt is the following:

Let $D_{jt}$ be an indicator for treatment, for country $j$ at time $t$. In our case this would be the adoption of a flexibility reform. Then the observed outcome variable $Y_{jt}$ can be defined as the sum of a time-varying treatment effect $\alpha_{jt} D_{jt}$ and the outcome that would have been observed for country $j$ at time $t$ if the reform had not taken place, expressed as $Y_{jt}^N$ (i.e. the counterfactual):

$$Y_{jt} = \alpha_{jt} D_{jt} + Y_{jt}^N = \alpha_{jt} D_{jt} + (\delta_t + \boldsymbol{\theta}_t \mathbf{Z}_j + \boldsymbol{\lambda}_t \boldsymbol{\mu}_j + \varepsilon_{jt}) \quad (2)$$

$Y_{jt}^N$ is determined by $\delta_t$, an unknown time factor; $\mathbf{Z}_j$, a vector of observed covariates (not affected by the treatment) which can be either time-invariant or time-varying; $\boldsymbol{\theta}_t$, a vector of unknown parameters; $\boldsymbol{\lambda}_t$, a vector of unobserved common factors; $\boldsymbol{\mu}_j$, a vector of unknown factor loadings and the error terms $\varepsilon_{jt}$ which are unobserved transitory shocks at the country level with zero mean. Assuming that only the first country is exposed to the treatment, the treatment effect $D_{jt}$ is estimated by approximating the counterfactual $Y_{1t}^N$ with a weighted average of untreated countries:

$$\hat{\alpha}_{1t} = Y_{1t} - \sum_{j \geq 2}^{J+1} w_j Y_{jt}$$

for $t \in \{T_0 + 1, ....., T\}$ with $0 \leq w_j \leq 1$ for $j = 2, ...., J+1$ and $w_2 + ..... + w_{J+1} = 1$, $T_0 + 1$ is the year of the treatment, $T$ is the total number of years and $J+1$ is the total number of countries in the sample. The weights are chosen such that pre-treatment characteristics of the treated country closely reflect those of the synthetic control country. These characteristics include all those salient covariates that explain the outcome variable and the pre-treatment values of the outcome variable.

Note that equation (2) is equivalent to estimating a traditional fixed effect model if $\lambda_t u_j = \phi_j$. That is, the traditional fixed effect model assumes that unobserved heterogeneity is time-invariant. The advantage of the synthetic control method over the fixed effect estimation is that it deals with endogeneity stemming from omitted variable bias by allowing the existence of unobserved time-varying variables in the estimation. Moreover, this method also allows for the presence of a common time trend across countries.

### 5.4.2. Treatment Effects

The quality of the estimation depends crucially on finding a good synthetic control. The synthetic control must provide a good approximation how the outcome variable of the treated country would have developed in the absence of the flexibility reform. This is the case if the counterfactual pre-treatment values of the outcome variable provided by the synthetic control are close to the corresponding values of the treated country. For constructing the synthetic control we use the average of the pre-treatment values of the outcome variables and a set of covariates which explain the outcome variable. These covariates are labor force participation at younger ages 25-54, the statutory eligibility age or the eligibility age for early retirement, GDP per capita, years of schooling, and life expectancy (see Tables A3 and A4 in the appendix for the quality of pre-treatment characteristics).[15][16] Since alternative specifications are possible we report robustness checks in the appendix (Figures A1 and A2). We were unable to establish the robustness of the treatment effects on labor force participation for Finland and The Netherlands, and on working hours for Sweden and The Netherlands. Therefore, we exclude those countries when reporting the treatment effects in the rest of the paper.

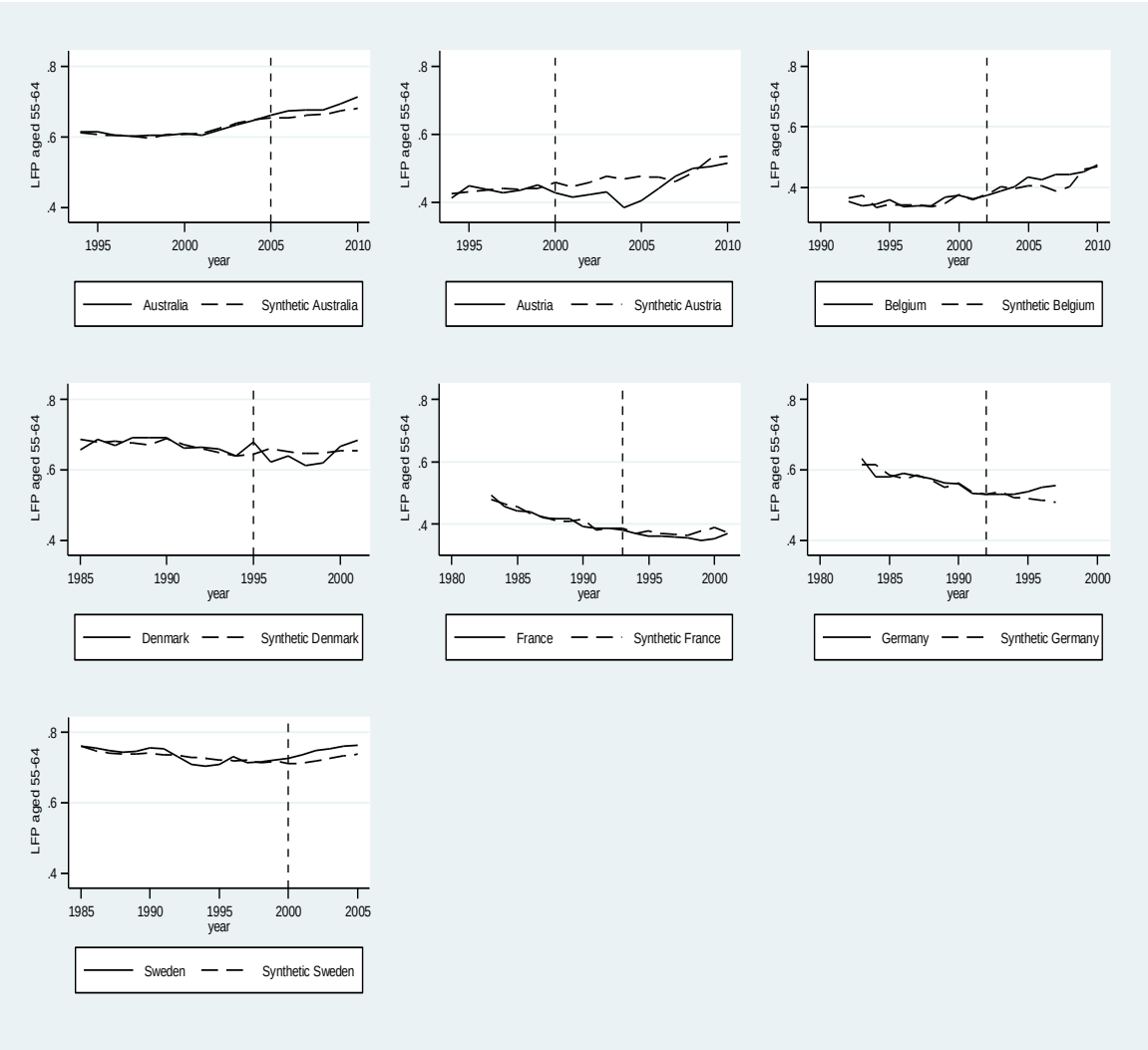
Figure 5 displays labor force participation rates of men aged 55 to 64 for the treated countries and their synthetic counterparts before and after the flexibility reforms. In general, the labor force participation trend for the synthetic control closely matches the corresponding trend for the treated country before the reform. In some countries such as Australia, the synthetic control almost exactly reproduces the actual labor force participation rates during the entire pre-treatment period. The treatment effect is given by the difference between labor force

[15] We do not include all lagged outcome values as predictors in order to increase the quality of the pre-treatment match since Kaul et al. (2015) show that the inclusion of the entire pre-treatment path of the outcome variable saturates the regression model and causes all other covariates to be irrelevant in the estimation.

[16] The control variables in the SCM are not identical to the controls of the pooled OLS. In OLS we pool countries and years. We therefore run into multicollinearity problems if we include too many variables that only vary by country or only over time. In SCM, however, we are interested in getting a very good prediction of the pre-treatment trend in the outcome variable, so we include all variables that contribute to an improvement in fit even if they are highly correlated.

participation rates in the treated country and in its synthetic counterpart after the implementation of the reform. The discrepancy between these two lines is positive for Australia, Belgium, Germany, and Sweden, indicating an increase in LFP. It is negative in France, indicating a decrease in LFP after the flexibility reforms. The picture for Austria and Denmark is mixed. In order to evaluate statistical significance in the following we present yearly treatment effects.

**Figure 5: Trends in Labor Force Participation: Treated vs. Synthetic Control**




Source: Authors' own calculations

Yearly treatment effects on labor force participation are summarized in Table 4 together with their statistical significance. To evaluate the significance of the treatment effects, we conduct placebo tests and calculate pseudo p-values. In other words, we check if the treatment effects are driven by chance by estimating the same model on each country in our control group, assuming it was treated at the same time in order to obtain a distribution of placebo effects. If

many of the placebo effects are as large as the actual effect, then it is likely that the actual effect is observed by chance.[17]

**Table 4: Post-treatment Results regarding LFP of Males aged 55-64, Effects and Pseudo p-values**

| **Australia** | | | **Austria** | | | **Belgium** | | |
|---|---|---|---|---|---|---|---|---|
| year | Estimates | pseudo p-values | year | estimates | pseudo p-values | Year | estimates | pseudo p-values |
| **2005** | **0.011*** ** | **0** | 2000 | -0.029 | 0.263 | 2002 | -0.005 | 0.823 |
| **2006** | **0.019*** ** | **0** | 2001 | -0.029 | 0.315 | 2003 | -0.013 | 0.529 |
| **2007** | **0.018*** ** | **0** | 2002 | -0.036 | 0.263 | 2004 | 0.008 | 0.823 |
| **2008** | **0.014*** ** | **0** | 2003 | -0.047 | 0.157 | 2005 | 0.026 | 0.411 |
| **2009** | **0.019*** ** | **0** | **2004** | **-0.083*** | **0.052** | 2006 | 0.021 | 0.529 |
| **2010** | **0.032*** ** | **0** | 2005 | -0.072 | 0.157 | **2007** | **0.054*** ** | **0** |
| | | | 2006 | -0.032 | 0.526 | 2008 | 0.041 | 0.117 |
| | | | 2007 | 0.015 | 0.736 | 2009 | -0.007 | 0.941 |
| | | | 2008 | 0.012 | 0.736 | 2010 | 0.005 | 0.941 |
| | | | 2009 | -0.023 | 0.473 | | | |
| | | | 2010 | -0.022 | 0.368 | | | |
| **Denmark** | | | **France** | | | **Germany** | | |
| year | Estimates | pseudo p-values | year | estimates | pseudo p-values | year | estimates | pseudo p-values |
| **1995** | **0.033*** ** | **0** | 1993 | -0.006 | 0.666 | 1992 | 0.001 | 0.846 |
| 1996 | -0.039 | 0.176 | 1994 | -0.003 | 0.866 | 1993 | -0.007 | 0.846 |
| 1997 | -0.013 | 0.411 | 1995 | -0.018 | 0.333 | 1994 | 0.009 | 0.923 |
| 1998 | -0.034 | 0.235 | 1996 | -0.007 | 0.733 | 1995 | 0.021 | 0.538 |
| 1999 | -0.028 | 0.294 | 1997 | -0.008 | 0.666 | 1996 | 0.036 | 0.307 |
| 2000 | 0.014 | 0.471 | 1998 | -0.007 | 0.6 | 1997 | 0.049 | 0.231 |
| 2001 | 0.03 | 0.352 | 1999 | -0.029 | 0.333 | | | |
| | | | 2000 | -0.035 | 0.333 | | | |
| | | | 2001 | -0.004 | 0.866 | | | |
| **Sweden** | | | | | | | | |
| year | Estimates | pseudo p-values | | | | | | |
| 2000 | 0.016 | 0.5 | | | | | | |
| 2001 | 0.024 | 0.285 | | | | | | |
| 2002 | 0.029 | 0.142 | | | | | | |
| 2003 | 0.028 | 0.142 | | | | | | |
| 2004 | 0.028 | 0.285 | | | | | | |
| 2005 | 0.026 | 0.357 | | | | | | |

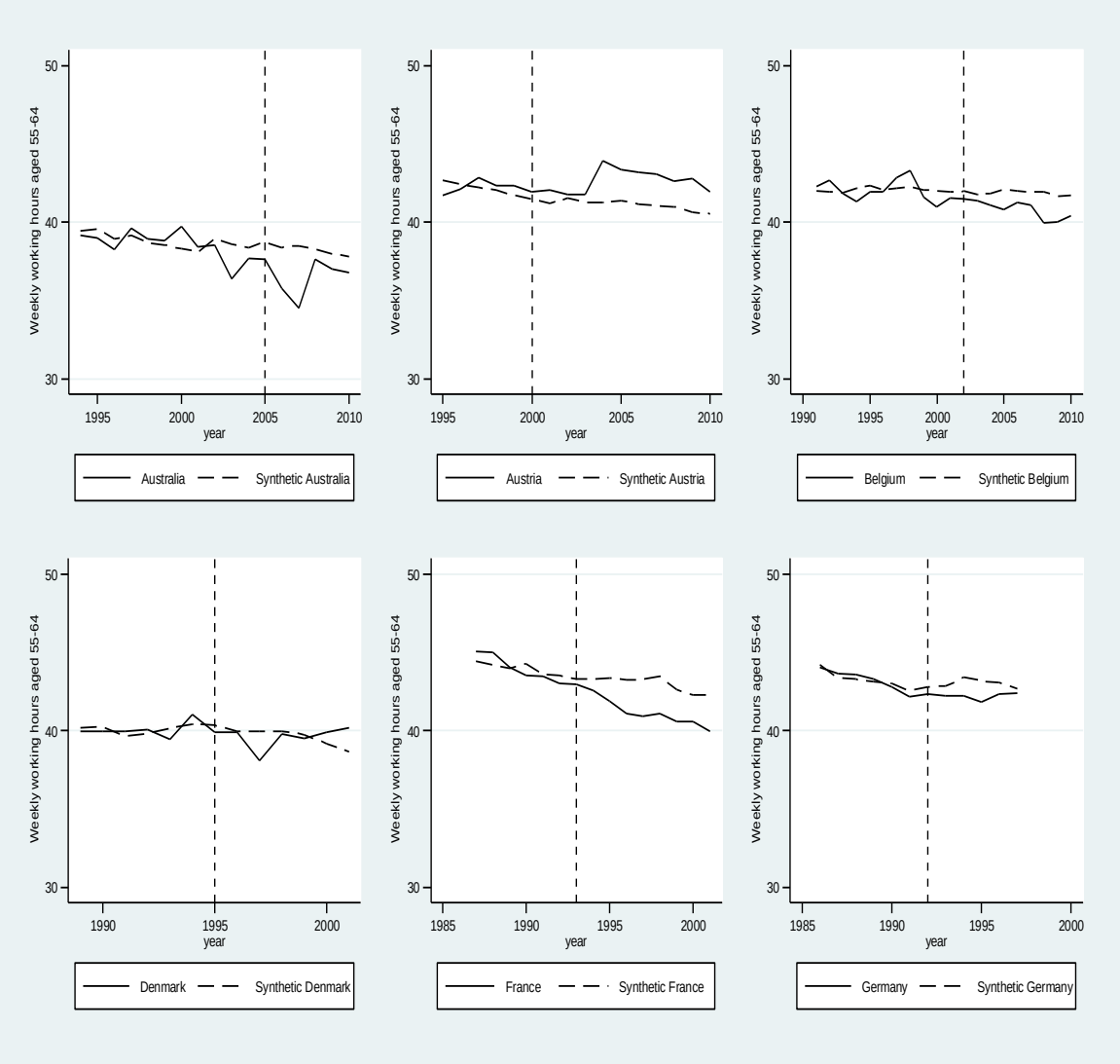
Note: $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Source: Authors' own calculations

[17] To evaluate the significance of the treatment effects, we conduct placebo tests and then calculate pseudo p-values. Those placebo effects can be quite large if the quality of matches in the pre-treatment period is poor. This would make p-values too conservative. Following Galiani and Quistorff (2016), we calculate the pseudo p-values by dividing the estimated treatment effects by the corresponding pre-treatment match qualities. Then the inferences are made based on these ratios instead of on the treatment effects solely. As defined by Galiani and Quistorff (2016), the pseudo p-value in one period is the proportion of placebo pseudo effects (each control unit's treatment effect divided by its pre-treatment root mean square error) that are at least as large as the actual treated unit's pseudo effect.

The results in Table 4 suggest that the estimated effect of the reform on labor force participation is close to zero in most of the post-reform years in most of the countries. It is positive and statistically significant only for Australia in all years after the reform. For Belgium there is a significant increase in labor force participation only in 2007, five years after the introduction of the reform. For Denmark the labor force participation significantly increased in the year of the reform only. For France, Germany, and Sweden the reform did not change the labor force participation significantly. Only for Austria we observe a weakly significant negative effect on labor force participation in 2004, four years after the reform was enacted. Thus, with the exception of Australia, there does not seem to be a consistent pattern of increased labor force participation due to the flexibility reforms.

In Figure 6 we show the trends in weekly working hours for men aged 55 to 64 for the treated countries and their synthetic counterparts. In general, pre-treatment observation periods for working hours are shorter compared to pre-treatment observation periods for labor force participation due to data restrictions. Nevertheless, the synthetic control matches for actual pre-treatment working hours were stable for six of our initial countries. Robustness checks are shown in the Appendix Figure A2.

**Figure 6: Trends in Working Hours: Treated vs. Synthetic Control**




Source: Authors' own calculations

According to Figure 6, the estimated effects of the flexibility reforms on working hours are negative in Australia, Belgium, France and Germany. The hours worked increased in Austria and the picture is mixed for the post-treatment years in Denmark.

The size of the treatment effects on working hours and pseudo p-values in each year are shown in Table 5. According to these results, the reforms' effect on working hours tends to be negative or close to zero for all post-treatment years and all countries except Austria. Effects are not always significant, but there are some significant negative effects determined in all countries. For Austria, on the other hand, there is a significant increase in working hours after the reform in 2004, 2005, and 2006 which may be due to other pension reforms which took place in Austria during the same time.

**Table 5: Post-treatment Results regarding Working Hours of Males aged 55-64, Effects and Pseudo p-values**

| Australia | | | Austria | | | Belgium | | |
|---|---|---|---|---|---|---|---|---|
| year | estimates | pseudo p-values | Year | estimates | pseudo p-values | year | estimates | pseudo p-values |
| 2005 | -1.081 | 0.333 | 2000 | 0.421 | 0.833 | 2002 | -0.484 | 0.571 |
| **2006** | **-2.607*** ** | **0** | 2001 | 0.838 | 0.333 | 2003 | -0.396 | 0.785 |
| **2007** | **-4.018*** ** | **0** | 2002 | 0.255 | 0.666 | 2004 | -0.755 | 0.214 |
| 2008 | -0.605 | 0.8 | 2003 | 0.522 | 0.666 | **2005** | **-1.254*** | **0.071** |
| 2009 | -0.956 | 0.666 | **2004** | **2.645*** ** | **0** | 2006 | -0.733 | 0.428 |
| 2010 | -1.070 | 0.733 | **2005** | **1.964*** | **0.055** | 2007 | -0.861 | 0.357 |
| | | | **2006** | **2.052*** | **0.055** | **2008** | **-1.983*** | **0.071** |
| | | | 2007 | 2.073 | 0.166 | 2009 | -1.618 | 0.142 |
| | | | 2008 | 1.657 | 0.277 | 2010 | -1.317 | 0.285 |
| | | | 2009 | 2.158 | 0.111 | | | |
| | | | 2010 | 1.378 | 0.444 | | | |
| **Denmark** | | | **France** | | | **Germany** | | |
| year | estimates | pseudo p-values | Year | estimates | pseudo p-values | year | estimates | pseudo p-values |
| 1995 | -0.477 | 0.333 | 1993 | -0.302 | 1 | 1992 | -0.492 | 0.231 |
| 1996 | -0.073 | 1 | 1994 | -0.75 | 0.538 | 1993 | -0.635 | 0.231 |
| **1997** | **-1.875*** | **0.066** | **1995** | **-1.485*** | **0.076** | 1994 | -1.16 | 0.154 |
| 1998 | -0.177 | 0.933 | **1996** | **-2.131*** | **0.076** | **1995** | **-1.352*** ** | **0** |
| 1999 | -0.231 | 0.933 | 1997 | -2.397 | 0.153 | 1996 | -0.723 | 0.154 |
| 2000 | 0.711 | 0.533 | 1998 | -2.393 | 0.153 | 1997 | -0.297 | 0.692 |
| 2001 | 1.5 | 0.2 | **1999** | **-2.02*** | **0.076** | | | |
| | | | 2000 | -1.723 | 0.153 | | | |
| | | | **2001** | **-2.36*** | **0.076** | | | |

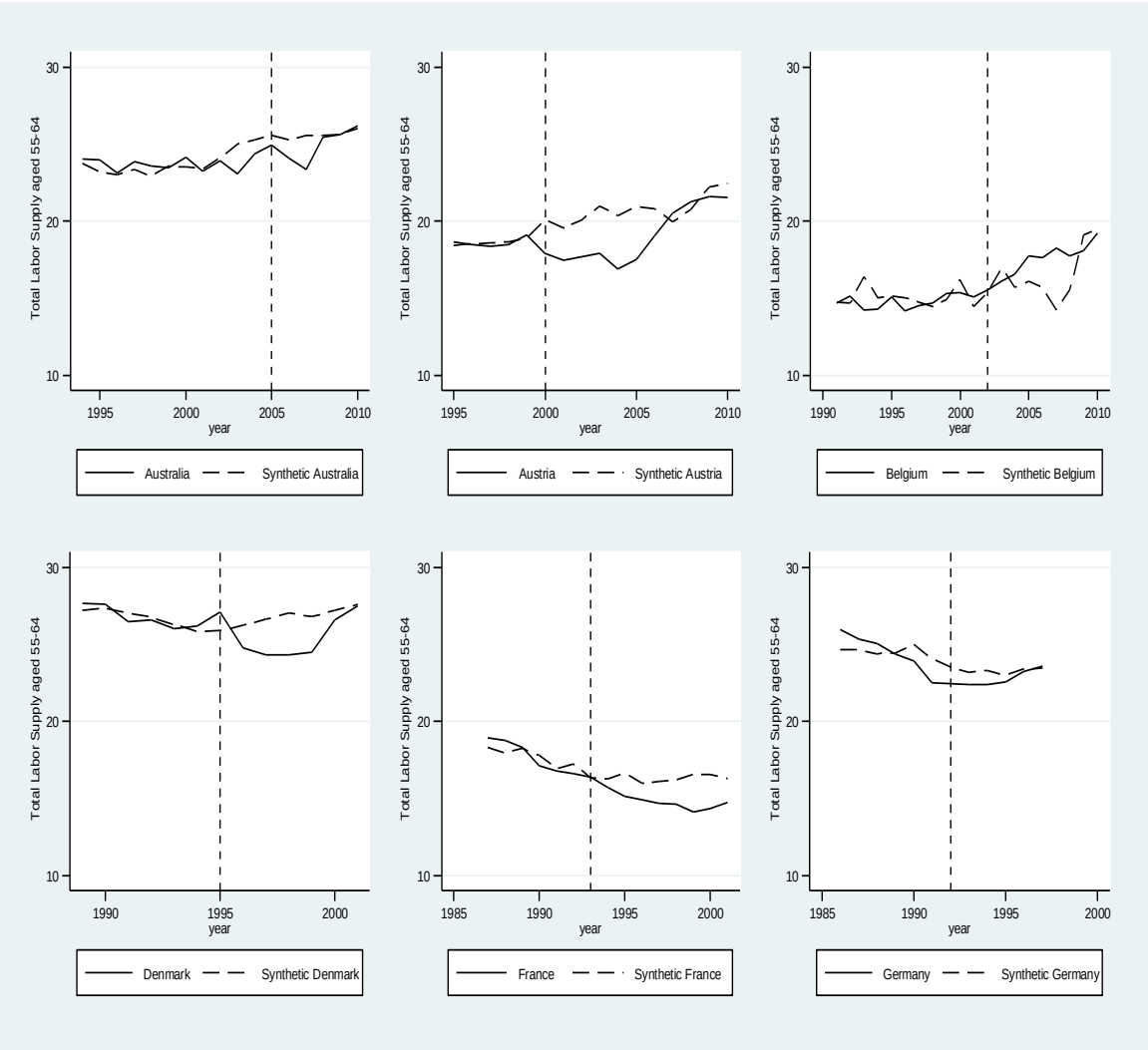
Note: $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Source: Authors' own calculations

As a final step, we estimate the effect of flexibility reforms on total labor supply of men aged 55-64. Total labor supply is measured as the product of labor force participation and working hours for those who participated. Time periods covered in this estimation are determined by the availability of the time series of working hours which are usually shorter than the time series of labor force participation.

Treatment effects on total labor supply of men aged 55-64 are shown graphically in Figure 7 and the yearly effect sizes and pseudo p-values are reported in Table 6. As Figure 7 shows, in all countries the change in total labor supply after the reform is negative except for Belgium. Table 6 reveals that total hours worked per week significantly decreased by 2.2 units (or 9%) in 2007 in Australia and by two to three units (or 11% to 16%) in the first seven years of the reform in Austria. In Denmark, we find a two unit (or 4%) increase in total hours worked per

week in the year of the reform, yet the direction of the effect changes starting from 1997, resulting in a reduction by two to three units (or 7% to 11%) between 1997 and 1999. In Belgium, on the other hand, total hours worked per week increased by four units (or 24%) in 2007, five years after the introduction of the reform. In France and Germany the total labor supply did not change significantly after the respective reforms.

**Figure 7: Trends in Males' Total Labor Supply: Treated vs. Synthetic Control**




Source: Authors' own calculations

**Table 6: Post-treatment Results for Total Labor Supply of Males aged 55-64, Effects and Pseudo p-values**

| Australia | | | Austria | | | Belgium | | |
|---|---|---|---|---|---|---|---|---|
| year | estimates | pseudo p-values | Year | estimates | pseudo p-values | year | estimates | pseudo p-values |
| 2005 | -0.647 | 0.733 | **2000** | **-2.192*** ** | **0** | 2002 | 0.190 | 0.928 |
| 2006 | -1.208 | 0.333 | **2001** | **-2.095 *** ** | **0** | 2003 | -0.872 | 0.714 |
| **2007** | **-2.214*** ** | **0.066** | **2002** | **-2.406*** ** | **0** | 2004 | 0.868 | 0.642 |
| 2008 | -0.072 | 1 | **2003** | **-3.055*** ** | **0** | 2005 | 1.605 | 0.5 |
| 2009 | -0.004 | 1 | **2004** | **-3.454*** ** | **0** | 2006 | 1.932 | 0.5 |
| 2010 | 0.133 | 0.933 | **2005** | **-3.459*** ** | **0** | **2007** | **4.011*** ** | **0** |
| | | | **2006** | **-1.786* ** | **0.055** | 2008 | 2.230 | 0.142 |
| | | | 2007 | 0.535 | 0.444 | 2009 | -1.008 | 0.642 |
| | | | 2008 | 0.485 | 0.5 | 2010 | -0.226 | 0.928 |
| | | | 2009 | -0.603 | 0.333 | | | |
| | | | 2010 | -0.919 | 0.166 | | | |

| Denmark | | | France | | | Germany | | |
|---|---|---|---|---|---|---|---|---|
| year | estimates | pseudo p-values | Year | estimates | pseudo p-values | year | estimates | pseudo p-values |
| **1995** | **1.192*** ** | **0** | 1993 | 0.040 | 0.923 | 1992 | -1.107 | 0.692 |
| 1996 | -1.457 | 0.133 | 1994 | -0.576 | 0.538 | 1993 | -.802 | 0.615 |
| **1997** | **-2.301* ** | **0.066** | 1995 | -1.543 | 0.307 | 1994 | -.892 | 0.769 |
| **1998** | **-2.744* ** | **0.066** | 1996 | -1.089 | 0.384 | 1995 | -.447 | 0.846 |
| **1999** | **-2.339* ** | **0.066** | 1997 | -1.431 | 0.461 | 1996 | -.155 | 0.923 |
| 2000 | -0.579 | 0.666 | 1998 | -1.576 | 0.615 | 1997 | .127 | 1 |
| 2001 | -0.124 | 1 | 1999 | -2.422 | 0.307 | | | |
| | | | 2000 | -2.209 | 0.307 | | | |
| | | | 2001 | -1.542 | 0.461 | | | |

Note: $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Source: Authors' own calculations

Finally, we would like to link the differences in the effects found in the various countries to the specific reform features or the context of the reform.

**Germany** and **France** show very similar labor market patterns: the effect on LFP is zero, hours worked decline slightly in the years after the reform and overall we find no effect on total labor supply. Both countries introduced the flexibility schemes in the early 1990s, Germany in 1992 and France in 1993. In Germany at the time several early retirement routes existed for workers. Those pathways to retirement were very generous since they were granted to qualifying workers mostly without deductions. Deductions for early retirement were phased in gradually by cohort at the end of the 1990s. Compared to those schemes the partial retirement scheme was never very attractive. In 1993 only 1,100 workers chose partial retirement. The total fraction of new pensioners claiming a partial pension was below 0.5% in

each year (Börsch-Supan et al. 2015). The reasons for the unattractiveness of the scheme were supposedly related to the very strict earnings tests and the complicated regulations (Börsch-Supan et al. 2012 and Gasche and Krolage 2012). In France the individuals selecting the so-called RPR scheme was larger – around 45,000 individuals at the end of the 1990s. However, compared to the alternative early retirement schemes the number was small. The scheme was abolished in 2004.

**Denmark** enacted the flexibility reform in 1995. We find a positive LFP effect in the first year after the reform, and a negative effect on WH after three years. Overall, total labor supply increased only in the first year of the reform and after that decreased slightly. Hansen (2001) reports that the Danish part-time scheme never attracted many participants (only around 1,000 per year). He proposes that this could be due to the unavailability of suitable part-time jobs. Additionally, an attractive early retirement scheme existed in Denmark, which attracted around 150,000 individuals at the end of the 1990s (Hansen 2001). Thus, similar to France and Germany the partial retirement scheme in Denmark seemed to lack popularity most likely due to the simultaneous existence of attractive routes for full early retirement.

**Austria** adopted the part-time scheme in 2000. We find no effect on LFP except in 2004, where we find a negative effect, which is contrary to our predictions but only weakly significant at the 10% level. We find a positive effect on weekly working hours in the years 2004 to 2006 which is again in contrast to all other countries in our study. It is strongly significant for the year 2004 in which the flexibility scheme was reformed again. What we see is most likely not the effect of the flexibility reform in 2000 but rather the effect of the pension reform in 2004. This reform made early retirement more costly by increasing eligibility ages to various early retirement pathways and introducing actuarial adjustments to benefits received before the statutory retirement age. Overall, however, we find a significantly negative effect of the flexibility reforms on total labor supply. These results are in line with the micro-econometric estimation results obtained by Graf et al. (2008 and 2011) who find a significant reduction of the part-time scheme on total labor supply for both men and women.

The **Belgian** part-time scheme was introduced in 2002, after the baby-boomers had already started to retire. We find zero effects on LFP in all years except in 2007, where we find a significantly positive effect on LPF. Effects on working hours are mostly negative, however they are only significant in 2005 and 2008. The effect of the flexibility scheme on total labor supply is zero in all years except in 2007. Here the positive effect on LFP creates an overall positive effect on labor supply. Overall, the so-called time credit scheme is evaluated as

successful scheme in terms of take-up. It was criticized because it did not show the desired effects of keeping individuals in the labor force longer, but it was used in some sectors as an early exit scheme (Albanese et al. 2015).

**Australia** enacted the reform in 2005, when the baby-boomers had already started to retire (the oldest babyboomer cohort reached the retirement window in 2001). It is the only country where we find a consistently positive effect of the reform on LFP. However, we find a slightly negative effect on working hours after two and three years, so that the overall effect of the reform on labor supply becomes zero (negative in year three after the reform). Overall, only few relatively wealthy workers opted for the scheme. This could be related to the tax incentives or lack of information about the available options (Australian Government 2015).

To summarize in line with the hypotheses derived from our theoretical model, we find that labor force participation slightly increased or stayed the same in most countries after the introduction of the flexibility reforms. At the same time hours worked largely decreased after the reforms. Both effects are in line with the prediction derived in our theoretical model. The overall effects on total labor supply are either zero or negative, except for Belgium, where we find a slight increase in total labor supply five years after the flexibility reforms. What is more, results from the pooled OLS and SCM approaches consistently point into the same directions and are in line with our theoretical predictions. This makes us confident that the evidence is robust in spite of the various caveats of the methods and the dearth of data available especially for working hours in the early periods of our investigation.

## 6. CONCLUSIONS

In the face of the demographic burden many countries have attempted to tap better into the pool of older workers and change patterns of transiting from full-time work to full retirement. For this purpose many countries have enacted reforms which make retirement more flexible. While the details of these reforms vary greatly from country to country, they have a common core: They allow older workers to remain working part-time on their job and earn a (sometimes subsidized) wage while already drawing part of their pension. In many cases, these reforms removed restrictions on labor supply in the form of minimum and maximum hours constraints. These policies have often been sold as an alternative for the unpopular policy of increasing the statutory retirement age.

Making things more flexible sounds like a good thing for sure. However, this paper shows that this is not true in such generality. From a theoretical point of view, it is *ex ante* unclear that these flexibility reforms are designed in such a way that total labor supply will increase. We show that flexibility reforms can actually endanger the intended goal of increasing total labor volume. Our empirical analyses show *ex post* that they have done so in most of the countries in our study.

Total labor supply is the product of labor force participation (the extensive margin) and average hours worked (the intensive margin). One has to consider the effects of increased flexibility on both margins. Our theoretical model shows that the effect of a reform on labor force participation is positive if workers value leisure highly. If they have a moderate or low preference for leisure, there will be no effect on labor force participation. Moreover, the effect on total hours worked can be positive or negative depending on the distribution of age-related leisure preferences in the population.

We exploit the evidence drawn from several flexibility reforms that were introduced in nine OECD countries between 1992 and 2006. Using two different econometric approaches, we reach the same conclusion: while on average (OLS) and in some countries and years (SCM) the flexibility reforms introduced since the 1990s have increased labor force participation rates of older men aged 55-64 they have decreased their weekly working hours, creating zero to slightly negative effects on total labor supply.

Thus, if the objective of flexibility reform is to increase labor supply of older workers, the flexibility reforms that have been enacted so far have failed to reach this objective. The positive effects on labor force participation were in most countries undone by negative effects on weekly working hours.

Notwithstanding this failure, flexibility reforms may have positive welfare effects. This is where the intuition of "more flexibility is better" holds because constraints are removed. Welfare is improved as individuals are put into a situation which permits them to better trade-off leisure and consumption in their specific life circumstances. For instance, if individuals would like to spend time caring for a relative or are not healthy enough to work full time but would like to work part-time and smooth consumption, more flexible working conditions may well be welfare improving.

The message of this paper is therefore that increasing flexibility has two sides to it. More flexibility may improve welfare but comes at an economic price, endangering much needed labor volume. Flexibility may taste sweet but policy makers cannot escape the fact that if one

wants to increase labor volume for an aging population, one must also increase the average exit age from the labor force.

How can one sweeten this sour fruit? Increasing the retirement age has often been perceived as exchanging years in sweet retirement for years in sour work. This view is wrong since during the period in which the retirement age will be gradually increased, life expectancy will also increase – short of an unlikely reversal of the trend during the last decades. This permits increasing the length of the working life in parallel to increasing the length of life in retirement. Stabilizing the financial base of a pension system with respect to ever longer lives only requires stabilizing the ratio of time spent in retirement to time spent in work. Thus, to make it concrete, the sour fruit of 2 years more work can be sweetened by 1 year more retirement made possible by an increase of life expectancy by 3 years. These numbers correspond to the ratio of roughly 40 years of work and 20 years of retirement in most OECD countries, plus the fact that these countries gain about 3 years of life expectancy in about 15 calendar years if the trend of the last decades will continue. Even better would be to make this proportionality rule an automatic stabilizer as proposed by Börsch-Supan (2007) and OECD (2011b) which could then also accommodate different speeds or even a reversal in the increase of life expectancy.

Other possible accompanying measures are the abolishment of all earnings tests – if, and this is a strong if, pension systems are made actuarially fair. Earnings tests are only necessary if the pension system provides non-actuarial transfers. In a DC system in which benefits match contributions, earnings tests are superfluous (Disney and Smith 2002).

Mandatory retirement ages are obviously counterproductive to flexibility and longer working lives. The often voiced argument that older workers need to make place for the young is wrong, at least in such generality, see the country chapters in Gruber and Wise (2010). As we have shown, minimum hours constraints imposed by employers have effects similar to a mandatory retirement age. In a modern service economy, fixed costs of work are probably much lower than they were in economies dominated by manufacturing, hence such constraints could be abolished.

In a package with all these elements, flexibility reforms are a complement, not a substitute. While the evidence is still outstanding, such a package is more likely to increase total labor volume and thereby strengthen the financial base of our pension systems.

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# 8. APPENDICES

## 8.1. Annex 1. Model without constraints on hours worked (situation after flexibility reform)

$\text{MaxU}(c_1,c_2,c_3,l_1,l_2,l_3)$

s.t. $wl_1 + wl_2 = c_1 + c_2 + c_3\,, \quad l_3 = 0$

where

$$\text{U}(c_1,c_2,c_3,l_1,l_2,l_3) = \sum_{t=1}^{3} u\left(c_t\right) + \alpha \sum_{t=1}^{3} v\left(1-l_t\right)$$

Optimal consumption is:

$c_1 = c_2 = c_3 = c^*$

$$c^* = \frac{wl_1 + wl_2}{3}$$

Let's assume that $u\left(c_t\right) = \ln c_t$ and $v\left(1-l_t\right) = \ln\left(1-l_t\right)$

Then optimal hours worked in the first two periods are obtained as follows:

$$l_1^* = l_2^* = \frac{3}{2\alpha + 3}$$

If N is the total number of people in the population, share of retirees= $\frac{N}{3}$

Total labor supply= $\frac{N}{3} \cdot \frac{3}{2\alpha+3} + \frac{N}{3} \cdot \frac{3}{2\alpha+3} = \frac{2N}{2\alpha+3}$.

## 8.2. Annex 2. Model with minimum hours constraints imposed (situation before flexibility reform)

In the second period the individual chooses whether he works or retires. If someone wishes to work in the second period, he must work for a minimum of $\bar{l}$ hours in that period. In this case $l_2^{**} \geq \bar{l}$ and the utility from working will be denoted by $U\left(c^{**}, l_1^{**}, l_2^{**}\right)$. If someone wishes to retire, the number of hours worked is equal to zero and the utility from being retired will be denoted by $U\left(c^{***}, l_1^{***}, 0\right)$.

If $U\left(c^{***}, l_1^{***}, l_2^{***}\right) > U\left(c^{**}, l_1^{**}, l_2^{**}\right)$, individual chooses to retire, he works otherwise.

The maximization of the utility function subject to the budget constraint and hours constraint $l_2 \geq \bar{l}$ yields $l_2^{**} = \bar{l}$ and $l_1^{**} = \dfrac{3 - \alpha\bar{l}}{\alpha + 3}$

If $l_2 = 0$, the solution of the maximization problem yields $l_1^{***} = \dfrac{3}{3+\alpha}$

Comparison of $U\left(c^{***}, l_1^{***}, l_2^{***}\right)$ with $U\left(c^{**}, l_1^{**}, l_2^{**}\right)$ reveals that the individual retires if

$$\alpha'' = \frac{-3\ln\left(1+\bar{l}\right)}{\ln\left(1+\bar{l}\right)+\ln\left(1-\bar{l}\right)} < \alpha \cdot$$

There are three cases depending on $\alpha$ and $\bar{l}$:

(a) If $\bar{l} < \dfrac{3}{2\alpha+3} = \alpha'$, we have the same problem as if there were no constraints on hours worked. So:

$$l_1^* = l_2^* = \frac{3}{2\alpha+3}$$

If N is the total number of people in the population, share of retirees= $\dfrac{N}{3}$

Total labor supply= $\dfrac{N}{3} \cdot \dfrac{3}{2\alpha+3} + \dfrac{N}{3} \cdot \dfrac{3}{2\alpha+3} = \dfrac{2N}{2\alpha+3}$.

(b) If $\bar{l} \geq \dfrac{3}{2\alpha+3} = \alpha'$, and if $\alpha'' = \dfrac{-3\ln\left(1+\bar{l}\right)}{\ln\left(1+\bar{l}\right)+\ln\left(1-\bar{l}\right)} < \alpha$,

individual retires in the second period, $l_1^{***} = \dfrac{3}{3+\alpha}$, $l_2^{***} = 0$,

Share of retirees= $\dfrac{2N}{3}$

Total labor supply= $\frac{N}{3}.\frac{3}{3+\alpha}=\frac{N}{3+\alpha}<\frac{2N}{2\alpha+3}$

implying that total labor supply is smaller compared to the unconstrained case.

(c) If $\bar{l}\geq\frac{3}{2\alpha+3}=\alpha'$, and if $\alpha''=\frac{-3\ln\left(1+\bar{l}\right)}{\ln\left(1+\bar{l}\right)+\ln\left(1-\bar{l}\right)}\geq\alpha$,

individual works in the second period, $l_1^{**}=\frac{3-\alpha\bar{l}}{3+\alpha}$, $l_2^{**}=\bar{l}$,

Share of retirees= $\frac{N}{3}$

Total labor supply= $\frac{N}{3}.\frac{3\left(\bar{l}+1\right)}{3+\alpha}=\frac{N\left(\bar{l}+1\right)}{3+\alpha}>\frac{2N}{2\alpha+3}$.

Together with $\bar{l}\geq\frac{3}{2\alpha+3}$, this implies that total labor supply is larger compared to the unconstrained case.

## 8.3. Annex 3. Synthetic Control Weights

### Table A1: Synthetic Control Weights, Outcome Variable: Labor Force Participation

| **Untreated Countries** | **Treated Countries** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Australia | Austria | Belgium | Denmark | Finland | France | Germany | The Netherlands | Sweden |
| Belgium | - | - | - | 0 | - | 0.468 | - | - | - |
| Canada | 0.507 | 0 | 0 | 0 | 0 | 0 | 0 | 0.479 | 0.328 |
| Czech republic | 0 | 0.042 | - | - | - | - | - | - | - |
| Estonia | 0 | - | - | - | - | - | - | - | - |
| Finland | - | - | - | 0 | - | 0 | - | - | - |
| Greece | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hungary | 0 | 0 | 0.285 | - | 0 | - | - | 0.059 | - |
| Iceland | 0 | 0 | 0 | - | 0 | - | - | 0 | - |
| Ireland | 0 | 0 | 0 | 0 | 0 | 0 | 0.472 | 0 | 0 |
| Israel | 0.327 | 0 | - | 0 | 0 | - | - | 0 | 0.205 |
| Italy | 0 | 0 | 0.094 | 0 | 0.487 | 0.217 | 0.181 | 0.024 | 0 |
| Japan | 0.047 | 0.005 | 0 | 0 | 0 | 0 | 0 | 0 | 0.375 |
| Korea | 0 | 0 | 0 | 0.136 | 0 | 0 | 0 | 0 | 0.092 |
| Luxembourg | 0.096 | 0.548 | 0.621 | 0.195 | 0.054 | 0.314 | 0.306 | 0.438 | 0 |
| The Netherlands | - | - | - | - | - | - | - | - | 0 |
| New Zealand | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Norway | 0 | 0 | 0 | 0 | 0.097 | 0 | 0 | 0 | 0 |
| Poland | 0 | 0.128 | 0 | - | 0.331 | - | - | 0 | - |
| Portugal | 0 | 0 | 0 | 0.052 | 0.031 | 0 | 0.04 | 0 | 0 |
| Slovak republic | 0 | - | - | - | - | - | - | - | - |
| Spain | 0 | 0.276 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sweden | - | - | - | 0.616 | - | - | - | - | - |
| Switzerland | 0 | 0 | 0 | - | 0 | - | - | 0 | - |
| UK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| US | 0.023 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Time periods covered | 1994-2010 | 1994-2010 | 1992-2010 | 1985-2001 | 1992-2010 | 1983-2001 | 1983-1997 | 1992-2010 | 1985-2005 |

Note: "-" means that the corresponding country is not included in the estimation.
Source: Authors' own calculations

## Table A2: Synthetic Control Weights, Outcome Variable: Weekly Working Hours

| **Untreated Countries** | **Treated Countries** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Australia | Austria | Belgium | Denmark | Finland | France | Germany | The Netherlands | Sweden |
| Australia | - | - | - | - | - | - | 0 | - | - |
| Belgium | - | - | - | 0.057 | - | 0.388 | 0 | - | - |
| Canada | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Czech republic | - | - | - | - | - | - | - | - | - |
| Estonia | - | - | - | - | - | - | - | - | - |
| Finland | - | - | - | 0.378 | - | - | - | - | - |
| Greece | 0 | 0 | 0 | 0 | 0 | 0 | 0.015 | 0 | 0 |
| Hungary | - | 0.066 | - | - | - | - | - | - | - |
| Iceland | - | 0 | - | - | - | - | - | - | - |
| Ireland | 0 | 0.154 | 0 | 0 | 0 | 0.092 | 0 | 0 | 0 |
| Israel | - | 0 | - | - | - | - | - | - | - |
| Italy | 0 | 0.207 | 0.09 | 0 | 0 | 0 | 0 | 0 | 0 |
| Japan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Korea | 0 | 0 | 0 | - | 0 | - | - | 0 | - |
| Luxembourg | 0 | 0 | 0 | 0.14 | 0 | 0.127 | 0.164 | 0 | 0 |
| The Netherlands | - | - | - | 0.378 | - | - | 0.307 | - | 0.855 |
| New Zealand | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Norway | 0.553 | 0.297 | 0.141 | 0 | 0.078 | - | - | 1 | 0.145 |
| Poland | - | - | - | - | - | - | - | - | - |
| Portugal | 0 | 0.042 | 0.038 | 0 | 0 | 0.011 | 0.399 | 0 | 0 |
| Slovak republic | 0.038 | 0 | - | - | - | - | - | - | - |
| Spain | 0 | 0.233 | 0.375 | 0 | 0 | 0.382 | - | 0 | 0 |
| Sweden | - | - | - | - | - | - | - | - | - |
| Switzerland | 0.409 | 0 | 0 | - | 0.642 | - | - | 0 | - |
| UK | 0 | 0 | 0 | 0 | 0 | 0 | 0.007 | 0 | 0 |
| US | 0 | 0 | 0.357 | 0.047 | 0.28 | 0 | 0.108 | 0 | 0 |
| Time periods covered | 1994-2010 | 1995-2010 | 1991-2010 | 1989-2001 | 1991-2010 | 1987-2001 | 1986-1997 | 1991-2010 | 1990-2005 |

Note: "-" means that the corresponding untreated country is not included in the estimation.
Source: Authors' own calculations

## 8.4. Annex 4. Robustness of the Treatment effects

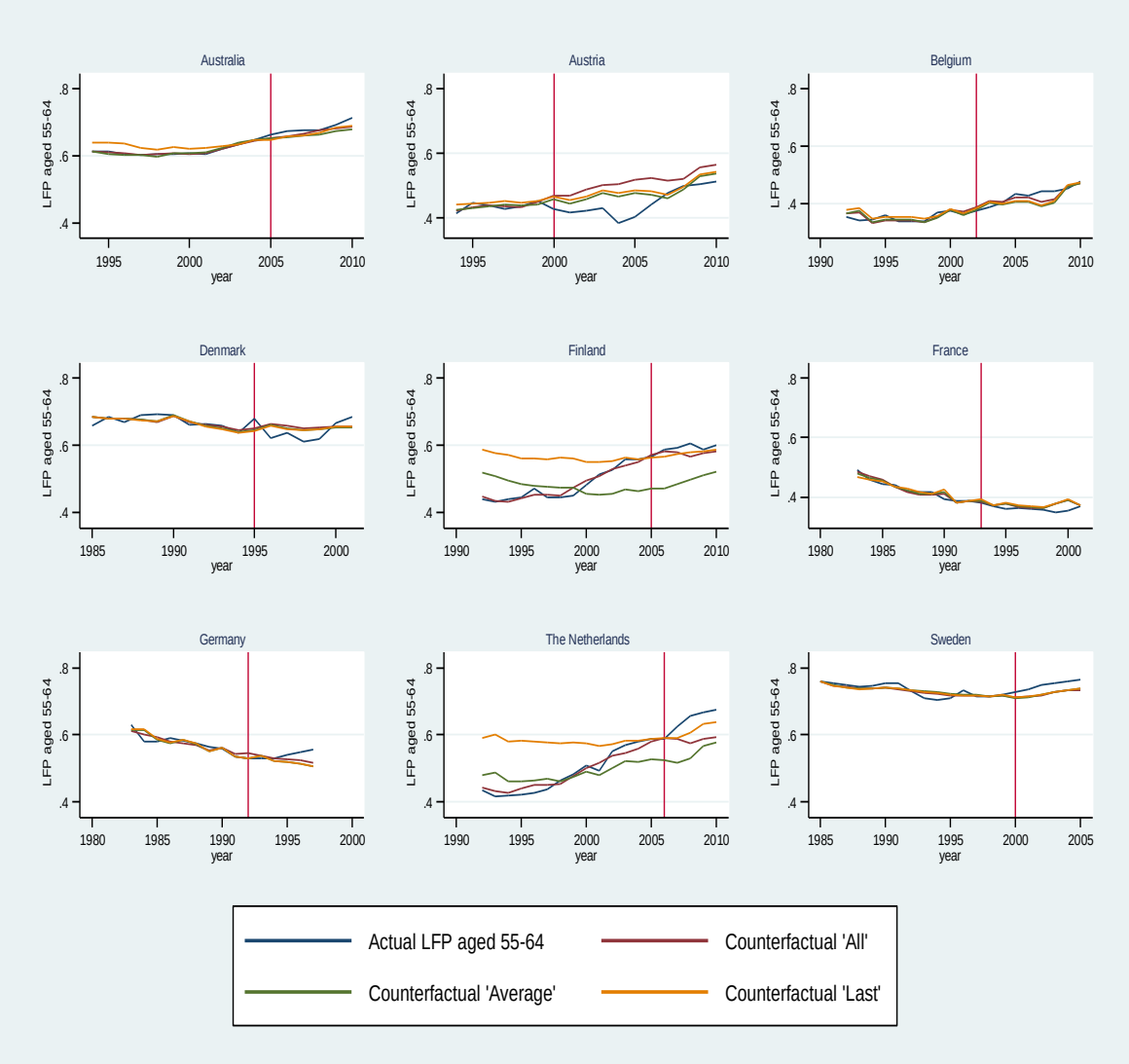
We check the robustness of the treatment effects using a method developed by Kaul et al. (2015). They point out that it is important to keep the number of pre-treatment outcome values as small as possible in the estimation. They also recommend applying the synthetic control method at least twice. One estimation should include only the average of the pre-treatment outcome variable in addition to the covariates, while the other estimation should use only the last pre-treatment value of outcome variable in addition to the set of covariates. If the two estimations yield similar results in the sense that if the weights of the corresponding synthetic units and, therefore, the pattern of the predicted counterfactuals are close to each other, the treatment effects are unbiased since the inclusion of the lagged outcome variable does not substantially change the size of the treatment effects.

Following Kaul et al. (2015), we report the treatment effects obtained using both estimators as discussed above. Figures A1 and A2 show the treatment effects on labor force participation and working hours for those aged 55-64, respectively, under different specifications and for all treated countries. The red vertical line stands for the year of the reform in each treated country. The blue line depicts the actual outcome trajectory for a treated country while the red line shows the synthetic control for the corresponding treated country constructed using all pre-treatment values of the outcome variable before the reform in addition to the set of covariates. The green and orange lines stand for the synthetic controls obtained using the average and the last pre-treatment values of the outcome variables, respectively, plus covariates. A comparison of the green and orange lines for labor force participation reveals a robust effect of the treatment for all countries except Finland and the Netherlands. In these two countries, the use of the pre-treatment average leads to a substantially different synthetic control than the use of the last pre-treatment value as additional predictor in the estimation. Although for these two countries the use of all pre-treatment values seems to provide a good match between the labor force participation series of the treated and the synthetic control before the treatment, the predicted treatment effects differ across the three alternatives. In other words, the data at hand and the covariates used in the estimation are not enough to find a robust effect of the reform on labor force participation using the synthetic control method for these countries. Therefore, we exclude Finland and the Netherlands from our analysis in the rest of the paper.

As Figure A2 demonstrates, the use of the pre-treatment average leads to similar treatment effects on working hours compared to the use of the last pre-treatment value in the estimation for most of the countries except Sweden. For the Netherlands, on the other hand, the match quality before the treatment is not good enough no matter which specification is used probably because Norway is the only country which receives a positive weight in its synthetic control (see Table A2 above).

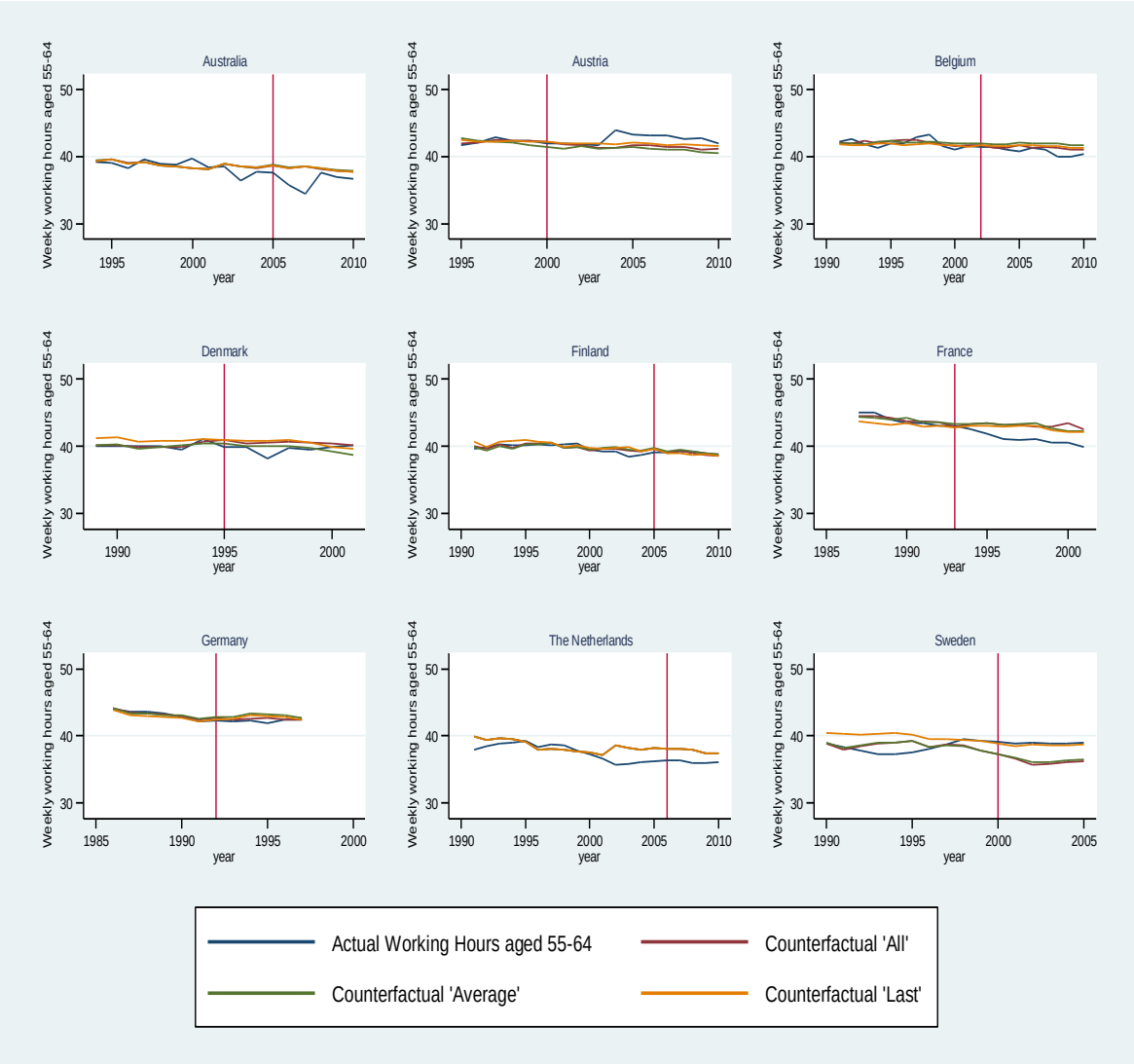
Since the use of the average and the last pre-treatment values give similar results for most of the countries, we will use the average pre-treatment outcome variable in addition to the set of covariates in the rest of our analysis.

**Figure A1: Trends in Males' LFP aged 55-64, Robustness of the Treatment Effects**




Source: Authors' own calculations

**Figure A2: Trends in Males' Working Hours aged 55-64, Robustness of the Treatment Effects**




Source: Authors' own calculations

## 8.5. Annex 5. The Quality of Pre-treatment Characteristics

Tables A3 and A4 compare the pre-treatment characteristics of the synthetic control to those of the treated country where the outcome variables are labor force participation and working hours, respectively. Overall, the results suggest that for all countries which adopted a flexibility reform in the past, the synthetic country provides a good approximation for the corresponding actual country before the reform. Only in few cases, there is a discrepancy between the treated country and its synthetic control in terms of GDP per capita. This stems from the fact that among all predictor variables GDP per capita has the lowest power especially for predicting labor force participation before the reform. For some countries we used the standard retirement age instead of the possible years of early retirement as the quality of the pre-treatment matches increased remarkably in those cases.

**Table A3: Labor Force Participation Predictor Means before the Partial Retirement Reform**

| | Australia | Synthetic Australia | Austria | Synthetic Austria |
|---|---|---|---|---|
| LFP aged 55-64 | 0.615 | 0.614 | 0.436 | 0.435 |
| LFP aged 25-54 | 0.907 | 0.906 | 0.937 | 0.932 |
| Statutory eligibility age | 65 | 65.013 | 65 | 64.739 |
| GDP per capita | 35416.880 | 34636.140 | 34008.580 | 44096.170 |
| Years of schooling | 11.257 | 11.135 | 9.705 | 9.612 |
| Life expectancy | 76.345 | 76.099 | 73.967 | 73.069 |
| | Belgium | Synthetic Belgium | Denmark | Synthetic Denmark |
| LFP aged 55-64 | 0.352 | 0.353 | 0.671 | 0.670 |
| LFP aged 25-54 | 0.919 | 0.915 | 0.938 | 0.941 |
| Years of early retirement | 5 | 5.001 | 7 | 6.140 |
| GDP per capita | 32488.350 | 47387.800 | 32369.450 | 30167.100 |
| Years of schooling | 10.284 | 10.035 | 9.791 | 10.083 |
| Life expectancy | 73.930 | 71.636 | 72.170 | 72.788 |
| | France | Synthetic France | Germany | Synthetic Germany |
| LFP aged 55-64 | 0.425 | 0.426 | 0.577 | 0.577 |
| LFP aged 25-54 | 0.956 | 0.938 | 0.922 | 0.935 |
| Years of early retirement | 5 | 4.995 | 2 | 2.907 |
| GDP per capita | 26884.150 | 33139.190 | 28163.860 | 27605.390 |
| Years of schooling | 7.528 | 9.040 | 8.510 | 9.137 |
| Life expectancy | 72.040 | 71.780 | 71.771 | 71.611 |
| | Sweden | Synthetic Sweden | | |
| LFP aged 55-64 | 0.733 | 0.732 | | |
| LFP aged 25-54 | 0.928 | 0.935 | | |
| Years of early retirement | 6.091 | 3.975 | | |
| GDP per capita | 29942.470 | 26400.500 | | |
| Years of schooling | 10.639 | 10.714 | | |
| Life expectancy | 75.420 | 74.667 | | |

Note: Years of early retirement is defined as the difference between the statutory and the early eligibility age.

Source: Authors' own calculations

**Table A4: Working Hours Predictor Means before the Partial Retirement Reform**

| | Australia | Synthetic Australia |
|---|---|---|
| Working hours aged 55-64 | 38.602 | 38.797 |
| Working hours aged 25-54 | 41.153 | 41.025 |
| Statutory eligibility age | 65 | 65.916 |
| GDP per capita | 35416.880 | 48025.180 |
| Years of schooling | 11.257 | 10.971 |
| Life expectancy | 76.345 | 76.033 |
| | Austria | Synthetic Austria |
| Working hours aged 55-64 | 42.275 | 42.226 |
| Working hours aged 25-54 | 41.472 | 41.784 |
| Statutory eligibility age | 65 | 64.877 |
| GDP per capita | 34428.920 | 34719.110 |
| Years of schooling | 9.788 | 9.722 |
| Life expectancy | 74.120 | 74.205 |
| | Belgium | Synthetic Belgium |
| Working hours aged 55-64 | 42.036 | 42.085 |
| Working hours aged 25-54 | 40.774 | 42.201 |
| Statutory eligibility age | 65 | 65.093 |
| GDP per capita | 32238.200 | 34919.590 |
| Years of schooling | 10.243 | 10.261 |
| Life expectancy | 73.836 | 74.264 |
| | Denmark | Synthetic Denmark |
| Working hours aged 55-64 | 40.093 | 40.094 |
| Working hours aged 25-54 | 40.883 | 40.636 |
| Years of early retirement | 7 | 4.906 |
| GDP per capita | 33021.480 | 33184.840 |
| Years of schooling | 9.995 | 9.713 |
| Life expectancy | 72.417 | 72.730 |
| | France | Synthetic France |
| Working hours aged 55-64 | 44.029 | 44.026 |
| Working hours aged 25-54 | 42.096 | 42.230 |
| Years of early retirement | 5 | 4.577 |
| GDP per capita | 28116.680 | 28237.570 |
| Years of schooling | 7.948 | 8.730 |
| Life expectancy | 72.617 | 72.711 |
| | Germany | Synthetic Germany |
| Working hours aged 55-64 | 43.265 | 43.266 |
| Working hours aged 25-54 | 42.088 | 42.596 |
| Years of early retirement | 2 | 2.581 |
| GDP per capita | 29266.270 | 28739.650 |
| Years of schooling | 8.810 | 8.791 |
| Life expectancy | 71.883 | 71.757 |

Source: Authors' own calculations

## 8.6. Annex 6: Descriptive Statistics

| Australia | | |
|---|---|---|
| | Pre Reform | Post Reform |
| Years included | 1983-2004 | 2005-2013 |
| LFP aged 55-64 | 0.6167 | 0.6943 |
| LFP aged 25-54 | 0.9194 | 0.9046 |
| HW aged 55-64 | 38.05 | 36.57 |
| HW aged 25-54 | 40.85 | 39.35 |
| Statutory eligibility age | 65 | 65 |
| Early eligibility age | 55 | 55 |
| GDP per capita | 31,558.27 | 42,299.18 |
| Years of schooling | 11.29 | 11.46 |
| Life expectancy | 74.86 | 79.32 |

| Austria | | |
|---|---|---|
| | Pre Reform | Post Reform |
| Years included | 1995-2000 | 2000-2013 |
| LFP aged 55-64 | 0.4382 | 0.4667 |
| LFP aged 25-54 | 0.9385 | 0.9258 |
| HW aged 55-64 | 42.20 | 42.47 |
| HW aged 25-54 | 41.40 | 43.13 |
| Statutory eligibility age | 65 | 65 |
| Early eligibility age | 60 | 62.57 |
| GDP per capita | 34,967.33 | 40,991.12 |
| Years of schooling | 9.81 | 10.32 |
| Life expectancy | 74.30 | 77.16 |

| Belgium | | |
|---|---|---|
| | Pre Reform | Post Reform |
| Years included | 1983-2001 | 2002-2013 |
| LFP aged 55-64 | 0.3780 | 0.4422 |
| LFP aged 25-54 | 0.9251 | 0.9158 |
| HW aged 55-64 | 42.83 | 40.79 |
| HW aged 25-54 | 41.06 | 40.97 |
| Statutory eligibility age | 65 | 65 |
| Early eligibility age | 60 | 60.04 |
| GDP per capita | 29,866.34 | 38,558.17 |
| Years of schooling | 9.86 | 10.78 |
| Life expectancy | 72.91 | 76.82 |

| Denmark | | |
|---|---|---|
| | Pre Reform | Post Reform |
| Years included | 1983-1994 | 1996-2013 |
| LFP aged 55-64 | 0.6708 | 0.6721 |
| LFP aged 25-54 | 0.9376 | 0.9189 |
| HW aged 55-64 | 41.16 | 39.00 |
| HW aged 25-54 | 41.65 | 39.70 |
| Statutory eligibility age | 67 | 65.95 |
| Early eligibility age | 60 | 60 |
| GDP per capita | 31,731.23 | 40,854.93 |
| Years of schooling | 9.63 | 11.11 |
| Life expectancy | 72.07 | 75.53 |

| Finland | | |
|---|---|---|
| | Pre Reform | Post Reform |
| Years included | 1989-2004 | 2005-2013 |
| LFP aged 55-64 | 0.4742 | 0.5982 |
| LFP aged 25-54 | 0.9084 | 0.9053 |
| HW aged 55-64 | 39.81 | 38.92 |
| HW aged 25-54 | 41.14 | 40.65 |
| Statutory eligibility age | 65 | 65 |
| Early eligibility age | 60.25 | 62 |
| GDP per capita | 29,798.10 | 38,794.72 |
| Years of schooling | 8.84 | 9.75 |
| Life expectancy | 73.18 | 76.72 |

| France | | |
|---|---|---|
| | Pre Reform | Post Reform |
| Years included | 1983-1992 | 1993-2013 |
| LFP aged 55-64 | 0.4253 | 0.4125 |
| LFP aged 25-54 | 0.9577 | 0.9434 |
| HW aged 55-64 | 44.75 | 41.74 |
| HW aged 25-54 | 42.14 | 41.26 |
| Statutory eligibility age | 65 | 60.47 |
| Early eligibility age | 60 | 60 |
| GDP per capita | 26,884.15 | 33,972.01 |
| Years of schooling | 7.52 | 10.13 |
| Life expectancy | 72.04 | 76.19 |

| Germany | | |
|---|---|---|
| | Pre Reform | Post Reform |
| Years included | 1983-1991 | 1992-2013 |
| LFP aged 55-64 | 0.5769 | 0.5987 |
| LFP aged 25-54 | 0.9273 | 0.9331 |
| HW aged 55-64 | 43.46 | 41.31 |
| HW aged 25-54 | 42.38 | 41.13 |
| Statutory eligibility age | 65 | 65.01 |
| Early eligibility age | 63 | 63 |
| GDP per capita | 28,163.86 | 37,002.58 |
| Years of schooling | 8.51 | 11.37 |
| Life expectancy | 71.54 | 75.81 |

| Netherlands | | |
|---|---|---|
| | Pre Reform | Post Reform |
| Years included | 1995-2005 | 2006-2013 |
| LFP aged 55-64 | 0.5022 | 0.6713 |
| LFP aged 25-54 | 0.9301 | 0.9332 |
| HW aged 55-64 | 37.31 | 36.15 |
| HW aged 25-54 | 39.59 | 39.02 |
| Statutory eligibility age | 65 | 65.01 |
| Early eligibility age | 61.45 | 65 |
| GDP per capita | 39,435.15 | 44,982.15 |
| Years of schooling | 11.09 | 11.53 |
| Life expectancy | 75.70 | 78.75 |

| Sweden | | |
|---|---|---|
| | Pre Reform | Post Reform |
| Years included | 1990-1999 | 2000-2013 |
| LFP aged 55-64 | 0.7245 | 0.7702 |
| LFP aged 25-54 | 0.9208 | 0.9202 |
| HW aged 55-64 | 38.26 | 38.83 |
| HW aged 25-54 | 40.78 | 39.99 |
| Statutory eligibility age | 66 | 65 |
| Early eligibility age | 60.1 | 61 |
| GDP per capita | 30,530.61 | 40,059.94 |
| Years of schooling | 10.80 | 11.33 |
| Life expectancy | 76.04 | 78.82 |

Source: Authors' own calculations