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Act Now: The Effects of the 2008 Spanish Disability Reform

Matthew J. Hill, Jose Silva and Judit Vall

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ACT NOW: THE EFFECTS OF THE 2008 SPANISH DISABILITY REFORM¹

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July 2015

Abstract

We evaluate the effects of a reduction in the generosity of the Spanish disability system (DI) implemented in 2008. The reform reduced the benefits for individuals that have a short contributory history relative to their age, theoretically discouraging potential applicants to disability. However, due to the method used to calculate the extent of lost benefits, the reform actually introduced an incentive for individuals to apply for disability now. We use a life-cycle model with heterogeneous disabled workers to understand the potential impact of the reform and confirm the predictions of the model empirically. Our estimates show that the reform increased the probability of applying to DI by 33% for men. Consistent with the theoretical model, the effect is much stronger for individuals that lost their job in the previous period (83%).

Keywords: disability benefits, life-cycle model, policy evaluation.

JEL classification: C33, I18, H51.

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Non-technical summary

In Spain there are approximately one million disabled individuals receiving disability benefits. Around half of them are still capable of developing a different job or professional activity to the one prior to becoming disabled. However, only twenty percent of those partially disabled individuals are working. Furthermore, from 2008 Spain has been one of the European countries most affected by the crisis and a number of measures have been adopted since 2008 in order to reduce public expenditures, promote employment and reduce unemployment.

In the context of budget cuts, the Spanish government introduced a reform in the contributory disability system in order to make it more similar to the old-age system and to take into account the number of years that an individual has contributed to the system when calculating the level of disability benefits that he will receive. In more detail, the reform reduced the benefits for individuals that have a short contributory history relative to their age, theoretically discouraging potential applicants to disability. However, due to the method used to calculate the extent of lost benefits, the reform actually introduced an incentive for individuals to apply for disability now.

In this paper, we present the first evaluation of the effects of this policy change. We make use of a theoretical as well as an empirical analysis of disability application in order to assess the extent to which the reform modified an individual's incentives to apply to the disability system. Both the theoretical model and the empirical analysis show that the reform had the unexpected result of increasing the probability of applying for disability benefits for individuals affected by the reform (particularly those with low labor force attachment). Our estimates show that the reform increased the probability of applying to disability insurance (DI) by 33% for men. Consistent with the theoretical model, the effect is much stronger for individuals that lost their job in the previous period since they expect a future reduction in the disability benefits with respect to the amount they will receive if they apply for DI now.

1. INTRODUCTION

Disability policies have increasingly attracted attention in OECD countries. Disability rates have surged, with an average disability rate of 10 percent in industrialized nations.² The growing rates have placed a strain on government budgets and countries have become progressively interested in curbing disability rates and re-integrating disabled individuals into the workforce. (Autor & Duggan, 2003; Chen & Van der Klaauw, 2008) We evaluate one such effort in Spain, the 2008 disability reform, which aimed to reduce disability and lower the overall fiscal burden of providing disability benefits. The effects of reform provide valuable lessons to governments who face high unemployment rates and demonstrate the dynamic nature of the disability application decision.

In 2008, the Spanish government introduced a reform in the contributory disability insurance (DI) system in order to make it more similar to the old-age system by taking into account the number of years that an individual has contributed to the system as well as the age of the individual when calculating the level of disability benefits. These two elements (age and years of contributions) constitute what we label as “the potential plus actual contributory” (PAC) years. Before the reform, both the number of years contributed to the system as well as the age of the individual was unrelated to the level of disability benefits. After the reform, individuals who had less than 35 remaining potential contributory years plus actual contributory years (PAC years) saw their benefits cut. The overall goal of the reform was to reduce the amount of benefits to individuals with short contributory histories relative to their age in order to create disincentives to apply to DI. However, due to the unusual method used to calculate the PAC years (specifically that, by definition, PAC years can only decrease over one’s life cycle), the reform actually may have incentivized application for individuals with low labor force attachment by increasing the present value of disability benefits.

In this paper, we present the first evaluation of the effects of this policy change. We make use of a theoretical as well as an empirical analysis of disability application in order to assess the extent to which the reform modified an individual’s incentives to apply to the disability system. Both the theoretical model and the empirical analysis show that the reform had the unexpected result of increasing the probability of applying

² Source: OECD, 2009.

for disability benefits for individuals affected by the reform (particularly those with low labor force attachment). This result can be explained by the presence of two effects that go in the opposite direction. On the one hand, the absolute value of disability benefits falls for those under the 35 PAC year threshold. On the other hand, if the current PAC years are greater than its expected future value, the individual expects a future reduction in the disability benefits with respect to the amount he will receive if he applies for DI this year. This relative effect (in that the current amount is the highest monthly amount an individual can expect to receive) generates the incentive to advance the decision of applying to the disability system.

We estimate the effect of the reform using a large administrative dataset that allows us to distinguish between the control group (individuals not affected by the reform because they have more than 35 PAC years) and the treatment group (individuals affected by the reform because they are under the 35 PAC year threshold). The estimated results show that the relative value effect of the reform dominates the absolute effect on average as the reform increased the probability of applying to DI by 33% for men. Consistent with the theoretical model, the effect is much stronger for individuals that separated from their job in the previous period (83%). This recently unemployed group will contain a large portion of *conditional applicants* (Maestas, Mullen, and Strand 2015), individuals with a health impairment who would prefer to remain in the labor force but apply if they lose their job. The reform is particularly salient for those affected in this group because if they search for a job and are unsuccessful, their benefit amount *decreases*. We provide several additional robustness checks to show that these effects are not the result of the Great Recession (although the Great Recession certainly increased the number of unemployed conditional applicants) or by unobserved heterogeneity.

A number of recent papers have examined reforms made to disability systems and show that the design of a disability system can have a significant impact on application³. The Netherlands is the country most active in reforming their disability system: in the 1990s and early 2000s the Dutch government changed the replacement ratios, experience rating (employers pay DI contributions according to firm-specific disability costs), gatekeeper controls (vocational rehabilitation plans) and enacted

³ A number of previous papers also analysed policies to re-integrate the disabled in the labor market (Campolieti and Riddell 2012; Gruber 2000; Gruber and Kubik 1997; Marie and Vall Castello 2012).

stricter examination criteria. All these reforms have reduced the inflow rate into DI (Van Sonsbeek et al. 2013, Autor 2011). Most notably, De Jong et al. (2011) show that stricter screening of disability applicants led to a reduction in long-term sickness absenteeism, as well as a decline in disability insurance applications. Similar results are found for Finland by Korkeamäki et al. (2012) where changes in the stringency of medical screening have had a direct effect on transitions into disability. Staubli (2011) analyzes a reform that increased the age at which conditions for disability insurance benefits are relaxed, from age 55 to age 57 for men in Austria. He applies a difference-in-difference model to find that enrollment to the disability system declined by 6 to 7.4 percentage points due to the policy change. In the Swedish context, Karlström et al. (2008) shows that abolishing special eligibility rules for workers aged 60 to 64 led to a small reduction in the entrance in disability after the reform. With respect to the private system, Autor et al, 2014 analyzes changes in plan parameters of a large private long term disability insurer and finds that introducing lower replacement rates and longer waiting times by the private provider significantly decreases the probability of applying for disability benefits.

While the aforementioned reforms were largely successful in their aims, the Spanish reform was not, and therefore reveals some crucial considerations for future policy-makers. Firstly, reforms must take into account the dynamic nature of disability insurance. In a one period model, the Spanish reform lowered the incentive to apply for disability. However, in a multi-period setting, the reform increased the incentive to apply in the present. Our results show that individuals took this change in future benefits into account when making their decision to apply for disability. Governments must be careful to consider how any change will affect the future benefits stream for their reforms to have the desired effect. A second important aspect of the Spanish case is the context of high unemployment. Although Spain's high unemployment may seem anomalous: unemployment has been rising in the developed world and recession recoveries have increasingly been jobless. Our model and empirical results show that one of the primary drivers of disability application is low expected labor force participation. In this context, the steady income stream of disability is appealing. This result suggests that in times of economic uncertainty, disability rates may rise even if the benefit amounts are low.

The paper proceeds as follows: section 2 describes the specificities of the Spanish disability system. Section 3 describes the main change introduced by the reform in 2008 and presents the main trends in disability rates in Spain. Section 4 describes the database used and section 5 introduces the life-cycle model and the main hypotheses on the effects of the reform on DI applications are derived. Section 6 presents the empirical strategy and in section 7 we simulate the fiscal impact of the reform on the government budget. In section 8 we simulate an alternative policy scenario which would entail much better results than the current reform while the final part of the paper develops some conclusions.

2. THE DISABILITY SYSTEM IN SPAIN

2.1 Types of disability benefits

The Spanish Social Security administration defines permanent disability insurance as the economic benefits to compensate individuals for lost wages due to a permanent reduction or complete loss of their working ability as a result of a pathologic or a traumatic process derived from an illness or an accident.⁴ The Social Security administration then classifies disability by degree: partial, total, severe; where the degree depends on the working capacity lost. Partial disability includes individuals who are impaired for the fundamental tasks of their job or professional activity, but are still capable of a different job or professional activity. Total disability is used when the individual is impaired for *all* jobs and professional activities; while severe disability is reserved for individuals who, as a result of anatomic or functional losses, require the assistance of a third person to aid in the essential activities of daily living.

2.2 Disability formula prior to 2008 reform

In order to be eligible to receive a disability benefit, individuals must have contributed to the system for 1/4 of the years from the age of 20 until the age of their disability onset, with a minimum of 5 years.⁵ For those eligible to receive a disability

⁴ There are two types of permanent disability benefits: i) contributory and ii) non-contributory. The size and benefit amount of the non-contributory system is small relative to the contributory system. (197,126 individuals versus 920,860 individuals in 2009 with average amounts of 417.09 euros/month and 831.49 euros/month, respectively). As the reform analyzed in this paper only affected the contributory part of the system, we limit our analysis to individuals in the contributory disability system.

⁵ The eligibility requirements for those under 30 are slightly different. Due to these differences and because the 2008 reform only applied to individuals over 30, we limit our sample to individuals age 31 and over.

benefit, the benefit amount is multiplied by a percentage that depends on the severity of the disability: 55 percent for partial disability beneficiaries, 100 percent for total disability and 150 percent for severe disability. The base for the benefit amount is determined by the nature of the disability (ordinary illness, work related accident, unrelated accident, or occupational illness). For ordinary illness the base is calculated by dividing the wage in the last 96 months (8 years) by 112. When the source of the disability is a work-unrelated accident, the regulatory base is calculated by dividing the wage in the chosen 24 months (where the individual can select any 24 months from the last 7 years of work) by 28. For work-related accidents or professional illness, the regulatory base is calculated by dividing by 12 the wage in the last 365 days before becoming disabled. Table 1 summarizes the main parameters of both the eligibility criteria and the benefit formula.

Table 1. Summary of the parameters to calculate permanent disability benefits.

Eligibility	Age \geq 31 and contributed 1/4 time between 20 years old and disabling condition. Minimum of 5 years. Waived for those who experience a work related accident or an occupational illness.
Percentage applied to the regulatory base	Partial Disability: 55% ⁶ Total Disability: 100% Severe Disability: 100%+50%
Regulatory Base	Ordinary illness: 0.86*average monthly wage last 8 years. Work unrelated accident: 0.86* average monthly wage in highest 24 earning months of past 7 years. Work related accident/ illness: average wage past year.

The benefit amount is then obtained by multiplying the percentage by the regulatory base:

$$\text{Benefit} = \text{Regulatory Base} * \text{Percentage} \left\{ \begin{array}{l} \text{Partial (55\%)} \\ \text{Total (100\%)} \\ \text{Severe (150\%)} \end{array} \right.$$

⁶ Individuals older than 55 with difficulties to find a job due to lack of education or characteristics of the social and labor market of the region where they live can obtain 75% of the regulatory base. For an evaluation of the effects of this increase in the benefits at age 55 see Marie & Vall-Castelló (2012).

The income tax rules of individuals receiving DI benefits also differ across disability types. Partial disability benefits are taxable under the general income tax rules, while total disability benefits are always exempted from income taxes. Furthermore, if the individual works while receiving the benefit, there is a reduction in the earnings used to calculate the income tax of 2,800 Euros/year if their degree of disability is low (between 33% and 65%) and of 6,200 Euros/year if the disability level is higher (more than 65%) or if the disabled has reduced mobility. In addition, individuals receiving partial disability benefits can combine the benefits with earnings from work, as long as the type of job is compatible with his/her disability. Note that this is a key difference between the Spanish and U.S. disability regimes. In the U.S., disability receipt requires exit from full-time work, whereas in Spain, individuals may still work, as long as the job is not similar to the job held at the time of disability.

All the rules described above were not changed by the reform in 2008. The only change introduced by the reform was to include an extra parameter (outlined in the next section) to the benefits calculation when the source of the disability is an ordinary illness.

3. THE 2008 REFORM

3.1 Disability formula after 2008 reform

In 2008,⁷ Spain reformed their disability system with the aim of discouraging applications from individuals who did not have long contributory histories.⁸ They did this by reducing the amount of benefits to individuals deemed to have short contributory histories relative to their age. But what constituted a long or short contributory history? The government defined a new variable that we refer to as potential plus actual contributory years (hereafter PAC years), constructed as follows:⁹

$$PAC\ years = \frac{\text{years contributed}}{\text{actual contributory years}} + \frac{(65 - age)}{\text{remaining potential contributory years}}$$

⁷ The law was published in the BOE (Boletín Oficial del Estado) on December 5th 2007 and came into effect from the 1st January 2008.

⁸ The change in law only applied to individuals that suffered from an ordinary illness and was not applied to the disabled due to a working accident.

⁹ The Spanish Social Security system did not give any specific name to the PAC years and we have decided to name it as “potential plus actual years of contribution” to reflect the idea behind the concept.

The formula gives individuals credit for the years that they have contributed to the Social Security system and then it assumes they will contribute for every year for the remainder of their working years (65- current age).¹⁰

Individuals with over 35 PAC years are deemed as having sufficiently long contributory histories and their disability pension amount was untouched by the reform. Individuals below the 35 PAC year threshold, however, now had their pension amount multiplied by a percentage based on their PAC years.

$$\textit{Benefit after 2008} = \textit{disability pension amount} * \textit{PAC percentage}$$

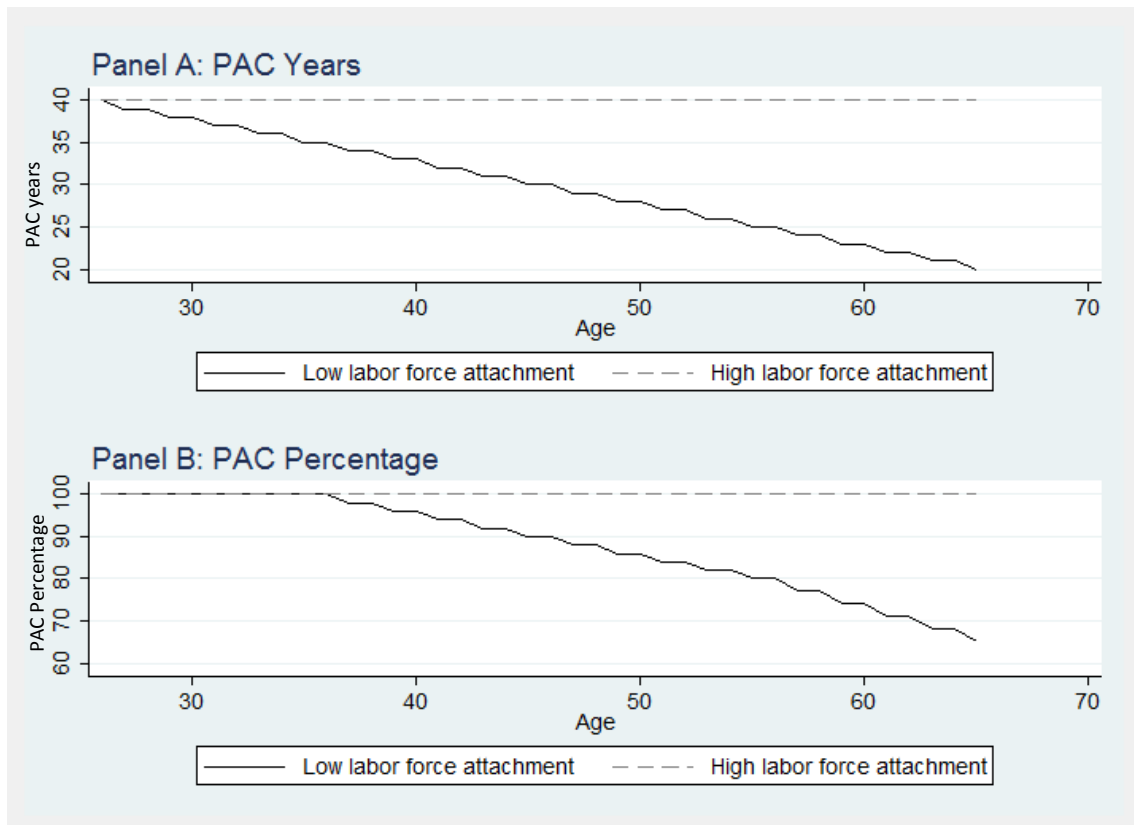
The PAC percentage takes a minimum value of 50 when the individual has 15 (or less) PAC years and is gradually increasing with the number of PAC years up to a maximum value of 100 for individuals with 35 (or more) PAC years.¹¹

The PAC years calculation has one key feature: PAC years can only decrease as one ages. For each year that passes, an individual loses a potential year (65-age) but if they worked, they gain an actual contributory year, and thus their PAC years are unchanged. However, if they do not work, their PAC years decrease by one year. Also note that everyone under age 30 has over 35 PAC years. For instance, someone with no contributory years will have exactly 35 PAC years at age 30, because the calculation gives everyone credit for the years from their current age to 65. Figure 1 illustrates the dynamics of PAC years over two hypothetical life courses.

¹⁰ In Spain, 65 is the normal retirement age.

¹¹ Appendix table A1 shows the corresponding percentages for each PAC year.

Figure 1. Simulation of the effects of the reform for two different individuals



In the figure we simulate the PAC experience for two individuals, one with a labor market trajectory of full employment (high labor force attachment) and the other with a labor market career in which he works only half of the time, that is, spends one year in employment and one year without it (low labor force attachment). Both enter the labor market at age 25 with no years contributed to the social security system, but they have 40 PAC years because of their 40 potential years remaining in the work force. For the individual with high labor force attachment, their PAC years remains at 40 for their life cycle, as each lost potential year of age is replaced with an actual contributory year. For the individual with the low labor force attachment, they gradually lose PAC years because for every potential year that they lose as they age, they replace it with only 0.5 actual contributory years. In Panel B, we show how their PAC percentage evolves over time. Both the low and high labor force attachment individuals have a full percentage (100) during their initial years in the labor force. However, the low labor force attachment individual crosses the 35 PAC year threshold at age 37, and thereafter the PAC percentage applied to their disability amount decreases for the remainder of their working years.

The government designed the reform to discourage individuals with low labor force attachment from applying for disability. They reasoned that because the actual amount of disability benefits were decreased, those with lower PAC years (and hence lower contributory years) would have less of an incentive to apply for disability. However, because of the unique formula used to calculate PAC years, the reform may have had the unintended consequence of incentivized application. As figure 1 shows, for those that dip below the 35 PAC year threshold, they can expect their PAC percentage to only decrease for the remainder of their lives. Therefore, the reform meant that as long as their regulatory base did not increase, the current year's disability benefit was their highest expected disability benefit for the remainder of their working career. Also recall that, unlike the United States, disability receipt does not preclude all full time work, only full time work in the recipient's most recent job type. Consider an individual below the threshold who was unemployed. He would certainly expect his disability benefit to decrease the next year through both a lowered regulatory base (due to a year of low or zero wages) and a lowered PAC percentage (due to a year of no contributions). Therefore, if eligible, he would have a strong incentive to apply this year. If successful, he would receive the DI benefit until age 65, the only penalty faced would be not being able to work in his most recent job type. However, given he is currently unemployed, his job prospects in this field are probably poor. Further, if this individual could secure employment in a different field, he could take that job and continue to receive his full benefit.

In Figure 2 we calculate the average entrance into disability over time for three different regimes (partial disability, total disability, and those that enter disability as a result of a work accident).¹² The figures show the disability entry rates for three groups: all individuals, those affected by the 2008 reform (<35 PAC years), and those unaffected by the reform (>=35 PAC years). Figure 2A and 2B show that those affected and those unaffected by the 2008 reform exhibit similar trends in disability entry until 2008. After 2008 the trends diverge: disability entry rates slightly increase (and then decrease for total disability) for those unaffected by the reform, while the rates skyrocket for those affected by the reform. We interpret this as evidence that the reform significantly increased the present value of disability benefits for those with less than 35 PAC years.

¹² We show entry rates for men, the entry rates for women exhibit similar trends.

The reform did not apply to individuals who entered disability due to a working accident and the rates for this group (shown in figure 2C) do not increase dramatically for those with less than 35 PAC years. This is further evidence that the reform incentivized disability for those affected and did not change disability rates for those unaffected.

A mitigating factor for our study is the financial crisis, which overlapped with the years of the reform. We attempt to account for the financial crisis in depth in our empirical analysis; however, it is useful to highlight two key trends. Firstly, as figure 2 shows, during the years of the financial crisis (2009-2011), disability rates did not rise for those unaffected by the reform. If the financial crisis was solely responsible for the rise in rates, we should observe some increase among the ≥ 35 PAC years group, and we do not observe any significant increase for this group. A second important fact about disability rates in Spain is illustrated by figure 3, which plots the aggregate disability rate, the unemployment rate and GDP growth from 1990-2014. The graph demonstrates that there was little correlation between the aggregate economic conditions and the disability rate in Spain during the period. Rather, the over-riding trend is a gradual decline in disability rates, a decline that continues unabated after the financial crisis.¹³ These two stylized facts are both consistent with our supposition that the global financial crisis was not the underlying cause for the increase in disability receipt observed among individuals affected by the reform.

¹³ As DI is a contributory program if employment decreases sharply due to the strong incidence of the economic crisis, it seems reasonable to expect that DI applications will also decrease.

Figure 2A: Partial disability rates 2001-2011 (men)

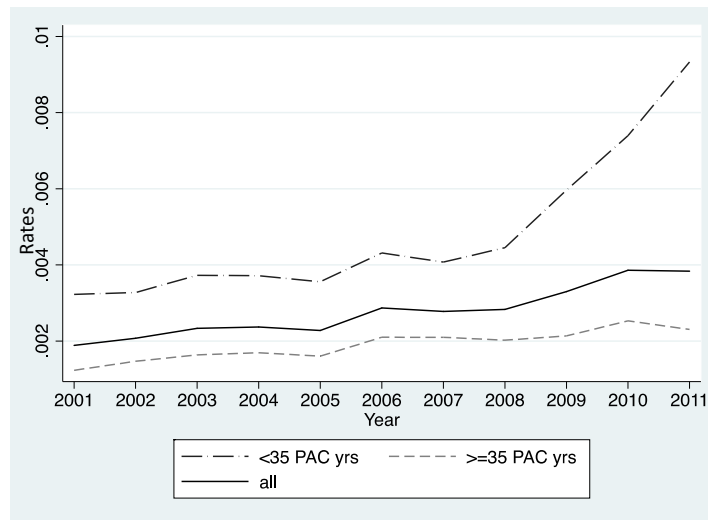


Figure 2B: Total disability rates 2001-2011 (men)

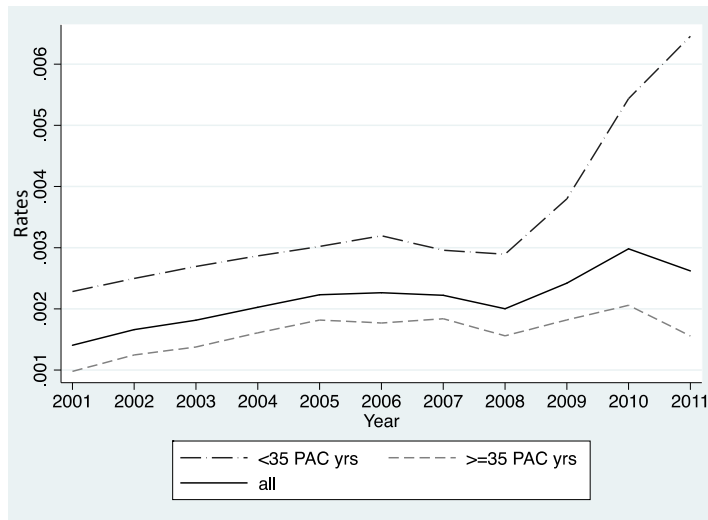


Figure 2C: Work accident disability rates 2001-2011 (men)

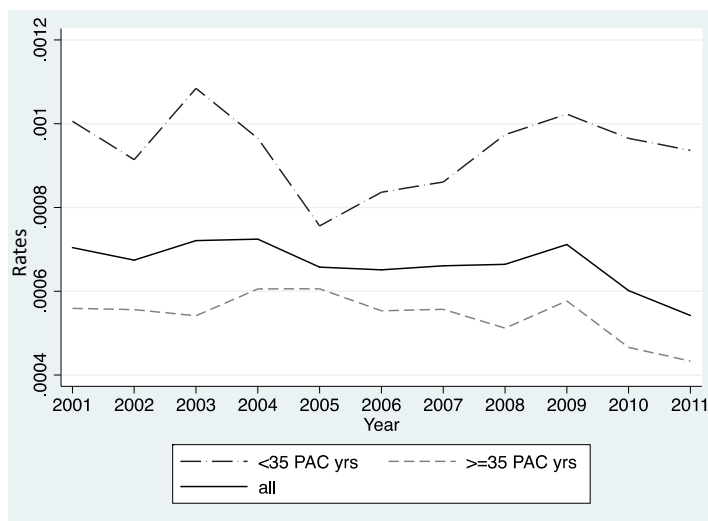
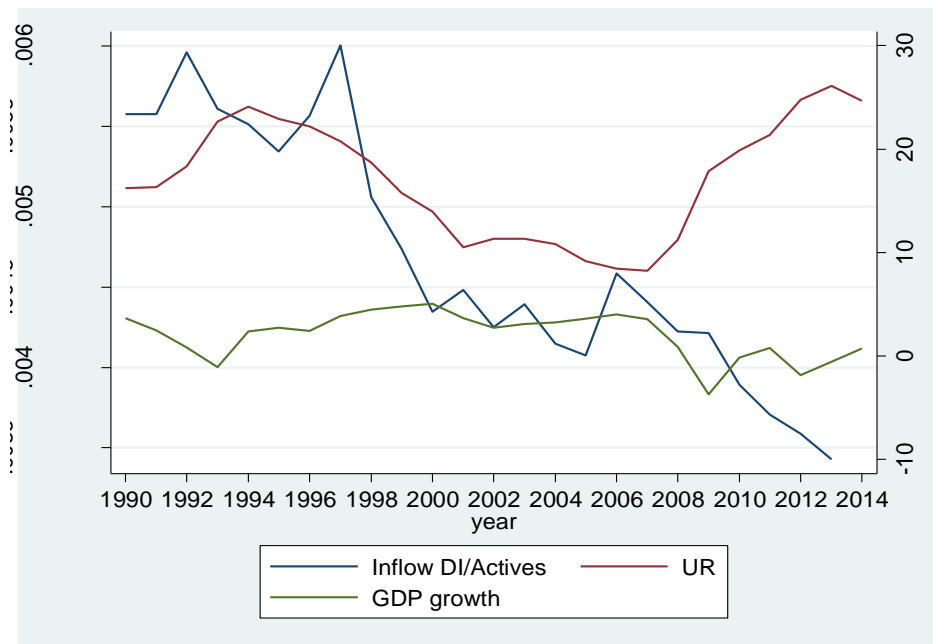


Figure 3: Disability Rates, Unemployment, GDP growth in Spain 1990-2014



4. DATA

We use the Continuous Sample of Working Lives (“Muestra Continua de Vidas Laborales”, MCVL), a microeconomic dataset based on administrative records provided by the Spanish Social Security Administration. This is a representative sample of individuals who participate or have participated in the labour market. Each wave contains a random sample of 4% of all the individuals who interacted with the social security system (either by working, receiving unemployment, receiving some type of pension, or being on disability for at least one day) in the previous year.¹⁴ We combine the data from 6 waves, starting with the 2006 wave and ending with the 2011 wave.

The MCVL has information on the entire employment and pension history of workers, including the exact duration of employment, unemployment and disability or retirement pension spells, and for each spell, several variables that describe the characteristics of the job or the unemployment/pension benefits. There is also information on personal characteristics, such as age, gender, nationality and level of education. Even though the first wave sampled is 2006, given the retrospective nature of the data, we have data on previous years. We set 2001 as the first year of observation. Because we are interested in modeling the flow into disability, individuals are dropped

¹⁴ It is rare that an individual would live in Spain for a time period and not interact with the SSA in some fashion. Therefore, our sample is representative of the population.

from our sample after their first year on disability.¹⁵ We also exclude from our sample individuals that enter the disability system due to a working accident, as they are not affected by the policy change.¹⁶ We merge our individual data with macroeconomic variables from the Spanish “Instituto Nacional de Estadística,” to capture the economic business cycle.

Table 2 shows the summary statistics by less than 35 PAC years and more than 35 PAC years. Our sample includes individuals aged 31 to 65 years old and we estimate a separate model for men and women. The male sample has 517,316 individuals (2,982,647 person-year observations in total). In the female sample, we have 414,977 individuals (2,272,090 person-year observations in total). Individuals with less than 35 PAC years are less educated and are concentrated in low skill sectors. By definition individuals with less than 35 PAC years will have lower labour force attachment, which is reflected in the experience variable. Given the differences between the two groups, we flexibly control for all observables in our empirical specification. We also run our empirical analysis on subsamples of the treatment (<35 PAC years) and control (≥ 35 PAC years) that are more similar on observables.

¹⁵ Including individuals past the first year of disability would confound effects on disability entrance with effects on disability retention. In practice, disability is an absorbing state with less than 0.25 percent of the sample leaving the disability system after entering it.

¹⁶ We drop 2979 men and 3763 women from the original sample that do not have any recorded contribution to the Social Security System as this is the variable that we use to create the treatment/control category.

Table 2: Summary Statistics by PAC years

Panel A: Men			
Variable	Overall	≥35 PAC	<35 PAC
age	43.5 (8.94)	42.2 (8.65)	46.4 (8.83)
years experience	15.6 (9.99)	18.7 (9.40)	9.1 (7.85)
High School or more	87.50%	92.01%	77.95%
<u>Sector</u>			
High Tech Man.	13.10%	16.32%	6.10%
Low Tech Man.	7.53%	8.48%	5.52%
High Tech	18.05%	20.03%	13.83%
Trade	13.51%	15.05%	10.20%
Hotels/Catering	4.90%	4.12%	6.55%
Other Low Tech	11.73%	11.73%	11.71%
Construction	17.80%	14.19%	25.50%
Real Estate	8.77%	7.99%	10.44%
Partial DI Entry	0.26%	0.18%	0.43%
Person-years	2982647	2029135	953512
Panel B: Women			
Variable	Overall	≥35 PAC	<35 PAC
age	42.2 (8.24)	39.6 (8.65)	45.2 (8.06)
years experience	11.6 (8.84)	15.62 (8.82)	6.99 (6.24)
H.S. or more	80.30%	90.37%	68.21%
<u>Sector</u>			
High Tech Man.	3.80%	5.36%	2.03%
Low Tech Man.	6.62%	6.74%	6.48%
High Tech	32.53%	38.34%	25.61%
Trade	16.12%	17.94%	13.95%
Hotels/Catering	9.03%	5.41%	13.33%
Other Low Tech	12.22%	9.03%	16.02%
Construction	1.92%	2.04%	1.77%
Real Estate	11.67%	11.91%	11.39%
Partial DI Entry	0.18%	0.11%	0.27%
Person-years	2272090	1234508	1037582

5. THEORETICAL MODEL BEFORE AND AFTER THE 2008 REFORM

In this section we introduce a theoretical model in order to understand how the incentives to apply to disability benefits for individuals changed after the introduction of the 2008 reform.

5.1 The model before the reform

We consider a working life cycle setting for partially disabled individuals characterized by a deterministic age, i , between 31 and 64 years old (before retirement). An individual becomes disabled at each age with probability μ_i . Then, a disabled person can either be officially disabled receiving disability benefits (d) or not (n). The non-officially disabled individual is working and must decide whether to apply to the d -status. We assume that non-officially disabled workers have a specific productivity level, z_i , which is independent and identically distributed across age, with cumulative distribution function $F(z_i)$ and support $[0, z^{max}]$. Thus, the wages of this type of workers have both an idiosyncratic, z , and an aggregate component, w_i^n . Moreover, due to the disability condition, there is a cost of working C_i . This parameter captures both the labor mobility costs and also the productivity gap with respect to the nondisabled status.

We also assume that the officially disabled person cannot work in his former job and, therefore, he has to search for a new one (as this is the definition in order to receive permanent disability benefits in Spain). The individual discounts future payoffs at the age-dependent discount rate, β_i , which, as in Butler (2001), decreases over the life-cycle. Time is discrete and the economy is at the steady-state. All individuals who are officially disabled receive a pension equivalent to a proportion, α_i , of their average wage for the years previous to becoming disabled, \bar{w}_i . When a disabled person is not working he/she enjoys an unemployment income ρw_{i-1}^n each period, where ρ is the replacement rate over the labor income before becoming disabled, w_i^n . This income has to be given up when the officially-disabled person finds a job. Each age, a non-employed individual finds a job with probability, λ_i . After finding a job, the worker receives a wage, w_i^d . Finally, officially disabled workers separate from their jobs with probability γ_i per age. Denoting the individual's value of being not officially disabled, W_i^n the workers' values of being officially disabled but non-employed or employed as U_i^d and W_i^d respectively, the following Bellman equations describe the model:

$$W_i^n(z) = z_i w_i^n - C_i + \beta_i \left[\int_{z_i^R}^{z^{max}} W_{i+1}^n d(z) + F(z_{i+1}^R) U_{i+1}^d \right], \quad (1)$$

$$U_i^d = \rho w_i^n + \alpha_i \bar{w}_i + \beta_i [\lambda_i W_{i+1}^d + (1 - \lambda_i) U_{i+1}^d], \quad (2)$$

$$W_i^d = \alpha_i \bar{w}_i + w_i^d - C_i + \beta_i [\gamma_i U_{i+1}^d + (1 - \gamma_i) W_{i+1}^d]. \quad (3)$$

At the beginning of each new age, $i+1$, a job productivity, z , is drawn from the general distribution $F(z)$ with $[0, z^{max}]$. Individuals decide to become officially disabled if, for a given threshold level z_i^R , the present-discounted return of being non-officially disabled, $W_i^n(z_i^R)$, is lower than the present-discounted return of being officially disabled, U_i^d . Formally, the application rule is

$$W_i^n(z_i^R) = U_i^d, \quad (4)$$

where $\mu_i F(z_{i+1}^R)$ is the probability of becoming officially disabled at age $i+1$.

It is easy to see that an increase in $\alpha_i \bar{w}_i$ will generate the incentive to become officially disabled, since it increases the value of U_i^d .

5.2 The model after the reform

As we mentioned before, the main change of the 2008 reform was a change in the way the regulatory base is calculated. Thus, from January 2008, the regulatory base, $\alpha_i \bar{w}_i$ is now multiplied by a fraction $\theta_{j,i}$ that depends on the PAC years. Remember that PAC years are equal to the number of years contributed to the system, j , plus the difference between 65 years old and the age at which the individual becomes disabled, i . The fraction, $\theta_{j,i}$, equals 1 (reflecting the PAC percentage of 100) if the PAC years are equal or bigger than 35 and decreases from 1 to 0.5 for individuals with 15-35 PAC years (reflecting the decrease in the PAC percentage from 100 to 50 for those PAC years, see Table A1 for details). For example, the PAC years for an individual with 10 contributory years and who is 35 is $10+(65-35)=40$. Because PAC years for this individual is greater than the threshold (35), the fraction $\theta_{j,i}$ is equal to one, implying that there is no difference between the disability benefits received before and after the reform. However, since $\theta_{j,i}$ decreases with i and increases with j , individuals with several or long periods under the unemployment status will have a decreasing number of PAC years and will, at some point, go below the 35 years needed to receive 100 percent of the benefits. Thus, it is reasonable to expect that, after the

reform, the decision for considering the possibility of applying for disability benefits does not only depend on $\theta_{j,i}$ but also on the expected future value of $\theta_{j,i}$ along the working life-cycle. More in detail, if the non-officially disabled individual expects that $\theta_{j,i}$ will change during the following years, then, for a given value of $\theta_{j,i}$, he can modify his decision to become an officially disabled individual. To capture this scenario, we assume that the age-dependent, discount rate of non-officially disabled workers now include the expected value of $\theta_{j,i}$ during the individual's working life-cycle, $\mathbb{E}(\theta_{m,k})$, where m is the expected number of contributory years before retirement and k the last age considered during the working life-cycle (e.g. the retirement age). Now, the model can be described by the following modified Bellman equations:

$$W_i^n(z) = z_i w_i^n - C_i + \beta_i \mathbb{E}(\theta_{m,k}) \left[\int_{z_{i+1}^R}^{z_i^{max}} W_{i+1}^n d(z) + F(z_{i+1}^R) U_{i+1}^d \right], \quad (5)$$

$$U_i^d = \rho w_i^n + \alpha_i \theta_{j,i} \bar{w}_i + \beta_i [\lambda_i W_{i+1}^d + (1 - \lambda_i) U_{i+1}^d], \quad (6)$$

$$W_i^d = \alpha_i \theta_{j,i} \bar{w}_i + w_i^d - C_i + \beta_i [\gamma_i U_{i+1}^d + (1 - \gamma_i) W_{i+1}^d], \quad (7)$$

It can be seen that the reform may increase or reduce the incentives to apply to disability benefits for partially disabled individuals. This result can be explained by the presence of two effects that go in the opposite direction to each other. On the one hand, a lower value of PAC years $\theta_{j,i}$ reduces the value of being an officially disabled worker, reducing the incentive to apply to this status and, therefore, the probability of being officially disabled. On the other hand, lower values of $\mathbb{E}(\theta_{m,k})$ (or lower expected PAC years) reduce the present-discounted return of being non-officially disabled, $W_i^n(z_i^R)$. As a result, the participation rule (4) tells us that the lower the value of $\mathbb{E}(\theta_{m,k})$ the higher the probability of applying for disability benefits since, for a given $\theta_{j,i}$, the value of $W_i^n(z_i^R)$ decreases while U_i^d remains constant. In other words, the lower the expected value of disability benefits along the working life-cycle, the higher the probability of applying to the disability system during the current year.

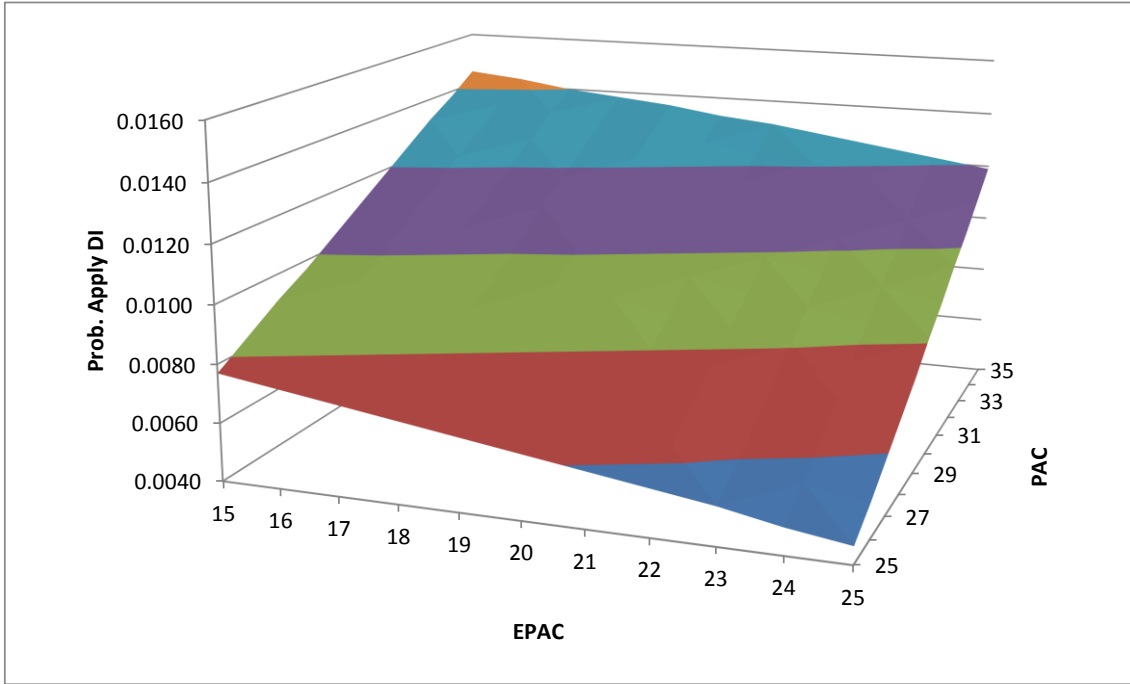
To illustrate the model's predictions, we simulate the reform considering different combinations of $\theta_{i,j}$ and $\mathbb{E}(\theta_{m,k})$, for an individual of age 50. For an easier interpretation, we present the results in terms of PAC and expected PAC (EPAC) years instead of $\theta_{i,j}$ and $\mathbb{E}(\theta_{m,k})$, respectively. The rest of the model's parameters are shown in Table A2 and have been calibrated using the MCVL for the period 2004-2007.

Figure 4 shows the simulated results. As we can see, the reform may increase or decrease the probability of applying to the disability system depending on the scenario considered. For a given PAC year value, a reduction in the EPAC increases the probability of applying to the disability system. Individuals with a lower value of EPAC expect to work less for the remainder of their working life and face a rapidly decreasing PAC years and therefore PAC percentage. It is these individuals who will have the greatest incentive to apply and the simulation bears this out. An individual with a PAC of 25 years ($\theta_{i,j} = 0.8$) will experience an increase from 0.0046 to 0.0077 in the probability of applying for DI if his EPAC falls from 25 to 15 years ($E(\theta_{m,k})$ falls from 0.8 to 0.5).

Next we consider changes in current level of PAC years. The simulation shows that the closer an individual is to the upper bound of 35 years, the higher the probability of applying for disability benefits. This represents the absolute value of the benefits, in that those with a higher PAC percentage are more likely to apply for disability than those with a lower value. For example, a 50 year old individual with PAC and EPAC of 25 years ($\theta_{i,j} = E(\theta_{m,k}) = 0.8$) shows a probability of applying to the DI of 0.0046. In turn, this probability increases to 0.0119 if the PAC increases from 25 to 35 years ($\theta_{i,j} = 1$).

According to our theoretical model, the overall effect of the 2008 reform depends on the composition of individuals affected by the reform. If those below the 35 PAC year threshold, all expect to work for the remainder of their career, then we should observe a reduction in DI inflow as a result of the reform. However, if those affected expect to have low labor force attachment then the reform should increase disability application. Therefore, we use the empirical analysis to estimate the actual effect of the reform.

Figure 4: Simulated effects of the reform under different scenarios of PAC ($\theta_{i,j}$) and EPAC $\mathbb{E}(\theta_{m,k})$. Probability of applying to the disability system.



6. EMPIRICAL STRATEGY AND RESULTS

6.1 Estimating the effect of the 2008 reform

The goal of the paper is to estimate the effect of the 2008 reform on disability entrance rates in Spain. Our starting point is to estimate a simple difference-in-difference specification on our sample of individuals from the MCVL. We include person-year observations for individuals between the age of 31 and 65, observed in the years 2001 through 2011. We estimate our specification separately for men and women and for partial and total disability. We estimate entrance into disability with equations of the form:

$$D_{ijt} = \alpha_j + \delta_t + \beta_1 treatment + \beta_2 treatment * post + X'\gamma + \varepsilon_{ijt} \quad (8)$$

Where D_{it} is a dummy variable equal to 1 if an individual i , in year t and region j receives disability. We include both province (α_j) and year fixed effects (δ_t). *Treatment* is a dummy variable equal to 1 if an individual has below 35 PAC years, while *post* is a dummy variable equal to 1 if the observation occurs after the reform, i.e. in years 2008-

2011. The coefficient of interest is then β_2 , which will be the effect of the reform on disability receipt for individuals whose benefits were reduced as a result of the reform.

A crucial assumption in identifying the effect of the reform is that our treatment (those with less than 35 PAC years) and control (those with more than 35 PAC years) groups are comparable. While we have shown in section 3 that both the groups exhibit similar trends prior to the reform, table 2 revealed stark differences between the groups. Further, by definition the treatment group will have lower labor force attachment than the control group. In order to account for these differences, our first step is to include a rich set of individual and region-level controls (X'). At the individual level we control for age decile, experience decile, education, and sector fixed effects. At the regional level (Autonomous Community) we control for the unemployment rate because disability may become more attractive during downturns. While we do not have individual wage data, we have average exit wage at an individual's last firm. We include this variable to proxy for the benefit amount base.

In section 5 we showed that the reform should positively impact the probability of disability application for treated individuals whose expected PAC years were less than their current PAC years, i.e. those that could expect their percentage of benefits to decline in the future (formally: individuals where $E(\theta_{m,k}) < \theta_{i,j}$). While there is no variable to identify individuals of this type, a proxy variable will be individuals who have separated from their job in the previous year. For employed individuals, their PAC years will remain constant because as they age, potential years will be replaced with actual contributory years. For individuals who left (or lost) their job, their PAC years will decrease unless they find a new job. If they are below the 35 year PAC threshold, their PAC percentage will decrease and so will their future benefits. Therefore, the population most likely to increase their disability application following the 2008 reform are individuals below the 35 PAC year threshold who have separated from the job in the previous year. In order to capture this effect, we add an additional interaction between the *treatment*post* and *jobloss*, a dummy variable equal to 1 if an individual left their job in the previous year.

6.2 Primary Results

Table 3 reports the marginal effects from a logit regression of equation (8). Panel A displays the results for men while panel B displays the results for women. In

column (1), the marginal effect of the interaction between the treatment group (those with less than 35 PAC years) and the post treatment dummy is positive and significant. Men affected by the reform were 33 percent (18 percent for women) more likely to be on permanent partial disability following the reform. In column (2) we add the additional interaction with job loss. Individuals who separated from their job were particularly more likely to be on partial disability after the reform (83 percent for men, 120 percent for women).

Table 3: The effect of the 2008 reform on partial disability receipt

Panel A: Men			
	(1)	(2)	(3)
Treatment	0.00059*** (.00013)	0.0001 (.0001)	0.0005*** (.0001)
Treatment*post	0.00088*** (.00014)	0.00088*** (.00014)	-0.0002 (.0002)
Treatment*post*jobloss		0.0013*** (.0002)	0.0019*** (.0002)
Unemployment interaction			X
Mean dep. Variable	0.0026	0.0026	0.0026
Observations	2725971	2725971	2725971
Panel B: Women			
	(1)	(2)	(3)
Treatment	0.0004*** (.00012)	0.0004*** (.0001)	0.0003*** (.0001)
Treatment*post	0.00035** (.00014)	0.0000 (.00014)	-0.0003 (.0002)
Treatment*post*jobloss		0.0022*** (.0002)	0.0022*** (.0002)
Unemployment interaction			X
Mean dep. Variable	0.0018	0.0018	0.0018
Observations	2083595	2083595	2083595

Standard errors in parentheses

***p<.01, **p<0.05, *p<0.1

Notes: Regressions include the following additional covariates: average wage at previous firm, regional unemployment rate, region and year fixed effects, total employment spells, dummy variables for experience decile, age decile, sector, job loss (columns 2 and 3) and high school graduate.

The primary possible confounding factor in our analysis is the financial crisis. While the reform was implemented 10 months before the onset of the Great Recession, the bulk of the years after the reform overlap with the crisis years. Research has shown disability rates are counter-cyclical with the economy (Rege et al. 2009; Black et al.

2002). However, in Spain, aggregate disability rates did not rise after the financial crisis. And in our microdata, we do not see a large increase in disability receipt following the crisis for our control group. Further, we control for both year fixed effects and the region (Autonomous Community) level unemployment rate which should account for the bulk of the crisis's effect on disability receipt. However, our treatment group has low labor force attachment and it is possible that the global financial crisis disproportionately affected them. Our estimated effect of the reform may then be merely the effect of the financial crisis not accounted for by year fixed effects and the local unemployment rate. In an attempt to further control for the financial crisis, we include an additional triple interaction between the local unemployment rate, the treatment group and job loss (column 3). This interaction will capture the effect of losing one's job in a poor economic environment for the treated (i.e. individuals with low labour market attachment). Even with this added interaction, we still observe a strong effect of the reform on the treated that have left their job, in fact, the effect is slightly stronger than in column 2. We interpret this result as evidence that the reform strongly induced disability application for those affected by the reform that had separated from their job. Before the reform these individuals might have waited to apply for disability, either hoping to recover from their disability and return to their old profession or choosing to search for a job that would accommodate their limitations. After the reform, wary of lowering their benefit amount, they prioritized applying for disability. Those individuals that are responding to the reform correspond to the so-called "*conditional applicants*" (Maestas, Mullen, and Strand 2015); that is, individuals with a health impairment who would prefer to remain in the labor force but apply if they lose their job.

In table 4 we show the results when the sample includes individuals who receive total disability benefits instead of partial disability. The 2008 reform changed the incentive structure for total disability in the same way that it changed the incentives for partial disability: a PAC percentage was now multiplied to one's monthly benefit amount for new beneficiaries. Similar to the results in table 3, the reform increased total disability receipt, with the effect primarily operating through individuals who have recently separated from their job.

Table 4: The effect of the 2008 reform on total disability receipt

Panel A: Men			
	(1)	(2)	(3)
Treatment	0.00029*** (.00011)	-0.0005 (.0001)	0.0001 (.0001)
Treatment*post	0.00086*** (.00012)	0.00097*** (.00013)	0.0002 (.0002)
Treatment*post*jobloss		0.0009*** (.0002)	0.0015*** (.0002)
Unemployment interaction			X
Mean dep. Variable	0.0020	0.0020	0.0020
Observations	2714116	2714116	2714116
Panel B: Women			
	(1)	(2)	(3)
Treatment	0.00007 (.00010)	0.00002 (.00010)	0.00005 (.00011)
Treatment*post	0.00051*** (.00011)	0.0003*** (.00011)	-0.0000 (.0002)
Treatment*post*jobloss		0.0016*** (.00016)	0.0017*** (.00019)
Unemployment interaction			X
Mean dep. Variable	0.0013	0.0013	0.0013
Observations	2074848	2074848	2074848

Standard errors in parentheses

***p<.01, **p<0.05, *p<0.1

Notes: Regressions include the following additional covariates: average wage at previous firm, regional unemployment rate, region and year fixed effects, total employment spells, dummy variables for experience decile, age decile, sector, job loss (columns 2 and 3) and high school graduate.

6.3 Additional Interactions

In this section, we examine how the probability of disability receipt differs by benefit level. Our theoretical model predicts that disability application should be higher for those closer to the 35 PAC year threshold. Remember that after the 2008 reform, for those below the 35 year PAC threshold, the amount that their disability benefits were reduced by depends on their PAC years. For instance, those with 15 PAC years or lower received 50 percent of their previous benefit amount, while those with 34 PAC years received 98 percent. To reflect this variation and capture the distance from the 35 PAC year threshold, we include the variable, *percent_lost*, the percent of benefits lost in a given year due to the 2008 reform. For all years prior to 2008 it takes value zero, as the

reform has not occurred. For individuals in a given year with above 35 PAC years, the variable will also be zero as no benefits are lost. For those below the 35 PAC year threshold in the post-reform years, *percent_lost* will take values corresponding to the percentage of benefits lost due to the reform. For instance, for the individual with 34 PAC years, *percent_lost* will equal 2, indicating that they loss 2 percent of their benefit amount due to the reform. We interact this variable with our previous interaction between *jobloss* and the *treatment_post* variable. Table 5, column (1) shows the results for the partial disability sample. The interaction between the *percent_lost* and *treatment_post*jobloss* is negative, meaning those with higher PAC years were more likely to apply for disability than those with less PAC years. This finding is consistent with the theoretical model's prediction that the absolute value of the benefit should matter. Another possible interpretation of the finding is that individuals with high PAC years have more to lose by staying off disability, as their PAC percentage will continue to erode as they age. On the contrary, those with less PAC years have already lost most of their PAC percentage, and are closer to the percentage floor of 50%.

In Table 5, column (2), we add an interaction between *treatment_post*jobloss* and the average wage in the firm an individual left.¹⁷ *Ceteris paribus*, those who separate from their job at higher wage levels will have a greater incentive to apply for disability as their benefits will be higher than if they wait and either do not find a job or find a job with a lower wage (recall that benefits are based on the previous 8 years of wages). The marginal effect of the interaction is positive, suggesting that this incentive does indeed impact the decision to apply for disability. Taken together, the results of table 5 show that, for individuals affected by the reform, those with a higher benefit amount and thus those with the most to lose by waiting to apply for disability (through a lower monthly benefit amount due to either a lower base or lower PAC percentage), were more likely to apply for disability.¹⁸

¹⁷ Recall that we do not have individual wage data.

¹⁸ Note that, even if individuals with lower wages have lower employment prospects this is a period with a strong economic crisis so that employment prospects after separating from a firm are low for all types of workers. In 2012 unemployment rates were over 24%.

Table 5: Effect of reform on partial disability receipt (interactions)

Panel A: Men		
	(1)	(2)
Treatment*post	0.00034* (.00019)	0.00088*** (.00014)
Treatment*post*jobloss	0.002 (.0002)	0.00085*** (.0003)
Treatment*post*jobloss*percent_lost	-0.00004*** (.000008)	
Treatment*post*jobloss*wage		0.0000003*** (.0000001)
Mean dep. Variable	0.0026	0.0026
Observations	2725971	2725971
Panel B: Women		
	(1)	(2)
Treatment*post	-.0003* (.00018)	0.0000 (.00014)
Treatment*post*jobloss	0.0026*** (.0003)	0.0016*** (.0002)
Treatment*post*jobloss*percent_lost	-0.00001* (.000008)	
Treatment*post*jobloss*wage		0.000001*** (.0000001)
Mean dep. Variable	0.0018	0.0018
Observations	2083595	2083595

Standard errors in parentheses

***p<.01, **p<0.05, *p<0.1

Notes: Regressions include the following additional covariates: average wage at previous firm, regional unemployment rate, region and year fixed effects, total employment spells, dummy variables for experience decile, age decile, sector, job loss and high school graduate.

6.4 Heterogeneous Effects

In this section, we assess how the 2008 reform impacted different groups. First we examine regional differences by estimating equation (8) on individuals living in the south of Spain versus the rest of Spain. We defined the south of Spain as the following regions: Andalusia, the Balearic Islands, the Canary Islands, Castile-La Mancha, Valencia, Extremadura, and Murcia. These 7 regions were most affected by the financial crisis and had the highest unemployment rates within Spain. Therefore, individuals in these regions would face the poorest economic prospects. Individuals that

were affected by the reform who had separated from their job would be less likely to find a new job and therefore have a lower expected PAC percentage than a similar individual in a non-southern region. Table 6, Panel A shows the effects of the reform by type of region. As expected, the positive effect of the reform on disability rates is stronger in the south of Spain. The marginal effect on the interaction between treatment in the post reform period and the job separation dummy is statistically significantly larger for the sample of individuals living in the South than the sample of individuals in other regions. The overall effect of the reform on individuals who separated from their job in the South is an 87 percent increase in disability receipt while the overall effect for the rest of Spain is a 73 percent increase.

In panel B, we examine the effect of the reform on individuals by skill classification. We divide the skill level into two main groups. The first have some skill (administrative workers and above) while the second group have minimal skills and work as “peones” or labourers. Given the nature of the financial crisis and the collapse of the construction industry in Spain, “peones” who separated from their job would face a worse labour market than skilled workers. The results displayed in table 6, panel B, confirm that the 2008 reform disproportionately affected these low skill individuals. The marginal effect of the triple interaction between treatment, post 2007, and the job separation dummy is four times larger for “peones” compared to semi-skilled workers. This finding is again consistent with our supposition that the reform increased disability application for those who expected to have low labour-force participation in the future.

Table 6: The effect of the 2008 reform on partial disability receipt (by group)

Panel A: Region				
	South of Spain		Rest of Spain	
	(1)	(2)	(3)	(3)
Treatment*post	0.0012*** (.00023)	0.0010*** (.00024)	0.0007*** (.0002)	0.0007*** (.00018)
Treatment*post*jobloss		0.0017*** (.00027)		0.0009*** (.00022)
Mean dep. Variable	0.0031	0.0031	0.0022	0.0022
Observations	1116163	1116163	1609808	1609808
Panel B: Education				
	Peones		Semi-skilled	
	(1)	(2)	(3)	(3)
Treatment*post	0.0009* (.0005)	0.0001 (.0005)	0.0009*** (.0001)	0.0010*** (.0001)
Treatment*post*jobloss		0.0042*** (.0006)		0.0009*** (.0002)
Mean dep. Variable	0.0038	0.0038	0.0024	0.0024
Observations	339556	339556	2386415	2386415

Standard errors in parentheses

***p<.01, **p<0.05, *p<0.1

Notes: Sample is men only. Regressions include the following additional covariates: average wage at previous firm, regional unemployment rate, region and year fixed effects, total employment spells, dummy variables for experience decile, age decile, sector, job loss and high school graduate.

6.5 Robustness

In the previous sections we have shown that individuals who recently separated from their jobs were much more likely to apply for disability after the 2008 reform. In table 6 we explore the robustness of this result. In column (1) we look at individuals with 31 to 39 PAC years. These are individuals that are within 4 years of the 35 PAC year cut-off and are more likely to be similar on unobservable characteristics than individuals in our main specification, which uses the entire distribution. The estimated effect on our variable of interest (treatment*post*jobloss) remains positive and statistically significant for both men and women, which suggests unobservable variables are not driving our results. In column (2) we perform a similar estimation, except we remove individuals with 34.5 to 35.5 PAC years. These are individuals who may be confused about where they stand with regards to the PAC threshold and therefore may

be biasing our results. With this subsample removed, the marginal effect of interest again remains positive and statistically significant.

A confounding effect of the reform is the financial crisis. We do not believe the financial crisis is solely responsible for our results because disability rates did not rise for the unaffected group. Secondly, we still find effects around the 35 PAC year cut off. However, the financial crisis did affect the labour market prospects of the treated group. Recall that our theoretical model suggests that the flow into disability is driven by individuals who have low expected future employment. Therefore, it is an open question as to whether we would find an effect of the reform absent of the crisis. Thus, essentially, what is the external validity of our results? We examine this question in column (3) where we re-run our estimation, limiting the sample to years less affected by the crisis. In column (3) we examine the years 2001-2010, which will cover enough years of the reform that the public had become aware of it. It will also only cover the initial years of the financial crisis when the effects in Spain were mild and before the unemployment reached the heights of 2011-2015. The marginal effects of our variable of interest (treatment*post*jobloss) remain positive and statistically significant, which suggest that the reform would still positively affect disability rates absent a large spike in unemployment.

Table 7: The effect of the 2008 reform on partial disability receipt (robustness)

Panel A: Men			
	31-39 PAC Years	31-34.5;35.5-39	2001-2010
	(1)	(2)	(3)
Treatment*post	-0.0000 (.00023)	0.0001 (.00023)	0.0006*** (.00015)
Treatment*post*jobloss	0.0019*** (.0003)	0.0017*** (.0003)	0.0007*** (.0002)
Mean dep. Variable	0.0025	0.0025	0.0023
Observations	1103679	1016166	2516131
Panel B: Women			
	31-39 PAC Years	31-34.5;35.5-39	2001-2010
	(1)	(2)	(3)
Treatment*post	-0.0002 (.00017)	-0.0002 (.00018)	-0.0000 (.00015)
Treatment*post*jobloss	0.0019*** (.0002)	0.0019*** (.0003)	0.0017*** (.0002)
Mean dep. Variable	0.0013	0.0013	0.0018
Observations	889992	817541	1909320

Standard errors in parentheses

***p<.01, **p<0.05, *p<0.1

Notes: Regressions include the following additional covariates: average wage at previous firm, regional unemployment rate, region and year fixed effects, total employment spells, dummy variables for experience decile, age decile, sector, dummy for job loss and high school graduate.

7. Discussion and the fiscal impact of the 2008 reform

In order to ascertain the fiscal impact of the 2008 reform, we perform a simple calculation using our main results to obtain an estimate of the monthly burden/savings of the reform. In the previous sections, we have documented that the 2008 reform, contrary to its intended aim, increased disability receipt in Spain. The estimates from table 3 suggest that the reform resulted in 264 more men in our sample receiving partial disability from 2008 to 2011. These were men added to the disability rolls because of the reform and the payments to them represent the cost of the reform for men's partial disability. However, there is another group of men who were affected by the reform (in terms of lowered benefits), but who would have entered into the disability system regardless of the reform. If we assume the disability rate stayed constant from 2007,

there are 1204 treated men (men with less than 35 PAC years) who would have entered disability from 2008 to 2011 without the reform. The government saved money on these individuals because their monthly payments were lowered as a result of the reform. Using the average monthly benefit amount to entrants in 2007 (501 Euros) and the average PAC percentage after the reform (80), we can now calculate overall the monthly burden/gain of the reform. On the cost side, the government is paying a combined monthly benefit of 105,811 Euros to the 264 induced partially disabled men. However, they are saving 120,640 Euros per month by paying the 1204 men, who would have entered regardless, 20 percent less per month. Thus, overall, the reform still saved the government money even though it induced disability application. We do this simple exercise for partial disability women, total disability men, and total disability women. We then scale these estimated costs and savings up to the population level. This rough calculation suggests that the 2008 reform was saving the Spanish government roughly 1.3 million Euros per month by the end of 2011. Given that the average monthly expenditures of the Spanish government are 37 billion Euros, 1.3 million euros a month is a tiny fraction of the overall budget. Therefore, while the reform had the unintended consequence of increasing disability receipt, those consequences did not have a significant impact (positive or negative) on the Spanish government's budget.

8. Alternative policy scenario: abolishing incentives to join the DI system

As we have seen above, the policy change introduced incentives to apply to the DI system for individuals with a low labor force attachment who expect to spend a number of periods without contributing to the social security system. In this section we simulate an alternative reform that would not have these incentives to enter the disability system. We propose a similar policy to the one implemented in 2008 but we exclude the age component (65-Age) from the formula to calculate the actual PAC. Thus, the new formula is almost identical to the old-age benefit formula that already exists in Spain;

$$\text{PAC years} = \frac{\text{years contributed}}{\text{actual contributory years}}$$

This is the only parameter that we change and we leave the PAC percentage unchanged. That is, we assume that the corresponding PAC percentage follows the same rule as the one introduced in 2008. Table 8 shows the simulated results for a 50 year-old individual under the presence of two different labor force attachment scenarios (following the

simulations in Section 5). The first one is a high labor force attachment scenario and assumes that the individual will work every year until retirement. The second is a low labor force attachment scenario that assumes individual will only work five more years until retirement. The rest of the model's parameters are the same to the ones used in section 5.

Table 8 shows the simulated results. In the first block we include the simulated probabilities of applying to the disability system after the 2008 reform while in the second block we show the simulated probabilities under the alternative policy scenario that we are proposing, which excludes the age component from the PAC formula.

Table 8. The effect of the proposed alternative policy scenario on the probability of applying to the disability system.

The Spanish Disability System after the 2008 Reform									
				Low labor force attachment scenario			High labor force attachment scenario		
Age	Contributed years	PAC	θ	E(PAC)	E(θ)	Prob Apply DI	E(PAC)	E(θ)	Prob Apply DI
50	10	25	0.8	15	0.5	0.0077	25	0.8	0.0046
50	15	30	0.9	20	0.65	0.0098	30	0.9	0.0067
50	20	35	1	25	0.8	0.0119	35	1	0.0091
50	25	40	1	30	0.9	0.0106	40	1	0.0091
50	30	45	1	35	1	0.0091	45	1	0.0091
An alternative Disability System									
				Low labor force attachment scenario			High labor force attachment scenario		
Age	Contributed years	PAC	θ	E(PAC)	E(θ)	Prob Apply DI	E(PAC)	E(θ)	Prob Apply DI
50	10	10	0.5	15	0.5	0.0005	25	0.8	0.0000
50	15	15	0.5	20	0.65	0.0002	30	0.9	0.0000
50	20	20	0.65	25	0.8	0.0011	35	1	0.0002
50	25	25	0.8	30	0.9	0.0033	40	1	0.0021
50	30	30	0.9	35	1	0.0051	45	1	0.0051

The most important result is that the alternative system shows lower probabilities of applying to the disability system (Prob Apply DI) than the actual system. For example, in the actual system (first block), a 50 year-old with 10 years of contributions has a PAC of 25 years with expected PAC of 15 (25) years in the low (high) labor attachment scenarios. In these two scenarios, the probabilities of applying to the disability system are 0.0077 and 0.0046, in each case. In contrast, in the alternative scenario proposed (second block), the actual PAC for this individual is reduced from 25 to 10 while the expected PAC will remain unchanged. In this case, the probabilities for applying to DI fall to 0.0005 and 0.000, in each case. The intuition behind this result is simple; eliminating the age component from the PAC formula reduces de actual PAC and, at the same time, ensures that the expected PAC (EPAC) will not be lower than the observed PAC, implying that $E(\theta) \geq \theta$ at any given age and number of years contributed.

Therefore, since the individual will not take into account a reduction in the future PAC during his working life, the incentive to apply to the disability system falls to virtually zero.

9. Conclusion

This paper adds to the growing body of evidence that shows that the design of a disability benefit system can have a significant impact on disability application. Disabled individuals clearly respond to incentives in terms of the decision to apply and the timing of that decision. We analyzed the 2008 disability reform in Spain and found that, contrary to its intended purpose, the reform increased disability application. The positive effect is due to the fact that the reform incentivized application for those affected by the reform who expected to have low labor force participation in the future. Although the absolute value of these individual's benefits were decreased by the reform, their present value was greater than it would be in the future after continued low labor force participation. Overall we find that the reform increased partial disability application for the treated by 33 percent for men and 18 percent for women. However, despite having the opposite effect of its intent, the reform had a minimal impact on government expenditures.

The Spanish case also showcases some of the pitfalls of a disability insurance system with minimal work disincentives. Spanish disability receipt does not have an explicit work disincentive in terms of a restriction on hours worked. The US system does place a restriction on hours worked. The work restriction makes it more difficult for disabled individuals to re-enter the labor force and maintain their human capital (Autor & Duggan, 2010; Burkhauser & Daly, 2011; MacDonald and O'Neil, 2006). For this reason, many believe that this component of the US disability system should be altered. The Spanish system and the 2008 reform demonstrate some of the drawbacks of having no hours worked restriction. Firstly, disability receipt is still an absorbing state in Spain, less than 1 percent of individuals leave disability in a given year. Secondly, with no work disincentive, unemployed disabled workers are incentivized to apply for disability over finding new employment if they expect their disability benefits to deteriorate as they will be allowed to work while receiving the benefits. Thus, in this paper we find that individuals that are responding to the reform correspond to the so-called "*conditional applicants*" (Maestas, Mullen, and Strand 2015); that is, individuals

with a health impairment who would prefer to remain in the labor force but apply if they lose their job. Overall, the 2008 Spanish reform highlights the difficulties of disability design, and governments with disability reform agendas (like in the USA) should be wary of possible unintended consequences.

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APPENDIX

Table A1: PAC percentages after 2008 reform

Number Potential and Actual (PAC) Years Contributed	Percentage applied after the Reform
15 or less	50
16	53
17	56
18	59
19	62
20	65
21	68
22	71
23	74
24	77
25	80
26	82
27	84
28	86
29	88
30	90
31	92
32	94
33	96
34	98
35	100

Table A2: Parameterization of the theoretical model for a given individual

Parameters	Value	Definition
i	50	Current age
μ_i	0.032	Disability probability shock
β^i	0.44	Discount factor
C_i	$0.33w_i^n$	Working disability costs
\bar{w}_i	1.15	Regulatory base
ρ	0.22	Unemployment replacement rate
α_i	0.55	Percentage applied to the regulatory base
λ_i	0.204	Job finding rate
γ_i	0.08	Job separation rate
w_i^d	0.892	Wage of the officially disabled
w_i^n	1.494	Wage of the non-officially disabled
σ	0.16	Standard deviation of $\log(z)$
η	0.00	Log normalization of the mean of z
k	65	Retirement age

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