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If Sick-Leave becomes More Costly, Will I go back to Work? Could it be too soon?

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Tinbergen Institute Discussion Paper

If Sick-Leave becomes More Costly, Will I go back to Work? Could it be too soon?

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IF SICK-LEAVE BECOMES MORE COSTLY, WILL I GO BACK TO WORK? COULD IT BE TOO SOON? *

Olivier Marie and Judit Vall Castello

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Abstract: We investigate the impact on work absence of a massive reduction in paid sick leave benefits. We exploit a policy change that only affected public sector workers in Spain and compare changes in the number and length of spells they take relative to unaffected private sector workers. Our results highlight a large drop in frequency mostly offset by increases in average duration. Overall, the policy did reduce number of days lost to sick leave. For some, however, return to work may have been premature as we document huge increases in both the proportion of relapses and working accidents rates.

Keywords: Sickness Insurance, Paid Sick Leave, Absenteeism, Presenteeism, Relapses Contagious Diseases, Benefit Displacement, Working Accidents, Negative Externalities, Spain

JEL classification: I12, I13, I18, J22, J28, J32

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1 - Introduction

How much does the generosity of sickness insurance (SI) affect health related work absences? This is a question almost as old as organized labor with the earliest evidence of sick leave rights uncovered among workmen who built the Egyptian royal tombs over 2,500 years ago (Austin, 2015). The potential distortionary impact on worker behavior of such entitlements has recently regained accrued interest among economists and policy makers. Many European states have cut back on previously high SI provision in response to the financial crisis while local US lawmakers have been expanding minimal SI coverage rights following failure to act at the federal level (Pichler and Ziebarth, 2020). The ongoing Covid-19 pandemic crisis has brought critical urgency to our need to understand how to design optimal benefits which simultaneously guarantee an individual's right to go on sick leave while still incentivizing return to work as early as possible without putting own and others' health at risk[1]. We study these issues by investigating the impact on work absences of Spanish public sector workers from a huge cut in the generosity of their sick leave benefits that did not affect employees from the private sector.

Theoretically – considering moral hazard issues that arise when asymmetric information is present in insurance markets – the predicted first order effect is simple: the more income one has to lose from taking sick leave, the less one will make use of it. In practice, however, obtaining credible causal estimate of the elasticity of benefit generosity on worker's behavioral adjustment is not straight forward for several reasons. There are two common threats to identification that any empirical study must tackle in this context: unobserved heterogeneity and adverse selection. The former arises because health and productivity are positively linked, which may lead to underestimating the effect as high earners are less likely to be absent due to illness. Conversely, adverse selection will result in an upward bias in the estimates of the moral hazard effect as individuals with preferences for more absences will tend to self-select into jobs with more generous SI provision (e.g. the public sector).

A number of previous studies have attempted to circumvent these issues by using sick leave reforms to obtain causal elasticity estimates of SI generosity on absences. The general consensus suggests a strong positive relationship which would point to an empirical confirmation of the theoretical predictions. However, the preciseness of the estimates produced and the credibility of the method of identification used have suffered from problems linked to:

[1] Employee paid sick leave was actually introduced in March 2020 at the federal level in the US as a response to the Covid-19 pandemic among other benefit legislation passed under the Families First Coronavirus Response Act (FFCRA). It is however a temporary measure which is expected to expire by the end of the same year. For more details see: https://www.dol.gov/agencies/whd/pandemic/ffcra-employee-paid-leave

(i) the manner of implementation of the policies used as quasi experiments; and/or (ii) the availability of adequate data to study them. One thorny issue has been that the impact on sick leave has been explored in contexts when *all* workers are affected by a reform, either by design or because of data availability[2]. In such a context, no control group exists and, thus, there is a risk that time specific shocks may bias causal effect estimates if one compares before vs after work absence behavior. There is also the tendency for sick leave policy changes to be implemented by combining modifications in *both* generosity *and* monitoring simultaneously[3]. In this case, it is difficult to know which channel is behind a change in absence behavior as monitoring will affect the level of asymmetric information this insurance market suffers from, making it almost impossible to obtain clean elasticity estimates of SI generosity. Another frequent limitation has been the reliance on self-reported absence information in this literature. Many papers have used survey questions which ask respondents how many days of work they have missed due to illness in the past year, or in the reference week, to measure sick leave behavior. For one, this raises the specter of the usual measurement error issues with self-reported recall data. For another, and more importantly, it prevents researchers from distinguishing between policy important extensive (incidence of absences) and intensive (length of absences) margin effects analysis of a sick leave reform (e.g. 20 sick days in a year could come from a single spell, two 10 day spells, and up to 10 single day spells)[4]. Finally, no paper has managed to cleanly estimate the causal impact of reducing SI generosity on absences, while also properly considering the possibility that these returns to work may occur 'too soon' with consequences for the health of affected individuals and the efficiency of such policies.

The policy change we study here and the data we use do not suffer from any of these recurrent problems. As such, we believe that we are able to provide very credible and clean causal estimates of a change in SI generosity on worker's absence behavior. In August 2012, the Spanish government imposed a radical cut on the replacement rate of the benefits public sector workers would receive during sickness absences: from providing 100% of regular wage for up to six months to be replaced with 50% in first 3 days, 75% days 4-20, and 90% after that. Crucially, this reform did not affect private sector workers, consequently allowing us to use this as a comparison group in a difference-in-difference setting. We make use of social security

[2] Such as, for example, the case for the Swedish sick leave reforms of the 1980s and 1990s studied by Johansson and Palme (2005).

[3] Both the generosity and monitoring intensity of sick leave entitlements for Italian public sector workers were affected simultaneously in a number of reforms evaluated by both Paolo et al. (2014) and D'Amuri (2017).

[4] The in-depth investigations of the impact of changes in sick leave generosity in Germany carried out by Ziebarth (2013) and Ziebarth and Karlssonn (2010, 2014) all have to rely on yearly self-reported sickness absence data.

register data on employer declared sick leave spells (number *and* length) with exact diagnostic for all individuals working in Spain between 2010 and 2014. All workers in our context are subject to the same very tight monitoring system throughout this period that makes it possible for us to estimate a pure income effect of the policy. From official statistics, we obtain the number of workers per sector and quarter to generate a denominator, i.e. how many individuals are eligible for sick leave among the treated and control groups throughout this period. We are then able to estimate how the reform affected both the sick leave incidence rate (extensive margin) and the mean spell duration (intensive margin). The main gauge of the overall policy effect on absence behavior is eventually obtained by the interaction of these two margins to give us the days lost to sick leave per worker each quarter. To get a more complete picture of its efficiency, we also consider potential externalities generated if return to work were premature as measured by the probability of treated individuals to fall ill again, or to suffer more (health related) working accidents.

To validate our difference-in-difference approach we first visually confirm that sickness absence rates of workers from different sectors and the length of these spells were following very similar trends before the policy change. We can then observe a marked drop in the number of spells taken by public sector workers, a reduction of 29% in sick leave rate by our estimates. The picture is almost perfectly reversed for the average length of spells with a visually sharp increase of 28% after the reform, according to our estimates. The latter result is perhaps not surprising as the change in the level of generosity was most severe for shorter spells, thus imposing large costs from returning to work after passing the 21 days threshold. We confirm this by checking where in the spell length distribution spectrum the intensive margin effects come from. In terms of total number of days lost, we still find that the reform had a substantial impact in reducing absenteeism that we estimate to be about 10 percent (from a baseline average of 1.3 days lost per public sector worker each quarter). We further study the potential for heterogeneity in policy response with respect to the type of illness causing the work absence. We do this by estimating the same difference-in-difference models separately for the six most common medical conditions declared to social security. The results reveal a similar pattern for all illness categories: large significant reductions – in the range of 20-40% – in the number of spells mirrored by increases in average duration of relatively similar magnitudes. In terms of reducing numbers of days lost to sick leave, the largest policy effects are revealed to be strongest for three disease types: respiratory (-26%), infectious (-22%), and muscle or joint (-18%) illness categories.

Finally, we investigate whether the incentives to return to work provided by the policy may have led some to do so prematurely with potential negative consequences to their health and that of others. This is an important issue to consider since it might change the assessed effectiveness of the SI benefit cut we study by increasing its medium to long run costs in various ways. We explore this in two ways. First, we look at the effect the reform may have had on the proportion of sick leave spells due to relapses, i.e., being absent from work because of a disease diagnosed during a previous sick leave spell from which the individual had not completely recuperated. We find evidence of a significant increase in the proportion of relapses (+8%) after the policy change which is especially strong when looking solely at short spells (+30%) and for sick leave due related to infectious diseases (+20%). This finding of an increased likelihood of falling ill at work again for an infectious disease not properly cured is especially worrying for the externalities that these premature returns may have on others' health. Second, we check for a potential post policy changes in absences due to work accidents of public sector employees, a benefit scheme unaffected by the reform. Here, we uncover a massive 56% increase in the number of days lost each quarter due to accidents at work which, even if this is from a low baseline of 0.086 days per worker, cancels out about half of the gains in sickness absences from the reform. The vast majority of accidents among public sector employees are due to muscular related issues ('back pain'), reinforcing the likelihood that much of this is the result of displacement from one benefit scheme to the other. Further evidence of this comes from the fact that muscular illnesses was the only disease category for which we observed a significant drop when looking at sick leave relapses. These findings generally point to important potential spillover effects of SI benefit cuts that may lead to workers returning too soon, and the costs that this may put on own and others' health in the medium run and on the Social Security system in the long run.

The rest of the paper is structured as follows. Section 2 gives background information about sick leave provision in Spain and explains the nature of the reform we study. Section 3 describes the administrative data and our methodological approach. Section 4 presents and interprets the main results. Section 5 examines compositional changes in the leave duration and the type of diseases under which such absences are classified. Section 6 explores the issue of policy spillovers if workers return to work too soon. Section 7 concludes.

2 - Sick leave and the reform

2.1 - The sick leave program

The temporary sick leave program is an economic benefit with the objective of compensating the loss of income suffered by workers who are temporarily unable to work due to an illness or an accident. An individual suffering from an ordinary illness becomes eligible for sick leave benefits only if the individual is currently employed and he/she has contributed to the Social Security system for at least 180 days of the last 5 years before the onset of the sick leave condition. If the sick leave condition arises from an accident or a professional illness, the individual also needs to be employed but there is no minimum contributive period required. The sick leave benefit is received until the individual has recovered from his/her condition to a maximum of 365 days, with a potential extension of 180 extra days if it is highly likely that the worker is going to recover during this additional time[5]. After this maximum period of one and a half years, the worker either goes back to work or is transferred to the permanent disability system.

To give some perspective on the economic importance of sick leave programs, if we focus attention on the evolution of expenditures (as a percentage of GDP) in paid sick leave in selected OECD countries, we can see that these programs were extremely important in Northern European countries at the beginning of the 1990s. For example, The Netherlands was spending 2% of its GDP on these programs in 1990 and Sweden reached 2.3% of its GDP to finance sick leave programs in the same year (OECD database). However, from the early 1990s, there was a strong reduction in sick leave benefits to the point that, in the mid- and late 2000s, Spain had a similar level of expenditure in paid sick leave as countries like Sweden and The Netherlands, spending around 1% of the GDP. This number is above the OECD average, which stands at 0.4% in 2015 and is also well above the expenditure in countries like France and Germany, which spend less than 0.5% of its GDP on sick leave (data extracted from the OECD database).

Our investigation of the impact of reforms in the SI system in the Spanish context will thus have informative policy implications not only for other European countries with similarly high levels of expenditure, but also in the US where Federal paid sick leave rights have recently been evolving rapidly.

2.2 The 2012 sick leave policy reform

[5] In the case of observation periods for professional illness, the maximum time is set at 6 months with a potential extension of 6 additional months if needed for observation and diagnosis of the disease.

Until 2012, public sector employees were subject to a sick leave policy that had been in place for over a decade (Royal Decree 3/2000 of 23rd of June 2000). Under this regime, the individual received a temporary sick leave benefit with a replacement rate equal to 100% of the wage that was applicable in the month before becoming temporarily sick. The 100% rule was in place for the complete duration of the sickness leave and independently of the cause of the sickness—be it a common illness or a working accident.

The rules governing sick leave benefits for private sector employees had been unchanged for almost two decades (in the Ley General de Seguridad Social of 1994) and they vary according to the duration and the source of the sick leave episode. If the sick leave spell is caused by a common illness during the first 3 days, private sector employees do not receive any amount as sick leave benefits, neither from the Social Security administration nor from the employer. From the 4th to the 20th day they receive 60% of the previous month's wage while from day 21 onwards they get 75%[6]. From the 4th to the 15th day these amounts are paid by the employer whereas from day 16 onwards the Social Security administration is in charge of the payment. However, if the sick leave episode is caused by a working accident or a professional illness, the benefit is 75% of previous wages from the first until the last day and is paid by the mutual insurance company.

Spain was one of the most economically affected country by the ramifications of 2008 financial crisis and, as a result, the government was looking for ways to limit public expenditures. This led to the legal introduction, on the 13th of July 2012, of a reform package with the explicit aim of reducing public sector wage-related costs while increasing the productivity of public employment. The central and most radical change was the immediate reduction in the generosity of sick leave benefits received by public workers, with the explicit objective of reducing absenteeism[7]. Public and private sector workers already had differential rules governing sick leave benefits, as explained above, and the change in law implemented in

[6] In Spain, all workers and employers are automatically included in the scope of a collective bargaining agreement. The rules of these agreements are compulsory for them. In some of the collective bargaining agreements there are rules that increase the amounts of sick leave benefits, establishing that the employer must complement the Social Security benefits up to certain amounts and for a given period of time. It is not unusual to find collective agreements establishing complements of sick leave benefits up to 100% of worker's wages for up to one year. In any case, there are huge differences among different collective agreements and summarizing them is out of the scope of this paper.

[7] Some of the other changes introduced included the incompatibility of the receipt of several compensatory benefits (for some previous high-level public workers), the abolishment of the extra-pay received in December of each year, and a reduction in the number of hours allocated for personal permission. We do not expect any of these other marginal changes to public sector worker statutory rights to have any substantial effect on sick leave absences.

2012 affected only public sector workers[8]. It is important to note that the reform in the sick leave program for public workers was only implemented for individuals suffering from a common illness. If the sick leave episode emanated from a working accident (or professional illness), the amount received was left unchanged at 100% of previous wages. Also, it is crucial to note that there was no change in the level of monitoring of sick leave absences throughout this period which was similarly *very stringent* for *both* private and public sector workers. It was the result of reforms in the mid-2000s, which made Spain an example cited by the OECD as one of the countries with the most elaborate monitoring system in the world[9].

[Table 1 about here]

The reform made the amount of benefits that public workers received contingent on the number of days of sick leave, following a similar structure as that of private sector employees but with different amounts of sick leave benefits. Thus, after the reform, public sector employees received 50% of previous wages during the first three days of the sick leave episode, 75% from the 4th until the 20th day and 100% from the 21st day onwards. [10] If the sick leave incident was due to a working accident or professional illness the amount was left unchanged at 100% independently of the duration of the sick leave. The pre- and post-reform features are summarized in Table 1 for public and private sector employees for cases in which the sick leave arises from a common illness.

3 - Data and methodology: administrative data

3.1 Data and descriptive statistics

In order to analyze the impact of the policy, we use register data from the Social Security administration in Spain using the entire population of sickness absences from 2010 until 2014. This means we have available all sickness leave spells that occurred in Spain between these

[8] Public sector employees include everybody that works in the public administration, even if the person does not have a contract as a public sector employee.

[9] In the 2010 OECD report on *Sickness, Disability, and Work*, it states that "Several countries … have increased their efforts to reduce sickness absence by making drastic modifications in their sickness *monitoring* policy …in Spain in 2004 when a new department at the National Institute of Social Security was created with the sole purpose of better monitoring and reducing absence rates. A new monitoring tool with daily updated complete individual sickness absence histories allows online selection of cases for reviews on the basis of longer-than-expected recovery phases. In addition, in 2005 a general absence control was put in place when the duration of absence was greater than six months." (pp 83-84)

[10]The law gives room for administrative units in the public sector system to consider exceptional cases than can be assigned a 100% rate of the wage. However, these cases must be duly justified and are always related to hospitalizations or surgical interventions. Furthermore, some public sector administrative units include benefits for dependent children on top of these amounts (like members of the judiciary system).

years. For these individuals, we have information on the month and year of birth, gender, day/month/year of the sick leave and that of the recovery (allowing us to calculate the duration of the spell), the type of diseases that caused the sickness spell (according to the CIE-10 classification), the province and the economic activity of the job (according to the CNAE classification at the 5 digit specification). As the number of individuals employed in this period has changed a lot in Spain, we aggregate the data at the quarterly level, and we divide it by the number of employed workers in each quarter as derived by the Spanish Labour Force survey. We focus our analysis on men aged between 25-60 years old and we aggregate the economic sectors in order to have 21 different activity groups.

As can be seen in Table A1 of the Appendix, for men we have 6,837,774 sickness absence spells from 2010 until 2014. The table provides information on the number of spells for each of the 21 economic activities as well as the percentage of workers in each activity. As we do not have information on whether the individual works in the private or public sector, we use the Spanish Labour Force Survey to calculate the percentage of workers that have declared to be public workers within each of the 21 activity groups. In the last column of Table A1 we can see that only 0.77% of workers in the manufacturing industry are public sector workers. Conversely, over 98% of workers in the public administration and defense category are classified as public sector workers.

Thus, based on that percentage, we construct two different treatment indicators. First, we classify individuals as public sector workers (treated group) if they belong to an activity group in which more than 95% of the workers are public employees. We classify them as private sector workers (control) if they work in an activity in which less than 5% of the workers are public employees. Thus, this is a dummy variable that we label "highly public" and has the value of 1, which is the case for the category of workers in Public Administration and Defense only. In this definition, we exclude the six categories for which the percentage of public sector workers ranges from 5% to 95% (water supply, sanitation, waste management & decontamination; transport & storage; professional, scientific & technical activities; education; health & social services; artistic, recreational and entertainment activities). Additionally, we create a second treatment variable which is a continuous variable that takes the value of the percentage of public sector workers (the last column in Table A1). Therefore, for this second definition of treatment we do not exclude any category.

[Table 2 about here]

Table 2 provides descriptive statistics for the proportion of public sector workers when using the dummy variable "very public"; we can see that 11.6% of the sample works in the public sector. We also note the differences in the mean duration of sick leave spell between public and private sector workers (32.2 days for public sector workers versus 29.5 days for private sector workers) as well as the differences in the distribution of the duration of the spells and mean age of workers in each of the two sectors.[11]

3.2 Methodology

We are interested in the impact of the policy on two margins of sick leave behavior; what we call the "extensive" margin, or the probability to take sick leave, and the "intensive" margin, or the length of sick leave conditional on taking it. As the cost of beginning a work absence spell increases, we expect to find a reduction in the incidence of work absences. However, the reform increases the cost of returning to work after 20 days (recall that after which you are at the 100% level) so that, if going back to work too soon causes a relapse, you go back to receiving 50% of the replacement rate. Therefore, individuals will have incentives to extend the long absence spell to make sure that they are fully recovered while they are at the 100% replacement rate.

As we are analyzing a period characterized by a severe and protracted economic crisis, when we look at the "extensive" margin, it is important to consider the number of individuals employed in each period. Therefore, we collapse the individual data at the level of gender, sector of activity and quarter and divide by the number of employed men/women in each activity group and quarter (derived from the Labour Force Survey of the National Institute of Statistics). Thus, our dependent variable is the absence rate as defined by the number of sickness absence spells per quarter (per 1,000 workers), which is the proportion of workers on sick leave for each gender, sector of occupation and quarter:

[11] Before moving to the empirical strategy, we recognized the possibility that the reform changed the incentives of workers moving from the public to the private sector (or vice versa). To address this, first, it is important to recall that between 2010 and 2014 the unemployment rate in Spain ranged from a minimum of 20% to a maximum of 27%. Thus, finding a new job in these conditions was not easy. Second, most of the jobs in the public sector in Spain are permanent until retirement and very few people lose or leave their jobs in the public sector. Finally, we can look at Figure A1.2 which plots the total number of workers per quarter in the public and private sectors from the first quarter of 2010 to the first quarter of 2015, we can see that there is a continuous and sustained drop for both sectors during our sample period as this was a period of rising unemployment rates in the context of an ongoing economic crisis. However, there is no differential trend after the introduction of the policy between public and private sector workers which, again, suggests no sorting between these two sectors as a response to the sickness absence reform.

$$AbsRate_{kt} = \alpha + \rho PolicyOn_t + \beta Pub_k * PolicyOn_t + \gamma Quarter_t + \delta Sector_k + \varepsilon_{kt} \quad (1)$$

"Pub" is one of the two treatment variables that we have described above for public sector workers ("highly public" or the percentage of public workers in each activity) and "PolicyOn" is an indicator variable that has a value of 1 from the third quarter of 2012 and onwards. The model includes quarters and sectors of activity fixed effects, and ε is the error term.

With respect to the "intensive" margin, or duration of the sick leave spells, we can use both the administrative data directly at the individual level or we can use the collapsed version of the data. For consistency reasons, we show the results of the collapsed model as our baseline and we present the individual results as a robustness check exercise. In the intensive margin case, conditional on taking sick leave, the duration of the spell is directly recorded in the data. As the reform introduced some thresholds for which benefits increase, we will also explore any changes in the duration of the sick leave spells within each of the thresholds (1-3, 4-20, 21+ days). Therefore, we employ the same model as above but using the individual sickness spells data, with the probability of the duration of the spell being in one of the three thresholds in each quarter as the dependent variable being the.

4- Results

4.1 Extensive margin results

In Figure 1 we plot what we call the absence rate for men calculated by dividing the number of sick leave spells by the number of employed individuals in the public and private sector categories for each quarter. The dashed line is for private sector men while the solid line is for public sector men. At first glance, we can see a strong seasonality pattern of the absence rate during our sample period, with a higher absence rate in the winter months and a lower one in the summer months. We also see that before the reform, public sector men have higher absence rates (as previous literature has documented) and that there is a decreasing trend in both groups with lower absence rates in recent years (probably as a result of the ongoing economic crisis). In any case, the evolution of the absence rate in both groups is remarkably parallel before the reform. In the third quarter of 2012, once the reform kicks in and benefits are cut for public sector workers, we can see a strong drop in the absence rate for those workers at exactly the third trimester of 2012 which stays for the remainder of the period. Thus, from this simple

graphical evidence, we can already expect to see a strong impact of the reform for public sector workers.[12]

[Figure 1 about here]

This is corroborated by the results presented in Table 3 where we estimate equation (1) above using the two treatment variables defined in section 3.1. Panel A of Table 3 shows the estimates of the effect of the reform on the absence rate for public sector men using the "highly public" dummy variable. We can see that the interaction term of this treatment variable post-reform suggests that sickness absences dropped by 14 per 1,000 workers per quarter. This coefficient is very stable in the regressions without fixed effects (column 1), with year and quarter fixed effects (column 2) and with year, quarter and economic sector fixed effects (column 3). As the mean sick leave rate for public sector workers before the reform is 47.8 per 1,000 workers per quarter, this implies that the reform reduced absence rates by 30%. When we use the proportion of individuals working in the public sector within each activity sector (Panel B of Table 3) as the treatment variable, we can see that the results are very consistent, and the point estimate is almost the same (a reduction of 13.4 sickness absences per 1,000 workers per quarter). Therefore, the estimated effect of the policy is a reduction by 29%, which is the same result as the model with the dummy treatment variable (very public).

[Table 3 about here]

4.2 Intensive margin results

We now turn to the impact of the reform on the duration of the sickness absence spell. As explained above, in this case we can use both individual as well as collapsed data. As our baseline model, we show the results using the collapsed data for consistency reasons (to make it more comparable to the extensive margin results) but we provide the results using individual level data as a robustness check. Of course, in this case, we estimate the impact conditional on going on sick leave. Figure 2 plots the average mean duration of the sick leave spell for men working in the public sector (solid line) and private sector (dashed line). Again, we see the

[12] Figure A1.1 plots the total number of sick leave spells in our administrative data for men from 2010 to 2014. In Figure A1.2 we plot the number of men employed in the public and the private sectors for the same period of time. We can see the sustained drop in the number of men employed in both sectors, again as a result of the persistence of the economic crisis but there is no jump at the time of the reform in the first trimester of 2012. Thus, we take this as additional evidence of the reform not providing enough incentives for individuals to shift employment between the public and the private sectors. As explained above, this was a period of very high unemployment rates (between 20 and 27%), so the possibility of changing jobs was not really an option in this environment.

seasonality of sickness absence behaviour with longer durations for absences in the winter months and shorter durations in the summer months. However, the pre-reform trends are exactly parallel for public and private sector workers, and, right after the reform, the mean duration of sickness absences increased substantially only for public sector workers.

[Figure 2 about here]

If we quantify this impact, in Table 4 we can see that the reform increased the mean duration of the sickness absence spells by around 9 days for both of our treatment definitions (Panel A and Panel B). As the mean duration for public sector workers before the reform is 27.8 days, we estimate an increase in mean duration ranging between 29% and 31.6% as a result of the policy.

[Table 4 about here]

4.3. Total effect of the reform

So far, we have reported two main results of the change in sickness absence benefits for public sector workers: a reduction in the number of sickness absences for affected workers by 30% (extensive margin) as well as an increase in the duration of sickness absences of public sector workers by 32% (intensive margin). In this section, we estimate the total effect of the policy by calculating the number of absent days per worker per quarter for public sector workers as well as for private sector workers. Thus, we add up all days of absence for workers in the two sectors for each quarter and divide it by the number of workers in each sector and quarter.

[Figure 3 about here]

Figure 3 plots the evolution of the variable that captures the number of absent days per worker per quarter for both public and private sector employees. We can see that the number of absent days per worker is consistently larger for public sector workers before the reform. However, this is reversed once the policy reform kicks in. In Table 5, we report results of regressions following equation (1) in which the dependent variable is the number of absent days per workers per quarter. In Panel A we report the results for the "very public" dummy variable while in Panel B we show the results for the continuous treatment variable. Our estimates show a strong drop in the number of absent days per worker of around 10% when controlling for economic sector and quarter fixed effects (although the results are very stable to the inclusion/exclusion of the fixed effects).

[Table 5 about here]

Thus, although there is an increase in the duration of sickness absence spells, we find that the policy led to a reduction in the total number of days of absence for public sector workers, which implies that the extensive margin results dominate the intensive margin results.

5. Compositional changes in duration and type of disease

5.1.1. Where is the increase in mean duration coming from?

In this section, we provide evidence on the reasons behind the observed changes in both the extensive and the intensive margins by looking at changes in the composition of the pool of sickness absences. We begin by having a closer look at the distribution of the sickness absence duration in order to understand what part of the duration distribution is driving the reported increase in mean duration. We first explore the effects by graphically plotting the distribution density of sick leave duration in days before and after the reform for public and private sector workers. Figure A2 in the top panel shows the distribution only for public sector men before (dashed line) and after (solid line) the reform. The vertical lines correspond to the new thresholds introduced by the reform. Note that before the reform, all durations would receive 100% of the replacement rate. The figure shows a drop in sick leave spells lasting from 3 to 20 days after the reform and an increase in those with durations longer than 20 days. Even if it may seem like a small effect, this corresponds to millions of observations. Figure 4 in the bottom panel plots the same distribution for private sector men—unaffected by the reform—and we can see that there is absolutely no change in the distribution of sick leave duration before and after the reform.

[Table 6 about here]

In order to quantify these effects, we create three dummy variables that capture the three thresholds introduced by the reform relating to the duration of the sickness absences. The first dummy captures whether the sickness absence lasted for 1 to 3 days, the second captures that for 4 to 20 days and the last one captures durations of 21 or more days. Note that here we use the individual level data so that we have more than 5 million sick leave spell observations. We can see in Table 6 that the probability of having short duration spells (1-3 days) slightly decreased for public sector workers after the reform (a drop of around 2%). For durations

between 4 and 20 days the drop was significantly higher around 13%. In counter to this, the probability of having the longest duration spell (21 days or more) significantly increased by 25% as a result of the reform. This is exactly what we expected as the cost of returning to work too soon increases post-reform, and as a result longer duration sick leave spells rise.

5.1.2 What type of diseases are most affected by the reform?

Next, we explore another margin of the composition of sickness absences: the administrative data on working accidents includes a detailed classification of the type of diseases that caused the sickness absence spell, as diagnosed by a doctor (according to the CIE-10 classification). Therefore, we use this information to explore which types of diseases reported as the cause of the leave spell are more likely to decrease as a result of the policy. We have classified the diseases into fifteen categories that include all CIE-10 groups: muscles and joints, respiratory system, infectious diseases, injuries, digestive system, mental disorders, senses and nervous system, circulatory system, skin diseases, genitourinary system, neoplasms, endocrine diseases, congenital anomalies, blood diseases, and, finally, diseases not well defined. Table A3 in the Appendix shows the main sub-categories of diseases included in each of the fifteen groups as well as information on the percentage that they represent within each category, the number of spells, the percentage of spells and the mean duration in days. Thus, in order to explore which types of diseases are more responsive to the policy, we estimate the same baseline difference-in-difference model for each of the disease categories that represent, at least, 5% of the total number of spells in our sample. Together, these account for over three quarters of all spells (muscles and joints, respiratory system, infectious diseases, injuries, digestive system, mental disorders and diseases not well defined).

We first present the regression results for incidence and duration of sick leave spells in Figure A2, where we plot the estimated policy impact in percentage changes (i.e. estimated coefficient/baseline) together with the 95% confidence intervals. The left-hand side graph reveals a strong reduction in the number of spells per worker in all illness categories. These extensive margin effects range between 21% and 42%, with the strongest reductions observed for the case of diseases related to muscles and joints (of which more than two-fifth belong to the back pain sub-category), followed by respiratory and infectious diseases with a reduction of 39% and 33% respectively. The right-hand side graph of Figure A2 summarizes the effect of the policy on the mean duration of sick leave spells. It shows large increases in average spell

length of between 19% and 35% across all disease categories as a result of the policy change. In a mirror image to the impact on the number of spells results, the strongest increase in duration is reported for the case of muscle and joints.

[Figure 4 about here]

Most relevant in order to gauge where the policy was most efficient in reducing absences is to look at changes in days lost per worker each quarter as the outcome for each disease type. This is what we report in Figure 4, again in terms of the estimated percentage change effect and a +/-2 standard error confidence interval. The average policy impact, as already discussed, is estimated to be a 10% reduction in days lost to sick leave. What pops out of our heterogeneity analysis is that this appears to be driven by very large drops in days taken off due to three disease categories: muscle and joint pains (-18%), infectious (-23%), and respiratory (-26%) illnesses. The first in the list may not be surprising as it consists of a majority of 'back pain' sufferers, a notoriously difficult ailment to objectively diagnose and for which the prevalence has already been shown to be very sensitive to change in benefit entitlement in other contexts (e.g. when looking at disability insurance claimant in both the US – Manasi and Lee, 2019 – and in the Netherlands – Godard et al, 2019). The other categories include the two most common types of viral diseases, gastroenteritis and influenza (see Table A3), both of which are highly contagious. The concern here is that not taking (enough) sick leave not only puts one's own health at risk, but also that of others as close physical contact would increase the virus' potential to spread, especially if one returned to work while still a carrier, with substantial cost-consequences (Adda, 2016). These two observations lead us to take a closer look at the potential negative consequences of "too early" returns to work with the reduction in sick leave generosity, resulting in falling ill again, or possibly displacing absences towards another type of benefit.

6. Policy spillovers: Back to work too soon?

In order to assess if the policy created incentives for workers to have potentially returned back to work too early (i.e. before they had properly recovered from the disease they were suffering from), we look at two potential externality channels. First, we focus on relapses, that is, the probability that the work absence is a result of a previous diseases that already required a sick leave spell and has recurred. Second, we analyze the extent to which the policy displaced

sickness absences to another social security program that covers individuals experiencing a work-related accident. This should provide us with a clearer picture of the net effect of the policy and also accounts for its potential spillover effects.

6.1. Relapses

The Spanish Social Security administration defines a relapse as a sick leave spell that is due to the same diagnosed illness that previously required an employee to be absent from work, and within 180 days of the antecedent spell. If these conditions are fulfilled, the examining doctor will categorize the new spell as a relapse in the administrative data to keep track of such events, otherwise, the individual is subject to all the same benefit conditions as for any regular sick leave occurrence. Figure 6 describes the evolution in the proportion of spells in each quarter due to relapses for public and private sector workers around the time of policy introduction. We first note that the pre-trends are extremely parallel with about 4-5% of all sickness absences due to relapse up until the reform was implemented. Once sick leave becomes more costly for public sector employees, we then observe a large divergence with the increase in relapse probability only occurring for the public sector group. The difference becomes especially marked two quarters after the policy is in place, which can be read as further evidence of its impact, as this is the time when all relapses will relate to a previous spell that had been filed post-reform (i.e. 180 days).

[Figure 6 about here]

Statistically, we formally estimate the size of this effect by running the same baseline model as in equation (1) with the probability of relapse as our dependent variable using the un-collapsed micro data. The first column in Table 6 reports that the proportion of absences due to a previously diagnosed disease is estimated to have increased by 8.3% on average. As this mean effect may hide heterogeneity in policy response, we consider how relapse probability changed depending on spell duration in columns (2) to (4) of Table 6. What is most striking here is the very large increase (35%) estimated in the proportion short spells (1-3 days) due to relapse. Longer spells (over 21 days), however, did appear to see a smaller but significant decrease in relapse cases. This is actually very much in line with the design of the benefit change we study which puts more financial pressure to return to work for short spells, and not for longer ones,

and, in so doing, may have inadvertently increased the likelihood to fall ill again for this category of sickness absences.

[Table 6 about here]

We continue our heterogeneity analysis of the policy's impact on relapses by splitting its effect depending on the type of diagnosed disease. We do this graphically in Figure 7 which presents these effects for the six more common illness categories in terms of percentage change (i.e. estimated coefficient/baseline) with a 95 percent confidence interval. Clearly, the largest increase is observed for infectious diseases where relapses increase by over one-fifth. This category mostly includes gastroenteritis cases, the most common type of any viral diseases and highly contagious. The large increase in the probability that workers would relapse from such infectious illnesses also increases the likelihood that these workers would have returned as carriers and infecting other individuals at their respective places of work[13]. This would be in line—even symmetric—with the positive effects on reducing the spread of another viral disease, influenza, using Google Flu data reported by Pichler and Ziebarth (2017) in the US after the introduction of sick pay mandates.

[Figure 7 about here]

We further explore relapse probability changes by disease type by plotting the policy effect separately, depending on the duration of the spell. The large increase in short term spell relapses noted earlier is due to four out of the six categories of digestive diseases, infections, mental disorders, and muscle and joints pains. The second graph of Figure A3 shows that the increase in relapses that last between 4 and 20 days is primarily driven by mental disorders. Finally, the reduction in relapses among spells with the longest duration is revealed to be entirely due to illnesses linked to muscle and joint ailments. Before we conclude that this is indicative of some positive policy externality as it would seem that fewer individuals suffered recurrently from 'back pain' – the most common reason for taking sick leave – we need to consider if displacement onto another benefit scheme may have been simultaneously occurring for this disease category.

[13] We would ideally want to test this contagion spill-over mechanism more directly, but unfortunately, we do not have granular data enough about where each employee works (e.g. firm) to do this properly.

6.2. Displacement effects towards working accident absences?

While sick leave generosity for public sector workers was severely reduced by the reform, there was no change in the replacement rate received for suffering a working accident: 100% of previous wage throughout a spell of any duration[14]. Could public sector employees have, instead, shifted absences using this alternative scheme as a result of the policy, either because it did not cost as them to do so, or because they took fewer needed sick leave days and, thus, became more prone to accidents at work as a result? Working accidents would be the primary culprits because a majority of cases among public sector employees—almost three-fifths—are the result of muscle and joint related issues, especially 'back pain' problems.

There is some evidence in the literature of displacement effects across benefit schemes after policies that tightened access were introduced in other contexts, examples include shifting from unemployment benefit to disability insurance in the UK (Pertongolo, 2009) and from disability insurance to social assistance in the Netherlands (Borghans et al., 2014). We know of no previous study exploring the possibility of displacement to other benefits emanating from changes in paid sick leave rights, which we believe to be essential to check in order to properly assess the overall effectiveness of such a policy.

[Figure 8 about here]

To see how working accident absences might have been indirectly affected by the sick leave reform, we obtain administrative data on the universe of working accident spells in Spain between 2010 to 2014. As before, we distinguish between public and private sector workers[15] and once again focus exclusively on male employees. We then proceed as in the main analysis by first graphically checking the evolution of working accident absences around a 'placebo' policy change in July 2012. Figure 6 plots the evolution of the average number of days lost per employee in each quarter attributable to a work-related accident, separately for the public and private sector. While the levels are quite different between the two, as accidents are much more common in the private than in the public sector (for this reason, we use two y-axes), we note that the trends were, however, very similar up to the time when the sick leave reform was

[14] As for sick leave benefit, working accident insurance is guaranteed until the individual has recovered from his/her condition for up to a maximum of 365 days, with a potential extension of 180 extra days if it is highly likely that the worker is going to recover from the accident during this period.

[15] The working accident data, however, does contain the actual public or private status of each employee, so we can use this information directly and do not need to rely on economic sector level classifications to categorize each worker, as was the case with the sickness absences administrative data.

introduced. After this, the number of days lost to working accidents jumps massively for public sector employees, while remaining flat for private sector employees, which, already visually, is strongly suggestive of displacement across benefit schemes. Figure A4 plots the incidence and duration of working accidents to verify where the change in absence behavior is coming from. We see that the change is primarily due to an increase in the number of spells taken by public sector employees (Figure A4.1) since their average length, at around 30 days, evolves in a very similar way pre- and post-policy across both sectors (Figure A4.2).

[Table 7 about here]

We formerly estimate the size of this potential displacement effect by running a slightly modified version of our difference-in-difference specification in equation (1) which now uses working accidents as the dependent variable and where individuals are classified as private or public sector employees, with the data collapsed accordingly for each quarter. Table 8 reports the coefficients and the associated percentage change this represents for three outcomes: the number of spells per 1,000 workers, the average duration of each spell, and total number of days lost due to working accidents per employee each quarter. These estimates confirm the information suggested in the earlier graphs with a huge increase in work-related accident incidence (+69%) combined with very little change in absences (-2.8%) resulting in days lost due to such events jumping by over a half (56%). To understand the magnitude in benefit displacement this could correspond to, we must first point out that public sector employees were absent far less often for accidents at work than for being sick, at 0.086 and 1.26 days per quarter before the reform, respectively. Still, since we estimated that each public sector employee was taking on average 0.048 more working accident days after the reform, and the gains from the reduced sick leave we estimated stood at 0.127 days per worker (taking our more conservative estimate in column (3) from Panel B in Table 5), we find that about 38% (0.048/0.127) of absences are potentially displaced across benefits. Therefore, this means that the overall 10% policy effect we estimated on absences should probably be scaled down by almost two-fifths of its value after considering possible switching behavior to the working accidents benefit scheme. This negative spillover effect is a phenomenon never before observed in the sick leave literature and its large size suggests that it should always be considered when evaluating the effectiveness of any policy restricting access to benefits in any context.

7 – Concluding Remarks

Understanding the impact of sick leave entitlement on worker's absence behavior has been an important policy issue in the last two decades, gaining new urgency with the Covid-19 crisis and our need to incentivize people back to work while still protecting their health and that of others. While many European countries had been reducing their very generous schemes as they implemented budgetary restrictions in the years following the financial crisis, some US cities were in the process of introducing the first tentative rights to paid sick leave. The pandemic has completely changed this configuration, with many countries implementing emergency measures for people's wage to be paid while they stay at home if sick, or to just not become sick while at work. This situation will not last and these measures will have to be scaled down, but the question remains as to the right, or appropriate, level of sick leave benefits that could simultaneously provide insurance for health shocks while reducing the scope for moral hazard.

In this paper, we contribute to knowledge needed for this debate by obtaining clean estimates of the impact of a large reduction in sickness insurance benefits on absences from work on the extensive (number of spells) and intensive (duration of the spells) margins, and total effect (days lost). Exploiting the introduction of a policy that only affected the benefits of certain workers in Spain and making use of very rich administrative data, we report our four main evaluation findings: first, the reform did lead to a large reduction in the number of sickness absences spells filed but the mean duration of those spells increased by almost as much; second, taking these opposite effects together, the total policy effect amounted to a significant reduction in the number of days absent due to sick leave taken by each employee; third, the change in duration was driven by large increases in the proportion of financially less costly long spells, while the probability of taking costly short and medium length spells decreased; and fourth, incidence (negatively) and duration (positively) of spells for all disease types were strongly affected, but in terms of reduction in days lost, the standout categories were respiratory, infectious, and muscle related illnesses.

Next, we explored for potential spillover effects if the increased incentive not to be absent from work may have resulted in some complying workers doing so while still not properly recovered from an illness (i.e., presenteeism). For this, we first looked at proportion of sick leave spells that were due to employees relapsing for the same disease that recently caused them to be absent from work. We found that this increased significantly after the policy was introduced and that this was especially strong for shorter spells and for infectious diseases. This last finding is especially worrisome given the strong likelihood of further spreading such diseases to others in the workplace. Second, we investigated the possibility that workers

affected by the policy may have ended up being absent more often under another benefit scheme, that of working accidents. We are the first to be able to soberly test this possibility and, indeed, we found that absences related to a work-related accidents significantly increased after sick leave generosity was curtailed. As most accidents experienced by the treated public sector employees are due to 'back pain', a category that experienced large drops in both sick leave absences and relapses, we interpreted this as being a further indication that cross-benefit displacement is at play here. Taking this into account slashed our main estimated effect on sick leave on absences by almost two-fifths, showing how crucial it is to take such spillovers into account when evaluating any benefit reform policy in the future.

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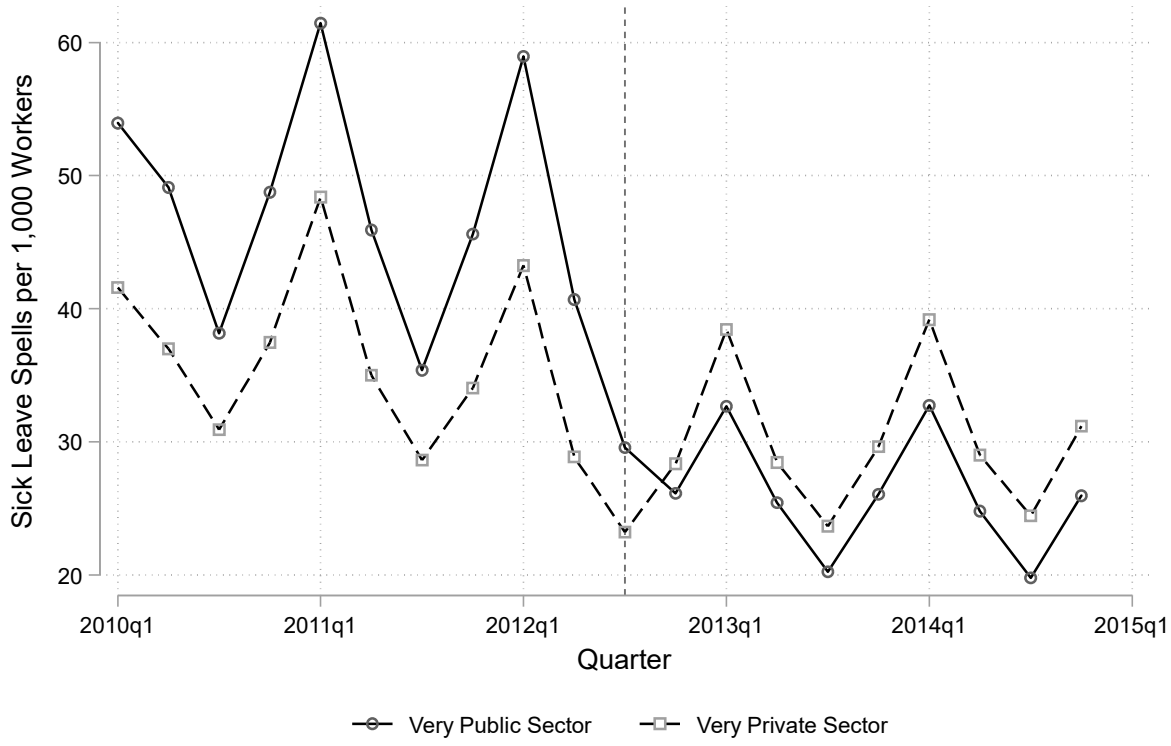
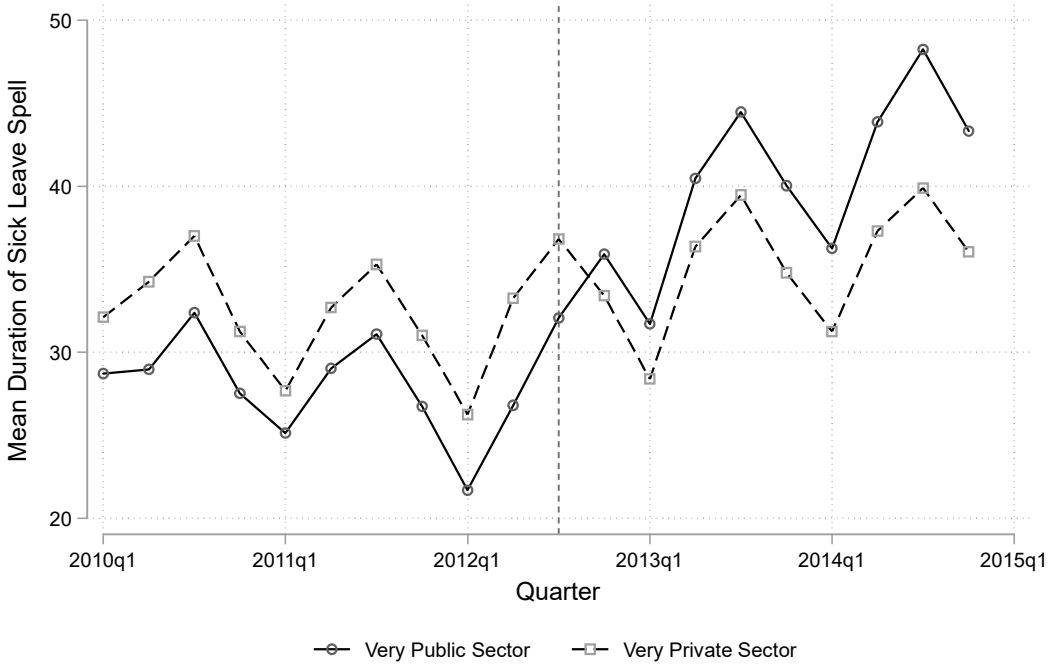
Figure 1. Sick Leave Incidence: Number of Spells per 1,000 Workers.



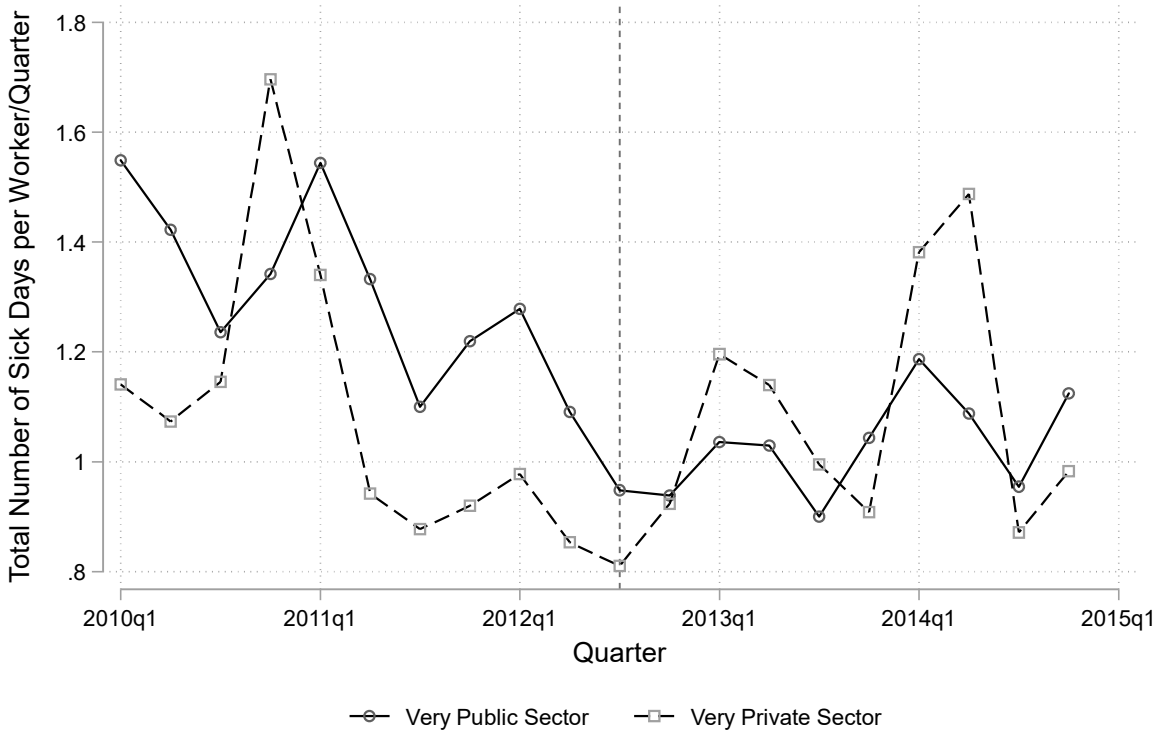
Source: Own elaboration with administrative Spanish Social Security data, which includes the universe of sickness absences in Spain from 2010 until 2014, and data from the Spanish Labour Force Survey on the number of employed workers in each quarter and sector for the same period. The vertical dashed line indicates the quarter of policy introduction. Very public sector includes workers in an activity group in which more than 95% of the workers are public employees (treated group). Very private sector includes workers in an activity in which less than 5% of the workers are public employees (control group). See Table A1 for more details.

Figure 2. Sick Leave Duration: Mean Length of Spells in Days.



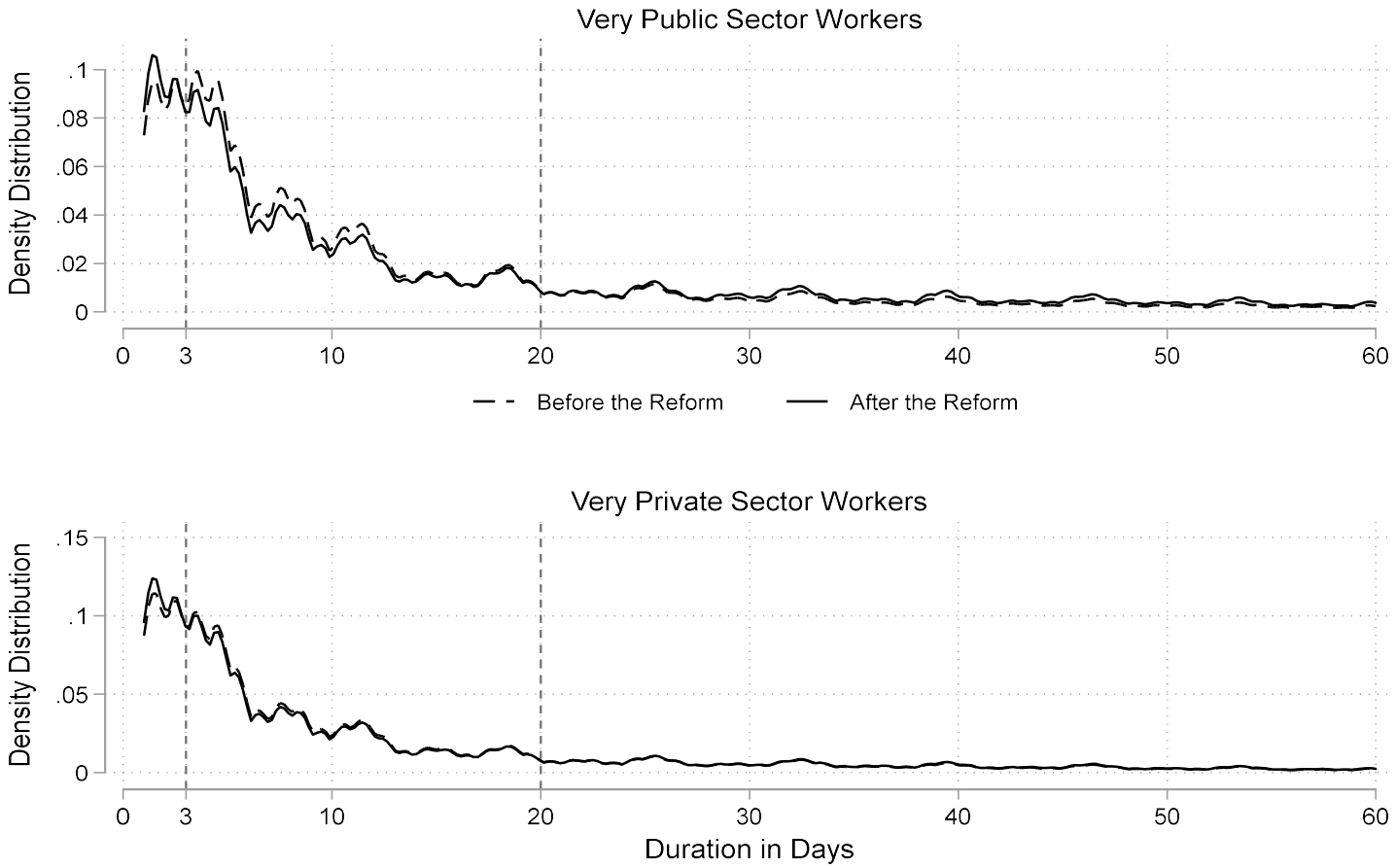
Source: Own elaboration with administrative Spanish Social Security data, which includes the universe of sickness absences in Spain from 2010 until 2014. The vertical dashed line indicates the quarter of policy introduction. Very public sector includes workers in an activity group in which more than 95% of the workers are public employees (treated group). Very private sector includes workers in an activity in which less than 5% of the workers are public employees (control group). See Table A1 for more details.

Figure 3. Days Lost to Sick Leave Absences per Worker each Quarter.



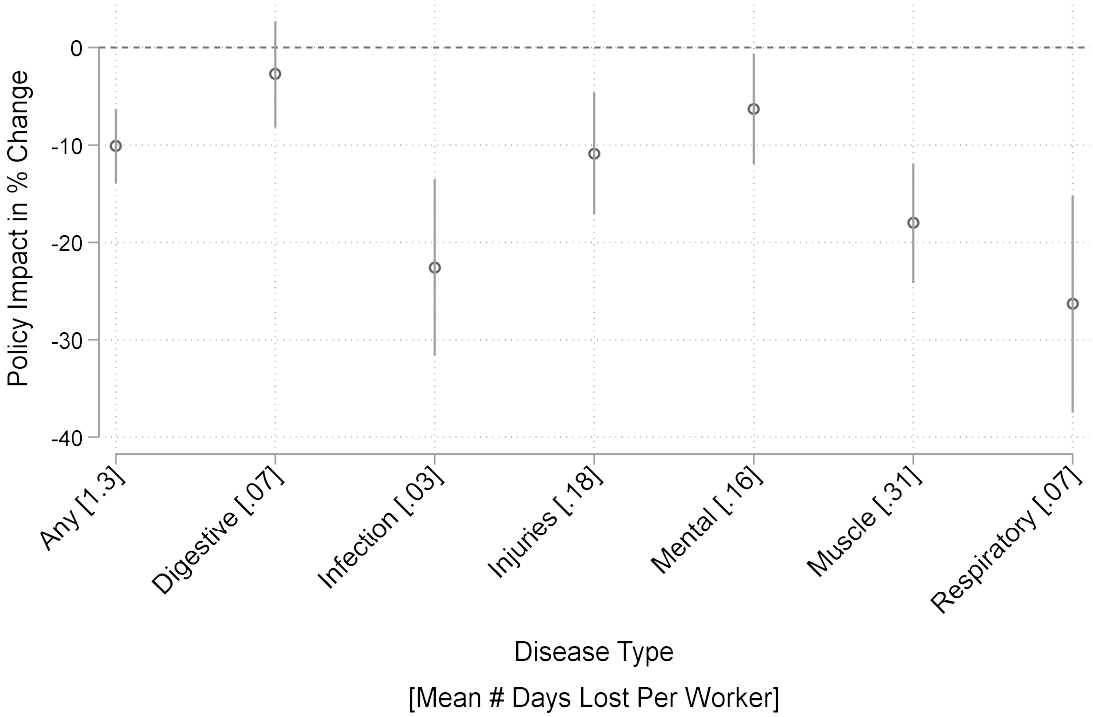
Source: Own elaboration with administrative Spanish Social Security data, which includes the universe of sickness absences in Spain from 2010 until 2014, and data from the Spanish Labour Force Survey on the number of employed workers in each quarter and sector for the same period. The vertical dashed line indicates the quarter of policy introduction. Very public sector includes workers in an activity group in which more than 95% of the workers are public employees (treated group). Very private sector includes workers in an activity in which less than 5% of the workers are public employees (control group). See Table A1 for more details.

Figure 4. Density Distribution of Duration of Sick Leave Spells Before and After the Reform



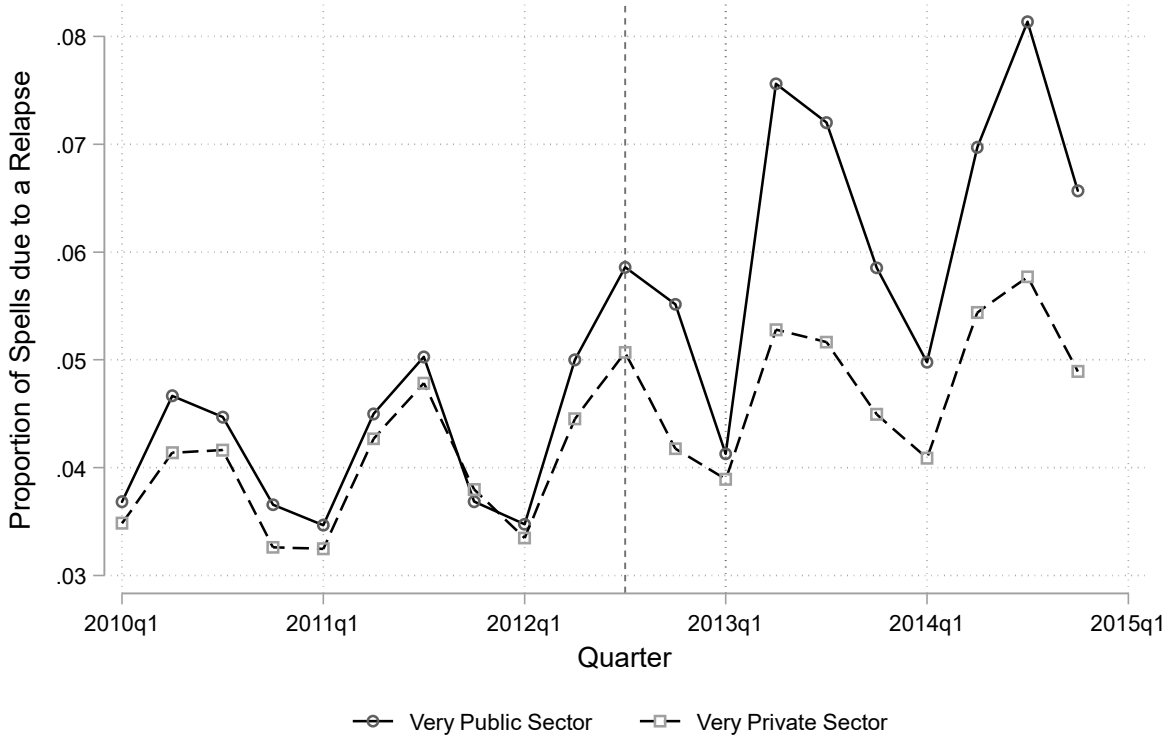
Source: Own elaboration with administrative Spanish Social Security data, which includes the universe of sickness absences in Spain from 2010 until 2014. The vertical dashed lines indicates the sick leave duration in days when the replacement rate for paid sick leave changed discontinuously for public sector workers (see Table 1). Very public sector includes workers in an activity group in which more than 95% of the workers are public employees (treated group). Very private sector includes workers in an activity in which less than 5% of the workers are public employees (control group). See Table A1 for more details.

Figure 5. Policy Impact on Number Days Lost to Sick Leave Absences per Worker each Quarter, by Disease Type.



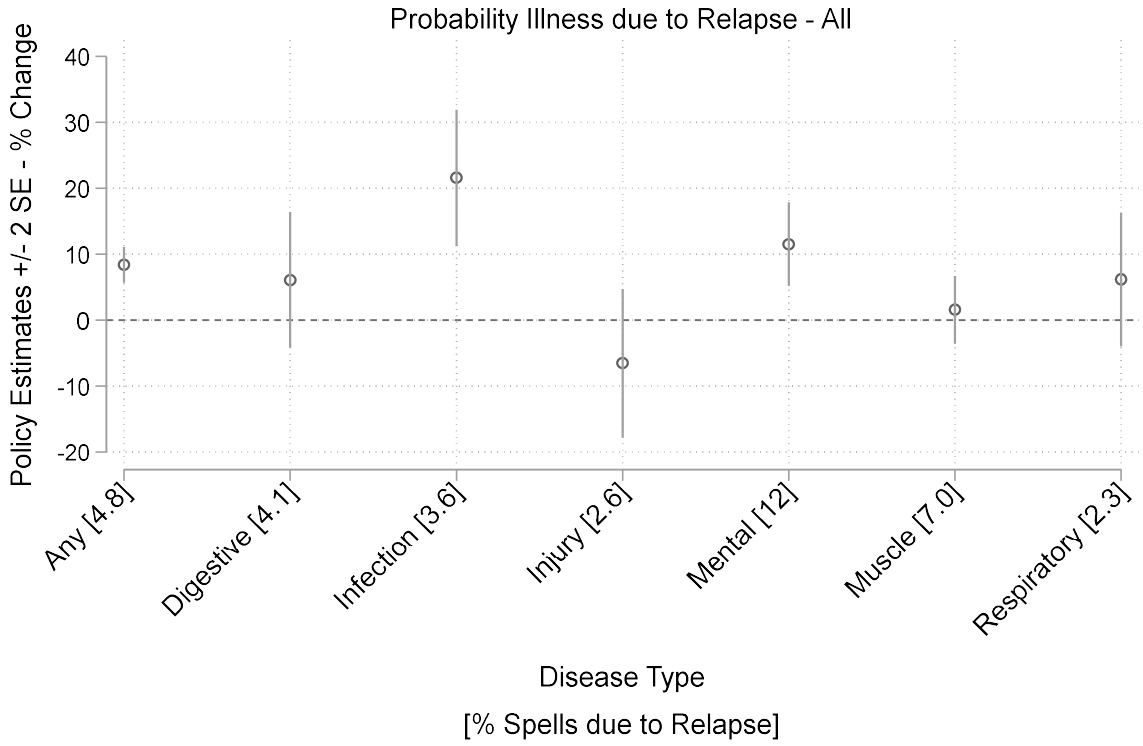
Source: Own elaboration with administrative Spanish Social Security data, which includes the universe of sickness absences in Spain from 2010 until 2014, and data from the Spanish Labour Force Survey on the number of employed workers in each quarter and sector for the same period. We report here the size of the policy impacts (i.e. coefficient estimates/mean pre-policy level) and the 95% confidence intervals of regressions following equation (1) where the dependent variable is the number of absent days per workers per quarter. We estimate the regression separately for each type of diseases.

Figure 6. Probability that Sick Leave Spell is due to a Relapse.



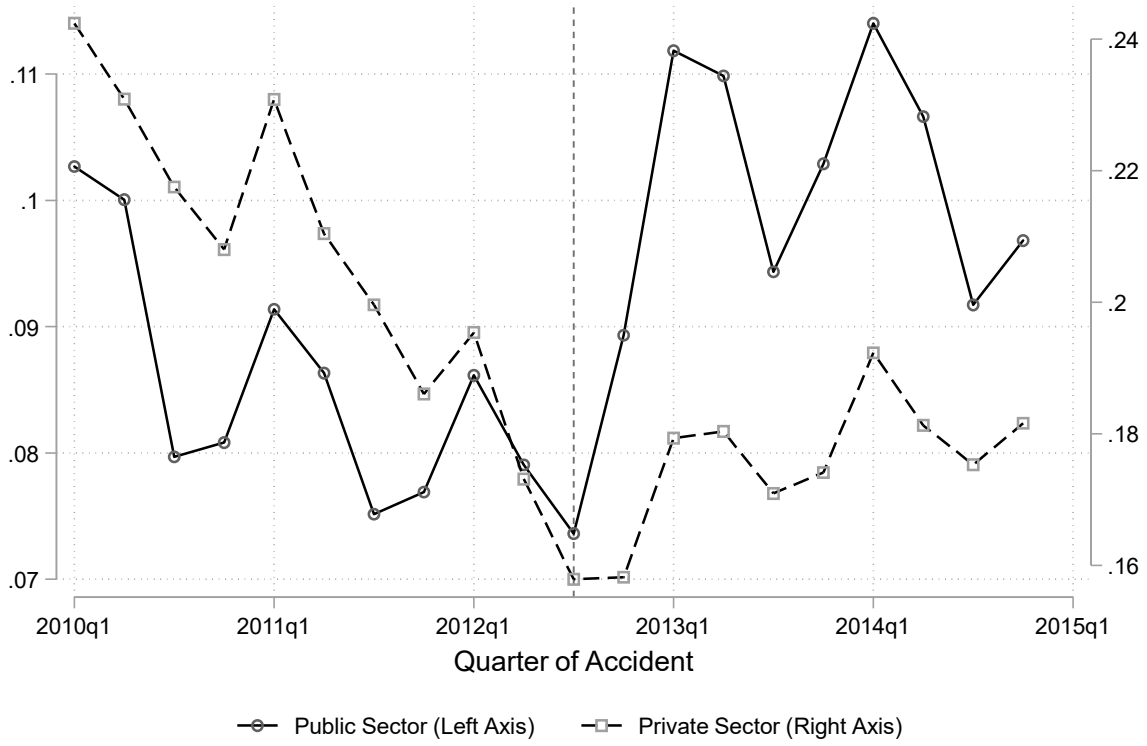
Source: Own elaboration with administrative Spanish Social Security data, which includes the universe of sickness absences in Spain from 2010 until 2014, and data from the Spanish Labour Force Survey on the number of employed workers in each quarter and sector for the same period. The vertical dashed line indicates the quarter of policy introduction. Very public sector includes workers in an activity group in which more than 95% of the workers are public employees (treated group). Very private sector includes workers in an activity in which less than 5% of the workers are public employees (control group). See Table A1 for more details.

Figure 7. Policy Impact on Proportion of Sick Leave Spells due to a Relapse, by Disease Type.



Source: Own elaboration with administrative Spanish Social Security data, which includes the universe of sickness absences in Spain from 2010 until 2014, and data from the Spanish Labour Force Survey on the number of employed workers in each quarter and sector for the same period. We report here the size of the policy impacts (i.e. coefficient estimates/mean pre-policy level) and the 95% confidence intervals of regressions following equation (1) where the dependent variable is the probability that the sickness absence is due to a relapse from a previous illness. We estimate the regression separately for each type of diseases.

Figure 8. Days Lost to Working Accident Absences per Worker each Quarter.



Source: Own elaboration with administrative Spanish Social Security data, which includes the universe of working accidents in Spain from 2010 until 2014, and data from the Spanish Labour Force Survey on the number of public and private sector workers employed each quarter. The vertical dashed line indicates the quarter of the sick leave policy introduction.

Table 1. Sick Leave Benefit Rights – Before/After 2012 Reform – Public/Private Sectors.

Duration of Sick Leave Spell	Public Sector		Private Sector
	Before the Reform	After the Reform	Throughout Period
0-3 days	100%	50%	0%
4-20 days	100%	75%	60%
21 days onwards	100%	100%	75%

Notes: Percentages indicate replacement rates relative to wage in last month before becoming sick leave spell started.

Table 2. Sick Leave Spells Descriptive Statistics by Very Public/Private Sector.

	Sample: Men Aged 25-60		
	All	Public	Private
Very Public Sector	0.116	1	0
Mean Duration (days)	29.9	32.2	29.5
Duration 1-3 days	0.270	0.229	0.275
Duration 4-20 days	0.447	0.462	0.444
Duration 21+ days	0.283	0.309	0.280
Mean Age (years)	40.2	42.7	39.9
Sample Size	5,103,371	593,904	4,509,467

Source: Own elaboration from data of the Spanish Social Security Administration, which includes the universe of sickness absences in Spain from 2010 until 2014. Very public and private sectors are defined using sector level data from the Spanish Labour Force Survey for the same period. See Table A1 for more information.

Table 3. Policy Impact on Sick Leave Frequency (i.e. Extensive Margin)

Panel A: Very Public/Private Definition	**Sick Day Spells per 1,000 Workers**		
	(1)	(2)	(3)
Very Public * After	**-14.52*** **	**-14.51*** **	**-14.37*** **
	(3.71)	**(2.40)**	**(1.38)**
Very Public Sector	11.32***	11.25***	-
	(3.11)	(1.71)	
After Policy Introduction	-7.04***	-10.73	-11.14***
	(2.28)	(6.53)	(1.37)
Year and Quarter Fixed Effects	No	Yes	Yes
Economic Sector Fixed Effects	No	No	Yes
Mean of Outcome	47.8	47.8	47.8
Size of Estimated Effect	*-.304*	*-.304*	*-.301*
Observations	300	300	300

Panel B: Proportion Public Definition	**Sick Day Spells per 1,000 Workers**		
	(1)	(2)	(3)
Proportion Public * After	**-13.31*** **	**-13.34*** **	**-13.42*** **
	(4.62)	**(3.94)**	**(1.52)**
Proportion Public Sector Workers	10.48***	10.44***	-
	(3.84)	(3.18)	
After Policy Introduction	-7.04***	-11.47**	-11.84***
	(1.99)	(5.49)	(1.33)
Year and Quarter Fixed Effects	No	Yes	Yes
Economic Sector Fixed Effects	No	No	Yes
Mean of Outcome	46.5	46.5	46.5
Size of Estimated Effect	*-.287*	*-.287*	*-.289*
Observations	420	420	420

Notes: Panel A presents standard differences-in-differences estimates where the treated sectors are those with a large majority of employees are public sector workers and the control group as sectors where a large majority of employees are private sector workers (i.e. in both cases they represent > 95% of employees). Panel B presents continuous differences-in-differences estimates where the treatment in each sector is assigned relative to the proportion of public sector workers they employ before policy introduction. Table A1 of the appendix reports these proportions for all 21 economic sectors. Data source is register data from the Spanish Social Security Administration, which includes the entire population of sickness absences in Spain from 2010 until 2014, and data from the Spanish Labour Force Survey on the number of employed workers in each quarter and sector (ages 25-60). Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 4. Policy Impact on Sick Leave Duration (i.e. Intensive Margin)

Panel A: Very Public/Private Definition	**Mean Duration of Sick Leave Spell in Days**		
	(1)	(2)	(3)
Very Public * After	**8.96*** **	**8.92*** **	**8.79*** **
	(2.32)	**(1.68)**	**(1.15)**
Very Public Sector	-2.89**	-2.85***	-
	(1.24)	(0.84)	
After Policy Introduction	2.93**	3.87	4.24***
	(1.33)	(3.77)	(0.93)
Year and Quarter Fixed Effects	No	Yes	Yes
Economic Sector Fixed Effects	No	No	Yes
Mean of Outcome	27.8	27.8	27.8
Size of Estimated Effect	.322	.321	.316
Observations	300	300	300
Panel B: Proportion Public Definition	**Mean Duration of Sick Leave Spell in Days**		
	(1)	(2)	(3)
Proportion Public * After	**7.98*** **	**7.94*** **	**7.89*** **
	(2.33)	**(1.84)**	**(1.09)**
Proportion Public Sector Workers	-4.19***	-4.14***	-
	(1.31)	(1.00)	
After Policy Introduction	2.66**	3.59	3.80***
	(1.21)	(3.09)	(0.78)
Year and Quarter Fixed Effects	No	Yes	Yes
Economic Sector Fixed Effects	No	No	Yes
Mean of Outcome	28.2	28.2	28.2
Size of Estimated Effect	.283	.282	.280
Observations	420	420	420

Notes: Panel A presents standard differences-in-differences estimates where the treated sectors are those with a large majority of employees are public sector workers and the control group as sectors where a large majority of employees are private sector workers (i.e. in both cases they represent > 95% of employees). Panel B presents continuous differences-in-differences estimates where the treatment in each sector is assigned relative to the proportion of public sector workers they employ before policy introduction. Table A1 of the appendix reports these proportions for all 21 economic sectors. Data source is register data from the Spanish Social Security Administration, which includes the entire population of sickness absences in Spain from 2010 until 2014, and data from the Spanish Labour Force Survey on the number of employed workers in each quarter and sector (ages 25-60). Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 5. Policy Impact on Days Lost due to Sick Leave

Panel A: Very Public/Private Definition	**Total # Days Lost per Worker/Quarter**		
	(1)	(2)	(3)
Very Public * After	**-.157****	**-.158*****	**-.160*****
	(.071)	**(.045)**	**(.020)**
Very Public Sector	.275***	.275***	
	(.059)	(.034)	
After Policy Introduction	-.132***	-.209	-.209***
	(.044)	(.139)	(.043)
Year and Quarter Fixed Effects	No	Yes	Yes
Economic Sector Fixed Effects	No	No	Yes
Mean of Outcome	1.31	1.31	1.31
Size of Estimated Effect	-.120	-.121	-.122
Observations	300	300	300
Panel B: Proportion Public Definition	**Total # Days Lost per Worker/Quarter**		
	(1)	(2)	(3)
Proportion Public * After	**-.118**	**-.121**	**-.127*****
	(0.109)	**(0.100)**	**(0.024)**
Proportion Public Sector Workers	.183**	.184**	
	(.086)	(.077)	
After Policy Introduction	-.143***	-.242*	-.247***
	(.042)	(.134)	(.047)
Year and Quarter Fixed Effects	No	Yes	Yes
Economic Sector Fixed Effects	No	No	Yes
Mean of Outcome	1.26	1.26	1.26
Size of Estimated Effect	*-.093*	*-.096*	-.101
Observations	420	420	420

Notes: Panel A presents standard differences-in-differences estimates where the treated sectors are those with a large majority of employees are public sector workers and the control group as sectors where a large majority of employees are private sector workers (i.e. in both cases they represent > 95% of employees). Panel B presents continuous differences-in-differences estimates where the treatment in each sector is assigned relative to the proportion of public sector workers they employ before policy introduction. Table A1 of the appendix reports these proportions for all 21 economic sectors. Data source is register data from the Spanish Social Security Administration, which includes the entire population of sickness absences in Spain from 2010 until 2014, and data from the Spanish Labour Force Survey on the number of employed workers in each quarter and sector (ages 25-60). Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table 6. Changes in the Probability of Sick Leave due to a Relapse, by Spell Duration.

Spells due to Relapse by Duration in Days	**All Spells** (1)	**1-3 days** (2)	**4-20 days** (3)	**21+ days** (4)
Proportion Public *After	**0.004*** (0.001)**	**0.015*** (0.001)**	**0.003*** (0.001)**	**-0.007*** (0.001)**
Year and Quarter Fixed Effects	Yes	Yes	Yes	Yes
Economic Sector Fixed Effects	Yes	Yes	Yes	Yes
Mean of Outcome	0.0482	0.0425	0.0406	0.0669
Policy Effect at Mean (%)	8.30	35.3	7.39	-10.4
Observations	6,760,115	1,871,520	2,972,169	1,916,424

Source: Table presents continuous differences-in-differences estimates where the treatment in each sector is assigned relative to the proportion of public sector workers they employ before policy introduction. Table A1 of the appendix reports these proportions for all 21 economic sectors. Own elaboration with register data from the Spanish Social Security Administration, which includes the entire population of sickness absences in Spain from 2010 until 2014. Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

Table 7. Changes in the Incidence and Duration of Working Accident Absences.

	Incidence	Duration	Days Lost
Public * After	**1.91*** (.251)**	**-.850** (.295)**	**.048*** (.006)**
Year-Quarter Fixed Effects	Yes	Yes	Yes
Public Sector Fixed Effects	Yes	Yes	Yes
Mean of Outcome	2.82	30.4	.086
Policy Impact at Mean (%)	67.9	-2.8	56.0
Observations	40	40	40

Source: Table presents standard differences-in-differences estimates where the treatment is assigned individually using information of employee being a public sector or not, information that is available in the working accident data. Own elaboration with register data from the Spanish Social Security Administration, which includes the entire population of working accidents absences in Spain from 2010 until 2014. Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

APPENDIX

Supplementary Figures and Table

Figure A1. Sick Leave: Number of Spells and Number of Workers

Figure A1.1. Total number of sick leave spells per quarter.

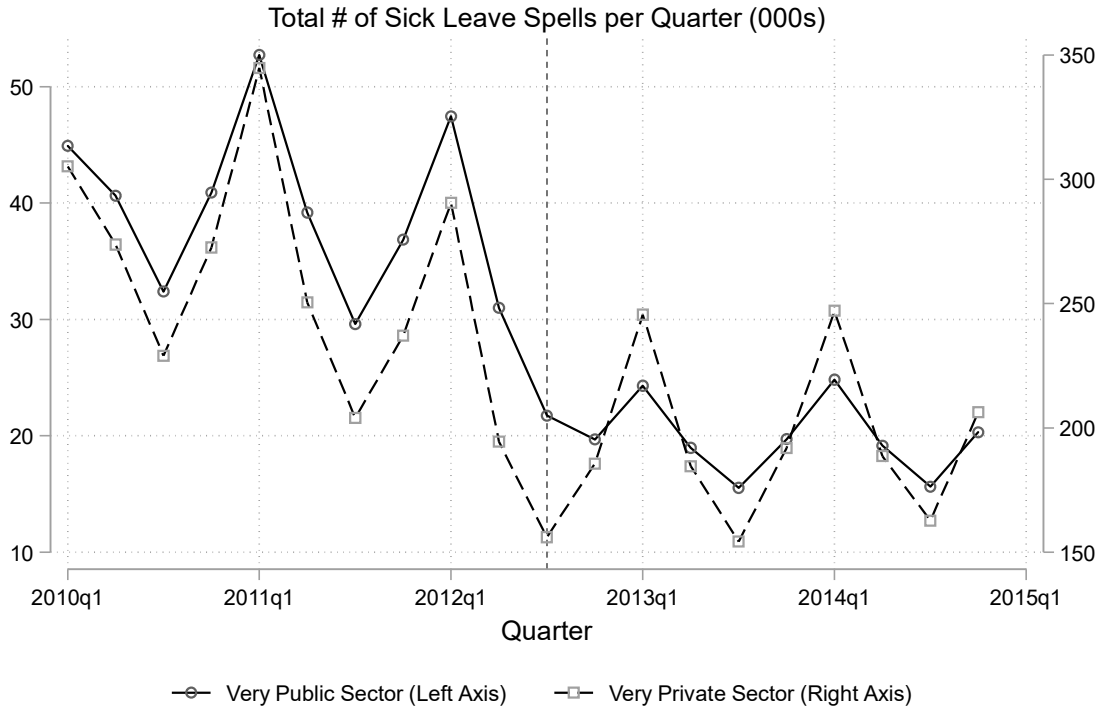
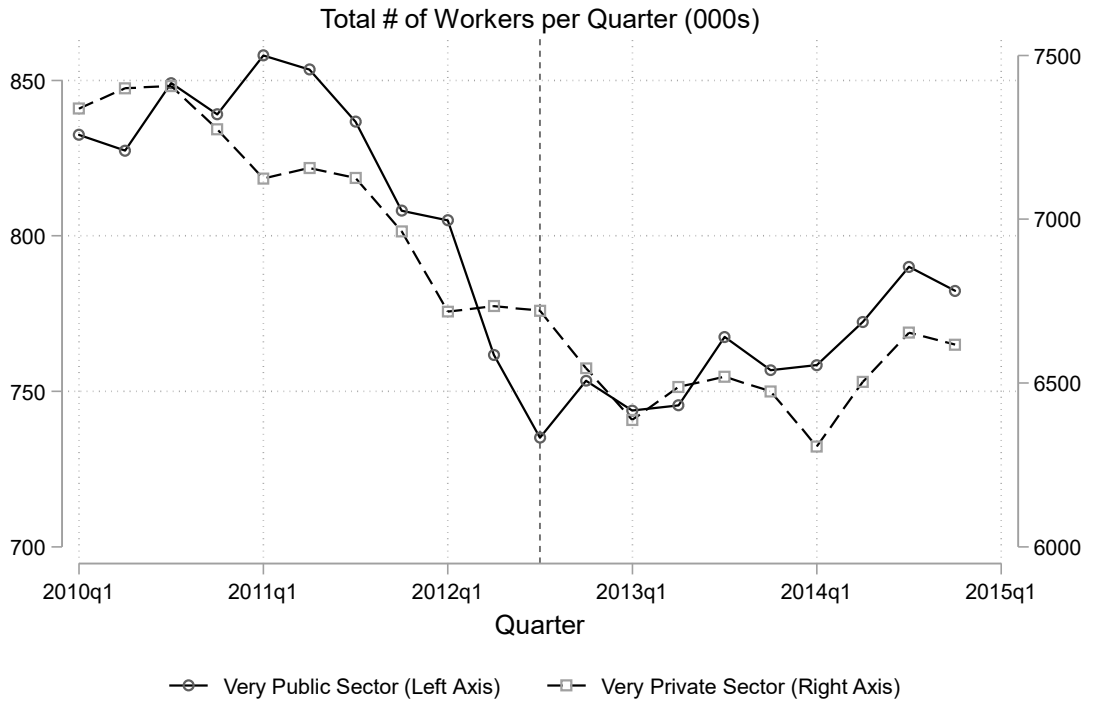
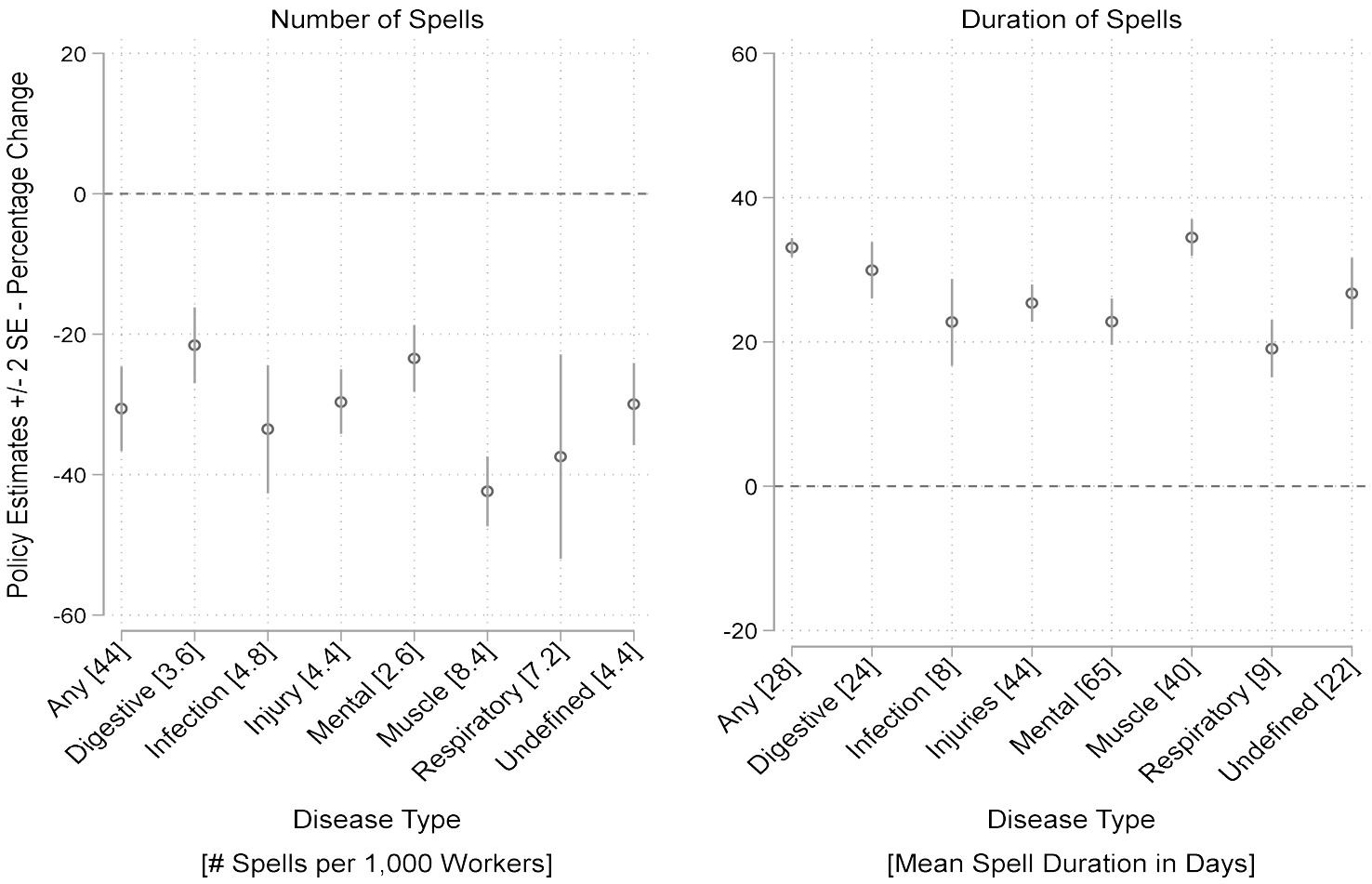


Figure A1.2. Total number of workers per quarter.



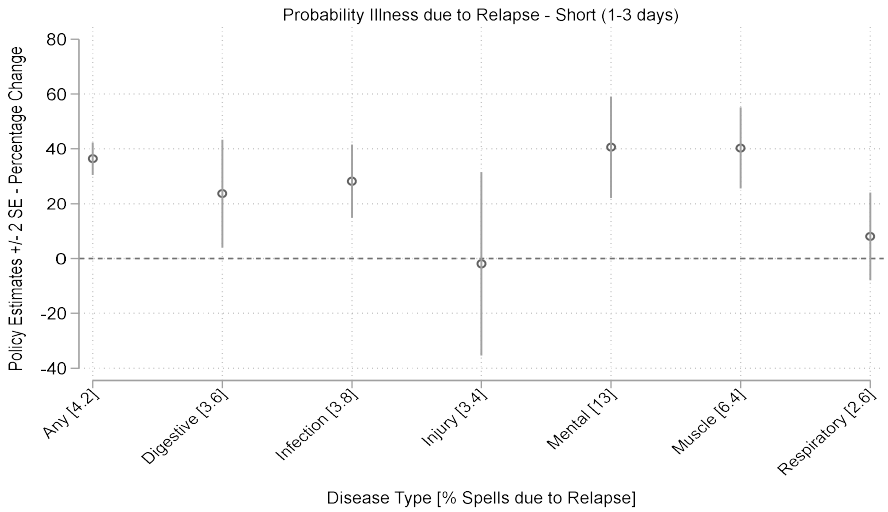
Source: Own elaboration with data from the Spanish Labour Force Survey on the number of employed workers in each quarter and sector for the 2010-2015 period. The vertical dashed line indicates the quarter of policy introduction. Very public sector includes workers in an activity group in which more than 95% of the workers are public employees (treated group). Very private sector includes workers in an activity in which less than 5% of the workers are public employees (control group). See Table A1 for more details.

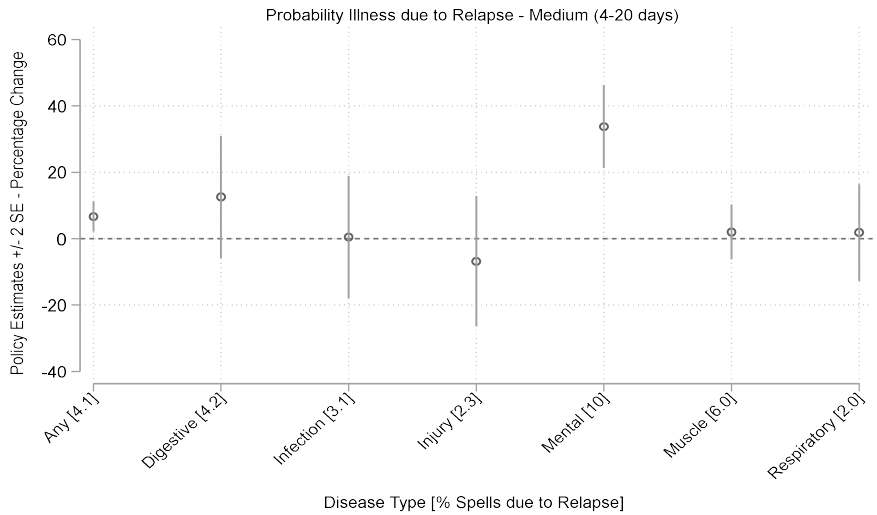
Figure A2. Policy Impact on Sick Leave Incidence and Duration, by Type of Diseases.

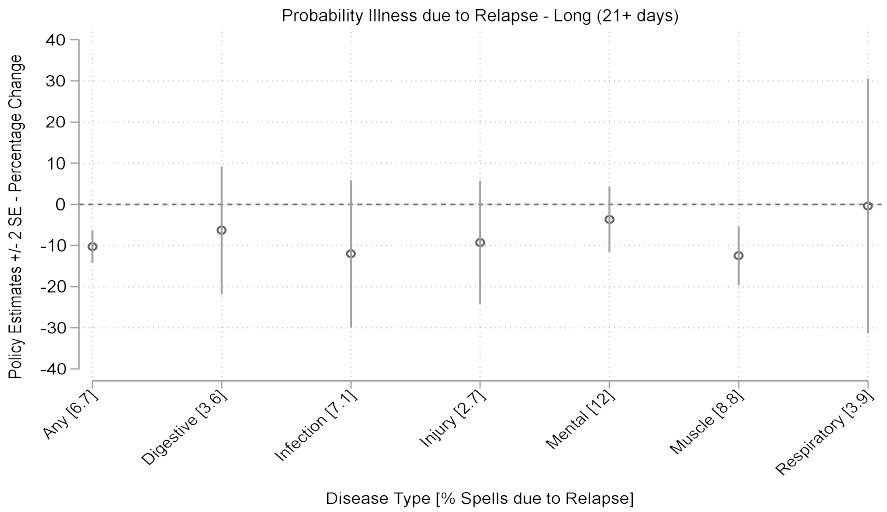


Source: Own elaboration with administrative Spanish Social Security data, which includes the universe of sickness absences in Spain from 2010 until 2014, and data from the Spanish Labour Force Survey on the number of employed workers in each quarter and sector for the same period. We report here the size of the policy impacts (i.e. coefficient estimates/mean pre-policy level) and the 95% confidence intervals of regressions following equation (1) where the dependent variable is either the number of sick leave spells per 1,000 workers (left graph) or the length in days of each spell (right graph). We estimate these regressions separately for each type of diseases.

Figure A3. % of Sick Leave Spell due to a Relapse, by Disease Type and Spell Duration.







Source: Own elaboration with administrative Spanish Social Security data, which includes the universe of sickness absences in Spain from 2010 until 2014, and data from the Spanish Labour Force Survey on the number of employed workers in each quarter and sector for the same period. We report here the size of the policy impacts (i.e. coefficient estimates/mean pre-policy level) and the 95% confidence intervals of regressions following equation (1) where the dependent variable is the probability that the sickness absence is due to a relapse from a previous illness. We estimate the regression separately for each type of diseases and for three different spell durations: 1-3 days (top left graph), 4-20 days (top right graph), and 21+ days (bottom left graph)..

Figure A4. Incidence and duration of working accidents.

Figure A4.1. Incidence of working accidents per 1000 workers

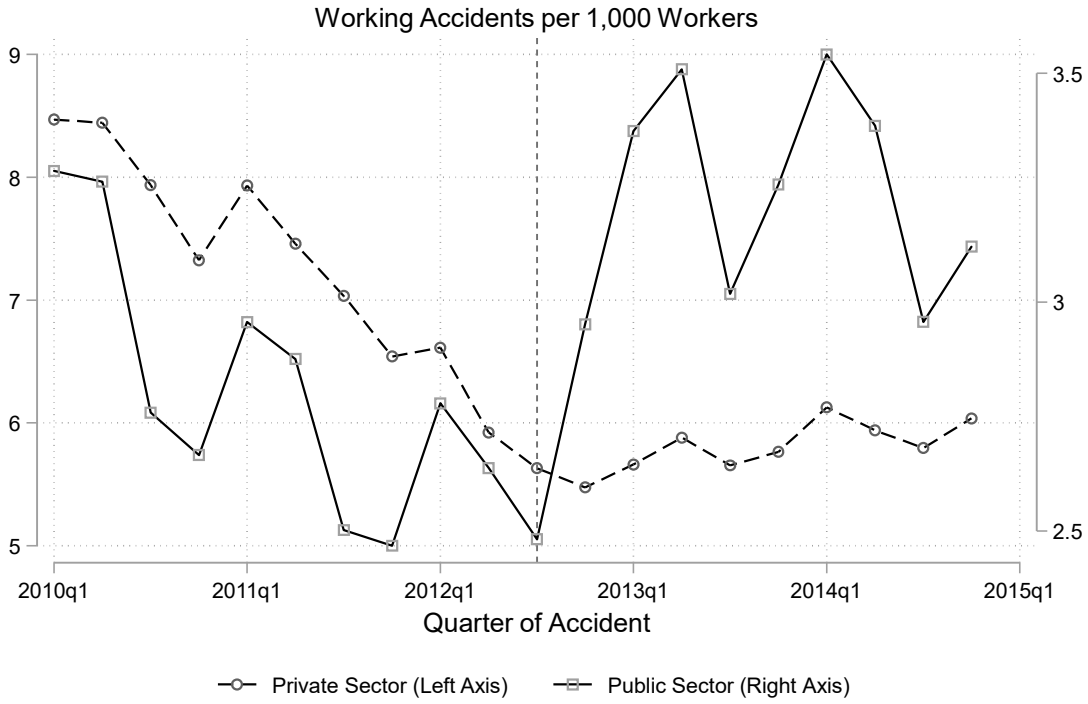
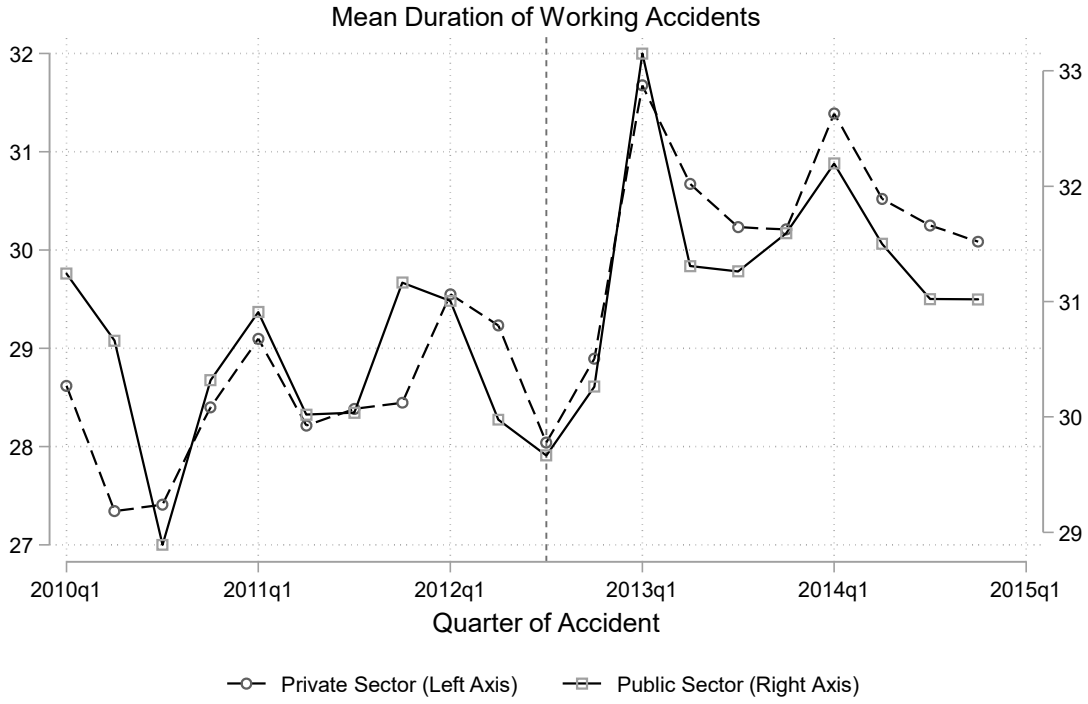


Figure A4.2. Mean duration of working accidents.



Source: Own elaboration with administrative Spanish Social Security data, which includes the universe of working accidents in Spain from 2010 until 2014, and data from the Spanish Labour Force Survey on the number of public and private sector workers each quarter. The vertical dashed line indicates the quarter of the sick leave policy introduction.

Table A1. Sector Level Descriptive Statistics of Number of Sick Leave spells, Percentage of Total Workforce and Percentage in Public Sector.

Economic Activity Sector Code	Description	# Sick Leave	% Total Workforce	% Public Sector
A	Agriculture, forestry and fishing	125,303	1.83	**2.12**
B	Extractive Industries	23,783	0.35	**3.54**
C	Manufacturing	1,519,611	22.22	**0.77**
D	Electricity, gas, steam and air conditioning supply	20,443	0.30	**0.47**
E	Water supply, sanitation, waste management & decontamination	166,369	2.43	**13.48**
F	Construction	621,778	9.09	**0.76**
G	Wholesale and retail; Motor vehicles and motorcycles repair	909,929	13.31	**0.11**
H	Transport and storage	540,237	7.90	**12.97**
I	Hostelry	351,417	5.14	**0.67**
J	Information and communications	204,901	3.00	**4.16**
K	Financial and insurance activities	120,855	1.77	**0.92**
L	Real state agencies	15,044	0.22	**0.71**
M	Professional, scientific and technical activities	333,609	4.88	**8.03**
N	Administrative activities and ancillary services	555,764	8.13	**4.42**
O	Public Administration and Defense	601,343	8.79	**98.07**
P	Education	134,562	1.97	**70.45**
Q	Health and social services	405,630	5.93	**59.60**
R	Artistic, recreational and entertainment activities	78,023	1.14	**13.00**
S	Other Services	87,363	1.28	**2.61**
T	Domestic staff hired for household activities	19,569	0.29	**0.00**
U	Extraterritorial organizations	2,241	0.03	**0.93**
Total		6,837,774	100.00	16.31

Source: Own elaboration with register data from the Spanish Social Security Administration, which includes the entire population of sickness absences in Spain from 2010 until 2014, and data from the Spanish Labour Force Survey on the percentage of workers employed in the public sector in each quarter and sector (ages 25-60).

Table A2. Changes in Sick Leave Spell Composition – Duration.

Panel A: Very Public/Private Definition	**Duration of Spell - Compositional Change**			
	Mean	**1-3 Days**	**4-20 Days**	**21+ Days**
Very Public * After	**9.18*** (0.21)**	**-.005*** (.002)**	**-.063*** (.002)**	**.068*** (.001)**
After Policy Introduction	1.68*** (0.19)	.049*** (.001)	-.076*** (.002)	.027*** (.002)
Year and Quarter Fixed Effects	Yes	Yes	Yes	Yes
Economic Sector Fixed Effects	Yes	Yes	Yes	Yes
Mean of Outcome	27.7	.238	.490	.272
Size of Estimated Effect	.331	-..021	-.129	.250
Observations	5,120,458	5,120,458	5,120,458	5,120,458
Panel B: Proportion Public Definition	**Duration of Spell - Compositional Change**			
	Mean	**1-3 Days**	**4-20 Days**	**21+ Days**
Proportion Public * After	**9.12*** (0.18)**	**-.006*** (.001)**	**-.061*** (.002)**	**.067*** (.001)**
After Policy Introduction	1.54*** (0.17)	.047*** (.001)	-.072*** (.001)	.025*** (.001)
Year and Quarter Fixed Effects	Yes	Yes	Yes	Yes
Economic Sector Fixed Effects	Yes	Yes	Yes	Yes
Mean of Outcome	27.6	.260	.469	.271
Size of Estimated Effect	.330	-.023	-.130	.247
Observations	6,760,117	6,760,117	6,760,117	6,760,117

Notes: Panel A presents standard differences-in-differences estimates where the treated sectors are those with a large majority of employees are public sector workers and the control group as sectors where a large majority of employees are private sector workers (i.e. in both cases they represent > 95% of employees). Panel B presents continuous differences-in-differences estimates where the treatment in each sector is assigned relative to the proportion of public sector workers they employ before policy introduction. Table A1 of the appendix reports these proportions for all 21 economic sectors. Data source is register data from the Spanish Social Security Administration, which includes the entire population of sickness absences in Spain from 2010 until 2014, and data from the Spanish Labour Force Survey on the number of employed workers in each quarter and sector (ages 25-60). Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table A3. Disease Categorization and Descriptive Statistics: Number of Sick leave Spells, Percentage of Spells, and Mean Duration.

Main Disease Category	Main Sub-Categories (%)	Number of Spells	% of Spells	Mean Duration
Muscles and joints	- Back pain (43%) - Joint paint (18%)	1,284,471	20	42
Respiratory system	- Influenza (22%) - Pharyngitis (15%)	1,101,492	17	8
Infectious diseases	- Gastrointestinal infections (53%) - Throat infections (17%)	759,605	12	6
Injuries	- Sprained ankle (46%) - Main symptom: fever (11%)	725,022	12	44
Digestive system	- Non-infectious gastro (24%) - Hernias (13%)	577,405	9.1	24
Mental disorders	- Anxiety (57%) - Depression (17%)	347,810	5.6	66
Senses and nervous system	- Vertigo (12%) - Conjunctivitis (12%)	285,364	4.5	29
Circulatory system	- Hemorrhoids (18%) - Varicose veins (12%)	183,813	2.9	66
Skin diseases	- Cellulite and abscess (23%) - Pilonidal cyst (18%)	123,553	2.0	26
Genitourinary system	- Urinary tract infection (15%) - Orchitis and epididymitis (12%)	118,589	1.9	27
Neoplasms	- Benign tumors (41%) - Malignant tumors (14%)	88,199	1.4	79
Endocrine diseases	- Gout (51%) - Diabetes (18%)	50,378	0.8	31
Congenital anomalies	- Musculoskeletal (17%) - Eyes (9%)	10,309	0.2	56
Blood diseases	- Anemias – iron (29%) - Anemias – iron (24%)	5,653	0.1	73
Disease not well defined	- Symptom: renal colic (11%) - Symptom: fever (11%)	666,394	10	21
All types of disease	- Back pain (9%) - Gastrointestinal infections (6%) - Flu (4%)	6,331,743	100	30

Source: Author's own calculation from administrative data using classifications from Ministry of Health, Consumption and Wellbeing (Ministerio de Sanidad Consumo y Bienestar Social) with details available at: https://eciemaps.mscbs.gob.es/ecieMaps/browser/index_9_mc.html