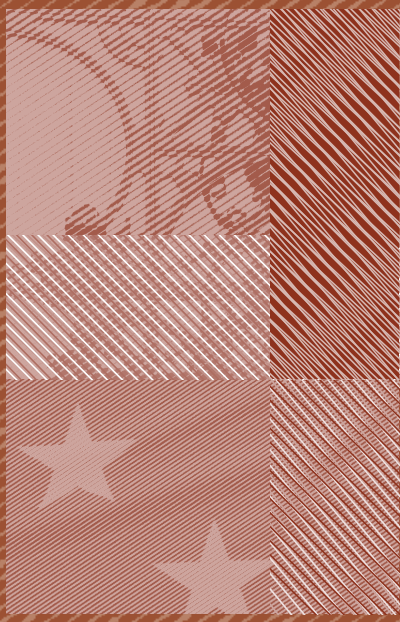
MINIMUM WAGES: DO THEY REALLY HURT YOUNG PEOPLE?

2012

Sofía Galán and Sergio Puente



Documentos de Trabajo
N.º 1237

BANCO DE ESPAÑA
Eurosistema

MINIMUM WAGES: DO THEY REALLY HURT YOUNG PEOPLE?

Sofía Galán [*] and Sergio Puente [**]

BANCO DE ESPAÑA

(*) sofia.galan@bde.es.
(**) sergio.puente@bde.es.

Documentos de Trabajo. N.º 1237

2012

ISSN: 1579-8666 (on line)

Abstract

We estimate the effects of a significant increase in the minimum wage in Spain between 2004 and 2010 on the individual probability of losing employment, using a large panel of social security records. Our main finding is that older people experienced the largest increase in the probability of losing their job, when compared with other age groups, including young people. The intuition is simple: among the affected (low-productivity) workers, young people are expected to increase their productivity more than older ones, who are in the flat part of their life-cycle productivity curve. Consequently, an employer facing a uniform increase in the minimum wage may find it profitable to retain young employees and to fire older ones.

Keywords: Minimum wage, labour demand, firing.

JEL classification: J23, J38, J63.

Resumen

Este artículo estima los efectos de la intensa subida del salario mínimo que se produjo en España entre los años 2004 y 2010 sobre la probabilidad individual de perder el empleo, utilizando datos de registros de la Seguridad Social. El principal resultado es que el mayor incremento en la probabilidad de perder el empleo se produjo entre los trabajadores de mayor edad, incluso cuando se los compara con los más jóvenes. La intuición de este resultado es sencilla: entre los trabajadores (de baja productividad) afectados, es de esperar que los más jóvenes experimenten incrementos de productividad superiores a los de los más mayores, que están ya en la parte plana de su ciclo vital de productividad. En consecuencia, un empleador que se enfrente a un incremento uniforme del salario mínimo puede encontrar ventajoso retener a los trabajadores jóvenes y despedir a los mayores.

Palabras claves: salario mínimo, demanda de trabajo, despidos.

Códigos JEL: J23, J38, J63.

1 Introduction

The impact of a rise in the minimum wage on employment has been extensively studied in the literature. Basic economic theory states that in a perfectly competitive economy an increase in the minimum wage expels less productive workers from the labour market, and the magnitude of this employment reduction depends on the wage rise required to reach the new minimum wage. However, expectations about future productivity could also play an important role (especially for young workers). Moreover, if the assumption of a perfectly competitive economy is not satisfied, employment destruction among less productive workers could be less intense.

There are several studies of the effects of minimum wages on employment, particularly for the United States and the United Kingdom. There is no consensus as to whether or not the effect on employment is negative. Stewart (2004) analyses the impact of the introduction of a minimum wage in the United Kingdom in April 1999 on the probability of continuing in employment. He uses a difference-in-differences estimator with three different individual micro datasets and he does not find any adverse effect on employment for any of them. However, this could be due to the short period of study because the minimum wage was introduced on 1 April 1999 in UK, and the time span analysed is March 1997 to March 2000 in the case of the Labour Force Survey, autumn 1994 to autumn 1999 in that of the British Household Panel Survey Data (BHPS), and 1994 to 1999 in the case of the New Earnings Survey Panel Data (NES), which is based on administrative records, like the one we use. In this latter case data refer to April of each year. This leaves only one month under the new minimum wage, which could be the reason for the absence of negative effects on employment found in Stewart (2004).

Other papers that do not find negative employment effects include Card and Krueger (in 1994 and 1995 a positive effect, and in 2000 a zero effect for the fast-food Industry in the United States), Machin and Manning (in 1997 an overall positive employment effect, but a negative effect for younger workers, for the Spanish case) and Portugal and Cardoso (2006). On the other hand, there are also papers that find the opposite effect: Burkhauser et al. (2000); Neumark and Wascher (2000); Sabia (2009); and Mulligan (2011). Specifically for the Spanish case, several studies have tried to analyse the impact of minimum wages increases on the labour market, mainly for younger workers. Dolado et al. (1996) find negative effects for workers between 16 and 18 years old, but positive ones for workers over the age of 18. Dolado and Felgueroso (1997), Dolado, Felgueroso and Jimeno (1999) and Blazquez, Llorente and Moral (2009) find no effect at all, and Cebrian et al. (2010) find a negative effect on employment. In spite of all this literature the impact of minimum wages is still a controversial issue.

Most of the previous studies for the case of Spain are based on the idea that minimum wages affect mainly young workers. From an aggregate point of view this is certainly true, because this group has low levels of experience and productivity, so that they earn lower wages, and their weight in the set of people affected by the minimum wage is consequently high. But when the effect on the individual probability of losing one's job is analysed, this is not necessarily true. Indeed, the effect could be more intense for older workers, because the productivity of young people is expected to increase faster.

The Spanish case is particularly interesting to analyse. The government effected a significant increase in the single national minimum wage in mid-2004, of 6.6%. The motivation was the loss of purchasing power suffered by workers on account of the decrease in the real minimum wage between 1999 and 2004. The new minimum did not become obligatory until January 2005, when an additional rise made a total increase in just one year of 11.4%. It was the largest increase since 1990. Subsequently, the real minimum wage continued to rise until 2010, albeit at a slower pace.

Against this background, we have the possibility of studying the introduction of this increase in the minimum wage using a rich micro panel dataset for workers. We will contribute to the international debate about the effects of minimum wages in the labour market by estimating the impact in Spain. The change in the minimum wage in 2004-2005 affected all workers irrespective of their age, so we do not have an age group that was affected and another age group that was not. However, we can use the "differential impact" approach, because we expect a higher impact for low productivity workers, or workers with a low potential productivity, than for other workers. Our identification strategy will be to use some sort of difference-in-differences estimator, comparing the affected group (people with salary in year t less than the real minimum wage in year t+1) with workers with slightly higher productivity, and with workers with the same low productivity, but in years when the minimum wage did not increase.

Until now, most papers exploring this issue for the Spanish case use aggregate data (Labour Force Survey, Employment Situation Survey, Wage Structure Survey or similar), and consequently, they find effects mainly for young workers. In contrast, in this paper we use individual data from social security records, which provide information on the entire labour history of individual workers. With this database we can estimate the effect of the increase of the minimum wage on the individual probability of remaining in employment for affected workers, defined as those whose wages would have to be raised to reach the new minimum.

We find that the estimated impact on the probability of losing employment is positive and significantly different from zero for young and older workers, although the magnitude of this effect in the case of older workers is double that in the case of young workers. The negative impact on the probability of remaining in employment might be particularly harmful in the case of older workers because they may be definitively expelled from the labour market. In contrast, young workers have greater chances of finding another job sooner or later, because they are at the beginning of their careers, on the upward-sloping part of their productivity curve (which is not the case for older workers).

The next section sets out the historical developments in minimum wages in Spain. After that, we describe our database (Social Security Administrative Labour Records), discussing its advantages and disadvantages. Section 4 presents the methodology used in this paper and the three models we use to estimate the different possible transitions that may occur as a consequence of increases in the minimum wage. The results for the employment probabilities are then presented in Section 5 and, finally, the conclusions are set out in Section 6.

2 Historical developments in minimum wages in Spain

In Spain, a mandatory minimum wage was established for the first time in 1964. A national minimum wage has existed since 1980 and the government decides whether to change its level each year. Between 1980 and 1990, Spain had three different minimum wages: one for workers less than 17 years old; another for 17 year olds, and the other for workers over the age of 17. From 1990 to 1998 two minimum wages existed, one for workers aged 18 and under, and another for workers over the age of 18. However, since 1998, the minimum wage has been independent of age and has covered all workers irrespective of the sector they are in.

Decisions on the level of the minimum wage are made on a discretionary basis, usually taking into account past and predicted inflation, with consultation of employers' and workers' representatives. The minimum wage in Spain is defined in terms of a monthly wage, but is rescaled in proportion to the hours and days actually worked.

The Government effected a significant increase in the single national minimum wage in mid-2004, of 6.6%. The motivation was the loss of purchasing power suffered by workers due to the decline in the real minimum wage between 1999 and 2004. This loss of purchasing power was estimated by the Government to be 6.6% (see Figure 1). The new minimum did not become obligatory until January 2005 when an additional rise made a total increase of 11.4% in just one year. It was the largest increase since 1990.

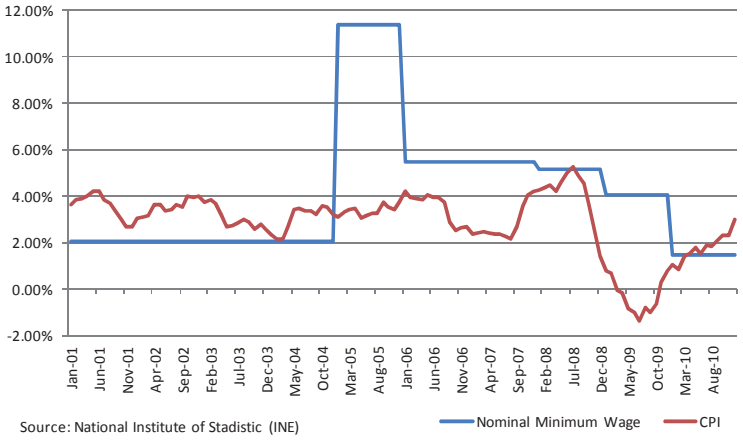


Figure 1. Year-on-year growth in the minimum wage and CPI

The impact of the minimum wage depends on how close it is to the productivity distribution. Consequently, we can define a directly affected group of people as workers with a real wage (deflated by the CPI) in year t that is less than the real minimum wage in year t+1. This affected group represents about 1% of all full-time workers each year between 2004 and 2009.

However, in Spain there is another variable very close to the minimum wage, namely the minimum base for social security contributions. This minimum base is exactly equal to the mandatory minimum wage for lower occupational categories, but is higher for higher occupational categories (see Table 1). We have considered these minimum bases as the

relevant minimum wage for higher occupational categories, taking into account the possibility for the employer of downgrading the occupational category of workers in order to pay them less than these minimum bases. As Table 1 shows, minimum social security bases for high groups have also increased, albeit at a lower pace than the minimum wage. This could mean that the impact of the rise in the minimum wage may differ from one occupation to another, because employers could downgrade the occupational category of workers in order to avoid the rise in the minimum social security base. We use separate models to analyse the effect on the individual employment probability for lower and higher categories, because the options available to avoid the increase are different.

Also, another way of avoiding the minimum wage increase is for workers to become self-employed. These two ways of avoiding minimum wage increases without falling into unemployment are analysed in Section 4.

Table 1. Nominal minimum wage by occupational category

Occupational Category	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Managers	739,1	753,8	768,9	784,2	799,8	836,1	881,1	929,7	977,4	1.016,40	1.031,70
Professionals	613,0	625,3	637,8	650,7	663,6	693,6	731,1	771,3	810,9	843,3	855,9
Technical staff	533,0	543,6	554,4	565,5	576,9	603	635,7	670,8	705,3	733,5	744,6
Others	495,7	505,8	516	526,5	537,3	598,5	631,2	665,7	699,9	728,1	738,9

Note: The minimum wage in 2004 refers to January 2004 and the minimum wage in 2005 refers to January 2005 which reflects the increase in mid-2004.
It is in the category "others" that the mandatory minimum wage is exactly the same as the minimum Social Security base

Source: Social Security Sistem

3 Data

The Social Security Administrative Labour Records (Muestra Continua de Vidas Laborales, hereinafter MCVL) is an organised set of anonymised micro data extracted from social security administrative records, matched with the Municipal Register to include personal data. This dataset is formed by a representative 4% random sample of the total population of people who had any kind of relationship with the Social Security System in a given year, which includes either having a working affiliation or receiving any social security benefit at some time in the reference year, regardless of how long they have been in this situation. The advantage of this sampling method is that it will include people who have short and frequent relationships with the Social Security System in a given year who could be excluded by a sampling process with a fixed date. This can be a numerous group: around three million people, who have worked at some time in a given year, but were not affiliated on a given day. This group of people consists mainly of women and young workers with short-term contracts. The MCVL sampling process consequently reduces the bias against these collectives. In particular, our sample includes all individuals who have had a relationship with the Social Security System at least once between 2005 and 2010, because we merge all observations from wave 2005 to 2010. People not in the sample are close to inactivity or a similar situation, because if a person returns to the labour market, even for one day, this person will be in the sample.

The sample provides detailed monthly information about job characteristics such as type of contract, length, sector of activity, working time, monthly earnings, occupational group, as well as other personal information (sex, age, nationality, place of birth, place of residence, household size…) from the Municipal Register. MCVL data for a given year are published in June of the following year.

The random sampling process selects everybody with a personal identification code belonging to some predetermined set, which is the same every year. This type of sampling ensures that people who maintain their relationship with the Social Security System are always sampled every year.

The MCVL provides accurate information about the transition between employment and unemployment because we have information covering the entire labour history of each person who worked or received benefits at any time between 2005 and 2010. We use monthly data from six MCVL waves. For our empirical analysis, the main advantage of the MCVL is that it provides a good picture of wages, because the information does not come from a survey. The disadvantage is that the bias against people with no relationship at all during the whole period is not completely eliminated. This bias is not too relevant, because these people are very close to inactivity.

The information of working histories starts from 1980, but we study the impact of minimum wages from 2000 to 2010 because during this time there was a period in which the real minimum wage was falling (2000-2004) and another period in which the real minimum wage increased (2005-2010). In this way, we can separate the effect of low wages and minimum wages, using the period 2000-2004 as a control to estimate the effect of low-wages alone on employment and then using 2005-2010 to estimate the effect of the minimum wage increase on employment.

We focus on the transition between employment[1] and unemployment, but we have also analysed the transition to self-employment.

Experience in the workplace is computed sequentially from the first affiliation after 1980. We accumulate days worked for the same firm, but from the moment the worker changes to another firm the tenure is set to zero. With this sample it is not possible to calculate the total experience of the worker in the labour market, because records which end before 1980 are not observable.

We have defined as ***failure*** the case of a person who works full-time throughout a given month under the General Social Security Regime , but twelve months later does not work on any day of the month as an employee (i.e. excluding self-employment, which is analysed later). The idea behind this definition is that a person who is capable of earning a daily wage above the minimum for at least one day in a month is still in the market.

We define those workers with a current wage below the minimum twelve months later as the affected group. The idea is that the wages of this group must be increased in order to comply with the new minimum, so the employer has to take the decision either to pay them a higher salary or to fire them.

Table 2. Percentage of full-time workers affected by an increase in the real minimum wage twelve months later, by age group

	AGE				
Year	Total	16-24	25-32	33-45	45-64
2004	0,88	1,74	1,01	0,69	0,63
2005	0,78	1,53	0,85	0,64	0,59
2006	0,76	1,48	0,79	0,64	0,62
2007	0,59	1,14	0,58	0,53	0,50
2008	0,93	2,06	0,87	0,83	0,77
2009 (*)	0,14	0,27	0,58	0,51	0,11

Source: MCVL

(*)2009 refers to January-March 2009 only, because there were falls in the real minimu wage from April

Table 2 shows the group of affected people, according to the previous definition, as a percentage of all workers in the same age group.[2] As can be seen, their incidence is higher among young people, a fact that is undoubtedly behind the result usually found in the literature, namely that this group is the most affected by minimum wages. However, from a micro perspective, nothing in the table suggests that the individual probabilities of losing a job are higher among the young.

Indeed, Table 3 shows the percentage of workers that had lost their employment twelve months later, depending on whether the worker was affected by the new minimum or not. As can be seen, affected workers are more prone to lose their job than those not affected. The recent crisis raised the probability of losing a job, but the difference between the two groups remains the same.

[1] Defined as being employed under the General Social Security Regime.
[2] The age groups were selected to have a similar number of affected people in each of them (see Table 4)

Table 3. Percentages of workers who lost their employment in the period 2000-2010, classified by affected vs. unaffected

	Year									
Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009*
Affected workers	ND	ND	ND	ND	16,7	16,6	15,3	18,2	23,7	21,7
Not affected workers	8,6	9,1	8,6	8,6	8,6	8,5	8,7	11,0	15,1	12,6

Source: MCVL

(*) 2009 refers to January-March 2009, there were falls in the real minimum wage from April
Note: Between 2000 and 2003 there is no affected group because there were no increases of real minimum wage

In order to estimate properly the impact of minimum wage by age, we need a large enough number of affected people for all age groups. In this respect, Table 4 shows that this number is greater than one hundred for almost all years and groups, including the 45-64 group, for which the incidence of the minimum wage was the lowest.

Table 4. Full-time workers affected by real minimum wage twelve months later, by age group

	AGE				
Year	Total	16-24	25-32	33-45	45-64
2004	1266	266	424	359	216
2005	1168	233	370	352	213
2006	1182	227	350	370	236
2007	941	173	255	315	198
2008	1400	264	353	478	306
2009 (*)	731	95	194	274	168

Source: MCVL

(*)2009 refers to January-March 2009 only, because there were falls in the real minimum wage from April

4 Methodology

This paper estimates the effect of the increase in minimum wages on employment. This effect may differ by age group and by occupational group.

The motivation for this study is that, from a macroeconomic point of view, one would expect the group of young workers to be more affected than other groups, because young workers receive lower wages. From a microeconomic perspective, however, the picture may be different, because the effect of minimum wages on individual probabilities of employment do not depend on the number of people affected, but rather on things like functional mobility, learning and long-term productivity. All of these issues have an effect that may depend on age.

In the Spanish case there is a single minimum wage, which is revised each year in nominal terms. In this study, we analyse the period 2000-2010, which includes a sub-period without increases in the real minimum wage (2000-2004) and another one with increases (2005-2009).[3] We use the period without increases as a control for the effect of low wages on the employment probability. We try to see what would have happened if the real minimum wage had not been increased.

The main characteristic of the methodology employed is the use of a large individual longitudinal dataset to compare the individual employment probability of workers who had a wage lower than the real minimum wage in *t*+12 (the affected group) with that of workers who were receiving a wage higher than the minimum in *t*+12. However, a direct comparison of these two groups can lead to an incorrect conclusion because, even in the absence of a minimum wage, workers with lower wages have more probability of losing their employment. In this respect, the increase in the real minimum wage in 2005 after a period of falls in the real minimum wage is very convenient. The fact that it approximates a "quasi-experiment" allows us to use a difference-in-differences estimator to identify the effect of the rise in the minimum wage. The strategy of identification consists of comparing a worker with a real wage below the real minimum wage twelve months later (the affected group) with a worker with similar characteristics but with a real wage above the real minimum wage twelve months later, who is therefore not affected by the increase, and with a worker with similar characteristics and a real wage equal to the real minimum wage twelve months later during the period in which the real minimum wage did not increase (2000-2004).

The approach used here defines the affected group in terms of a gap between the individual's real wage and the real minimum wage in *t*+12, but only if the former is lower than the latter. Consequently, we have a continuous variable measuring the distance from the real wage to the real minimum wage in *t*+12. This is convenient for our case study, because in the period 2005-2010 the real minimum wage increased with varying intensity from year to year. The *wagegap* is defined as:

$$wagegap_{i,t} = \begin{cases} m_{i,t+12} - wage_{i,t} & if \quad m_{i,t+12} > wage_{i,t} \\ 0 & else \end{cases}$$

[3] By contrast, Stewart (2004) uses data from 1994 to April 1999 in the NES to analyse the introduction of the minimum wage in April 1999

Where *m* is the real monthly minimum wage of individual[4] *i* in month *t+12* and *wage* is the individual monthly real wage of the same individual in month *t*. The difference in the behaviour of the affected group and the comparison groups, after controlling for individual characteristics, can be interpreted as the effect of the minimum wage. So, we have two groups, one of them with *wagegap*=0, which includes the two comparison groups defined above, and the other with *wagegap*>0 which corresponds to the affected group. We propose the following Logit model for the probability of losing employment:

$$\Pr[d_{i,t} = 1] = \Lambda\{\beta' x_{i,t} + \theta\, wagegap_{i,t} + \alpha\, wage_{i,t} + \Phi'\, g_{i,t}\}$$

Where Λ is the Logit transformation. The dummy d_{it} has two possible values, 0 when the worker continues working in t+12 as an employee, and 1 if the worker is no longer working in t+12 as an employee. We consider the situation twelve months later to avoid seasonality, which is particularly important in the Spanish labour market. Also, we introduce as a control a vector x_{it} with individual characteristics, including gender, tenure in the firm, nationality, type of contract (temporary or permanent), multiple job-holding, age and family size. We divide individuals into four age groups: group 1, aged 16-24, group 2, aged 25-32, group 3, aged 33-45 and finally, group 4, aged over 45. We have chosen these thresholds because in this way we have more or less the same numbers of affected workers in each age group (see Table 4). For family size, we have four variables, to control for the different ages of the dependants in the family: less than 6 years old, 7-15, 16-65 and over 65 years old. In this way, we capture the different impact of infants, children and retired people on working decisions by gender.

θ^* is the estimator of the effect of an increase in the minimum wage. With *wagegap* we measure how far the wage of a worker is from the new real minimum wage twelve months later. We cannot expect a similar effect for someone who would need a significant increase in their monthly wage as for someone who would need only a small increase to comply with the new minimum. Hence, the gap not only indicates who is affected, but also measures to what extent they are affected. Estimation with this variable has more precision than with a simple dummy variable capturing whether the individual is affected or not.

Finally, g_{it} is a set of dummies, which include month, year and the interaction of month and the variable *wagegap* as controls for macroeconomic and seasonal effects.

We add to the previous specification an interaction between *wagegap* and age group. We use this interaction because we want to ascertain whether the effect of minimum wages differs according to the age of workers. The effect could be different as a result of different productivity growth rates across age groups.

Figure 2 shows real wage growth by age. This graph shows that the maximum wage increases are seen in the intermediate age groups, descending as the age increases until reaching a minimum for older workers of around 1%. By gender we can see that the increase in women's wages is lower for all age groups except the oldest, where increases are similar to

[4] The real monthly minimum wage is individual because minimum wages are different depending on the occupation group.

men's. These developments suggest that the impact of the minimum wage on employment should be higher for women and for old people.[5]

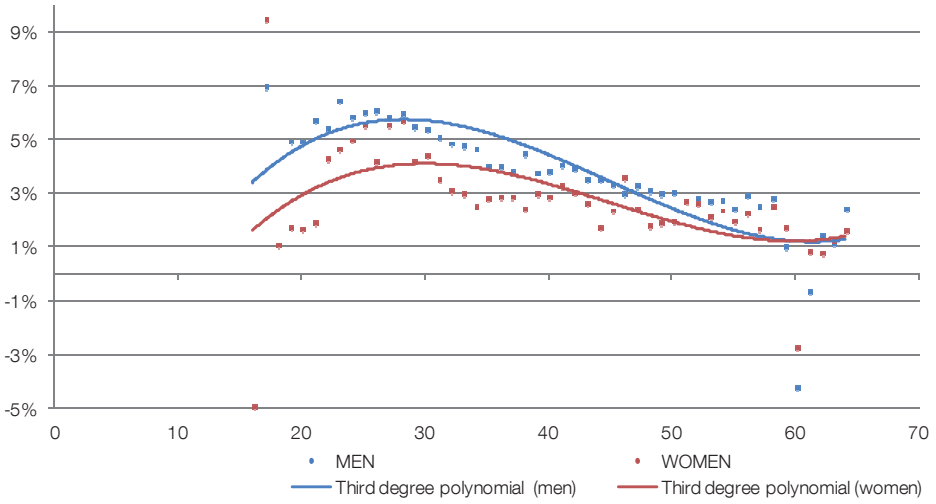


Figure 2. Increase in real wages by age in the period 2003-2004

The increase in the real minimum wage in Spain depends on the occupational category (see Table 5). The largest cumulative increase was for the lowest occupational category, amounting to 18.4%. This is 7 percentage points more than the increase for the rest of the categories, and represents over €108 more per month.[6]

Table 5. Cumulative increase from 2004 in the real minimum wage, by occupational category

	Occupational category			
Period	Managers	Professionals	Technical staff	Others
2004-2005	1,13%	1,12%	1,12%	7,76%
2004-2006	2,95%	2,96%	2,98%	9,79%
2004-2007	5,69%	5,68%	5,72%	12,65%
2004-2008	6,76%	6,75%	6,81%	13,80%
2004-2009	11,34%	11,33%	11,39%	18,72%
2004-2010	11,02%	11,00%	11,08%	18,36%

Source: MCVL

For that reason, our benchmark model of employment probability is estimated for this occupational category. In order to cover the possibility that these workers may choose to keep working for the same (or a different) firm, but with self-employed status, so that the firm does not have to increase their wage, we estimate a multinomial Logit model (named Multinomial 1 from now on) with the same specification as above, but replacing the dependent variable with a categorical variable (S_{it}) that takes three possible values: 0, when the worker continues working twelve months later (t+12) as an employee; 1, if the worker does not continue working in t+12; and finally, 2, if the worker works as a self-employed

[5] The graph depicts wage increases between 2003 and 2004. Choosing different years (not affected by minimum wage increases) does not alter the picture.
[6] Real wages, base 2006.

worker in t+12 and not as an employee. Other variables of the model keep the same definition.

In this case, we want to estimate the effect of the minimum wage on the transition from employment to unemployment or to self-employment, for workers in the lowest occupational category.

Another possible wage floor in Spain is that provided by the collectively bargained wage. This bound is usually higher than the mandatory minimum wage and affects all workers who work in the sector concerned. The increase in the mandatory minimum wage may have been passed through to these bargained wages, at least in the case of those that were already close to the minimum. To study this possibility we have considered another affected group of people. The model proposed (see Table 8) is the same as our benchmark, but we have added a second affected group of workers who have a real wage that is less than 110% of the real minimum wage twelve months later, but also higher than the real minimum wage twelve month later. We estimate different effects for these two groups.

Also, we wish to analyse the transitions in higher categories (managers, professionals and technical staff), in which the increase in the minimum social security base has been lower. However, in this case the employer could decide to downgrade workers to lower categories to avoid that increase (see Table 1). At the same time, workers could choose to work on a self–employed basis, for the same reasons explained before. Hence, we have proposed another multinomial Logit for analysing the transition to unemployment, to a lower occupational category or to self-employment (which we will refer to as "Multinomial 2"). In this case, we have defined a category variable (M_{it}) that takes four possible values: 0, when the worker continues working as an employee and in the same or in a higher occupational category twelve months later (t+12); 1 and 2, in the same cases as defined above; and finally, 3, when the worker continues working as an employee, but in a lower occupational category, in t+12.

With these three different models we cover all the possible transitions affecting workers that could have been influenced by the increase in the real minimum wage in the period 2005-2010.

5 Results: probability of losing employment

The sample is restricted to those aged between 16 and 65 in low occupational categories who had a relationship with the Social Security System. In the first column of Table 6, we present the estimation results for our benchmark model, in which the dependent variable d_{it} measures the probability of not working any day in month t+12, conditional on working full-time the entire month in t.[7]

All specifications include an interaction term of age with both wage and *wagegap*, as well as other control variables. Standard errors are in parentheses in each case.

Table 6. Probability of losing employment. Marginal effects in percentage points for different specifications of Logit model

	Total	Women	Men	January only [1]	48 months [2]
Wage, 16-24 years old (euro)	-0.004*** (6.47 10^{-5})	-0.0046*** (0.0001)	-0.0038*** (7.62 10^{-5})	-0.0038*** (0.0002)	-0.0053*** (0.0002)
Wage, 25-32 years old (euro)	-0.006*** (3.63 10^{-5})	-0.0065*** (6.31 10^{-5})	-0.005*** (4.5 10^{-5})	-0.0058*** (0.0001)	-0.0089*** (0.0001)
Wage, 33-45 years old (euro)	-0.0062*** (3.25 10^{-5})	-0.0071*** (6.06 10^{-5})	-0.0054*** (3.88 10^{-5})	-0.0061*** (0.0001)	-0.0098*** (9.07·10^{-5})
Wage, more than 45 years old (euro)	-0.002*** (3.11 10^{-5})	-0.004*** (7.0510^{-5})	-0.0012*** (3.52 10^{-5})	-0.0018*** (0.0001)	8.35·10^{-5} (7.2·10^{-5})
Wagegap[A] , 16-24 years old (euro)	0.076*** (0.0205)	0.073** (0.0294)	0.0932*** (0.0295)	0.0038 (0.0002)	0.0475*** (0.0183)
Wagegap, 25-32 years old (euro)	0.026 (0.0199)	0.04 (0.0282)	0.019 (0.0289)	-0.0089 (0.025)	0.0381** (0.0173)
Wagegap, 33-45 years old (euro)	0.05129*** (0.0197)	0.119*** (0.0281)	0.02 (0.0284)	0.03 (0.025)	0.061*** (0.0175)
Wagegap, more than 45 years old (euro)	0.14199*** (0.0205)	0.1795*** (0.029^{2})	0.092*** (0.0294)	0.094*** (0.031)	0.1*** (0.0184)
Spanish nationality	-2.4519*** (0.02)	-0.023*** (0.0372)	-2.6367*** (0.0238)	-2.594*** (0.071)	-4.643*** (0.073)
Dummy temporary contract	6.4362*** (0.0163)	6.6424*** (0.0283)	6.4751*** (0.0201)	6.479*** (0.056)	4.032*** (0.047)
Tenure in the firm (days)	-0.0019*** (7.91·10^{-6})	-0.0018*** (1.43·10^{-5})	-0.0019*** (9.43·10^{-6})	-0.0019*** (2.8·10^{-5})	-0.0016*** (1.95·10^{-5})
Other family members, 0-6 years old	0.7551*** (0.0151)	3.05*** (0.0255)	-0.381*** (0.0188)	1.005*** (0.051)	0.622*** (0.047)
Other family members, 7-15 years old	-0.5315*** (0.0146)	0.05* (0.0264)	-0.755*** (0.0175)	-0.4416*** (0.0509)	-1.119*** (0.044)
Other family member, 16-65 years old	-0.10182*** (0.0062)	-0.2509*** (0.0118)	-0.0258*** (0.0073)	-0.0791*** (0.022)	-0.113*** (0.0206)
Other family members, over 65 years old	0.07624*** (0.0202)	-0.28256*** (0.0372)	0.245*** (0.024)	0.1038 (0.069)	0.3613*** (0.065)

Notes: Other control variables: Year and month dummies, age group, multiple job-holding and the interaction between month and wagegap.

A. Wagegap is only for workers who receive a salary lower than real minimum wage in t+12

***Significant at 1% level

**Significant at 5% level

*Significant at 10% level

(1) This model is like our benchmark, but using only January observations

(2) This model is only estimated for 2000 and 2004 and the employment status 48 months later

The marginal effect of wages is negative and significantly different from zero for all age groups. This captures the fact that wages rise with productivity, and higher productivity makes it less likely that workers will lose their jobs. On top of that, we find that the *wagegap* has an additional effect for workers with a real wage lower than the real minimum wage twelve months later. Therefore, this effect can be interpreted as the effect of yearly increases in the real minimum wage on the probability of losing employment. The *wagegap* effect is

[7] These two latter restrictions are needed to ensure that the observed wage is comparable to the minimum.

positive and significantly different from zero for all age groups, except workers between 25 and 32 years old. Moreover, the effect of the minimum wages is highest among the oldest workers, and almost twice the effect observed for young workers. Analysing the results by gender (second and third columns), we find that the impact of the real minimum wage for workers between 33 and 45 years old is due, exclusively, to female workers, the effect on male workers in this age group being insignificant. Figure 2 may shed some light on the interpretation of this fact, since it shows that the productivity growth curve is lower in the case of females, which may explain why the impact on women affects more age groups than in the case of men. The marginal effect of the *wagegap* on older workers is also higher for women.

Table 6 shows the effects of other control variables. Nationality and tenure in the firm are negative and significant for both genders. Thus, Spanish workers have less probability of losing their employment, and as tenure in the firm increases the probability of losing employment decreases. Also, workers with temporary contracts are more prone to losing their jobs. Finally, we control for dependants in the family. In this case we find that dependants between 0 and 6 years old and dependants over the age of 65 have a positive and significant effect on the probability of losing employment. Other control variables also have the expected sign.

In the fourth column we can see results for a model which is the same as the benchmark, but restricted to January observations. This is done for the purpose of comparison with the model in Stewart (2004) using the New Earnings Survey Panel Data.[8] In his model, he analyses the effect only one month after introducing the minimum wage. Hence, restricting our sample to January observations makes these two models comparable. We find that the *wagegap* effect is only positive for workers over the age of 45. The effect of the rest of the variables is similar to that in the benchmark model (first column). Therefore, the lack of time to fully observe the effects of the introduction of the minimum wage could be the reason for the absence of significant effects found in Stewart (2004).

In the last column we show a modified version of our main model. We take workers in year 2000 and their labour status in 2004 and workers in 2004 and their labour status in 2008. In this case, the affected group is workers who had a wage that was lower than the real minimum wage 48 months later. With this model, we wish to avoid the problem of self-selection. In other words, with our benchmark model we may only see the evolution of surviving workers after the first increase in minimum wage, but with this variation of the main model we can see whether our estimation is affected by this problem. We find that the *wagegap* effect on the probability of losing employment is positive and significantly different from zero for all age groups. Also, the magnitude of the effect is still largest for older workers, being twice that for young workers.

Table 7 shows the estimations by sector of activity, as a robustness check. In agriculture there are not enough observations because the majority of workers in this sector are subject to a special social security regime, and hence not well covered in the MCVL.[9]

---

[8] This database is based on administrative records and is the most similar to our database. Stewart analyses the period from 1994 to 1999, but the data are yearly and the survey is conducted in April, so that he really only analyses the situation one month after the introduction of the minimum wage.

[9] Other robustness checks that we have considered are: fixed and random effects, separate models for high and low productivity sectors, and a restricted model similar to that of the fifth column of Table 6, but with the affected and comparison groups based on labour status 24 months later. All of them show a bigger effect on the group of older workers than on that of young workers, so the main conclusion of the paper seems to be fairly robust.

We see that the greatest effects are in the construction sector, although in all sectors the effect for older workers is positive and significantly different from zero, and the marginal effect is greater for older workers than for young workers. Therefore, the main conclusion is maintained. For the rest of the variables the results are similar to those obtained with the aggregate model, with some differences in the effect of dependants in the family by sector.

Table 7. Probability of losing employment. Marginal effects in percentage points for sector[1] especifications of Logit model

	Total	Industry	Construction	Services
Wage, 16-24 years old (euro)	-0.004*** (6.47 10^{-5})	-0.0036*** ($1.1 \cdot 10^{-4}$)	-0.0033*** ($2.07 \cdot 10^{-4}$)	-0.0045*** ($8.74 \cdot 10^{-5}$)
Wage, 25-32 years old (euro)	-0.006*** (3.63 10^{-5})	-0.0059*** ($6.55 \cdot 10^{-5}$)	-0.005*** ($1.3 \cdot 10^{-4}$)	-0.0058*** ($4.5 \cdot 10^{-5}$)
Wage, 33-45 years old (euro)	-0.0062*** (3.25 10^{-5})	-0.006*** ($5.85 \cdot 10^{-5}$)	-0.0057*** ($1.1 \cdot 10^{-4}$)	-0.0064*** ($4.13 \cdot 10^{-5}$)
Wage, more than 45 years old (euro)	-0.002*** (3.11 10^{-5})	-0.0018*** ($4.7 \cdot 10^{-5}$)	-0.0037*** ($1.13 \cdot 10^{-4}$)	-0.0023*** ($4.25 \cdot 10^{-5}$)
Wagegap[A], 16-24 years old (euro)	0.076*** (0.0205)	-0.026 (0.0629)	0.2539** (0.1063)	0.0992*** (0.0211)
Wagegap, 25-32 years old (euro)	0.026 (0.0199)	-0.019 (0.0624)	0.2714** (0.1095)	0.0517** (0.0203)
Wagegap, 33-45 years old (euro)	0.05129*** (0.0197)	0.037 (0.0608)	0.3476*** (0.1048)	0.0779*** (0.0202)
Wagegap, more than 45 years old (euro)	0.14199*** (0.0205)	0.1783*** (0.06297)	0.5247*** (0.1199)	0.1624*** (0.0209)
Spanish nationality	-2.4519*** (0.02)	-1.47*** (0.0449)	-2.7173*** (0.0533)	-2.331*** (0.0255)
Dummy temporary contract	6.4362*** (0.0163)	6.064*** (0.0323)	5.74*** (0.0559)	5.616*** (0.0202)
Tenure in the firm (days)	-0.0019*** ($7.91 \cdot 10^{-6}$)	$-8.42 \cdot 10^{-4}$ *** ($1.1 \cdot 10^{-5}$)	-0.0049 *** ($3.29 \cdot 10^{-5}$)	-0.0019*** ($1.05 \cdot 10^{-5}$)
Other family members, 0-6 years old	0.7551*** (0.0151)	0.35*** (0.03)	-0.24*** (0.0421)	1.151*** (0.019)
Other family members, 7-15 years old	-0.5315*** (0.0146)	0.6684*** (0.029)	-0.755*** (0.0391)	-0.4376*** (0.0189)
Other family member, 16-65 years old	-0.10182*** (0.0062)	-0.036*** (0.0126)	-0.1151*** (0.0166)	-0.1715*** (0.0081)
Other family members, over 65 years old	0.07624*** (0.0202)	0.1015*** (0.0383)	0.5754*** (0.0604)	0.043*** (0.0253)

Notes: Other control variables: Year and month dummies, age group, multiple job-holding and the interaction between month and wagegap

A. Wagegap is only for workers who receive a salary lower than real minimum wage in t+12

***Significant at 1% level

**Significant at 5% level

*Significant at 10% level

(1) The agriculture sector cannot be analysed because it has a special Social Security regime and hence there are not enough observations

The overall conclusion is that increases in the real minimum wage have negative effects on the individual probability of employment for both young and older workers. However, the magnitude of this effect in the case of older workers is double that for young workers. Moreover, for older workers (and to some extent female workers) the negative impact on the probability of employment could be more harmful because the affected workers may be definitively expelled from the labour market, as they are probably working in very low productivity activities, in which the possibility that future increments in productivity will overcome the effect of the minimum wage is lower. In contrast, young workers have greater chances of finding another job sooner or later because they are at the beginning of their careers, and situated on the upward-sloping part of their productivity curve, which is not the

case of older workers. Interestingly, the negative effects of minimum wages on employment appear to be associated with groups with low productivity growth, which is consistent with this theory.

In the next model (see Table 8) we incorporate a second group of affected workers in low occupational categories. This group of affected workers includes workers with a real wage (deflated by the CPI) in year t that is less than 110% of the real minimum wage twelve months later, but also above the real minimum wage in t+12 (*wagegap_2*). In the first column of Table 8, we present the estimation results for our benchmark model adding this second group of affected workers, in which the dependent variable d_{it} measures the probability of not working on any day in month t+12, conditional upon working full time the entire month in t.

All specifications include an interaction term of age with both *wage*, *wagegap* and *wagegap_2*, as well as other control variables. Standard errors are in parentheses in each case:

Table 8. Probability of losing employment. Marginal effects in percentage points for different specifications of Logit model with second group of affected workers

	Total	Women	Men
Wage, 16-24 years old (euro)	-0.0039*** (6.69·10^{-5})	-0.0045*** (0.0001)	-0.0038*** (7.83·10^{-5})
Wage, 25-32 years old (euro)	-0.0058*** (3.7·10^{-5})	-0.0065*** (6.46·10^{-5})	-0.005*** (4.56· 10^{-5})
Wage, 33-45 years old (euro)	-0.0061*** (3.30·10^{-5})	-0.0071*** (6.17·10^{-5})	-0.0054*** (3.93·10^{-5})
Wage, more than 45 years old (euro)	-0.0018*** (3.15·10^{-5})	-0.004*** (7.151·0^{-5})	-0.0012*** (3.55·10^{-5})
Wagegap[A] , 16-24 years old (euro)	0.0791*** (0.0205)	0.0759** (0.0294)	0.0964*** (0.0295)
Wagegap, 25-32 years old (euro)	0.0272 (0.0199)	0.0417 (0.0282)	0.019 (0.0289)
Wagegap, 33-45 years old (euro)	0.0532*** (0.0197)	0.1237*** (0.0281)	0.02 (0.0284)
Wagegap, more than 45 years old (euro)	0.1444*** (0.0205)	0.1843*** (0.0292)	0.0924*** (0.0294)
Wagegap_2[B] 16-24 years old (euro)	0.0159*** (0.0028)	0.0089** (0.0042)	0.0226*** (0.0039)
Wagegap_2, 25-32 years old (euro)	0.0067*** (0.0026)	0.0077** (0.0034)	0.0055 (0.004)
Wagegap_2, 33-45 years old (euro)	0.0169*** (0.0025)	0.0272*** (0.0036)	0.0052 (0.0037)
Wagegap_2, more than 45 years old (euro)	0.0319*** (0.0033)	0.0435*** (0.005)	0.0121*** (0.0045)
Spanish nationality	-2.4526*** (0.02)	-2.267*** (0.0372)	-2.6371*** (0.0238)
Dummy temporary contract	6.4388*** (0.0163)	6.643*** (0.0283)	6.475*** (0.0202)
Tenure in the firm (days)	-0.0019 *** (7.91·10^{-6})	-0.0018*** (1.43·10^{-5})	-0.0019 *** (9.43·10^{-6})
Other family members, 0-6 years old	0.7551*** (0.0151)	3.0484*** (0.0255)	-0.381*** (0.0188)
Other family members, 7-15 years old	-0.5315*** (0.0146)	0.0508* (0.0264)	-0.7552*** (0.0175)
Other family member, 16-65 years old	-0.10164*** (0.0062)	-0.2503*** (0.0118)	-0.0258*** (0.0073)
Other family members, over 65 years old	0.0751*** (0.0202)	0.2846*** (0.0372)	0.245*** (0.024)

Notes: Other control variables: Year and month dummies, age group, multiple job-holding and the interaction between month and wagegap.

A. Wagegap is only for workers who receive a salary lower than real minimum wage in t+12

B. Wagegap_2 is only for workers who receive a wage that is higher than the real minimum wage in t+12, but by less than 10%

***Significant at 1% level

**Significant at 5% level

*Significant at 10% level

The main result of our benchmark model is maintained. On top of that, we find that the *wagegap* for the second affected group has an effect for workers with a real wage that is lower than 110% of the real minimum wage twelve months later. This effect can be interpreted as a proxy for the effect of yearly increases in the real minimum wage on bargained wages, and sequentially on the probability of losing employment. This *wagegap_2* effect is positive and significantly different from zero for all age groups, but analysing the results by gender (second and third columns), we find that the impact of the real minimum

wage for workers between 25 and 32 years old, and 33 and 45 years old is due, exclusively, to female workers, whereas the effect on male workers is insignificant in these age groups. As in the benchmark model, this can be interpreted by looking at productivity growth by gender in Figure 2. In any case, the magnitude of the effect of this second wage gap is much lower than the original. This means that the pass-through of minimum wages to collectivelly bargained wages has some effect on the probability of losing employment, but is of secondary importance when compared to the minimum wage increase itself.[10]

In the next model (see Table 9) we incorporate the possibility that workers may choose to keep working for the same or different firm, but with self-employed status, so that the firm does not have to increase their wages. We estimate a multinomial Logit model with a categorical dependent variable (S_{it}) with three possible values, 0 is when the worker continues working twelve months later (t+12) as an employee; 1 if the worker is unemployed in t+12 and finally, 2 if the worker works as self-employed in t+12.

The marginal effects of wages have the expected sign. Their effect on the probability of maintaining the job is positive and significant, and it is negative and significant in the probability of going to unemployed or self-employed. Other control variables have the same effect as in the benchmark model. Regarding the *wagegap* variable, the effect is negative and significant in the probability of maintaining employment for young and older workers, while it is non-significant for other age groups. In both affected groups, we find positive and significant effects on the probability of going to unemployment. In contrast, we found significant (positive) effect on the probability of working as self-employed only for older workers.

In conclusion, young and older workers have a significant and positive effect on the probability of becoming unemployment. Also, the group of older workers has a significant and positive effect to change their employment status to self-employed. Therefore, part (but not all) of the effect found for older workers in previous Logit models is capturing a change in employment status to self-employment status.

[10] This is true in terms of individual probabilities. The aggregate macroeconomic effect of bargained minimum wages on employment could be higher, because they affect more people.

Table 9. Effect on the probability of ending in state (marginal effects in percentage points): Reference group: Employee

	Employed	Unemployed	Self- employed
Wage, 16-24 years old (euro)	0.0042*** ($6.5 \cdot 10^{-5}$)	-0.004*** ($6.3 \cdot 10^{-5}$)	$-1.42 \cdot 10^{-4}$*** ($1.81 \cdot 10^{-5}$)
Wage, 25-32 years old (euro)	0.0065*** ($3.64 \cdot 10^{-5}$)	-0.0063*** ($3.57 \cdot 10^{-5}$)	$-2.64 \cdot 10^{-4}$*** ($8.5 \cdot 10^{-6}$)
Wage, 33-45 years old (euro)	0.0068*** ($3.25 \cdot 10^{-5}$)	-0.0064*** ($3.18 \cdot 10^{-5}$)	$-4.31 \cdot 10^{-4}$*** ($8.17 \cdot 10^{-6}$)
Wage, more than 45 years old (euro)	0.0023*** ($3.13 \cdot 10^{-5}$)	-0.0022*** ($3.00 \cdot 10^{-5}$)	$-1.47 \cdot 10^{-4}$*** ($1.05 \cdot 10^{-5}$
Wagegap[A] , 16-24 years old (euro)	-0.0707*** (0.0207)	0.0611*** (0.01974)	0.0095 (0.0063)
Wagegap, 25-32 years old (euro)	-0.012 (0.201)	0.0027 (0.0192)	0.0089 (0.006)
Wagegap, 33-45 years old (euro)	-0.0296 (0.0199)	0.0014 (0.019)	0.0156*** (0.0059)
Wagegap, more than 45 years old (euro)	-0.1298*** (0.0206)	0.1054*** (0.0197)	0.0244*** (0.0062)
Spanish nationality	2.89*** (0.0202)	-2.7863*** (0.0195)	-0.1056*** (0.0056)
Dummy temporary contract	-6.44*** (0.0163)	6.358*** (0.0159)	0.084*** (0.0043)
Tenure in the firm (days)	0.0032*** ($8 \cdot 10^{-6}$)	-0.0030*** ($7.82 \cdot 10^{-6}$)	$-1.44 \cdot 10^{-4}$*** ($2.13 \cdot 10^{-6}$)
Other family members, 0-6 years old	-0.7617*** (0.0152)	0.6611*** (0.0148)	0.1006*** (0.0037)
Other family members, 7-15 years old	0.4173*** (0.0147)	-0.4417*** (0.0143)	0.0244*** (0.0037)
Other family member, 16-65 years old	0.065*** (0.0063)	-0.0592*** (0.0061)	-0.0059*** (0.0018)
Other family members, over 65 years old	-0.1246*** (0.0204)	0.1253*** (0.0197)	$-6.52 \cdot 10^{-4}$ (0.0056)

Notes: Other control variables: Year and month dummies, age group, multiple job-holding and the interaction between month and wagegap.
A. Wagegap is only for workers who receive a salary lower than real minimum wage in t+12

***Significant at 1% level

**Significant at 5% level

*Significant at 10% level

In the last model estimated (Table 10) we have covered the analysis of workers in higher occupational categories, in which the increase in the minimum wage has been lower. For these occupational categories, the employer could decide either to downgrade workers to lower categories to avoid the increase in minimum wage, or to fire them. And as before, workers could choose to work on a self-employed basis.

In order to cover all these possibilities, we have proposed another multinomial Logit that covers all these transitions (see Table 9). In particular, we have defined a category variable (M_{it}) that takes four possible values: 0 when the worker continues working as an employee and in the same or in a higher occupational category twelve months later (t+12); 1 and 2 in

the same cases as defined above; and finally 3 when the worker continues working as an employee, but in a lower occupational category in *t*+12.

The marginal effects of wages have the expected sign. Their effect on the probability of staying employed is positive and significant, while it is negative and significant in the probability of changing to unemployed, self-employed or to a lower occupational category. Regarding the *wagegap* variable, only young workers of higher occupational categories have a significant and positive effect on the probability of changing to unemployed status or to be downgraded to a lower occupational category, while all these effects for older workers are not significantly different from zero. The presence of high firing costs in the Spanish labour market could explain these results, making young qualified workers more prone to be fired or downgraded. Another interpretation could be the importance of specific human capital for qualified jobs, which makes an older worker less replaceable.

Table 10. Effect on the probability of ending in state (estimated coefficients) for higher occupation categories: Reference group: Employee

	Maintaining employment	Unemployed	Self- employed	Downgrade of occupational category
Wage, 16-24 years old (euro)	0.007***	-0.0027***	-2.98·10^{-4}***	-0.0039***
	(2.4·10^{-4})	(1.73·10^{-4})	(8.5·10^{-5})	(1.47·10^{-4})
Wage, 25-32 years old (euro)	0.0062***	-0.0027***	-3.73·10^{-4}***	-0.0031***
	(6.9·10^{-5})	(5.34·10^{-5})	(1.9·10^{-5})	(4.54·10^{-5})
Wage, 33-45 years old (euro)	0.0065***	-0.0029***	-5.32·10^{-4}***	-0.0030***
	(6.92·10^{-5})	(5.16·10^{-5})	(1.9·10^{-5})	(5.1·10^{-5})
Wage, more than 45 years old (euro)	0.0047***	-0.0011***	-3.6·10^{-4}***	-0.0032***
	(9.92·10^{-5})	(6.15·10^{-5})	(2.6·10^{-5})	(8.06·10^{-5})
Wagegap[A] , 16-24 years old (euro)	-0.2295***	0.1647***	-0.0029	0.0939**
	(0.0692)	(0.0428)	(0.0321)	(0.0398)
Wagegap, 25-32 years old (euro)	-0.0143	0.0501	-0.0064	-0.0295
	(0.0546)	(0.0361)	(0.0193)	(0.035)
Wagegap, 33-45 years old (euro)	-0.0373	0.0598	-0.0109	-0.0116
	(0.0559)	(0.0365)	(0.0192)	(0.0365)
Wagegap, more than 45 years old (euro)	0.017	-0.0083	-0.0025	-0.0062
	(0.062)	(0.0415)	(0.0198)	(0.0413)
Spanish nationality	3.1454***	-2.1416***	-0.162***	-0.8419***
	(0.0799)	(0.0559)	(0.0213)	(0.0562)
Dummy temporary contract	-4.89***	2.6961***	0.0271**	2.168***
	(0.0474)	(0.0353)	(0.0132)	(0.0321)
Tenure in the firm (days)	0.0032 ***	-0.0012 ***	-1.53·10^{-4}***	-0.0018***
	(2.5·10^{-5})	(1.7·10^{-5})	(1.42·10^{-5})	(2.1·10^{-5})
Other family members, 0-6 years old	0.0325	0.3678***	0.0578***	-0.4582***
	(0.0444)	(0.0315)	(0.0107)	(0.0327)
Other family members, 7-15 years old	0.7691***	-0.6263***	0.0432***	-0.186***
	(0.0506)	(0.0373)	(0.0118)	(0.0361)
Other family member, 16-65 years old	-0.1222***	0.044**	-0.004	0.0816***
	(0.0213)	(0.0156)	(0.0059)	(0.0146)
Other family members, over 65 years old	-0.173***	0.2719***	0.272***	-0.1506***
	(0.0591)	(0.0418)	(0.0151)	(0.0427)

Notes: Other control variables: Year and month dummies, age group, multiple job-holding and the interaction between month and wagegap.
A. Wagegap is only for workers who receive a salary lower than real minimum wage in t+12

***Significant at 1% level
**Significant at 5% level
*Significant at 10% level

6 Conclusions

This study uses Social Security Administrative Labour Records (MCVL, an individual level longitudinal dataset), to estimate the impact of increases in real minimum wages on employment probabilities for affected workers, defined as those whose wages must be increased to comply with the new real minimum wage twelve months later. Our identification strategy compares a worker with real wage lower than the real minimum wage twelve months later (affected group) with a worker of similar characteristics but with a real wage high enough so that he is not affected by the increase, and also with a worker of similar characteristics and same wage, but in a period in which the real minimum wage did not increase.

We have estimated a Logit model of transitions from employment to unemployment for low occupational categories, to analyse possible consequences of an increase in minimum wages. We find a positive and significant impact on the probability of losing the employment for young and older workers. The magnitude of this effect in the case of older workers doubles that of young workers. Also, we have estimated a multinomial Logit to add a new possible transition (from employment to self-employment status), finding that part (but not all) of the job losses for older workers actually end up as self-employed.

The intuition of our results is that, from a macroeconomic point of view, one would expect the group of young workers to be more affected than other groups, because young workers receive a lower wage. From a microeconomic perspective, however, the picture can be different, because the effect of minimum wages on individual employment probabilities does not depend on the number of people affected, but rather on characteristics like functional mobility, learning, or long-term productivity. All of these issues are against older people.

In summary, the increase in minimum wages that occurred between 2004 and 2010 had a negative effect on individual employment probabilities for young and older workers, being this last effect almost twice as large as the former. This result is of particular importance because the negative impact on employment probabilities might be very harmful in the case of older workers, because they may be definitively expelled from the labour market. In contrast, young workers have greater chances of finding another job sooner or later because they are at the beginning of their careers, and situated on the upward-sloping part of their productivity curve, which is not the case of older workers.

References

Blázquez, M., Llorente, R. and Moral, J. (2009) “Minimum wage and youth employment rates in Spain” *Working Paper 2/2009 of Universidad Autónoma de Madrid*.

Burkhauser, Richard V., Kenneth A. Couch, and David C. Wittenburg (2000). "A Reassessment of the New Economics of the Minimum Wage Literature with Monthly Data from the Current Population Survey" *Journal of Labor Economics*, 18, 653-680.

Card, D. and Alan, B. Krueger. (1994). "Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania."*American Economic Review*, 84, 772-793.

Card, David and Alan B. Krueger (1995). “Time-Series Minimum-Wage Studies: A Meta-analysis.” *American Economic Review*, 85, pp. 238-243.

Card, David and Alan B. Krueger (2000). "Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania: Reply." *American Economic Review*, 90 (5), 1397-1420.

Casey B. Mulligan (2011), ”Simple Analytics and Empirics of the Government Spending Multiplier and Other “Keynesian” Paradoxes,” *The B.E. Journal of Macroeconomics*: Vol. 11: Iss. 1 (Contributions), Article 19.

Cebrián, I., Pitarch, J., Rodríguez, C. and Toharia, L. (2010) “Análisis de los efectos del aumento del salario mínimo sobre el empleo de la economía española*”. Revista de Economía Laboral*, 7, pp.1-37.

Dolado, J. J. and Felgueroso, F. (1997). “Los efectos de salario mínimo: evidencia empírica para el caso español”. *Moneda y Crédito*, 204, pp. 213-254.

Dolado, J., Kramarz, F., Machin, S.,Manning, A., Margolis, D. and Teulings, C. (1996). “The economic impact of minimum wages in Europe”, *Economic Policy*, October, pp. 219-372.

Dolado, J. J., Felgueroso, F. and Jimeno, J. F. (1997). “The effects of minimum bargained wages on earnings: Evidence from Spain”. *European Economic Review* 41, pp. 713-721.

González, I., Jiménez, S., and C. Pérez (2003). “Los efectos del salario mínimo sobre el empleo juvenil en España: nueva evidencia”. *Revista Asturiana de Economía*, 27, pp. 147-168

Machin, S. and Manning, A. (1997). "Minimum wages and economic outcomes Europe" *European Economic Review*, 41, 733-742.

Neumark, D. and William, W. (2000). "Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania: Comment." *American Economic Review*, 90 (5), 1362-1396.

Portugal, P. and Cardoso, A. R. (2006) “Disentangling the Minimum Wage Puzzle: An Analysis of Worker Accessions and Separations” *Journal of the European Economic Association*, 5, 988-1013.

Sabia, J. J. (2009) “The effects of Minimum Wage Increases on Retail Employment and Hours: New Evidence from Monthly CPS Data” *Journal Labor Response*, 30, pp. 75-97.

Stewart, Mark B. (2004). "The Impact of the Introduction of the UK Minimum Wage on the Employment Probabilities of Low Wage Workers" *Journal of the European Economic Association*, 2, 67-91.

BANCO DE ESPAÑA PUBLICATIONS

WORKING PAPERS

1115 ENRIQUE MORAL-BENITO and CRISTIAN BARTOLUCCI: Income and democracy: Revisiting the evidence.
1116 AGUSTÍN MARAVALL HERRERO and DOMINGO PÉREZ CAÑETE: Applying and interpreting model-based seasonal adjustment. The euro-area industrial production series.
1117 JULIO CÁCERES-DELPIANO: Is there a cost associated with an increase in family size beyond child investment? Evidence from developing countries.
1118 DANIEL PÉREZ, VICENTE SALAS-FUMÁS and JESÚS SAURINA: Do dynamic provisions reduce income smoothing using loan loss provisions?
1119 GALO NUÑO, PEDRO TEDDE and ALESSIO MORO: Money dynamics with multiple banks of issue: evidence from Spain 1856-1874.
1120 RAQUEL CARRASCO, JUAN F. JIMENO and A. CAROLINA ORTEGA: Accounting for changes in the Spanish wage distribution: the role of employment composition effects.
1121 FRANCISCO DE CASTRO and LAURA FERNÁNDEZ-CABALLERO: The effects of fiscal shocks on the exchange rate in Spain.
1122 JAMES COSTAIN and ANTON NAKOV: Precautionary price stickiness.
1123 ENRIQUE MORAL-BENITO: Model averaging in economics.
1124 GABRIEL JIMÉNEZ, ATIF MIAN, JOSÉ-LUIS PEYDRÓ AND JESÚS SAURINA: Local versus aggregate lending channels: the effects of securitization on corporate credit supply.
1125 ANTON NAKOV and GALO NUÑO: A general equilibrium model of the oil market.
1126 DANIEL C. HARDY and MARÍA J. NIETO: Cross-border coordination of prudential supervision and deposit guarantees.
1127 LAURA FERNÁNDEZ-CABALLERO, DIEGO J. PEDREGAL and JAVIER J. PÉREZ: Monitoring sub-central government spending in Spain.
1128 CARLOS PÉREZ MONTES: Optimal capital structure and regulatory control.
1129 JAVIER ANDRÉS, JOSÉ E. BOSCÁ and JAVIER FERRI: Household debt and labour market fluctuations.
1130 ANTON NAKOV and CARLOS THOMAS: Optimal monetary policy with state-dependent pricing.
1131 JUAN F. JIMENO and CARLOS THOMAS: Collective bargaining, firm heterogeneity and unemployment.
1132 ANTON NAKOV and GALO NUÑO: Learning from experience in the stock market.
1133 ALESSIO MORO and GALO NUÑO: Does TFP drive housing prices? A growth accounting exercise for four countries.
1201 CARLOS PÉREZ MONTES: Regulatory bias in the price structure of local telephone services.
1202 MAXIMO CAMACHO, GABRIEL PEREZ-QUIROS and PILAR PONCELA: Extracting non-linear signals from several economic indicators.
1203 MARCOS DAL BIANCO, MAXIMO CAMACHO and GABRIEL PEREZ-QUIROS: Short-run forecasting of the euro-dollar exchange rate with economic fundamentals.
1204 ROCIO ALVAREZ, MAXIMO CAMACHO and GABRIEL PEREZ-QUIROS: Finite sample performance of small versus large scale dynamic factor models.
1205 MAXIMO CAMACHO, GABRIEL PEREZ-QUIROS and PILAR PONCELA: Markov-switching dynamic factor models in real time.
1206 IGNACIO HERNANDO and ERNESTO VILLANUEVA: The recent slowdown of bank lending in Spain: are supply-side factors relevant?
1207 JAMES COSTAIN and BEATRIZ DE BLAS: Smoothing shocks and balancing budgets in a currency union.
1208 AITOR LACUESTA, SERGIO PUENTE and ERNESTO VILLANUEVA: The schooling response to a sustained Increase in low-skill wages: evidence from Spain 1989-2009.
1209 GABOR PULA and DANIEL SANTABÁRBARA: Is China climbing up the quality ladder?
1210 ROBERTO BLANCO and RICARDO GIMENO: Determinants of default ratios in the segment of loans to households in Spain.
1211 ENRIQUE ALBEROLA, AITOR ERCE and JOSÉ MARÍA SERENA: International reserves and gross capital flows. Dynamics during financial stress.
1212 GIANCARLO CORSETTI, LUCA DEDOLA and FRANCESCA VIANI: The international risk-sharing puzzle is at business-cycle and lower frequency.

1213 FRANCISCO ALVAREZ-CUADRADO, JOSE MARIA CASADO, JOSE MARIA LABEAGA and DHANOOS SUTTHIPHISAL: Envy and habits: panel data estimates of interdependent preferences.

1214 JOSE MARIA CASADO: Consumption partial insurance of Spanish households.

1215 J. ANDRÉS, J. E. BOSCÁ and J. FERRI: Household leverage and fiscal multipliers.

1216 JAMES COSTAIN and BEATRIZ DE BLAS: The role of fiscal delegation in a monetary union: a survey of the political economy issues.

1217 ARTURO MACÍAS and MARIANO MATILLA-GARCÍA: Net energy analysis in a Ramsey-Hotelling growth model.

1218 ALFREDO MARTÍN-OLIVER, SONIA RUANO and VICENTE SALAS-FUMÁS: Effects of equity capital on the interest rate and the demand for credit. Empirical evidence from Spanish banks.

1219 PALOMA LÓPEZ-GARCÍA, JOSÉ MANUEL MONTERO and ENRIQUE MORAL-BENITO: Business cycles and investment in intangibles: evidence from Spanish firms.

1220 ENRIQUE ALBEROLA, LUIS MOLINA andPEDRO DEL RÍO: Boom-bust cycles, imbalances and discipline in Europe.

1221 CARLOS GONZÁLEZ-AGUADO and ENRIQUE MORAL-BENITO: Determinants of corporate default: a BMA approach.

1222 GALO NUÑO and CARLOS THOMAS: Bank leverage cycles.

1223 YUNUS AKSOY and HENRIQUE S. BASSO: Liquidity, term spreads and monetary policy.

1224 FRANCISCO DE CASTRO and DANIEL GARROTE: The effects of fiscal shocks on the exchange rate in the EMU and differences with the US.

1225 STÉPHANE BONHOMME and LAURA HOSPIDO: The cycle of earnings inequality: evidence from Spanish social security data.

1226 CARMEN BROTO: The effectiveness of forex interventions in four Latin American countries.

1227 LORENZO RICCI and DAVID VEREDAS: TailCoR.

1228 YVES DOMINICY, SIEGFRIED HÖRMANN, HIROAKI OGATA and DAVID VEREDAS: Marginal quantiles for stationary processes.

1229 MATTEO BARIGOZZI, ROXANA HALBLEIB and DAVID VEREDAS: Which model to match?

1230 MATTEO LUCIANI and DAVID VEREDAS: A model for vast panels of volatilities.

1231 AITOR ERCE: Does the IMF's official support affect sovereign bond maturities?

1232 JAVIER MENCÍA and ENRIQUE SENTANA: Valuation of VIX derivatives.

1233 ROSSANA MEROLA and JAVIER J. PÉREZ: Fiscal forecast errors: governments vs independent agencies?

1234 MIGUEL GARCÍA-POSADA and JUAN S. MORA-SANGUINETTI: Why do Spanish firms rarely use the bankruptcy system? The role of the mortgage institution.

1235 MAXIMO CAMACHO, YULIYA LOVCHA and GABRIEL PEREZ-QUIROS: Can we use seasonally adjusted indicators in dynamic factor models?

1236 JENS HAGENDORFF, MARÍA J. NIETO and LARRY D. WALL: The safety and soundness effects of bank M&As in the EU: Does prudential regulation have any impact?

1237 SOFÍA GALÁN and SERGIO PUENTE: Minimum wages: do they really hurt young people?

BANCO DE **ESPAÑA**
Eurosistema

Unidad de Servicios Auxiliares
Alcalá, 48 - 28014 Madrid
Telephone +34 91 338 6360
E-mail: publicaciones@bde.es
www.bde.es