MINIMUM WAGE AND EMPLOYMENT:

the case of Spain

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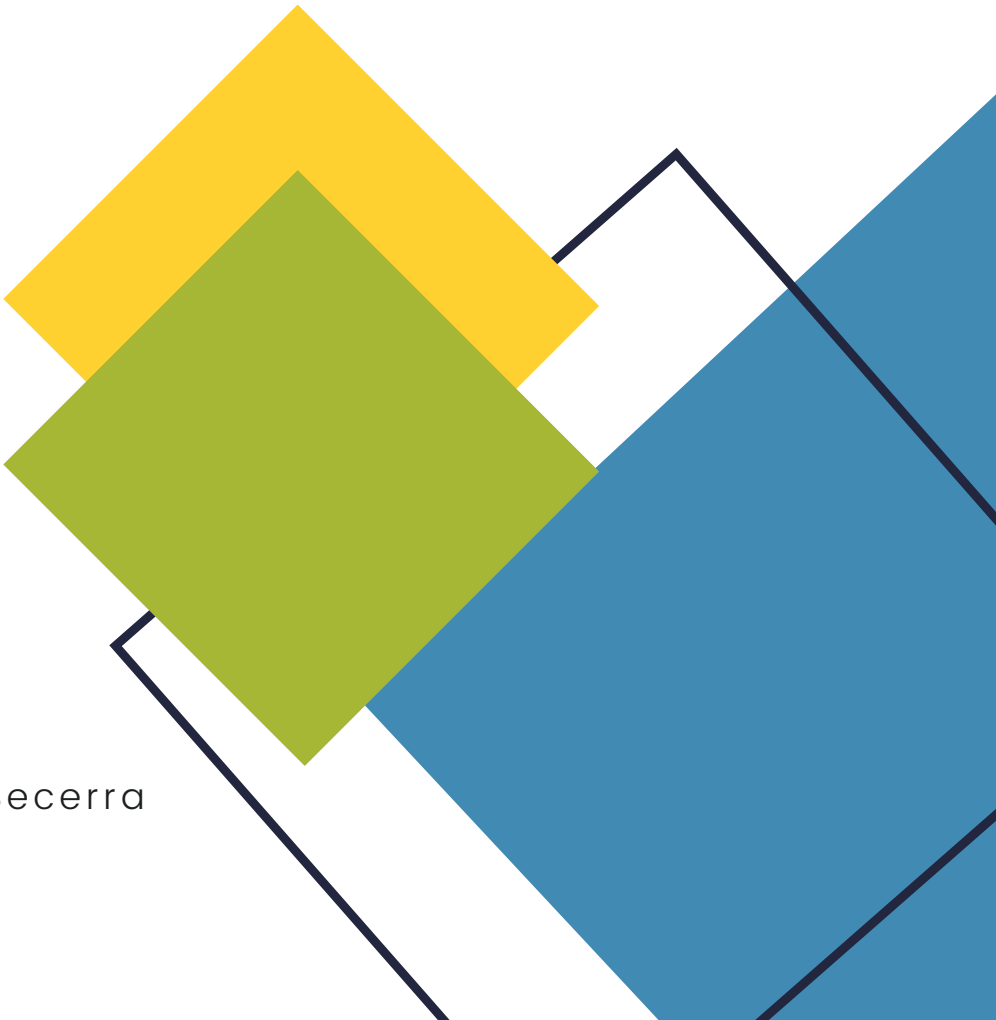

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ABSTRACT

Minimum wage policies are intended to increase the standards of living of low-wage workers and reduce income inequality. However, there are concerns that minimum wage increases could have a negative impact on employment for several reasons. This study examines the effects of increases in the minimum wage on the level of employment in Spain between 2008 and 2019, considering the average wage and checking for potential different effects on women. Our OLS estimates show that minimum wage increases have a negative impact on employment when they are not accompanied by a proportional increase in average wages. On the contrary, when minimum wages increase at the same rate as average wages do, the effects on employment prove to be positive. As for women, our OLS estimates show that, indeed, effects are different for the female population, but, contrary to what we would have expected, not in a negative way.

Key words: minimum wage, employment, Kaitz Index, average wages

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INTRODUCTION

There has been a long and ongoing debate amongst economists about minimum wages. There seems to be no agreement on which and to what extent their effects might be, when being introduced or increased. Indeed, they are a double-edged economic tool. While they can be beneficial in many aspects, they can also cause other undesired effects, which can be tricky and difficult to predict. These effects — both the positive and the negative— can be assessed from many approaches as they are related to many aspects, such as inequity, poverty, price levels, employment, and even more as we widen the circle. In this study, we will focus on how minimum wages may have an impact on employment, leaving aside its potential effects in other fields, which would require further discussion.

This study aims to analyse the relationship between minimum wages and employment in Spain, controlling by autonomous community, age group, time trend, and sex. Because the various theories do not appear to be in agreement, empirical evidence must be used to predict any relationship. Nevertheless, conclusions drawn from empirical evidence in some contexts cannot be applied lightly to another context, as economic measures' effects depend on a wide range of conditions and characteristics. Consequently, as the impact of policies may differ among countries or regions with different features, it is important to examine the own data of the country in which we wish to see the effect in order to draw any conclusions. This is precisely what this study will do.

Thus, the goal is not to prove one theory right or wrong, nor to find any universal answers to the discussion, which would be merely unrealistic, but to analyse the behaviour of the studied variables in this particular country and period of time (2008-2019), while checking how economic theories and previous studies gathered about this topic might be applicable to our case.

The main indicator used in the study is the Kaitz Index, constructed with the average wage[1], one of the most widely used indicators in the literature, which is nothing other than a minimum-to-average wage ratio. It is a useful tool since it enables an analysis of the minimum wage not in an isolated way but studied along with the average wage level, which is a crucial variable, as it plays a surprisingly large role.

The hypotheses we want to prove have their foundations in the classic economic theory, which states that minimum wage increases above the equilibrium will be

[1] It can also be constructed with the median wage.

followed by a decrease in employment. We reformulated this general hypothesis, including the minimum-to-average wage ratio, into the following two hypotheses.

First, we hypothesize that employment is negatively related to the minimum-to-average wage ratio, implying that, as the ratio rises, employment decreases. The ratio increases either when the minimum wage is raised while the average wage level remains unchanged (or grows at a lower proportion), or when the average wage decreases. Our second hypothesis is that when increases in the minimum wage are followed by proportional increases in the average wage level (thus maintaining the ratio constant), they have a positive impact on employment. The latter derives from the idea that an increase in the minimum wages will increase the consumption of those earning the minimum wage –and thus, aggregate demand– which will bring with it an increase in production and, therefore, an increase of both the labour demand and wages. Also, we want to check if women, as a vulnerable group, may be affected differently by minimum wage changes.

In order to prove these hypotheses, data from reliable sources such as the Instituto Nacional de Estadística (INE) and Eurostat was collected and sorted into a database that will allow us to empirically study the underlying relationships using econometric tools. The database contains information about wages, employment and GDP growth in Spain by region, sex, and age group, throughout the period of 2008-2019.

Our results agree with both hypotheses. According to our estimators, when the minimum-to-average ratio increases by 1%, employment decreases by 1.47%. However, when the minimum wage increases by 1% while the ratio remains unchanged, we observe that employment increases by 1.18%. Also, unexpectedly, we found that in this particular case, women were not negatively affected at a greater rate, as some studies do suggest. Instead, when the minimum wage rises while the ratio remains still, employment has proved to increase more in women than in men.

The structure of the paper is as follows. We first explain the existing theories on the topic and some previous results found in literature. Next, we present the criteria followed to set minimum wages and the indicators used in literature in order to measure its generosity, along with some graphs that show the Spanish case in data. Then, we explain and develop our empirical study and, finally, we present our results and conclude the paper.

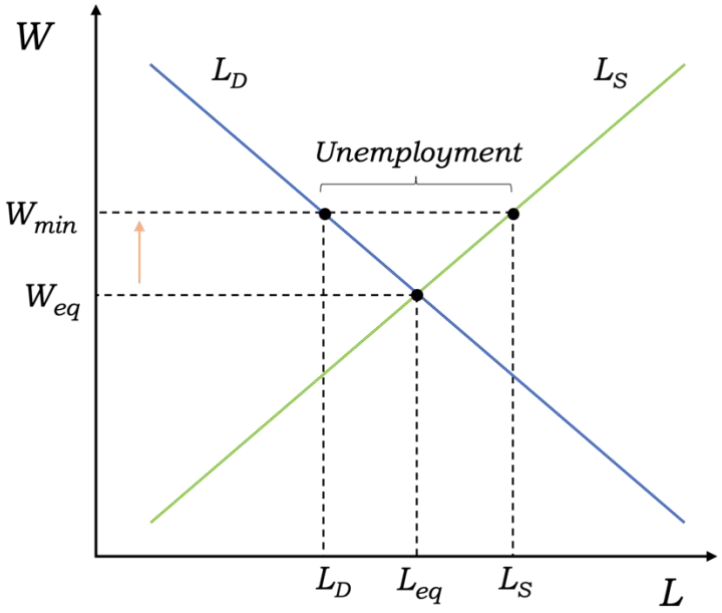
CONCEPTS AND LITERATURE REVIEW

The minimum wage discussion

There have been numerous discussions about the potential consequences of raising the minimum wage. It is a measure aimed at tackling abusive low wages, wage inequality, and poverty. However, some argue that it can cause job losses and lead to ambiguous welfare effects (Campos-Vazquez & Esquivel, 2021).

On the one hand, according to the classic economic theory, an increase of the minimum wage in a perfectly competitive labour market, will bring a labour supply surplus, which means unemployment. Its logic is obvious and easily observable in the model of the labour market (see Figure 1). If the wage is increased above the equilibrium, it will lead to an imbalance between labour supply and labour demand, the latter being inferior, which means that there is unused labour force, that is, unemployed people.

Figure 1. Competitive labour market model

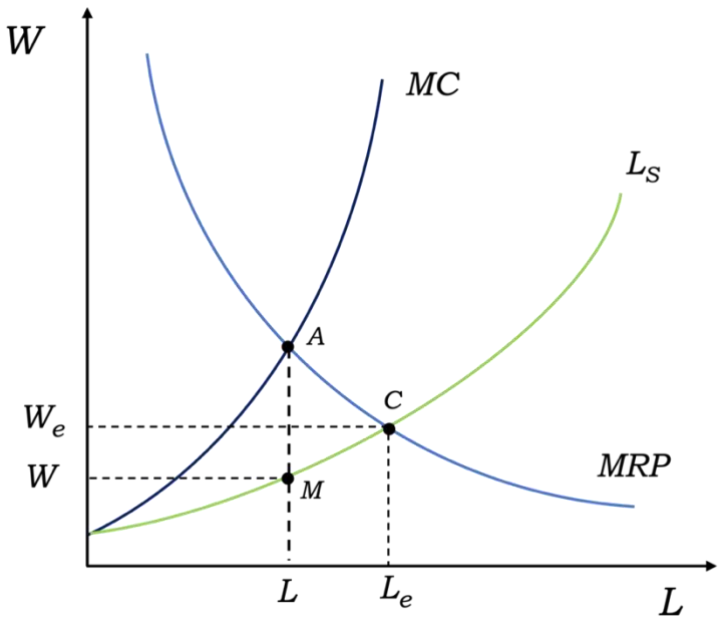


On the other hand, many empirical studies have indicated little impact or none at all. Instead, they claim to see increased worker earnings, higher growth rates (due to the measure inducing workers to accumulate human capital in order to avoid unemployment), and an overall improvement in individual welfare (Cahuc & Michel, 1996; Campos-Vazquez & Esquivel, 2021; Pantea, 2020). Others found that the introduction of the minimum wage led to a significant reduction in marginal employment in the first two years after the reform, but found no evidence that it caused regular employment to significantly decline over the respective period (Bonin et al., 2020).

A neoclassical way out of this contradiction was the monopsony case (Herr et al., 2009), that is, when there is an inequality of power amongst the labour market agents. Monopsonist employers, as they have more influence and power in the market, can fix wages lower than equilibrium ones. As we can see in Figure 2,

monopsonist employers –following the maximization criterion (Marginal Revenue Product (*MRP*) equals Marginal Cost (*MC*), point A in the figure)– use the amount of labour *L*, at the price *W*, where it meets the labour supply curve (point M in the figure). Hence, the wage set by the employer (w) is inferior to the one set by the market in a competitive context (w_e) which is given by labour supply curve meeting the labour demand curve (point C). Notice then, that in a monopsony context, both the wage and the level of employed people is lower than it could be. Given this scenario, an increase or the introduction of a minimum wage until the equilibrium level, would only increase labour (from L to L_e), as all those workers unwilling to work for such a low wage would now enter the market.

Figure 2. Monopsony labour market model



Alternatively, from a Keynesian perspective, the employment effects of a minimum wage are indeterminate; in the case of homogeneous work, only nominal wages should be affected, while real wages –and thus aggregate demand– are predicted to remain unchanged, which means that no relevant positive or negative employment effects resulting from changes in minimum wages can be expected (Herr et al., 2009).

As the International Labour Organization points out, other macro-economic theories highlight the fact that higher wages not only raise labour costs for employers, but they also boost consumption demand among low-wage employees and their families, and their propensity to increase consumption when their income grows is higher than in rich households. Therefore, assuming there are no large negative effects on external competitiveness (which might be the case for very export-oriented economies) or investment, such positive "consumption effects" can lead to increases in aggregate demand and employment. Macro-economic perspectives show that even if some low-productivity firms reduce employment or go out of business, this does not necessarily mean that aggregate employment will be reduced. Employment may expand in other firms and higher wages may attract more people into the labour market (International Labour Office, 2014).

Furthermore, it is not only about overall employment, since some claim that an increase in the minimum wage may also lead to substitution effects between different types of workers (the firing of less-skilled workers and hiring of those with more skills) (Campos-Vazquez & Esquivel, 2021) or have effect only in some kinds of jobs, such as security or cleaning services, for instance (Herr & Kazandziska, 2011). That is why it is interesting to focus on the study of specific groups such as youth, unskilled or female workers that might be particularly affected by the measure. Also, it can have a different and probably higher impact when it comes to emerging economies, which are usually countries whose competitiveness depends more on low labour costs (Pantea, 2020).

Thus, given the ambiguous theoretical predictions, the impact of minimum wages on the labor market remains an empirical question (Bonin et al., 2020) that is convenient to be answered for each particular case.

Some other facts have been shown to affect economies with high minimum wages more than others. For example, the polarization process was proved to have negative impacts on employment only in high minimum wage countries (Maarek & Moiteaux, 2021). The polarization of the labour market consists of a significant increase in the proportion of people employed in high-paying abstract occupations and low-paying manual occupations, as compared to the proportion of people employed in routine occupations in the middle of the wage distribution. It is a well-documented phenomenon that is increasingly affecting developed countries, resulting in wage disparities and rising poverty levels.

Criteria for setting an appropriate minimum wage

As well as theories about minimum wage effects, many different criteria on how to set them can be found in the literature. Setting and adjusting the level is likely the most difficult –and at the same time most important– aspect of determining the minimum wage. Minimum wages, if set too low, will have little effect in safeguarding workers and their families from low pay or poverty. If minimum wages are set excessively high, they might be violated and/or result in negative employment outcomes. According to Keynes, minimum wage policies should be based on the following principles (Herr et al., 2009):

a) Minimum wages must affect a sufficient number of employees,

b) they should be adjusted frequently,

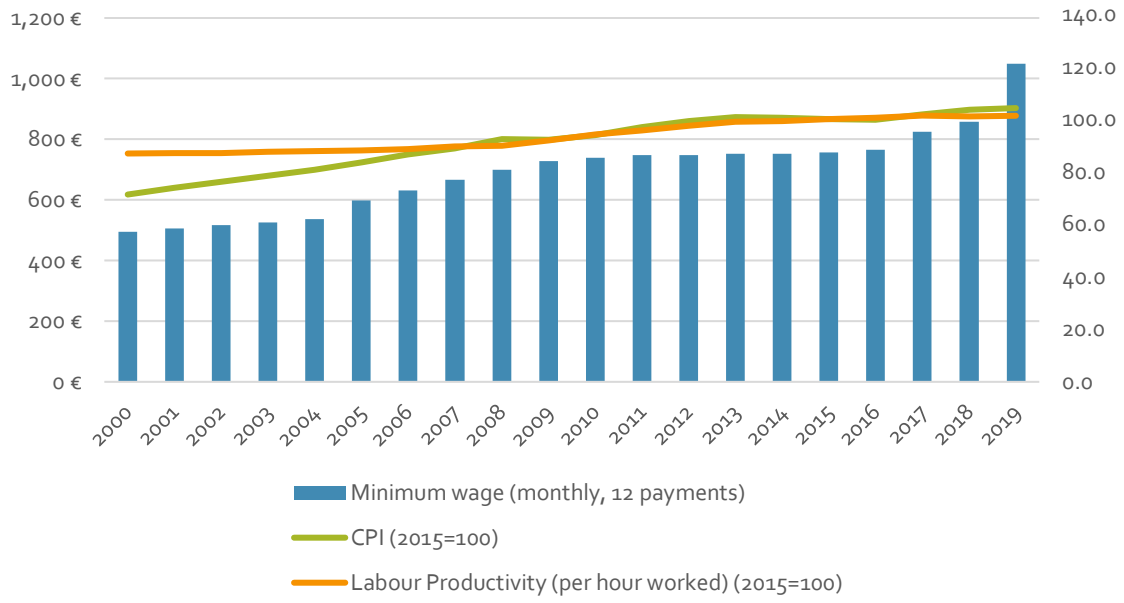
c) they should increase at least according to trend productivity growth plus the central bank's target inflation rate,

d) they should increase at least in line with average wages because this is the only way to prevent an increase in the wage gap. As long as low wages are considered to be too low in comparison to average wages, minimum wages should increase faster than average wages.

It is also important that periodical adjustments are not only based on mathematical formulae and theoretical criteria, but also discussed with social partners and affected collectives. In Spain, according to Instituto Nacional de Estadística (INE), the minimum wage is regulated by the Government annually, after consultation with the most representative Trade Union Organizations and business associations, taking into account the Consumer Price Index, the average national productivity achieved, the increase in labor participation in national income and the general economic situation.

We have elaborated a graph which includes the evolution of the minimum wage along with the consumer price index (CPI) and an index of labour productivity within the period from 2000 to 2019. This allows us to see the actual adjustments more clearly, and whether they were made in accordance to some of the specified criteria.

Figure 3. Minimum wage along with the CPI and the labour productivity evolution.



Source: own elaboration with data from The World Bank and Eurostat.

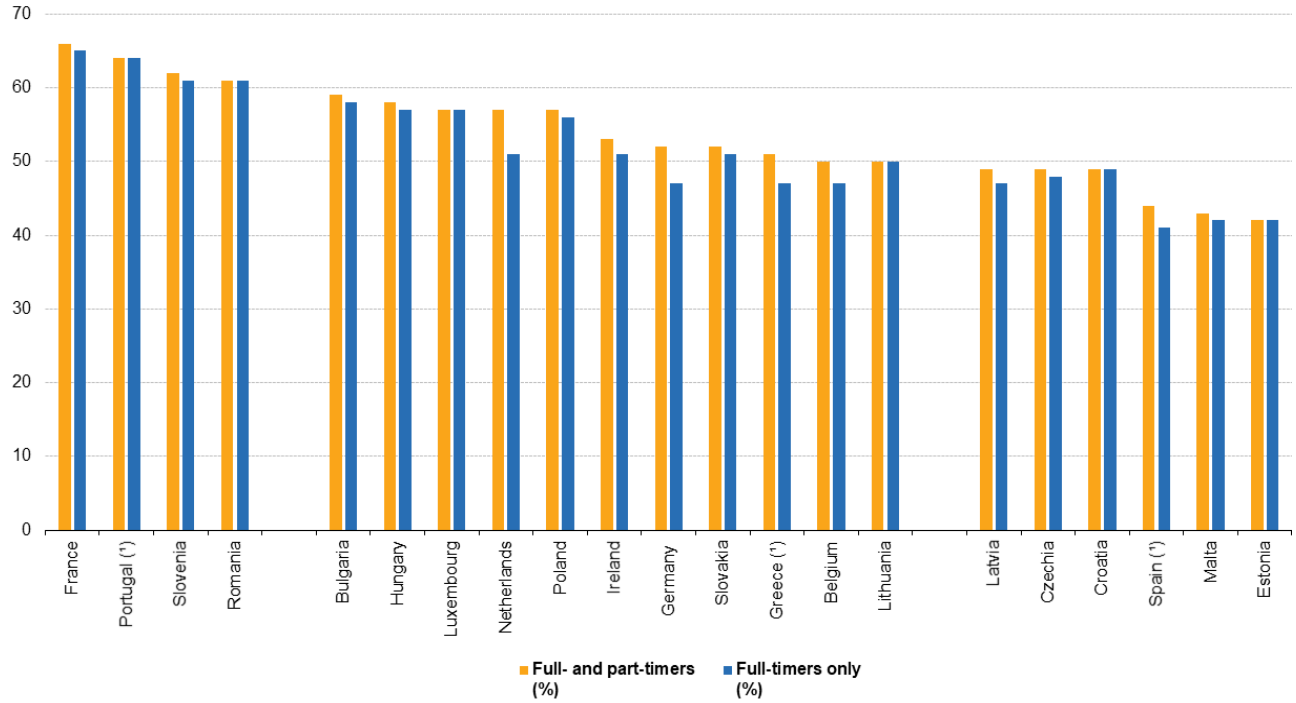
As shown in the graph above, the general trend between 2000 and 2016 was to maintain the minimum wage's purchasing power by periodically adjusting its value in line with changes in the country's CPI (see Figure 3). It is not until 2017 that the series of increases is such that, between 2017 and 2020, the minimum wage increased by an accumulative 31.1% in terms of purchasing power, according to a report of The Barcelona Chamber of Commerce (2020). However, in the previous years (2010-2016), both the CPI and labour productivity were growing, while the changes in the minimum wage were rather slight, possibly due to the fragile economic situation caused by the crisis.

Main indicators

Many authors agree that the main indicator of the generosity of minimum wages is the ratio of the minimum wage to the average (or mean) wage, also referred to as Kaitz Index. According to Rutkowski (2003) the higher the ratio the better is the relative position of minimum wage workers, but also the larger the “bite” of the minimum wage, that is its potentially harmful employment effects. The minimum wage/average wage ratio is used to both describe and guide policy decisions in the minimum wage system. A decrease in this ratio, unless deliberate and agreed among social partners, often spurs upward minimum wage adjustments so as to maintain the minimum wage at a fixed level relative to the mean wage (Rutkowski, 2003).

As mentioned above, this indicator can be constructed both with the average and the median wage. Using the median wage is an option many take in order to avoid alterations caused by the presence of atypical values or by changes at the upper end of the wage distribution, such as increases in highly skilled professional workers’ salaries, and also to take into account labour market conditions faced by low-productivity workers, according to Rutkowski. Below we can see this relationship across the EU countries that have minimum wages.

Figure 4. Minimum wages as a proportion of median gross earnings, 2018 (%)



Median earnings refer to the level of earnings, which divides the employees into two equal groups: half earn less than the median and half earn more. Data refer to the gross monthly earnings covering the wages and salaries earned by full-time and part-time employees in the reference month (October 2018 in most countries) before any tax and social security contributions are deducted.

(1) The levels mentioned in the table are calculated excluding 13th and 14th month to be consistent with the monthly earnings based on SES 2018

Source: Eurostat.

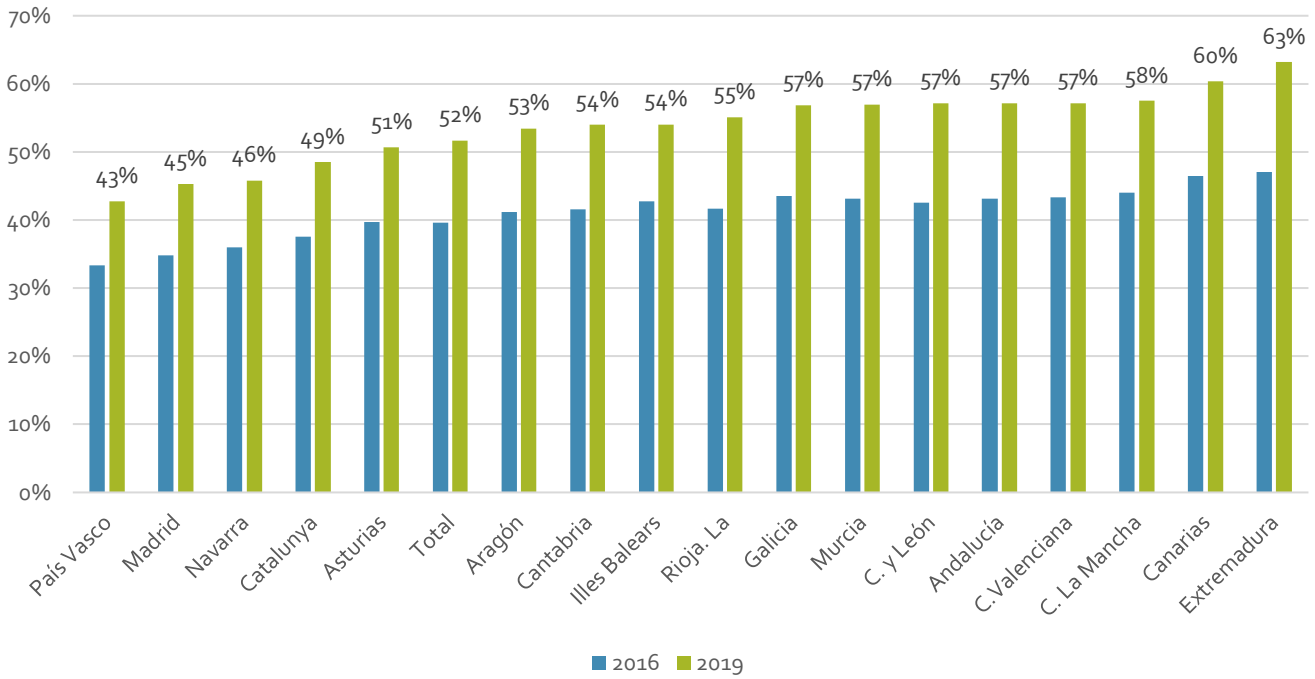
Spain, in 2018, was among the countries with a lower ratio of minimum wage to median gross earnings, as shown in the graph. This ratio means that the minimum wage in Spain represents 44% of the median gross earnings, which are the earnings of the worker in the middle of an ordered income scale. While in France, the country with the highest ratio, the minimum wage is equivalent to 66% of the median gross income, which means that their minimum salary is 22 percentage points more generous in relation to the country's mean wage than the Spanish. Note that this is merely a measure of how the minimum wage compares to the rest of the country's wages; it does not account for purchasing power or the possibility that the country's mean salary might be too low.

As for our study, there is no data available concerning the median wage by autonomous communities, so we will be working with the average wage. It would be a bigger issue when comparing between different countries, but within the same one, potential changes at the upper end of the wage distribution might be similar enough

not to alter the index significantly. However, it does weaken the results of the women to men comparison, precisely because their salaries might be differently distributed.

Also, it is interesting to note that, as the minimum wage is set nationally, the ratio between the national wage and the average wage fluctuates considerably between the Autonomous Communities (see Figure 5). Specifically, in 2019, there was a difference of 20% between the lowest value (País Vasco) and the highest (Extremadura). This means that in 2019, the minimum wage in Extremadura represented 63% of the average wage, while in País Vasco it represented only 43%, because the latter's average wage was higher. The country's total is somewhere in the middle, with a ratio of 52% in 2019. Also, notice that from 2016 to 2019, all ratios have substantially increased, around ten and fifteen percentage points, which is explained by the last years' higher raises of the minimum wage.

Figure 5. Ratio of minimum wage and average wage per autonomous community.



Source: own elaboration using data from INE and Eurostat.

As for its evolution these past years, as mentioned above, the higher increases in the Spanish minimum wage started in 2017. Before that, the series of increases were quite moderate. Average wage growth has been light but steady, as shown in graph 6. Therefore, from 2017 on, the ratio of both variables has seen a rather large increase.

Figure 6. Evolution of the minimum and average wage and its ratio by sex.

Source: own elaboration using data from INE and Eurostat.

Also notice (see Figure 6) how the women's ratio line is always higher than the men's. That is because the average gains of women have been inferior to men's throughout the whole period, while the minimum wage is the same for all. Precisely because of that, minimum wages could make a significant contribution towards the gender pay gap. However, if Rutkowski's statement mentioned above (the higher the ratios, the greater the risk of suffering negative consequences) holds true on a smaller scale, women are also more likely to be negatively affected. Indeed, many studies have shown that female workers, along with youth and low-skilled workers, constitute one of the demographic groups that can be most negatively affected by changes in the minimum wage (Addison & Ozturk, 2012; Dreepaul-Dabee & Tandrayen-Ragoobur, 2022; Jiménez Martínez & Jiménez Martínez, 2021). We will see below if this applies to our data.

Finally, we can see a plot of the minimum wage growing rate in Spain during the period 2006 to 2021, along with the average wage growing rate for those periods in which data is available, and the employment rates of men and women separately.

Figure 7. Minimum and average wage growth rates along with employment rate by sex.

Source: own elaboration using data from INE and Eurostat.

* Growth rates take reference in primary axis (right) and employment rates, in secondary axis (left).

There seems to be a slight pattern when the minimum wage growth rate is high, the subsequent periods have a lower rate of employment, while when the average wage growth has been higher or maintained a similar growth rate to the minimum wage (2011-2016) the subsequent years saw an increase in employment. However, we can see that the employment rate is strongly influenced by the economic cycle. It starts with high levels, which correspond to the period of the real estate bubble. We see how, after 2007, it has a downward trend due to the subsequent crisis, then its level escalates as the economy recovers from the downturn, until the COVID-19 pandemic erupts in 2020, which brings it down again. That is why we will introduce a time trend control variable, so we can eliminate this effect in our estimates and be able to see the relationship between the variables more clearly. Also note that women's employment rate has been less volatile, mainly because it was already at a much lower level, which has only been maintained throughout the period.

EMPIRIC ANALYSIS AND VARIABLES

The database we are working with consists of 170 cross-section units observed over 13 periods, which makes a total of 2210 observations[2]. The sample was given a panel structure by using index variables (*ident*). It contains data collected by the Spanish National Statistical Institute (INE) and Eurostat, about employment (*empl*), GDP growth (*growthGDPcap*), average earnings (*wage*), minimum wage (*minwage*) and the ratio of minimum wage to average wage –the so-called Kaitz Index– (*minaveratio*) by age group, sex (*sex*) and autonomous community (*ac*) throughout a period of 13 years (*year*). The first unit, for example, would be men between 16 and 25 from Andalucía (ac=1, sex=1, age=1). For it, as for every other unit, the database contains information about its employment, minimum wage, average wage, GDP per capita growth and the ratio of these last two from 2008 to 2020.

The main variable of study is *employ*, it consists of the four-quarter average of employed people, in thousands of people. Subsequently, we have the above mentioned Kaitz Index, expressed with the variable *minaveratio*, which consists of the quotient of *minwage* and *wage* (*minwage/wage*), expressed in percentage. The variable *minwage* contains the annual minimum wage (for full-time workers) set in the country for that period, in euros, and the variable *wage* collects data on average annual earnings per worker, in euros. Natural logarithms were applied to the four continuous variables (i.e. empl, wage, minwage, minaveratio).

In the regressions that will be carried out, the variable that will be taken as the dependent is *employ*, as we want to see how the minimum wage influences employment and how it does so along with the average wage, controlling the factors of autonomous community, sex and time. Therefore, the main independent variable is *minaveratio*, as it contains information about the minimum wage in relation to the average wage for each of the studied units.

As mentioned above, the ratio of minimum wage to average (*minaveratio*), also known by Kaitz Index, is considered one of the strongest indicators to describe the generosity of minimum wages. It is as follows:

$$Kaitz\ Index = \frac{Minimum\ wage}{Average\ wage}$$

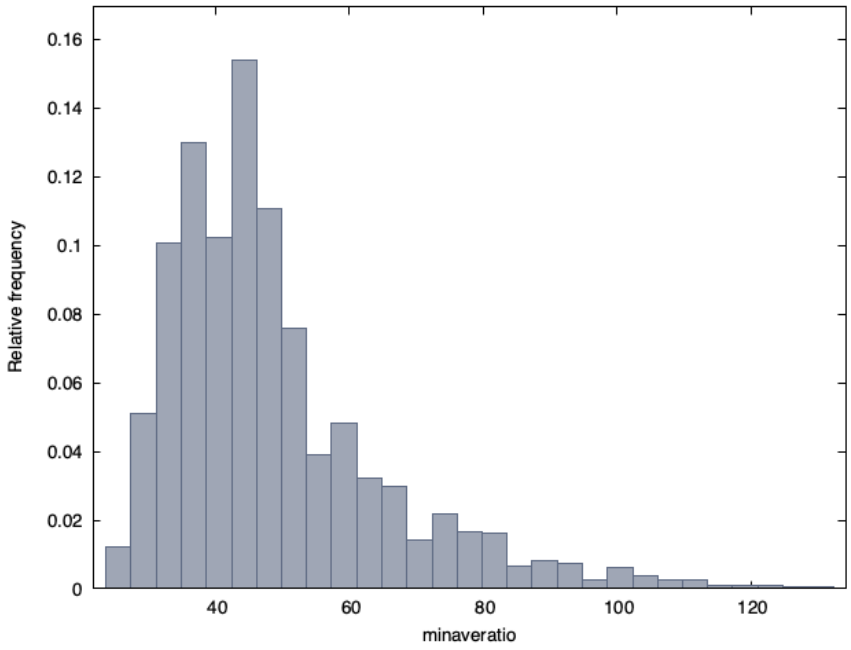
By its nature, when there is an increase in the minimum wage along with an increase in the average wage, the ratio will remain at the same value. The ratio is

[2] As the average earnings are not yet available in 2020, the final workable size of the database is 1914 observations.

altered either when average wage increases are not followed by a raise in the minimum wage, in which case the ratio diminishes, or when there is a raise in the minimum wage with a smaller or no increase in the average wage, then the ratio increases.

In Figure 8, we can see that the majority of units find themselves between a minimum-to-average wage ratio of 30% and 50%. Which means that on an important part of the cases the minimum wage represents between a 30% and 50% of the average wage they have. In other words, a worker earning the minimum wage is earning between 30% and 50% of the average wage of their unit. The higher level, the better situation of the minimum wage workers but also the higher risk of counter-productive effects.

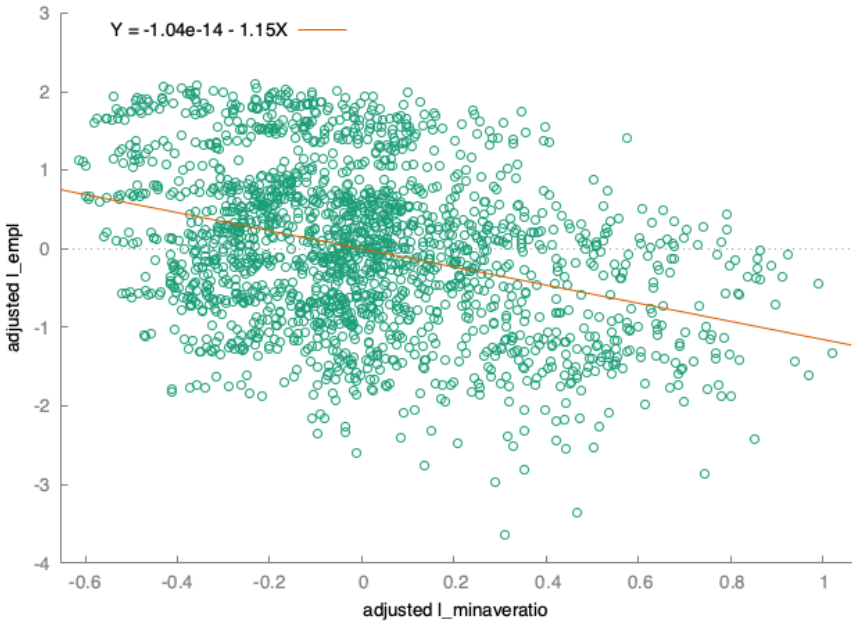
Figure 8. Frequency chart of variable *minaveratio*



The first of our hypotheses is that employment is negatively related to the minimum-to-average wage ratio; that is, an increase in the ratio would lead to a decrease in employment.

As we can see below (Figure 9), the dispersion graph of the two variables adjusted by the GDP per capita trend seems to indicate agreement with the hypothesis. When the ratio increases, the employment tendency is to decrease. In particular, according to this first estimate, it decreases by 1.15%, though we shall conduct a proper regression in order to determine a more accurate value.

Figure 9. Dispersion plot of variable *l_empl* versus *l_minaveratio* (with least squares fit), with the GDP per capita growth as control variable



For further testing, a pooled OLS regression will be carried out using the natural logarithm of *minaveratio* as the main independent variable. The specification is as follows:

$$Y_{it} = \beta_0 + \beta_1 \; l\_minaveratio_{\,it} + \beta_2 \; time_{\,it} + \varepsilon_{it}$$

where Y_{it} represents the natural logarithm of employment being examined for unit *i* in year *t*, *l_minaveratio,* the natural logarithm of the minimum wage to average wage ratio, also being examined for unit *i* in year *t,* and *time* is a set of time dummies that represent the time trend in order to control economic fluctuation and other potential time-related trends.

Model 1: Pooled OLS, using 1914 observations
included 170 cross-sectional units
time-series length: minimum 2, maximum 12

Dependent variable: l_empl					
	coefficient	std. error	t-ratio	p-value	
const	9.00695	0.29326	30.71225	1.51E-168	***
l_minaveratio	-1.25583	0.07517	-16.70471	1.47E-58	***
dt_2	0.00330	0.10321	0.03200	0.97447	
dt_3	-0.08185	0.10260	-0.79782	0.42507	
dt_4	-0.02817	0.10324	-0.27290	0.78495	
dt_5	0.02881	0.10456	0.27552	0.78294	
dt_6	0.06137	0.10597	0.57914	0.56255	
dt_7	-0.03073	0.10437	-0.29451	0.76839	

dt_8	0.06123	0.10540	0.58095	0.56134	
dt_9	0.11698	0.10596	1.10407	0.26969	
dt_10	0.19343	0.10543	1.83457	0.06672	*
dt_11	0.21860	0.10500	2.08183	0.03749	**
dt_12	0.44088	0.10652	4.13886	3.64E-05	***

Mean dependent var	4.26469035	S.D. dependent var	1.01016461
Sum squared resid	1695.73532	S.E. of regression	0.94446958
R-squared	0.13132205	Adjusted R-squared	0.12583855
F(12, 1901)	23.9485784	P-value(F)	2.04E-50
Log-likelihood	-2599.9759	Akaike criterion	5225.95183
Schwarz criterion	5298.19218	Hannan-Quinn	5252.53599
Rho	0.98927105	Durbin-Watson	0.038818

Although this first model is quite poor in terms of explanatory power (as the R-squared is only 13%), we can see how the variable has individual significance (as it has a p-value lower than 1%). This gives us a hint that the relationship might be statistically significant, but we should add more variables in order to find a better fitting model. The variable *time*, accounting for time-related trends, indicates that the employment level was higher in the last three periods than in the first one, exactly by 0.19, 0.21 and 0.44 points respectively in 2017, 2018 and 2019 in contrast with 2008.

In a second pooled OLS regression, fictitious variables were added to the non-dichotomous qualitative variable, that is, *ac*. One category was left out in order to avoid multicollinearity. The left-out (and thus, the reference) one was Comunidad de Madrid (=13). The specification is as follows:

$$Y_{it} = \beta_0 + \beta_1\ l\_minaveratio_{it} + \beta_2\ ac_{it} + \beta_3\ time_{it} + \varepsilon_{it}$$

Model 2: pooled OLS, using 1914 observations
included 170 cross-sectional units
time-series length: minimum 2, maximum 12

Dependent variable: l_empl
Robust (HAC) standard errors
Omitted due to exact collinearity: dt_1, dac_13

	coefficient	std. error	t-ratio	p-value	
const	10.90398	0.42777	25.49004	0.00000	***
l_minaveratio	-1.46833	0.10949	-13.41118	0.00000	***
dac_1	0.27442	0.19736	1.39044	0.16623	
dac_2	-1.39555	0.16566	-8.42415	0.00000	***
dac_3	-1.68209	0.16960	-9.91780	0.00000	***
dac_4	-1.50095	0.17640	-8.50883	0.00000	***
dac_5	-0.91056	0.19164	-4.75147	0.00000	***
dac_6	-2.11299	0.16474	-12.82615	0.00000	***
dac_7	-0.76850	0.17080	-4.49937	0.00001	***
dac_8	-1.00080	0.18506	-5.40801	0.00000	***
dac_9	0.22372	0.16398	1.36431	0.17429	

dac_10	-0.07527	0.17474	-0.43075	0.66720	
dac_11	-1.59711	0.19242	-8.30005	0.00000	***
dac_12	-0.65226	0.17633	-3.69910	0.00029	***
dac_14	-1.29582	0.19506	-6.64326	0.00000	***
dac_15	-2.23684	0.16489	-13.56529	0.00000	***
dac_16	-1.19584	0.17719	-6.74900	0.00000	***
dac_17	-2.72917	0.16640	-16.40157	0.00000	***
dt_2	-0.01666	0.01395	-1.19435	0.23402	
dt_3	-0.07464	0.01779	-4.19571	0.00004	***
dt_4	-0.04367	0.01908	-2.28904	0.02331	**
dt_5	-0.01947	0.02198	-0.88592	0.37692	
dt_6	0.00713	0.02324	0.30691	0.75929	
dt_7	-0.07024	0.02677	-2.62409	0.00948	***
dt_8	0.00428	0.02462	0.17392	0.86213	
dt_9	0.06405	0.02599	2.46398	0.01474	**
dt_10	0.16332	0.02642	6.18178	0.00000	***
dt_11	0.19450	0.02772	7.01675	0.00000	***
dt_12	0.47722	0.03852	12.39022	0.00000	***

Mean dependent var	4.26469	S.D. dependent var	1.01016
Sum squared resid	346.03570	S.E. of regression	0.42845
R-squared	0.82274	Adjusted R-squared	0.82010
F(28, 169)	38.67299	P-value(F)	2.53814E-59
Log-likelihood	-1078.98730	Akaike criterion	2215.97459
Schwarz criterion	2377.12616	Hannan-Quinn	2275.27772
Rho	0.94323	Durbin-Watson	0.08724

Robust standard errors had to be applied in order to correct heteroskedasticity.

We can now see how the goodness-of-fit has increased up to 82.27%, this means that 82.27% of the data fit the regression model, which is quite a good value. Also, we can observe that most of the variables are individually significant to 1% or 5%, as their p-values are under these levels.

Specifically, our main variable of interest appears to be highly significant. Thus, indicating that, when there is a 1% increase of the minimum to average wage ratio, *ceteris paribus*, there is a decrease of 1.47% in employment.

As for the autonomous communities, amongst those who are statistically significant, we can see that they all indicate a lower level of employment than that of the reference category, which is Madrid. For example, *dac_17*, which stands for La Rioja, shows an employment level of 2.73% lower than in Madrid. Time related differences are significant in years 2010, 2011 and 2014, which have lower levels of

employment than 2008; and also 2017, 2018 and 2019 are significant, which have higher levels than in 2008.

In a third pooled OLS regression, the variable *l_minwage* was also added to the model, in order to prove the second of our hypotheses. That is, when the minimum wage is increased while the minimum-to-average wage remains unchanged, the employment will increase. The specification is as follows:

$$Y_{it} = \beta_0 + \beta_1\ l\_minaveratio_{it} + \beta_2\ l\_minwage_{it} + \beta_3\ ac_{it} + \beta_4\ time_{it} + \varepsilon_{it}$$

Model 3: pooled OLS, using 1914 observations
Included 170 cross-sectional units
Time-series length: minimum 2, maximum 12"

Dependent variable: l_empl Robust (HAC) standard errors Omitted due to exact collinearity: dt_1, dac_13					
	coefficient	std. error	t-ratio	p-value	
const	0.26892	0.67195	0.40020	0.68951	
l_minaveratio	-1.46833	0.10949	-13.41118	0.00000	***
l_minwage	1.17697	0.09499	12.39022	0.00000	***
dac_1	0.27442	0.19736	1.39044	0.16623	
dac_2	-1.39555	0.16566	-8.42415	0.00000	***
dac_3	-1.68209	0.16960	-9.91780	0.00000	***
dac_4	-1.50095	0.17640	-8.50883	0.00000	***
dac_5	-0.91056	0.19164	-4.75147	0.00000	***
dac_6	-2.11299	0.16474	-12.82615	0.00000	***
dac_7	-0.76850	0.17080	-4.49937	0.00001	***
dac_8	-1.00080	0.18506	-5.40801	0.00000	***
dac_9	0.22372	0.16398	1.36431	0.17429	
dac_10	-0.07527	0.17474	-0.43075	0.66720	
dac_11	-1.59711	0.19242	-8.30005	0.00000	***
dac_12	-0.65226	0.17633	-3.69910	0.00029	***
dac_14	-1.29582	0.19506	-6.64326	0.00000	***
dac_15	-2.23684	0.16489	-13.56529	0.00000	***
dac_16	-1.19584	0.17719	-6.74900	0.00000	***
dac_17	-2.72917	0.16640	-16.40157	0.00000	***
dt_2	-0.06282	0.01307	-4.80828	0.00000	***
dt_3	-0.13829	0.01698	-8.14586	0.00000	***
dt_4	-0.12220	0.01747	-6.99664	0.00000	***
dt_5	-0.09801	0.01963	-4.99182	0.00000	***
dt_6	-0.07861	0.02080	-3.77977	0.00022	***
dt_7	-0.15599	0.02502	-6.23565	0.00000	***
dt_8	-0.08739	0.02214	-3.94765	0.00012	***
dt_9	-0.03954	0.02230	-1.77321	0.07800	*
dt_10	-0.03106	0.01870	-1.66111	0.09855	*
dt_11	-0.04587	0.01806	-2.54024	0.01198	**
Mean dependent var	4.26469	S.D. dependent var	1.01016		

Sum squared resid	346.03570	S.E. of regression	0.42845
R-squared	0.82274	Adjusted R-squared	0.82010
F(29, 169)	38.67299	P-value(F)	2.53814E-59
Log-likelihood	-1078.98730	Akaike criterion	2215.97459
Schwarz criterion	2377.12616	Hannan-Quinn	2275.27772
Rho	0.94323	Durbin-Watson	0.08724

As for the explanatory power, the model did not change, the R-squared is still at 82.27%. However, the introduced variable is indeed statistically significant, as it has a p-value of 0. It is important to see that the newly added variable coefficient indicates that, when the minimum wage increases in 1%, the employment actually raises in 1.18%, *ceteris paribus*. That means that when the minimum wage increases, but the ratio stays still, that is, when average wages follow minimum wages along in a proportional increase, its effect is indeed positive to employment, proving our second hypothesis right and contrary to what happened when the ratio was also altered. In the previous case, because the raise of the minimum wage was not followed by a proportional positive change in the average wage, the effect on employment was negative, as shown also in the addition of both estimators ($\beta_1 + \beta_2$), which indicate a decrease of employment in 0.29 percentage points.

As for the differences amongst autonomous communities, for those that are significant (all but dac_1, dac_9, dac_10), our model shows that their level of employment tends to be lower than Madrid's. Time related differences are all significant, two at a 10%, but the rest at a 1%. They show that all periods have lower employment compared to the period of reference, that is, 2008.

Note that these last OLS regression results seem to agree with some of the previously stated guidelines, but, of course, disagree with others. Basically, we observe what Rutkowski put in other words, that the ratio serves as a measure to know when an increase in the minimum wage is appropriate, and it is precisely when the average wages increase, that is, when the ratio decreases, that it should be increased to maintain the same relative level as the average salary. The Keynesian criterion also mentions that minimum wages should be increased at least in line with average wages and that it would even be appropriate for minimum wages to rise at a faster rate than average wages when their ratio is considered too low. Based on our estimates we cannot state whether the actual level of the ratio is too low or too high, but they seem to indicate that the minimum wage is set on an appropriate level in relation to the average wages, as when the ratio remains the same, the effects are positive, but when it increases, the effects become negative. In summary, what we can observe is that the effect of an increase in the minimum wage is positive when

the minimum-to-average wage remains stable, that is, when the minimum wage raise is accompanied by an increase in average wages.

Finally, we found it appropriate to estimate the regression separately for women and men in order to find out if the relationship is different. As stated before, women, as well as youth, and low-skilled workers, tend to be considered a risk group. Because, in an aggregated way, they usually find themselves in a lower position within the wage distribution, their employment numbers can be more sensitive to changes in the minimum wage.

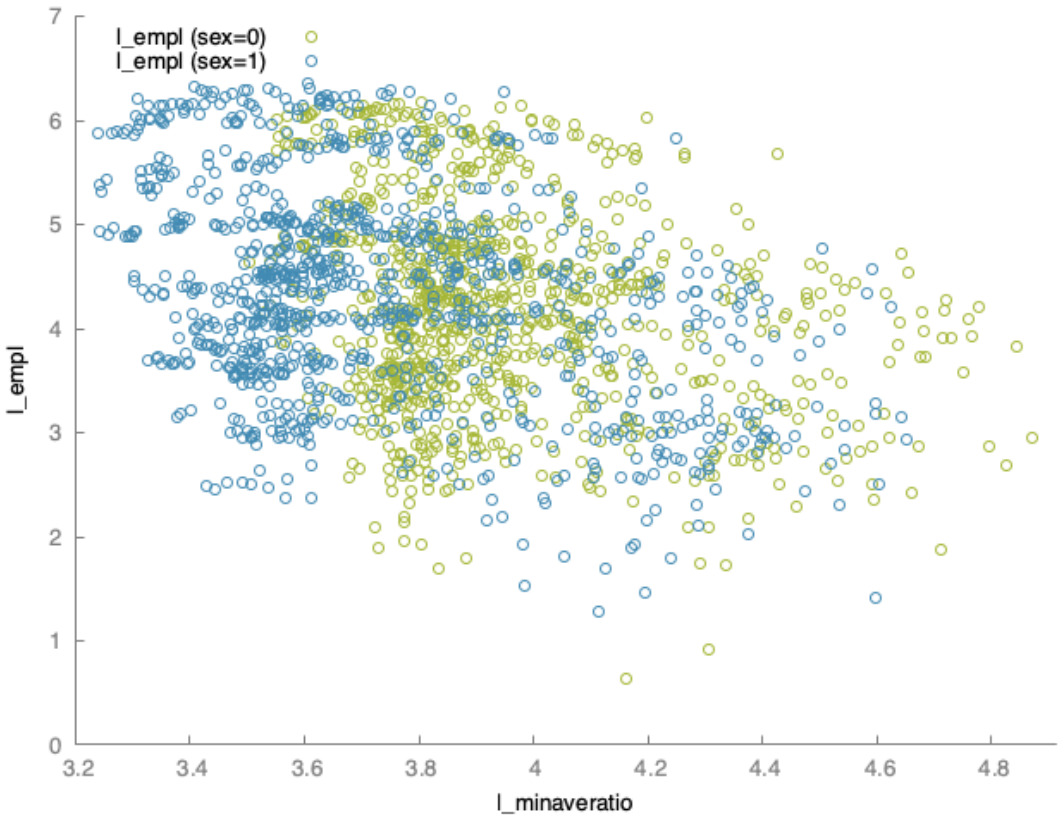


Figure 10. Dispersion plot of variables l_employ and l_minaveratio by sex, being 0 women and 1 men.

Indeed, as we can see above, women's ratio tends to be higher because the minimum wage represents a bigger share of their lower average wage. Next, we will see if these higher levels of the ratio translate into a steeper relationship between the minimum wage and the level of employment. The following model is specified as the previous one, only the sample was reduced to only the women.

Model 4: pooled OLS, using 933 observations
Included 85 cross-sectional units (only women)
Time-series length: minimum 2, maximum 12"

Dependent variable: l_empl
Robust (HAC) standard errors
Omitted due to exact collinearity: dt_12, dac_13

	coefficient	std. error	t-ratio	p-value	
const	-1.58784	0.98671	-1.60923	0.11132	
l_minaveratio	-1.44629	0.18546	-7.79820	0.00000	***
l_minwage	1.37533	0.13337	10.31236	0.00000	***
dac_1	0.18565	0.29195	0.63590	0.52657	
dac_2	-1.40696	0.22510	-6.25032	0.00000	***
dac_3	-1.61812	0.23265	-6.95509	0.00000	***
dac_4	-1.58089	0.24161	-6.54325	0.00000	***
dac_5	-1.02096	0.27203	-3.75313	0.00032	***
dac_6	-2.12139	0.22999	-9.22381	0.00000	***
dac_7	-0.82656	0.23096	-3.57876	0.00058	***
dac_8	-1.09836	0.28050	-3.91571	0.00018	***
dac_9	0.22686	0.21410	1.05963	0.29235	
dac_10	-0.12177	0.24627	-0.49447	0.62227	
dac_11	-1.77396	0.29234	-6.06821	0.00000	***
dac_12	-0.64853	0.23610	-2.74679	0.00736	***
dac_14	-1.36324	0.28728	-4.74532	0.00001	***
dac_15	-2.21762	0.22558	-9.83064	0.00000	***
dac_16	-1.18272	0.23958	-4.93664	0.00000	***
dac_17	-2.78135	0.23615	-11.77803	0.00000	***
dt_2	-0.02200	0.02446	-0.89951	0.37095	
dt_3	-0.08336	0.02742	-3.03992	0.00315	***
dt_4	-0.03046	0.02779	-1.09620	0.27612	
dt_5	0.00318	0.02947	0.10793	0.91430	
dt_6	0.04994	0.02868	1.74094	0.08535	*
dt_7	-0.04314	0.03791	-1.13801	0.25835	
dt_8	0.02787	0.03172	0.87869	0.38207	
dt_9	0.06894	0.03482	1.97972	0.05101	*
dt_10	0.07006	0.02679	2.61563	0.01056	**
dt_11	0.03409	0.02766	1.23282	0.22108	

Mean dependent var	4.19264	S.D. dependent var	0.99207
Sum squared resid	172.43569	S.E. of regression	0.43675
R-squared	0.81201	Adjusted R-squared	0.80619
F(28, 84)	20.73814	P-value(F)	4.88191E-27
Log-likelihood	-536.24000	Akaike criterion	1130.48000
Schwarz criterion	1270.79375	Hannan-Quinn	1183.98816
Rho	0.92035	Durbin-Watson	0.11052

As shown by our estimators in Model 4, the effect of an increase of 1% in the minimum wage, while maintaining the rest unchanged, brings with it an increase in

employment of 1.38%, which is 0.20 percentage points more than in the aggregated (Model 3) and the men's estimation (Model 5, Annex). Hence, in our case, women's employment is more sensitive when changes in the minimum wage are accompanied by proportional changes in the average wage, and, therefore, an increase in the minimum wage has a greater positive effect on them. When both variables increase, the aggregated effect ($\beta_1 + \beta_2$) is a decrease of 0.07%, 0.22 percentage points less than in the general model (Model 3), and 0.46 percentage points less than in the men's (Model 5, Annex), which means that in the women's case, when the ratio is also altered, the negative effect is not as high as in the men's case, contrary to what we could have expected. However, as mentioned before, these results are limited by the fact that we are working with the average wage instead of the mean wage and that we do not know the percentage of men and women earning the minimum wage, which could have a fair influence on the results.

CONCLUSIONS

The minimum wage is a challenging policy; it ought to find the idyllic level where improving the conditions of those low-wage "insiders" of the labour market does not cause a reduction of working places that could cause this same target to lose their jobs or make it impossible for those "outsiders" who might want to join the market. Needless to say, illegal hiring and undeclared work are also not to be encouraged. As for any other economic measure, unfortunately, there is no exact and universal formula to find such an idyllic level. However, by studying the existing data, we can bring to light certain underlying relations and behaviours of the market that can help us withdraw indicators and orientate economic measures in a way that minimises their negative outcomes.

This study, in addition to the results provided by the estimators concerning our hypotheses, highlights the importance of the general wage level of the country when it comes to adjustments of the minimum wages. As we saw, depending on the behaviour of average wages (if they increased together with the minimum wage or not), we either have an effect or the complete opposite. Consequently, the minimum-to-average ratio appears to be quite a useful indicator to guide minimum wage policies, as it is mentioned in some previous literature.

As for our results, as mentioned above, we hypothesized, firstly, that the minimum-to-average ratio is negatively related to employment, meaning that increases in the first one will be accompanied by decreases in the latter; and secondly, that the minimum wage is positively related to employment when the ratio level stays fixed. Our OLS estimates support both hypotheses, reinforcing the notion that the measure is highly dependent on average wage behaviour and should be taken into account when raising the minimum wage. We can see from our data that whenever the increases in the minimum wage were accompanied by a proportional average wage increase, the aggregated impact on employment was positive. On the contrary, when the increase in the minimum wage was proportionally higher than that of the average wage, employment decreased. Therefore, if we ought to draw any recommendation from this data, we could say that it seems appropriate for policies to aim to maintain this ratio at a constant level, as it is when it is not altered that it appears to be the least harmful in terms of employment.

Moreover, we found that the intuitions described and demonstrated in some articles on how female workers might be affected more negatively by minimum wage policies do not apply to our case. The effect is indeed different, but not at all worse in this particular demographic group. However, we must admit that this can also be

due to one of our study's limitations, which is the unavailability of data on the median wage level, which could be of significance in this particular case. Another limitation of the study is the unavailability of data on the percentage of workers earning the minimum wage, which could also be relevant to the results. It is left to further research to study the topic including these variables.

Furthermore, because the minimum wage in Spain is set nationally and universally, its adjustments do not take into account the specifics of each autonomous community, economic sector, or demographic group, but only the aggregate figure. Therefore, further studies could also explore the feasibility and appropriateness of minimum wages by autonomous community, by economic sector, or by age group, as this type of minimum wage already exists in some other countries.

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Table of Figures

ANNEX

Code	Description
dac1	Andalucía
dac2	Aragón
dac3	Asturias. Principado de
dac4	Balears. Illes
dac5	Canarias
dac6	Cantabria
dac7	Castilla y León
dac8	Castilla – La Mancha
dac9	Catalunya
dac10	Comunitat Valenciana
dac11	Extremadura
dac12	Galicia
dac13	Madrid. Comunidad de
dac14	Murcia. Región de
dac15	Navarra. Comunidad Foral de
dac16	País Vasco
dac17	Rioja. La
sex (=0)	Women
sex (=1)	Men
dage1	Ages 16-24
dage2	Ages 25-34
dage3	Ages 35-44
dage4	Ages 45-54
dage5	Ages 55+

Model 5: pooled OLS, using 933 observations
Included 85 cross-sectional units (only men)
Time-series length: minimum 2, maximum 12"

Dependent variable: l_empl
Robust (HAC) standard errors
Omitted due to exact collinearity: dt_12, dac_13

	coefficient	std. error	t-ratio	p-value	
const	1.08039	0.72026	1.50000	0.13736	
l_minaveratio	-1.72217	0.13911	-12.38023	0.00000	***
l_minwage	1.18379	0.11399	10.38472	0.00000	***
dac_1	0.40583	0.26822	1.51309	0.13401	
dac_2	-1.34703	0.21975	-6.12976	0.00000	***
dac_3	-1.73807	0.21192	-8.20162	0.00000	***
dac_4	-1.38094	0.24989	-5.52613	0.00000	***
dac_5	-0.73070	0.26466	-2.76086	0.00708	***
dac_6	-2.08080	0.22150	-9.39432	0.00000	***
dac_7	-0.65338	0.23033	-2.83676	0.00571	***
dac_8	-0.85284	0.23865	-3.57352	0.00059	***
dac_9	0.22996	0.23062	0.99717	0.32155	
dac_10	0.01674	0.23993	0.06977	0.94454	
dac_11	-1.36447	0.25350	-5.38258	0.00000	***
dac_12	-0.59986	0.23590	-2.54284	0.01283	**

dac_14	-1.18109	0.26772	-4.41162	0.00003	***
dac_15	-2.24400	0.20831	-10.77225	0.00000	***
dac_16	-1.21278	0.22717	-5.33870	0.00000	***
dac_17	-2.65173	0.22945	-11.55694	0.00000	***
dt_2	-0.09893	0.01001	-9.88131	0.00000	***
dt_3	-0.20048	0.01919	-10.44634	0.00000	***
dt_4	-0.20954	0.01759	-11.91403	0.00000	***
dt_5	-0.19808	0.01979	-10.00735	0.00000	***
dt_6	-0.20173	0.02099	-9.61027	0.00000	***
dt_7	-0.26792	0.02741	-9.77499	0.00000	***
dt_8	-0.20340	0.02383	-8.53568	0.00000	***
dt_9	-0.15139	0.02230	-6.78887	0.00000	***
dt_10	-0.12434	0.01992	-6.24055	0.00000	***
dt_11	-0.13042	0.02146	-6.07653	0.00000	***

Mean dependent var	4.33321	S.D. dependent var	1.02288
Sum squared resid	148.60139	S.E. of regression	0.39509
R-squared	0.85507	Adjusted R-squared	0.85081
F(28, 84)	28.51761	P-value(F)	5.13865E-32
Log-likelihood	-466.25560	Akaike criterion	990.51120
Schwarz criterion	1132.27980	Hannan-Quinn	1044.44331
Rho	0.94721	Durbin-Watson	0.07883

Minimum wage and employment:
the case of Spain

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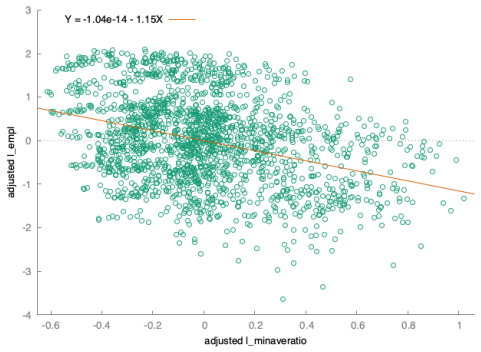
ABSTRACT

Minimum wage policies are intended to increase the standards of living of low-wage workers and reduce income inequality. However, there are concerns that minimum wage increases could have a negative impact on employment. This study examines the employment effects of increases in the minimum wage in Spain between 2008 and 2019, considering the average wage level and checking for potential different effects on women.

HYPOTHESES



H1: employment is negatively related to the minimum-to-average wage ratio.

H2: when increases in the minimum wage are followed by proportional increases in the average wage level (thus maintaining the ratio constant), they have a positive impact on employment.

DATA AND MAIN VARIABLES

The database consists of 170 cross-section units observed over 13 periods, which makes a total of 2210 observations. The sample was given a panel structure by using index variables. It contains data collected by INE and Eurostat on the following variables: employment, autonomous community, time dummies, sex, minimum wage, and Kaitz Index, which is the indicator used as the main independent variable in the analysis. It is as follows:

$$\textit{Kaitz Index (minaveratio)} = \frac{\textit{Minimum wage}}{\textit{Average wage}}$$

SPECIFICATION AND RESULTS

$$\textit{Employment} = \beta 0 + \beta 1 \textit{l\_minaveratio} + \beta 2 \textit{l\_minwage} + \\ + \beta 3 \textit{ac} + \beta 4 \textit{time} + \varepsilon$$

Our OLS estimates agree with both of our hypotheses; they show that minimum wage increases have a negative impact on employment when they are not accompanied by a proportional increase in average wages. On the contrary, when minimum wages increase at the same rate as average wages do, the effects on employment appear to be positive. As for women, our OLS estimates suggest that, indeed, effects are different for the female population, but, contrary to what we would have expected, not in a negative way. These findings also highlight the importance of the country's overall wage level when it comes to adjusting minimum wages.

MODEL	1	2	3	4	5
l_minaveratio	-1.25583*** (0.75178)	-1.46833*** (0.10949)	-1.46833*** (0.10949)	-1.44629*** (0.18546)	-1.72217*** (0.13911)
l_minwage	-	-	1.17697*** (0.09499)	1.37533*** (0.13337)	1.18379*** (0.11399)
Controls	11	27	26	26	26
R^2	0.13132	0.82274	0.82274	0.81201	0.85507
F	23.94857	38.67299	38.67299	20.73814	28.51761
Observations	1914	1914	1914	933	933

GENDER APPROACH

As women have lower average wages, their minimum-to-average ratio levels are higher. Does this imply a different impact on female employment when the minimum wage is raised?