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New answers to old questions: The effects of the minimum wage hike in Spain in 2019

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Abstract

Our paper examines the effects of the significant 2019 minimum wage hike in Spain on labour market outcomes, prices, and firm bankruptcies. We use the synthetic control method (SCM) to analyze the impact of the policy on the Spanish economy. We find no significant impact of the minimum wage increase on labour market outcomes for low-skilled individuals, suggesting no major job losses or increased unemployment among this group. However, we observe a significant increase in prices, especially for services and processed food, with treatment effects reaching up to 3 percentage points in 2021 relative to the synthetic control group. In addition, we observe a slight increase in firm bankruptcies in industry and construction during the COVID-19 pandemic. While our results suggest that the minimum wage increase did not lead to significant job losses among vulnerable groups, it did lead to higher prices in certain sectors, which could negatively affect consumers. This is consistent with recent research from Germany, which found minimal effects on labour market outcomes but significant effects on prices following the introduction of a minimum wage.

Keywords: Minimum wage, Synthetic Control Method, labour market, prices, employment *JEL codes:* J20, J38, J48

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1. Introduction

The effects of minimum wages on employment and broader economic outcomes are among the most debated topics in labour economics. Changes in the minimum wage can have significant effects through a wide range of economic channels, from employment to inflation, and understanding these dynamics is critical for policymakers.

The most widely discussed channel is the employment channel. Many studies have found that raising the minimum wage negatively affects employment, especially for the groups most affected, such as young and low-skilled workers. Another channel is the price channel, where firms may adjust their prices in response to increases in labour costs. An additional mechanism that has not been much discussed in the literature is the bankruptcy channel in the Schumpeterian view, where minimum wages increase the exit rate of less productive firms.

In this paper, we study the impact of a unique and substantial increase in the minimum wage in Spain in 2019. On December 21, 2018, the Spanish government decided to increase the Spanish monthly minimum wage from EUR 735.90 to EUR 900 (in 14 gross payments per year) starting in 2019. This increase of more than EUR 150 was significantly higher than in other EU countries, where minimum wages typically increase somewhere close to the inflation rate, making the Spanish minimum wage increase an interesting natural experiment.

One of the main contributions of this paper is the application of the Synthetic Control Method (SCM) to analyze the 2019 minimum wage increase in Spain¹. While much of the existing literature on minimum wages relies on traditional difference-in-differences (DiD) approaches or regression-based methods to estimate policy effects, SCM offers a more sophisticated technique for constructing a counterfactual scenario in situations where a single region or country is treated and others are not. By using SCM, our study is able to address potential biases arising from unobserved heterogeneity and better isolate the causal effects of the minimum wage increase, especially in complex settings with different pre-treatment trends. This methodological innovation not only adds rigor to the evaluation of labour market effects, but also contributes to a growing body of research using SCM for policy evaluation in non-experimental settings.

We use quarterly EUROSTAT data to analyze the impact of the Spanish minimum wage increase in 2019 on several different labour market outcomes, as well as on prices and business bankruptcies and business registrations over the period

¹Please note that the labour market effects of the minimum wage increase have also been discussed by Arnadillo et al. (2024).

from Q1 2015 to Q3 2023. In addition, we control for several other factors that influence these outcomes.

The analysis of minimum wage effects is important for several reasons. Policymakers rely on minimum wage analyses to formulate and adjust labour market policies. These analyses provide valuable insights into the potential impact of different minimum wage levels on the labour market and the broader economy. In addition, the study of minimum wages helps to understand the dynamics of the labour market, including how wage changes can affect job seekers, workers, and employers. This knowledge is essential for maintaining a balanced and functioning labour market.

With this paper, we aim to add an economic impact assessment to the existing literature that could contribute to existing and future labour policy formulation. In summary, minimum wage analyses provide a comprehensive understanding of the multiple effects that wage policies can have on the economy, firms, and individuals, thereby supporting evidence-based decision making and fostering a more equitable and sustainable economic environment.

2. Background on the minimum wage reform 2019 in Spain

The 2019 increase in the Spanish minimum wage was a landmark policy shift aimed at addressing growing income inequality and the purchasing power loss experienced by lower-wage workers. The Spanish government, led by the Socialist Party (PSOE) and supported by the left-wing Podemos, approved a significant hike in the minimum wage from 735.90 EUR per month to 900 EUR per month (a 22.3% increase), marking the largest increase in over four decades.

The reform emerged amidst a challenging political climate, as the government struggled to pass its 2019 budget. The minimum wage hike was a key element of an agreement with Podemos, who pushed for higher wages as part of broader social policies. This rise, which came into effect on January 1, 2019², was positioned as a crucial step to improve conditions for the lowest-paid workers, who had been disproportionately affected by the economic crisis of 2008.

In context, the Spanish minimum wage was notably lower than that of other advanced EU economies. Before the hike, Spain represented about 33.9% of the average wage, placing it among the lower ranks in Europe. This disparity was partly explained by the fact that a significant proportion of Spanish workers were paid through collective agreements rather than at the statutory minimum

²Established in the Royal Decree 1462/2018. For more detailed information, see Boletin Oficial del Estado (2018).

level. The government argued that the increase would not only help restore purchasing power for those most affected by economic downturns but would also stimulate economic growth by increasing consumption. The reform was, however, not without controversy. Critics, including the Spanish Central Bank and opposition parties like the Peoples Party, warned that such an aggressive rise could lead to job losses, particularly among low-skilled and temporary workers. These concerns often reflected classical economic theories, suggesting that higher minimum wages could result in higher costs for employers, leading to reduced hiring.

As already mentioned before, the reform implied an increase by more than 20%, the highest increase registered in our data. On a European perspective, this yearly increase is substantial and has not been reported in any other EU Member State over the last centuries³. Figure 1 highlights the ratio between the minimum wage and the average wage in EU Member States. This measure, usually called the Kaitz Index, measures the minimum wage bite, signaling at which level of the wage distribution the minimum wage enters. As we can see, the Spanish minimum wage bite was on a very low level compared to other EU Member States. However, the increase in 2019 led to an increase in the Kaitz index of almost 10 percentage points, increasing the minimum wage bite of Spain to an average level. As we can also see in Figure 1, in other EU Member States, the minimum wage bite stays fairly stable over the observed time period. There are some minor movements, for example in Lithuania in 2013 or in Ireland in 2018, but overall, and specifically in 2019, we do not see any substantial changes of the minimum wage bite over the observed time period.

Looking at other data related to labour market legislation, such as the Economic Freedom of the World Index, subsection Labour market regulation (Gwartney et al., 2024) or the CBR Labour Regulation Index (Adams et al., 2023) we do not see any significant change in Spain in 2019, nor in other European countries, indicating that labour market legislation itself has not been influenced significantly during out treatment time. Therefore, our treatment (the increase of the minimum wage) seems to be valid, and no other labour market changes should have impacted our estimated treatment effect.

³According to the Monthly minimum wages - bi-annual data of EUROSTAT (earn_mw_cur).



Figure 1: Kaitz Index in European countries, 2010 - 2023

3. Literature review

The impact of minimum wage increases on employment and other economic variables has been widely studied, though results remain contested. Classical economic theory predicts that raising the minimum wage could reduce employment by increasing labour costs for firms, particularly for low-skilled and younger workers who are often paid at or near the minimum wage. Seminal works by Neumark et al. (2014) and more recent studies by Neumark and Shirley (2022) argue that minimum wage hikes can have adverse effects on employment, especially in labour markets characterized by high levels of informality or limited wage flexibility. These studies suggest that while moderate increases might have minimal effects, more substantial hikes could lead to significant job losses.

However, other scholars challenge these findings. Early studies by Card (1992) and Card and Krueger (1993) in the U.S. found little to no evidence that minimum wage increases reduce employment. Their work sparked a wave of research that questioned the robustness of traditional theoretical models. More recently, Cengiz et al. (2019) revisited the U.S. context and found that, while some low-wage jobs were lost following minimum wage hikes, they were often replaced by higher-paying positions, resulting in little net employment loss. This debate has led to a broad recognition that the employment effects of minimum wages are context-dependent, influenced by local labour market conditions, institutional factors, and the magnitude of the wage increase.

Beyond the U.S. and Spanish contexts, cross-country studies have provided additional insights. Wolfson and Belman (2019) conducted a meta-analysis of minimum wage effects in developed economies and found that while negative employment effects do exist, they are typically small and concentrated among

specific groups, such as young and low-skilled workers. A study by Schmitt et al. (2013) in OECD countries supports this conclusion, suggesting that most advanced economies can implement moderate minimum wage increases without significant adverse employment effects. More recent work by Dube (2019) expands this cross-country analysis and argues that carefully designed minimum wage policies, which consider local economic conditions and wage-setting mechanisms, can help mitigate potential downsides while improving earnings for low-wage workers.

While employment effects dominate much of the discussion, other economic channels affected by minimum wage increases, such as prices, firm profitability, and market structure, are also critical but less frequently studied. In sectors where labour costs constitute a substantial portion of total production costs, minimum wage hikes can lead firms to pass on higher costs to consumers in the form of increased prices (Card and Krueger, 1995; MacDonald and Nilsson, 2016). Research by Lemos (2008) offers a comprehensive survey on the impact of minimum wages on prices, showing that price increases are often concentrated in industries such as food services and retail, where low-wage workers are more prevalent. More recently, Link (2024) examined the effects of Germany's 2015 minimum wage introduction, finding modest price increases in certain consumer goods but no significant impacts on overall inflation.

Another underexplored area in the literature is the effect of minimum wage increases on firm dynamics, particularly in terms of firm exit and market concentration. Draca et al. (2011) argue that minimum wage hikes can increase firm exit rates by pushing less-productive firms out of the market, leading to a more concentrated market structure dominated by more productive firms. This "survival of the fittest" dynamic has been observed in sectors with a high reliance on low-wage labour, such as retail and hospitality. Recent studies, such as Luca and Luca (2019), build on this framework, finding that while firm exit rates may rise, the overall impact on employment is often neutralized by the entry of more competitive firms or through increased productivity among surviving firms.

Focusing specifically on Spain, research on the 2019 minimum wage hike is beginning to grow. Fernández-Baldor Laporta (2022) used detailed administrative data to analyze short-term employment effects, finding that the reform increased the likelihood of job loss by 0.38 to 0.44 percentage points, particularly among low-skilled workers. Gorjón et al. (2024) similarly found that the reform increased unemployment risk by 1.7 percentage points among workers affected by the hike, with a 0.9 percentage point increase in the likelihood of reduced working hours. Arnadillo et al. (2024) found in a very recent study no impact of the minimum wage hike in 2019 in Spain, using the synthetic control method. While these studies provide valuable insights into employment outcomes, they do not fully account for broader effects such as price increases or firm bankruptcies, areas that are increasingly recognized as important in assessing the full impact of minimum wage policies.

Thus, our study aims to fill these gaps by providing a more comprehensive evaluation of the 2019 minimum wage hike in Spain, looking beyond employment effects to assess its impact on prices and firm dynamics. By applying the Synthetic Control Method (SCM), we are able to construct a robust counterfactual for Spain and provide a clearer picture of the policy's overall economic impact. Furthermore, our use of SCM allows us to draw comparisons with other EU countries that did not experience similar wage hikes, strengthening the causal interpretation of our findings.

4. Methodology

The Synthetic Control Method (SCM) is a statistical technique used for causal inference in observational studies, particularly when assessing the effects of interventions or treatments on outcomes of interest. It is especially relevant in contexts where randomized controlled trials (RCTs) are not feasible, such as policy evaluations in economics and social sciences.

Formally speaking, this approach considers several different groups J + 1 which are indexed by j = 0, ..., J. Group 0 refers to the group in which the event happens while the rest of the groups are defined as the so-called donor pool. Let G_0 be a vector with k elements that are equal to the number of variables that are used to predict our variable of interest. We define G_J as a kxJ-matrix in which each row represents the sequence of the same variables and years relative to country j in the donor pool.

The SCM searches for a vector of weights W^* that constructs a convex combination of variables in countries in the donor pool G_J that has the lowest quadratic error in comparison with the pre-treatment vector G_0 . Formally, this means:

$$W^* = argmin(G_0 - G_J W)'V(G_0 - G_J W) \quad s.t. \quad w_i = 1, w_i \ge 0$$
(1)

Once we receive the weights W^* , we are able to identify post-treatment outcome variables for this synthetic control group and the treated group.

Let Y_{it} be the outcome of interest for unit *i* at time *t*. The treatment effect can be expressed as:

Treatment Effect = $Y_{1t} - Y_{0t}$ (2)

Where:

- Y_{1t} is the observed outcome for the treatment unit post-intervention.
- Y_{0t} is the predicted outcome for the treatment unit had it not received the intervention (using the synthetic control estimate).

The choice of the synthetic control group is essential for the results. Therefore, validation of the chosen control group is very important when applying this method. The SCM also allows for an adequate descriptive way of validation. Pre-treatment levels of the outcome variable of the control group and the treated group can be easily compared. If they match quite well in the years before the treatment, this is typically a sign of a reasonable choice of synthetic control group.

The Synthetic Control Method (SCM) offers several advantages for causal inference in observational studies. One of its primary strengths is its robustness to unobserved confounding, as it constructs a synthetic control group that closely mimics the treatment group based on observable characteristics. Additionally, SCM's flexibility allows researchers to include multiple control units, enhancing the reliability of the counterfactual scenario. However, SCM also has notable limitations. It requires comprehensive pre-treatment data, which may not always be available, and the effectiveness of the method hinges on the careful selection of control units. If the control group does not adequately represent the treatment unit, the results may be biased. Furthermore, SCM relies on the assumption of parallel trends, meaning that it assumes the treatment and control units would have followed similar trends in the absence of the intervention.

5. Data

Our analysis draws on data provided by Eurostat, covering all EU-27 countries over the period Q1 2015 to Q3 2023 on a quarterly frequency. The dataset includes detailed labour market indicators such as unemployment rates, activity rates, and employment and unemployment data by education level (concretely, individuals with at most lower secondary education (ISCED level 2)). The data is comprehensive, allowing us to focus on specific groups within the labour force, such as individuals with low educational attainment, which helps to track the effects of economic policies on vulnerable segments. In addition to labour market variables, we utilize macroeconomic data including inflation, measured through the Harmonized Index of Consumer Prices (HICP), as well as economic growth figures. These indicators provide critical context for understanding the broader economic environment in which labour market changes occur and control for these effects. The dataset further breaks down price indices into specific categories, such as services, processed and nonprocessed food, and industrial goods, allowing for a nuanced analysis of inflationary effects across different sectors.

Moreover, the dataset includes market structure data, particularly focusing on bankruptcy rates across various industries, including the construction and industry sectors. The information on bankruptcies is complemented by data on registrations, helping to capture a more comprehensive view of business dynamics within these sectors. We use bankruptcy declarations and registrations in the industry sector (classified as B-S_X_O_S94 by NACE) and additional bankruptcy data on the construction sector (classified as F by NACE) due to its relevant impact in the Spanish economy. Together, this extensive dataset provides a solid sample for our analysis of the potential impact of minimum wage adjustments on an economy exploring different channels.

Variable	Panel	Mean	Sd	Min	Max	Observations
Employment rate	Overall	33.23	9.66	10.63	57.35	N = 1510
	Between		9.39	14.77	49.56	n = 27
	Within		2.87	21.82	41.75	T = 55.9
unemployment rate (l.e.)	Overall	16.51	9.10	3.60	62.10	N = 1507
	Between		7.97	7.13	46.90	n = 27
	Within		4.64	3.89	32.76	T = 55.8
unemployment rate	Overall	8.53	4.57	2.00	27.90	N = 1512
	Between		3.66	4.18	19.61	n = 27
	Within		2.82	-0.03	19.43	T = 56
activity rate	Overall	64.66	4.56	54.17	75.95	N = 1510
	Between		4.24	56.13	72.57	n = 27
	Within		1.86	56.50	74.65	T = 55.9
GDP growth	Overall	0.01	0.03	-0.20	0.27	N = 1485
	Between		0.01	-0.00	0.02	n = 27
	Within		0.03	-0.19	0.26	T = 55
HICP	Overall	104.64	10.69	85.62	161.99	N = 1512
	Between		2.17	101.70	109.22	n = 27
	Within		10.47	82.86	157.41	T = 56
HICP (s.a))	Overall	104.64	10.61	85.91	161.95	N = 1512
	Between		2.17	101.71	109.23	n = 27
	Within		10.40	83.61	157.36	T = 56
HICP (Services)	Overall	104.49	11.04	85.00	160.78	N = 1512
	Between		2.56	101.66	111.65	n = 27
	Within		10.76	82.58	153.62	T = 56
HICP (Pro. Food)	Overall	105.50	14.65	78.94	195.49	N = 1512
	Between		3.52	98.84	113.64	n = 27
	Within		14.23	71.51	187.34	T = 56
HICP (Non-pro. Food)	Overall	106.97	16.10	76.57	200.09	N = 1512
	Between		3.72	100.05	114.85	n = 27
	Within		15.68	72.71	192.22	T = 56
HICP (Industry)	Overall	101.76	6.14	83.37	133.32	N = 1512
	Between		1.91	96.17	105.50	n = 27
	Within		5.85	88.79	130.77	T = 56
Bankcruptcy Index (Industry)	Overall	128.21	66.06	0.00	512.37	N = 831
	Between		45.98	71.62	243.60	n = 26
	Within		49.66	-17.45	396.98	T = 31.9
Bankcruptcy Index (Construction)	Overall	162.06	222.05	0.00	2800.00	N = 793
	Between		131.38	77.03	755.56	n = 25
	Within		176.28	-593.50	2206.50	T = 31.72

Table 1: Summary Statistics

6. Results

6.1. The impact of the minimum wage increase on the labour market

First, we analyse the impact of the Spanish minimum wage increase of 2019 on labour market outcomes. As argued in the literature (Neumark et al., 2014; Christl et al., 2017, 2018), the effects on general labour market aggregates might be very low. However, there might be an effect on groups that are especially exposed to minimum wages, such as low-educated workers. We therefore analyse the impact of the minimum wage hike on the employment rate of low-skilled workers. Figure 2 highlights our results, when controlling for similar trends in the employment rate, but also for economic growth as well as Inflation. The pre-treatment fit of our synthetic control group is very good, indicating that the control group does well in replicating the results from Spain before the minimum wage increase. The same actually holds true for the period after 2019, indicating that there was no effect of the minimum wage increase on low-skilled workers. As highlighted in Figure 2a, the treatment effect is very close to zero and there is no change after the minimum wage hike in 2019. Therefore we conclude that there were no effects on the employment rate of low-skilled workers.

Figure 2: The impact of minimum wages on the employment rate of low-skilled workers



Focusing on another possible variable that might be influenced by the minimum wage hike, we focus now on the unemployment rate. In more detail, we estimate a synthetic controls model that tries to replicate the unemployment rate of low-educated individuals in Spain. We define low-education as an ISCED level of maximum 2, covering unemployed that have at most lower secondary education. Again, we use a model that controls for pre-trends in the unemployment rate, but also for economic growth and inflation. It is worthwhile mentioning, that Spain has a very high unemployment rate compared to other European countries. Therefore, when setting up the synthetic control group, the options in the donor pool are limited when replicating the pre-trend in unemployment rates. As shown in Figure 3, our SCM more or less fits the pre-treatment period, and again, we can not see any significant treatment effects after the increase in the minimum wage in 2019 on the unemployment rate of low-educated. On the contrary, we can even see a slight increase in the unemployment rate of the synthetic Spain.

Figure 3: The impact of minimum wages on the unemployment rate of low-skilled



Our results confirm previous findings from Arnadillo et al. (2024) for Spain that indicate that this significant minimum wage increase did not reduce employment⁴. These findings are also in line with the findings of Christl et al. (2018), who showed that there is a potential of increasing the minimum wage in Spain without having adverse employment effects.

6.2. The impact of the minimum wage increase on prices

To set up a general model for prices, we will control not only for economic growth, but also for consumption growth and two key labour market variables, such as the level of unemployment as well as the activity rate of an economy as they are all decisive for firms price setting behaviour. Our synthetic Spain therefore will reflect not only similar supply factors (labour market conditions), but also the general demand side factors, such as the economic growth, as well as the general consumption behaviour (consumption growth).

⁴Please note that while the authors use a similar methodology, the model specification is substantially different.

Figure 4 highlights the prediction of our model, when looking at the general HICP. As we can see, we quite well fit again the pre-treatment HICP of Spain with our synthetic Spain. Contrary to the impact on the labour market, we can see now a clear shift in the HICP, however, not straight after the reform in 2019 but in 2020, where the HICP of the synthetic Spain starts to be significantly lower than in Spain. The treatment effect reaches a level of about 1, indicating that the HICP of Spain is about 1 percentage point higher compared two the synthetic Spain. There are several reasons, why a later adjustment of prices could happen. As argued by Neumark et al. (2014), impacts on the labour market, as well as related changes on prices might take some time.

Figure 4: The impact of minimum wages on the HICP



Our model indicates that there is an impact on the general price level caused by the minimum wage increase, however, this increase seems to be modest. However, further investigations on the disaggregated price indicators might reveal more insights on the impacts. Therfore, we look on the HICP for different categories, namely services, processed food, non-processed food as well as industrial goods (excluding energy). Using the same model as before, we estimate the treatment effect, using the synthetic control method controlling for demand and supply factors that can influence prices in an economy. Figure 5 highlights the results for all 4 subcategories of the HICP.

As highlighted in Figure 5a, we can see a clear devide between Spain and the synthetic Spain, again not exactly in the first quater of 2019, but shortly after. The treatment effect is quite substantial reaching almore than 2 percentage points in 2021.

Similarly, the model for the HICP of processed food suggests (Figure 5b) a strong divergence between Spain and the synthetic Spain after the introduction



Figure 5: The impact of minimum wages on the prices of processed food

of the minimum wage in 2019. The treatment effect is even higher, reaching almost 3 percentage points in 2021. Looking at unprocessed food (Figure 5c), we do not see any significant difference between Spain and our synthetic Spain. Given that the price of unprocessed food is usually given by the international markets, economically it is not surprising that the increase in the Spanish labour market do not affect these prices. Lastly, we also look on the impact on industrial goods (without energy). Again, as highlighted by Figure 5d, we can see a divers development of Spain after the treatment (minium wage increase), where the treatment effect is smaller compared to services and non-processed food, but with 1 percentage point still not negligible.

6.3. The impact of the minimum wage increase on bankruptcies

Lastly, we also want to see whether there is an impact of the 2019 minimum wage increase in Spain on the number of firm bankruptcies. We do that by using the bankruptcies index of EUROSTAT. Please note that we are loosing 7 coun-

tries of our donor pool because of missing data on bankruptcies⁵. We set up a model controlling for two factors that should influence bankruptcies: the general economic condition, as well as the refinancing costs. We have information on the industry sector (NACE categories B-E).

Figure 6 highlights the impact on the bankruptcies in the industry. We can see that pre-trends for Spain and our synthetic control are pretty similar, while the post-trend looks slightly different. While we do not see any clear pattern, we notice that the synthetic control shows a substantially lower bankruptcy index during the COVID-19 pandemic that Spain. It is important to note that we do not control for policy support during the pandemic, which might be different between Spain and the synthetic control. Therefore we are not in the position to interpret this difference as consequence of the minimum wage increase.





A very similar drop in the bankruptcies can be seen when looking on a sector that is more exposed to the minimum wage, namely the construction sector (see Figure 11 in the Appendix).

6.4. Robustness of results

To assess the robustness of our results, we run two different kind of tests: First, a in-space placebo test ensures that the observed treatment effect is not due to random variation or chance. Following Abadie and Gardeazabal (2003) and Bertrand et al. (2004), we conduct a series of placebo simulations by applying the synthetic control estimator to each country in the donor pool that did not

⁵THe countries with no data available are Austria, Czechia, Finland, Greece, Sweden, Ireland, Malta and Cyprus.

experience an increase in minimum wage in 2019. As highlighted by Abadie et al. (2010) and Abadie et al. (2015), and mentioned by Gilchrist et al. (2023), "placebo simulations with high prediscovery RMSE may fail to provide the evidence on the rarity of estimating a large post-discovery ... for a country that was reasonably well fitted prior to the discovery." To address this concerns, we present results dropping the countries with large values of pre-treatment RMSE. More specifically we drop countries that have a RMSE 3 times higher than the one estimated for Spain.

By comparing the actual treatment effect to placebo effects - effects estimated in countries that did not show an increase in the minimum wage - we are able to verify that the treatment effect is unique to the treated unit. We therefore create counterfactual scenarios where the our treatment is applied to countries that had no increase in the minimum wage in reality. The logic is that if the placebo units show no significant change while the treated unit shows a substantial effect, it strengthens the argument that it is really the treatment causing the effect. Additionally, we perform the LOO (Leave-one-out) test to assesses the robustness of the SCM by recalculating the synthetic control group, each time excluding one of the donor units used to construct the synthetic control. This helps us check if the results are highly dependent on any single country.

Looking on the results for the general inflation development in Spain (using the HICP) in Figure 7a, we can see a clear divergence in the post-treatment period, however, the effect seems to start with a delay of about some quarters. Given that price adjustments to increased labour costs might take a while, this does not seem to be very surprising. Looking on the size of the treatment effect, we can see an increase of more than 1 percentage point, implying the the Harmonized Index of Consumption Prices was more than 1 percentage point higher in Spain compared to our synthetic Spain.

The leave-one-out test (Figure 7c) indicates a generally positive and significant impact of the treatment on the HICP, with stable results even after accounting for different donor pool configurations through leaving out one by one a country of the donor pool. The in-space placebo test indicates that the treated unit is almost never mirrored in the placebo units. This strengthens the argument that the observed treatment effect is not due to random chance but can be attributed to the intervention

Figure 8 highlights again the impact of the minimum wage increase in Spain, compared to the synthetic control where no such hike was observed. We can see that the HICP for services for both Spain and synthetic Spain are very similar in the pre-treatment period, but then drifting substantially apart after 2019.



Figure 7: The impact of minimum wages on the HICP

This leads to a treatment effect of about 1.5 percentage points at the end of the observation period (2021), as highlighted by Figure 8b.

Focusing on our robustness checks, Figure 8c indicates the treatment effect of the leave-one-out test. We can see that the treatment effect follows a similar path also when excluding single countries from the donor pool, indicating that the treatment effect remains stable even when individual donor units are excluded (except of one donor country). We can not can not completely neglect that our results are sensitive to a single donor country, which questions the consistency of the findings across various synthetic control group constructions.

Figure 8d reports the in-space placebo test results. Our results show a clear divergence between the treatment effect and the placebo effects starting in the first quarter of 2019, indicating that the treatment began to significantly influence the HICP for services from that point onward. The placebo effects remain close to zero, suggesting that the observed treatment effect is unlikely to be due to random chance in the absence of the treatment. The substantial gap between

the treatment and placebo effects over time reinforces confidence that the 2019 minimum wage increase had a causal impact on the HICP of processed food.



Figure 8: The impact of minimum wages on the HICP for services

Figure 9 highlights again our results for the impact of the minimum wage hike of 2019 on the HICP of processed food. Similar to the price index for services, our model predicts very similar pre-treatment trends for both, Spain and the synthetic Spain. The treatment effect is estimated to increase after the treatment, up to more than 3 percentage points in 2021. This means that our model suggests that the HICP for processed food in synthetic Spain (no treatment), was about 3 percentage points lower than what was observed in Spain.

Looking at Figure 9c, both the treatment effect and the leaving-one-out treatment effect largely follow the same trajectory, suggesting that the treatment effect remains consistent even when individual donor units are excluded. We conclude that the results are robust and not driven by any single donor unit in the control group, confirming the stability of this result across different synthetic control group constructions. Figure 9d represents an "In-space Placebo Test" using the Synthetic Control Method (SCM) to assess the impact of a treatment. We can see that the treatment effect diverges from the placebo effects around the first quarter of 2019, suggesting that the treatment had a noticeable impact on the HICP for processed food from that time on. The placebo effects suggest that the observed treatment effect is unlikely to have happened by random chance in the absence of treatment. The relatively large divergence between treatment and placebo effects over the period strengthens the confidence that the increase in the minimum wage in 2019 had a causal effect on the HICP of processed food.



Figure 9: The impact of minimum wages on the HICP for processed food

Figure 10 describes the results of our model estimating the impact of the minimum wage hike of 2019 on the HICP of industrial goods (without energy). Our model predicts very similar pre-treatment trends for both, Spain and the synthetic Spain, indicating a good fit of the model. We can see a clear increase in the treatment effect after the treatment, going up to almost 1 percentage point in 2021. This treatment effect is significant, but substantially smaller than in the

case of the HICP for processed food and services.

The results of the leave-one-out test (Figure 10c) show that the treatment effect only in some cases follow similar trajectory when individual countries are excluded from the donor pool. That implies that specific donor countries causes noticeable changes in the treatment effect. This suggests that our results may be somewhat sensitive to the influence of these single donor. This raises concerns about the consistency of the findings across different synthetic control group constructions in our model.



Figure 10: The impact of minimum wages on the HICP for industrial goods

Our In-space Placebo Test (Figure 10d) shows a clear divergence between the treatment effect and the placebo effects starting in the first quarter of 2019, indicating that the treatment significantly influenced the Harmonized Index of Consumer Prices (HICP) for industrial goods in the post-treatment period. The placebo effects provide evidence that the observed treatment effect is unlikely to be due to random chance in the absence of the intervention. The substantial and sustained gap between the treatment and placebo effects throughout the period reinforces the conclusion that the 2019 minimum wage increase had a causal effect on the HICP for industrial goods.

7. Conclusion

Our paper examines the impact of the 2019 minimum wage hike in Spain on various labour market outcomes, prices, and firm bankruptcies. The 2019 minimum wage hike in Spain was an important policy shift aimed at addressing income inequality and the loss of purchasing power of low-wage workers. The increase, from EUR 735.90 to EUR 900 per month, was the largest in more than four decades.

We use the Synthetic Control Method (SCM) to analyze the impact of the policy change on the Spanish economy. The SCM is a statistical technique that creates a synthetic control group by combining the characteristics of other countries that did not experience the policy change.

We find no significant impact of the minimum wage increase on the employment rate, nor on the unemployment rate of low-skilled workers. The results suggest that the policy change did not lead to significant job losses or unemployment among these groups. This finding is consistent with previous research suggesting that minimum wage increases may not have a significant impact on employment rates and therefore unemployment.(Card and Krueger, 1993; Cengiz et al., 2019; Link, 2024; Arnadillo et al., 2024).

However, we find a significant effect of the minimum wage increase on prices, especially on the prices of services and processed food. The treatment effect reaches up to 3 percentage points in 2021, indicating that prices in these sectors were higher in Spain compared to the synthetic control group where no minimum wage increase took place. This finding is consistent with previous research suggesting that minimum wage increases can lead to higher prices.

We also find a slight increase in the index of firm bankruptcies in industry and construction in Spain, compared to synthetic Spain, during the COVID-19 pandemic. The results suggest that the minimum wage increase may have led to a more concentrated market structure, with more productive firms surviving and less productive firms exiting the market. However, we cannot control for general policy measures that may have been different in Spain compared to other countries in the donor pool. Therefore, we are cautious about interpreting these differences as caused by the minimum wage increase.

Our results have important implications for policy makers. The results suggest that the 2019 minimum wage increase in Spain did not lead to significant

job losses or unemployment among low-skilled individuals. However, the policy change did lead to higher prices in certain sectors, which may have negative consequences for consumers. This finding is consistent with recent findings for Germany, where the introduction of the minimum wage in 2015 had a very small impact on standard labour market outcomes, but a significant impact on prices.

In conclusion, this study provides new insights into the impact of the 2019 minimum wage increase in Spain on various labour market outcomes, prices, and firm bankruptcies. The results suggest that the policy change had both positive and negative effects, highlighting the need to carefully consider the potential consequences of minimum wage policies.

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8. Appendix



Figure 11: The impact of minimum wages on bankruptcies in the construction sector

(b) Treatment effect



Figure 12: The impact of minimum wages on the Employment rate of low-skilled workers



Figure 13: The impact of minimum wages on the unemployment rate of low-skilled



Figure 14: The impact of minimum wages on the HICP



Figure 15: The impact of minimum wages on the HICP fer services



Figure 16: The impact of minimum wages on the HICP for processed food



Figure 17: The impact of minimum wages on the HICP for non-processed food



Figure 18: The impact of minimum wages on the HICP for industrial goods (without energy)



Figure 19: The impact of minimum wages on the Bankruptcy Index in the industry