International Journal of Health Economics and Management (2023) 23:85–107
https://doi.org/10.1007/s10754-022-09340-x

RESEARCH ARTICLE

Minimum wages and health: evidence from European countries

Laetitia Lebihan[1]

Received: 28 May 2021 / Accepted: 4 November 2022 / Published online: 22 November 2022

Abstract
This study investigates the effects of minimum wage on health, well-being, and income security in European countries. The empirical strategy consists of exploiting variations in the minimum wage across European countries over time. We show that minimum wage increases improve individuals' self-reported health and income security. Minimum wage increases also improve life satisfaction and happiness. The effects are largest among women, employed individuals, married individuals, and those with less than a secondary education. Our results are robust to several robustness checks and consistent with existing evidence on the relationship between minimum wage and health.

Keywords Minimum wage · Health · European countries

JEL Classification I10 · J30 · I18 · J38

Introduction

To improve the standard of living for low-skilled workers, one solution policymakers have proposed is to increase the minimum wage. Advocates of a higher minimum wage often point to a decrease in income inequalities (via higher earnings) and an increase in the well-being of lower-income individuals (by increasing consumption and investing in health) (Kuroki, 2018). Meanwhile, opponents of a higher minimum wage argue that it will increase lay-offs and prices (Andreyeva and Ukert, 2018). The empirical evidence of minimum wage's effect on employment is mixed and inconclusive, with some studies reporting a negative relationship between minimum wage increases and employment (Neumark et al., 2014; Neumark & Wascher, 1992) while others report no significant relationship (Card & Krueger, 1994). Regarding prices, in general, studies have shown a modest rise (Card & Krueger, 1995).

The existing literature on the effects of minimum wage changes on health is rarer and also mixed. On the one hand, several studies have shown that higher minimum wages improve individuals' physical and mental health (Reeves et al., 2017; Lenhart, 2017a) and

✉ Laetitia Lebihan
laetitia.lebihan@univ-reunion.fr

[1] Department of Economics, University of Reunion Island, 15 avenue René Cassin - CS 92003, 97744 Saint-Denis Cedex 9, Reunion Island, France

birth outcomes (Wehby et al., 2020). On the other hand, some studies have found negative or no effects of minimum wage increases on health outcomes (Horn et al., 2017; Averett et al., 2017).[1]

In this paper, we investigate the effect of minimum wage increases on the health and well-being of individuals in European countries. Minimum wages can affect health through several pathways. First, minimum wages can impact health outcomes through changes in income. In the Grossman (1972) model, individuals inherit an initial stock of health which depreciates over time, but which can be positively affected through investments like exercise and a healthier diet. Assuming health as a normal good, workers will increase health inputs and see their health improve when minimum wage increases. However, increased income could also increase risky behaviors by enabling individuals to purchase unhealthy goods (e.g., junk food, tobacco, alcohol, and illicit drugs).[2] Second, minimum wages could affect health by impacting workers' financial stress and income security. The medical literature reports the existence of physiological reactions to stress in the form of complications with the circulatory system and heart diseases (Henry, 1982). Existing evidence also shows that minimum wage increases have a beneficial effect on mental health while reducing financial stress (Horn et al., 2017; Reeves et al., 2017; Lenhart, 2017a). Third, rises in minimum wage increase opportunity costs of leisure time and may not allow workers to invest in health-enhancing activities (Horn et al., 2017). In other words, an increase in hourly wages could induce individuals to work more hours and reduce the number of hours allocated to activities improving their health, such as exercise and healthier diet. Given the lack of consensus in economic theory on the relationship between minimum wage increases and health, there is a need for further research in this field.

We contribute to the existing literature on the relationship between minimum wage and health/well-being in four ways. First, to the best of our knowledge, this is the first study to provide an empirical analysis of the impact of minimum wage on health/well-being in European countries. Previous studies have focused on a single country, such as the United States (the majority of previous work) (Horn et al., 2017; Andreyeva and Ukert, 2018) or the United Kingdom (Reeves et al., 2017). Lenhart (2017b) examined the relationship between minimum wages and population health for 24 OECD countries. However, the study used countries as the units of analysis, and the sample sizes varied between 63 and 381. Using individual-level data is crucial when investigating the relationship between minimum wage and health, as is the case in our paper, because the effects of minimum wage are unlikely to be uniform. For example, the health effects may be different depending on whether the individual remains employed or experiences a decrease in employment outcomes. Moreover, Lenhart's study did not focus on those directly or most likely affected by minimum wages (i.e., low-wage/low-skilled workers), but rather combined low- and high-wage workers. However, it is unlikely that minimum wage affects high-wage workers (Leigh et al., 2019). Moreover, European countries are different from the United States in several ways, including fewer social inequalities, public health insurance, a more redistributive tax/transfer system, labor markets, and the healthcare system.

Second, we contribute to a small but growing collection of literature that seeks to investigate the effects of minimum wage changes on non-employment outcomes. More

[1] See Leigh et al. (2019) for a review of evidence on the effect of minimum wages on health outcomes.

[2] For example, Huang et al. (2021) showed that a $1 increase in the minimum wage in the United States raises the prevalence of smoking by about 2.3% and diminishes cessation by about 13.7% among the low-skilled employees. They also report an income effect as a potential mechanism for increased smoking.

generally, we investigate the causal impact of increased income on health and well-being outcomes.[3]

Third, we examine heterogeneous effects of minimum wage on a variety of characteristics (gender, employment status, age, education level, marital status, minority, and country characteristics). Indeed, following an increase in minimum wage, improvements in health outcomes could be more plausible for some sub-populations, like women or employed individuals.

Finally, this paper has important implications for policymakers and could contribute to the ongoing debate regarding the introduction of a common framework on minimum wage in Europe (Forbes, 2020). This is particularly crucial following the Covid-19 pandemic, which may cause health inequalities to increase.

In this study, we use the European Social Survey (ESS) data. Our empirical strategy consists of exploiting variations in the minimum wage across countries and over time using individual-level data. Our estimates suggest that minimum wage increases improve individuals' self-reported health and income security. Minimum wage increases also improve life satisfaction and happiness. These positive effects are largest among women, employed individuals, married individuals, minorities, those with less than a secondary education, and those living in the poorest countries. Our results are robust to several robustness checks.

The rest of the paper is organized as follows. In the sections Data and Empirical strategy present, respectively, the sample data and the empirical strategy. In Section Results summarizes the empirical results, and section Conclusion concludes the paper.

Data

We use data from the European Social Survey (ESS), a cross-sectional survey of more than 30 European countries. Since 2001/2002, ESS interviews have been conducted biennially and include questions on the attitudes, beliefs, and behaviors of European residents over 15 years old.[4] In this study, we use the 2001/2002 to 2016/2017 cycles of ESS on 17 European countries.[5]

Our sample includes individuals 18 to 64 years old with no more than a high school degree. This approach is consistent with existing evidence on minimum wages and health for several reasons (Andreyeva and Ukert, 2018; Horn et al., 2017). First, we focus on individuals 18 to 64 years old because we would like to know how minimum wages affect the health of individuals likely to be persistently impacted by low wages throughout their careers. Second, we want to focus on individuals likely affected by minimum wages (i.e., lesser-skilled workers). Existing evidence uses education as an hourly wage proxy and

[3] Several studies have exploited income shocks, such as changes in the Earned Income Tax Credit (Evans & Garthwaite, 2014) or inheritances and lottery winnings (Gardner & Oswald, 2007), to estimate the causal effect of increased income on health. The use of minimum wages as natural experiments is a very recent approach adopted in the literature (Leigh et al., 2019)

[4] The ESS questionnaire includes a combination of repeated key items (the core section), which remains relatively similar from round to round, as well as several rotating modules, repeated at intervals.

[5] Only countries that had effective minimum wages in place during our study period are included in the analysis. These countries are Belgium, the Czech Republic, Estonia, France, Germany, Hungary, Ireland, Israel, Latvia, Lithuania, Luxembourg, the Netherlands, Poland, the Slovak Republic, Slovenia, Spain, and the United Kingdom.

classifies individuals with high school education or less as the group most commonly affected by minimum wage (Leigh et al., 2019; Andreyeva and Ukert, 2018; Horn et al., 2017; Hoynes et al., 2015; Sabia & Nielsen, 2015; Evans & Garthwaite, 2014). Thus, we follow the approach adopted by previous studies and focus on low-educated individuals–a group most likely to be affected by minimum wages.

We also excluded respondents not in the labor force or who were self-employed.[6] These sample restrictions allow us to focus on those individuals likely to be affected by changes in the minimum wage and whom policymakers target when considering raising the minimum wage: low-skilled workers with low salaries.

Next, we match individuals surveyed in a particular country, month, and year with annual data on the real hourly minimum wages, which are collected from the OECD database (OECD Database).[7]

We use self-reported health status as an outcome variable to measure an individual's health with the question: "How is your health in general?" Responses are coded on a 5-point Likert scale: 1 ("Very good"), 2 ("Good"), 3 ("Fair"), 4 ("Bad"), and 5 ("Very bad"). We also construct three indicator variables: a dummy that equals 1 if the individual is in "very good" health and 0 otherwise; a dummy that equals 1 if the individual reports "very good" or "good" health and 0 otherwise; and finally a dummy that equals 1 if the individual reports "bad" or "very bad" health. All of these indicators are very common in the health economics literature and are, in particular, used to investigate the relationship between minimum wages and health (Lebihan & Takongmo, 2018; Horn et al., 2017; Barbaresco et al.., 2015; Humphreys et al., 2014). Existing evidence shows that self-assessed health variables are associated with objective measures of health (DeSalvo et al., 2006; Idler & Benyamini, 1997).

We also use two variables related to well-being: life satisfaction and happiness. Evidence shows that life satisfaction and happiness are associated with overall health and, specifically, with mental health (Lombardo et al., 2018; Siahpush et al., 2008; Bray & Gunnell, 2006). We measure life satisfaction using the following question: "All things considered, how satisfied are you with your life as a whole nowadays?" Responses are coded on a scale from 0 (extremely bad) to 10 (extremely good). Happiness is measured using the following question: "Taking all things together, how happy would you say you are?" Responses are coded on a scale from 0 (extremely unhappy) to 10 (extremely happy).

Financial distress is known to have a detrimental effect on well-being (Berrill et al., 2021). Increasing minimum wage may reduce financial stress on vulnerable individuals because studies show that minimum wage increases raise income for low-income groups (Gertner et al., 2019). We measure economic insecurity using the following question: "Which of the descriptions on this card comes closest to how you feel about your household's income nowadays?" Responses were coded as: 1 ("Living comfortably on present income"), 2 ("Coping on present income"), 3 ("Difficult on present income"), and 4 ("Very difficult on present income"). We construct an indicator variable on economic insecurity: a dummy that equals 1 if it is "difficult on present income" or "very difficult" and 0 otherwise.

[6] Respondents who are not in the labor force include those who are retired, are students, or reported being a homemaker.

[7] "Real hourly minimum wages are calculated first by deflating the series using the consumer price index taking 2020 as the base year. The series are then converted into a common currency unit (USD) using Purchasing Power Parities (PPPs) for private consumption expenditures in 2020." (OECD Database).

We include several covariates to control for individual- and country-level characteristics that might correlate with both minimum wage and our dependent variables. The individual-level controls are gender, age and age squared, immigrant status (whether the respondent was not born in the country of residence), partnership status (whether the respondent is married/cohabiting), minorities (whether the respondent is a visible minority), education categories (less than secondary education, secondary schooling), religion (whether the respondent belongs to particular religion or denomination), and living in an urban area. We also include the natural logarithm of household size.

The country-level characteristics are the natural logarithm of real GDP per capita (in 2018 US dollars), government health expenditures and family expenditures (as a share of total GDP), annual unemployment rate, and the number of hospital beds and physicians per 1000 people. We also include net replacement rate in unemployment, tax wedge, trade union density, and collective bargaining coverage. Net replacement rate in unemployment and tax wedge are measured for a single person without children earning an average wage. Net replacement rates in unemployment measure the proportion of income that is maintained after two months of unemployment. Tax wedge is used as a control for labor taxation. Trade union density is defined as the number of net union members (i.e., excluding those who are not in the labor force, unemployed, and self-employed) as a proportion of the number of employees. The collective bargaining coverage rate represents the share of workers covered by valid collective agreements in force. These variables are available in the OECD database and are similar to those used in studies of minimum wage (Andreyeva and Ukert, 2018; Horn et al., 2017).[8]

Appendix Table 5 provides an overview of the OECD countries studied in this paper. The year when minimum wage was introduced as well as summary statistics for the minimum wage and the Kaitz index is presented for each country throughout the study period. In our sample, the first country to introduce a minimum wage was Spain (1963); the last country to do so was Germany (2015). The three countries with the most generous minimum wages are Belgium (11.00 USD PPP), France (11.77 USD PPP), and Germany (11.33 USD PPP). The three countries with the less generous minimum wages are Estonia (3.48 USD PPP), Latvia (3.04 USD PPP), and Slovak Republic (2.44 USD PPP). We note large variations in minimum wages and the Kaitz index between countries and within countries during the period of this study. Poland and Slovenia experienced the largest jump in their minimum wages and the Kaitz index. In our sample, all the countries have a national minimum wage system, meaning that, according to the law, the minimum wage is geographically homogeneous in the country. There are no geographically heterogeneous minimum wage policies within the country.[9]

Table 1 presents the summary statistics for our study sample. We show statistics for the dependent variables. The average self-reported general health is 2.12, with 20.9% reporting their health as very good health and 71.3% reporting their health as very good or good. About 3.5% of respondents report that their health as bad or very bad, and

[8] In Europe, and particularly in our sample, between 90% and 99% of the total population is covered by public health insurance. Many European countries benefit from universal access to health care. This contrasts sharply with the United States, where only about 30% of the total population is covered by public health insurance such as Medicare and Medicaid. (OECD, 2021).

[9] Some OECD countries such as the United States or Canada have a regional minimum wage, meaning the minimum wage varies by region. In these countries, there is a federal wage minimum wage, but states may set a minimum wage above the federal level. In our sample, all countries have geographically homogeneous minimum wage policies within the country (Adema et al., 2019).

Table 1 Descriptive statistics

	Mean	SD	Min	Max
Outcomes				
Health	2.116	0.777	1	5
Very good health	0.209	0.407	0	1
Very good or good health	0.713	0.452	0	1
Bad or very bad health	0.035	0.184	0	1
Life satisfaction	6.594	2.251	0	10
Happiness	7.089	1.934	0	10
Difficult or very difficult to live on present income	0.301	0.459	0	1
Country characteristics				
Minimum wage	6.769	3.271	1.820	12.100
Government health expenditures (% of GDP)	6.075	1.512	3.608	9.576
Family expenditures (% of GDP)	2.169	0.738	0.905	3.941
GDP per capita	35,680.51	13,493.21	16,163.75	97,605.62
Hospital beds (per 1000)	5.538	1.661	2.540	8.130
Physicians (per 1000)	3.152	0.504	2.160	4.560
Unemployment rate	9.137	4.470	3.100	26.100
Tax wedge	41.319	7.529	20.351	56.331
Net replacement rate in unemployment	60.418	11.591	35.000	85.000
Trade union density	20.943	12.066	4.700	56.900
Collective bargaining coverage	52.396	29.866	8.300	100.000
Personal characteristics				
Female	0.458	0.498	0	1
Age	40.949	11.811	18	64
Household size	3.246	1.405	1	20
Less than secondary education	0.273	0.445	0	1
Secondary schooling	0.727	0.445	0	1
Immigrant	0.087	0.282	0	1
Partnered	0.674	0.469	0	1
Minority	0.063	0.243	0	1
Any religion	0.518	0.500	0	1
Urban	0.281	0.449	0	1

This table displays the weighted summary statistics for outcome variables, country, and personal characteristics

30.1% find that it is difficult or very difficult to live on their present income. The average life satisfaction and happiness are, respectively, 6.59 and 7.09. We also present statistics for country-level and individual characteristics. For example, in our sample of low-educated individuals, about 27% of respondents have less than a secondary education and 73% have completed secondary schooling. The average age is 40.9 years, and the minority share is roughly 6%. On average, the unemployment rate is 9.14%, and the GDP per capita is around US $35,681. The average net replacement rate in unemployment is 60.4%.

Empirical strategy

Our empirical strategy consists of exploiting the variation in the minimum wages across countries and over time. We estimate the following model:

$$Y_{icmt} = \beta_0 + \beta_1 MW_{ct} + \beta_2 Z_{ct} + \beta_3 X_{icmt} + \theta_c + \tau_t + M_m + \Omega_{ct} + \varepsilon_{ictm} \quad (1)$$

where Y_{icmt} is an outcome variable for individual i in country c in month m and in year t. The MW_{ct} variable is the current minimum wage in country c in year t. Z_{ct} and X_{icmt} are, respectively, country and individual control variables. θ_c, τ_t, and M_m are, respectively, country, year, and month fixed effects. Country fixed effects control for time-invariant country-level characteristics that influence individuals, and year fixed effects control for changes in health over time common to all countries. Month fixed effects control for seasonality in health outcomes (Christodoulou et al., 2012). We also include country-specific linear time trends Ω_{ct} to control for time-varying country-level factors. Finally, ε_{ictm} is the error term.

In the Grossman (1972) model, there could be a time delay between minimum wage variations and health. In order to take this into account, we also estimate the following model with the lagged minimum wage:

$$Y_{icmt} = \beta_0 + \beta_1 MW_{ct-1} + \beta_2 Z_{ct-1} + \beta_3 X_{icmt} + \theta_c + \tau_t + M_m + \Omega_{ct} + \varepsilon_{ictm} \quad (2)$$

where MW_{ct-1} is the one-year lagged minimum wage for each country and year.

Following the minimum wage literature, we consider the natural logarithm of the minimum wage, and coefficient estimates can be interpreted as semi-elasticities.[10] For continuous dependent variables, we use ordinary least squares (OLS); for binary dependent variables, we use linear probability models.[11] We also use the weights available in the ESS data. Standard errors are clustered at the country level to account for shocks correlated within country over time.

Results

This section is arranged as follows. First, we report the main estimates of minimum wage on health. Second, we explore heterogeneous effects. Finally, we present results from a series of robustness checks.

Main estimates

In Table 2, four specifications are presented for the main estimates: (i) only countries, year, and month dummies; (ii) the addition of individual control variables; (iii) the addition of country-specific control variables; and (iv) the addition of linear country-specific time trends. In the first three specifications, the results are consistent. Indeed, Panel A

[10] Results using unlogged minimum wages are similar and available from the authors.

[11] Linear models are commonly used in the literature for ease of interpretation. Results are similar if we use ordered probit models (available on request). Moreover, existing evidence shows that results are similar when well-being and health are treated as an ordinal or cardinal concept (Kuroki, 2018; Haeck et al., 2018; Horn et al., 2017).

Table 2 Main estimates

	MW (1)	MW (2)	MW (3)	MW (4)	N
Panel A: Current min.wage					
Health	−0.358***	−0.420***	−0.347***	−0.167*	45,464
	(0.095)	(0.091)	(0.105)	(0.094)	
Very good health	0.087	0.114**	0.125**	0.115***	45,464
	(0.051)	(0.043)	(0.049)	(0.039)	
Very good or good health	0.205***	0.233***	0.174***	−0.014	45,464
	(0.051)	(0.051)	(0.057)	(0.065)	
Bad or very bad health	−0.054***	−0.062**	−0.040*	−0.055*	45,464
	(0.017)	(0.021)	(0.020)	(0.028)	
Life satisfaction	1.600***	1.705***	0.885***	0.493	45,313
	(0.279)	(0.288)	(0.237)	(0.422)	
Happiness	1.213***	1.306***	0.770***	0.774**	45,272
	(0.200)	(0.227)	(0.222)	(0.298)	
Difficult or very difficult to live	−0.386***	−0.410***	−0.227***	−0.201**	45,140
on present income	(0.060)	(0.078)	(0.040)	(0.072)	
Panel B: Lagged min.wage					
Health	−0.331***	−0.387***	−0.323**	−0.029	45,309
	(0.104)	(0.101)	(0.121)	(0.129)	
Very good health	0.072	0.097*	0.077	0.031	45,309
	(0.054)	(0.047)	(0.058)	(0.072)	
Very good or good health	0.202***	0.227***	0.181**	−0.061	45,309
	(0.057)	(0.057)	(0.065)	(0.075)	
Bad or very bad health	−0.049***	−0.055**	−0.058***	−0.049*	45,309
	(0.016)	(0.020)	(0.016)	(0.028)	
Life satisfaction	1.250***	1.325***	1.177***	−0.361	45,158
	(0.327)	(0.315)	(0.363)	(0.507)	
Happiness	0.958***	1.025***	0.541**	−0.026	45,117
	(0.227)	(0.228)	(0.222)	(0.466)	
Difficult or very difficult to live	−0.316***	−0.333***	−0.111	−0.031	44,985
on present income	(0.061)	(0.076)	(0.081)	(0.081)	
Countries dummies	Yes	Yes	Yes	Yes	
Year dummies	Yes	Yes	Yes	Yes	
Month dummies	Yes	Yes	Yes	Yes	
Individual X's	No	Yes	Yes	Yes	
Country-specific X's	No	No	Yes	Yes	
Linear country-specific time trends	No	No	No	Yes	

For each dependent variable, we report the estimated effects under different specifications (β_1 shown). Standard errors (in parentheses) are clustered at the country level. ***significant at 1% ; **significant at 5% ; *significant at 10%

(Column 3) shows that minimum wage increases have a beneficial and significant effect on the health status of individuals. The results also suggest that a 10% increase in minimum wage is associated with a 1.25 percentage point increase in the likelihood of being in very

good health. Relative to the baseline proportion (0.209), this coefficient estimate implies a 6% increase in this probability. Similarly, we report that a 10% increase in minimum wage is associated with a 1.74 percentage point increase in the likelihood of being in very good/good health and a 0.40 percentage point decrease in the likelihood of being in bad/very bad health. The results also show that an increase in minimum wage significantly raises life satisfaction and happiness. In addition, we find that the minimum wage increases are associated with a decrease in the likelihood of finding it difficult to live on the present income.

Panel B shows that these findings are similar when using the one-year lagged minimum wage. In the last specification, we include state-specific time trends and show that our results remain similar.[12]

Overall, the results indicate that minimum wage improves individuals' self-reported health, well-being, and income security. These findings are in line with Lenhart (2017a), who found that the introduction of the National Minimum Wage (NMW) in the United Kingdom improved the self-reported health status of individuals and reduced their financial stress. The author also shows that the NMW improved overall job satisfaction and satisfaction with the pay. Our results are consistent with evidence from the United States. Indeed, Andreyeva and Ukert (2018) reported that minimum wage increases are associated with a decrease in the number of days in poor health. Similarly, Kuroki (2018) found a positive and significant relationship between life satisfaction of low-skilled workers and higher minimum wages. Finally, Lenhart (2017b) showed that higher minimum wage levels are associated with significant improvements in population health (mortality, life expectancy, doctor consultations, etc.) and poverty.

Heterogeneous effects

Following an increase in minimum wage, improvements in outcomes could be more plausible for some sub-populations. For example, women are more likely to be paid minimum wage than men, suggesting that the impact of minimum wage increases can be more important for women. Similarly, the effects may be different depending on whether the individual remains employed or experiences a decrease in employment outcomes. Individuals with less than secondary education account for a larger proportion of low-income individuals, suggesting the effects of increases in the minimum wage may be larger for this group.

Thus, in Table 3, we evaluate the heterogeneous effects across gender, employment status, age group, education level, marital status, minorities, and country characteristics. The results show that the minimum wage increases significantly improve individuals' health, well-being, and income insecurity, regardless of gender; however, the effects are larger for women.

Minimum wage increases are also expected to have different effects depending on employment status. Indeed, existing evidence reports negative effects on employment, particularly in European countries. For example, Caliendo et al. (2018) find that overall

[12] In general, existing evidence includes state-specific linear time trends to remove bias due to unobservable state-specific time trends when studying the impact of minimum wages on labor and health outcomes. However, Sabia and Nielsen (2015) reported that the using such trends substantially reduces the ability to identify variations (decrease of more than 60%). Thus, some studies have not included these trends in their models (Averett et al., 2018, 2017). Here, we present the results both with and without these trends, showing that, although the magnitude of the effects decreases, minimum wage increases still improve individuals' health, well-being, and personal income security.

Table 3 Heterogeneous effects

	By sex		By employment status		By age		By education	
	MW	MW*Female	MW	MW*Employed	MW	MW*Noyoung	MW	MW*LessHS
Panel A: Current min.wage								
Health	−0.149	−0.043**	−0.095	−0.098***	−0.099	−0.077***	−0.168*	−0.067*
	(0.093)	(0.018)	(0.105)	(0.012)	(0.096)	(0.013)	(0.092)	(0.032)
Very good health	0.112***	0.007	0.098**	0.023***	0.099**	0.018**	0.115**	−0.010
	(0.038)	(0.010)	(0.041)	(0.007)	(0.040)	(0.008)	(0.040)	(0.013)
Very good or good health	−0.028	0.033***	−0.055	0.056***	−0.060	0.053***	−0.012	0.057***
	(0.064)	(0.011)	(0.069)	(0.006)	(0.065)	(0.008)	(0.064)	(0.018)
Bad or very bad health	−0.054*	−0.003	−0.043	−0.017***	−0.051*	−0.004*	−0.056*	−0.020*
	(0.028)	(0.004)	(0.029)	(0.003)	(0.028)	(0.002)	(0.027)	(0.009)
Life satisfaction	0.485	0.020	0.042	0.604***	0.374	0.135***	0.500	0.253***
	(0.430)	(0.048)	(0.391)	(0.043)	(0.427)	(0.043)	(0.430)	(0.075)
Happiness	0.782**	−0.019	0.478	0.401***	0.669**	0.120***	0.780**	0.261***
	(0.302)	(0.046)	(0.277)	(0.038)	(0.301)	(0.030)	(0.305)	(0.062)
Difficult or very difficult to live	−0.193**	−0.021**	−0.073	−0.174***	−0.199**	−0.003	−0.204**	−0.095***
on present income	(0.072)	(0.009)	(0.065)	(0.015)	(0.076)	(0.009)	(0.075)	(0.029)
Panel B: Lagged min.wage								
Health	−0.011	−0.040**	0.042	−0.098***	0.033	−0.078***	−0.034	−0.063*
	(0.129)	(0.017)	(0.140)	(0.012)	(0.134)	(0.014)	(0.130)	(0.030)
Very good health	0.028	0.006	0.015	0.023***	0.017	0.018**	0.030	−0.011
	(0.072)	(0.010)	(0.074)	(0.007)	(0.071)	(0.008)	(0.072)	(0.013)
Very good or good health	−0.074	0.031***	−0.101	0.056***	−0.104	0.054***	−0.056	0.055***
	(0.074)	(0.010)	(0.081)	(0.006)	(0.079)	(0.008)	(0.076)	(0.017)
Bad or very bad health	−0.048	−0.003	−0.037	−0.017***	−0.046	−0.004	−0.051*	−0.019*
	(0.027)	(0.004)	(0.028)	(0.003)	(0.028)	(0.002)	(0.027)	(0.009)

Table 3 (continued)

	By sex		By employment status		By age		By education	
	MW	MW*Female	MW	MW*Employed	MW	MW*Noyoung	MW	MW*LessHS
Life satisfaction	−0.369	0.018	−0.800	0.604***	−0.469	0.136***	−0.339	0.251***
	(0.516)	(0.047)	(0.497)	(0.044)	(0.507)	(0.045)	(0.498)	(0.072)
Happiness	−0.017	−0.021	−0.317	0.402***	−0.123	0.120***	−0.002	0.255***
	(0.474)	(0.044)	(0.462)	(0.039)	(0.463)	(0.031)	(0.461)	(0.057)
Difficult or very difficult to live	−0.021	−0.021**	0.097	−0.174***	−0.027	−0.004	−0.040	−0.093***
on present income	(0.082)	(0.009)	(0.094)	(0.015)	(0.084)	(0.009)	(0.079)	(0.028)
	By marital status		By minority		By country characteristics	
	MW	MW*Married	MW	MW*Minority	MW	MW*Developing
Panel A: Current min.wage						
Health	−0.079	−0.118***	−0.149	−0.043**	−0.736	0.598
	(0.096)	(0.016)	(0.093)	(0.018)	(0.464)	(0.477)
Very good health	0.074*	0.055***	0.112***	0.007	0.185	−0.074
	(0.037)	(0.010)	(0.038)	(0.010)	(0.226)	(0.214)
Very good or good health	−0.058	0.059***	−0.028	0.033***	0.349	−0.381
	(0.067)	(0.009)	(0.064)	(0.011)	(0.245)	(0.260)
Bad or very bad health	−0.053*	−0.003	−0.054*	−0.003	−0.199**	0.151**
	(0.028)	(0.004)	(0.028)	(0.004)	(0.069)	(0.064)
Life satisfaction	0.302	0.256***	0.485	0.020	0.333	0.169
	(0.430)	(0.073)	(0.430)	(0.048)	(1.321)	(1.265)
Happiness	0.697**	0.104**	0.782**	−0.019	0.605	0.178
	(0.292)	(0.045)	(0.302)	(0.046)	(0.976)	(0.823)
Difficult or very difficult to live	−0.176**	−0.035**	−0.193**	−0.021**	0.267	−0.492**
on present income	(0.076)	(0.015)	(0.072)	(0.009)	(0.193)	(0.185)

Table 3 (continued)

	By marital status		By minority		By country characteristics	
	MW	MW*Married	MW	MW*Minority	MW	MW*Developing
Panel B: Lagged min.wage						
Health	0.047	−0.113***	−0.025	−0.036	−0.902*	0.912*
	(0.135)	(0.016)	(0.130)	(0.024)	(0.460)	(0.451)
Very good health	−0.003	0.051***	0.030	0.016	0.217	−0.194
	(0.072)	(0.010)	(0.073)	(0.018)	(0.215)	(0.194)
Very good or good health	−0.099	0.057***	−0.063	0.029*	0.518*	−0.604**
	(0.078)	(0.009)	(0.075)	(0.015)	(0.274)	(0.264)
Bad or very bad health	−0.047	−0.003	−0.049*	0.003	−0.158**	0.114*
	(0.028)	(0.004)	(0.027)	(0.010)	(0.067)	(0.058)
Life satisfaction	−0.529	0.251***	−0.385	0.256*	−0.503	0.149
	(0.502)	(0.073)	(0.496)	(0.129)	(1.020)	(1.333)
Happiness	−0.092	0.099**	−0.042	0.173	0.373	−0.417
	(0.476)	(0.044)	(0.462)	(0.133)	(0.874)	(1.078)
Difficult or very difficult to live	−0.008	−0.034**	−0.028	−0.026	0.489	−0.543*
On present income	(0.083)	(0.015)	(0.081)	(0.026)	(0.299)	(0.300)

employment was reduced by around 140,000 jobs, or 0.4%, after the implementation of a minimum wage in Germany. Similar results are obtained by Holtemöller and Pohle (2020). Consistent with these findings in Germany, studies of the UK's minimum wage show small negative effects on employment (Dolton et al., 2015) Workers who remain employed following a minimum wage increase will experience income gains (all else being equal) whereas those who lose their jobs because of the minimum wage will experience income losses. Workers with higher incomes should invest more in market goods and see their health improve when minimum wage increases (all else being equal) (Grossman, 1972). However, job losers earn less and, therefore, their health could decline as a result of this decrease in income.[13] According to the relative income hypothesis and as wage changes are common knowledge, individuals who lose their jobs could also experience worse health outcomes because they are not benefiting from the higher salaries and they compare themselves to their employed peers who are benefiting from them. Job loss due to minimum wage can also have a negative effect on financial security and therefore on mental health. Our findings here are consistent with all of these hypotheses. Indeed, the beneficial effects of minimum wage on health, well-being, and income security are driven by employed individuals. The coefficient on the interaction term $MW * Employed$ is significant for all outcomes, suggesting that individuals who remain employed with an increase in the minimum wage experience fewer financial difficulties, which is beneficial for their health and well-being. Thus, low-wage workers who are still employed are better off in terms of health and income security at the expense of those who lost their jobs due to minimum wage. Our results are consistent with those of Horn et al. (2017), who document heterogeneous effects by employment status. Clearly, to the extent minimum wages cause unemployment, there is also a negative effect on health that needs to be accounted for. Although the causality between minimum wage and unemployment is beyond the scope of this paper, these results could be important for policymakers and choosing to put these policies in place could improve the outcomes of low-wage workers. Indeed, if these minimum wage increases lead to unintended consequences, such as reduced health outcomes in addition to job losses, these effects should not be ignored.

In Table 3, we also report the heterogeneous effects across age groups. We show that minimum wage increases have a significant and beneficial impact on health and income insecurity, regardless of individuals' age; however, the effects are more important for older individuals.[14] We also find significant beneficial effects on individuals' health, well-being and income insecurity, regardless of education, but the effects are significantly larger for respondents with less than secondary education. For example, the results show that a 10% increase in minimum wages is associated with a 0.56 percentage point decrease in the likelihood of being in bad/very bad health for all individuals, but this effect is 0.76 percentage point ($0.056 + 0.020 = 0.076$) for lower educated. Similarly, we report a larger impact of minimum wage increases on married individuals and minorities. Finally, we explore if there are differential effects between rich and poor countries because existing evidence has reported that income inequality and poverty are important drivers of adverse health outcomes in poor countries (Deaton, 2003). Estimates show that the minimum wage increases

[13] Colman and Dave (2013) report that individuals who lose their jobs experience a decrease in overall physical activity and an increase in sedentary activity (e.g., television watching).

[14] Older individuals include those 30 years old or older.

have a significant effect on health, well-being, and income insecurity, regardless of the richness of country; however, the effects are larger for poor countries.[15]

Clearly, the positive effects on health are largest among women, employed individuals, married individuals, minorities, those with less than secondary education, and those living in the poorest countries. Indeed, these subgroups are more vulnerable to financial constraints and economic insecurity and have a higher marginal utility of income. These findings are similar to those reported by Andreyeva and Ukert (2018) and Lenhart (2017b).

Robustness checks

In Table 4, we present estimates from a number of robustness checks. In each panel, a different regression is shown. In Panel A, we exclude individuals 55 years old or older because they may be marginally attached to the labor force. Panel B excludes respondents younger than 20 years old. Teens could move into higher-wage jobs and earn more than the minimum wage once they get additional education or gain more work experience (Horn et al., 2017). In Panel C, we exclude the years of the recession (2008 and 2009) from the sample. These first three specifications allow us to test whether the sample composition and sample period affect our findings. Regardless of the specification, our results remain similar and indicate that minimum wage increases have a beneficial effect on health, well-being and income security.

In Panel D, we replace state-specific linear time trends with state-specific quadratic time trends. This allows us to be less restrictive concerning specific forms on unobservable differences, and we show that results remain similar.

In existing evidence on minimum wage, standard errors are clustered at the country level (or state level). However, several concerns about inference exist (Cameron et al., 2008; Donald & Lang, 2007; Bertrand et al., 2004). Indeed, the conventional methods underestimate cluster-adjusted standard errors when they are limited in number, like in our study with 17 clusters. To overcome this, in Panel E, we use the wild cluster bootstrap suggested by Cameron et al. (2008) and Webb (2014). Again, no matter the specification, our estimates remain consistent.

We also estimate the impact of minimum wage using the Kaitz index. This index, available in the OECD database, measures the ratio between a country's minimum wage and the mean wages of full-time workers. The Kaitz index has been widely used in studies examining minimum wage effects and has the advantage of including information on the relative level of minimum wages (Lenhart, 2017b; Neumark et al., 2014; Brown et al., 1982). Estimates are shown in Appendix Table 6 and confirm the findings presented earlier.

In Appendix Table 7, we report additional robustness tests. In Panel H, we replace the one-year lagged minimum wage, in equation (2), with the two-year lagged minimum wage. Similarly, we replace the one-year lagged minimum wage with the three-year lagged minimum wage. We found no significant effect of minimum wage increases on the outcomes studied, suggesting that the effects are essentially contemporaneous or with a time lag of up to one year.

[15] The division of countries is based on GDP per capita. Poor countries include countries whose GDP per capita is lower than the median GDP per capita in the sample (i.e., the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, the Slovak Republic, and Slovenia). Rich countries include countries whose GDP per capita is higher than the median GDP per capita of the sample (i.e., Belgium, France, Germany, Ireland, Israel, Luxembourg, the Netherlands, Spain, and the United Kingdom).

Table 4 Robustness checks

			Health	Very good health	Very good or good health	Bad or very bad health	Life satisfaction	Happiness	Difficult or very difficult to live on present income
Panel A: Drop 55 and more	Cur. min.wage	MW	−0.091	0.106**	−0.091	−0.066**	0.250	0.724*	−0.156*
			(0.094)	(0.045)	(0.070)	(0.023)	(0.429)	(0.395)	(0.075)
	Lag. min.wage	MW	−0.069	0.028	−0.037	−0.069**	−0.545	0.048	−0.007
			(0.129)	(0.076)	(0.074)	(0.028)	(0.486)	(0.494)	(0.082)
Panel B: Exclude teens (18−19 years)	Cur. min.wage	MW	−0.169*	0.118***	−0.015	−0.056*	0.473	0.791**	−0.210**
			(0.088)	(0.037)	(0.064)	(0.027)	(0.450)	(0.307)	(0.072)
	Lag. min.wage	MW	−0.020	0.025	−0.067	−0.053*	−0.344	−0.033	−0.042
			(0.129)	(0.072)	(0.076)	(0.027)	(0.525)	(0.480)	(0.085)
Panel C: Drop 2008/09 recession	Cur. min.wage	MW	−0.082	0.055	−0.055	−0.062*	−0.088	0.487	−0.090
			(0.081)	(0.061)	(0.062)	(0.031)	(0.402)	(0.344)	(0.073)
	Lag. min.wage	MW	0.044	−0.047	−0.059	−0.050	−0.897**	−0.179	−0.027
			(0.139)	(0.083)	(0.072)	(0.035)	(0.379)	(0.418)	(0.087)
Panel D: Country−specific quadratic									
time trends included	Cur. min.wage	MW	−0.227*	0.146**	0.017	−0.056**	0.739	0.919**	−0.194**
			(0.115)	(0.057)	(0.061)	(0.024)	(0.441)	(0.337)	(0.078)
	Lag. min.wage	MW	−0.141	0.081	−0.009	−0.060*	0.122	0.384	−0.098
			(0.126)	(0.070)	(0.071)	(0.030)	(0.409)	(0.364)	(0.068)
Panel E: Bootstrap p−values									
	Cur. min.wage	MW	0.1692	0.016	0.8639	0.0681	0.4224	0.0831	0.1431
	Lag. min.wage	MW	0.8579	0.7157	0.4995	0.1111	0.6146	0.972	0.7648
Panel F: Placebo group -									

Table 4 (continued)

			Health	Very good health	Very good or good health	Bad or very bad health	Life satisfaction	Happiness	Difficult or very difficult to live on present income
Universitary only -DD	Cur. min.wage	MW	−0.164	0.118	0.012	−0.027	0.371	0.601	0.140
			(0.122)	(0.070)	(0.091)	(0.038)	(0.252)	(0.357)	(0.132)
	Lag. min.wage	MW	−0.093	0.077	−0.003	−0.005	−1.077**	−0.117	0.207**
			(0.174)	(0.099)	(0.128)	(0.036)	(0.376)	(0.324)	(0.079)
Panel G: DDD with University									
	Cur. min.wage	MW	−0.146	0.130**	−0.030	−0.042	0.287	0.681***	−0.060
			(0.086)	(0.046)	(0.055)	(0.024)	(0.260)	(0.218)	(0.102)
		MW*LowEduc	−0.005	−0.031***	0.030*	−0.005	0.327***	0.310***	−0.094***
			(0.023)	(0.010)	(0.015)	(0.004)	(0.110)	(0.070)	(0.026)
	Lag. min.wage	MW	0.022	0.051	−0.103	−0.023	−0.836*	−0.262	0.081
			(0.122)	(0.072)	(0.062)	(0.022)	(0.424)	(0.326)	(0.085)
		MW*LowEduc	−0.007	−0.030***	0.031**	−0.005	0.323***	0.304***	−0.090***
			(0.022)	(0.010)	(0.014)	(0.004)	(0.107)	(0.070)	(0.026)

All estimates include country dummies, year dummies, month dummies, individual characteristics, country characteristics, and linear country−specific time trends. Standard errors (in parentheses) are clustered at the country level. ***significant at 1% ; **significant at 5% ; *significant at 10%

In Panel I (Appendix Table 7), the minimum wage is divided into five quantiles in order to study the potential effects of non-linearities (the first quantile is the reference category). The estimates show that the effects are significant across the entire minimum wage distribution (significant effects across all five quantiles), although the effects are larger for the highest quintiles.

In Panel J (Appendix Table 7), as a falsification test, we replace the one-year lagged minimum wage in equation (2) with the one-year lead minimum wage for each country and year. The underlying intuition is that current health outcomes are unlikely to be affected by future minimum wages. We found that the lead minimum wage has no significant effect on outcomes at the 5% level, except for financial security. This finding may simply reflect that minimum wage changes are correlated with some unobservable variables that affect financial security. However, we argue that it is reassuring that this concerns only one outcome and that our results are robust to all robustness tests.

Finally, similar to Huang et al. (2021), we conduct a falsification test using one placebo group: university-educated adults aged 18–64 years old. The DD estimates show no significant effect of the minimum wage on this group (Table 4, Panel F). The only exceptions are life satisfaction and income insecurity with lagged minimum wage, but the coefficient estimates instead show a decrease of life satisfaction and an increase of income insecurity for this group.[16] In Panel G, we use the university group as the placebo group to estimate a difference-in-differences-in-differences (DDD) model. We add an indicator for whether an individual belongs to the low-educated group. We find that the observed effects are mostly significant for low-educated individuals. The estimates are consistent with those estimated in the DD model. Clearly, these results give us confidence that our results are not spurious.

Conclusion

This paper presents new empirical evidence of the effects of minimum wage on self-reported health, well-being, and income insecurity in European countries. To the best of our knowledge, this study is the first to investigate the impact of minimum wage on health/well-being in European countries using individual-level data. We show that minimum wage increases improve individuals' self-reported health and income security. Minimum wage increases also improve life satisfaction and happiness. The effects are larger for women, employed individuals, married individuals, minorities, those with less than secondary education, and those living in the poorest countries. Our results are also robust to several robustness checks and consistent with existing evidence.

These findings have important implications for policymakers and contribute to the ongoing debate on the introduction of a common framework on minimum wage in Europe, especially in the context of the Covid-19 pandemic. In general, countries wishing to introduce or increase the minimum wage are motivated to reduce poverty and improve social equity. Our results show that this type of reform can also have unexpected impacts on health outcomes and reduce existing health disparities. Due to data limitations, this study is viewed as an important first step in exploring the relationship between health and minimum wages, and future studies should examine the effects of

[16] In Appendix Table 7, we report DD results using a different placebo group: retired adults who are 65 years old and older (Panel H). Despite a few exceptions, the results generally show a non-significant effect of minimum wage increases on the outcomes studied.

minimum wage increases on other health outcomes and its potential mechanisms, such as health care access and health care utilization.

Appendix

See Tables 5, 6 and 7.

Table 5 Minimum wage (details), 2001–2017 (Appendix)

Country (Year of Introduction of the Minimum Wage)	Variable	Mean	SD	Min.	Max.	System
Belgium (1975)	Minimum Wage	11.00	0.16	10.76	11.40	National
	Kaitz index	0.41	0.01	0.39	0.43	
Czech Republic (1991)	Minimum Wage	3.95	0.28	3.34	4.44	National
	Kaitz index	0.33	0.01	0.31	0.35	
Estonia (1991)	Minimum Wage	3.48	0.64	2.54	4.78	National
	Kaitz index	0.33	0.02	0.30	0.37	
France (1970)	Minimum Wage	11.77	0.22	11.43	12.10	National
	Kaitz index	0.51	0.00	0.50	0.51	
Germany (2015)	Minimum Wage	11.33	0.09	11.29	11.57	National
	Kaitz index	0.42	0.00	0.42	0.43	
Hungary (1991)	Minimum Wage	3.68	0.54	3.22	4.80	National
	Kaitz index	0.38	0.03	0.34	0.43	
Ireland (2000)	Minimum Wage	8.97	0.22	8.78	9.38	National
	Kaitz index	0.36	0.01	0.33	0.38	
Israel (1987)	Minimum Wage	5.78	0.40	5.31	6.61	National
	Kaitz index	0.42	0.01	0.39	0.44	
Latvia (1991)	Minimum Wage	3.04	0.00	3.04	3.04	National
	Kaitz index	0.37	0.00	0.37	0.37	
Lithuania (1990)	Minimum Wage	3.95	0.71	3.19	4.88	National
	Kaitz index	0.42	0.02	0.39	0.44	
Luxembourg (1973)	Minimum Wage	10.87	0.03	10.86	11.07	National
	Kaitz index	0.45	0.00	0.45	0.46	
Netherlands (1969)	Minimum Wage	10.96	0.11	10.80	11.17	National
	Kaitz index	0.41	0.01	0.39	0.42	
Poland (1970)	Minimum Wage	4.42	0.99	3.26	6.41	National
	Kaitz index	0.37	0.03	0.34	0.44	
Slovak Republic (1991)	Minimum Wage	2.44	0.39	1.82	2.90	National
	Kaitz index	0.35	0.01	0.34	0.37	
Slovenia (1995)	Minimum Wage	6.49	0.88	5.30	7.55	National
	Kaitz index	0.46	0.04	0.41	0.50	
Spain (1963)	Minimum Wage	7.42	0.39	6.64	8.07	National
	Kaitz index	0.31	0.02	0.28	0.34	
United Kingdom (1999)	Minimum Wage	9.10	0.40	8.79	9.95	National
	Kaitz index	0.40	0.02	0.38	0.44	

Hourly minimum wages are measured in USD PPP

Table 6 Kaitz index (Appendix)

	MW	MW	MW	MW
Panel A: Current Kaitz index	(1)	(2)	(3)	(4)
Health	−0.798	−1.055*	−1.054**	−0.099
	(0.485)	(0.553)	(0.422)	(0.397)
Very good health	0.166	0.268	0.417	−0.129
	(0.254)	(0.264)	(0.251)	(0.237)
Very good or good health	0.481*	0.600*	0.537**	0.205
	(0.266)	(0.293)	(0.226)	(0.213)
Bad or very bad health	−0.123*	−0.157	−0.083	−0.027
	(0.069)	(0.090)	(0.078)	(0.115)
Life satisfaction	2.607	3.202	1.161	−1.524
	(1.816)	(2.059)	(0.926)	(1.497)
Happiness	2.952*	3.421*	0.744	−0.766
	(1.406)	(1.619)	(0.720)	(0.993)
Difficult or very difficult to live	−0.452	−0.637	−0.047	0.419
on present income	(0.476)	(0.567)	(0.265)	(0.345)
Panel B: Lagged Kaitz index				
Health	−1.308***	−1.475***	−1.008***	−0.048
	(0.335)	(0.442)	(0.316)	(0.406)
Very good health	0.406**	0.476**	0.390*	0.055
	(0.164)	(0.172)	(0.200)	(0.281)
Very good or good health	0.750***	0.823***	0.459**	−0.106
	(0.187)	(0.237)	(0.161)	(0.234)
Bad or very bad health	−0.127*	−0.150	−0.137**	−0.096
	(0.069)	(0.093)	(0.060)	(0.095)
Life satisfaction	2.231	2.551	1.768*	−2.072*
	(1.662)	(1.903)	(0.843)	(1.151)
Happiness	2.784**	3.025**	1.063**	−0.323
	(1.191)	(1.411)	(0.465)	(0.656)
Difficult or very difficult to live	−0.480	−0.607	−0.034	0.536
on present income	(0.416)	(0.517)	(0.248)	(0.381)
Countries dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Month dummies	Yes	Yes	Yes	Yes
Individual X's	No	Yes	Yes	Yes
Country-specific X's	No	No	Yes	Yes
Linear country-specific time trends	No	No	No	Yes

For each dependent variable, we report the estimated effects under different specifications (β_1 shown). Standard errors (in parentheses) are clustered at the country level. ***significant at 1%; **significant at 5%; *significant at 10%

Table 7 Robustness checks (Appendix)

		Health	Very good health	Very good or good health	Bad or very bad health	Life satisfaction	Happiness	Difficult or very difficult to live on present income
Panel H: More lags								
Two-year lags	MW	−0.069	0.067	−0.023	−0.023	−0.588	−0.236	−0.085
		(0.121)	(0.077)	(0.047)	(0.024)	(0.579)	(0.438)	(0.069)
Three-year lags	MW	−0.113	0.056	0.038	−0.020	−0.552	−0.089	−0.063
		(0.136)	(0.069)	(0.061)	(0.017)	(0.365)	(0.299)	(0.084)
Panel I: MW quantile								
Cur. min.wage	Q2	−0.026*	0.016**	0.007	−0.002	0.125*	0.122***	−0.019
		(0.014)	(0.007)	(0.009)	(0.003)	(0.062)	(0.038)	(0.014)
	Q3	−0.058	0.054**	−0.008	−0.005	0.247*	0.110	−0.047
		(0.054)	(0.023)	(0.025)	(0.011)	(0.121)	(0.135)	(0.034)
	Q4	−0.220***	0.098***	0.093***	−0.022*	0.310**	0.064	−0.057*
		(0.042)	(0.020)	(0.022)	(0.011)	(0.124)	(0.104)	(0.029)
	Q5	−0.221***	0.093***	0.090***	−0.032***	0.469***	0.201*	−0.093**
		(0.051)	(0.028)	(0.022)	(0.011)	(0.137)	(0.103)	(0.035)
Lag. min.wage	Q2	0.002	0.009	−0.020*	−0.008**	0.042	0.134*	0.009
		(0.018)	(0.010)	(0.010)	(0.004)	(0.096)	(0.069)	(0.022)
	Q3	−0.021	0.022	−0.008	−0.007	0.059	0.017	−0.028
		(0.049)	(0.018)	(0.032)	(0.010)	(0.200)	(0.193)	(0.054)
	Q4	−0.005	0.023	−0.015	0.002	0.250	0.237	−0.024
		(0.061)	(0.024)	(0.038)	(0.018)	(0.229)	(0.198)	(0.056)
	Q5	0.038	−0.008	−0.028	0.001	0.414	0.391	−0.071
		(0.065)	(0.027)	(0.044)	(0.018)	(0.257)	(0.234)	(0.056)
Panel J: One-year lead								
Lead min.wage	MW	−0.127	0.099	−0.001	−0.019	0.635	0.842*	−0.211***
		(0.137)	(0.088)	(0.056)	(0.018)	(0.451)	(0.413)	(0.068)

Table 7 (continued)

		Health	Very good health	Very good or good health	Bad or very bad health	Life satisfaction	Happiness	Difficult or very difficult to live on present income
Panel H:–Placebo group - Retired only —DD								
Cur. min.wage	MW	−0.134	0.068**	0.053	−0.063	0.874	1.401**	−0.116
		(0.217)	(0.030)	(0.106)	(0.109)	(0.542)	(0.506)	(0.101)
Lag. min.wage	MW	0.251**	0.005	−0.154*	0.046	−0.489	−0.032	0.114
		(0.110)	(0.052)	(0.080)	(0.067)	(0.375)	(0.309)	(0.109)

For each dependent variable, we report the estimated effects under different specifications (β_1 shown). Standard errors (in parentheses) are clustered at the country level. ***significant at 1% ; **significant at 5% ; *significant at 10%

Acknowledgement We wish to thank Professors Catherine Haeck, Pierre Lefebvre and Philip Merrigan. All computations were prepared by the authors, who assume responsibility for the use and interpretation of these data.

Funding This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declarations

Conflict of interest Author declares that they have no conflict of interest.

References

Adema, J. , Giesing, Y. , Schönauer, A., &Stitteneder, T. (2019). Minimum wages across countries. *ifo DICE Report 16*(4), 55–63.

Andreyeva, E., & Ukert, B. (2018). The impact of the minimum wage on health. *International Journal of Health Economics and Management, 18*(4), 337–375.

Averett, S. L. , Smith, J. K., &Wang, Y. (2017). The effects of minimum wages on the health of working teenagers. *Applied Economics Letters 24*(16), 1127–1130.

Averett, S. L., Smith, J. K., & Wang, Y. (2018). Minimum wages and the health of hispanic women. *Journal of Economics, Race, and Policy, 1*(4), 217–239.

Barbaresco, S. , Courtemanche, C. J., &Qi, Y. (2015). Impacts of the Affordable Care Act dependent coverage provision on health-related outcomes of young adults. *Journal of Health Economics 40*, 54–68.

Berrill, J., Cassells, D., & OHagan-Luff, M., & van Stel, A. (2021). The relationship between financial distress and well-being: Exploring the role of self-employment. *International Small Business Journal, 39*(4), 330–349.

Bertrand, M. , Duflo, E., &Mullainathan, S. (2004). How much should we trust differences-in-differences estimates? *The Quarterly Journal of Economics 119*(1), 249–275.

Bray, I., &Gunnell, D. (2006). Suicide rates, life satisfaction and happiness as markers for population mental health. *Social Psychiatry and Psychiatric Epidemiology 41*(5), 333–337.

Brown, C. , Gilroy, C., &Kohen, A. (1982). The effect of the minimum wage on employment and unemployment: a survey (Rapport technique). National Bureau of Economic Research.

Caliendo, M., Fedorets, A., Preuss, M., Schröder, C., & Wittbrodt, L. (2018). The short-run employment effects of the German minimum wage reform. *Labour Economics, 53*, 46–62.

Cameron, A. C., Gelbach, J. B., & Miller, D. L. (2008). Bootstrap-based improvements for inference with clustered errors. *The Review of Economics and Statistics, 90*(3), 414–427.

Card, D., & Krueger, A. B. (1994). Minimum wages and employment: A case study of the fast food industry in New Jersey and Pennsylvania. *The American Economic Review, 84*(4), 772–793.

Card, D., &Krueger, A. B. (1995). Myth and measurement: The new economics of the minimum wage-twentieth-anniversary edition. Princeton University Press.

Christodoulou, C., Douzenis, A., Papadopoulos, F. C., Papadopoulou, A., Bouras, G., Gournellis, R., & Lykouras, L. (2012). Suicide and seasonality. *Acta Psychiatrica Scandinavica, 125*(2), 127–146.

Colman, G., & Dave, D. (2013). Exercise, physical activity, and exertion over the business cycle. *Social Science AND Medicine, 93,* 11–20.

Deaton, A. (2003)March. Health, inequality, and economic development. *Journal of Economic Literature 41*(1), 113–158.

DeSalvo, K. B. , Bloser, N. , Reynolds, K. , He, J., &Muntner, P. (2006). Mortality prediction with a single general self-rated health question. *Journal of General Internal Medicine 21*(3), 267.

Dolton, P., Bondibene, C. R., & Stops, M. (2015). Identifying the employment effect of invoking and changing the minimum wage: A spatial analysis of the UK. *Labour Economics, 37*, 54–76.

Donald, S. G., & Lang, K. (2007). Inference with difference-in-differences and other panel data. *The review of Economics and Statistics, 89*(2), 221–233.

Evans, W. N., & Garthwaite, C. L. (2014). Giving mom a break: The impact of higher EITC payments on maternal health. *American Economic Journal: Economic Policy, 6*(2), 258–90.

Forbes. (2020 Jan). European commission to launch consultations on first EU minimum wage. *Forbes*. https://www.forbes.com/sites/anagarciavaldivia/2020/01/16/european-commission-to-launch-consultations-on-first-eu-minimum-wage/#4350b7794943

Gardner, J., &Oswald, A. J. (2007). Money and mental wellbeing: A longitudinal study of medium-sized lottery wins. *Journal of health economics 26*(1)49–60.

Gertner, A. K. , Rotter, J. S., &Shafer, P. R. (2019). Association between state minimum wages and suicide rates in the us. *American Journal of Preventive Medicine 56*(5), 648–654.
Grossman, M. (1972). On the concept of health capital and the demand for health. *Journal of Political Economy, 80*(2), 223–255.
Haeck, C., Lebihan, L., & Merrigan, P. (2018). Universal child care and long-term effects on child well-being: Evidence from Canada. *Journal of Human Capital, 12*(1), 38–98.
Henry, J. P. (1982). The relation of social to biological processes in disease. *Social Science and Medicine, 16*(4), 369–380.
Holtemöller, O., & Pohle, F. (2020). Employment effects of introducing a minimum wage: The case of Germany. *Economic Modelling, 89*, 108–121.
Horn, B. P., Maclean, J. C., & Strain, M. R. (2017). Do minimum wage increases influence worker health? *Economic Inquiry, 55*(4), 1986–2007.
Hoynes, H., Miller, D., & Simon, D. (2015). Income, the Earned Income Tax Credit, and infant health. *American Economic Journal: Economic Policy, 7*(1), 172–211.
Huang, C., Liu, F., & You, S. (2021). The impact of minimum wage increases on cigarette smoking. *Health Economics, 30*(9), 2063–2091.
Humphreys, B. R. , McLeod, L., &Ruseski, J. E. (2014). Physical activity and health outcomes: evidence from Canada. *Health Economics 23*(1), 33–54.
Idler, E. L., &Benyamini, Y. (1997). Self-rated health and mortality: a review of twenty-seven community studies. *Journal of Health and Social Behavior*, pp 21–37.
Kuroki, M. (2018). Subjective well-being and minimum wages: Evidence from US states. *Health Economics 27*(2), e171–e180.
Lebihan, L., & Takongmo, C.- O. M. (2018). The impact of universal child benefits on family health and behaviours. *Research in Economics, 72*(4), 415–427.
Leigh, J. P. , Leigh, W. A., &Du, J. (2019). Minimum wages and public health: a literature review. *Preventive Medicine 118*, 122–134.
Lenhart, O. (2017). Do higher minimum wages benefit health? Evidence from the UK. *Journal of Policy Analysis and Management, 36*(4), 828–852.
Lenhart, O. (2017). The impact of minimum wages on population health: evidence from 24 OECD countries. *The European Journal of Health Economics, 18*(8), 1031–1039.
Lombardo, P. , Jones, W. , Wang, L. , Shen, X., &Goldner, E. M. (2018). The fundamental association between mental health and life satisfaction: results from successive waves of a canadian national survey. *BMC public health 181*(1), 9.
Neumark, D. , Salas, J. I., &Wascher, W. (2014). More on recent evidence on the effects of minimum wages in the United States. *IZA Journal of Labor Policy 3*(1), 24.
Neumark, D., & Wascher, W. (1992). Employment effects of minimum and subminimum wages: Panel data on state minimum wage laws. *ILR Review, 46*(1), 55–81.
OECD. (2021). OECD Health Statistics 2021 Definitions, Sources and Methods: Government/social health insurance (Rapport technique). Auteur.
Reeves, A. , McKee, M. , Mackenbach, J. , Whitehead, M., &Stuckler, D. (2017). Introduction of a national minimum wage reduced depressive symptoms in low-wage workers: a quasi-natural experiment in the UK. *Health economics*26(5)639–655.
Sabia, J. J., & Nielsen, R. B. (2015). Minimum wages, poverty, and material hardship: new evidence from the SIPP. *Review of Economics of the Household, 13*(1), 95–134.
Siahpush, M., Spittal, M., & Singh, G. K. (2008). Happiness and life satisfaction prospectively predict self-rated health, physical health, and the presence of limiting, long-term health conditions. *American Journal of Health Promotion, 23*(1), 18–26.
Webb, M. D. (2014). Reworking wild bootstrap based inference for clustered errors (Rapport technique). Queens Economics Department Working Paper.
Wehby, G. L., Dave, D. M., & Kaestner, R. (2020). Effects of the minimum wage on infant health. *Journal of Policy Analysis and Management, 39*(2), 411–443.