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Minimum Wages and Wage Inequality in the OECD Countries*

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This paper investigates the impact of the effective minimum wage, defined as the log difference between the minimum and the median wages, on wage inequalities in the OECD countries. Unlike the previous studies that focus on single countries in which the minimum wage has no cross-sectional variation and rely instead on within-country variations of wage distribution across regions or socio-economic characteristics, we use a country panel that allows for both cross-sectional and time-series variations in minimum wage. We also control for more factors than in the previous studies whose absence may cause endogeneity. Our results confirm the previous findings that increases in minimum wage alleviate the wage inequality at the lower tail of the wage distribution, while having little effect at the upper tail. The estimated effect is larger for women than for men, which is consistent with the fact that the share of workers who are directly affected by the changes in minimum wage is bigger among women than men. An application of the IVs of Autor, Manning and Smith (2016) supports the robustness of our findings.

Keywords: Minimum Wage, Wage Inequality, Effective Minimum Wage, Labor Demand, Labor Supply

JEL Classification: J23, J31, J38

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I. INTRODUCTION

Minimum wage increase often provokes intense debates, as was the case in South Korea in 2018 when the government increased the statutory minimum wage by 16.4%.[1] While the debates largely focus on its employment effect, it is known to, and intended to, affect inequality. For instance, DiNardo, Fortin and Lemieux (1996) and Lee (1999) show that the decline in real value of the U.S. federal minimum wage during the 1980s accounted for a large share of the concurrent increase in wage inequality, particularly for women.[2] In a similar vein, Dickens and Manning (2004a, 2004b) show that the introduction of a national minimum wage in the U.K. in 1999 improved the inequality at the lower tail. Seong (2014) finds similar effect of minimum wage in Korea during 2008-2012.

This paper attempts to complement the existing literature on the impact of minimum wage on inequality, using the panel of those OECD countries that had statutory minimum wage during any time between 1960 and 2017. As briefly mentioned above, many studies focus on a single country, within which the minimum wage has no cross-sectional variation. They rely instead on the variation of its relative level, across regions or socio-economic groups for instance, such as the log difference between the minimum and the median wages. To identify the impact of minimum wage, they rely on sensible but strong assumptions (see the review in the next section). By using a country-level panel, which has both cross-sectional and time-series variation in minimum wage, we estimate the impact of minimum wage. Also, by not relying on a single country, we deliver a more general picture of this impact, controlling for other relevant factors such as the changes in international trade and production technology which are likely to affect all regions or all socio-economic groups of a single country used in previous studies.

[1] In the academic literature, Card and Krueger (1995) and Dube, Lester and Reich (2010), for instance, argue that minimum wage has little impact on employment, while Neumark and Wascher (2010) argue the opposite for less skilled workers. For the debates on the Moon Jae-In administration's minimum wage policy, see, for instance, The Economist (Oct. 25, 2017), "South Korea's soaring minimum wage."

[2] Autor, Manning and Smith (2016) extend the data of Lee (1999) to more recent periods, include fixed effects and use an instrumental variables estimation. They find a similar effect but at a significantly smaller magnitude.

Our empirical models are similar to those of Lee (1999) and Autor, Manning and Smith (2016) who use the U.S. state-level panel. In particular, we employ the cross-sectional unit specific trends in Autor, Manning and Smith (2016) to mitigate the potential bias from endogeneity and omitted variables. We also apply their IV strategy to check the robustness of our findings. Because we use a country panel, we are able to control for more macroeconomic factors that are likely to affect wage inequality than in these previous studies. Our results show that the findings of the previous studies largely extend to the cross-country setting; that is, minimum wage increase alleviates the wage inequality at the bottom of the wage distribution, while having little effect at the top of the wage distribution.

The composition of this paper is as follows. Section 2 reviews the literature on the effect of minimum wage on wage inequality. Section 3 describes the data and our empirical approach. Section 4 presents the estimation results and discusses their robustness. Section 5 concludes.

II. RELATED LITERATURE

Wage inequality is a function of labor demand, labor supply and labor market institutions, among other factors. While the focus in the related literature is more on the demand factor,[3] several existing studies analyze the particular institutional factor that we study in this paper, namely the minimum wage. As briefly mentioned above, DiNardo, Fortin and Lemieux (1996), Lee (1999) and Autor, Manning and Smith (2016), for instance, investigate how much of the rapid expansion of wage dispersion in the 1980s in the U.S. is explained by the concurrent decrease in real value of the federal minimum wage, using the Current Population Survey data.[4] During this period,

[3] Many existing analyses of the rising wage inequality focus on the increase of demand for skills. Two popular explanations are skill-biased technological changes (Bound and Johnson, 1992; Katz and Murphy 1992; Krueger 1993; Berman, Bound and Griliches, 1994, for instance) and the expansion of international trade (Borjas and Ramey, 1995, for instance). Skill-biased technological changes are known to have raised the demand for skilled workers relative to unskilled workers within industries, while the rapid expansion of international trade is known to have induced structural changes across industries that favor skilled workers.

[4] Until the late 1980s, most U.S. states did not have a state minimum wage and thus had a common (federal) minimum wage. Nominal value of the federal minimum wage remained constant during the period of 1980-88. This stagnancy had forced the state governments to adopt their own state-level minimum wages.

wage inequality occurred largely at the bottom of the wage distribution in the US, which corresponds to a decline in the real value of the federal minimum wage as well as to the factors that induce the increase in the demand for skills.

DiNardo, Fortin and Lemieux (1996) use a kernel density estimation method and find that the minimum-wage decline accounted for a substantial portion of the increase in wage inequality at the lower tail, but not the gap between the ninth decile and the median. Lee (1999) constructs a state-level panel and estimates the impact of the log difference between the minimum and the median wages on the gap between the first decile and the median. Surprisingly, he finds that the minimum-wage decline explains nearly all the wage gap between the first decile and the median, particularly for women. Autor, Manning and Smith (2016) extend the panel data of Lee (1999) until 2011 and control for state fixed effects and state-specific trends. They also apply an instrumental variables estimation. Albeit smaller in magnitude, they also find that the minimum-wage decline widens the wage inequality at the lower tail of wage distribution.

Several studies investigate the impact of minimum wage on wage inequality in other countries. For instance, Dickens and Manning (2004a, 2004b) estimate the effect of the introduction of the national minimum wage in the UK, using a difference-in-difference method. They find that the introduction of the national minimum wage modestly reduced wage inequality, mainly due to a spike effect, with no significant spill-over effect; that is, it induced rightward shifts at the lower end of the wage distribution, without having affecting those that are located further right. Jeong et al. (2011) estimate the impact of minimum wage increase in Korea, using a panel of 15 Korean provinces during 1998-2008, based on the Korean Labor and Income Panel Study (KLIPS). Because the minimum wage is the same across provinces, they use the variation across provinces in the percentage of workers below the increased minimum wage (i.e., the impact rate). They find that the increase in impact rate reduces the gap between the ninth and the first deciles. Seong (2014) calculates the ratio of minimum wage to median wage using the fact that the median wages are different across regions, although the minimum wage is the same. He finds that the increase in the ratio reduces wage inequality at the bottom of the wage distribution. Seong (2014), following the approaches of Lee (1999) and Autor, Manning and Smith (2016), finds that the minimum wage increase reduces the wage gap at the lower half of the wage distribution. On the contrary, Lee and Hwang (2018), using the variation in the impact rate across socio-economic groups in Korea during 2006-2016, finds little impact of minimum wage increase on wage inequality.

III. DATA AND EMPIRICAL MODEL

1. Minimum Wage in the OECD Countries

Before we introduce our empirical model, let us first describe the variation of the minimum wage across the OECD countries, our population of interest. Figure 1 shows the real hourly minimum wages in 1997, 2007 and 2017 of the OECD countries that had a statutory minimum wage in 2017,[5] expressed in the 2018 USD PPPs (Purchasing Power Parities). Since it is real and PPP, both time-series and cross-sectional comparisons make sense. Notice first the wide cross-country dispersion. For instance, in 2017, the minimum wages in Mexico, Colombia and Chile were less than or around 3 dollars, while it was more than 11 dollars in Germany, France, Australia and Luxembourg. The average and the median among the OECD countries in 2017 were around 7 dollars. Also, there were substantial increases over time in most countries. In Korea, for instance, it increased by about 2 dollars every 10 years, from 2.61 in 1997 to 4.65 in 2007, then to 6.91 in 2017. However, it was stagnant in Mexico, while Greece saw it decreasing from 6.18 in 2007 to 5.02 in 2017. These variations in both cross-sectional and time-series dimensions also suggest that our explanatory variable, to be defined below, has enough variation.

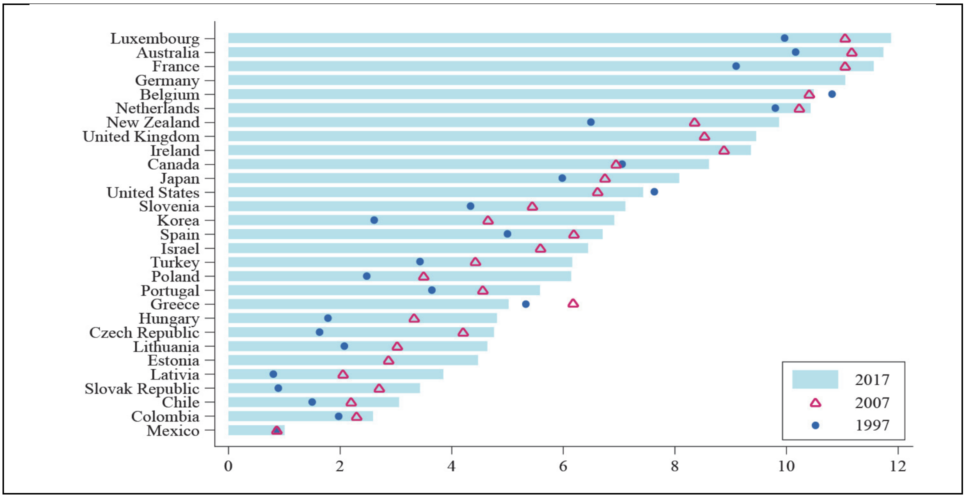
Even if two countries have the same level of minimum wage, its effectiveness can differ, depending on its location in the wage distribution in each country. To have a glimpse of the variation of the effectiveness of minimum wage, Figure 2 shows the ratio of the minimum wage to the median wage of full-time workers in 1997, 2007 and 2017 of the OECD countries that had a statutory minimum wage in 2017.[6] Notice again the wide cross-country dispersion. In 2017, for instance, the ratio in Colombia was nearly 0.9, while it was a mere 0.3 in the U.S. and between 0.4 and 0.6 in most

[5] The latest available data from the source is 2018. We show the year 2017, because it has more observations. For instance, the data for Japan is not available for 2018.

[6] The OECD provides the data for the ratio of minimum wages to median earnings of full-time employees for cross-country comparisons of earnings dispersion of full-time workers. According to the OECD, these earnings include overtime and bonus payments which generate measurement errors and make international comparisons further difficult. To mitigate these measurement errors, our empirical analysis focuses on within-county variations by employing fixed effect estimation approach. We also include the country specific trends in the specifications to capture the effects of some labor market institutional changes over time.

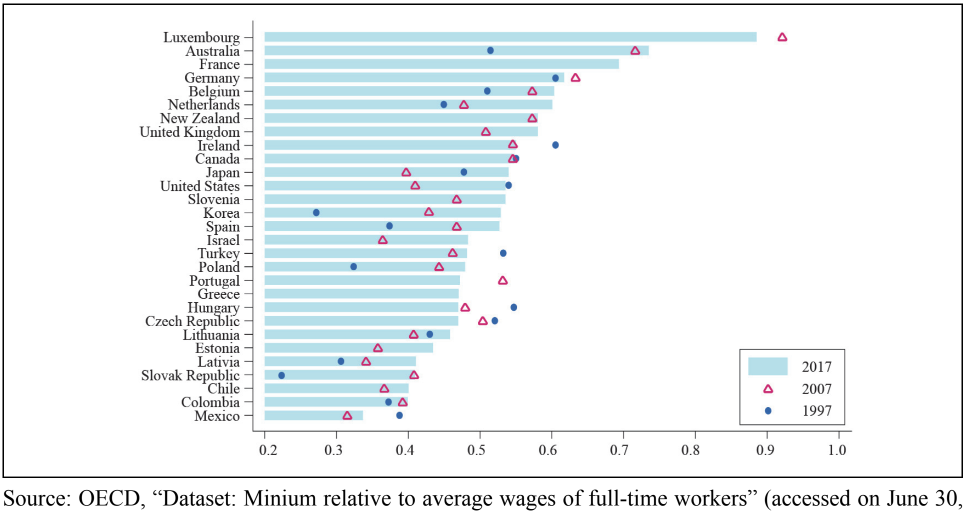
other countries. Also, it continuously and rapidly increased in Korea and Japan, while it stagnated, or even decreased, in many Western European countries.

Figure 1. Minimum Wage in the OECD Countries



Note: In 2018 constant prices at 2018 USD PPPs.
Source: OECD, "Real minimum wages" (accessed on June 26, 2020).

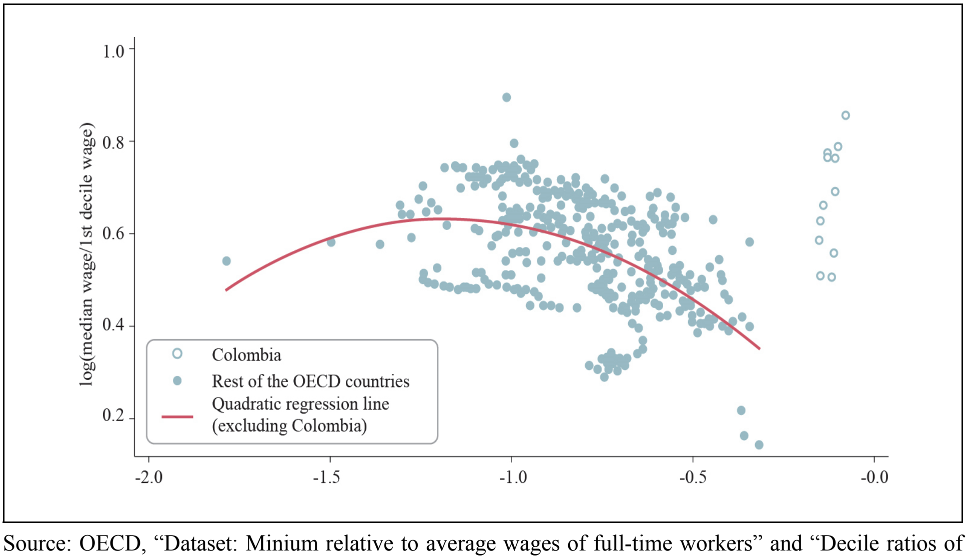
Figure 2. Minimum to Median Wage Ratio in the OECD Countries



Source: OECD, "Dataset: Minium relative to average wages of full-time workers" (accessed on June 30, 2020).

Log of the ratio in Figure 2, which is equivalent to the log difference between the median and minimum wages, is often used as a measure of the effective minimum wage in the related literature (see Section 2), and we follow this usage in this paper, denoting it by *MWM*. To have a first look at its relation with wage inequality, Figure 3 depicts it against the log of the ratio of the median to the first decile in the wage distribution in 2017for the same set of countries in Figures 1 and 2. It suggests that the relation between the effective minimum wage and wage inequality, when the latter is measured by the log difference between the median and the first decile in the wage distribution, is negative and quadratic, at least when excluding the data for Colombia who joined the OECD in April 2020. This apparent quadratic relation implies that the marginal impact of minimum wage on wage inequality depends on the distance between the minimum and median wages. This is in line with the underlying intuition when calling the log distance between the minimum and median wages effective minimum wage, because it captures the proportion of workers that are affected by changes in minimum wage. Motivated by this observation, we also use a quadratic model in the empirical analysis.

Figure 3. Income Inequality and the Median to Minimum Wage Ratio in the OECD Countries in 1990-2018



Source: OECD, “Dataset: Minium relative to average wages of full-time workers” and “Decile ratios of gross earnings” (all accessed on June 30, 2020).

2. Empirical Model

Following Lee (1999), Newmark and Wascher (2004), and Autor et al. (2016), we estimate

$$\log Y_{it} = \beta_1 \log MWM_{it} + \beta_2 (\log MWM_{it})^2 + \gamma' X_{it} + \alpha_i + \delta_t + \alpha_i * t + \varepsilon_{it}, \quad (1)$$

where the subscripts i and t denote, respectively, country and year.[7] Y is a measure of wage inequality, and we use the following variables: (*i*) the ratio of the median wage to the first decile of the wage distribution (i.e., P50/P10, denoted by *P5010*), for men, women and both; and (*ii*) the ratio of the ninth decile to the median (i.e., P90/P50, denoted by *P9050*) for men, women and both. The former variable represents the inequality at the lower-tail of the wage distribution, while the latter represents the inequality at the upper-tail. *MWM* is, as explained above, the ratio of the minimum to median wages (i.e., the effective minimum wage). Based on our observation (see Figure 3), we also include the quadratic term, i.e., the square of *logMWM*. As discussed above, this is to capture the possibility that the effect of a change in minimum wage on wage inequality is larger when the minimum wage is closer to the median wage. α controls for the country-fixed effect, such as the influence of culture, institutions, labor market policies and relative income levels that are time-invariant. Its interaction with time, $\alpha * t$, is a country-specific trend, which captures the economic fluctuations of the country that are not captured by the control variables explained below. δ controls for the time-fixed effect, such as global economic shocks, that have a common impact on wage inequality in all countries in a given year. ε is the error term which is assumed to be independent of the fixed effects and the country-specific trend.

X is a vector of control variables, which consists of three groups. First, to control for macroeconomic conditions, we include, all in logarithm, the unemployment rate for the population aged 25-64 (denoted by *UR*), the employment rate (*ER*) and the gross value added per hours worked of the entire industry (*LabProd*). The unemployment rate for the population aged 25-64and the employment rate proxy the overall labor market condition of the economy. A high unemployment rate, or a low employment

[7] Joe et al. (2018) uses a similar specification to estimate the effects of the effective minimum wage on employment, firm profit and wage inequality.

to population ratio, means that the overall economic condition is bad, which may be reflected in the wage distribution. Controlling for these variables allows a more accurate estimation of the impact of minimum wage on wage inequality. The gross value added of the all industries measures the economy's overall labor productivity. This can also affect wage inequality, since the change in the average labor productivity may have different impacts on wage between the low-skilled and the high-skilled.

Secondly, to control for the impact of labor supply, we include, all in logarithm, the ratio of the population aged15-24 and 65 or older to those aged 25-64 (denoted by *Depend*), a human capital index (*HumanCap*) and the share of self-employment in total employment (*SelfEmp*). Dependency ratio captures the relative supply of low-skilled workers who are relatively more sensitive to the changes in minimum wage. In most OECD countries, the proportion of old people engaged in economic activities is rising due to aging. And many of them participate in low-skilled jobs after retirement, in which they cannot fully utilize their human capital accumulated over their lifetime. Their relative size to the working population reflects the relative supply of low-skilled labor, which affects wage inequality. The human capital index is based on the average years of schooling (see Barro and Lee, 2013) and the returns to education from Mincer equation from the Penn World Table. They capture the relative supply of skilled workers. The self-employed, who are most prevalent in food, lodging and retail, are likely to be relatively low-skilled; and hence their relative size also reflects the relative supply of the low skilled.

Finally, to control for the impact of labor demand, we include the external openness (denoted by *ImptoGDP*) and the backward participation in the global value chain (*GVC*). The globalization hypothesis (e.g., Feenstra and Hanson, 1996; and Krugman, 2008) argues that developed countries engage in outsourcing via the import of intermediary goods whose production is mainly through routine tasks performed by low-skilled workers. On the other hand, domestic part of the production is largely focused on R&D and marketing, thereby increasing the demand for the high skilled.[8] This way, globalization affects the relative demand for the high skilled and the low skilled.

[8] Another explanation, the skill-biased technological change hypothesis (Katz and Murphy, 1992, for instance), argues that the development of the information and communication technology has led to a relative increase in the demand for the high-skilled, resulting in their wage increases.

3. Data

We use the data from the OECD and the Penn World Table (for the human capital index and the external openness), for the period of 1990-2017. Our sample consists of the 27 OECD countries that have had a statutory minimum wage any time during the sample period. Due to the difference in time of the introduction of minimum wage and data availability, our panel is unbalanced. Table 1 shows the summary statistics of our sample.

Table 1. Summary Statistics

	N	mean	sd	min	max
P5010	552	1.71	0.22	1.15	2.44
logP5010	552	0.53	0.13	0.14	0.89
P9050	552	1.95	0.31	1.40	3.56
logP9050	552	0.66	0.15	0.33	1.27
MWM	636	0.47	0.10	0.17	0.74
logMWM	636	-0.77	0.22	-1.79	-0.30
$(\log MWM)^2$	636	0.65	0.36	0.09	3.19
UR	936	6.55	3.69	0.47	25.54
logUR	936	1.74	0.54	-0.75	3.24
ER	936	56.52	7.62	37.74	81.33
logER	936	4.03	0.14	3.63	4.40
LabProd	908	88.55	17.84	32.73	163.53
logLabProd	908	4.46	0.22	3.49	5.10
Depend	936	50.25	6.80	33.47	74.01
logDepend	936	3.91	0.14	3.51	4.30
HumanCap	980	3.13	0.40	1.80	3.81
logHumanCap	980	1.13	0.14	0.59	1.34
SelfEmp	739	17.51	9.03	6.26	52.81
logSelfEmp	739	2.75	0.46	1.83	3.97
ImptoGDP	980	-0.43	0.25	-1.48	-0.05
logImptoGDP	980	3.61	0.58	1.62	4.99
GVC	782	33.14	12.76	7.82	64.42
logGVC	782	3.42	0.43	2.06	4.17

IV. RESULTS

This section presents our estimation results of equation (1). Our benchmark estimation strategy is the OLS with country fixed effects and country-specific trends. Later, we check the robustness of our results by applying the IV strategy of Autor, Manning and Smith (2016).

1. Main Results

Table 2 presents the OLS estimates for both male and female. Columns 4 to 6 include country-specific trends. Columns 1 and 4 do not include the control variables (X); columns 2 and 5 control for the macroeconomic conditions and labor supply factors; and columns 3 and 6 control for the labor demand factors in addition. All specifications include country-specific fixed effects and year fixed effects.

In all specifications, we find that the effective minimum wage significantly shrinks the lower-tail of the wage distribution. In particular, recall from equation (1) that the elasticity of *P5010*, the ratio of the median wage to the first decile of the wage distribution, with respect to *MWM*, the effective minimum wage, is $\beta_1+2\beta_2 logMWM$ and thus depends on the level of *logMWM*. In column (3), for instance, the estimates of β_1 and β_2 are, respectively, -0.473 and -0.217, which are both statistically significant at the 1% level. The mean of *logMWM* in the sample used in column (3) is –0.833. The estimated elasticity is thus -0.111 at the sample mean. The joint F test for the hypothesis $\beta_1+2\beta_2 logMWM=0$ at the sample mean is rejected at the 1% level. This suggests that an increase in the minimum wage reduces wage inequality in the lower-tail of the wage distribution. When we include country specific trends, as presented in column (6), the estimates of β_1 and β_2 are, respectively, -0.677 and -0.313, and the estimated elasticity is -0.156 at the same sample mean. The joint F test also indicates that this estimate is statistically significant at the 1% level.

Let us consider the specific cases of some countries using the results in column (6). In 2017, the effective minimum wage, *MWM*, was 0.34 in the U.S., 0.42 in Japan, 0.53 in Korea and 0.62 in France. A 1% increase in the effective minimum wage in 2017 is thus predicted to reduce the inequality at the lower-tail of wage distribution, measured by the ratio of the median wage to the first decile of the wage distribution, by 0.00% in the U.S., 0.13% in Japan, 0.28% in Korea and 0.38% in France. All estimates except for the U.S. are statistically significant at the 1% level. Clearly, the increase in the (effective) minimum wage is predicted to reduce wage inequality at the lower-tail in these countries. The difference in magnitude among them can be explained by the fact the effective minimum wage is much higher in France and Korea than in the U.S., for instance, which implies that the share of workers who are directly affected by minimum wage is much higher in the former countries, and hence bigger impacts, *ceteris paribus*.

Columns (2) and (5) include variables measuring the relevant macroeconomic conditions, namely unemployment rate (*UR*), employment rate (*ER*) and labor productivity (*LabProd*). The estimates for employment rate are negative, large and statically significant at the 1% level, suggesting that an increase in employment rate is strongly related to the compression of the lower-tail of the wage distribution. Naturally, high-skilled workers are less likely to be affected by macroeconomic conditions than low-skilled workers, because the latter are more likely to be unemployed than the former in bad economic conditions. This way, favorable macroeconomic conditions are likely to increase the demand for low-skilled workers (more than the high-skilled) and thus increase their wages, resulting in a reduction of the wage gap between the low-skilled and the high-skilled. The estimates for unemployment rate, on the other hand, lose statistical significance when we include country-specific trends. The estimates for labor productivity are positive and statistically significant at conventional levels, suggesting that an overall improvement in labor productivity tends to expand wage inequality. This implies that an improvement in labor productivity benefits the high-skilled more than the low-skilled.

Columns (2) and (5) also include variables measuring the relevant factors of labor supply, namely the shares of unskilled workers (*Depend*) and the self-employed (*SelfEmp*), and the human capital index (*HumanCap*). Their estimates, however, lose statistical significance when we include country-specific trends. While they are expected *a priori* to affect the lower-tail of wage distribution, the results suggest that their impacts are dominated by country-specific trends. Similarly, the additional factors included in columns (3) and (6) to control for the changes in labor demand related to a country's trade relations, namely the import-to-GDP ratio (*ImptoGDP*) and the backward participation rate in the global value chains (*GVC*) are not statistically significant (when we include country-specific trends, as for the former).

We conduct the analogous analyses for women and men separately. Table 3 presents the results. Because we observe in most, if not all, countries an over-representation of women in low-skill jobs and an under-representation in high-skill jobs, as well as a general wage gap between the genders, these results can show how minimum wage is related to these issues. Columns (1) and (2) are for the male sample, and columns (3) and (4) for the female sample. Columns (2) and (4) include country-specific trends. To increase the sample size, we do not include the backward participation rate in the global value chains (*GVC*), which is not statistically significant at the 10% level (as in Table 2).

Table 2. Impact of the Effective Minimum Wage on the Lower-tail of the Wage Distribution

	(1)	(2)	(3)	(4)	(5)	(6)
logMWM	-0.617***	-0.467***	-0.473***	-0.595***	-0.849***	-0.677***
	(0.167)	(0.159)	(0.131)	(0.072)	(0.097)	(0.142)
$(\text{logMWM})^2$	-0.272***	-0.201**	-0.217***	-0.244***	-0.393***	-0.313***
	(0.072)	(0.075)	(0.064)	(0.031)	(0.055)	(0.078)
logUR		-0.034**	-0.003		-0.013	-0.010
		(0.015)	(0.015)		(0.019)	(0.017)
logER		-0.476***	-0.324***		-0.398***	-0.310**
		(0.074)	(0.107)		(0.098)	(0.117)
logLabProd		0.202***	0.283***		0.269**	0.237*
		(0.024)	(0.018)		(0.113)	(0.134)
logDepend		0.124***	0.187***		0.092	0.077
		(0.044)	(0.042)		(0.093)	(0.092)
logSelfEmp		0.072***	0.038*		-0.035	0.107
		(0.024)	(0.022)		(0.052)	(0.064)
logHumanCap		0.020	-0.217		-0.827	-1.258
		(0.228)	(0.175)		(0.591)	(0.941)
logImptoGDP			0.025**			0.033
			(0.011)			(0.029)
logGVC			0.001			-0.035
			(0.034)			(0.050)
Country trends	N	N	N	Y	Y	Y
N. Obs.	382	343	264	382	343	264
R-squared	0.306	0.566	0.605	0.612	0.679	0.696
N. Countries	27	24	22	27	24	22

Note: See Section 3 for definitions. All specifications control for country fixed and year fixed effects. Numbers in parentheses are clustered robust standard errors. *, **, *** means significance at the 10%, 5%, and 1% levels, respectively.

Table 3. Impact of the Effective Minimum Wage on the Lower-tail of the Wage Distribution by Gender

	Male		Female	
	(1)	(2)	(3)	(4)
logMWM	-0.367**	-0.707***	-0.540**	-0.762***
	(0.136)	(0.155)	(0.203)	(0.157)
$(\text{logMWM})^2$	-0.203***	-0.373***	-0.233**	-0.351***
	(0.068)	(0.085)	(0.097)	(0.083)
logUR	-0.046**	-0.023	-0.026	0.015
	(0.019)	(0.021)	(0.019)	(0.012)
logER	-0.574***	-0.437***	-0.506***	-0.293**
	(0.119)	(0.141)	(0.104)	(0.126)
logLabProd	0.209***	0.257*	0.183***	0.293**
	(0.039)	(0.140)	(0.036)	(0.130)
logDepend	0.137**	0.156	0.206**	0.152
	(0.054)	(0.098)	(0.078)	(0.104)
logSelfEmp	0.071**	-0.033	0.072**	-0.035
	(0.026)	(0.068)	(0.033)	(0.053)
logHumanCap	0.000	-1.012	0.259	-0.559
	(0.174)	(0.725)	(0.267)	(0.411)
logImptoGDP	-0.002	-0.003	-0.020	0.044
	(0.018)	(0.047)	(0.022)	(0.029)
Country trends	N	Y	N	Y
N. Obs.	340	340	340	340
R-squared	0.476	0.606	0.531	0.707
N. Countries	24	24	24	24

Note: See Section 3 for definitions. All specifications control for country fixed and year fixed effects. Numbers in parentheses are clustered robust standard errors. *, **, *** means significance at the 10%, 5%, and 1% levels, respectively.

Overall, we find that the effective minimum wage significantly shrinks the lower-tail of the wage distribution for each gender, similarly to when they are considered together. In all specifications, the estimates of β_1 and β_2 are statistically significant at the conventional levels. To compute the elasticity, the estimates of β_1 and $\beta 2$ are, respectively, -0.707 and -0.373 in column (2). The sample mean of *logMWM* in column (2) is -0.830. Thus the estimated elasticity is -0.088; that is, a 1% increase in the effective minimum wage is expected to reduce the inequality at the lower-tail of the wage distribution for male, measured by the ratio of the median to the first decile of the wage distribution, by 0.088%. The *F*-test indicates that this effect is statistically significant at the 1% level. Similarly, in column (4), the estimates of β_1 and $\beta_2$are, respectively, -0.762 and -0.351, and the sample mean of *logMWM* is -0.811. Thus the elasticity is -0.193, which is statistically significant at the 1% level. Notice that the magnitude is more than twice for women than for men. This suggests that the mass of low-skilled workers who are directly affected by the minimum wage is bigger in female than in male. This implies that minimum wage raise can contribute to reducing the gender wage gap.

2. Robustness

We have shown the evidence that the (effective) minimum wage shrinks the lower-tail of the wage distribution in the OECD countries, even when the genders are considered separately. This section provides some evidence that our findings are robust.

We first examine if the relation between minimum wage and the lower-tail of the wage distribution is spurious, following Lee (1999) and Autor, Manning and Smith (2016). Specifically, we estimate regression (1) for the ratio of the ninth decile to the median, denoted by *P9050*, instead of *P5010,* the ratio of the median wage to the first decile of the wage distribution. Changes in minimum wage are unlikely to affect higher wages significantly. That is, the spill-over effect of minimum wage is unlikely to reach the upper-tail of the wage distribution. Finding a significant impact of minimum wage on the upper-tail of the wage distribution will indicate that our main results are capturing other factors affecting the wage distribution than the minimum wage.

Table 4 shows results, columns (1) and (2) for the entire sample, columns (3) and (4) for the male sample, and columns (5) and (6) for the female sample. The estimates of β_1 and β_2 are not statistically significant at the conventional levels, except in columns (2) where they are both significant only at the 10% level and in column (6) where only β_2 is significant at the 10% level. Further, the joint *F*-test indicates that the elasticity at the sample mean of *logMWM* is not statistically significant at the conventional levels, except in column (6). Even in that case, the estimated elasticity is -0.090, which is less than a half of the estimated elasticity in the corresponding column (4) of Table 3. Thus, minimum wage has no statistically significant impact on the upper-tail of the wage distribution, except in the female sample, and even in that case, it is statistically significant only at the 10% level, at a much smaller magnitude than on the lower-tail.

This exercise suggests that our main results in Tables 2 and 3 are not driven by spurious relations.

Table 4. Impact of the Effective Minimum Wage on the Upper-tail of the Wage Distribution

	Both		**Male**		**Female**	
	(1)	(2)	(3)	(4)	(5)	(6)
logMWM	0.052	-0.295*	0.037	-0.171	-0.254	-0.440*
	(0.097)	(0.168)	(0.119)	(0.150)	(0.212)	(0.243)
$(\text{logMWM})^2$	-0.022	-0.211*	0.001	-0.098	-0.121	-0.216
	(0.047)	(0.114)	(0.061)	(0.076)	(0.115)	(0.134)
logUR		-0.017		-0.012		0.001
		(0.015)		(0.019)		(0.029)
logER		-0.116		-0.099		-0.202
		(0.191)		(0.247)		(0.253)
logLabProd		0.058		0.154		0.243*
		(0.066)		(0.104)		(0.135)
logDepend		0.053		0.051		-0.042
		(0.091)		(0.090)		(0.116)
logSelfEmp		-0.065		-0.042		-0.020
		(0.052)		(0.069)		(0.077)
logHumanCap		-0.361		-0.040		-0.625*
		(0.382)		(0.251)		(0.317)
logImptoGDP		0.017		0.056*		-0.021
		(0.021)		(0.027)		(0.021)
Country trends	Y	Y	Y	Y	Y	Y
N. Obs.	382	343	379	340	379	340
R-squared	0.808	0.825	0.813	0.846	0.742	0.792
N. Countries	27	24	27	24	27	24

Note: See Section 3 for definitions. All specifications control for country fixed and year fixed effects. Numbers in parentheses are clustered robust standard errors. *, **, *** means significance at the 10%, 5%, and 1% levels, respectively.

Next, to take care of the potential endogeneity of the effective minimum wage in regression (1), we apply the instrumental variables of Autor, Manning and Smith (2016), namely the log of the statutory minimum wage, its square and its interaction with the sample mean of each country of the log median wage. The idea is that because median wage is used to construct the effective minimum wage (the main explanatory variable) *and* the wage inequality (the explained variable), transitory shocks to and measurement errors in median wage can cause endogeneity in regression (1). Even in such cases, the channel through which the instruments listed above can affect the wage inequality is the effective minimum wage. Based on this idea, Table 5 reports the 2SLS estimation results using these IVs: columns (1) and (2) for the entire sample; columns (3) and (4) for the male sample; and columns (5) and (6) for the female sample.

Table 5. Impact of the Effective Minimum Wage on the Lower-tail of the Wage Distribution: An IV Estimation

	Both		**Male**		**Female**	
	(1)	(2)	(3)	(4)	(5)	(6)
logMWM	-0.951***	-1.908***	-1.598**	-1.461***	-2.031***	-1.520***
	(0.328)	(0.502)	(0.774)	(0.443)	(0.720)	(0.470)
$(\text{logMWM})^2$	-0.425***	-0.944***	-0.816**	-0.755***	-0.995***	-0.748***
	(0.152)	(0.249)	(0.403)	(0.226)	(0.362)	(0.231)
logUR		0.003		-0.016		0.022
		(0.023)		(0.025)		(0.015)
logER		-0.257**		-0.368**		-0.220*
		(0.117)		(0.150)		(0.120)
logLabProd		0.327*		0.287**		0.328**
		(0.168)		(0.139)		(0.128)
logDepend		0.140		0.183		0.202*
		(0.116)		(0.126)		(0.104)
logSelfEmp		-0.113		-0.092		-0.096
		(0.073)		(0.074)		(0.076)
logHumanCap		-1.251**		-1.255		-0.852*
		(0.636)		(0.789)		(0.454)
logImptoGDP		0.014		-0.004		0.039
		(0.037)		(0.045)		(0.028)
Country trends	Y	Y	Y	Y	Y	Y
N. Obs.	381	343	378	340	378	340
N. Countries	27	24	27	24	27	24

Note: See Section 3 for definitions. All specifications control for country fixed and year fixed effects. Numbers in parentheses are clustered robust standard errors. *, **, *** means significance at the 10%, 5%, and 1% levels, respectively. The effective minimum wage and its square are instrumented by the log of the statutory minimum wage, its square and its interaction with the average of log median wage of each country over the sample period.

Overall, the IV results are consistent with our main results that the effective minimum wage significantly shrinks the lower-tail of the wage distributions. In all columns, the estimates of β_1 and β_2 are statistically significant at the conventional levels, and the joint F-test indicates that the elasticity at the sample mean of *logMWM* is statistically significant at the conventional levels. Also, comparing the magnitudes of the estimates in columns (4) and (6) implies that the effect of minimum wage is stronger for female than for male, as in our main results (see Table 3).

V. CONCLUSION

This paper investigates the impact of minimum wages on wage inequality in the OECD countries, using an unbalanced country-level panel data from 1990 to 2017. We estimate several specifications relating wage inequality measures to the effective minimum wage, controlling for the changes in macroeconomic conditions, labor supply and labor demand. The use of the effective minimum wage is particularly useful for our empirical setting for several reasons. First, the effective minimum wage is less sensitive to the economy-wide income level and price level. It can also mitigate the influence of the difference in data sources for wage distribution across countries. Further, the effective minimum wage reflects the proportion of potential workers who will be affected by a change in minimum wage: the closer the (log) distance between the minimum wage and the median wage, the greater the share of potential workers affected by changes in minimum wage.

We find that an increase in minimum wage alleviates the wage inequality at the lower-tailof wage distribution (i.e., the log distance between the median and the first decile of the wage distribution). The magnitude of this effect is larger for women than for men, implying that minimum wage increase can reduce the gender wage gap. This last observation can be explained by the fact that there are more female workers than male workers who can be directly affected by changes in minimum wage. We also find that minimum wage has little effect on the wage inequality at the upper-tail of the wage distribution (i.e., the log distance between the ninth decile and the median of wage distribution). We take this last finding as supporting evidence that our main results are not spurious. All these findings are consistent with the theory that minimum wage increases mainly affect the lower-tail of wage distribution and their ripple effects decrease towards the upper-tail of wage distribution.

Final words of caution when using our results for policy implications: Our data for wage dispersion are of gross earnings of full-time dependent employees which exclude part-time workers who are more likely to be dis-employed when minimum wage is raised.[9] Taking account of part-time workers when estimating the impact of minimum wage using cross-country data is, while being difficult due to the lack of available data, will be a valuable contribution to our understanding of the effect of minimum wage.

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