JOURNAL OF TECHNOLOGY AND OPERATIONS MANAGEMENT
http://e-journal.uum.edu.my/index.php/jtom

How to cite this article:
Pherng, W., Buddhawongsa, P., Leurcharusmee, S., & Maneejuk, P. (2022). Journal Of Technology And Operations Minimum Wages And Wage Distribution In Thailand : A Quantile Selection Model With Copula. *Journal of Techgnology and Operations Management*, 17(2), 40–50. https://doi.org/10.32890/jtom2022.17.2.4

MINIMUM WAGES AND WAGE DISTRIBUTION IN THAILAND: A QUANTILE SELECTION MODEL WITH COPULA

Wittawat Pherng, Piyaluk Buddhawongsa, Supanika Leurcharusmee, Paravee Maneejuk
Faculty of Economics, Chiang Mai University, Thailand

Corresponding author: witt2goal@gmail.com

Received: 13/08/2022 Revised: 15/09/2022 Accepted: 10/11/2022 Published: 29/12/2022

ABSTRACT

A minimum wage policy is established generally to raise the wages of low-skilled workers. In this study, we use data from the Thai Labor Force Survey (2011-2020) to examine the impact of the minimum wage policy on wage distribution using a quantile regression model corrected for sample selection with a copula. We find that the minimum wage has the strongest effect on the lowest quantile and the effect decreases toward the higher quantiles. This confirms the effectiveness of the minimum wage policy in raising the wages of low-income individuals. In addition, there is also a spill-over effect on individuals in higher wage quantiles. The effect of the minimum wage estimated by our model is smaller compared to the standard quantile regression. This suggests that without correcting for sampling bias, the estimated effect of the minimum wage leads to an upward bias.

Keywords: Minimum Wage, Wage Distribution, Quantile Regression, Sample Selection, Copula.

INTRODUCTION

An increase in the minimum wage directly increases workers' income. However, the impact of this policy may also affect other workers who are paid above the minimum wage. Because the minimum wage increases the relative price of low-skilled workers, it leads to an increase in demand for higher-skilled workers with substitutable skills. In the longer run, the increase in the minimum wage may lead firms to invest more in machinery and technology, reducing the demand for workers who can be replaced by machines and increasing the demand for workers with complementary skills (Borjas, 2013). In addition, there may also be a spillover effect as firms raise wages above the minimum wage to maintain wage differentials within firms to motivate workers (Stewart, 2012). On the labor supply side, workers may also increase their reservation wage due to inflation expectations and perceptions of fairness (Fedorets & Shupe, 2021). Through the spillover effect, minimum wage policies could

affect the wage distribution of all workers. To examine the effectiveness of the minimum wage policy in supporting low-wage workers as well as its spillover effects, this study examines the impact of the minimum wage on the wage distribution of workers in Thailand. Several studies examine the impact of the minimum wage on labor income and the distribution of wages. In developed countries, DiNardo et al. (1996), Ferraro et al. (2018), Fortin et al. (2021), Lee (1999), Lukiyanova (2011), Machin and Manning (1994), and Pelek (2018) found that minimum wages reduce wage inequality. There was a significant spill-over effect on higher wage quantiles but the effect becomes smaller than the lower wage quantiles (Gregory & Zierahn, 2020; Louzao & Tarasonis, 2022; Redmond & McGuinness, 2021; David et al., 2016; Dickens & Manning, 2004; Joe & Moon, 2020; & Laporšek et al., 2019).

In developing countries, it is more difficult to estimate the impact of the minimum wage because compliance with the minimum wage is weak and there is little panel data on the labor force. Studies in developing countries include Bosch and Manacorda (2010), who used repeated cross-sectional data to examine urban areas in Mexico from the late 1980s to the early 2000s. They found that an increase in the minimum wage reduces wage inequality and a decrease in the real minimum wage leads to a widening of wage inequality, especially at the bottom of the distribution. More recent studies, like that of Choi et al. (2021) in Ecuador, showed that an increase in the minimum wage had spillover effects up to the 77th percentile. Hinojosa (2019)'s study in Brazil for the period 1995-2015 found that a decrease in inequality at the bottom of the distribution for all workers was due to the increase in the minimum wage and that there was also evidence of potential spillover effects from the minimum wage. Engbom and Moser (2021) found from their study in Brazil that the minimum wage was responsible for a large decline in income inequality between 1996 and 2018. For Asian countries, using data from urban China from 1993 to 2013, Ma and Li (2017) found that the minimum wage affects the wage level for low-wage earners, and the result also suggests the presence of a spillover effect in 1993-1995, but not in 1998-2002 or 2007-2013. However, Fang et al. (2021) studied in China during 2004-2009 and learned that the minimum wage increases the wages of low-wage workers and has little or no spillover effects. Chun and Khor (2010) used Indonesia data from 1993 to 2007 and found that an increase in the minimum wage had a positive effect on the monthly wages of the population below the minimum wage in the formal sector. This suggests that minimum wage legislation has helped reduce wage inequality.

In Thailand, the provincial minimum wage system was first introduced in 1973. Four decades later, in 2012, the provincial minimum wage levels were drastically increased and combined into a single rate of 300 baht for all provinces. Lathapipat and Poggi (2016) examined the impact of the minimum wage on male workers in the nonfarm private sector and found that the minimum wage had an impact on the 15-45 percentiles, while no impact was observed in the lower percentiles due to noncompliance by microenterprises. Leckcivilize (2015), in his study of male workers in the formal and informal sectors, found that in the formal sector, an increase in the minimum wage reduced wage inequality, while in the informal sector, wage inequality was not affected by the minimum wage due to noncompliance and weak enforcement of the law. Del Carpio et al. (2019) examined the impact of the minimum wage on 15- to 60-year-old male workers in the formal sector from 2002 to 2013 and found that the minimum wage had a negative impact on the wage distribution in the 25th to 50th percentile. They also noted that the minimum wage has an inverted-U-shaped effect on the wage distribution, peaking around age 25 to 55. Samart and Kilenthong (2020) found the positive effect of the real minimum wage on the real wage and real total compensation using data from 2001-2013.

To measure a causal effect of minimum wage policy on the distribution of wages, we look at the process of whether a person participates in the market and how much they would earn if they did participate. When the data were collected, we could only observe the wages of participants. This led to the problem of sample selection bias resulting from non-random participation in the labor market. Heckman (1979) proposes a model to solve this problem that simplifies the problem as an omitted variable problem by capturing the effect of sample selection in the Inverse Mill's Ratio (IMR) and adding it as another independent variable in the wage equation. Buchinsky (1998) extends the sample

selection method of Heckman (1979) to include the quantile regression of Koenker and Bassett (1978). Later Arellano and Bonhomme (2017) introduce a sample selection correction method in quantile regression using a copula to model the percentile error in the outcome equation and the error in the participation decision. With the copula, the distributional assumption required for estimation is more flexible. In this paper, we adopt Heckman (1979)'s sample selection model and quantile regression to estimate the impact of the minimum wage on wage distribution in Thailand over the period 2011-2020. In addition, we also follow recent studies by Arellano and Bonhomme (2017) and Koenker (2017) to account for sample selection bias in quantile regression with copulas.

The organization of this paper is as follows. After the introduction, in Section 2, we provide the data description. In Section 3, we propose a methodology and specify a model to estimate the data. In Section 4, we estimate the model from the previous section and interpret the result. In the last section, Section 5, we conclude the study and draw policy conclusions.

DATA AND DESCRIPTIVE STATISTICS

This article uses data from the 2011-2020 Labor Force Survey (LFS), which collects data on individual labor, including socioeconomic characteristics, labor income, and employment status. The LFS is collected monthly, published quarterly, and conducted by the National Statistical Office of Thailand (NSO) using a stratified two-stage sample survey for the entire country. The surveyed sample consists of workers between the ages of 15 and 50 who are employed in the private sector and work more than 35 hours per week. The descriptive statistics of the sample are presented in Table 1. The total number of workers in the sample is 3,008,869. In terms of wages, it can be seen that the mean of the daily wage is about three times higher than that of the minimum daily wage, while the median of the daily wage is higher than that of the minimum daily wage, indicating that some workers are not directly affected by the minimum daily wage and at least 50 percent of them receive wages that are higher than the minimum wage. Although the mean is larger than the median, the skewness of the distribution is positive and is 28.55, suggesting that the distribution is positively skewed to the right due to some extreme outliers that have a strong effect on the mean but only a weak effect on the median. The minimum wage seems to have a direct effect on the lower quantiles of the distribution, and a stronger one than on the upper quantiles, which are indirectly influenced by spillover effects.

Table 1

Descriptive statistics of labor in the sample.

Variable	Min	Max	1st Quartile	Median	Mean	3rd Quartile	S.D.
Wage per hour	0.06	62499.94	37.50	50.89	106.88	88.54	450.81
Minimum wage	159.00	336.00	300.00	300.00	286.33	310.00	45.34
Age	15.00	60.00	24.00	36.00	36.08	48.00	13.64
Years of education	0.00	20.00	6.00	9.00	9.66	12.00	4.31
Municipal area	-2.00	0.00	-2.00	0.00	-0.79	0.00	0.98
Northern region	0.00	1.00	0.00	0.00	0.19	0.00	0.39
Central region	0.00	1.00	0.00	0.00	0.35	1.00	0.48
Northeastern region	0.00	1.00	0.00	0.00	0.22	0.00	0.41
Southern region	0.00	1.00	0.00	0.00	0.07	0.00	0.26
Time trend	1.00	40.00	10.00	20.00	20.09	30.00	11.47

PCPI	78.40	102.70	95.40	97.80	96.71	99.20	3.51
Female	0.00	1.00	0.00	1.00	0.55	1.00	0.50
Northern trend	0.00	40.00	0.00	0.00	3.73	0.00	9.24
Central trend	0.00	40.00	0.00	0.00	7.09	12.00	11.78
Northeastern trend	0.00	40.00	0.00	0.00	4.39	0.00	9.83
Southern trend	0.00	40.00	0.00	0.00	1.48	0.00	6.10
Married	0.00	1.00	0.00	1.00	0.55	1.00	0.50
Head	0.00	1.00	0.00	0.00	0.31	1.00	0.46

To further examine the causal effect on wage distribution, let's consider Figure 1. The annual wage distribution shifts to the right each year and begins to narrow at about 3.5 to 4 (about 33-55 baht per hour or 264-440 baht per 8 hours per day) in 2013-2016, when a minimum wage of 300 baht was enforced for the entire country. The minimum wage policy changes again in 2017-2020, further widening the wage distribution and increasing the minimum wage, but only by a small amount (less than 4 percent). Figure 2 shows that the median increases significantly in 2013 and changes little thereafter, suggesting that the 300-baht policy strongly influences the wage distribution.

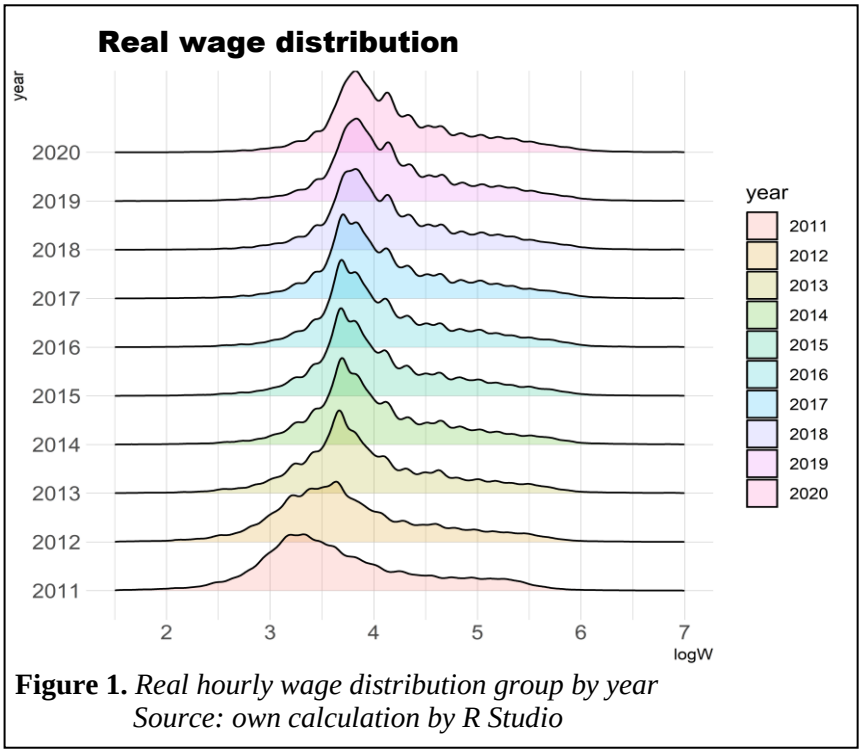

Figure 1. *Real hourly wage distribution group by year*
Source: own calculation by R Studio

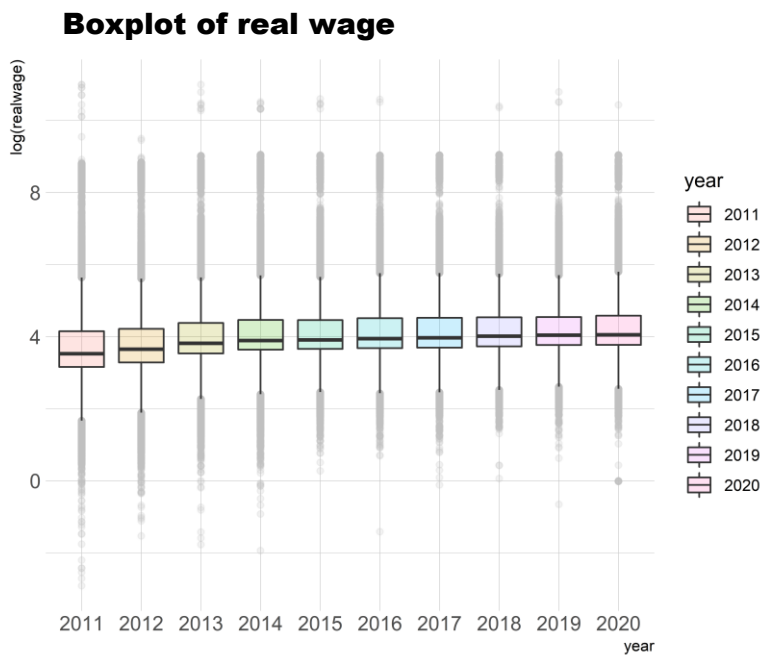

Figure 2. *Boxplot of real hourly wage group by year*
Source: own calculation by R Studio

METHODOLOGY

This paper uses quantile regression, which was first introduced by Koenker and Bassett (1978), to assess the effect of changes in the minimum wage on wage distribution in Thailand. To account for sample selection bias with copula, we follow the empirical strategy proposed by Arellano and Bonhomme (2017) and practical implementation in R by Koenker (2017). First, we estimate the labor force participation as follows.

$$LFP = \mathbf{1}\{V \leq p(Z)\}, \quad (1)$$

where *LFP* is labor force participation, $\mathbf{1}\{\cdot\}$ is the indicator function, *V* is the error term, and *p(Z)* is the propensity score for LFP determined by factors in Table 2.

Table 2

Independent variables and explanations.

Independent variable	Explanation
Age (*Age*)	Age of labor as a proxy of experience that labor has in the wage equation.
Education (*Edu*)	Years of education of labor.
Gender (*Female*)	Dummy variable which equals 1 if labor is female and 0 otherwise.
Marital status (*Married*)	Dummy variable which equals 1 if labor is married and 0

	otherwise.
Head of the family (*Head*)	Dummy variable which equals 1 if labor is head of family and 0 otherwise.
Whether living in urban (*Urban*)	Dummy variable equals 1 if living in an urban area and 0 otherwise.
Region (*Region*)	Set of dummy variables of the region where labor is living which consist of 5 areas: Northern, Northeastern, Central, Southern, and the last, Bangkok and Vicinity area which is used as reference
Provincial Consumer Price Index (*PCPI*)	Monthly Provincial Consumer Price Index
Provincial Minimum Wage rate (*MW*)	Provincial minimum wage rate

We also control for time trend and regional time trends to account for deference [due to changes over time and region in each sample.

Then, we estimate quantile regression for the wage equation. We use the same factors as in the LFP equation excluding marital status and head of the family status. The wage equation based on quantile regression can be written as follows:

$$Q(\ln w^* \mid \tau) = q(X, U), \tag{2}$$

$$w = w^* \text{ if } LFP = 1, \tag{3}$$

where $Q(\cdot)$ is the quantile function given τ. w* is the latent market hourly wage, which is observed only when the individual participates in the labor force. X is the vector of wage determinants and U is the error term.
Since *U* and *V* are potentially dependent which can lead to sample selection bias, the conditional copula $G_x(\cdot,\cdot)$ is applied in this study. Following Arellano and Bonhomme (2017), Frank copula is used for the estimation. For all quantiles $\tau \in (0,1)$,

$$\begin{aligned} \Pr(Q(\ln w^* \mid \tau) \le q(\tau, x) \mid LFP = 1, Z = z) &= \Pr(U \le \tau \mid V \le p(z), Z = z), \\ &= G_x(\tau, p(z)), \end{aligned} \tag{4}$$

In this study, we apply the probit model for the labor force participation equation and obtain the propensity score. Then, we estimate copula parameters and quartile regression parameters for the wage equation.

RESULTS

In this paper, we estimate the impact of the minimum wage on workers' wages using three models, including the sample selection model of Heckman (1979), the standard quantile regression of Koenker and Bassett (1978), and the quantile regression of Arellano and Bonhomme (2017) with sample selection using Frank-Copulas. The results of the estimations are presented in Table 3.

The first-stage estimate of the Heckman model for the labor force participation equation shows a significant but small positive effect of the minimum wage on labor force participation. For the wage equation, the result shows that, on average, a 1 baht increase in the minimum wage leads to a 0.18 percent increase in workers' wages. The results of the standard quantile regression without controlling for sample selection bias show that a 1 baht increase in the minimum wage leads to a 0.23 percent

increase in wages (25th quantile). At the higher quantiles, the coefficients of the minimum wage are lower at 0.20 (50th quantile) and 0.14 percent (75th quantile). The Frank-Copula estimated quantile regression with sample selection yields similar results to those of the standard quantile regression. The coefficient of the minimum wage is higher in the lower quantiles and lower in the upper quantiles. However, the coefficients in all quantiles are slightly lower than in the standard quantile regression. Specifically, the results show that a 1 baht increase in the minimum wage leads to a 0.22 percent increase in wages in the regression for the lower quantile (25th quantile), 0.18 percent for the median (50th quantile), and 0.11 percent for the upper quantiles (75th quantiles).

Table 3

Coefficients of minimum wage

	(M1) Heckman Model		(M2) Standard Quantile Regression			(M3) Quantile Regression with Copula		
	Probit	OLS	0.25th	0.50th	0.75th	0.25th	0.50th	0.75th
Dependent variable	*LFP*	ln(*w*)	ln(*w*)	ln(*w*)	ln(*w*)	ln(*w*)	ln(*w*)	ln(*w*)
Intercept	-4.9893***	2.1556***	1.2407***	1.3437***	1.9418***	1.8031***	2.1987***	2.9417***
MW	0.0004***	0.0018***	0.0023***	0.0020***	0.0014***	0.0022***	0.0018***	0.0011***
Age	0.2971***	-0.0218***	0.0223***	0.0164***	-0.0041***	-0.0057***	-0.0305***	-0.0455***
Age ^{2}	-0.0038***	0.0005***	-0.0002***	0.0000***	0.0004***	0.0002***	0.0006***	0.0009***
*E*du	0.0626***	0.0938***	0.0825***	0.0973***	0.1025***	0.0778***	0.0941***	0.0912***
Urban	0.0141***	0.0475***	0.0340***	0.0388***	0.0533***	0.0321***	0.0428***	0.0555***
Northern region	-0.0238***	-0.1724***	-0.1850***	-0.1858***	-0.1493***	-0.1823***	-0.1805***	-0.1160***
Central region	0.1677***	-0.0070*	0.0354***	-0.0026***	-0.0183***	0.0163***	-0.0278***	-0.0309***
Northeastern region	-0.2493***	-0.1119***	-0.1508***	-0.1291	-0.0944***	-0.1214***	-0.0963***	-0.0320***
Southern region	0.0190*	0.1511***	0.1751***	0.1159***	0.0969***	0.1587***	0.0927***	0.1243***
Time trend	-0.0055***	0.0016***	0.0018***	0.0012***	0.0014***	0.0022***	0.0015***	0.0024***
PCPI	-0.0029***	0.0066***	0.0044***	0.0059***	0.0066***	0.0048***	0.0068***	0.0063***
Female	-0.7518***	-0.0211***	-0.0837***	-0.0950***	-0.0943***	-0.0208***	-0.0070***	0.0203***
Northern trend	0.0008***	0.0014***	0.0023***	0.0017***	0.0013***	0.0020***	0.0017***	0.0009***
Central trend	0.0021***	0.0015***	0.0014***	0.0009***	0.0009***	0.0009***	0.0008***	0.0010***
Northeastern trend	0.0010***	0.0000	0.0017***	0.0003***	-0.0007***	0.0010***	-0.0001***	-0.0017***
Southern trend	0.0040***	0.0019***	0.0021***	0.0017***	0.0007***	0.0017***	0.0013***	0.0000
Married	0.1953***							
Head	0.4404***							
Inverse Mills Ratio		0.2033***						

Note: ***, **, * denote statistical significance at 1%, 5%, and 10% respectively

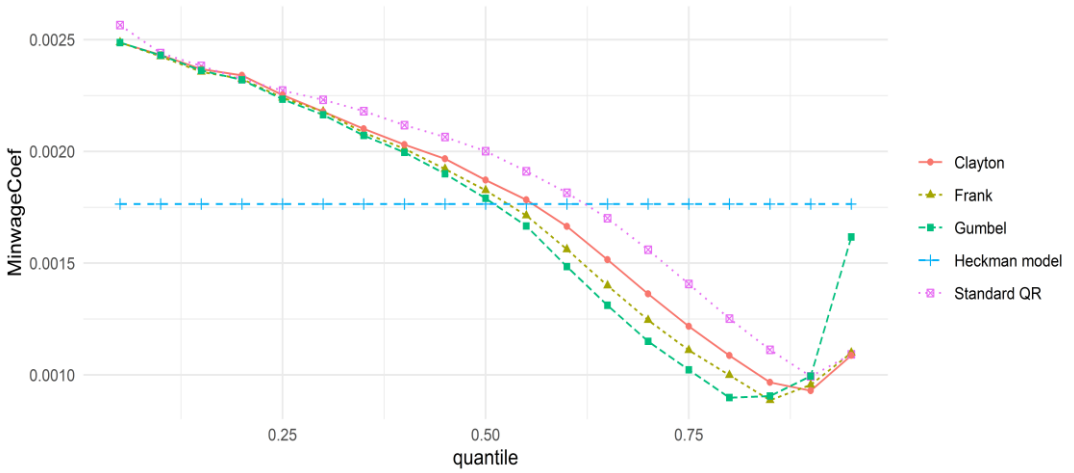

Figure 3 *Minimum wage Coefficients (Source: own calculation by R Studio)*

For comparison purposes, Fig. 3 shows the results of the coefficients of the minimum wage from the three models from the 0.05th to the 0.95th quantile. To check robustness, we examined three types of copulas from the Archimedean family in the quantile regression with sample selection of Arellano and Bonhomme (2017) using copulas which have the nice property of capturing a relationship between random variables with only one parameter, including Frank copula, Clayton copula, and Gumbel copula.

The results of the Heckman model and the standard quantile regression model show that the minimum wage affects workers' wages differently across quantiles. In particular, the minimum wage coefficients of the quantile regression are higher in the low quantiles than the Heckman model estimates. The coefficients of the quantile regression decrease for higher quantiles and become lower than the Heckman model estimate from the 55th quantile onward. This suggests that the minimum wage effectively increases the wages of workers in low-wage quantiles. It also confirms spillover effects on all workers. The spillover effects are larger for workers with low wages and smaller for workers with high wages.

In quantile regression with sample selection using the copula, we find that the results of models with different copulas of the Archimedean family yield similar minimum wage coefficients, indicating the robustness of the choice of copula within the Archimedean family. Compared to the standard quantile regression, the results are consistent in that the effects of the minimum wage are larger for workers in the lower quantiles and smaller for workers in the upper quantiles. However, the coefficients in all quantiles are slightly lower than in the standard quantile regression. This suggests that without correcting for sample selection, the results of the standard quantile regression exhibit a slight upward bias, especially in the estimation of the middle quantiles.

CONCLUSION AND DISCUSSION

This study examines the impact of the minimum wage on wage distribution in Thailand using data from the 2011-2020 Labor Force Survey. In 2013, a minimum wage of 300 baht was enforced in all provinces of the country. Since 2017, minimum wages have been raised further in several provinces. The results suggest that the minimum wage has had little impact on overall employment over the past decade. The results are consistent with those of Lathapipat and Poggi (2016), who find little impact on overall employment. Lathapipat and Poggi (2016) find that the minimum wage reduces employment among low-skilled youth and small and medium-sized firms, but increases employment in large firms.

Our results show that the rising minimum wage effectively raises the wages of the target population with low wages and has spillover effects on higher-wage earners. The spillover effect is larger for low-wage earners and decreases in higher quantiles. The results differ from those of Lathapipat and Poggi (2016), who find that the minimum wage affects workers between the 15th - 45th percentiles. The insignificant effects in lower quantiles are due to non-compliance by microenterprises and the delayed effects of the policy. Lathapipat and Poggi (2016) also show that the impact of the minimum wage varies over time. Since this study examines the impact from 2011-2020, workers' compliance with the minimum wage policy may have improved. In addition, this study uses the quantile regression model, which adjusts for selection bias

One limitation is that the data used in this study include only the wages of government, SOE, and private sector employees, not those of employers, self-employed, or freelancers. Therefore, the sample is dominated by workers in the formal sector. Since it is more difficult to enforce the minimum wage in the informal sector, the estimate of the impact of the minimum wage on Thai workers as a whole may be overstated. Further studies could estimate the impact of the minimum wage on workers in all sectors. Moreover, the magnitudes of spillover effects are measured as percentage changes in workers' wages. Note that a large percentage increase for low-wage workers may be smaller than a small percentage increase for high-wage workers. Therefore, the ability to discuss the impact of the minimum wage on wage inequality is limited.

For future research, many factors not considered in this paper can be taken into account, like those in the industry sector. This is because the effect may vary from industry to industry. Also, the effect of the minimum wage should differ between workers in the formal and informal sectors

ACKNOWLEDGMENT

This article is part of the first author's master's degree thesis at Chiang Mai University We would like to thank all the officers involved at the National Statistical Office for their continual and lengthy-time guidance and support as well as the provision of kind and convenient services.

REFERENCES

Arellano, M., & Bonhomme, S. (2017). Quantile selection models with an application to understanding changes in wage inequality. *Econometrica*, *85*(1), 1-28. https://doi.org/10.3982/ecta14030

Belman, D., & Wolfson, P. (2015). *What does the minimum wage do in developing countries?: A review of studies and methodologies.* https://nationalminimumwage.co.za/wp-content/uploads/2016/10/2.pdf

Borjas, G. J., (2013). *Labor economics*. McGraw-Hill Education.

Bosch, M., & Manacorda, M. (2010). Minimum wages and earnings inequality in urban Mexico. *American Economic Journal: Applied Economics, 2*(4), 128-49. https://doi.org/10.1257/app.2.4.128

Buchinsky, M. (1998). The dynamics of changes in the female wage distribution in the USA: a quantile regression approach. *Journal of applied econometrics*, *13*(1), 1-30. https://doi.org/10.1002/(sici)1099-1255(199801/02)13:1<1::aid-jae474>3.0.co;2-a

Choi, J., Rivadeneyra, I., & Ramirez, K. (2021). *Labor Market Effects of a Minimum Wage: Evidence from Ecuadorian Monthly Administrative Data*. (CESifo Working Paper No. 8987). https://doi.org/10.2139/ssrn.3820289

Chun, N., & Khor, N. (2010). *Minimum wages and changing wage inequality in Indonesia*. (Asian Development Bank Economics Working Paper Series No. 196). https://doi.org/10.2139/ssrn.1632245

David, H., Manning, A., & Smith, C. L. (2016). The contribution of the minimum wage to US wage inequality over three decades: a reassessment. *American Economic Journal: Applied Economics*, *8*(1), 58-99. https://doi.org/10.1257/app.20140073

Dickens, R., & Manning, A. (2004). Has the national minimum wage reduced UK wage inequality? *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, *167*(4), 613-626. https://doi.org/10.1111/j.1467-985x.2004.aei2.x

Del Carpio, X. V., Messina, J., & Sanz-de-Galdeano, A. (2019). Minimum wage: Does it improve welfare in Thailand? *Review of Income and Wealth*, *65*(2), 358-382. https://doi.org/10.1111/roiw.12360

DiNardo, J., Fortin, N. M., & Lemieux, T. (1996). Labor market institutions and the distribution of wages, 1973-1992: A semiparametric approach. *Econometrica: Journal of the Econometric Society*, 1001-1044. https://doi.org/10.3386/w5093

Engbom, N., & Moser, C. (2021). *Earnings inequality and the minimum wage: Evidence from Brazil.* (Working Paper 28831). https://doi.org/10.3386/w28831

Fang, T., Gunderson, M., & Lin, C. (2021). The impact of minimum wages on wages, wage spillovers, and employment in China: Evidence from longitudinal individual-level data. *Review of Development Economics, 25*(2), 854-877. https://doi.org/10.2139/ssrn.3734746

Ferraro, S., Meriküll, J., & Staehr, K. (2018). Minimum wages and the wage distribution in Estonia. *Applied Economics*, *50*(49), 5253-5268. https://doi.org/10.1080/00036846.2018.1486017

Fedorets, A., & Shupe, C. (2021). Great expectations: Reservation wages and minimum wage reform. *Journal of Economic Behavior & Organization*, 183, 397-419. https://doi.org/10.1016/j.jebo.2021.01.006

Fortin, N. M., Lemieux, T., & Lloyd, N. (2021). Labor market institutions and the distribution of wages: The role of spillover effects. *Journal of Labor Economics*, *39*(S2), S369-S412. https://doi.org/10.3386/w28375

Gregory, T., & Zierahn, U. (2020). *When the minimum wage really bites hard: Impact on top earners and skill supply*. (CESifo Working Paper No. 8540). https://doi.org/10.2139/ssrn.3689461

Heckman, J. J. (1979). Sample selection bias as a specification error. *Econometrica: Journal of the econometric society*, 153-161. https://doi.org/10.2307/1912352

Hinojosa, P. G. (2019). The Role of the Minimum Wage on the Declining Wage Inequality in Latin America: Evidence from Brazil. *Review of Economic Analysis,* 11, 39-82. https://doi.org/10.15353/rea.v11i1.1517

Howell, A. (2020). Minimum wage impacts on Han-minority Workers' wage distribution and inequality in urban China. *Journal of Urban Economics,* 115, 103184. https://doi.org/10.1016/j.jue.2019.103184

Joe, D. H., & Moon, S. (2020). Minimum wages and wage inequality in the OECD countries. *East Asian Economic Review*, *24*(3), 253-273. https://doi.org/10.11644/kiep.eaer.2020.24.3.379

Koenker, R. (2017). *Quantile selection models: An R Vignette.* http://www.econ.uiuc.edu/~roger/courses/NIPE/handouts/QSMx.pdf

Koenker, R., & Bassett Jr, G. (1978). Regression quantiles. *Econometrica: Journal of the Econometric Society*, 33-50. https://doi.org/10.2307/1913643

Laporšek, S., Vodopivec, M., & Vodopivec, M. (2019). Spillover effects of a minimum wage increase–evidence from Slovenia. *Post-communist economies, 31*(5), 603-622. https://doi.org/10.1080/14631377.2019.1578582

Lathapipat, D., & Poggi, C. (2016). *From many to one: Minimum wage effects in Thailand.* (PIER Discussion Papers No. 41). https://www.pier.or.th/files/dp/pier_dp_041.pdf

Leckcivilize, A. (2015). Does the minimum wage reduce wage inequality? Evidence from Thailand. *IZA Journal of Labor & Development, 4*(1), 1-23. https://doi.org/10.1186/s40175-015-0041-7

Lee, D. S. (1999). Wage inequality in the United States during the 1980s: Rising dispersion or falling minimum wage? *The Quarterly Journal of Economics, 114*(3), 977-1023. https://doi.org/10.1162/003355399556197

Lukiyanova, A. (2011). *Effects of minimum wages on the Russian wage distribution.* (Higher School of Economics Research Paper No. WP BRP 09). https://doi.org/10.2139/ssrn.2002938

Louzao, J. G., & Tarasonis, L. (2022). *Wage and Employment Impact of Minimum Wage: Evidence from Lithuania.* (CESifo Working Paper No. 10064). https://doi.org/10.2139/ssrn.4273438

Ma, X., & Li, S. (2017). *The Effects of Minimum Wage on Wage Distribution in Urban China: Evidence from the CHIP Data.* (CHCP Working Paper, No. 2017-24). https://www.econstor.eu/bitstream/10419/180869/1/1027498043.pdf

Machin, S., & Manning, A. (1994). The effects of minimum wages on wage dispersion and employment: Evidence from the UK Wages Councils. *ILR Review, 47*(2), 319-329. https://doi.org/10.1177/001979399404700210

NSO. (2020). The 2011-2020 labor force participation survey data. [Data file]. Bangkok: National Statistical Office of Thailand.

Pelek, S. (2018). The Impact of the Minimum Wage on Wage Distribution: The Evidence from Turkey. *Ekonomi-tek, 7*(1), 17-59. http://giam.gsu.edu.tr/wp-content/uploads/2014/07/WP-13-08.pdf

Redmond, P., Doorley, K., & McGuinness, S. (2021). The impact of a minimum wage change on the distribution of wages and household income. *Oxford Economic Papers, 73*(3), 1034-1056. https://doi.org/10.2139/ssrn.3525242

Samart, W., & Kilenthong, W. (2021). *Effect of Minimum Wage on Changes in Thai Labor Market.* (PIER Discussion Papers No. 137). https://www.pier.or.th/files/dp/pier_dp_137.pdf

Stewart, M. B. (2012). Wage inequality, minimum wage effects, and spillovers. *Oxford Economic Papers, 64*(4), 616-634. https://doi.org/10.1093/oep/gps003