The Impact of Raising the Minimum Wage on Migrant Workers' Living Standards: An Empirical Research Based on the Difference-in-Difference-in-Difference Model

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Abstract: In the context of rapid urbanization in recent years, it is of great significance to study whether the increase of the minimum wage can improve the living standards of migrant workers in terms of boosting the realization of the "common prosperity" goal. Based on the "Dynamic Monitoring and Survey Data of China's Floating Population" (CMSD) from 2011 to 2018 and the minimum wage in various regions, this paper used the Difference-in-Difference-in-Difference model (DDD) to analyze the impact of raising the minimum wage on migrant workers' living standards from three aspects: household income, expense and rent. The result showed that: (1) Rising the minimum wage can promote the increase in household income and expense of migrant workers, thereby helping to improve their living standards. (2) Since China has vigorously promoted and continuously improved affordable housing policies and measures in recent years, the housing needs of migrant workers have been diverted to a certain extent. Therefore, the phenomenon of rural population gathering in cities caused by the raising of minimum wage has not led to the increase of rent, which guarantees the basic life of migrant workers.

Keywords: the minimum wage; migrant worker; living standards; the Difference-in-Difference-in-Difference model

1 Introduction

In recent years, in the construction of infrastructure and cities, migrant workers are playing an increasingly significant role. The society is also paying more and more attention to the minimum wage. After promulgating "Minimum Wage Regulations for Enterprises," the Chinese government furthermore clarified the juridical status of the minimum wage in "Labor Law of the People's Republic of China," which came in effect in 1994. Then, after the promulgation of "Minimum wage regulations" in 2004, cities all over China has been adjusting the minimum wage standard to different extent and different frequency. The initial objective of setting the minimum wage is to ensure the legitimate right of labor renumeration, and to protect the basic livelihoods of the laborers and their families[1]. However, there has always been scholars raising their worries for this. They think that the raising the minimum wage will increase firms' working costs, while workers who have low levels of education and lack working skills will hence be dismissed, which means the living standards of some migrant workers will be negatively influenced[2]. Therefore, based on different opinions of the scholars, researching on the influence

ICIDC 2023, June 02-04, Nanchang, People's Republic of China

DOI 10.4108/eai.2-6-2023.2334652

of raising the minimum wage on migrant workers becomes valuable and meaningful.

Unemployment will undoubtedly decrease migrant workers' income, expense, as well as living standards. In neo-classical economy theory, the minimum wage is regarded as one of the most important factors of increasing unemployment rate, scholars such as Gong[3] thought the minimum wage led to transfer of labor between companies and unemployment of some workers in the labor market. On the other hand, some scholars held different views, David et al.[4] used natural experiment and found out that in lower-end labor market, there were few competitive market structures, most of which are monopsony market structures. Therefore, raising the minimum wage could not only increase salary for the low-income group, but would also not affect the employment. Many researches thereafter supported the hypothesis, such as Cao et al.[5] and Wang et al.[6] found that raising the minimum wage has negligible effect on the unemployment rate of Shenzhen and Tianjin. However, some scholars found out that raising the minimum wage deteriorated the phenomenon of working overtime, and that population aggregation may occur, leading to rocketing of housing rent and price[7, 8].

Based on the above literature review, many researches discussed the impact of raising the minimum wage on migrant workers through unemployment rate or employment rate. However, few of them directly analyzed impact of such policies on the earning and expense of migrant workers. Thus, this paper combined the data from "Dynamic Monitoring and Survey Data of China's Floating Population" (CMSD), and used the Difference-in-Difference-in-Difference model (DDD) to investigate the impact of raising the minimum wage on migrant workers from the perspectives of income, expense and housing problems, providing direct theoretical supports for policy adjustments and promulgation.

2 Theory and hypothesis

2.1 Raising the minimum wage and income of migrant workers

Income of people in China are mainly composed of wage income, income from household business operation, property income, and transfer income, Most households rely mostly on wage income[9]. Currently, most scholars believed that the minimum wage helps improve the financial condition of the low-income people. However, some scholars held the opinion that minimum wage is a burden to the companies, confronting low-skilled labor with greater chances of being dismissed, widening the gap between the rich and the poor[10]. Given the abundant labor resource in China nowadays, albeit raising the minimum wage will make companies dismiss workers to a certain extent, but will also attract a large amount of labor into the labor market, which will reach a new equilibrium. As a result, the "employment crowding out effect" caused by the raise in the minimum wage is still relatively small, and the number of employed people has hardly changed. The "wage spillover effect" is significantly greater than the "employment crowding out effect". Based on this, hypothesis1 is raised:

Hypothesis1: Raising the minimum wage will generally increase the income of migrant workers.

2.2 Raising the minimum wage and expense of migrant workers.

Scholars usually analyzed the relationship between expense of migrant workers and minimum wage from durable goods and nondurable goods. On the one hand, there is a close relationship

between the consumption of durable goods with the characteristics of saving and the constraints of personal credit loan. Current research found out that while the minimum wage is raising, the real wage low-income groups will increase, which effectively reduces the constraints of individual credit loan, increasing number of mortgage debts and accelerating household expense[11]; on the other hand, nondurable goods, due to characteristics of smooth expenditure of permanent income hypothesis, are susceptible to the positive influence of change in income under the influence of instant family reaction, relatively low adjustment cost, and stable welfare demand[11, 12]. Based on this, hypothesis2 is raised:

Hypothesis2: Raising the minimum wage will generally increase the expense of migrant workers.

2.3 Raising the minimum wage and housing rent.

Raising the minimum wage will promote urbanization to some extent, advocating population flow from rural to urban areas, which will also boost the demand of city housing rent and expense, increasing housing prices[13, 14]. Therefore, hypothesis3 is raised:

Hypothesis3: Raising the minimum wage will generally increase housing rent.

3 Research design

3.1 Data source

The minimum wage data from this paper were collected from announcements made by the Ministry of Human Resources, Social Security Department and the municipal government of different areas, the data related to migrant workers were mainly from “Dynamic Monitoring and Survey Data of China's Floating Population” (CMSD) from 2011 to 2018. Referring to the definition of floating population in the census[15] and definition of migrant workers in the study of Xiao et al.[15], this paper retained the samples in CMDS with flow range “between countries”, “between provinces” or “between cities within the province,” with flow reason “work needed,” and who are non-local residence registration. After deleting the missing values, 570073 samples were left, covering 267 prefecture-level cities.

3.2 Variables selection

All variables in this paper were from the “National Floating Population Health and Family Planning Dynamic Monitoring Survey Floating Population Questionnaire (Volume A)”. The specific description of each variable were shown in Table1.

Table1 Variable description

Variable	Description
income	The monthly income of respondents' households
expense	The monthly expense of respondents' households
rent	The monthly housing rent of respondents' households
mw	The minimum wage set by laws

time	Used to measure whether the minimum wage was increased in the previous year (0=no increase, 1=increase)
group	Used to measure whether the respondent is of higher income group (0= the monthly salary of respondents exceeds 70% quantile, 1=The monthly salary of respondents did not exceed 70% quantile)
gender	The gender of respondents (0=male, 1=female)
age	The age of the respondents
education	The diploma of respondents (0=no education, 1=primary school, 2=middle school, 3=high school, 4=vocational school, 5=high school/vocational school, 6=undergraduate, 7=junior college, 8=graduate)
range	The flow range of the respondents (1=move between provinces, 2=move between nations, 3=move between cities)
residence	The residence time of respondents
marriage	The marital status of respondents (0=married, 1=just married, 2=divorced, 3=widow/widower, 4=living together, 5=not married, 6=remarried)
job	The job property of the sample individual (0=European and American enterprises, 1=Hongkong-Macao-Taiwan sole proprietorship enterprises, 2=Hongkong-Macao-Taiwan enterprises, 3=individual business, 4=joint-stock/associated enterprises, 5=country owned or country-owned holding enterprises, 6=government department or public institutions, 7=collective enterprises, 8=else, 9=Japanese, South Korean enterprises, 10= enterprises mainly invested by Japanese, South Korea enterprises 11=club/private organizations,12 land provider, 13= private enterprises, 14=enterprises rely solely on foreign investment, 15=no job, 16=enterprises that rely both on Chinese and foreign investments)

3.3 Model construction

In order to quantitatively compare the effects of raising the minimum wage in different areas, the Difference-in-Difference-in-Difference model (DDD) is used. Although the Difference-in-Difference model (DID) is more commonly used to compare the effects certain policies, in this paper, following aspects do not satisfy the precondition of DID. First, the duration between adjacent adjustments of the minimum wage is sometimes too short (a year), making it difficult to testify the parallel trend assumption, while measuring dependent variable in months can't reflect true effect of policies. Second, the time of minimum wage change is not standardized throughout the country, so it is not possible to find a time base for policy's implementation to use most of the sample. Third, people's living standards with respect to time is not always linear. Thus, the DID model is not adequate for the essay.

The DDD model, on the other hand, satisfy the need of this paper. One of the biggest benefits is that it can compare the effect of policies without examining parallel trend assumption, which solves the problem with short duration between policies, thus, it is often used to compare the effect of policy across regions. SUTVA (stable unit treatment value assumption) that the DDD model needs to satisfy requires that the individuals' potential outcome is unaffected by whether other individuals are treated. Referred to the study of Yao et al.[16], the living quality of people with higher incomes will not be affected by changes in the minimum wage. Therefore, on the basis of distinguishing the control group and the treatment group according to whether the minimum wage in the region has been raised, this paper further grouped the samples according to the monthly wages of the interviewed samples to meet the operating conditions of the DDD

model. Also, since the question in the questionnaire is "What is the average monthly total income (total expense/housing rent) of your home in the past year?", this paper referred to the study of Duan et al.[17], processed the minimum wage data for each region with one year lag. In addition, logarithmic processing was performed on variables such as mw, income, expense and rent to ensure the stationarity of data. The specific model is as follows:

$$Y_{ijt} = \beta_0 + \beta_1 \ln mw_{jt-1} \times time_{jt-1} \times group_i + \beta_2 \ln mw_{tj-1} \times time_{jt-1} + \beta_3 \ln mw_{itj-1} \times group_i + \beta_4 time_{jt-1} \times group_i + \gamma X_{itj} + \delta_j + \eta_t + \varepsilon_{itj} \quad (1)$$

In the formula, i represents individuals; j represents regions; t represents years. Y_{itj} represents dependent variables, including three variables: $lnincome_{ijt}$, $lncost_{ijt}$, $lnrent_{ijt}$; $lnmw_{jt-1}$ represents the minimum wage of region j at time t-1; $time_{jt-1}$ is set to evaluate whether region j raises the minimum wage in period t-1. Value 1 for this variable stands for increase, and value 0 stands for no increase; $group_i$ represents grouping variable. It has value 1 if monthly salary of the respondent i does not exceed 70% quantile and has value 0 otherwise; X_{itj} represents control variables; δ_j represents regional fixed effect; η_t represents time fixed effect; ε_{itj} represents noise.

4 Results and analysis

4.1 Descriptive statistics

The descriptive statistics of main variables were shown below in Table 2. It can be seen that the minimum wage of China differs from region to region, with overall range between 500 to 2300 yuan, averaging about 1315 yuan. Migrant workers are mainly married males with an average age of 42, working for an average of 5 to 6 years. In addition, their average household income is about 6248 yuan, and average household expense is about 3858 yuan, indicating that there is some disposable space.

Table2 Descriptive statistics

Variable	Mean	SD	Min	Max
gender	0.4134	0.4924	0	1
age	41.8528	9.2281	19	85
education	2.9770	1.8885	0	8
range	1.3501	0.4771	0	2
residence	5.6695	5.5282	0	51
marriage	1.8241	1.6228	1	6
salary	4131.6398	4018.4964	0	500000
rent	765.8439	1128.9109	0	80000
income	6247.8749	6243.5461	0	1000000
expense	3857.8850	4440.2249	0	600000
job	8.2004	5.1817	0	16
mw	1314.6758	309.7788	500	2300

4.2 Regression results

The results obtained by using the DDD model were shown in Table 3. The dependent variable in the column1 and column2 were migrant worker monthly household income. According to column1, raising the minimum wage in the previous year can effectively promote the growth of household income. Column2 listed the regression results after control variables was added. Although the estimated coefficient of DDD variable decreased, the influence direction remained the same. Thus, hypothesis1 was supported.

The dependent variable in the column3 and column4 were migrant worker monthly household expense. According to these columns, the coefficient of DDD variable were significant and positive, meaning that raising the minimum wage in the previous year can also promote household expense, so hypothesis2 was also supported.

The dependent variable in the column5 and column6 were migrant worker family housing rent. It could be found that the estimated coefficient of DDD variable was not significant whether control variables were added or not, indicating that raising the minimum wage in the previous year can't have a significant impact on housing rent. Therefore, hypothesis3 was not supported. This was consistent with the research conclusion of Yang et al.[18], benefiting from China's active promotion and development of affordable housing policies in recent years, the housing rent burden of migrant workers have been eased to a considerable extent. Housing demand have been diverted, and migrant workers also get a basic life.

Table3 Results of the DDD model

Dependent Variable	lnincome	lnincome	lnexpense	lnexpense	lnrent	lnrent
DDD	0.0037***	0.0033***	0.0026***	0.0022***	0.0003	-0.0002
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0010)	(0.0010)
lnmw×time	0.0003***	0.0004***	0.0000	0.0001**	0.0027***	0.0027***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0004)	(0.0004)
lnmw×group	-0.0061***	-0.0054***	-0.0057***	-0.0049***	-0.0071***	-0.0065***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0002)	(0.0002)
time×group	-0.3064***	-0.2810***	-0.1940***	-0.1658***	-0.1699**	-0.0976
	(0.0075)	(0.0071)	(0.0075)	(0.0070)	(0.0662)	(0.0656)
gender		0.0625***		0.0521***		0.1020***
		(0.0015)		(0.0015)		(0.0140)
age		-0.0008***		-0.0023***		-0.0218***
		(0.0001)		(0.0001)		(0.0009)
education		0.0450***		0.0502***		-0.0747***
		(0.0004)		(0.0004)		(0.0044)
range		-0.0366***		-0.0030*		-0.2854***
		(0.0018)		(0.0018)		(0.0176)
residence		0.0077***		0.0117***		-0.0333***

		(0.0001)		(0.0002)		(0.0015)
marriage		-0.1057***		-0.1041***		-0.3628***
		(0.0006)		(0.0006)		(0.0050)
job		-0.0053***		-0.0090***		-0.0579***
		(0.0001)		(0.0001)		(0.0013)
constant	8.6834***	8.7355***	7.9526***	8.0303***	2.2965***	4.8847***
	(0.0079)	(0.0093)	(0.0078)	(0.0093)	(0.0885)	(0.1017)
regional fixed effects	yes	yes	yes	yes	yes	yes
year fixed effects	yes	yes	yes	yes	yes	yes
observations	570073	570073	570073	570073	570073	570073
R^2	0.306	0.385	0.410	0.479	0.092	0.106

Note: Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.3 Robust test

4.3.1 Robust test based on salary breakpoints difference

In order to test the reliability and validity of empirical results, this article set different salary breakpoints under the framework of the DDD model to test whether grouping methods with different breakpoints will lead to bias in the results. In addition to taking the 70% quantile of the monthly salary of individuals as the classification basis to distinguish the experimental group from the control group, in the robustness test, this paper also classified the samples with the monthly salary of individuals above 80% quantile as the control group, and the remaining samples were divided into the experimental group, and the DDD model was conducted again to test the robustness of the results. The specific estimation results were shown in Table4, it can be found that the results were basically consistent with Table3, meaning that the results obtained in this paper were relatively robust.

Table4 Robust test based on salary breakpoints difference

Dependent Variable	lnincome	lnincome	lnexpense	lnexpense	lnrent	lnrent
DDD	0.0026***	0.0024***	0.0017***	0.0015***	-0.0003	-0.0005
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0010)	(0.0010)
lnmw×time	0.0008***	0.0008***	0.0004***	0.0004***	0.0037***	0.0034***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0005)	(0.0005)
lnmw×group	-0.0064***	-0.0056***	-0.0059***	-0.0051***	-0.0077***	-0.0072***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0003)	(0.0003)
time×group	-0.2693***	-0.2481***	-0.1647***	-0.1418***	-0.1831***	-0.1225**
	(0.0071)	(0.0067)	(0.0071)	(0.0066)	(0.0629)	(0.0624)
controls	no	yes	no	yes	no	yes
constant	8.7517***	8.8244***	8.0142***	8.1089***	2.3888***	5.0173***

	(0.0079)	(0.0094)	(0.0080)	(0.0095)	(0.0891)	(0.1022)
regional fixed effects	yes	yes	yes	yes	yes	yes
year fixed effects	yes	yes	yes	yes	yes	yes
observations	570073	570073	570073	570073	570073	570073
R^2	0.295	0.377	0.401	0.473	0.091	0.106

Note: Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.3.2 Robust test based on gender difference

This paper also distinguished the gender of samples, dividing them into sub-datasets of males and females, then analyzed results based on the DDD model. Regression results were shown in Table5. Due to the limitation of space, control variables were added into all regression models here. The significance and direction of the impact of DDD variable on each dependent variable in the estimation results of the two sub-datasets were consistent with Table3, indicating that the results were robust.

Table5 Robust test based on gender difference analysis

Sample Category	Male Sample			Female Sample		
Dependent Variable	lnincome	lnexpense	lnrent	lnincome	lnexpense	lnrent
DDD	0.0030***	0.0021***	-0.0001	0.0013***	0.0005***	-0.0018
	(0.0001)	(0.0001)	(0.0013)	(0.0002)	(0.0002)	(0.0016)
lnmw×time	0.0005***	0.0002***	0.0036***	0.0015***	0.0009***	0.0037***
	(0.0001)	(0.0001)	(0.0006)	(0.0001)	(0.0001)	(0.0009)
lnmw×group	-0.0059***	-0.0053***	-0.0072***	-0.0053***	-0.0048***	-0.0077***
	(0.0000)	(0.0000)	(0.0003)	(0.0000)	(0.0000)	(0.0004)
time×group	-0.2730***	-0.1676***	-0.1231	-0.2091***	-0.1018***	-0.0998
	(0.0092)	(0.0088)	(0.0832)	(0.0099)	(0.0102)	(0.0949)
controls	yes	yes	yes	yes	yes	yes
constant	8.7694***	8.0657***	5.0634***	8.9398***	8.2008***	5.0639***
	(0.0121)	(0.0119)	(0.1280)	(0.0142)	(0.0151)	(0.1693)
regional fixed effects	yes	yes	yes	yes	yes	yes
year fixed effects	yes	yes	yes	yes	yes	yes
observations	334418	334418	334418	235655	235655	235655
R^2	0.393	0.482	0.117	0.372	0.470	0.097

Note: Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.3.3 Robust test based on age and generation difference

Finally, according to the study of Xie et al.[19], this paper also divided sample into two sub-

datasets: youth sample datasets (age below 45 years old), and elderly sample datasets (age above 45 years old). The estimation was conducted using the DDD model, and the specific results were shown in Table6. It can be shown that regardless of age sample, the significance and direction of DDD variable influence on each dependent variable were consistent with Table3, meaning the results were still robust.

Table6 Robust test based on age and generation difference

Sample Category	Youth Sample			Elderly Samples		
Dependent Variable	lnincome	lnexpense	lnrent	lnincome	lnexpense	lnrent
DDD	0.0024***	0.0018***	-0.0014	0.0023***	0.0011***	0.0021
	(0.0001)	(0.0001)	(0.0012)	(0.0002)	(0.0002)	(0.0017)
lnmw×time	0.0007***	0.0003***	0.0028***	0.0009***	0.0006***	0.0038***
	(0.0001)	(0.0001)	(0.0006)	(0.0001)	(0.0001)	(0.0010)
lnmw×group	-0.0052***	-0.0048***	-0.0091***	-0.0059***	-0.0050***	-0.0015***
	(0.0000)	(0.0000)	(0.0003)	(0.0000)	(0.0000)	(0.0005)
time×group	-0.2490***	-0.1560***	0.0036	-0.2401***	-0.1172***	-0.3258***
	(0.0086)	(0.0084)	(0.0792)	(0.0106)	(0.0107)	(0.1013)
controls	yes	yes	yes	yes	yes	yes
constant	8.5560***	7.7450***	3.2032***	9.0977***	8.5115***	6.3635***
	(0.0148)	(0.0140)	(0.1468)	(0.0161)	(0.0179)	(0.1884)
regional fixed effects	yes	yes	yes	yes	yes	yes
year fixed effects	yes	yes	yes	yes	yes	yes
observations	353981	353981	353981	216092	216092	216092
R^2	0.423	0.531	0.113	0.319	0.386	0.120

Note: Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

5 Conclusion and suggestion

5.1 Conclusion

This paper used the DDD model to analyze the impact of raising the minimum wage on migrant workers living standards from the monthly household income, expense and housing rent. Compared to the most existing researches that indirectly analyze the impact on the living standards of migrant workers by discussing the impact of raising minimum wage on the unemployment rate and employment rate, this paper provided the direct evidence that raising the minimum wage can help to improve the migrant workers living standards. Specific results were listed below: (1) Raising the minimum wage can effectively promote the increase in household income and expense of migrant workers, to some extent, it helps to improve their

living standards. (2) In recent years, China has vigorously promoted and developed affordable housing, which has to some extent diverted the housing needs of migrant workers and ensured their basic livelihood. As a result, the phenomenon of rural population gathering in cities caused by raising the minimum wage has not led to an increase in housing rent.

5.2 Suggestion

With the conclusions above, this paper proposed the following suggestions: (1) When adjusting and determining the minimum wage standard, relevant departments should not only follow scientific methods, but also further improve the employment system and improve the employment environment. These measures will help to ensure the reasonable flow of labor force, promote the balanced development of all regions, and guard against the “Matthew effect” caused by too large differences between regions. (2) Although indemnificatory houses have played an important role in improving living standard of migrant workers, it is still of great significance to further explore the effective connection between housing sources and security objects, search for the potential housing sites, optimize the follow-up management and reduce the impact of the dual registered residence system on the construction of the housing security mechanism for saving resources and promoting security efficiency.

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