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THE IMPACT OF MINIMUM WAGE REGULATIONS ON INDUSTRIAL PRODUCTIVITY IN CHINA

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Abstract: Based on the dynamic OP method, this paper examines the impact of Minimum wage regulations on the productivity of China's manufacturing industry from two aspects: resource allocation and production incentive. It is found that the implementation of the policy improves the compliance of enterprises, Narrows the labor price distortion gap, and improves the static configuration. At the same time, the policy will also dredge the exit channel of the market and improve the dynamic allocation of resources between the exiting enterprises and the surviving enterprises. Policy benefits also exist in the productivity incentive of enterprises under the forced mechanism. Using the data of Chinese industrial enterprises and the minimum wage data of prefecture-level cities, the empirical test is carried out. Therefore, the Chinese government should speed up the improvement of the minimum wage system supervision system, "grasp the small and magnify", and pay attention to the incentive effect of such systems on the market mechanism and production efficiency.
Keywords: Minimum wage regulation; Industry productivity; Enterprise productivity; Static resource allocation; Dynamic resource allocation

1 THEORETICAL ANALYSIS

The introduction of Minimum Wage Regulations explicitly prohibits violations disguised as overtime pay, piecework wages or commission wages. It also clarifies the supervision responsibility of labor and security administration while increasing penalties for violations, thereby raising the cost for non-compliant enterprises. This will negatively impact labor costs for small-scale businesses by elevating their low labor price and reducing labor price distortion compared to market equilibrium prices. On the other hand, although Minimum Wage regulations also affect labor costs for large enterprises through spillover effects[1], this impact is relatively minor compared to that on small enterprises. Consequently, it reduces the degree of differentiation in labor price distortion between large and small firms, promotes income productivity equality among businesses, and minimizes deviations from optimal resource allocation. These findings indicate a flow of resources from low-productivity small firms to high-productivity large firms while enhancing static allocation efficiency among surviving entities. Theoretical hypothesis 1: The implementation of the Minimum Wage Regulations is expected to mitigate labor price differentiation among enterprises and enhance the static allocation efficiency of resources.

According to recent studies[2], the critical level of entering market is influenced by factors such as industry-wide material productivity, enterprise compliance levels, and average wage levels within the industry. Specifically, a higher average wage paid to workers in an industry corresponds to a higher threshold for firms entering into production.After the implementation of Minimum Wage Regulations, enterprises face strict constraints in implementing minimum wage standards. This not only increases the wages of low-skilled workers but also generates a spillover effect on high-skilled workers, leading to an overall increase in wages. However, this rise will further elevate the market threshold and hinder new entrants from joining the market. As a result, enterprises with high productivity that do not exceed the critical level fail to enter while those with low productivity continue to occupy resources, resulting in a decline in resource allocation efficiency between surviving enterprises and potential entrants. Theoretical hypothesis 2: minimum wage regulations promote wage growth, raise the critical productivity level for entering markets, impede potential entrants from joining markets and ultimately reduce resource allocation efficiency between surviving enterprises and potential entrants.

In addition, from the perspective of market exit, small enterprises with wages lower than the minimum wage standard will bear the brunt of the impact, as they face an increased cost burden in terms of wages and salaries. These enterprises often lack sufficient capital, technology, and operational capacity to internalize labor costs, exacerbating their business difficulties and leading to their withdrawal from the market. While large businesses are also affected by spillover effects of the minimum wage policy, they are relatively less impacted by labor costs compared to small businesses. Moreover, due to fewer borrowing or capital constraints, large enterprises possess a stronger ability to withstand shocks and sustain their presence in the market. Consequently, heterogeneous labor costs generate a selection effect among enterprises[2]. As a result of this effect, low-productivity small enterprises are eliminated while high-productivity large enterprises remain in the market. This process releases resources previously occupied by low-productivity small enterprises and enhances dynamic allocative efficiency between surviving and exiting firms. Theoretical hypothesis 3: minimum wage regulations facilitate the market exit of low-productivity enterprises, thereby enhancing resource allocation efficiency between surviving and exiting firms.

Faced with costly labor resources, enterprises are likely to opt for machinery and equipment as a rational choice to replace low-skilled workers, thereby increasing the input of material capital in the production process[2,3]. According to the theory of capital-skill complementarity, advanced machinery and equipment require a highly skilled workforce. In response to this demand, enterprises may enhance employee training programs aiming at improving human capital levels[4], resulting in alterations in both labor employment structure and production factor composition.

Influenced by labor costs, managers will pay more attention to performance gaps among peers and strive towards enhancing enterprise profitability[5]. Alternatively, they may improve management practices by implementing measures such as inventory reduction to cope with shocks[3]. The backward forcing mechanism involving factor substitution and management promotion effects contributes positively towards enhancing enterprise productivity. Theoretical hypothesis 4: Following the implementation of minimum wage regulations, enterprises will be compelled to engage in factor replacement and managerial improvement processes that ultimately drive their own productivity enhancement.

On the aforementioned assumptions, it is evident that the implementation of minimum wage regulations has the potential to foster industry productivity progress. This can be achieved by stimulating enterprise productivity growth and enhancing both static resource allocation efficiency among surviving enterprises and dynamic resource allocation efficiency between surviving and exiting enterprises. However, it is this policy may also result in market blockage, thereby reducing dynamic resource allocation efficiency between surviving and entering enterprises, consequently impeding industry productivity progress. Consequently, Competitive Hypothesis 5 posits that the implementation of minimum wage regulations may facilitate industry productivity improvement. Additionally, Competitive thesis 6 suggests that such implementation may hinder industry productivity progress.

2 MODEL SETTING, VARIABLE SELECTION AND DATA DESCRIPTION

2.1 Model Construction and Variable Selection

This paper constructs the following DID model to evaluate the effect of Minimum wage regulation on manufacturing industry productivity. Where, the variable $Exposed_{ci03}$ indicates the susceptibility of city c industry i to policy influence prior to its implementation. $Change_t$ serves as a determinant for whether the policy has been implemented or not. Additionally, ΔTFP_{cit} represents the productivity change value of industry i in city c from year t-1 to t. CV_{cit} acts as a control variable at the city-industry level. The model also accounts for city-industry fixed effects μ_{ci} and time fixed effects ν_t. Lastly, ε_{cit} refers to the random error term.

$$\Delta TFP_{cit} = \chi + \beta Exposed_{ci03} \times Change_t + CV_{cit} + \mu_{ci} + \nu_t + \varepsilon_{cit} \quad (1)$$

Dependent Variable. Melitz and Polanec method[6] (referred to as DOP method) is used to calculate the change value of industry productivity. Core Independent Variables: If the proportion of industry i of city c in 2003, whose monthly average wage is below the local minimum wage standard, exceeds the national median level, it indicates that this industry is susceptible to the impact of Minimum Wage regulation, $Exposed_{ci03} = 1$. Since the implementation of Minimum Wage regulations in 2004, subsequent years including 2004 are considered as occurring at which time, $Change_t = 1$. To assess the sensitivity of grouping variables, we define wage density as the average ratio between average monthly wage and minimum wage in industry i of city c in year t. Industries with a wage density lower than the national median level in 2003 are classified as being susceptible to policy impact.Control Variables:Net assets; Export ratio; State capital; Number of employed persons; Per capita real capital; Degree of monopoly; Proportion of labor dispute case settlements;Logarithmic GDP; Population; Average wage; Number of employees.

2.2 The Source of Data and the Processing of Data

The enterprise data in this paper primarily originate from the National Bureau of Statistics' "Database of non-state-owned industrial enterprises". Given that this study focuses on manufacturing enterprises, only samples within this category are retained. Additionally, the minimum wage standards across different regions are included as supplementary data. For empirical analysis purposes, this paper selects prefecture-level cities as research scope. Additionally, to reflect the proportion of concluded labor dispute cases and the level of economic development in each city, we also cross-referenced data from China Statistics Yearbook and China City Statistics Yearbook for the respective years.

3 FINDINGS AND ANALYSIS BASED ON EMPIRICAL RESULTS

3.1 The Analysis of Benchmark Results

After employing formula (1) as the benchmark model and clustering parameters to the city level based on standard error, the regression results are presented in column (1) of Table 1. It is evident that the coefficient of the secondary interaction term exhibits significant positive association at a significance level of 1%. This finding confirms, initially, the competitive hypothesis5 by demonstrating a substantial increase in productivity growth rate for low-wage industries following the implementation of Minimum Wage Regulations. In column (2), we present estimated results after further

controlling for variables at both city and industry levels; notably, even with this additional control, the coefficient of the interaction term remains significantly positive at a significance level of 1%, indicating that Minimum Wage Regulations continue to exert their promoting effect on low-wage industries' productivity regardless of city-industry characteristics. To mitigate any influence from contemporaneous policies, we employ labor dispute cases closed as a proxy $dispute_{pt}$ for assessing the impact degree of Labor Security Supervision Regulations within each province. The results after incorporating this variable are displayed in column (3). Although there is some decrease in significance observed for the coefficient associated with interaction terms, it still retains positive statistical significance at a level of 5%. This suggests that while of Labor Security Supervision Regulations may amplify to some extent the promotion effect exerted by Minimum Wage Regulations on industrial productivity, removal of corresponding policy influences does not diminish Minimum Wage Regulations' ability to significantly enhance industrial productivity growth rates. Considering the impact of urban economic development on minimum wage levels, as well as its influence on enterprises and industry productivity through various channels, we have controlled variables in column (4) at this level. The significant interaction coefficient at the 5% level suggests that the city-level economic development does not significantly alter the industry's promotion effect on minimum wage regulation, thus further confirming competitive hypothesis 5.

Table 1 Results of Baseline Regression

	(1) ΔLP_{cit}	(2) ΔLP_{cit}	(3) ΔLP_{cit}	(4) ΔLP_{cit}
$Exposed_{ci03} \times Change_t$	0.0053***	0.0061***	0.0053**	0.0051**
	(3.38)	(3.86)	(2.58)	(2.47)
City-Ind,Year	Yes	Yes	Yes	Yes
N	32545	32544	28849	28257

3.2 Mechanism Verification

(1)Static Resource Allocation. Using the OP, LP, and ACF methods, calculate the enterprise productivity and its annual city industry level OP covariance, and then use the annual change value of this covariance as the dependent variable of equation (1). The regression results are shown in columns (1) to (3) of Table 2. It can be seen that the interaction coefficient is significantly positive at the level of at least 10%, indicating that the implementation of the Minimum Wage Regulations has significantly promoted the growth of static resource allocation efficiency in the industry, confirming the judgment on static resource allocation in theoretical hypothesis 1.

Table 2 Mechanism Verification - Static Resource Configuration

	(1) $\Delta Op\,\mathrm{cov}\_LP$	(2) $\Delta Op\,\mathrm{cov}\_OP$	(3) $\Delta Op\,\mathrm{cov}\_ACF$	(4) $Exit\_lp$	(5) $Entry\_lp$
$Exposed_{ci03} \times Change_t$	0.0027***	0.0023**	0.0017*	0.0431**	-0.0077
	(2.71)	(2.44)	(1.84)	(2.06)	(-0.38)
City-Ind,Year	Yes	Yes	Yes	Yes	Yes
N	28140	28140	28140	4853	7535

(2) Dynamic Resource Allocation. We use the proportion of exiting enterprises with productivity lower than the average productivity of incumbent enterprises in the total exiting enterprises as the dependent variable of equation (1) for regression. Columns (4) of Table 2 show the regression results. It can be seen that the Minimum Wage Regulations significantly promote the exit of low-productivity enterprises from the market, confirming theoretical hypothesis 3. Columns (5) show the regression results after using the proportion of incoming enterprises with productivity higher than the average productivity of incumbent enterprises as the dependent variable. From this perspective, the Minimum Wage Regulations have not significantly hindered the proportion of high productivity enterprises entering the market, proving that theoretical hypothesis 2 is not valid.

(3) Enterprise Productivity Mechanism. Referring to the practice of Mayneris et al.[3], enterprises whose average monthly wage in the previous year was lower than the local minimum wage standard in the current year were defined as enterprises affected by policies ($Exposed_{ft}=1$), and the rest were not affected by policies ($Exposed_{ft}=0$). Using this policy variable, the control variable at the firm level and a series of fixed effects, a DID model is constructed as shown in formula (2).

$$\Delta TFP_{ft} = \chi + \alpha Exposed_{ft} + \beta Exposed_{ft} \times Change_t + CV_{ft} + \mu_{ci} + \nu_{it} + \kappa_f + \varepsilon_{ft} \quad (2)$$

ΔTFP_{ft} is the productivity change value of the surviving enterprise f during the period t-1 to t; CV_{ft} is a series of control variables at the enterprise level, including logarithmic employment $labor_{ft}$, logarithmic capital per capita $cap\_intense_{ft}$, asset-liability ratio lev_{ft} , state holding soe_hold_{ft} , export proportion $\exp_{ft}$ and foreign capital proportion $foreign_{ft}$. μ_{ci} is the fixed effect of city-industry level. ν_{it} is the fixed effect of industry-year and κ_f is the fixed effect of individual enterprises. ε_{ft} is a random error term. The regression results are shown in columns (1)

of Table 3. It can be found that, consistent with the expectation, the greater the impact of policies, the greater the productivity growth of enterprises, which confirms the judgment of enterprise productivity in theoretical hypothesis 4.
This productivity promotion effect may come from the management improvement, factor substitution and innovation incentive effect under the "backforcing mechanism". Consistent with Mayneris et al.[3], we used the proportion of finished products in inventory in sales revenue $Inven_{ft}$ to reflect the inventory situation of enterprises. The capital input of enterprises is reflected by fixed assets per capita of production and operation $Fact_{ft}$, and the influence of policy on factor substitution of enterprises is verified. This paper estimates the educational level of employees in enterprises from 2001 to 2007, and reflects the human capital level of enterprises with the proportion of employees with college degree or above Edu_{ft} . At the same time, productivity improvement may also come from innovation incentives. We also use the logarithmic value of the number of total patents $Paten_{ft}$ to reflect the innovation behavior of enterprises. After replacing the explained variable in equation (2) with this series of variables and conducting regression, the results are shown in columns (2) to (5) of Table 3.
According to the regression results, consistent with expectations, after the introduction of the Minimum Wage Regulations, the inventory of enterprises is indeed reduced, the substitution of capital for labor and the level of human capital of enterprises is improved, which is conducive to the productivity growth of enterprises, and confirms the judgment on the productivity improvement mechanism of enterprises in theoretical hypothesis 4. However, the effect of rising labor costs brought about by the minimum wage regulations has also squeezed out the innovation expenditure of enterprises and reduced the number of patent applications of enterprises.

Table 3 Mechanism Test - Firm Productivity

	(1)	(2)	(3)	(4)	(5)
	ΔLP_{ft}	$Inven_{ft}$	$Fact_{ft}$	Edu_{ft}	$Paten_{ft}$
$Exposed_{ft}$	0.0092***	-0.003***	1.9002***	0.0073***	-0.0043**
$\times Change_t$					
	(3.30)	(-3.50)	(3.37)	(4.56)	(-2.17)
City-Ind,Year	Yes	Yes	Yes	Yes	Yes
N	818330	818330	818330	502824	605968

4 CONCLUSIONS

Based on dynamic OP method and HK method, this paper explores the mechanism of minimum wage Regulation on industry productivity from two aspects of resource allocation and enterprise productivity. The results show that: (1) the minimum wage regulation not only protects the compensation rights of workers, but also creates policy benefits for the productivity of the manufacturing industry, and truly realizes the dual goals of "ensuring safety" and "increasing efficiency". This policy benefit not only comes from the improvement of configuration, but also from the production incentive. (2) The reason for the improvement of static allocation is that after the introduction of the Minimum Wage Regulations, the distortion of labor price caused by the increase of corporate policy compliance is weakened and the marginal benefit of factors is equalized. (3) This policy also triggers the market competition mechanism, forcing enterprises to adopt measures such as factor substitution, changing employment structure, and improving management level to improve their own productivity, so as to achieve dual incentives for workers and enterprises. The market competition caused by the system also dredged the market exit channel, cleaned up the inefficient enterprises in time, released the resources occupied by them, and improved the dynamic allocation efficiency.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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