

Research on Monopsonistic Models and Magnitude of Minimum Wage's Effects on Employment Level

Junyi Li *

A Level International Course Center of UESTC, Chengdu, China

* Corresponding Author Email: fuchunlili@yeah.net

Abstract. Modern labour economics has been focusing on the topic of the effects of minimum wage on employment level. Empirical studies have found that an introduction of minimum wage may increase employment level under certain circumstances. Some theoretical researches are also developed later. Most of these theoretical studies are based on the model of monopsonistic competition, which seems to be commonly existing in the general market. However, it seems that several problems still exist within the models. First, a plausible assumption that firms will always earn a normal profit may result in our underestimation in minimum wage's positive effect on employment levels. This paper would discuss a possibility that firms usually earn sustained supernormal profit in the general market in reality. Second, the original model of monopsony supposes that the marginal revenue curve of labour would not shift after an introduction of minimum wage. However, in the real world settings, companies may well adjust their employment levels of other factors such as capital after the introduction of minimum wage, and this process may influence the MR curve for labour. This paper, however, takes account of this effect and tries to establish a more accurate model to anticipate minimum wage's effect on labour employment levels for each firm.

Keywords: Monopsony; Monopsonistic Competition; Minimum wage; Unemployment; Economic profit.

1. Introduction

As human beings ushered in the industrial era, ensuring the basic rights of employed workers from their employers became a more and more important issue. As a result, many governments introduced minimum wage policies in the recent centuries. However, many economists argued that an introduction of minimum wage is likely to reduce the employment level and force many workers into unemployment.

Recent researches, on the other hand, are beginning to find out more and more empirical evidence of minimum wage's positive effect on employment levels in the general market, such as the well-known results from the study by Card and Krueger in 1993. As a result, some theoretical studies on the underlying reasons of this phenomenon is also carried out.

This paper is going to have a quick review of the existing theories now, make some revisions to the current theories and have some practical analysis on this topic.

2. Previous models of labour market

2.1. The Perfect Competition Model

Supposedly, in a perfectly competitive market, an introduction of minimum wage would definitely reduce employment level. As shown in the Fig.1, the market equilibrium of labour is at point A. However, with an introduction of minimum wage, the demand for labour contract to point C. During this process, employment level of labour drops from B to D.

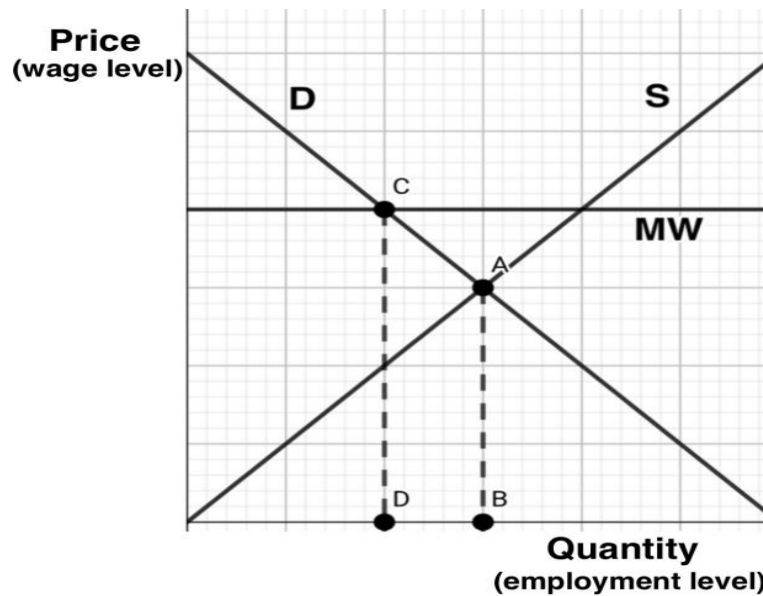


Fig 1. The perfect competition model and introduction of minimum wage.

2.2. The Monopsony Model

In a monopsony market (as shown in Fig. 2), on the other hand, marginal cost curve for labour hiring for companies has a greater gradient than average cost. If people do not intervene in the market, firms will employ labours at point A. However, if we could introduce a minimum wage standard at a level which is under point C (where AC intercepts with MR) but still effective in the market, we would enjoy an increase in employment level, optimally rising from B to D.

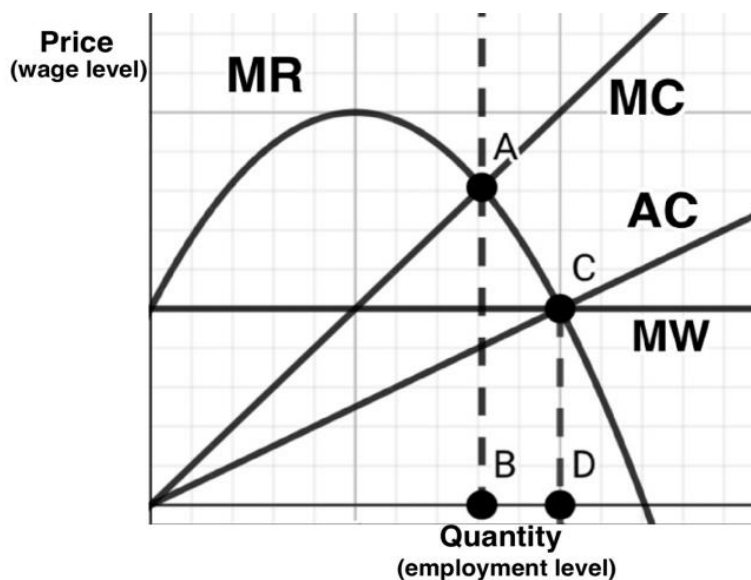


Fig 2. The monopsony model and introduction of minimum wage.

2.3. Brief Analysis on The Impact of Curves' Gradients on Minimum Wage's Effectiveness in Promoting Employment Level

Through this model, we could obtain a reductionist result about the impact of curves' gradients on minimum wage's effectiveness in promoting employment level.

As shown in Fig. 3, with the same cost curves, when the marginal revenue curve is more elastic (MR1), or the magnitude of marginal revenue changes relative less against different quantities of employment, the introduction of minimum wage has a potential to increase the employment level from A to C. However, for the situation where the marginal revenue curve (MR2) is less elastic, the magnitude of minimum wage's potential of increasing employment level drops to?from point A to

point B. The same thing happens on cost curves. For more elastic cost curves (MC2 and AC2), this potential (from point C to point D) is greater than that (from point A to point B) of less elastic cost curves (MC1 and AC1), as shown in Fig. 4.

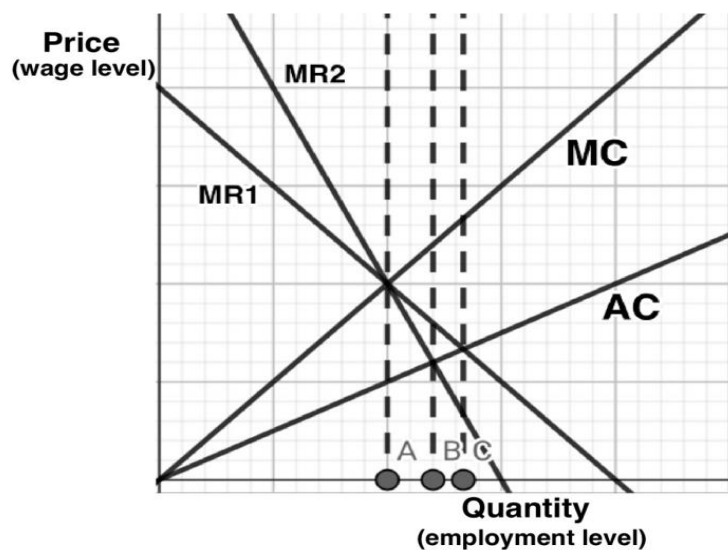


Fig 3. Impact of marginal revenue curve's gradient on minimum wage's potential of promoting employment level.

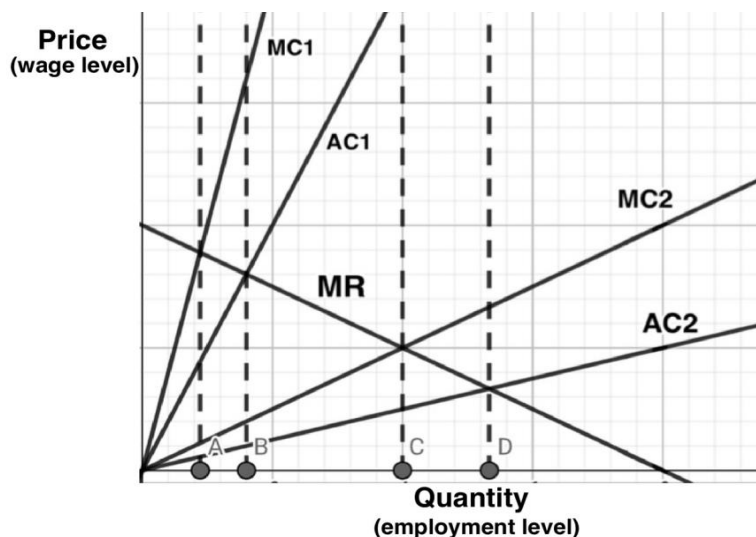


Fig 4. Impact of cost curves' gradient on minimum wage's potential of promoting employment level.

As to the marginal revenue of labour, that would depend on firms' marginal revenue of products and marginal cost of other factors. Therefore, when more goods and in need and more available materials are in supply, the marginal revenue curve of labour would be more elastic, and minimum wage's positive effect would be greater. This inference also matches one main conclusion of the bi-factor model that we will discuss in the later part of the paper. The model illustrates that minimum wage is going to promote employment level when the firms are under economies of scale and decrease employment level otherwise. When the firm is under economies of scale, their marginal revenue curve is more elastic, and the introduction of minimum wage is more likely to promote employment level.

For the cost curves' elasticity of labour, that mainly depends on the economy's overall labour supply elasticity. For the general supply elasticity of labour, that mainly depends on whether people have other ways to subsist their livelihoods. One important factor is the informal job opportunities (where minimum wage doesn't apply strictly) and self-employment opportunities. Li and Qiu suggested that China's urban-rural structure created enormous informal working opportunities, which considerably promote the overall labour supply elasticity for the formal labour market in China and

benefit the implementation of minimum wage policies [1]. Meanwhile, unemployment benefit may also increase the general labour supply elasticity, the higher the unemployment benefit is, the greater the general supply elasticity is. It seems that developed democratic countries possess a greater general labour supply elasticity. Lemos concluded that the previous studies indicated that developing countries in Latin America suffer more severe employment loss than the developed countries when introducing minimum wage [2]. However, this is not an absolute rule. There are also other factors that could influence the situation. Lemos conducted a study of Brazil and found that an increase in minimum wage did not have a significant effect on employment in Brazil. Brazil is a growing economy at that time, and Lemos also mentioned its considerable informal markets, which might be a reason of its invulnerability to employment loss when introduced with minimum wage. The greater the cost curves elasticity is for firms, the greater the positive effect of minimum wage on employment is, but when it becomes perfectly elastic, the effect will be eliminated as a whole.

3. Previous Studies Alluding to The Monopsonistic Natures of General Labour Market

Somet individuals would assume that the general labour market is a perfectly competitive market. However, this assumption might have been incorrect in real economy.

Card and Krueger found that labour supply is elastic to wage and the elasticity is about 5 [3]. Bhaskar and to accounted for this empirical finding and suggested that each job possesses certain non-wage factors, such as working hour, location of workplace and social environment of the firm. They concluded that most jobs from across various companies are actually differentiated, resulting in the general labour market being under monopsonistic competition [4].

Moreover, irrational behaviour may also play a role in this process. Kahneman and Tversky proposed the prospect theory, which suggests that people generally weigh loss greater than a gain of the same magnitude [5]. In the working situations, a worker would use their current job as a reference point. When they are considering a new job, they may well weigh a loss in certain job characteristics more than a gain in another characteristic. This fact would make people more likely to stay in their original job even if a new job might be slightly better, so this behaviour pattern of people may exemplify the monopsonistic nature of the general labour market.

Other scholars have proposed an alternative scenario that contributes to the common existence of monopsony in the general labour market. Manning proposed that a portion of the labor force experiences dynamic monopsony conditions due to a constant lack of job information, limiting their access to certain jobs. [6].

As a result, a more accurate approach may be to model the general labour market as a monopsonistic competitive market than a perfectly competitive market. Based on this assumption, Bhaskar and to deduct that introducing a minimum wage would result in more employees being hired by a single firm, fewer firms surviving in the market and higher product prices. They supposed that the minimum wage's effect within firms and over firms would offset each other in terms of total employment level, and a moderate minimum wage is likely to have a negligible overall impact on the employment of the market [4].

As a result, it is expected to observe a more positive employment effect of minimum wage if firms have greater monopsonistic power. The extent of firms' monopsonistic power, which also contributes to minimum wage's positive effect on employment, mainly depends on three factors. The first is the differentiation of jobs. Fiorillo, Santacrose and Staffolani suggested that those heterogeneous workers are most likely to be employed by monopsonistic firms providing differentiated jobs, and in those settings, minimum wage would be most effective in promoting employment level [7]. Second, the lack of information among workers would increase firms' monopsonistic power. Chen Jing proposed that western China is under a more monopsonistic market than eastern China since information passes on slower in western China. Therefore, introducing a minimum wage in western China would have a greater positive impact on employment. [8]. Third, psychological and cultural factors may also

influence this process, but previous research is limited on the topic of psychological process and minimum wage.

4. Specialisation of Firms and Potentially Existing Sustained Supernormal Profit in The General Market

Despite Bhaskar and To's belief of insignificant impact of minimum wage on the general employment level, there are also instances that demonstrate that increasing the minimum wage might have a significant positive effect on employment level in the general market. According to the China Labour Statistical Yearbook between 2001 and 2015, the total unemployment population decreased by about 37.4% in Shanghai during this time while more rural workers found jobs in the city. Li and Dong suggested that the increasing minimum wage in Shanghai may have contributed to this result. [9].

Moreover, as Bhaskar and to have suggested, based on previous models, minimum wage is likely to drive up the product price of firms, leading to a higher price level that would reduce the purchasing power of labour's wage and reduce their benefits from the introduction of minimum wage [4]. This theory may not be sufficient to justify implementing a minimum wage policy in the general market. What really leads to this conclusion are the commonly held incorrect assumptions about economic profit.

However, as it has helped to explain various economic phenomena, the theory of economic profit is unquestioned among economists. Unfortunately, this theory appears to be untrue for most cases in the reality.

It is evident that most firms in our world are specialize in their own areas, which means that if they want to shift to another industry, they will incur losses. This fact indicates that even those in industries commonly considered to have a perfectly competitive market for their products inherently make sustained supernormal profits.

According to the mainstream viewpoint among economists, a second best opportunity would also earn the business owners a same profit as their current undertaking. However, if we consider the question more realistically, we will find more evidence to object to this hypothesis rather than to support it.

A firm's profits are derived from two separate parts: the capital and land factors held by the firm, and the human capital or efforts made by the investors

On the one hand, the capital and land factors held by the firm are bought for specialised production, so the firm could exploit it no more if it were to shift its industry. While some may argue that these factors could be sold, many of them could only be sold in a second-hand market, and their value would likely decrease as buyers may not be sure if they work well.

On the other hand, the human capital is even more specialised in the industry. Investors have the potential to earn higher profits than the interest earned from saving due to their knowledge about specific areas. For instance, they need to know who the better suppliers of production factors are or who the better managers are that they could delegate to, information about customers, concerned regulations, and more. All of this knowledge is a precious asset that could only be accumulated during their running of business, and simply shifting from their familiar industry would result in considerable costs for them.

In reality, most industries have significant barriers to entry and exit, resulting in firms making sustained supernormal profits. This situation also applies to those that are monopolistic competitive in labour employment.

Thus far we've established a theoretical framework that could provide adequate evidence for our original hypothesis that minimum wage standards have a positive effect on employment level under certain conditions. Since the general labour market is under monopsonistic competition, every firm could fit into the model that shares graphs and patterns of the monopsony model. Therefore, a rise in minimum wage level could not significantly reduce the positive effect on employment level, as firms

shutting down due to subnormal profit is not a major factor. At an appropriate level, minimum wage may have significantly positive effect on employment level in general market.

The negative effect of minimum wage on employment mainly results from firms shutting down. What determines firms' likelihood of shutting down is how much economic profit they have, which includes not only their initial profit before the introduction of minimum wage, but also the reduction in opportunity cost after the carrying out of the policy.

Regarding the initial profit, Li Xiaochun and Dong Yuzh demonstrated that big firms such as conglomerates, which seem to earn more economic profit, tend to shut down less after the introduction of minimum wage but increased their employment level of labour [8].

Regarding the reduction in opportunity cost of hiring labour, it depends on firms' access to capital substitutes for labour and their geographical mobility across locations that do not introduce the same or higher minimum wage standard simultaneously. For instance, Wang et al. suggested that in China the introduction of minimum wage caused firms to employ more capital in proportion to labour [9]. China has an abundant supply of cheap automation, so when the labour wage rises, firms could shift to capital-intensive industries or production procedures, and the opportunity cost for labour-intensive industries does not decrease significantly. However, if we consider a location where all industries are labour-intensive, the introduction of minimum wage would reduce firms' opportunity cost. Mobility of firms across locations also plays a role in the negative effect of minimum wage on employment. Jardim et al. illustrated that the minimum wage increment in Seattle caused greater unemployment than in other cases, partially because that it was only implemented in a city scale and firms could easily move to nearby regions to avoid new minimum wage standard [10].

5. The Interaction Between Factors' Revenue Curves

5.1. The Existence of Factor Revenue Interactions

Current theories on the relationship between minimum wage and employment level are mostly based on the classical monopsony model. However, this model may have limitations since it postulates that the marginal revenue curve of labour does not change after an introduction of minimal wage.

In fact, these curves do change due to the interaction between the revenues of different factors, which is where the price and quantity employed of one factor may influence the revenue curves of other factors. As a result, the quantity of other factors employed will change due to shift of revenue curves and this change would come back and influence the revenue curves of the original factor again.

For instance, there might be cases where the proportion of factors needed for unit production is inflexible, so when a minimum wage is introduced, the revenue for every marginal unit of other factors would decrease. This fact may reduce the company's employment level for other factors and result in lower demand for labour since when the employment level of other factors decreases the quantity of labour needed for a marginal unit of production may increase. On the other hand, there may also be situations where firms experience an increase in the marginal revenue of other factors since they now hire more labours and need to invest more into other factors as well to carry out production. As a result, the marginal revenue of labour would rise again and a multiplier effect would appear after the initial increase in labour employment level.

5.2. Mathematical Analysis of Factor Revenue Interactions

To predict how those effect works in real situations, we may need to establish a three-dimensional model, which comprise employment level of both labour and other factors and the final profit. This model would be based on the context of a firm who is a monopsonistic buyer of labour.

First, we use the Cobb-Douglas production function to model the production level under a labour employment level of x and other factors employment level to be y , the production level will be (1)

$$x^a * y^b \quad (1)$$

Then we assume the wage level at labour employment level of x to be

$$\frac{c*x}{2} \quad (2)$$

Assume that the company is under perfect competition in both product market and employment of other factors, so price of product is p and the price of a unit basket of other factors is o.

As a result, the total profit of the firm is

$$x^a * y^b * p - \frac{c*x^2}{2} - o * y \quad (3)$$

Then we apply a partial derivative to the equation, that is to take derivative of profit equation to x and y respectively. To find the maximum point of profit, we need to find the point where both of these derivatives equals to 0.

$$a * p * x^{a-1} * y^b - c * x = 0 \quad (4)$$

$$b * p * x^a * y^{b-1} - o = 0 \quad (5)$$

Divide equation1 by equation2

$$\frac{a*y}{b*x} - \frac{c*x}{o} = 0 \quad (6)$$

Solve the equation for y

$$y = \frac{b*c}{a*o} * x^2 \quad (7)$$

Substitute this y value into equation1

$$a * p * x^{a+2b-1} * \left(\frac{b*c}{a*o}\right)^b - c * x = 0 \quad (8)$$

Solve the equation

$$x = \left(\frac{c}{a*p} * \left(\frac{a*o}{b*c}\right)^b\right)^{\frac{1}{a+2b-2}} \quad (9)$$

Then we come to the situation where minimum wage is introduced, assume that the minimum wage level is effective to the firm at any possible production position (it may cause errors when you do not double check this point) and equations about production model, other factors' price and product price do not change, but the wage level become a constant m. As a result, the profit equation changes to

$$x^a * y^b * p - m * x - o * y \quad (10)$$

We still use two partial derivatives to form two equations.

$$a * p * x^{a-1} * y^b - m = 0 \quad (11)$$

$$b * p * x^a * y^{b-1} - o = 0 \quad (12)$$

Divide equation3 by equation4

$$\frac{a*y}{b*x} - \frac{m}{o} = 0 \quad (13)$$

Solve the equation for y

$$y = \frac{b*m}{a*o} * x \quad (14)$$

Substitute this y value into equation3

$$a * p * x^{a+b-1} * \left(\frac{b*m}{a*o}\right)^b - m = 0 \quad (15)$$

Solve this equation

$$x = \left(\frac{m}{a \cdot p} * \left(\frac{a \cdot o}{b \cdot m} \right)^b \right)^{\frac{1}{a+b-1}} \quad (16)$$

Suppose that the introduction of minimum wage at a standard equal to the market equilibrium price of the firm's labour employment does not change the employment level initially. Now we could consider all the effects under a single model of $x = \left(\frac{m}{a \cdot p} * \left(\frac{a \cdot o}{b \cdot m} \right)^b \right)^{\frac{1}{a+b-1}}$. First, we could view the whole stuff of $\left(\frac{1}{a \cdot p} * \left(\frac{a \cdot o}{b} \right)^b \right)^{\frac{1}{a+b-1}}$ as a single constant N to simplify the problem, so the employment level under minimum wage m is

$$m^{\frac{1-b}{a+b-1}} * N \quad (17)$$

According to the Cobb-Douglas model, a and b are constants between 0 and 1, with 1-b>0. Therefore, despite the shutdown situation, when a+b-1>0, a higher minimum wage would cause a rise in employment within the firm and vice versa. That illustrates that when a firm has economies of scale, minimum wage would promote its employment level, while when it has diseconomies of scale that would result in a reduction in the employment level.

Those interactive effects are more significant in some cases and less significant in others, and two factors influence the magnitude of those impacts. First, in situations where the firm is either labor-intensive or other factors-intensive, the interactions would have a minimal effect, but in an intermediate scenario, the interactive effects will be substantial. Moreover, the interdependence of labour and other factors also influences the interactive effect that is how much a change in one factor's employment affect the other factor quantity has needed for unit production curve. When the combination of both factors is inflexible, the interactive effects will be significant; otherwise, they will be small.

6. Conclusion

To calculate an exact appropriate minimum wage level for an economy, it is necessary to consider various factors. These factors, in theory, could be predicted by modelling if enough data is available, but data collection require considerable effort.

Meanwhile, it might be economically appropriate to set different minimum wage standard for different groups of labour. Majchrowska and Żółkiewski illustrated that a uniform minimum wage policy of Poland caused more unemployment in poorer regions than in developed ones and it might be beneficial to carry out different minimum wage standard in different regions [11]. Nevertheless, it might not always be politically appropriate for us to divide labour into groups and set different minimum wage standards, but in countries where regional governments have considerable political powers(such as US and China), it might be easier to carry out different minimum wage policies in different regions.

As observed, the complexity of this problem makes empirical studies more suitable for the measurement of appropriate minimum wage level than theoretical studies. However, we may also try to address the problem by promoting competition in the labour market. We may provide more job information to the workers and try to teach them a more rational approach of decision making to avoid underpayment, such policies are also likely to promote employment levels.

Reference

- [1] C. Li, J. Qiu. 2013. "The Employment Effect of Minimum Wage in a Dual Economy: Theory and Evidence-Analysis on the Employment Effect of Minimum Wage in Bi-Sector Economies: Theory and Evidence" *Reform of Economic System*, 2013(04): 15-19
- [2] S. Lemos. 2009. "Minimum Wage Effects in a Developing country" *Labour Economics* 16(2), 224-237, 2009
- [3] D. Card, A. B. Krueger. 1995. "Myth and Measurement: The New Economics of the Minimum Wage" Princeton University Press
- [4] V. Bhaskar and T. To. 1998. "Minimum Wages for Ronald McDonald monopsonies: A Theory of Monopsonistic Competition" *The Economic Journal* 109(455), 190-203, 1999
- [5] D. Kahneman, A. Tversky. 1979. "On the Interpretation of Intuitive Probability: A Reply to Jonathan Cohen" *Cognition*, 7(4), 409-411
- [6] A. Manning. 2003. "Monopsony in Motion: Imperfect Competition in Labor Markets" Princeton University Press
- [7] F. Fiorillo, S. Santacroce, S. Staffolani. 2000. "Monopsonistic Competition for the 'Best' Workers" *Labour Economics* 7(3), 313-334, 2000
- [8] X. Li, Y. Dong. 2017. "The Minimum Wage and the Existence of Monopsony in the Labour Market. The Employment Effect of Minimum Wage on Workers: A Case Study of the Yangtze River Delta Region" *Journal of Audit & Economics* 2017, 32(06): 90-10
- [9] W. Wang, H. Yin, R. Gong. 2022. "The Effects of China's Minimum Wage Hikes on Firms' Capital-Labour Ratio" *Journal of Financial Research*, 2022(01): 95-114
- [10] E. Jardim, M. C. Long, R. Plotnick, E. van Inwegen, J. Vigdor, H. Wething. 2017. "Minimum Wage Increases, Wages, and Low-Wage Employment: Evidence from Seattle" National Bureau of Economic Research, Working Paper 23532
- [11] A. Majchrowska, Z. Żółkiewski. 2012. "The Impact of Minimum Wage on Employment in Poland" *Investigaciones Regionales-Journal of Regional Research*, 211-239, 2012