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Minimum Wage Policy and Country's Technical Efficiency

Mohd Zaini Abd Karim[1]*, Sok-Gee Chan[2], Sallahuddin Hassan[3]

[1]Othman Yeop Abdullah Graduate School of Business, Universiti Utara Malaysia, 06010 Sintok, Kedah, Malaysia, [2]Faculty of Business and Accountancy, University of Malaya, 50603 Kuala Lumpur, Malaysia, [3]School of Economics, Finance and Banking, Universiti Utara Malaysia06010 Sintok, Kedah, Malaysia. *Email: zaini500@uum.edu.my

ABSTRACT

Recently, the government has decided that Malaysia would introduce a minimum wage policy. However, some quarters argued against the idea of a nationwide minimum wage asserting that it will lead to an increase in the cost of doing business and thus will hurt Malaysian competitiveness. Although standard economic theory unambiguously implies that wage floors have a negative impact on employment, the existing empirical literature is not so clear. Some studies have found the expected negative impact on employment, yet others have found no impact or, in occasional cases, a positive effect of minimum wages on jobs. It is also argued that, a minimum wage law, if pegged above the market wage, could leads to a general misallocation of resources and loss of efficiency in the overall economy. However, there is no study linking minimum wage on a country's efficiency. Hence, the objective of this study is to analyse the effect of minimum wage policy on a country's technical efficiency. To achieve the objective, in the first stage, we estimate technical efficiency for all the sample countries by using the non-parametric method. In the second stage, after having estimated the efficiency scores, we analysed the effect of minimum wage on efficiency by estimating a Tobit regression fixed-effect model where the efficiency scores is included as the dependent variable. Results of the study show that there is no difference in technical efficiency between countries with and without minimum wage policy. Hence, minimum wage policy is not harmful to an economy's efficiency. Furthermore, looking at the countries with minimum wage policy, the amount of minimum wage up to a certain level has a positive effect on economic efficiency. The results suggest that minimum wage helps in increasing a country's efficiency provided that the rate does not exceed the optimal level.

Keywords: Minimum Wage, Efficiency, Non-parametric, Tobit, Competitiveness
JEL Classification: J30

1. INTRODUCTION

Recently, the government has decided that Malaysia would introduce a minimum wage policy. However, some quarters, particularly Malaysian Employees Federation argued against the idea of a nationwide minimum wage asserting that it will lead in an increase in the cost of doing business and thus will hurt Malaysian competitiveness. The business community instead coaxed the government to adopt a market friendly policy and which wages levels must be determined by market forces. This is in line with the economist argument that minimum wage is a form of government interference with the free market and this only causes inefficiency in the market. As demonstrated by Stigler (1946) in his classic article on the minimum wage, if one starts with a model of a competitive labor market it readily appears that a minimum wage is socially harmful and a bad idea (Mincer, 1976). If pegged above the market wage, a minimum wage law, according to this simple model, leads to fewer jobs, higher unemployment, higher prices for consumers, reduced profits for firms, lower wages in the uncovered sector, and most critically, a general misallocation of resources and loss of efficiency in the overall economy.

However, other scholars argue that market failure may justify government interference with the free market. Therefore there is need to interfere with the free market but at the same time taking into consideration the consequences of the policy measures in an economy. The proponents of minimum wage policy argued that minimum wage is not just a social tool to reduce poverty, it is a fiscal tool to enhance economic growth and productivity improvements.

Recent literature in empirical labor economics argues that moderate increases in mandated minimum wages do not lead to

adverse employment outcomes for low-wage workers. Many of these findings are collected or summarized in Card and Krueger's (1995). Card and Krueger say that their "strongest and most important finding" is the absence of disemployment effects from moderate increases in minimum wages. Proponents for an increase in the minimum wage claim that the policy will stimulate consumption in the long-run. By putting more money in the hands of low income consumers, this will increase their standard of living and thus decrease government's payout for social welfare services. They also argue that a raise in the minimum wage leads to increases in workers' productivity. Wage is a crucial incentive for increment in productivity of labor. Reasonable pay raise produces quality of life, a motive of enhancing capability and deterring labor turnover which causes uninterrupted production.

Our study takes a different approach to the issue. By exploiting properties of the traditional micro economic theory of production, we study how the efficiency with which individual countries produce gross domestic product (GDP) may be linked to the minimum wage policy. Although there are ample studies on the effect of minimum wage policy on output and employment, there is no empirical study linking minimum wage with economic efficiency at both the micro and macro level. This is quite surprising since a minimum wage law, if pegged above the market wage, could leads to a general misallocation of resources and loss of efficiency in the overall economy. Hence this study will analyze the effect of minimum wage policy on a country's efficiency. By analyzing the minimum wage effect on efficiency, we can address the question of whether the proposed minimum wage legislation in Malaysia has any effect on the efficiency of Malaysian economy. This is a very pertinent issue in the case of Malaysia as any policy that could erode its competitiveness would be detrimental to its quest of becoming a high income economy.

2. LITERATURE REVIEW

An important and largely debated argument in the economic literature concerns the effects of minimum wages. In particular, as regards the causes and consequences of labor market rigidities, policy debates around the effects of legislated wage minima traditionally have focussed on two themes. Opponents argue that binding minimum wages negatively affect employment and output and thus they are viewed mainly as bad social policies. Proponents, typically, did not deal with employment effects; rather, they focused on redistributive goals that minimum wages might imply trading off thus between efficiency and equity. Some economists believe in the idea of efficiency wages where the performance of the worker is directly linked to their pay. Offering a decent wage provide an incentive for people in work to improve their performance. Minimum wage laws had come under significant criticism with Stigler (1946) explaining its negative impact on low wage workers. His argument continues to explain the potential negative consequences of the wage floor on employment.

Although standard economic theory unambiguously implies that wage floors raise the wages of the low paid and have a negative impact on employment (Hammermesh, 1982), the existing empirical literature is not so clear. Whilst many studies have shown that minimum wages significantly affect the structure of wages by increasing the relative wages of the low paid (e.g. DiNardo et al., 1996), empirical evidence on the effect on jobs is considerably more mixed (see the recent comprehensive review by Newmark and Wascher, 2007). Some studies have found the expected negative impact on employment, yet others have found no impact or, in occasional cases, a positive effect of minimum wages on jobs.

Douty (1960) found minimum wages reduced employment in low wage industries, while Brozen (1962) and Welch (1974) found that minimum wage legislation drove workers to employment in jobs not covered by minimum wage laws (e.g. the shadow economy). Beranek (1982) argues that minimum wage legislation promoted illegal immigrant labor. Others, including Gallasch (1975), Peterson (1957), Peterson and Stewart (1969) found the minimum wage reduced employment.

International studies of the minimum wage have confirmed most of the impacts observed in the U.S. (Forrest, 1982; Corbo, 1981; Gregory, 1981; Rosa, 1981, Freeman and Freeman, 1981; Bosch and Manacorda, 2008). Some newer research also points to the absence of an impact on employment due to increases in the minimum wage (Card, 1992a and b) and Card and Kreuger (1992). These studies also found a modest positive wage impact. Card and Krueger (1994) substantiated that increasing minimum wage not only has no negative impact on employment but also help hiring more labor. The study give minimum wage policies in many countries a theoretical background.

Further, Betsey and Dunson (1981) find that cyclical unemployment, especially among youths contributes to an over estimate of the impact of the minimum wage on employment. Despite finding job losses associated with minimum wages, Cox and Oaxaca (1981) find that income for low wage workers rises more proportionately. The research here to date can be summarized easily in providing a range of results. First, the overwhelming majority of studies find small, albeit small negative employment effects of a minimum wage. A small number of studies find no effect on employment. A few studies find small positive wage effects, a much larger number of studies find no effect. These results can be explained by the timing of the studies, and particularly the absence of effects could well result from a minimum wage increase that was beneath the market wage for the affected workers. A recent study of economists opinions found that between half and three quarters did not support the minimum wage, and felt it could cause reduced employment (Whaples, 2006). What is clear is that the minimum wage is a relatively high cost mechanism for ensuring low wage workers are better off.

By looking at the research that had been done before, we can summarized it as follows. First, the overwhelming majority of studies find only small negative employment effects of a minimum wage. A small number of studies find no effect on employment. And only few studies that find small positive wage effects. These variety of results is been obtained maybe because the timing of studies is different. A recent study of economists opinions found that between half and three quarters did not support the minimum wage, and felt it could cause reduced employment (Whaples,

2006). And little studies find that minimum wage can promote growth. What is clear is that the minimum wage is relatively high cost mechanism for ensuring low wage workers are better off. However, there are yet to be studied the effect of minimum wage on efficiency.

3. METHODOLOGY AND DATA

First, we estimate technical efficiency for all the countries in the sample by using the non-parametric method. Measures of efficiency are based on ratios of observed output levels to the maximum level that could have been obtained for a given inputs level. This maximum level constitutes the efficient frontier which will be the benchmark for measuring the relative efficiency of the observations. There are various techniques to estimate this frontier and these methods have been recently applied to examine the efficiency of public spending (Murillo-Zamorano, 2004).

In this study, we will use the data envelopment analysis (DEA) method based on Banker et al. (1984) to estimate technical efficiency. DEA is a non-parametric linear programming-based technique designed to calculate relative efficiency based on the sample countries' efficient production frontier (Casu and Molyneux, 2003). The most efficient countries operate on the frontier while countries below the frontier are considered to be inefficient. According to Koop et al. (2000), economic growth can occurs if a country is able to avoid inefficient used of resources and move closer to the world production frontier. We employ the output-oriented variable return to scale (VRS) model with the assumption that the government maximize output in each economic sector given a fixed amount of expenditure. Equation 1 shows the Bankers et al. (1984) model for calculating technical efficiency.

Max θ

subject to

$$\sum_{j=1}^{n} \lambda_j x_{ij} \leq x_{io} \quad i=1, 2,\ldots,m$$

$$\sum_{j=1}^{n} \lambda_j x_{rj} \geq \theta y_{ro} \quad r=1, 2,\ldots,s$$

$$\sum_{j=1}^{n} \lambda_j = 1; \lambda_j \geq 0 \quad j=1, 2,\ldots,n \qquad (1)$$

Where DMU_0 represents one of the n DMUs under evaluation, and x_{io} and y_{ro} are the i^{th} input and r^{th} output for DMU_0, respectively. λ_j are unknown weights, where $j = 1, 2, \ldots n$ represents the number of DMUs. The optimal value of θ^* represents distance of sector from the efficient frontier. Hence, the most technical efficient country will have $\theta^* = 1$ and the inefficient country exhibit $\theta^* < 1$. The VRS model is a better representation of efficiency analysis with the assumption that output levels cannot be reduced proportionately with the levels of input. By solving the above mathematical programming problem, we are able to get efficiency scores for each country. The efficiency scores calculated from these inputs/output is a reflection of the capability of a country in transferring inputs into output. The efficiency concept used (obtained through the DEA, DEA, method), tells us how successful different countries are when "producing" GDP. This is a relative measure of efficiency, and the efficiency of a country is thus measured relative to the efficiency of all the other countries. The DEA method creates a best practice, or efficiency frontier which then serves as a benchmark against which the efficiency of the different countries is measured for each of the 5 years. Given the amount and combination of resources used, the estimated efficiency values thus indicate how much GDP a country "produced" as a portion of the GDP that would have been possible to produce had the country in question employed the resources in a more efficient way.

In the second stage, after having estimated the efficiency scores, we analysed the effect of minimum wage on efficiency by estimating a regression where the efficiency scores is included as the dependent variable. Economists have long puzzled over why there are such astounding differences in productivity across both firms and countries. The identification of the factors that explain differences in efficiency is essential for improving the performance of firms and countries. However, unfortunately, economic theory does not supply a concrete theoretical model in explaining the determinants of efficiency. Nevertheless, according to Caves and Barton (1990), studies on efficiency have analysed various factors that are related to efficiency. The most important channel through which new ideas and new technology hence efficiency are imports of high technology products, adoption of foreign technology and acquisition of human capital. Frontier technology is embodied in physical and human capital. As a result, the positive effect of the advances in technology and knowledge in domestic productivity depends on its transmission through trade channel such as foreign direct investment (FDI) and import of machinery and equipment. Following Romer (1990) and Aghion and Howitt (1992) and the evidence that the level of productivity depends on international technology transfer (Eaton and Kortum, 1999; 2001), efficiency is a function of trade openness and FDI. Other factors that could contribute to efficiency is private investment and government expenditure. Besides these variables, the level of technology and hence efficiency is also determine by country characteristics including, institutional quality, climate and endowment. These variables will be included as a control in examining the effect of minimum wage policy on country's efficiency. To control for the unobservable variables that Islam (1995) called "initial efficiency," we used fixed-effect panel model.

Furthermore, since the efficiency scores take value between 0 and 1, to address the effect of minimum wage policy on efficiency, we estimated a Tobit regression fixed-effect model based on Equation 2.

$$Eff_{jt}=\alpha_0+\alpha_1 MW_{jt}+\alpha_2 FDI_{jt}+\alpha_3 INV_{jt}+\alpha_4 OPEN_{jt}+\alpha_5 GOV_{jt}+e_{jt} \qquad (2)$$

Where,

EFF is the efficiency score of country *j* at time *t* obtained by the DEA estimation in the first stage.

MW is the minimum wage policy variable. It can be included as a dummy variable or the level of minimum wage rate. The dummy

variable MW equals one for countries with minimum wage and zero otherwise. We include this variable to investigate how countries with minimum wage perform in comparison with other countries without minimum wage. Although standard economic theory unambiguously implies that wage floors raise the wages of the low paid and have a negative impact on employment (Hammermesh, 1982), the existing empirical literature is not so clear. Whilst many studies have shown that minimum wages significantly affect the structure of wages by increasing the relative wages of the low paid (e.g., DiNardo et al, 1996), empirical evidence on the effect on jobs is considerably more mixed (see the recent comprehensive review by Newmark and Wascher, 2007). Some studies have found the expected negative impact on employment, yet others have found no impact or, in occasional cases, a positive effect of minimum wages on jobs. Some economists believe in the idea of efficiency wages where the performance of the worker is directly linked to their pay. Offering a decent wage provide an incentive for people in work to improve their performance. Hence, the relationship between the variables can be either positive or negative.

FDI is foreign direct investment. We argue earlier that the level of productivity depends on international technology transfer (Eaton and Kortum, 1999; 2001).

INV is the private investment as a percentage of GDP. The standard neoclassical explanation is that increased investment raises the steady-state level of output per effective worker and therefore raises the growth rate for a given starting value of GDP. The studies of Edwards (1992), Onafowora and Owoye (1998), Harrison and Hanson (1999), and Greenaway et al. (2002) also showed that investment is positively correlated with growth and productivity. Based on the assumption we expect to find a positive coefficient on this variable.

OPEN is a measure of trade openness. Index of trade openness is calculated as sum of exports and imports divided by the value of GDP. Trade openness facilitates the adoption and diffusion of advanced technologies and technical expertise hence, have a positive effect on efficiency. Policies promoting free trade and importing foreign capital goods will help developing countries to increase productivity growth and to close the gap with the technology frontier.

GOV is government expenditure measured as a percentage of GDP. Government expenditure has traditionally been a component of fiscal policy which is an instrument of the state to influence economic growth. Several studies like Gandhi (1971), Gupta (1967), and Dritsakis and Adamopoulos (2004) recognized a positive correlation between government expenditure and economic growth. However, if the government expenditure results in a crowding out effect, then the impact on economic growth will be negative. Likewise, does larger government raise economic efficiency or lower efficiency? The only overarching answer that can be offered is: It depends. Economic theory is clear that government intervention has the potential to improve efficiency when market failures exist, but is likely to reduce efficiency when markets are already "perfect," which is defined below. In reality, government intervenes both in cases of market failure and in cases where markets are already operating relatively efficiently. As a result, some government policies raise economic efficiency and some lower efficiency. Finally, e_{jt} is the error terms of country j at time t.

Non-parametric techniques will be use to measure countries' economic efficiency based on the production process (Fare et al., 1989; Chung et al., 1997; Zaim, 2004). Following Halkos and Tzeremes (2009a and b), we measure countries economic efficiency based on production of two inputs and one output. We use data for the time period 2000-2009 for all the countries chosen. The inputs that will be use are total labour force and gross capital formation (in US dollars at current prices in millions) whereas the output that will be use is the GDP (market prices) in volumes. The inputs/output data were obtain from the UNCTAD database (UNCTAD, 2008). Data on minimum wage were taken from World Bank. Data on private investment, FDI, export, import, and government expenditure were obtained from the World Bank (World Development Indicators, various issues).

4. RESULTS AND DISCUSSION

The descriptive statistics for the average technical efficiency scores obtained from the DEA estimation are presented in Table 1. The average efficiency score of the full sample is 52.7% which means that the countries are wasting 47.3% of their inputs mix. Hence, countries may further reduce their input mix by 47.3% in order to enhance their efficiency level. From Table 1, it is clearly indicated that the countries with minimum wage policy are relatively less efficient as compared to countries without minimum wage policy. However, the difference in both mean and variance efficiency score are not statistically significant (Table 2).

Table 1: Descriptive statistics of technical efficiency scores for the sample countries

Sample	Mean±Standard deviation	Minimum	Maximum
Full sample	0.527±0.152	0.143	0.9654
Countries with minimum wage	0.512±0.0275	0.148	1.000
Countries without minimum wage	0.553±0.0227	0.139	0.981

Table 2: Test for variance and mean difference

Statistical measure	Countries with minimum wage	Countries without minimum wage
Mean efficiency	0.583	0.512
Variance cost efficiency	0.0066	0.0071
F test: Two-sample for variance		
F-statistic	1.092	
P (F≤f) one-tail	0.215	
t-test: Two-sample assuming equal variances		
t-statistic	1.528	
P (T≤t) two-tail	0.2539	

*Significant at 10% level, **Significant at 5% level, ***Significant at 1% level

Hence, there is no sufficient evidence to conclude that there is differences in the efficiency level between countries with minimum wage policy and countries without minimum wage policy even though countries with minimum wage policy exhibit a lower efficiency score than countries without.

To further study the effect of minimum wage on the country's efficiency, a Tobit fixed-effect regression model (Equation 2) was estimated. The Tobit fixed-effect regression model was used in this study as the efficiency scores take on values between 0 and 1 and to control for unobservable variables like institutional quality and endowment. The minimum wage variable is the dummy variable that takes value of 1 if the country has minimum wage policy and zero otherwise. The estimation results are presented in Table 3.

The results obtained from the Tobit equation model show that the coefficient of D_{MW} in the equation where efficiency is the dependent variable is negative but is not statistically significant at the 5% level. This indicates that minimum wage does not have a negative effect on efficiency. The results does not support the argument that minimum wage is detrimental to the economy. The results would also suggest some evidence that the negative effect of minimum wage is offset by the effect of efficiency wages. The result does not contradict with the observation in many economies with minimum wage which does not seem to be less efficient or grow more slowly than others (Cahuc and Michel, 1996). In fact, recent theoretical and empirical studies imply that under some conditions, these economies can grow faster (Askenazy, 2003).

The coefficient of *OPEN* is positive and significant at the 1% level. This indicate that globalization factors proxied by trade-GDP ratio help countries improving their efficiency position suggesting that openness is vital factor in fostering technology catch-up. The coefficient of FDI is positive and significant as the level of productivity depends on international technology transfer (Eaton and Kortum, 1999; 2001). The coefficient of GOV is positive and but not significant indicating that there is no evidence that government expenditure is harmful to technical efficiency. If government expenditure is being spend productively, it could also enhance efficiency.

To further analyze whether the effect of minimum wage on efficiency depends on the level of minimum wage rate, we run a new regression on the sample of countries with minimum wage policy. In this case, the dummy variable for minimum wage was replaced with the ratio of minimum wage to average wage rate (MWAW). We also includes the square of MAW as the independent variable (MAW^2). We hypothesized that as the difference between the minimum wage rate and average rate increased up to a certain level, efficiency will be increase but decrease after a certain level. The results of the estimation is presented in Table 4.

The coefficient of MAW rate is positive and significant at the 5% level indicating that as the ratio of minimum wage rate to the average wage rate increase, efficiency tends to increase. However, the coefficient of the square of the minimum wage/average wage ratio is negative and significance at the 5% level. The results suggest that initially, at lower level of minimum wage rate, minimum wage has a positive effect on efficiency. However, too large of a rate relative to average wage will have a detrimental effect on a country's technical efficiency.

4.1. Robustness Test

It should be necessary to differentiate developing countries because developing countries' economy tend to have different structural than developed countries. This is because the stochastic frontier

Table 3: Tobit fixed-effect model estimates (sample both countries with and without minimum wage)

Dependent variable: *Eff*	Efficiency VRS		Efficiency CRS	
	Coefficient	t-ratio	Coefficient	t-ratio
Constant	0.561	5.311***	0.454	5.291***
D_{MW}	−0.075	−1.774	−0.042	−1.747
INV	0.003	1.442	0.0004	1.647
FDI	0.0001	3.344***	0.0003	3.357***
OPEN	0.0001	2.279**	0.0004	3.440***
GOV	0.0005	1.321	0.0003	1.122
Log-likelihood	404.429		562.553	
Sigma	0.204		0.212	

*Significant at 10% level, **Significant at 5% level, ***Significant at 1% level

Table 4: Tobit fixed-effect model estimates (countries with minimum wage only)

Dependent Variable: *Eff*	Efficiency VRS		Efficiency CRS	
	Coefficient	t-ratio	Coefficient	t-ratio
Constant	0.007	0.427	0.005	1.154
MAW	0.0001	2.601**	0.0002	3.046***
MAW^2	−0.0002	−2.863**	−0.0003	−3.068***
INV	0.0003	1.701	0.0001	1.804
FDI	0.0001	4.258***	0.0001	3.945***
OPEN	0.002	3.399***	0.0007	2.941***
GOV	−0.0008	−0.736	−0.0001	−0.388
Log-likelihood	203.737		1312.291	
Sigma	0.231		0.241	

*Significant at 10% level, **Significant at 5% level, ***Significant at 1% level

Table 5: Tobit fixed-effect model estimates (developing countries only)

Dependent variable: *Eff*	Efficiency VRS		Efficiency CRS	
	Coefficient	t-ratio	Coefficient	t-ratio
Constant	0.561	11.177	0.843	13.122
D_{MW}	−0.0001	−0.601	−0.0002	−1.046
INV	0.0001	0.863	−0.0003	0.968
FDI	0.0001	3.331***	0.0003	2.304**
OPEN	0.002	6.297***	0.0006	2.941**
GOV	0.0008	1.364	0.0009	1.751
Log-likelihood	203.737		1312.291	
Sigma	0.301		0.321	

*Significant at 10% level, **Significant at 5% level, ***Significant at 1% level

model assumes a common production technology frontier for all countries in the sample, and pooling developed and developing countries together would be erroneous. In this case, we restrict our sample to developing countries. Using only the sample of developing countries, the regression results shows not much difference except for the control variables (Table 5).

The results of our analysis tend to be more consistent with the proponents of minimum wage, since we are able to uncover a statistically significant relationship between the minimum wage and the aggregate level of technical efficiency. One should be careful, however, in interpreting those results for policy purposes. Our results, for example, may not be directly comparable with those of studies that focus on the minimum wage-total factor productivity relationship. Here we consider technical efficiency, which is practically the ratio of total factor productivity to an optimum total factor productivity benchmark. Thus when we test for the effects of minimum wage we don't explicitly distinguish how it affects the numerator and the denominator. In addition, it would be misleading to suggest that that growth and technical efficiency should necessarily be expected to move the same direction. One should rather expect changes in technical efficiency to do so.

5. CONCLUSION

We examine a relatively unexplored issue, namely the relationship between minimum wage and the overall productive efficiency performance. In particular, we consider whether higher minimum wage affects the technical efficiency of economies, as measured by a linear programming technique - DEA. Our results indicate that there is no difference in efficiency between countries with and without minimum wage policy. Hence, Minimum wage policy is not harmful to an economy's efficiency. Furthermore, looking at the countries with minimum wage policy, the amount of minimum wage up to a certain level has a positive effect on economic efficiency. The results suggest that minimum wage helps in increasing a country's efficiency provided that the rate does not exceed the optimal level.

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