

WAGES AND LABOUR PRODUCTIVITY: AN ANALYSIS IN MANUFACTURING SECTOR

Syed Omar Faizal Syed Mohd Yusof and Halimahtun Saadiah Abu Hasim¹

ABSTRAK

Teori upah kecekapan mengatakan bahawa produktiviti buruh adalah berkorelasi positif dengan upah yang mereka terima. Sebaliknya, teori konvensional mengusulkan bahawa upah boleh menyebabkan lebih produktiviti. Teori produktiviti marginal pula menunjukkan bahawa buruh yang dibayar dengan upah yang tinggi adalah buruh yang sangat produktif. Oleh kerana itu, terdapat hipotesis yang mengatakan produktiviti akan mempengaruhi upah dan juga sebaliknya secara positif. Kajian ini menggunakan data siri masa upah dan produktiviti buruh antara tahun 2005 hingga 2013 yang melibatkan tujuh subsektor pembuatan di Malaysia. Kajian ini menunjukkan empirikal hubungan antara upah dan produktiviti buruh dengan menggunakan ujian Vector Autoregression (VAR). Berdasarkan ujian VAR, hasil kajian menunjukkan wujudnya tiga senario iaitu hubungan satu hala, dua hala dan tiada hubungan antara pembolehubah dalam jangka pendek dan jangka panjang. Hasil kajian dapat memberikan pandangan terhadap impak polisi kepada pembangunan sumber manusia dan daya saing di peringkat antarabangsa.

Kata Kunci: Upah, Produktiviti, Sektor Pembuatan, Ujian Causality

ABSTRACT

Efficiency wage theory stated that labour productivity is positively correlated with the wages paid. On the other hand a conventional theory suggested that wages may lead to a surplus of productivity. Marginal productivity theory shows that a higher paid worker is the most productive workers. Therefore, the hypothesis says that productivity will affect wages positively and vice versa. This paper uses time series data of wages and labour productivity from 2005 to 2013 which involves seven groups of sub-sectors of manufacturing sector. This paper shows the empirical relationship between wages and labour productivity using vector autoregression (VAR). Based on VAR test, the results indicate three scenarios which are one way relationship, bilateral relationship and no relationship in short run and long run causality. The results provide insights on policy implications for the human resource development and international competitiveness.

Keywords: Wages, Productivity, Manufacturing Sector, Causality Test

¹Syed Omar Faizal Syed Mohd Yusof and Halimahtun Saadiah Abu Hasim are currently Assistant Directors of Industrial Production and Construction Statistics Division, Department of Statistics Malaysia.

1. INTRODUCTION

Wages and labour productivity are important economic indicators that contribute towards growth and development of the national economy especially in manufacturing sector. To improve the standard of living and reduce poverty, wages level should increase as it also influenced the labour productivity in the labour market. The theory of wages efficiency indicates that labour productivity is positively correlated with the wages paid. In this kind of situation, higher paid wages can motivate workers to increase productivity and efficiency (Blackwell, Andrew 2011). Cobb-Douglas Theory, 1928 also stated that there is a positive long run relationship between wages and productivity, although the relationship of these two variables have not been one to one.

The relationship between wages and labour productivity in manufacturing as a whole has been discussed many times by researchers such as Ho and Yap, 2001 and Nailah et. al, 2012 from all around the world, but far too little known to be focusing on specific industries in the manufacturing sector, especially in Malaysia. What is not yet clear is the impact of wages and labour productivity in different industries.

This study seeks to examine the relationship between wages and labour productivity of manufacturing sub-sectors from 2005 to 2013. Hence, this paper aims to produce an additional empirical evidence for all seven manufacturing sub-sectors in Malaysia. Moreover, the findings can shed light on issues relating to the increasing in wages and productivity growth. The results also provide insights on policy implications for the human resource development and international competitiveness.

2. LITERATURE REVIEW

Many studies focused on relationship between wages and productivity. Various reasons were highlighted in these studies. Firstly, Saten Kumar (2008), highlighted that higher real wages increase the opportunity cost of job loss, which can stimulate greater work effort to avoid redundancy (an efficiency-wage type hypothesis). Secondly, an increase in real wages will result in an increase in the unit cost of labour and cause firms to substitute capital for labour, which will be reflected in an increase in the marginal productivity of labour as stated by Saten Kumar (2008). Thirdly, Gordon (1987) highlighted that substitution from labour to capital in response to inexorable increases in real wages has been at the heart of the economic growth process for centuries. Fourthly, increased the living standard for those who work in manufacturing sector highlighted by Gordon (1987).

Although many studies had been done, several issues still arise. Among these issues are discussed in Andrew Sharpe, Jean-François Arsenault, and Peter Harrison (2008). The issues of conceptual, definitional and measurement associated with the relationship between labour productivity and real wages are still intact.

The relationship has been applied in many countries, for example in United States by Erenburg (1998), examined the long run relationship between real wages and productivity in the US from 1948-1990 and identified a long run counter-cyclical

relationship between real wages and productivity. Strauss and Wohar (2004) examined the long run relationship between inflation, real wages and productivity for a panel of 459 US manufacturing industries between 1956-1996. They found that in the long run, inflation does Granger-causes productivity, while bi-directional Granger causality exists between real wages and productivity .

Gunay *et al.* (2005) examined the relationship between inflation, real wages and profit margins over twenty-nine Turkish manufacturing sub-sectors over the period of 1980-1996. They found that profit margins (markups) are positively and significantly affected by real wage costs and price inflation. Similar conclusions were obtained for Turkey by Blanchard (1985) and Metin-Ozcan *et al.* (2002). In United Kingdom, Hall (1986) and Alexander (1993) found empirical evidence that inflation, real wages and productivity have a cointegrating relationship with an implication that higher wage rates stimulate labour productivity via the efficiency wage argument. Andrew Sharpe, Jean-François Arsenault and Peter Harrison (2008) examined the relationship between labour productivity and real wage growth in Canada and OECD countries. Saten Kumar, Don J. Webber and Geoff Perry (2008) examined the effect of inflation and real wages on productivity of Australia firms using time series annual data for the period 1965 to 2007.

In Malaysia, similar studies concerning wages were carried out by some researchers, among others Nijhar (1976), Chan (1991) and Soon (1991). Nijhar (1976) and Chan (1991) have conducted studies on wage structure but very little attention was paid to explaining the mechanism of wage formation at sectoral levels in the Malaysian economy. Nijhar (1976) conducted a survey on the wage structure in the rubber estates in West Malaysia while Chan (1991) provided a benchmark report on the wage structure and analysed the wage trends at a disaggregated level. Later study by Soon (1991) attempted to assess the influence of non-competitive forces on wage in the Malaysian manufacturing context. The study also looked at the effects of salary scale wage setting on real wage rigidity and employment during the 1985–86 recession.

Then, a study by Lee-Peng Ho and Su-Fei Yap (2001), examined the link between wages and labour productivity of the Malaysian Manufacturing Industry. Koi Nyen Wong (2010), analysing the Productivity-Wage-Unemployment Nexus in Malaysia attempts to examine whether there exists a productivity-wage-unemployment relationship in Malaysia at the macroeconomic level. Meanwhile, Dr. Goh Soo Khoon (2009), investigated the relationship between labour productivity, real wages and unemployment of 10 economic sectors in Malaysia. Lee-Peng Ho and of Su-Fei Yap, (2001), analysed the Link Between Wages and Labour Productivity of 13 sub-sector of manufacturing industry in Malaysia from 1975 to 1997.

This paper differed in three perspectives. First, it provides an additional empirical evidence on the link between wages and labour productivity. Second, it employs monthly data from 2005 to 2013 of manufacturing sub-sectors and third, the relationship of wages-productivity for all seven manufacturing sub-sectors in Malaysia using VAR model.

3. DATA AND METHODOLOGY

The data used in this paper was obtained from Monthly Manufacturing Statistics (MMS) released by Department of Statistics, Malaysia (DOSM) from the period of January 2005 to December 2013. The data covered large establishments only with above certain employment cut-offs and only accounted for 90 per cent of the census value added and 92.8 per cent of the value of gross output of the manufacturing sector in 2005. The monthly times series data were divided into seven groups of manufacturing such as Food, Beverages and Tobacco (FBT), Textiles, Wearing Apparel, Leather Products and Footwear (TWALS), Wood Products, Furniture, Paper Products, Printing (WFPP), Petroleum, Chemical, Rubber and Plastic Products (PCRP), Non-metalic Mineral Products, Basic Metal and Fabricated Metal Products (METAL), Electrical and Electronics Products (E&E) and Transport Equipment and Other Manufactures (TEOM).

All of the data series were transformed to natural logarithms before further analysis, so that the first differences can be interpreted as growth rates as well as to reduce the variation in time series data sets.

The data series were denoted as LWages (log of wages) and LProd (log of productivity). The Johansen co-integration test was conducted on the following pairs of variables: wages → productivity, productivity → wages were applied to all seven sub-sectors. Under Johansen and Juselius (1990), procedure for estimating the number of co-integrating relationships the following equations has been applied:

$$\begin{bmatrix} LWages_t \\ LProd_t \end{bmatrix} = \begin{bmatrix} a_1 \\ a_2 \end{bmatrix} + \begin{bmatrix} \beta_{1,1}(L) & \beta_{1,2}(L) \\ \beta_{2,1}(L) & \beta_{2,2}(L) \end{bmatrix} \begin{bmatrix} LWages_t \\ LProd_t \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \end{bmatrix} \quad (1)$$

Where, LWages is total wages and LProd is labour productivity. Meanwhile α_1 and α_2 are the intercept. β_1 and β_2 are the coefficient and ε_1 and ε_2 are the error terms. The equation (1) was tested using seven groups of manufacturing sub-sectors data sets for the causality relationships between wages and labour productivity.

This paper used Granger causality test as defined by Granger (1998), which takes into consideration the time series properties of the data to examine the incidence of causality and Johansen and Juselius (1990), procedure for estimating the number of co-integrating relationships in these sectors. All analyses were carried out using EViews econometrics software package. The procedures have been discussed by Nailah et. al., 2012 and Ismail et. al., 2013.

Study by Granger and Newbold (1974) stated that, if x and y series were non-stationary random processes (integrated), then modelling the relationship between x and y as a simple Ordinary Least Square (OLS) as in equation 2 will generate a false regression.

$$Y_t = \alpha + \beta X_t + \varepsilon_t \quad (2)$$

The statistic test indicates that the null hypothesis contain a unit root, it is proved that the data is not stationary where else if the data does not contain a unit root, the data is stationary.

Selection of Lag Length

The first step in co-integration analysis was selected an appropriate lag for the two variables. The best subsets selection using Information Criteria is the smallest value of Akaike Information Criterion (AIC) as mentioned by C. Mitchell Dayton, 2003. In this paper, the optimal lag selection suggested by Akaike Information Criterion with two, three and four lags was used.

Co-integration Test

This study utilised co-integration test as suggested by Johansen and Juselius (1990) which involves three steps. The order of integration for the two variables under observation was determined. The co-integrating regression was estimated using vector auto regression (VAR) model. Finally, if the times series data are co-integrated, the error-correction modeling (ECM) was constructed. The following VAR model was formulated:

$$y_t = \lambda_i(L)y_{t-1} + \varepsilon_{t-p} \quad (3)$$

Where $y_t = [LWages, LProd]$ is a column vector and $\lambda_i(L)$ with $i = 1, \dots, p$ is a lag operator. ε is the white noise residual of zero mean and constant variance. According to Greene (2000, p. 795-796), the order of the model p must be determined in advance using AIC, then we tested the null hypothesis that there were r or fewer co-intergration vectors using the following two likelihood ratio tests statistics:

(a) Trace Test

$$\tau_{trace} = -N \sum_{i=r+1}^M \ln[1 - (r_i^*)^2] \quad (4)$$

Where N is the total number of observation, M is the number of variables and r_i^* is the i correlation between i -th pair of variables. τ_{trace} has a chi-square distribution with $M - r$ degrees of freedom. Large values of τ_{trace} give evidence against the hypothesis of r or fewer cointegration vectors.

(b) Maximal Eigenvalue Test

The second test statistic was the maximal eigenvalue test, which evaluates the null hypothesis $H_0: r = r_0$ against $H_A: r = r_0 + 1$,

$$\tau_{max} = -T \ln(1 - \lambda_{r+1}) \quad (5)$$

In the test, the null hypothesis of r co-integrating vectors was tested against the alternative of $r + 1$. Nevertheless, Johansen and Juselius (1990) suggested that the maximal 1 co-integration vectors eigenvalue test is more powerful than the trace test.

Granger Causality Test

For this paper, the Granger causality in Vector Auto Regression (VAR) was used to estimate the dynamic interrelation between variables. Granger (1969) identified that the past and present value of y_t provides some useful information to forecast x_{t+1} at time t , defined as y_t Granger causes x_t . According to Granger (1988), co-integration was concerned with long-run equilibrium. On the other hand, Granger causality was concerned with short-run forecast ability. These two different concepts were considered in an error correction model (ECM).

4. EMPIRICAL RESULTS

4.1 Granger Causality Test

Granger-causality statistics examine whether lagged values of one variable helps to predict another variable. Granger Causality test has been conducted using VAR and VECM provides a framework to study short run and long run causal relationship as well as the direction of the causality between the variables.

4.1.1 Short Run Causality:

The results of Granger causality for short run are in Table 1 below.

Table 1: Granger Causality Wald Tests (VECM Model)

The null hypothesis is the coefficients on the lags of variable are equal to zero	p-value
DLWAGESMETAL $\rightarrow$ DLPRODMETAL	0.003*
DLPRODMETAL $\rightarrow$ DLWAGESMETAL	0.037*
DLWAGESTEOM $\rightarrow$ DLPRODTEOM	0.175
DLPRODTEOM $\rightarrow$ DLWAGESTEOM	0.028*

Note: * indicate significance at the 5% levels and ($\rightarrow$) donate the direction of causality.

The result in table 1 showed that there is one way causality exists between wages and productivity for TEOM. Meanwhile, there are two way causality exists between wages and productivity for METAL in the short run. Due to the absence of co-integration between wages and productivity for FBT, TWALS, WFPP, PCRP, and E&E, we tested causality by using VAR. The result is shown in table 2 as follow.

Table 2: Granger Causality (VAR model)

	Null Hypothesis:	p-value
FBT	DLWAGES does not Granger Cause DLPROD	0.022*
	DLPROD does not Granger Cause DLWAGES	0.318
TWALS	DLWAGES does not Granger Cause DLPROD	0.745
	DLPROD does not Granger Cause DLWAGES	0.067
WFPP	DLWAGES does not Granger Cause DLPROD	0.023*
	DLPROD does not Granger Cause DLWAGES	0.001*
PCRP	DLWAGES does not Granger Cause DLPROD	0.176
	DLPROD does not Granger Cause DLWAGES	0.364
E&E	DLWAGES does not Granger Cause DLPROD	0.013*
	DLPROD does not Granger Cause DLWAGES	0.010*

*: indicates significant at the 5% level

The result in table 2 indicates that WFPP and E&E showed the existence of a bilateral relationship where else TWALS and PCRP do not have any relationship between productivity and wages. On the other hand, FBT showed the evidence of a one way causality relationship.

4.1.2 Long Run Causality:

VECM Granger Causality provides a framework to study long run causal relationship as well as the direction of the causality between the variables. So the equation of error correction model (ECT) for four endogenous variables such as productivity and wages for METAL and TEOM as follows:

Table 3 : Error Correction Term (ECT)

	ECT(-1)	p-value
DLWAGESMETAL	→ DLPRODMETAL	p<0.001
DLPRODMETAL	→ DLWAGESMETAL	0.721
DLWAGESTEOM	→ DLPRODTEOM	p<0.001
DLPRODTEOM	→ DLWAGESTEOM	p<0.05

Table 3 showed the results that wages does granger cause labour productivity for both METAL and TEOM sub-sectors in the long run. Here, we can conclude that there is long run one-way causality between METAL and TEOM sub-sectors.

5. DISCUSSION AND CONCLUSION

The discussion of the results begin with wages and labour productivity for the WFPP, METAL and E&E sub-sectors showed that there are two way causality exist in the short run. Meanwhile the other two sub-sectors, FBT and TEOM showed only one way causality relationship. On the other hand, in the long run, two sub-sectors showed one way causality relationships which are METAL and TEOM sub-sectors.

Based on the main purpose of this paper aims to investigate the causal direction between wages and labour productivity in all seven sub-sectors. As it has been seen in literature, theories and empirical studies, a direct relationship between wages and labour productivity where by better paid employees do not want to lose jobs and work more productively. It was assume that higher wages increase labour cost, business expenditures therefore businesses seek to increase marginal productivity. Labour productivity help compensate decrease labour for supply (Zita Tamasaukiene, 2013).

Thus, there has important policy implication that continuing promoting wages and productivity relationship will influence the output of the sub-sectors in manufacturing in both short and long-term. Furthermore, the expectation theory suggested that firms may need to meet the demand for additional wages for increase in productivity. Later, as the unemployment rate increases the wages is expected to reduce as the oversupply of manpower in the market.

REFERENCES

- Al-Yousif, Yousif K. (1999). On the role of exports in the economic growth of Malaysia: A multivariate analysis. *International Economic Journal* 13: 67 – 75.
- Azam J. P, Fosu. A and Ndung'u .N. S. (1999). Explaining Slow Growth in Africa. African Development Bank.
- Balassa B. (1985). Exports, policy choices, and economic growth in developing countries after the 1973 oil shock. *Journal of Development Economics* 18: 23-35.
- Bulanch, N and Verner, D. (2006). Shared Growth Versus the Dual Economy Module: Evidence from Cote d'Ivoire, Ghana and Zimbabwe. African Development Bank.
- Choong Chee Keong, Zulkornain Yusop and Venus Khim-Sen Liew. (2009). Export-led Growth Hypothesis in Malaysia: An Application of Two-Stage Least Square Technique
- Dickey, D.A. and Fuller, D.A. (1979). Distributions of the estimators for autoregressive time series with a unit root. *Journal of American Statistical Association* 74: 427- 431
- Engle, R.F. and C.W.J. Granger. (1987). Cointegration and error correction: Representation, estimation and testing. *Econometrica* 55: 251-276.
- Granger, C. W. J. (1988). Some recent developments in a concept of causality. *Journal of Econometrics* 39: 199-211.
- Johansen, S. and K. Juselius. (1990). Maximum likelihood estimation and inference on cointegration with applications to the demand for money. *Oxford Bulletin of Economics and Statistics* 52: 169-211.
- Kalirajan. K.P and Shand.R.P. (1994). Economics in Disequilibrium. An Approach from the Frontier. MacMillan India.
- Leila Vaezi, Reza Moghaddasi. (2009). Relationships between Total Exports with Agricultural and Manufacturing GDP in IRAN
- McCarville. M and Nnadozie. E. (1995). Causality Tests of Export-led Growth: The case of Mexico Atlantic Economic Journal 140-145 Volume 23.
- Nicolaus Herman Shombe. (1998). Causality Relationships between Total Exports with Agricultural and Manufacturing GDP in Tanzania, IDE discussion paper, No.136.
- Nur Zaimah Ubaidillah, Wan Nur Izni Wan Ahmad Kamar. (2013). Causal Analysis on the Contribution of Agriculture Sector on Economic Growth: The Case of Malaysia and New Zealand; International Peer Reviewed Journal; IAMURE

Syed Omar Faizal Syed Mohd Yusof and
Halimahtun Saadiah Abu Hasim

Syed Hossain VECM. (2009). - Lecture Note on Vector Error Correction Model and
Eviews Application.

Thornton, J. (1996). Cointegration, causality, and export-led growth in Mexico, 1895-
1992. *Economics Letters* 50: 413-416.