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**ANALYZING THE PRODUCTIVITY-WAGE-UNEMPLOYMENT
NEXUS IN MALAYSIA: EVIDENCE FROM THE
MACROECONOMIC PERSPECTIVE**

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ABSTRACT

ANALYZING THE PRODUCTIVITY-WAGE-UNEMPLOYMENT NEXUS IN MALAYSIA: EVIDENCE FROM THE MACROECONOMIC PERSPECTIVE

Using multivariate cointegration and error-correction modeling techniques, this paper attempts to examine whether there exists a productivity-wage-unemployment relationship in Malaysia at the macroeconomic level. The main findings show that unemployment is dichotomized from the long-run equilibrium relationship between labor productivity and real wages, implying labor productivity is an important long-run factor in determining real wages, while unemployment has a negligible effect on the real wage rates. However, real wages are very responsive to a change in labor productivity, signaling a tight labor market that leads to an increase in unit labor cost. To be more resilient to rising wages and productivity gaps in a globally competitive environment, Malaysian industries should move up the value chain, and promote skill-and technology-intensive production.

JEL CLASSIFICATION CODES: J39

KEYWORDS: Real wages, productivity, Malaysia

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1. INTRODUCTION

Human resources play a vital role in the export-led industrialization of the Malaysian economy. Low labor costs coupled with relatively higher skills and capabilities of the workforce then were the major pull factors that attracted foreign firms to set up their subsidiaries in the country since the early 1990s. The rapid structural change in the economy from a commodity-dependent economy into a manufacturing export-based one has caused a shortage of skilled workers in the country. It is interesting to note that a series of successful adoption of industrialization programs during the past three decades had repercussions on Malaysia's labor market. The labor market in Malaysia has been enjoying near full employment with an unemployment rate of as low as 2.5 per cent in 1996. The current tight labor market conditions have a tendency to exert upward pressure on the labor costs which makes the country a less attractive destination for inward foreign direct investment (FDI), particularly with the emergence of low-wage countries such as the People's Republic of China (PRC), India as well as transitional economies from Indochina (see Hussain and Radelet (2000) and Yusof (2006)). At present, there are several multinational corporations (MNCs) in Penang, Malaysia, which have already relocated their production bases to the PRC because of its comparative advantage in producing labor-intensive goods.

Consequently, this observation poses an interesting empirical question pertaining to the implications of labor-cost competitiveness for the nation in an exceptionally tight labor market condition. Hence, this paper attempts to ascertain empirically how productivity, wage and the level of unemployment interact in the long run to address this empirical question. Applying multivariate cointegration and error-correction modeling techniques, the analysis examines whether there is a cointegrating relationship as well as the causality patterns among these three variables of interest. The study not only provides further evidence concerning the empirical validity of labor market theories¹ but also have salient contributions to the empirical literature using Malaysia as a case since the available evidence is limited for developing economies especially in Southeast Asia. Moreover, the findings can shed important light on issues relating to the rising wages and productivity growth currently experienced by the country and can have useful policy implications for the economy's manpower development and international competitiveness in the face of trade liberalization and the entry of low-wage countries.

The structure of the paper is as follows. Section 2 presents the labor market theories and the previous empirical work on the productivity-wage-unemployment relationship. Section 3 describes the data and outlines the methodologies used in the present study. Section 4 reports the empirical results, and the main conclusions and policy implications are summarized in Section 5.

¹ Section 2 of the paper will provide a review of the empirical literature testing for the validity of labor market theories.

2. LABOR MARKET THEORIES AND THE EMPIRICAL LITERATURE

2.1 LABOR MARKET THEORIES

According to different wage determination theories, the evolution of wages is not only influenced by productivity but also influenced by unemployment (see Blanchflower and Oswald, 1994, Blanchard and Katz, 1999, Bell *et al.*, 2002). Real wage, productivity and unemployment represent an important nexus within labor markets which has received a significant amount of attention in economic literature.

The marginal productivity theory suggests that highly productive workers are highly paid, and less productive workers are less highly paid. Higher productivity in turn could cause real wages to rise. Therefore, it is hypothesized that productivity has a positive impact on real wages. However, the effect of an increase in labor productivity on unemployment is ambiguous. As labor productivity increases, workers are more efficient (which implies lower demand for labor), hence, unemployment rate could increase. Alternatively, a rise in productivity could have a positive impact on employment via its contribution to higher output (which implies higher demand for labor), thereby reducing the unemployment rate, *ceteris paribus* (Alexander, 1993; Wakeford, 2004).

On the other hand, efficiency wage theory proposes that wages affect both productivity and unemployment. Firms pay their employees more than the market clearing wages in order to increase their employees' productivity or efficiency. Akerlof (1982) argued that raising wages can stimulate worker effort and strengthen long-term employment relationships. High wage workers are less likely to quit. Thus firms can retain more experienced and productive workers than newly hired workers who may not be as productive as experienced workers. This could add to the unemployment rate. Therefore, it is hypothesized that wages positively affect both productivity and unemployment.

There is also a large volume of analysis making use of insider-outsider models, which suggests an important role for insider effects in wage determination. Unlike the efficiency wage theories, the insider-outsider approach does not assume a direct effect of wages on productivity and unemployment. By contrast, this model rests on the assumption that insider workers exploit various labor turnover costs² to resist wage competition from outsiders (Lindbeck & Snower, 2002).

2.2 EMPIRICAL LITERATURE

There has been an increasing volume of empirical literature concerning the relationship between real wage, productivity and unemployment. For instance, using the two-step procedure of Engle and Granger (1987), Hall (1986) found real wages, productivity and unemployment formed a cointegrated system in the United Kingdom (U.K.). However, Alexander's (1993) empirical study showed that there was no direct link between wages and productivity from 1955 to 1979 in the U.K. when unemployment was the central variable, being caused by both wages and productivity during this period. On the other hand, after the structural break in 1979, a negative

² According to Lindbeck and Snower (2002), there are various types of labor turnover costs which give insider market power, such as costs associated with the dismissal of workers and costs associated with the hiring and training of new workers.

causality from wages to productivity was found, while unemployment became almost divorced from the system. Wakeford (2004) found that though a long run relationship existed between real wages and productivity in South Africa, unemployment was apparently not connected to the two variables. In the short run, real wages had a negative impact on productivity but not for the reverse case. Strauss and Wohar (2004) found the long-run relationship between real wages and productivity at the industry level for a group of manufacturing industries in the United States (U.S.) over the period 1956 – 1996, and the increases in productivity were associated with a less than unity increase in real wages. Using Geweke's linear feedback technique, Meghan (2002) estimated the relationship between wages and productivity for several industrialized countries to distinguish between conventional and efficiency wage behaviors. Results suggested that efficiency wages were being paid in Canada, Italy and the UK. In contrast, Sweden, the U.S. and France exhibited no efficiency wage setting, with very negligible wages and productivity feedback measures. The study also found that economic institutions such as worker unions played an important role on the wage-productivity settings for this group of industrialized countries. Scott and Meghan (2002) found that efficiency wage behavior had not been the norm in Japan from 1975 to 1997. Nevertheless, efficiency wage setting cannot be ruled out for some key areas of manufacturing in Japan.

There is a lack of empirical studies concerning the relationship between real wages-productivity-unemployment in Malaysia. Ho and Yap (2001) analyzed both the long-run and short-run dynamics of wage formation in the Malaysian manufacturing industry as a whole and also for 13 selected sub-sectors of the industry using the Engle-Granger cointegration test. The main explanatory variables in the estimated long run wage equation for the entire manufacturing industry were labor productivity, unemployment rate and union density. They found a positive long run relationship between labor productivity and real wages and a negative relationship between unemployment and real wages, and no significant relationship of union density on real wages. Furthermore, the short-run dynamic model revealed a negative relationship between real wages and labor productivity suggesting that labor productivity gains did not bring about higher wages in the short run.³ The main drawback of the methodology applied in this study is that the authors used the Engle-Granger two step procedure to test the cointegration relationship among four variables, namely, real wages, productivity, unemployment and union density. As pointed out by Enders (2004), the Engle-Granger two-step procedure can identify only one long-run relationship with a maximum of two variables. And, in a set of four variables as estimated by Ho and Yap (2001), it can, in fact, identify up to three long-run relationships.

The focus of this study is to examine the relationship between real wages, productivity and unemployment by applying the tri-variate model, namely, real wages, productivity and unemployment, as have been used in international literature (Alexander, 1993; Wakeford, 2004; Meghan, 2002; Scott and Meghan, 2002). In Malaysia, although the number of unions has increased over the years, data from the Ministry of Human Resources showed that union members constituted only 7.3% of the workforce in year 2005 compared to 15% in 1996. In addition, as pointed out by Ayadurai (1985), restrictions on labor to organize labor movement have resulted in small and ineffective unions. Hence, it is not surprising that in Ho and Yap's (2001) study, the variable on union density, which measures union power, was statistically insignificant both in the long run and short run cointegration models. Therefore, our study will not consider the union density variable in the model.

³ However the authors ignored the insignificance of the error correction term in the short run model.

3. DATA AND METHODS

The present study uses annual time series data from 1970 to 2005 (see Appendix 1 for the definition, sources and transformation of the data; the plots of the data can be found in Appendix 2). We would have preferred to work with quarterly data so that the study has an adequate number of observations for analysis. However, quarterly time series data for the variables required in this study are not available.

A common practice prior to performing cointegration test is to determine the stationarity of the series or its degree of integration, $I(d)$. Augmented Dickey Fuller (ADF) and Phillips and Perron (PP) tests were then applied to all series to determine their order of integration. It is important to note that these tests assume no structural breaks.⁴ The next step is to apply the Johansen multivariate cointegration procedure to test whether there is a cointegrating vector(s) among the non-stationary series (Johansen and Juselius, 1990). The assumption imposed on the cointegration equations is linear deterministic trend with an intercept in data. If the economic time series are found to be cointegrated, an econometric framework for an Error Correction Model (ECM) representation can be specified. The error-correction process can reconcile the long-run equilibrium with disequilibrium behavior in the short-run which allows testing for short-term or dynamic causality.

The ECM specification can be written as follows:

$$\Delta LRW_t = a_0 - a_1 ECT_{t-1} + \sum_{j=1}^p a_{3j} \Delta LPROD_{t-j} + \sum_{j=1}^p a_{4j} \Delta LRW_{t-j} + \varepsilon_t$$

$$\Delta LPROD_t = b_0 - b_1 ECT_{t-1} + \sum_{j=1}^p b_{2j} \Delta LPROD_{t-j} + \sum_{j=1}^p b_{3j} \Delta LRW_{t-j} + \mu_t$$

where LRW_t is logged average real wage, $LPROD_t$ is logged average labor productivity, Δ is the first-order differencing operator and ECT_{t-1} stands for the previous period's error-correction term generated from a cointegrating equation using OLS estimator.⁵ Given the study has only 36 observations, and to save degrees of freedom, a maximum lag length of four is imposed on the ECM.⁶

⁴ The paper has cautiously considered the possible structural break(s) in the unit root tests. The conventional unit root tests (i.e. ADF, PP, KPSS, and so on) do not take into account the possible structural changes in the underlying series, hence the power to reject the unit root null declines. However, the Bai and Perron (1998, 2003) test fails to reach conclusive results for the potential structural breaks. For example, the $\sup F_{\tau}(K)$ tests, UDmax and WDmax tests suggest at least one break, while the sequential procedure and the BIC and LWZ suggest no structural break. Given the well-documented facts that the sequential procedure perform better than other tests, we decided in favor of no break for all series. For comparison purposes, the paper also computed unit root tests with structural break(s) i.e. unit root tests proposed by Lanne *et al.* (2002) and Saikkonen and Lutkepohl (2002). In general, the empirical results for unit root are consistent with the alternative specifications which allow for possible structural break(s) and without structural break(s).

⁵ Since the model is left with two variables, hence, it is safe to use OLS as an estimation technique.

⁶ As a general rule, an optimal lag length of four quarters is sufficient in an empirical study when annual data are being used.

4. EMPIRICAL RESULTS

Table 1 presents the results of ADF and PP tests for a unit root for each individual series. The regressions were run with trend for real wages and productivity series, and without trend for unemployment series. It is found that the null hypothesis of unit roots cannot be rejected at conventional significance levels, and therefore it can be concluded that all series are non-stationary in level, but are stationary in first difference. Therefore, all series are $I(1)$.

Table 1: Results of Unit Root Tests – the ADF and PP tests

Series	ADF		PP	
	In levels	In first differences	In levels	In first differences
LRW	-2.14	-8.93***	-3.32	-8.93***
LPROD	-1.61	-4.92***	-1.80	-6.13***
LU	-1.15	-7.02***	-1.55	-6.89***

Note: Constant and time trend have been included in the unit root equation for LRW and LPROD data (in level). For first-differenced data, the unit root equation was estimated without a time trend. For the ADF test, the optimum lag (.) is selected based on Akaike Information Criterion (0 to 4 lags). For the PP test, the lag truncation of four was used for the Bartlett Kernel based on the Newey-West adjusted variance estimators. *** denotes rejection of the unit root null at the 1% level, based on MacKinnon's (1991) critical values.

Table 2 reports the estimated trace and maximum test statistics. Overall, the cointegration test results confirm that there exists at least one cointegrating relationship among the three variables.

Table 2: Johansen Multivariate Cointegration Test

Hypothesized number of CE	Trend and Intercept			
	λ_{trace} statistics	5% critical value	λ_{Max} statistics	5% critical value
None	47.89**	42.91	27.12**	25.82
At most 1	20.77	25.87	15.56	19.38
At most 2	5.21	12.52	5.21	12.52

Note: ** denotes significance at 5%

The long-run equilibrium vector is estimated to be $Z = LRW - 1.28LPROD - 0.067 LU$ which is shown in Table 3, column 2. The coefficient of LPROD has a standard error of 0.054 and is therefore significant at 1 percent level of significance, while the coefficient of LU has a standard error of 0.051 and is clearly insignificant. The result is tested further via an over-identifying restriction (that the coefficient of $LU = 0$), which produces a χ^2 statistic of 1.71 which is not significant ($p=0.1907$). The evidence suggests that LU is not part of the long-run relationship.⁷ Hence, a cointegration test for the bivariate relationship between LRW and LPROD should be conducted. Applying the same methodology as before, the estimated trace test statistics (see Table 4) show the

⁷ This evidence is consistent with plots shown in Figure 1 that the trend of unemployment was never similar to the other two variables for Malaysia.

existence of a single cointegrating vector. The trace and maximum tests clearly indicate a single cointegrating vector at the 5 per cent level of significance.⁸

Table 3: Ordinary Least Squares estimation for long-run elasticity parameters

Regressor	LRW	LRW
Constant	-1.139*** (0.215)	-0.882*** (0.088)
LPROD	1.280*** (0.054)	1.223*** (0.033)
LU	0.067 (0.051)	
R ²	0.977	0.976
Adjusted R ²	0.976	0.975
F-statistic	717.265	1403.4
(p-value)	(0.000)	(0.000)

Note: *** denotes level of significance at 1%.

Table 4: Johansen multivariate cointegration test

Hypothesized number of CE	Trend and Intercept			
	λ_{trace} statistics	5% critical value	λ_{Max} statistics	5% critical value
None	24.38**	18.39	22.16**	17.15
At most 1	2.22	3.84	2.22	3.84

Note: ** denotes level of significance at 5%

The long-run equilibrium vector is estimated as $Z = LRW - 1.223LPROD$ (Table 3, column 3). The standard error of the coefficient of LPROD is 0.033 implying a high degree of significance level. This suggests that for every 1 per cent rise in productivity, real wage rises by 1.223 per cent in the long run.

The results of the ECM estimations are reported in Table 5. The DLPROD model is not robust statistically; none of the lagged of the DLW and DLPROD (including the error correction term) is significant in the model, but the DLRW model has reasonable explanatory power. The F-statistic for the DLRW model is significant and the model passes all of the conventional tests for serial correlation, functional form and residual normality. The CUSUM plot reveals stability of parameters in the equation. All the Quandt-Andrew Unknow Breakpoint Tests (i.e. Maximum LR F-statistic, Exp LR F-statistic, or Ave LR F-statistic) do not reject the null hypothesis of no structural break within the sample size tested.

It can be seen that in the DLRW model, the error correction term is significant at 10 per cent level but not the error correction term in the DLPROD model. This implies that real wages adjust back towards long-run equilibrium (but not productivity) following a shock. The coefficient of the error correction term in the DLRW model is quite large, indicating a fairly rapid adjustment of real wage to equilibrium.

⁸ We also ran the two-step Engle-Granger (1987) cointegration test. The ADF t-statistics for the residuals from the cointegration equations (both for the constant or constant and time trend) lie below the 1% and 5% critical value, indicating the null hypothesis of no cointegration can be rejected.

The significance of the 4th lag of the productivity term in the DLRW model and the positive coefficient imply that productivity Granger causes real wages, supporting the marginal productivity theory as discussed in Section 2. The relatively long lags suggest that changes in productivity are not immediately reflected in real wages. This evidence conforms to the observation by Feldstein (2008), who used a longer data set from 1947 till 2006, that changes in productivity were not immediately reflected in wages or total compensation per hour in the US.

Conversely, for the DLPROD model, none of the lagged of real wages and productivity is significant, which implies that real wage has no impact on productivity in the short run.⁹

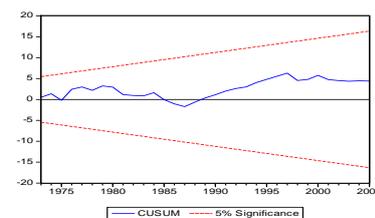
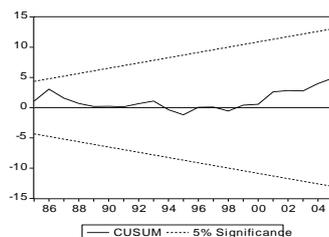
In sum, the econometric evidence suggests the following dynamic causal system: productivity impacts on real wages positively but real wages have no effect on productivity. The adjustment to equilibrium occurs through wages only but not productivity.

Table 5: Error Correction Models for Real Wage and Productivity

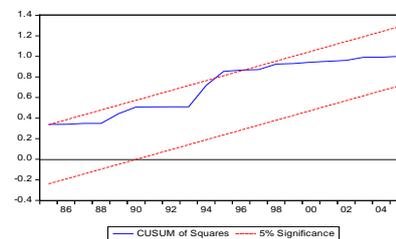
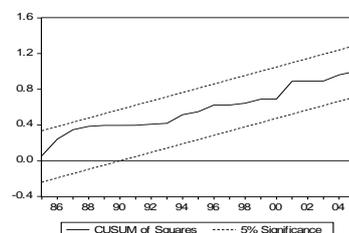
Regressor	Dependent Variable	
	DLRW	DLPROD
Constant	0.025 (0.035)	0.032 (0.018)
ECT(-1)	-0.798 (0.402)*	-0.130 (0.205)
DLRW(-1)	-0.124 (0.348)	0.098 (0.178)
DLRW(-2)	0.006 (0.274)	-0.018 (0.140)
DLRW(-3)	-0.170 (0.232)	0.045 (0.118)
DLRW(-4)	0.029 (0.164)	0.116 (0.089)
DLPROD(-1)	-0.473 (0.635)	-0.174 (0.325)
DLPROD(-2)	-0.024 (0.619)	-0.249 (0.316)
DLPROD(-3)	0.408 (0.543)	0.165 (0.277)
DLPROD(-4)	0.847 (0.463)*	-0.086 (0.252)
R ²	0.622	0.213
Adjusted R ²	0.459	-0.123
F-statistics (p-value)	3.837 (0.005)	0.632 (0.756)
Jarque-Bera (p-value)	1.24 (0.537)	5.23 (0.07)
Ramsey's RESET: F-statistics(p-value)	0.711 (0.408)	1.59 (0.221)
Quandt-Andrew Unknown Breakpoint Test		
	2.348 (0.923)	2.149 (0.971)
Maximum LR F-statistic		
Exp LR F-statistic	0.412 (0.904)	0.424 (0.890)
Ave LR F-statistic	0.724 (0.891)	0.743 (0.857)

⁹ We also performed the "general to specific" modeling paradigm for the ECM model using the individual t-test. Regressor with small absolute t-values was eliminated sequentially until all absolute t-values were greater than a threshold value. Note that only a single regressor is eliminated in each step. Then new t-values are computed for the reduced form. The result is not much different from the ECM model which includes all lags, i.e. only the fourth lagged of the productivity variable is significant in the DLRW model but none of the real wages and productivity is significant for the DLPROD model.

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Note: * denotes significant at 10 per cent. Parentheses indicate standard errors. For the Quandt-Andrew Unknown Breakpoint Test, the result of the LR F-statistic is identical to the Wald F-statistic since the equation is linear estimation.

5. CONCLUSIONS AND POLICY IMPLICATIONS

This study provides new empirical evidence on the productivity-wage-unemployment nexus from the macroeconomic perspective using Malaysia as a case. In light of its current experience of a relatively high level of productivity coupled with tight labor market and rising wages, this area of empirical investigation is useful especially for the Malaysian government to design appropriate strategies to enhance the country's productivity and international competitiveness. With the emergence of low-wage countries such as the PRC, India and Vietnam, to name a few, in an increasingly global competitive environment, the findings can provide important implications for policy formulation and analysis of human resource development and labor market.

The key findings show that there exists a long-run equilibrium (cointegrating) relationship between real wages and productivity from 1970 to 2005 despite the fact that unemployment appears to be dichotomized from this equilibrium relationship. Although labor productivity is an important long-run factor in determining real wages, the productivity elasticity of real wages is greater than 1 (i.e. real wages are very responsive to a change in labor productivity), signaling that labor productivity gains lag behind the increase in real wages. As pointed out by Rahmah and Yussof (2003), the labor market competitiveness has an impact on FDIs in Malaysia. In this regard, an increase in unit labor cost, which is caused by high productivity elasticity of real wages, is one of the main factors behind the decrease in FDI inflows into the country. In fact, the entry of low-wage countries is also posing a further threat to the country's labor-intensive manufacturing sector, which used to be one of the major recipients of FDI in the region.

Moreover, the plausible explanations for the phenomenon that unemployment has negligible effects on real wages are as follows: (1) there is a lack of wage underbidding when the unemployed are willing to work for lower wages than the incumbent workers as put forward by the insider-outsider theory of the labor market (see Lindbeck and Snower, 1988); (2) the labor market in Malaysia has been enjoying near full employment with an unemployment rate of as low as 2.5 per cent during the study period. Even though the labor market is tight, the sizeable recruitments of cheap foreign workers from neighboring countries tend to cushion the pressure of the tight labor

market that it exerts on the real wages. This is why the low level of unemployment does not seem to have a significant negative long-run effect on real wages.

To be more resilient to the rising wages and productivity gaps (as indicated by the high productivity elasticity of real wages), the skill of the workforce should be enhanced in order to develop a pool of highly-skilled knowledge workers which is critical to raising the nation's labor productivity. This productivity enhancement strategy is a way forward to ease the shortage of skilled workers in the long run which is in line with the human capital development thrust prescribed by the *Ninth Malaysia Plan*.¹⁰ To support these efforts, it is timely for Malaysian industries to move upstream to produce high value-added skill- and technology-intensive products particularly when their comparative advantage in producing labor-intensive products have been eroded by the entry of low-wage countries.

¹⁰ This document is the Government's blueprint for national development for the period 2006-2010.

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APPENDIX 1

Productivity is measured by real GDP per worker. As pointed out by Wakeford (2004), the most appropriate concept of productivity in economics is marginal productivity or output per hour of labor input. However, such data is not available in Malaysia. Following the study by Alexander (1993) and Wakeford (2004), this study resorts to the use of average labor productivity, which is real GDP divided by total employment.

Real wages are based on the aggregate wages of 10 economic sectors, namely, manufacturing, utilities, transportation, finance, government services, wholesale and retail trade, agriculture, construction, mining and other services and then deflated using the consumer price index. In this analysis, average (i.e. per worker) real wages are being considered. Feldstein (2008) commented it is better to compare the productivity rise with the increase of total compensation rather than with the increase of wages. With the rise in fringe benefits and other non cash payments, wages have not risen as rapidly as total compensation. Nonetheless, such fringe benefits data is not available in Malaysia.

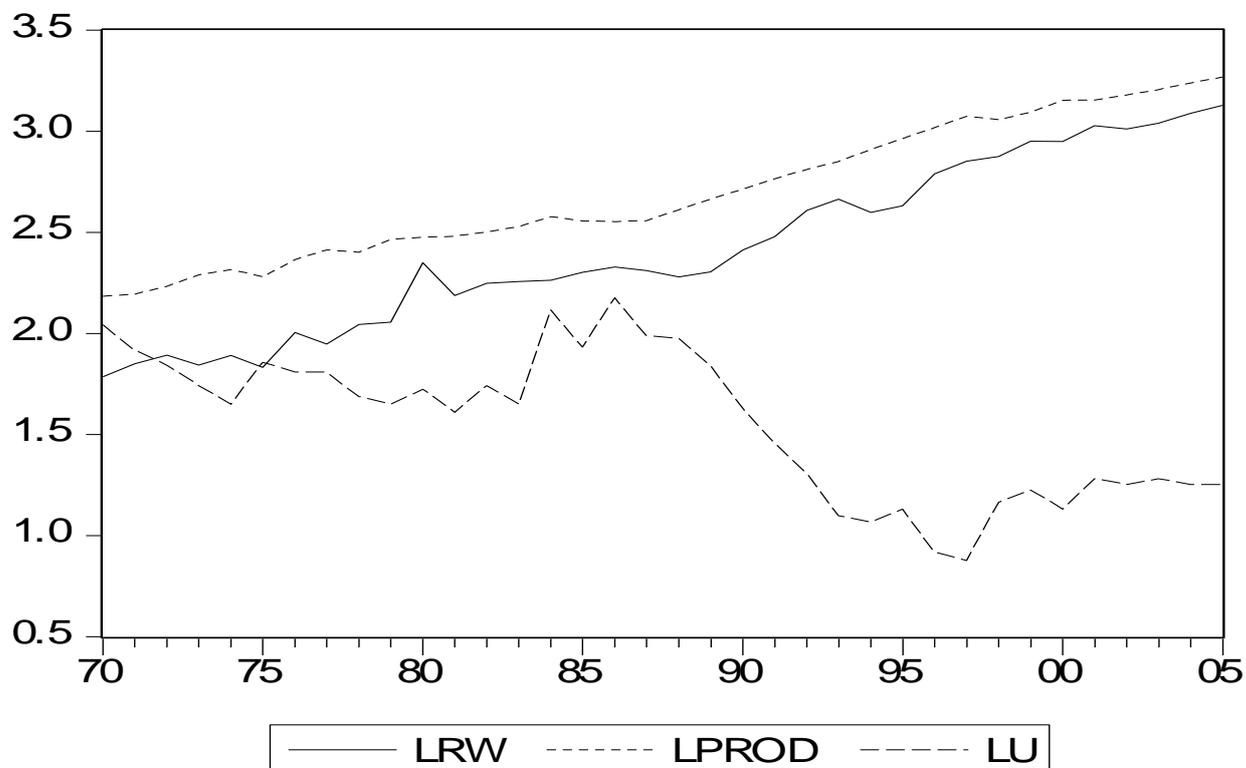
The unemployment rate data is compiled and released by the Department of Statistics, Malaysia which include both actively and inactively unemployed.

The annual GDP, total employment, the consumer price index and the unemployment rate data is available from the Department of Statistics, Malaysia, whereas the nominal wages of 10 economic sectors is made available to the author by the Malaysia Productivity Council (MPC).

Data transformation: All variables were transformed in logarithmic form so that coefficients can be interpreted as elasticities. It is noted that Alexander (1993) and Wakeford (2004) only transformed real wages and productivity into logarithms, while unemployment was retained as a percentage. In this study, we transformed all the variables into logarithmic form to ensure that all variables are unit free. The data for the unemployment data is annual. The highest value of the unemployment rate throughout the sample size is 7.7% while the lowest is 2.4%. Hence, the values of the logarithm of the unemployment rate are all positive.

APPENDIX 2

Figure 1: Real Wages, Productivity and Unemployment, 1970 - 2005



Note: LRW = logged average real wage, LPROD = logged average labor productivity, LU = logged unemployment rate.