"Wages and Labor Productivity : Panel Data Analysis"

27 October 2015

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INTRODUCTION

The Manufacturing sector continued to contribute to the Malaysia economy from year 2012 to 2014, This performance was supported by a productivity growth. In 2014, productivity in the manufacturing sector grew by 3.8% and labour cost grew by 1.9%. (*Source : Productivity Report, MPC; 2011/2012 to 2014/2015*)

Year	% Growth	
	Productivity	Labour Cost
2011	-0.6%	-1.3%
2012	4.5%	0.8%
2013	4.1%	5.5%
2014	3.8%	1.9%

INTRODUCTION

Figure 4.7: Productivity Growth of Selected Manufacturing Sub-Sectors, 2013-2014

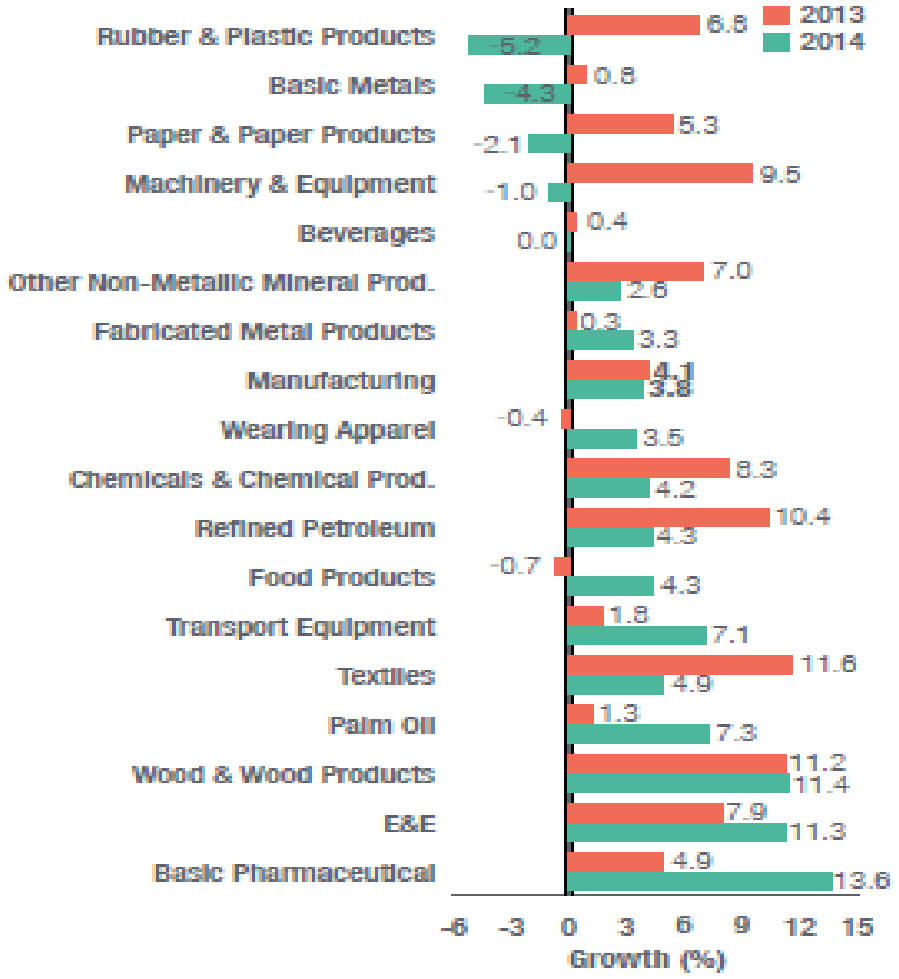
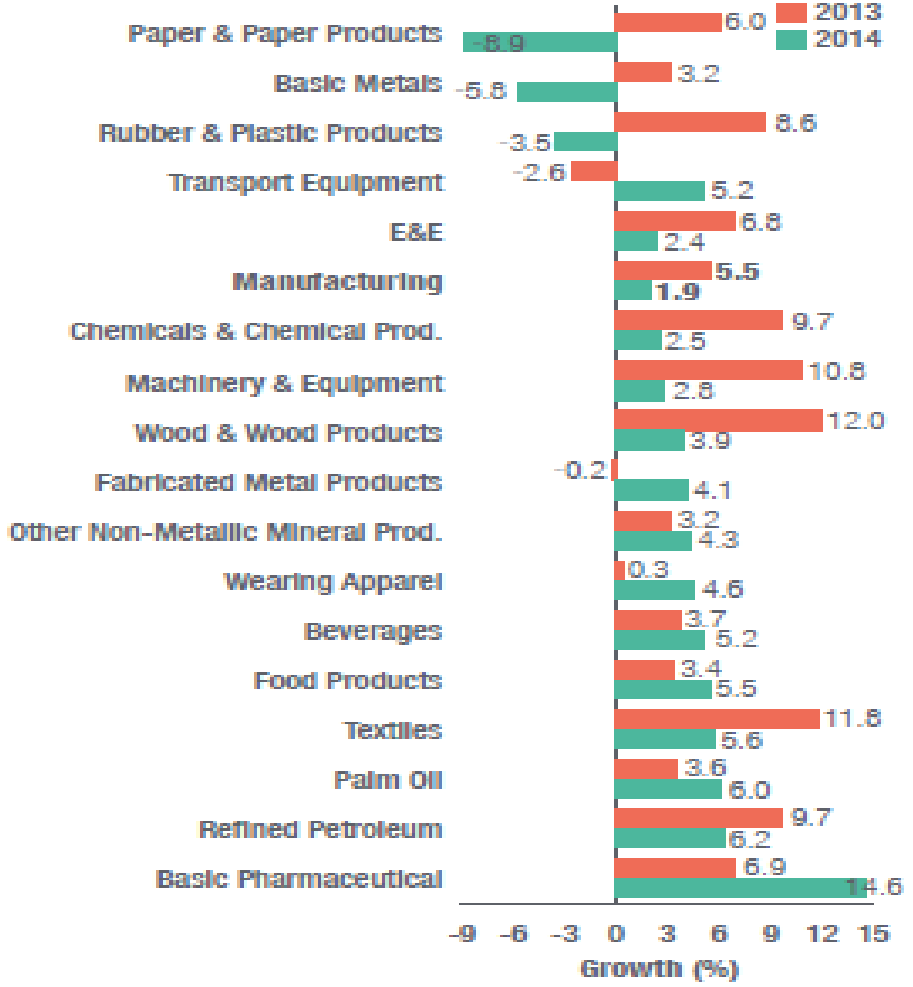


Figure 4.9: Growth of Labour Cost per Employee of Selected Manufacturing Sub-Sectors, 2013-2014



Source : Productivity Report 2014/2015, MPC

INTRODUCTION

- In Malaysian Goverment has long placed much emphasis on the Importance of the relationship between wages and productivity.

- Increase in wages without corresponding increase in productivity could aggravate inflationary pressures

Problem Statement

- Increase in wages without corresponding increase in productivity could aggravate inflationary pressures as well as erode the country's international competitiveness and its attractiveness as a profitable centre for foreign investment.

ISSUE

- One of the causes for the decline in FDI in Malaysia is that the country has been losing its competitiveness due to pressure on wages

- Malaysia is no longer a centre for cheap labor and low-cost production as compared with countries like China, India or Vietnam (Yusof, 2006)

LITERATURE REVIEW

Researcher	Year	Empirical Study	Summary of Finding
Saten Kumar & Don J. Webber & Geoff Perry,	2012	Real wages, inflation and labour productivity in Australia	Granger causality test results suggest that real wages and inflation both Granger-cause productivity in the long run
Dr. Goh Soo Khoon	2009	Is Productivity Linked To Wages? An Empirical Investigation in Malaysia	The increase in real wage exceeds the increase in labor productivity; this partly reflects a tight labor market in Malaysia.
Andrew Sharpe, Jean-François Arsenault, and Peter Harrison	2008	The Relationship Between Labour Productivity And Real Wage Growth In Canada And OECD Countries	Labour productivity growth is the only way to raise living standards in the long run, and real wages are the most direct mechanism to transfer the benefits of productivity growth to Canadians
Jack Strauss	2004	The Linkage Between Prices, Wages, and Labor Productivity: A Panel Study of Manufacturing Industries (US Manufacturing)	Increases in prices lead to less than one-for-one movements however, a one-to-one relationship is strongly rejected between real wages and productivity. Increases in labor productivity are associated with a less than unity increase in real wages
Lee-Peng HO and Su-Fei YAP	2001	The Link Between Wages and Labour Productivity: an Analysis of the Malaysian Manufacturing Industry	The increase in real wage exceeds the increase in labour productivity, causing an increase in unit labour cost. Unemployment exerts a negative effect on wages real wage changes and labour productivity increases is negative and insignificant statistically.

OBJECTIVE

- To re-examine the relationship between wages and productivity in the Malaysia manufacturing industries from 1983 to 2012 using more appropriate time series techniques and longer data set.
- To produce an additional empirical evidence for manufacturing industries in Malaysia.
- Shed important light on issues relating the rising wages and productivity.

DATA & METHODOLOGY

According to different wages determination theories, the wages are not only influenced by productivity but also influenced by other factors, such as unemployment (see Blachflower & Oswarld, 1994, Carneiro,1998, Blanchard Kartz, 1999, Lee-Peng Ho & Su-Fei Yap, 2001, Dr Goh Soo Khoon, 2009).
The wages equation specified as follows:

$$Wages_t = \alpha_0 + \beta_1 cpi_t + \beta_2 Prod_t + \beta_3 Unemp_t + u_t \qquad (1)$$

Where, *cpi* is a proxy to inflation rate, Prod is labor productivity, *Unemp* is unemployment rate, and Wages is real wages. Meanwhile, α is the intercept, *u* is the error term and β is the coefficient for independent variable. The equation (1) will be tested using the Malaysia data.

DATA & METHODOLOGY

- This study uses annual times series of Industrial Manufacturing data from 1983 to 2012 that, in principal cover 7 sub-sector industrial manufacturing of Malaysia.

- All data for wages, cpi and unemployment rate are obtain from Department Statistics of Malaysia (DOSM). While productivity is measured by average output per worker and real wages is measured by nominal wages divide by inflation rate. All variables were transformed in logarithmic form so that coefficients can be interpreted as elasticities

Unit Root Test

One of the first unit root tests to be developed for panel data is that of Levin, Lin and Chu (2002). Their test (denoted LLC) involves the null hypothesis:

H_0: ρi = 0 for all *i*, against the alternative
H_1: ρi = ρ < 0 for all *i*.

First, we applied the LLC and IPS, panel unit root tests for the variables employed in our estimations.

For the variables in level, we obtained that they are all not stationary, therefore we decided to use the first difference of the log values for all variables. The results are reported in Table II

Table II: Panel Unit Root Test

Method	Levin, Lin & Chu		Im, Pesaran & Shin	
	Stat	P-value	Stat	P-value
dlwages	-2.9679	0.00	-6.4233	0.00
dlcpi	-4.2781	0.00	-5.9021	0.00
dlprod	-4.1073	0.00	-6.9411	0.00
dlunemp	-3.7698	0.00	-6.1723	0.00

The next step is to estimate the equation. The general form is the following:

$$lwages_{it} = \beta_{0} + \beta_{1} lcpi_{it} + \beta_{2} lprod_{it} + \beta_{3} dlunemp_{it} + u_{it} \qquad (2)$$

FIX EFFECT AND RANDOM EFFECT

- Panel data sets are more orientated towards cross section analyses. Heterogeneity across units is central to the issue of analyzing panel data. Therefore, there is a need to reconstruct equation (1) that is able to capture the fixed and random effect. The equation (1) can be rewritten for fixed effects and random effects model in equation (3) and (4) respectively

- The fixed effect estimation model for panel data with N cross-section observations, and T periods, consider model is:

$$W_{it} = \beta_0 + \beta_1 P_{it} + \beta_2 PROD_{it} + \beta_3 UNEMP_{it} + \alpha_i + u_{it} \qquad (3)$$

This assumes that differences across units of observation can be captured by differences in the constant term.

- Meanwhile, the unobserved effect model for random effect estimation with N cross-section observations, and T periods is:

$$W_{it} = \beta_0 + \beta_1 P_{it} + \beta_2 PROD_{it} + \beta_3 UNEMP_{it} + (\alpha_i + u_{it}) \qquad (4)$$

v_{it}

This assume that α_i are not correlated with any of the explanatory variables, we can estimate the model more efficiently

HAUSMAN TEST

- One common method for testing this two assumption is to employ a Hausman (1978) test to compare the fixed and random effects estimates of coefficients.

- Hausman test said, the lower the p-value, fixed effects model will be suitable and the random effects model probably not appropriate

- If the null hypothesis is not rejected, a random effect model is better than its fixed counterpart (Hun Myoung Park, 2009)

- First we have check the Pooled Regression Model vs Fix Effect Model

Pooled Regression Model

```
. xi: regress dlwage dlProd dlunEmp dlcpi
```

Source	SS	df	MS
Model	27.0212108	3	9.00707027
Residual	11.5201761	199	.057890332
Total	38.5413869	202	.190798945

Number of obs	= 203
F(3, 199)	= 155.59
Prob > F	= 0.0000
R-squared	= 0.7011
Adj R-squared	= 0.6966
Root MSE	= .2406

dlwage	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dlProd	.1335746	.0298506	4.47	0.000	.0747105	.1924388
dlunEmp	-.1585472	.1224268	-1.30	0.197	-.3999675	.0828731
dlcpi	2.93056	.2411863	12.15	0.000	2.454952	3.406169
_cons	-.8241755	.3335824	-2.47	0.014	-1.481985	-.1663656

Fixed Effect Model

```
Fixed-effects (within) regression               Number of obs      =       203
Group variable: Ind_id                          Number of groups   =         7

R-sq:  within  = 0.9476                         Obs per group: min =        29
       between = 0.0814                                        avg =      29.0
       overall = 0.6773                                        max =        29

                                                F(3,193)           =   1163.03
corr(u_i, Xb)  = -0.1405                        Prob > F           =    0.0000
```

dlwage	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dlProd	.2657561	.0359367	7.40	0.000	.194877	.3366353
dlunEmp	-.1353281	.0447047	-3.03	0.003	-.2235005	-.0471556
dlcpi	2.24671	.2053671	10.94	0.000	1.841658	2.651762
_cons	-1.144823	.138308	-8.28	0.000	-1.417612	-.8720339
sigma_u	.2536309					
sigma_e	.08717131					
rho	.89435417	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(6, 193) =   220.51                 Prob > F = 0.0000
```

Pooled Model or Fix Effect Model

```
. estimates table fixed ols, star stats(N r2 r2_a)
```

Variable	fixed	ols
dlProd	.26575611***	.13357463***
dlunEmp	-.13532805**	-.1585472
dlcpi	2.2467098***	2.9305604***
_cons	-1.1448232***	-.82417553*
N	203	203
r2	.947584	.70109596
r2_a	.94513973	.69658987

legend: * p<0.05; ** p<0.01; *** p<0.001

Fix Effect Model more superior then Pooled Model

Random Effect Model

```
. xtreg dlwage dlProd dlunEmp dlcpi, re

Random-effects GLS regression                   Number of obs      =       203
Group variable: Ind_id                          Number of groups   =         7

R-sq:  within  = 0.9476                         Obs per group: min =        29
       between = 0.0811                                        avg =      29.0
       overall = 0.6790                                        max =        29

                                                Wald chi2(3)       =   3498.07
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000
```

dlwage	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
dlProd	.2605025	.035235	7.39	0.000	.1914431	.3295618
dlunEmp	-.1361892	.0446316	-3.05	0.002	-.2236655	-.0487129
dlcpi	2.275075	.2017323	11.28	0.000	1.879687	2.670463
_cons	-1.134302	.1699143	-6.68	0.000	-1.467327	-.8012758
sigma_u	.26454232					
sigma_e	.08717131					
rho	.90205346	(fraction of variance due to u_i)				

Fix Effect Model or Random Effect Model ?

```
. hausman fixed random
```

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
dlProd	.2657561	.2605025	.0052537	.0070671
dlunEmp	-.1353281	-.1361892	.0008612	.0025552
dlcpi	2.24671	2.275075	-.0283655	.0384674

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 0.55
Prob>chi2 = 0.9068

Random Effect Model is more appropriate

SUMMARY

dlwage	Fixed effects Model	Random effects Model
dlprod	0.266 ***	0.261 ***
	(0.036)	(0.035)
dlcpi	2.246***	2.275***
	(0.205)	(0.202)
dlrunem	-0.135***	-0.136***
	(0.045)	(0.045)
F-Statistic	1163.03	3498.07
Prob>F	0.000	0.000
R-squared	0.677	0.679
D-Watson	2.272	2.272

*Note : *** Significant at 1% , **Significant at 5%, and *Significant at 10%*
( ) donated std error

DIAGNOSIS TEST

Serial Correlation Test

- When running autocorrelation test for residual which proposed by Wooldridge where the null hypothesis is no first order autocorrelation.
- We found that we fail to reject null hypothesis at the probability was 0.156 and conclude that no serial correlation. (D-Watson = 2.27)

Heteroskedasticity Test

- We test for heteroskedasticity is available for the Random- effects model using this command :

```
. xtcsd, pesaran abs

Pesaran's test of cross sectional independence =     3.211, Pr = 0.0513
Average absolute value of the off-diagonal elements =     0.387
```

- We fail to reject null hypothesis at 5% significant level. We conclude no heteroskedasticity exists in this model.

EMPIRICAL RESULTS

dlwages = 2.275 dlcpi + 0.261 dlprod - 0.136 dlruenm
(0.202) (0.035) (0.045)

All of the variables are statistically significant at 1% level. Based on report in above, all signs of coefficients in the wage equation are consistent with economic theory.

Labour Productivity

- For every 1% change in labour productivity, wages increase by 0.26% holding other variables constant.

- The finding reveals that rising in wages is lower than labour productivity. Eventually, this will slightly increase the labour cost, thus it becomes competitive in the manufacturing sector

EMPIRICAL RESULTS

Unemployment Rate

- Unemployment rate appears to be significant at 1% level and it shows a negative relationship.
- As the number of unemployed workers increase, the excess in labour supply will result in lowering of wages.
- The finding reveals that 1% increase in unemployment rate will decrease wages by 0.14%. The relative low elasticity suggests a measure of stickiness in wage adjustment.

Inflation Rate

- Inflation rate is significant at 1% level it shows a positive relationship.
- It shows the strong positive impact and influence wages at the rate of 2.28% increase with 1% increase in inflation.

CONCLUSION

- Domestic and foreign investments are paramount in accelerating the Malaysian Economy.

- Similarly, efforts should be given on the training schemes for the semi as well as the unskilled workers as to be relevant in the job market as stated in 11MP through Technical and Vocational Education and Training (TVET).

- In the **Eleventh Malaysia Plan (2016-2020),** Government strengthening macroeconomic resilience for sustained growth such as unlocking the potential of productivity, improving labour market efficiency and investment to accelerate economic growth.

- Future studies recommended:
  Impact of minimum wages policy and job creation in Manufacturing sector

THANK YOU