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LABOUR DEMAND ELASTICITY AND MANPOWER REQUIREMENTS OF SKILLED LABOUR IN MALAYSIAN MANUFACTURING SECTOR

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Abstract: *The objective of this study is to analyse short term and long term effects of labour demand, which are professional and technical labour using the dynamic panel model. By using the seemingly unrelated regression, this study estimates the elasticities of labour demand for these two high-level occupations. Based on the elasticities, this study forecast the requirements of these two occupational categories. The data of fifteen sub sectors of the manufacturing sector from 1990 to 2010 period obtained from the Industrial Manufacturing Survey, Malaysia were utilized. The findings show the elasticity of labour-output is generally positive, while the elasticity of labour-wage are positive and negative depending on the occupational category. The forecast of the manpower requirements both for professional and technical group are highly dependent on the output growth of a sector, and the initial manpower stocks are dominated by the technical labour group.*

Key words: *Labour demand elasticity, manpower requirement, skilled labour, manufacturing sector*

JEL codes: *J2, J23, J24*

INTRODUCTION

The rapid change in technology and globalization has transformed the practice of production, transition of the economic sectors, outsourcing of products and services, management practices and so forth. These factors lead to change in demand for labour, particularly demand for labour by skills in terms of proportion and the number of labour required. Due to change in demand for labour market, firms attempt to cope with such changes that imply the need of manpower planning. Moreover, the manpower requirements would be able to forecast the manpower needs whether at sectoral level, industrial level or national level.

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The projection of manpower planning can be strategies into two types of planning, i.e. short term and long term planning. The short term planning concerned with the process of matching the existing employees with their present jobs so that they perform efficiently, while the long term manpower planning taking into account a dynamic process of technological advancement strive to develop that organisational structure will meet future manpower requirements in the best possible manner. Therefore, to make as far as possible correct estimates of future manpower requirements is the main focus of manpower planning.

Therefore, new manpower requirements over and above the replacements, matching the existing employees with their job specifications in terms of qualifications and abilities needed for different types of jobs will minimize mismatch problem, so that worker can performed efficiently. It can be concluded that manpower inventory and analysis provides valuable information pertaining to present and future employees needed in any level. The information may not be completely accurate but it is valuable and provides basis for the recruitment, selection and training processes.

In Malaysia, globalization and rapid change in technology has transformed demand for labour entirely. Transformation of the economy from agriculture sector to the manufacturing sector has also attributed to change in labour demand by industry. The decreases in the contribution of the agricultural sector reflects the structural changes taking place in the Malaysian economy as shown by the increase in the contribution of the manufacturing sectors and services to the Gross Domestic Product (GDP) and employment. In the face of international competitive market, should be formulated economic strategies in order to maintain the competitiveness of the country. Increased competitiveness depends not only on physical inputs such as capital and labor, but it also depends on the productivity of the labor. In efforts to get to the advanced industrial countries by 2020, labor quality and marketability of all the skills that are required.

The manufacturing sector has contributed significantly to growth of the Malaysian economy, though its current contribution however relatively smaller compared to services sector. Until October 2012, the value added of the manufacturing sector increased by 5.2%, an increase of RM 25.6 billion in the first ten months in 2012. The number of manpower in this sector has increased by 1.7%, an increase of 16,867 persons to 1,024,352 persons (Malaysia, 2013). For the same period, the average sales value per employee has increased by 3.5%, where the increase is a positive sign of economic growth. Despite the slower growth as mentioned above, the manufacturing sector is still needed a larger workforce, especially for unskilled category approximately 34%, while skilled category comprise of 26%. The overall of contribution of the total employment in the manufacturing sector is about 17.8% (Malaysia, 2013). Given the significant contribution of the manufacturing sector to economic growth, it is desirable that the manufacturing sector is supplied with sufficient manpower requirements, so that it can continuously drive the economy. But in ensuring that the needs sufficient manpower needed in every sector, Malaysia is still facing various issues in the labour market, particularly unemployment and mismatch problem.

Unemployment is a problem that may arise due to the change in production techniques from labor-intensive to capital-intensive and mismatch problem. In a tight labor market, to find a job is very competitive among graduates, so in turn it may increase the unemployment rate. In 2012, the number of unemployed workers in Malaysia is about 396,300 people (LFS, 2013). To overcome that problem, skill is very important to enhance employability among the graduates (Rasul *et al.*, 2009). Technical students in Malaysia has more than sufficient technical skills, but some employers feel less satisfied, especially in terms of motivational skills, communication skills, interpersonal skills, critical thinking, problem solving and entrepreneurial skills that are part of the employability skills that are not controlled in circles this technical graduates (Ramlee, 2002).

Data and information on the labor market and manpower projection needs of the economy and employment by sector is very important in planning and policy formulation and economic development strategies, particularly human capital development planning. However, the issue of lack of information on labor market demand has also been a main issue for the policy maker discussion. Where it is one of the major challenges faced by institutions of higher education, particularly for the provision of skills training in education planning and training (Siti Nor Habibah et al, 2012). These challenges include determining the courses offered and the number of students required being consistent with labour market needs. So the suitable manpower planning must be implemented to ensure that the labour supply at this sector has always been sufficient in the future.

Though a number of studies have been done on labour demand analysis, particularly on the manufacturing sector, none of the studies have analysed labour demand in the context of dynamic-panel model. Therefore, this study has advantage in observing labour demand both in short term and long term period. The first objective of this study is to analyze the effect of labour demand for output and wage rate for two high-level occupations, which are professionals and technical workers. The second objective of this study is to project the requirements of these two occupational categories in the future. This paper is organized into the following section. The next section is a review of existing literature followed by a section on the methodology, data and model specification. The fourth section presents the findings and discussion. The final section entails the conclusion of the study.

Literature Review: Over the past decade, there has been a choice of techniques and approaches been used in quantifying manpower labour requirements. The technique of forecasting attempts to achieve the optimal number of employees with the right skills and ability for the right type of job, so that is able to minimize the mismatch problems as well. However, experts in this area still dispute in terms of pertinent and effective methods or techniques used for manpower planning forecasting. In principle, debates between two schools of thoughts is still prolonged between structuralists and neoclassical. The former group perceives the manpower requirements through the employer's perspective. From the viewpoint of employers, they always require a capable worker in achieving and maintaining desired production levels, reduction in labour turnover, effective utilisation of manpower resources and undertaking program for the development of employees. The labour market is relatively stiff (Hughes, 1991). Hence, the manpower requirement forecasts is essential to balance demand and supply in labour markets as well as to ensure that labour is obtainable in the required quality and quantity in each occupation in the future.

Meanwhile, the latter observes labour as the supplier of workforce. Neoclassical economists incline that labour markets are flexible, skill substitution is relatively free and that wage differentials adjust spontaneously to any imbalances that arise (Papps, 2001). These two contrast viewpoint analyse using different models. The Manpower Requirements Approach (MRA) is appropriate for the demand side of manpower planning, while for the supply side, the pertinent approach is the Rate of Return Approach (RRA). The MRA approach insists that manpower requirement forecasts strongly deal with labour demand. The analysis of manpower planning is helpful in projecting future manpower needed due to mismatch problems. In addition, retirement, resignation, retrenchment, discharge, demotion, separation and etc. also create an additional job in labour market. Manpower planning is a logical result to the continuous mismatch in skills between supply of and demand for labour, resulting in persistent increase in unemployment (Hopkins, 2002). Another problem is job-worker mismatch exhibits the inefficiency in resource allocation in the economy. Moreover, the investment in human capital by the labour is not utilized at the maximum level production activity, consequently resulting in the different wages between workers (Badillo & Vila, 2013).

Moreover, manpower planning is an important in the process of achieving economic goals and facilitating growth, workforce needs in various stages of approval and various types of jobs created. The importance of human resource development in Malaysia can be divided into three elements; labor productivity, labor skills to adapt and restructure society (Rahmah & Idris, 2004). The study suggests that the demand for skilled manpower in economic sectors can be reinforced by considering labor skills adjustment. For instance, labor supply should be adapted to the structure of demand employment as this is necessary to avoid the problem of skills mismatch and unemployment problems. In the others words, manpower planning is a process to predict manpower needs in accordance with the requirements of output by sector in the economy.

In the previous study, they forecast the manpower needs in agriculture-based industries from 1997 to 2001 using Manpower Requirement Approach (MRA) (Rahmah & Idris, 2000). The study found that during period, high demands for labor can be seen in wood products and rubber products industries. However, skilled labour such as engineers and technicians are less needed in agriculture-based industries as compared to non-agriculture-based industries. Using similar approach, another study conducted by Zakariah & Siti (1997) showed that the number of people employed in the manufacturing sector for the year 2000 has a large decline and it is likely occurred on technical and professional skilled labour. Although, a variety of programs have designed to drive the skilled manpower imbalance, but there still always be manpower imbalance in the labour market.

The reduction of employment in the manufacturing sector is also demonstrated in a study by Judith (2004) in China. The number of employment estimates was around 98 million in 1995 and it is dropped to 80 million in 2001 and recovering to 83 million in 2002. The study in the United States found that the composition of exports has affected the manufacturing sector manpower by reducing labor demand during the recession in 1991 (LeClair, 2002). In a study of the Mexican manufacturing sector, trend in employment has been declining especially for the export-oriented industries covering the period from 1970 to 1993 (Alarcon & Zepeda, 1998).

Meanwhile, using the same approach, Poo *et al.* (2012) forecast manpower needs in Malaysian manufacturing sector for a different job categories under the Third Industrial Master Plan (IMP3). The study observes that the labour productivity of the manufacturing sector has increased and there is reduction in demand for labour, particularly demand for high-skilled category. The larger demand for manpower is obtained in industries of machinery, raw materials product and, wood and wood products. Similar study also revealed the sub sector of domestic equipment, sub sector of radio and television and the manufacturing of plastic products is among the three sub sectors that needs larger manpower requirement (Siti Nor Habibah *et al.*, 2012).

A number of studies analyse demand for labour using the econometric methods. A recent study by Akay *et al.* (2013) have utilized panel data at firm level of six industries from 1991 to 1997, which consists of food, furniture, wood, metal, machinery and textiles. The results showed that elasticity of wage both for skilled and unskilled labour are negative ranging from -0.88 to -0.92 for skilled and from -0.65 to -0.89 for unskilled labour. The long-term demand for skilled and unskilled labour using panel data in Colombia recorded that the output elasticity was 0.89 and 0.76 and the wages elasticity for both categories of labour are -0.42 and -0.65, respectively (Roberts & Skoufias, 1997). Another study estimate only the substitution among white-collar labour, blue collar labour and capital in eighteen industries of the manufacturing sector in Canada from 1962 to 1982 (Betts, 1997). The study obtained that the capital and labour demand by category are complementary skills.

A different dimension of study by Zaleha, Rahmah & Mohd Anuar (2007) attempts to identify the factors that affect demand for high-level manpower requirement consists of professional, skilled workers and managerial workers of the manufacturing sector in Malaysia. The study focused on timber industry, transportation equipment, electrical and electronics, metal and food industries. The results showed that the output level becomes an important factor for the professional and highly-skilled managerial workers in all industries, while wage rate and the price of capital are not significant. This study concludes that the professional and skilled workforce is an important contributor to the increase in output of the manufacturing sector in Malaysia.

Several studies have examined the elasticity of substitution between capital and labor of the manufacturing sector. A higher elasticity of substitution between labour and capital may result in a higher level of labour productivity in the steady-state (Klump & de La Grandville, 2000). Further, the substitution of capital-labour elasticity may also implies demand for labour and manpower requirements. In 1969, a study by Thillainathan on the capital-labor elasticity of West Malaysia was recorded positive elasticity, ranging from 0.45 to 1.18. The similar result obtained in a study by Virmani & Hashim (2009) estimates the elasticity of substitution between capital and labour approximately about 0.64. The results show the substitution between both inputs is low in the case of the manufacturing industries in India.

In contrast, the result obtained by Upender (2009) is contradictory with the result acquired by Virmani & Hashim (2009), which found the elasticity of substitution between capital and labor of the manufacturing industries in India is more than unity. A current study by Bishwanath *et al.* (2013) attempt to reconfirm the elasticity of substitution between capital and labor in Indian manufacturing industries by considering twenty-two industries at two-digit-level indicate that the elasticity of substitution commonly less than one. It shows the elasticity range from 0.54 to 0.97 of the study period from 1980 to 2007.

Considering all of this evidence, it seems that manpower requirements of the manufacturing sector tend to be reduced. Together, these studies indicate that output or labour productivity of the manufacturing sector increased consistently with an increasing forecasts in the workforce, particularly demand for high skilled labour. All of the studies reviewed here support the human capital theory that labour quality, whereby skilled labour ultimately contribute to a larger output or higher productivity of a firm. However, previous published studies are limited to analyse manpower requirements on the forecasting by observing labour demand elasticity or capital-labour elasticity. Based on this observation, this study attempts to provide some insights of labour demand analysis by observing the short term and long-term period. In addition, using the seemingly unrelated regression (SUR), this study forecast demand for labour of the manufacturing, specifically skilled labour professional and technical.

THE METHODOLOGY

Source of Data: This study utilizes data from the Industrial Manufacturing Survey (IMS) published by the Department of Statistics Malaysia (DOS). This study employs dynamic panel regression analysis, which data covers the period from 1990 to 2010 of the manufacturing sector. The sub sectors of the manufacturing sector are classified at 3 digit-level of the Malaysian Standard Industrial Classification (MSIC, 2000 & 2008) consists of 15 sub sectors of the manufacturing sector. The total number of sub sectors accounted for 315 observations.

Labour demand estimation dynamic-panel model: This study utilizes a dynamic panel data models, where the number of time series observations, T, is ralatively large and of the same order of magnitude as N, the number of groups. In this study, we analyses group by the sub sectors. The general equation of autoregressive distributed lag (ARDL) ($p, q_1, \ldots . q_k$) of the panel dynamic model can be written as follows:

$$\Delta y_{it} = \phi_i y_{i,t-1} + \beta_i x_{i,t-1} + \sum_{j=1}^{p-1} \lambda^{*}_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta^{*}_{ij} \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \qquad (1.0)$$

$i = 1, 2, \ldots, N$, and $t = 1, 2, \ldots, T$, where $\phi_i = -\left(1 - \Sigma_{j=1}^{p} \lambda_{ij}\right), \beta_i = \Sigma_{j=0}^{q} \delta_{ij}$

y_{it} is a $T \times 1$ vector of the observation on the dependent variable of the i-th group indicates labour demand by occupational, X_{it} is a $T \times k$ matrix of observations on the regressors that vary both across groups and time periods, t. μ_i represents fixed effects, ϕ_i presents scalar coefficient of lagged dependent variable, β_i is a coefficient vector $k \times 1$ of explanatory variables, λ^{*}_{ij} is coefficient of lagged explanatory variable at first-differences, and $y_{i,j}$ is a coefficient of vector $k \times 1$ explanatory variable lagged first-differences.

The ARDL model relies on the assumption that disturbances ε_{it} are independently distributed across i and, t, with zero means and varians, $\delta_i^2 > 0$. Furthermore, the assumption of the model is stable ensures that error correction term $\phi_i < 0$, and hence there exists a long run relationship between y_{it} and, x_{it}. The long run relationship can be written as follows:

$$y_{it} = \theta'_{ij} x_{ij} + \eta_{ij} \quad i = 1,2,\ldots .. N; t=1,2,\ldots \ldots T \qquad (2.0)$$

Where; $\theta'_{ij} = -\frac{\beta_i}{\phi_i}$ the long run coefficients on X_i, η_{ij} is a stationary process. Finally equation (1) can be rewritten in the system vector error correction model (VECM) as in equation (3).

$$\Delta y_{it} = \phi_i \eta_{i,t-1} + \sum_{j=1}^{p-1} \lambda_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} y_{i,j} \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \qquad (3.0)$$

Where; $\eta_{i,t-1}$ is the error component generated from long run equation as in equation (2), is the error correction term to standardized long run balance. If =0, there is no long run relationship between regressors and dependent variable. The parameters estimate are expected negatively significant under assumption of the long run equilibrium. In this study, we identify the short run and long run relationship between labour demand by category for both types of occupational. The estimation model of labour demand for both categories in the present study is divided into two types as below: Labour demand estimation ARDL model and PMG procedure:

$$\Delta \ln PR_{it} = \alpha_0 + \phi_{1i} \ln PROF_{i,t-1} + \beta_{1i} \ln OP_{i,t-1} + \beta_{2i} \ln WP_{i,t-1} + \beta_{3i} \ln WT_{i,t-1} + \beta_{4i} \ln INF_{i,t-1} + \beta_{5i} \ln KL_{i,t-1} + \sum_{j=1}^{p-1} \lambda_{1ij} \Delta \ln PR_{i,t-j} + \sum_{j=0}^{q-1} \gamma^*_{1i,j} \Delta \ln OP_{i,t-j} + \sum_{j=0}^{q-1} \gamma^*_{2i,j} \Delta \ln WP_{i,t-j} + \sum_{j=0}^{q-1} \gamma^*_{3i,j} \Delta \ln WT_{i,t-j} + \sum_{j=0}^{q-1} \gamma^*_{4i,j} \Delta \ln INF_{i,t-j} + \sum_{j=0}^{q-1} \gamma^*_{5i,j} \Delta \ln KL_{i,t-j} + \varepsilon_{1t} \quad (4.0)$$

$$\Delta \ln TC_{it} = \alpha_0 + \phi_{1i} \ln TC_{i,t-1} + \beta_{1i} \ln OP_{i,t-1} + \beta_{2i} \ln WP_{i,t-1} + \beta_{3i} \ln WT_{i,t-1} + \beta_{4i} \ln INF_{i,t-1} + \beta_{5i} \ln KL_{i,t-1} + \sum_{j=1}^{p-1} \lambda_{1ij} \Delta \ln TC_{i,t-j} + \sum_{j=0}^{q-1} \gamma^*_{1i,j} \Delta \ln OP_{i,t-j} + \sum_{j=0}^{q-1} \gamma^*_{2i,j} \Delta \ln WP_{i,t-j} + \sum_{j=0}^{q-1} \gamma^*_{3i,j} \Delta \ln WT_{i,t-j} + \sum_{j=0}^{q-1} \gamma^*_{4i,j} \Delta \ln INF_{i,t-j} + \sum_{j=0}^{q-1} \gamma^*_{5i,j} \Delta \ln KL_{i,t-j} + \varepsilon_{2t} \quad (5.0)$$

Labour demand estimation model SUR procedure

$$\ln PR_{it} = \alpha_3 + \beta_{31} \ln OP_{it} + \beta_{32} \ln WP_{it} + \beta_{33} \ln WT_{it} + \beta_{34} \ln KL_t + \beta_{35} \ln INF_t + \varepsilon_{3t} \quad (6.0)$$

$$\ln TC_{it} = \alpha_4 + \beta_{41} \ln OP_{it} + \beta_{42} \ln WP_{it} + \beta_{43} \ln WT_{it} + \beta_{44} \ln KL_t \beta_{45} \ln INF_t + \varepsilon_{4t} \quad (7.0)$$

Where: ln *PR* : total labour of professional
In *TC* : total labour of technical
ln *OP* : total output
ln *WP* : monthly wage of professional labour
ln *WT* : monthly wage of technical labour
ln *KL* : capital labour ratio
ln *INF* : inflation rate

The Findings

Unit Root Test Analysis: This study utilizes the unit root test of Augmented Dickey Fuller (ADF) dan Philips Perron to test the stationary of each variables. The outcome of the unit root test for both procedures are presented in Table 1. From the table, all the variables are stationary at first difference l(1) at both conditions of with trend and without trend at 1%, 5% and 10% level of significant. These conditions implied that the spurious regression can be avoided as all variables are stationary at first difference, result the use of the ARDL model is more appropriate.

Table 1
Results of unit root test Augmented Dickey Fuller (ADF) dan Philips Perron (PP)

Variable	*ADF*		*PP*	
	without trend	*with trend*	*without trend*	*with trend*
		at level		
lnPR	-0.2154	-0.8945	-1.428	-3.605
	(0.1352)	(0.2481)	(0.1351)	(0.2480)
lnTC	-1.0462	-1.0978	-1.0500	-1.0800
	(0.2352)**	(0.2436)**	(0.2350)**	(0.2440)**
lnOP	-1.0274	-1.0834	-1.0274	-1.0835
	(0.1590)***	(0.1665)***	(0.1591)***	(0.1656)*
lnWP	-10.933	-10.822	-1.150	-1.2935
	(0.8536)***	(0.8965)***	(0.2334)**	(0.2383)***
lnWT	-1.1278	-1.4162	-1.2097	-1.4161
	(0.2341)**	(0.2268)***	(0.2299)**	(0.2268)***
lnKL	-0.6734	-0.7014	-0.673	-0.7014
	(0.2074)**	(0.2244)*	(0.2735)**	(0.2240)**
INF	-0.8155	-1.0224	0.8200	-1.0223
	(0.2363)**	(0.2395)***	(0.2364)**	(0.2400)**
		at first difference		
ΔlnPR	-1.4531	-1.4572	-7.1982	-7.027
	(0.2166)***	(0.2224)***	(0.2170)***	(0.2224)**
ΔlnTC	-1.5001	-1.5023	-1.5001	-1.5023
	(0.2099)***	(0.2162)***	(0.2100)***	(0.2162)***
ΔlnWP	-2.7839	-2.7729	-1.8755	-1.8773
	(0.4994)**	(0.51334)**	(0.1172)***	(0.1199)***
ΔlnWT	-12.163	-14.907	-1.7956	-1.7984
	(2.4845)**	(2.0749)**	(0.1469)***	(0.1505)***
ΔlnOP	-1.2724	-2.6767	-1.2724	-1.2643
	(0.1948)***	(0.4290)***	(0.1948)***	(0.1933)***
ΔlnKL	-1.864	-1.9691	-1.3479	-1.3628
	(0.3931)**	(0.4002)**	(0.2289)***	(0.2334)***
ΔINF	-1.5718	-1.5792	-1.6000	-1.5800
	(0.1989)***	(0.2060)***	(0.1990)***	(0.2100)***

Note: i. ***, **, * significant at level 0.01, 0.05, 0.10, respectively & ^{ns} not significant.
ii. Figures in parentheses are standard deviation.

Results of Labour Demand Model - Pooled Mean Group: Table 2 reports the results of labour demand model by category of occupation using the pooled mean group model. The Hausman's specification test is used to test hypotheses in terms of bias or inconsistency of an estimator (Hausman, 1978). The test evaluates the consistency of an estimator when compared to an alternative, less efficient, estimator which is already known to be consistent. It helps one evaluate if a statistical model corresponds to the data. From the test, the selection of appropriate model can be made between the mean group estimator (MG) and pooled mean group estimator (PMG).

Under null hypothesis, the selection of PMG estimator can be made if the value of chi-square is not significant to present the PMG estimator is more efficient.

For professional group, the test shows the chi-square value at 1.26, and prob> chi-square = 0.9394 present the null hypothesis of the Hausman test is not significant, whereby the PMG model should be the best estimator (see Appendix 1a). The similar result obtained for the technical group. The chi-square indicates 1.92 and prob> chi-square = 0.8596 reject null hypothesis that shows probability value is more than 0.05. This means the Hausman test is not significant in order to select the PMG estimator (see Appendix 1b).

Results of the estimation shows that the ECT value is significant and less than one, meaning that there is a short run and long run relationship between the dependent and explanatory variables. The study also found that in the short run, the significant determinants for professional labour demand are real output (OP), capital labour ratio (KL) and inflation rate (INF).

Table 2
Results of estimation for profesional and technical categories of occupation
Pooled Mean Group (PMG)

Variable	*ln Professional* *ARDL (0,2,0,0,2,1)*	*ln Technical* *ARDL (0,0,0,0,1,0)*
Short run effects		
ΔlnOP	0.4116	0.327
	(0.0584)***	(0.0857)***
ΔlnWP	-0.0819	0.3348
	(0.0514)	(0.2594)
ΔlnWT	0.0048	-0.3195
	(0.0224)	(0.3240)
ΔlnKL	-0.0036	0.2018
	(0.0012)**	-0.1285
ΔnlNF	0.0179	0.0221
	(0.0072)*	(0.0283)
Konstan	-0.4897	0.4564
	(0.0997)***	(0.0960)***
Error correction term (ECT)	-0.3776	-0.3807
	(0.0595)***	(0.0820)***
Long run effects		
ΔlnOP	0.6393	0.5314
	(0.0274)***	(0.0476)***
ΔlnWP	-0.0728	0.6675
	(0.0158)***	(0.0760)***
ΔlnWT	-0.0235	-0.7532
	(0.0097)*	(0.0772)***
ΔlnKL	-0.0078	-0.2369
	(0.0035)*	(0.1012)*
ΔnlNF	-0.0556	-0.0100
	(0.0108)***	(0.0219)***

Note: i. ***, **, * significant at level 0.01, 0.05, 0.10, respectively, ns not significant.
ii. Figures in parentheses are standard deviation.

Professional Group: According to Pesaran, Shin & Smith (1999), the error correction term (ECT) and the hypothesis $\varphi_i \neq 0$ are needed to ensure the long-term effects of the relationship in the variables. The results of the profesional group that uses ARDL (0,2,0,0,2,1) found that in the short term, the negative ECT is -0.3776 and significant at 1% level of significance. The result highlights the existence of long-term relationships in the group based on the negative sign of the ECT value. In other words, the long-term relationships exist between independent variables and the dependent variable in this study.

The finding from this study in short term shows the variables of OP, KL and INF have significant relationship of the demand for professionals. The coefficient obtained for OP and INF are positive indicate for 0.4116 and 0.0179, respectively, while KL with -0.00355. The wage variable for both groups (WP and WT), however insignificant. In the long run, all variables found to be significant to demand of the professional workforce. This is reflects by 1% increase in real output will increase demand for professional workforce of 0.639%.

Technical Group: The similar result obtained for the technical group that uses ARDL (0,0,0,0,1,0) found that in the short term, the ECT value is also -0.3807 and significant at 1% level of significance. This highlights the existence of long-term relationships in the model studied as to demonstrate the existence of long-term relationships between independent variables and the dependent variable. The study found that the variable WT, K/L and INF negatively correlated and significant at 1% and 10% level of significance. The variable WP and OP, even though significant at 1% level of significance, but both variables have a positive sign. This means the effect of change in wage rate of professional workers to demand for the technical workforce is positive.

Results of Seemingly Unrelated Regression (SUR): The results of the labour demand model estimation using the seemingly unrelated regression approach for the manufacturing sector are presented in Table 3. The value of R^2 for the professional labour demand is 0.7357, while for the technical labour is 0.6392. This means that 73.57% and 63.92% of the variations of the respective dependent variables can be explained by the independent variables included in the model. The estimation outcome indicate that the influence of wage rate and output are still consistent with the labour demand theory with output playing a positive and significant role in determining labour demand for the two categories of occupation. Meanwhile, the wage rate influences demand for labour for both occupational categories negatively and significantly.

The cross effect results from changes in wage rate are still similar to PMG results. Elasticity of labour-output is relatively high for professional labour compared to technical labour category. This highlights an increase in output by 1% will increase demand for labour of profesional of the manufacturing sector by 0.728%. A similar trend indicated for technical labour with a 1% increase in output resulting in a 0.665%

increase of technical labour of the manufacturing sector. Regarding own wage rate of elasticity, the profesional workers recorded elasticity value is negative, while the technical workers indicate positive value of elasticity. A 1% increase in own wage rate of professional workers decrease demand for this category of labour by -0.121%. The similar trend obtains for technical workers showing that 1% increase in own wage rate of technical workers decrease demand for this occupational group by -0.331%.

The results of cross wage rate elasticity for both profesional and technical workers, respectively recorded positive value of elasticity. This finding shows the substitutability between the technical and professional occupations of the manufacturing sector. This findings can be related to skills of labour among industries of the manufacturing sector strongly associates with the general skills. Workers with general skills are more substitutable among industries and occupations compared to the specific skills (Daron & Pischke, 1999).

Table 3
Results of Seemingly Unrelated regression (SUR) - estimation for profesional and technical categories of occupation

Variable	*ln Professional*	*ln Technical*
lnrealOP	0.7282	0.6651
	(0.0281)***	(0.0337)***
lnrealWP	-0.1215	0.2494
	(0.0517)*	(0.0612)***
lnrealWT	0.0454	-0.3313
	(0.0495)**	(0.0593)***
lnKL	-0.000534	-0.000655
	(0.000426)***	(0.000511)***
lnINF	-0.0439	0.03092
	$(0.0508)^{ns}$	$(0.0610)^{ns}$
constant	-3.1374	-1.810
	(0.5322)***	(0.6382)**
R^2	0.7357	0.6392
Chi-square	876.71	558.18
prob	0.000	0.000
Obs	315	315

Note: i. ***, **, * significant at level 0.01, 0.05, 0.10, respectively, ^{ns} not significant.
ii. Figures in parentheses are standard deviation.

From the results, both categories of workers show an elasticity of capital labour ratio is significant and negatively correlated with demand for these two groups. A 1% increase in capital labour ratio will decrease demand for professional workers by 0.0004% and technical workers by 0.0005%. This findings is supported by the theory that implies substitutability between capital and labour by occupational categories.

Manpower Requirements Forecast: Table 4 provides the projection of high-level manpower requirements of the manufacturing sector. The growth rates for the manufacturing sector as a whole are relatively low, indicating by 3.3% during the period of 1990 till 2010. This projection took into account the labour output elasticity and the output growth rate. Manpower requirement is dominated by the technical group compared to the professional. However, the output growth rate recorded 3.3% for both categories of occupational group. The professional group relatively indicates larger labour output elasticity compared to the technical. The annual manpower requirement growth rate is rather low which is to grow at 2.16% a year for the 2010-2020 period. The slower growth of the manufacturing sector partly due to the sufficiency of present workforce in the sector leading to lower growth in demand for future recruitment. In addition, the same structure of production and technology used for the next five years results the projection of manpower recruitment for both professional and technical occupations does not change much.

Table 4
Employment projection of the manufacturing sector

Labour force group	*Labour output elasticity* (β_{ij})	*Output growth rate (1990-2010)* (g_r)	*Manpower inventory 2010* (L_{ij0})	*2015 Projection* (L_{ijt})	*2020 Projection* (L_{ijt})	*Annual growth rate (1990-2010)* (%)
Professional	0.7282	0.03306	118485	127042	137737	2.17
Technical	0.6651	0.03306	155134	165369	178163	2.15
Total			273619	292411	315900	2.16

Notes: 1. Calculation of output growth rate (g_r) use output data for professional and technical (year 1990-2010) using the following formula;

$$g_r = \left[n\left(\sqrt{\frac{2010}{1990}} \right) \right] \times 100$$

2. Projection of L_{ijt} is obtained using this formula: $L_{ijt} = L_{ij0} \times n \times \beta_{ij} \times g_r$

CONCLUSION AND POLICY RECOMMENDATIONS

The findings of PMG obtained that in long run the most factor influencing demand for labour in the manufacturing sector is output. Wage rate also influenced labour demand negatively. This supports the labour theory both for demand for professional and technical labour. The finding shows an increase in wage rate of professional workers will increase demand for technical labour. In contrast, an increase in wage rate of technical workers, demand for professional labour will decrease. This study concludes that the technical workers is a substitution of professional workers. However, it did not occurred in the other way around, meaning that, the professional workers cannot be substituted by the technical workers.

The findings from SUR conclude that all variables except inflation are obtained significant with demand for professional and technical workers. From this findings, it shows the similar relationship with the findings from PMG results, in which cross wage rate elasticities are positive for technical workers, while it is negative for the professional workers.

The projection of professional and technical labour requirements show that both occupational categories need more labour parallel with the total inventory in 2010. More specifically, technical occupation relatively needs more labour compared to professional for both projection in 2015 and 2020. As a result, the annual growth rate of labour requirement, technical occupation is expected to have larger growth between 2010 and 2020 compared to professional labour. The implication of these findings is that an effort has to be made to increase labour requirement growth rate for high level occupations to reduce unemployment amongst prospective university graduates. A wage rate that helps improve the welfare of workers can still be increased since it can still increase demand for labour for the whole manufacturing sector. Furthermore, the encouraging growth of demand for these two types of labour implies that present efforts of education and training need to be continued. At the same time, education planning ultimately help policymakers to make decisions towards the formulation of manpower policies more closely, since projections of manpower is also useful for education planning.

A sufficient supply of labour is imperative for a sustained economic growth and this can be done through the education and training system. However, the researchers concede that this study has not covered the supply side of the labour market and consequently unable to project the difference between supply and demand of high level labour in the manufacturing sector. Other study would need to include projection of supply with tertiary education graduates as indicator. A more comprehensive study shall be conducted as an extension to the present study to include supply of high level labour in the manufacturing sector.

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Appendix 1a
PMG Model : Hausman test for professional group

	Coefficients			
	(B) *mg*	*(b)* *pmg*	*(b-B)* *Difference*	*sqrt(diag (V_b-V_B))S.E*
lnWP	2.007854	-0.0728621	2.080716	2.388642
lnWT	-1.755868	-0.0235219	-1.732346	1.881990
lnOP	0.6412847	0.6392953	0.0019894	0.2938005
lnKL	0.0044327	-0.007806	0.0052133	0.0287926
lnINF	-0.2628009	-0.0556217	-0.2071792	0.3376629
Chi-square (5) = (b-B)’[(V_b-V_B)^(-1)](b-B) =1.26				
Prob>chi-square = 0.9394				

b = consistent under Ho and Ha;
B = inconsistent under Ha, efficient under Ho;
Test: Ho: difference in coefficients not systematic

Appendix 1b
PMG Model : Hausman test for technical group

	Coefficients			
	(b) *mg*	*(B)* *pmg*	*(b-B)* *Difference*	*sqrt(diag (V_b-V_B))S.E*
lnWP	0.8071021	0.6674553	0.1396468	1.059482
lnWT	-0.6506025	-0.7531856	0.1025831	1.045508
lnOP	-0.6506025	0.5313622	0.1612403	0.8688803
lnKL	1.96999	-0.2368927	2.206883	2.200759
lnINF	0.3090377	-0.0998951	0.4089328	0.4295577
Chi-square (5) = (b-B)'[(V_b-V_B)^(-1)](b-B) =1.92				
Prob>chi-square =0.8596				

b = consistent under Ho and Ha;
B = inconsistent under Ha, efficient under Ho;
Test: Ho: difference in coefficients not systematic

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