# Chapter 3: Theoretical Outline

## 3.1 Introduction

Based on previous empirical studies discussed in Chapter Two, the hypothesis we can draw upon is that FDI will generate a positive impact on the growth of manufacturing output, increase the import dependency of the manufacturing sector as well as increase the export of goods. At the same time, FDI is believed to increase employment generation in the manufacturing sector as well. In this study, various models proposed by Jansen (1993), Fry (1990) and Dees (1998) will be adopted in order to assess the impact of FDI on manufacturing output growth, imports, exports and employment in Malaysia.

## 3.2 Multiple Regression Models

Multiple regression is adopted in this study since it provides a relatively macro perspective in the assessment of the role of FDI on the growth of the manufacturing sector and it serves our objectives in providing an explanation on the relationship between FDI and key variables in the economy.

### 3.2.1 Manufacturing Output Growth Equation

Basically, the output growth analysis adopts the neo-classical growth model based on Meade's production function (1966) which develops the Cobb-Douglas production function first introduced by Solow(1956). This was adapted by Jansen in 1993.

The original Meade's production function is as followed:

$$Y=F\ (K,\ L,\ R,\ t)$$

Where K = capital, L= labour, R= land and t= time. The t factor represents a trend for constant technological improvement. In that general form, each of the input factors is related to overall output. This implies that by increasing any one or any combination of them, output will increase by some unspecified amount. When land is a fixed factor while both labour and capital can be increased and time marches on, changes in output over time can be stated in terms of changes in factors :

$$\Delta Y=V.\Delta K + W.\Delta L +\Delta Y'$$

where V is the marginal productivity of capital, W the marginal productivity of labour, and ΔY' the improvement in output owing to technological change. This implies that by holding other factors constant, output will increase resulting from one additional unit of a given factor.

To assess the role of FDI in Malaysia's manufacturing growth, we assume that the relationship between the levels of foreign capital inflows and of investment and the rate of growth is based, implicitly and explicitly, on the production function similar to Meade's but with a little modification made by Jansen (1993):

$$Y = f(A, K, L) \qquad (1)$$

In this general form, the level of production (Y) depends on available capital (K) and labour (L) and on a factor A that represents the level of technical knowledge. When expressed in growth rates, this leads to:

$$g = \Delta Y/Y = f'(A', I/Y, g_L) \qquad (2)$$

where $g_L$ is the growth rate of the labour force and A' indicator of the technical progress. There is a tendency to use the Export/GDP ratio (X/GDP or ΔX/GDP ) as indicator of A' in comparative analysis of growth in developing countries.[1] The identity, I = S+F which implies that the excess of investment over the domestic saving is equal to net foreign capital inflows, can be substituted into this equation to shift the attention from the level of investment to its financing. This leads to the general form used by Husain & Jun (1992) in the analysis for the grouped data of ASEAN countries:

$$g = f(X/Y, S/Y, F_i/Y, g_L) \qquad (3)$$

[1] This is base on the assumption that export markets require and impose a higher efficiency.

where $F_i$ are the different types of capital inflows : DFI, aid, private loans, etc. However, this study followed another route from equation (2) and concentrated on the composition of investment rather than on its financing. For instance, Khan & Reihart (1990) split up total investment into private and public investment and estimate an equation of the form:

$$g = a_0 + a_1 I_p/Y + a_2 I_g/Y + a_3 g_L + a_4 g_x \qquad (4)$$

where $I_p$ and $I_g$ are private and public investment respectively and $g_x$ the growth rate of real exports and $g_L$ the growth rate of the labour force. This is also the equation form adopted by Jansen (1993) in analysing the impact of FDI on the economy of Thailand.

Therefore, this research paper adopts the same equation as Jansen (1993) to analyse the impact of FDI on the manufacturing sector in Malaysia. The lagged public investment and foreign investment are included in the regression:

$$g = a_0 + a_1 PIY + a_2 PIY1 + a_3 FDIY + a_4 FDIY1 + a_5 g_L + a_6 g_x \qquad (5)$$

where g = growth rates of the manufacturing output.

$a_0$ = constant coefficient of the model

PIY= share of public investment on fixed capital to manufacturing output

PIY1= lagged PIY

FDIY = share of foreign direct investment to manufacturing output

FDIY1 = lagged FDIY

$g_L$ = growth rate of labour in manufacturing sector

$g_x$ = growth rate of real manufacturing exports

Based on economic theories mentioned above, we should expect public investment, foreign direct investment, growth rate of labour as well as growth rate of real manufacturing exports to yield positive effects on manufacturing output growth.

### 3.2.2 Import Equation

In order to investigate the impact of FDI on manufacturing imports, this study adopts the import demand equation generated by Fry (1990) who tried to assess the differential impacts of foreign direct investment in Southeast Asia.

$$IMY = a_7 + a_8FDIY + a_9REXL + a_{10}XY + a_{11}IMY1 \quad (6)$$

The import demand equation *IMY* is expressed as the ratio of manufacturing imports to manufacturing output (both in constant prices). We assume that Malaysia faces an infinitely elastic supply of imports, thus the country's import volume is determined by its own demand. These demands are affected by the relative prices of imports and non-tradable goods. The real exchange rate (REXL) used as a proxy for the relative price of non-traded goods to imports.

The level of imports may be constrained by the availability of foreign exchange earned by exporters. Therefore the ratio of nominal manufacturing exports to nominal manufacturing output *XY* is used to proxy rationing constraint. Finally, to assess the impact of FDI on manufacturing import, FDI is expressed as a ratio to output where *FDIY* is used. We also assume that current imports are influenced by the previous imports, in this case imports lagged one period is applied in the equation.

Based on the import demand equation generated by Fry(1990), one should expect positive relationship between the ratio of FDI to manufacturing output and imports of goods. As indicated by the trend of imports for the manufacturing sector, an increase of imports seems to be associated with an increase in the flows of FDI. Real exchange rate will yield a negative relationship with imports since an appreciation of the real exchange rate would make the price of imports relatively cheaper, therefore increase the volume of imports. Terms of trade (TTL) would have a positive impact on manufacturing import because an improvement in the terms of trade will tend to increase the imports. XY which is used to proxy the rationing constraint should have a positive link with imports. Finally imports lagged one period would have an uncertain relationship with current import.

### 3.2.3 Export Equation

In the export equation model, export supply $\overline{XY}$, expressed as the ratio of real manufacturing export to manufacturing output (Y), is determined by the relative prices of exports and non-traded goods *REXL* as well as by *FDIY*. Furthermore, we also assume that $\overline{XY}$ is influenced by the lagged ratio of imports to output because it is assumed that the raw material or intermediate imports in the previous year would be used to produce export goods. Hence, the export equation estimated here takes the form of equation (7) as follows:

$$\overline{XY} = a_{12} + a_{13}FDIY + a_{14}REXL + a_{15}IMY_{t-1} \qquad (7)$$

Therefore, the ratio of FDI to manufacturing output will generate a positive impact on export of goods as advocated in the previous studies that FDI generally would be pro-export biased rather than anti-export biased especially with export- oriented FDI. Real exchange rate (REXL) will yield a positive relationship with exports since an depreciation of real exchange rate associated with a devaluation of ringgit will make the export goods relatively cheaper, therefore increases the export of goods. Lagged import of goods would have a positive relationship with current exports.

### 3.2.4 Employment Equation

In order to assess the role of FDI on employment as well as technical progress in the manufacturing sector, the model of long run labour demand equation generated by Stephan Dees (1998) based on the analysis of Barrell and Pain (1997) and Grossman and Helpman(1991) is adopted. Basically the model is based on a constant elasticity of substitution (CES) production function:

$$Q = \gamma[s(K)^{-\rho} + (1-s)(Le^{\lambda t})^{-\rho}]^{1/\rho} \qquad (8)$$

Where $Q$, $K$ and $L$ denote output, capital stock and labour, $t$ technical progress, $\gamma$ a scale parameter and $s$ the contribution of capital to growth. The elasticity of substitution ($\sigma$) is given by $1/1+\rho$. Technical progress is assumed to be labour augmenting. To estimate $\sigma$ and $\lambda$, we use the labour demand equation that can be derived from the first-order condition that marginal product of labour must equal the mark-up adjusted real wage:

$$\partial Q/\partial L = \gamma^{-\rho}(1-s)Q^{(1+\rho)}(Le^{\gamma t})^{-(1+\rho)}e^{\lambda t} = \beta(w/p) \qquad (9)$$

where w, p and $\beta$ denote respectively wage, prices and the mark-up.

The log-form of the labour demand equation can be derived from (9) and can be written as equation (10):

$$Ln(L/Q) = -\sigma ln\beta - \sigma ln(w/p) + (\sigma - 1)ln(\gamma) + \sigma ln(1 - s) + (\sigma - 1)\lambda t \quad (10)$$

However, the empirical work will be built on the theoretical models of innovation – driven growth[2]. The Total Factor Productivity (TFP) term ($\lambda t$) can be written as equation (11):

$$\lambda t = \lambda_{TIME} TIME + \lambda_{FDI} ln(FDI)_{t-1} + \lambda_M ln(M/GDP)_{t-1} \quad (11)$$

We assume that technical progress is a function of the stock of FDI, together with an exogenous element proxied by a linear time trend (TIME). We add also an indicator of openness proxied by the share of import in GDP (M/GDP). The model above implies that technical progress will grow at a constant rate if direct investment and imports over GDP grow at a constant rate. We assume that the effects of FDI and imports affect technological change with a lag.

With equation (11) we can rewrite (10) as (12) which becomes the central equation to analyse the impact of FDI on employment and technical progress:

$$Ln(L/Q) = \alpha - \sigma \ln (w/p) + (\sigma - 1)(\lambda_{TIME} TIME + \lambda_{FDI} ln(FDI)_{t-1} + \lambda_M ln(M/GDP)_{t-1}) \quad (12)$$

Where $\alpha = \sigma ln\{1-s)/\beta\} + (\sigma - 1)ln(\gamma)$.

[2] This kind of innovation-driven growth is developed for instance by Grossman and Helpman (1991)

In this study, modification to the above employment equation was made as the lnmgdp and time factors were found to be only weakly linked to the dependent variable when applied to Malaysia data. Therefore, the labour demand function takes the log-linear function form as :

$$\ln L = \ln Q + \alpha - \sigma \ln w/p + (\sigma - 1)[\lambda_{FDI} \ln(FDI)_{t-1}]$$

In this case, it is expected that the lagged lnFDI would generate a positive impact on labour demand, lnL. However real wages will have negative relationship with labour demand as the increase in the real wages will render an increase of labour cost, thus reduce the labour demand in the market. This is indicated by the $-\sigma$ coefficient

## 3.3 Conclusion

The growth equation model is based on the hypothesis that FDI as an increase in capital stock would stimulate output growth. It is in line with the theory of neo-classical growth model as well as the conventional Harrod-Domar capital-output ratio model. Whereas for the employment model, it is derived from a CES (Constant Elasticity of Substitution) production function which is intrinsically, a technological progress function. Export and import equation models are based on the theory which advocate that the real exchange rate and terms of trade will affect the exports and imports. In these two cases, FDI is added in the models in order to evaluate the effect of FDI flows on these two economic sectors.