CHAPTER 4

THEORY

4.1 OVERVIEW

For the quantitative analysis of this research paper, a simultaneous equation models is suggested in the methodology part. This chapter outlines the theories underlying the equations so that the economic relationship between the independent and dependent variables used in each model can be clearly defined. The theories that being adopted here are all established and supported by previous empirical result.

4.2 CONSUMPTION GROWTH AND THE INTEREST RATE

Part 4.2 is to explain how CSUMTION is determined by R. We allow for a nonzero interest rate here (Romer, 1996). An individual's budget constraint is that the present value of lifetime consumption cannot exceed initial wealth plus the present value of lifetime labor income. For the case of a constant interest rate and a lifetime of T periods, this constraint is

$$\sum_{t=1}^{T} [1/(1+r)^t]\, C_t \leq A_0 + \sum_{t=1}^{T} [1/(1+r)^t]\, Y_t,$$

where r is the interest rate and where all variables are discounted to period 0.

When we allow for a nonzero interest rate, it is also useful to allow for a nonzero discount rate. In addition, it simplifies the analysis by assuming that the instantaneous utility function takes the constant-relative-risk-aversion form used in $u(C_t) = C_t^{1-\theta}/(1-\theta)$, where θ is the coefficient of relative risk aversion (the inverse of the elasticity of substitution between consumption at different dates). Thus the following utility function,

$$U = \sum_{t=1}^{T} u(C_t),\quad u'(\bullet) > 0,\ u''(\bullet) < 0$$

becomes

$$U = \sum_{t=1}^{T} [1/(1+\rho)^t]\,[C_t^{1-\theta}/(1-\theta)]$$

where ρ is the discount rate.

Now consider an experiment of a decrease in consumption in some period, period t, accompanied by an increase in consumption in the next period by 1 + r times the amount of the decrease. Optimization requires that a marginal change of this type has no effect on lifetime utility. Since the marginal utilities of consumption in periods t and t + 1 are $C_t^{-\theta} / (1+\rho)^t$ and $C_{t+1}^{-\theta} / (1+\rho)^{t+1}$, this condition is

$$[1 / (1+\rho)^t]\, C_t^{-\theta} = (1+r)\,[1 / (1+\rho)^{t+1}]\, C_{t+1}^{-\theta}$$

We can rearrange this condition to obtain

$$C_{t+1}/C_t = [\,(1+r)/(1+\rho)]^{1/\theta}$$

This analysis implies that once we allow for the possibility that the real interest rate and the discount rate are not equal, consumption need not be a random walk : consumption is rising over time if r exceeds ρ and falling if r is less than ρ. In addition, if there are variations in the real interest rate, there are variations in the predictable component of consumption growth. Among the world economists who had examined how much consumption growth responds to variations in the real interest rate are Mankiw (1981), Hansen and Singleton (1983), Hall (1988), Campbell and Mankiw (1989).

4.3 INVESTMENT AND THE COST OF CAPITAL (THE DESIRED CAPITAL STOCK)

Part 4.3 is to explain how IVESTMEN is determined by R. The following theoretical explanation is quoted from Romer (1996). Consider a firm that rents capital at a price of r_k. The firm's profits at a point in time are given by π (K, X_1, X_2, ..., X_n) - r_kK, where K is the amount of capital the firm rents and the X's are variables that it takes as given. In the case of a perfectly competitive firm, for example, the X's include the price of the firm's product and the costs of other inputs. $\pi(\bullet)$ is assumed to account for whatever optimization the firm can do on dimensions other than its choice of K. For a competitive firm, for example, π(K, X_1,..., X_n) - r_kK gives the firm's profits at the profit-maximizing choices of inputs other than capital given K and the X's. We assume that $\pi_k > 0$ and $\pi_{kk} < 0$, where subscripts denote partial derivatives.

The first-order condition for the profit-maximizing choice of K is

$$\pi_k\,(K, X_1,..., X_n) = r_k \qquad (4b)$$

That is, the firm rents capital up to the point where its marginal revenue product equals its rental price.

Equation (4b) implicitly defines the firm's desired capital stock as a function of r_k and the X's. We can differentiate this condition to find the impact of a change in one of these exogeneous variables on the desired capital stock. Consider for example, a change in the rental price of capital, r_k. By assumption, the X's are exogeneous; thus they do not change when r_k changes. K, however, is chosen by the firm. Thus it adjusts so that (4b) continues to hold. Differentiating both sides of (4b) with respect to r_k shows that this requires

$$\pi_{KK}(K, X_1,..., X_n)\,[\delta K(r_k, X_1,..., X_n)/\delta r_k] = 1$$

Solving this expression for $\delta K/\delta r_k$ yields

$$[\delta K(r_k, X_1,..., X_n)]/\delta r_k = 1/\pi_{kk}(K, X_1, ..., X_n) \;\ldots\ldots\ldots\ldots\ldots\ldots\; (4c)$$

Since π_{kk} is negative, (4c) implies that K is decreasing in r_k. A similar analysis can be used to find the effects of changes in the X's on K.

The above theoretical explanation is also in line with Tobin's q (Tobin, 1969). Tobin's q is known as the ratio of the market value to the replacement cost of capital. q has a natural economic interpretation. What is relevant to investment is marginal q - the ratio of the market value of a marginal unit of capital to its replacement cost. It is important to know how marginal q and average q (the ratio of the total value of the firm to the replacement cost of its total capital stock) are related. With the assumption of diminishing returns to scale in adjustment costs, a firm's lifetime profits rise less than proportionally with their capital stocks, and so marginal q is less than average q.

The gist of Tobin's q theory is that a firm increases its capital stock if the market value of capital exceeds what it costs to acquire it, and that it decreases its capital stock if the market value of the capital is less than what it costs to acquire it.

4.4 CONSUMPTION AND INVESTMENT

Part 4.4 is to explain how CSUMTION is determined by IVESTMEN. The following theoretical explanation is quoted from Dornbusch and Fischer (1994). First of all, we need to address the economic relationship between investment and saving as any change in investment will diffuse its effect on consumption via some change in saving. At the equilibrium level of

. income, planned investment equals saving. By contrast, above the equilibrium level of income, Y_0, saving exceeds planned investment, while below Y_0 planned investment exceeds saving.

Starting with the basic equilibrium condition, equation Y = AD (aggregate demand), we subtract consumption from both Y and AD, we realize that Y - C is saving and AD - C is planned investment.

In symbols,

$$Y = AD$$

$$Y - C = AD - C$$

$$S = I$$

$$S = I \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4d)$$

Equation (4d) clearly shows that saving and investment rates are strongly correlated. Hence, when we increase a nation's investment, its saving will increase accordingly or vice versa. When the nation's saving increases, its consumption will follow suit and this can be explained by the life-cycle theory. The life-cycle hypothesis views individuals, instead, as planning their consumption and saving behaviour over long periods with the intention of allocating their consumption in the best possible way over their entire lifetimes. This hypothesis views savings as resulting mainly from individuals' desires to provide for consumption in old age.

Consider a person who expects to live for NL years, work and earn income of YL each year for WL years, and then to live in retirement for (NL - WL) years. We assume there is no uncertainty about either life expectancy or the length of working life and no interest is earned on savings and that prices are constant (so that current saving translates dollar for dollar into future consumption possibilities). Given WL years of working life, lifetime income (from labor) is (YL x WL). Over the lifetime, the individual can spend a maximum of (YL x WL). With lifetime consumption equals to lifetime income, the planned level of consumption, C, which is the same in every period, times the number of years of life, NL, equals lifetime income :

$$C \times NL = YL \times WL$$

Dividing through by NL, we have planned consumption per year, C, which is proportional to labor income :

$$C = \frac{WL}{NL} \times YL$$

$$\Rightarrow \quad S = YL - C = \frac{NL - WL}{NL} \times YL \qquad (4e)$$

To anticipate, we state here that we will derive a consumption function of the form

$$C = aWR + cYL \qquad (4f)$$

where WR is real wealth, a is the marginal propensity to consume out of wealth, YL is labor income, and c is the marginal propensity to consume out of labor income.

From equation (4e), assuming that NL and WL are constant, the higher is the S, the higher will be the YL. Then, from equation (4f), assuming that WR is constant, the higher is the YL, the higher will be the C.

4.5 MONEY DEMAND, DEPOSITS AND HIGH INFLATION

Part 4.5 is to explain the economic relationship between DEPOSITS and CPI. The demand for real balances depends on the alternative cost of holding money. That cost is normally measured by the yield on alternative assets, say treasury bill, commercial paper or money market fund. However there is another margin of substitution. Rather than holding their wealth in financial assets, households or firms can also hold real assets : stocks of food or houses or machinery. This margin of substitution is particularly important in countries in which inflation is very high and capital markets do not function well. In that case it is quite possible that the return on holding goods can even be higher than that in financial assets.

This "flight out of money" occurs systematically when inflation rates become high. In a famous study of hyperinflations (defined as inflation rates of more than 50 per cent per month), Philip Cagan of Columbia University (1956) found large changes in real balances taking place as inflation increased. In the most famous hyperinflation, that in Germany in 1922 -1923, the quantity of real balances at the height of the hyperinflation had fallen to one-twentieth of its preinflation level. The increased cost of holding money leads to reduction in real money demand and with it to changes in the public's payments habits as everybody tries to pass on money like a hot potato.

The above explanation might not reflect the real situation in Malaysia and Singapore for the past 20 years as both of them had been successfully maintaining their CPI in single digit. However, we have to bear in mind that the basic economic relationship between money demand and inflation rate is still hold. What looks different might be the degree of elasticity between the two economic variables and the discernment of their changes.

In well-developed capital markets, interest rates will reflect expectations of inflation and hence it will not make much difference whether we measure the alternative cost of holding money by interest rates or inflation rates. But when capital markets are not free because interest rates are regulated or have ceilings, it is often appropriate to use inflation, not interest, rates as the measure of the alternative cost (as what has been happening in Malaysia and Singapore in the past 20-year). Modigliani and Cohn (1979) have offered the following rule of thumb : the right measure of the opportunity cost of holding money is the higher of the two, interest rates or inflation.

4.6 REAL EFFECTIVE EXCHANGE RATE AND EXPORTS

Part 4.6 is to explain the economic relationship between REER and EXPORTS. The following theoretical explanation is quoted from Dornbusch and Fischer (1994). REER is the ratio of foreign to domestic prices, measured in the same currency. It measures a country's competitiveness in international trade. It is defined as

$$REER = eP_f/P$$

where P and P_f are the price levels here and abroad, respectively, and e is the dollar price of foreign exchange.

A rise in the REER, or a real depreciation, means that goods abroad have become more expensive relative to goods at home. Other things equal, this implies that people - both at home and abroad - are likely to switch some of their spending to goods produced at home. This is often described as an increase in the competitiveness of our products (total exports will increase). Conversely a decline in REER, or a real appreciation, means that our goods have become relatively more expensive, or that we have lost the export competitiveness.

4.7 TOTAL FACTOR PRODUCTIVITY (TFP) AND EXPORTS

Part 4.7 is to explain the economic relationship between TFP and EXPORTS. The amount of exports is determined by the total output a country can produce. Assuming that other economic factors are constant, the higher is the output, the higher will be the expors or vice versa.

Output grows through increases in the inputs of factors of production - labor and capital - and through improvements in technology. In a production function, the amount of output produced in an economy is linked to the inputs of factors of production and to the statte of technical knowledge. Equation (4f) represents the production function in symbols :

$$Y = AF(K, N) \qquad \text{.......(4f)}$$

where K and N denote the inputs of capital and labor and A denotes the state of technology. The production function AF (K, N) in equation (4f) states that the output produced depends on factor inputs K and N and on the state of technology. Increases in factor inputs and improved technology lead to an increase in output supply.

The next step is to make these links more precise by looking at an expression for the growh rate of output. In the growth accounting equation (4g), the determinants of output growth are shown as follows :-

$$\Delta Y/Y = [(1 - \theta) \times \Delta N/N] + (\theta \times \Delta K/K) + \Delta A/A \qquad \text{.......(4g)}$$

Output growth = (labor share x labor growth)+ (capital share x capital growth) + technical progress

where (1 - θ) and θ are weights equal to the income shares of labor and of capital in production.

Equation (4g) summarizes the contributions of growth of inputs and of improved productivity to growth of output :

- Labor and capital each contribute an amount equal to their individual growth rates multiplied by the share of that input in income.
- The rate of improvement of technology, called technical progress, or the growth of total factor productivity, is the third term in equation (4g).

The growth rate of total factor productivity is the amount by which output would increase as a result of improvements in methods of production, with all inputs unchanged. In other words, there is growth in total factor productivity when we get more output from the same factors of production.

4.8 IMPERFECT CAPITAL MOBILITY

Part 4.8 is to explain the economic relationship between SC and R or RW. It is too strong to assume that there are no barriers to capital movements between countries and that investors are risk-neutral. Transaction costs and the desire to diversify, for example, cause investors not to put all of their wealth into a single country's assets in response to a small difference in expected returns. It is therefore natural to consider the effects of imperfect capital mobility.

A simple way to model imperfect capital mobility is to assume that capital flows depend on the difference between domestic and foreign interest rates (Romer, 1996). Specifically, define the capital flow, CF, as foreigners' purchases of domestic assets minus domestic residents' purchases of foreign assets. The assumption is

$$CF = CF\,(\,i - i_w), \qquad CF'\,(\bullet) > 0$$

The high degree of capital market integration implies that any one country's interest rates cannot get too far out of line without bringing about capital flows that tend to restore yields to the world level. For example, if Malaysia yields fell relative to Singapore yields, there would be a capital outflow from Malaysia because lenders would take their funds out of Malaysia and borrowers would try to raise funds in Malaysia. From the BOPs point of view, this implies that a relative decline in interest rates - a decline in Malaysia's rates relative to those abroad (Singapore) - will worsen the balance of payments of Malaysia because foreign capital will mostly flow into Singapore instead of Malaysia.

4.9 THE EXPECTATIONS-AUGMENTED PHILLIPS CURVE

Part 4.9 is to explain the economic relationship between U and CPI. The following thereotical explanation is quoted from Romer (1996). It is assumed that high GNP will be accompanied by low U. A typical modern Keynesian formulation of aggregate supply is

$$\ln P_t = \ln P_{t-1} + \pi_t^* + \lambda\,(\ln Y_t - \ln Y_t) + \varepsilon_t^s$$

or

$$\pi_t = \pi_t^* + \lambda\,(\ln Y_t - \ln Y_t) + \varepsilon_t^s$$

where $\pi_t \equiv \ln P_t - \ln P_{t-1}$ is inflation. The $\lambda\,(\ln Y_t - \ln Y_t)$ term implies that at any time there is an upward-sloping relationship between inflation and output (GNP). ε_t^s captures supply shocks.

π_t^* is what inflation would be if output is equal to its natural rate and there are no supply shocks. It is known as core or underlying inflation.

Since $\pi_t^* = \pi_{t-1}$, there is a trade-off between output and the change in inflation, but no permanent trade-off between output and inflation. For inflation to be held steady at any level, output must equal the natural rate. But for inflation to fall, there must be a period when output is below the natural rate. When output is below the natural rate, unemployment regardless of the reasons (quits, layoffs, involuntary quits, etc.) will occur. For a given value of the previous period's price level, the price level in the current period is an increasing function of the inflation rate. It means that if the inflation rate is high (low), the unemployment rate will be reduced (increased) as the GNP increases (decreases).