

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Much effort has been devoted to the study of fiscal sustainability in the developed countries, notably the U.S. Among the studies in the U.S., various groups have come out with different conclusion for their studies. Hamilton and Flavin (1986) and Trehan and Walsh (1988) found that the U.S. long term fiscal policy is sustainable. On the other hand, more recent studies by Hakkio and Rush (1991) and Wilcox (1989) derived a different conclusion, suggesting that the fiscal policy there is not sustainable. Literature on testing the long term sustainability of fiscal policy is largely developed by these studies in the U.S.

Nonetheless, very little attention has been devoted and there is practically an absence of study on the fiscal sustainability issue in Malaysia although there were some empirical works on developing countries as a whole where Malaysia is included. Adam and Bevan (2003) examines for a panel of 45 developing economies while a more comprehensive literature on testing fiscal sustainability of developing countries was laid down by Cuddington (1996). These studies however, did not specifically test Malaysia on a stand-alone basis.

Before we proceed to discuss the literatures on the subject matter, it is useful to review the term “sustainability”. Is the test of sustainability a test of insolvency? IMF, in its paper “Assessing Sustainability” (Geithner, 2002, IMF, SM/02/166,

Pg 4-5) clearly made the following distinctions between solvency, liquidity and sustainability:

- Solvency: An entity is solvent if the present discounted value of its current and future primary expenditure is no greater than the PDV of its current and future path of income, net of any initial indebtedness.
- Liquidity: An entity is illiquid if, regardless of whether it satisfies the solvency condition, its liquid assets and available financing are insufficient to meet or roll-over its maturing liabilities.
- Sustainability: An entity's liability position is sustainable if it satisfies the PVBC without a major correction in the balance of income and expenditure given the costs of financing it faces in the market.

If the definition of IMF is to be followed, then it is clear that the concept of "Sustainability" will incorporate both solvency and liquidity conditions. The term sustainability infers something parallel to insolvency as reflected by the formulation in the budget constraint set up. Hence, concept of solvency and sustainability are said to be interchangeable and one aspect of the test of sustainability is the assessment of whether the government is solvent. If maintaining the current fiscal policy mix indefinitely would lead to insolvency, then the policy is considered as unsustainable.

However, while insolvency implies default, the analysis of fiscal sustainability should not be based on default itself. This is because default is the end result and

government frequently takes step to avoid arriving at that end. Therefore, the role of the sustainability analysis is to provide some indication as to whether a particular policy mix is sustainable or not and the consequences of the policy changes needed to avoid eventual default.

2.2 Longer Term Risk of Fiscal Sustainability: Testing Inter-Temporal Budget Constraint

The starting point for the analysis is the public sector static budget constraint. This was largely based on the seminal input by Hamilton and Flavin (1986)

$$\tilde{D}_t = (1 + i_t) \tilde{D}_{t-1} - \tilde{S}_t \dots\dots\dots(2.1)$$

The formulation indicates that the outstanding government debts D_t at period t , is a function of the preceding period outstanding government debts D_{t-1} at period $(t-1)$ with nominal interest rate minus the primary fiscal surplus S_t at period t . S_t is defined as $R_t - G_t$ where G_t is the government's expenditure net of interest payment while R_t is the government's revenue collection in period t . \sim denotes nominal term.

As the sustainability is more likely to be satisfied if real debts are considered, equation (2.1) can be reformulated into the real form by considering the price factor using price index P_t (which can either be GDP deflator or CPI). Dividing equation (1) with P_t and knowing $\frac{P_t}{P_{t-1}} = (1 + \pi_t)$ where π_t is the inflation rate between period $t-1$ and t .

$$\frac{\tilde{D}_t}{P_t} = (1+i_t) \frac{\tilde{D}_{t-1}}{P_t} - \frac{\tilde{S}_t}{P_t} = \frac{(1+i_t)\tilde{D}_{t-1}}{(1+\pi_t)P_{t-1}} - \frac{\tilde{S}_t}{P_t}$$

In the real form, it can be stated that

$$d_t = (1+r_t)d_{t-1} - s_t \dots \dots \dots (2.2)$$

where $r_t = \frac{(1+i_t)}{(1+\pi_t)} - 1$

Equation (2.2) above describes the dynamic of debts. If government's budget is balanced, then the real debts will grow by the rate of the real interest rate. On the other hand, if government's budget is in deficit the stock of debts will grow at a rate faster than the interest rate. In the case of budget surplus, the surplus will go to offset the interest rate payment and the debt will ultimately shrink over a period of time.

Solving equation (2.2) above forward yields the inter-temporal budget constraint and assuming that interest rate is constant over time yields (APPENDIX I)

$$d_{t-1} = -\sum_{j=0}^{\infty} \frac{s_{t+j}}{(1+r)^{t+j}} + \lim_{j \rightarrow \infty} \frac{d_{t+j}}{(1+r)^{t+j}} \dots \dots \dots (2.3)^1$$

Equation (2.3) suggests that the present value of future primary surpluses must exceed the difference between initial debts and present value of terminal debts for

¹ Two assumptions are made as in Flavin & Hamilton (1986)
a. real interest rate is stationary with an unconditional mean equals to r .
b. the supply of bonds on average do not grow more than the average interest rate.

sustainability to hold. Some suggested that if the PV of terminal debts is positive, government can roll over debts by borrowing in every period. However, this was ruled out by O'Connell and Zeldes (1988) where they found that it is not possible when there is finite number of agents involved. This is the "No Ponzi Game" condition that is imposed in the analysis of sustainability. The condition states that government cannot run such a scheme as rational individuals will refuse to hold such debts and it cannot therefore roll over the debts indefinitely. This is because if a government is conducting such a scheme, some individuals will have to be holding government debts at some point in the future and hence they will have lower consumption and wealth. The option not to hold the debts will dominate the option to hold it in the case of finite number of agents. This condition is the basis of the sustainability analysis.

Hamilton and Flavin (1986) regarded this as synonymous with the transversality condition that $\lim_{j \rightarrow \infty} \frac{d_{t+j}}{(1+r)^{t+j}} \leq 0$, suggesting that $d_{t-1} = -\sum_{j=0}^{\infty} \frac{s_{t+j}}{(1+r)^{t+j}}$. The above condition states that government's debt at present must be matched by the excess of the present value of future primary surpluses over the present value of future primary deficits of the government. Otherwise, the fiscal policy cannot be deemed to be sustainable

2.2.1 Seigniorage

There is another effect that needs to be taken into consideration, the seigniorage effect. Seigniorage revenue is defined as the growth in the monetary base. By

including seigniorage revenue, we are implicitly defining the public sector to include the central bank (Burnside, Craig, 2004, Pg 3). This is intuitive as it allows the analysis to capture the effect of both fiscal and monetary policy in our analysis of sustainability.

Incorporating the effect in the formula yields the following

$$d_{t-1} = -\sum_{j=0}^{\infty} \frac{(s_{t+j} + \sigma_{t+j})}{(1+r)^{t+j}} + \lim_{j \rightarrow \infty} \frac{d_{t+j}}{(1+r)^{t+j}} \dots\dots\dots(2.4)$$

where σ simply indicates the seigniorage and in its mathematical form

$$\sigma_t = (M_t - M_{t-1})$$

and M_t denotes the monetary base.

Equation (2.4) shows that the PVBC condition can be satisfied by two ways. Either through running a large primary surplus or by generating a large seigniorage revenue through the expansion of monetary base. The method to satisfy the PVBC condition hence has implication on the ultimate outcome. This will be discussed in 2.2.3 Government Deficit on Inflation.

2.2.2 NPG and PVBC Condition

The test of sustainability is to see whether the historical process that generates the fiscal data is likely to result in the PVBC eventually being violated (Chalk, Nigel and Hemming, Ricard, WP/00/81, Pg 1-18). There are two ways to look at

equation (2.4) for testing purposes. Hamilton and Flavin (1986), who adopted Flood and Garber (1980) bubble test, test the NPG condition that

$$\lim_{j \rightarrow \infty} \frac{d_{t+j}}{(1+r)^{t+j}} = 0 \dots\dots\dots (2.5)$$

Where in the PVBC test, it invokes the condition that if equation (2.5) is fulfilled then it can also be shown that

$$d_{t-1} = - \sum_{j=0}^{\infty} \frac{(s_{t+j} + \sigma_{t+j})}{(1+r)^{t+j}}$$

Note that $\frac{1}{(1+r)}$, in which r is the generalization of a constant interest rate for convenient. Some literature and studies imposed strict condition that expected real interest rate to be constant (Rose, Andrew K., 1998, Pg 1095-1112) while others think that it is sufficient that real interest rate is stationary and its conditional expectations need not be constant (Burnside, Craig, 2004, Pg 26). The prospect of incorporating time-varying interest rate is discussed below.

In the case where a time-varying r_t from period to period is used. Equation (2.4) becomes

$$d_{t-1} = - \sum_{j=0}^{\infty} \theta_{t+j} (s_{t+j} + \sigma_{t+j}) + \lim_{j \rightarrow \infty} \theta_{t+j} d_{t+j} \dots\dots\dots (2.6)$$

θ_{t+j} denotes the discount factor $\sum_{i=0}^j (1+r_{t+j})^{-1}$ which is the discount factor on a compounded basis for period t+j.

With this, the NPG and PVBC test is restated as equals

$$\lim_{j \rightarrow \infty} \theta_{t+j} d_{t+j} = 0 \quad \text{and}$$

$$d_{t-1} = - \sum_{j=0}^{\infty} \theta_{t+j} (s_{t+j} + \sigma_{t+j})$$

Equation (2.6) above states that: the PV of the primary surplus of the government must equal to the government's debt at a given point in time. Failure to comply with the condition indicates that the prospect of higher taxes or lower fiscal spending must set in if the budgetary process is to be balanced. A condition exists such that the above is only possible if the real interest rate is positive for the PV surpluses to remain finite. It makes no sense for the last term to take any value other than zero as a positive value would mean that the government is rolling over its debts indefinitely and is inconsistent with the No-Ponzi Scheme. On the other hand, a negative value would be indicating that the government is a net lender, in which case, the issue of fiscal sustainability does not come into picture and there is no need to pursue the test.

2.2.3 Government Deficits on Inflation

Burnside (2004) looked at the effect of government deficit on inflation and discussed the issue of fiscal and monetary policy coordination (Burnside, Craig 2004, Chapter 2, Pg 5-11). In his analysis, he added that in many cases, the role of fiscal sustainability analysis is not to point out concerns about default but rather, to show that the role of the analysis is to discuss the macroeconomic

consequences of alternative policies which happen to be consistent with equation (2.4). The literature in this section is based largely on the work of Sargent and Wallace (1981) and Burnside (2004).

There are two methods of satisfying the inter-temporal budget constraint. This could be done either through increasing the future primary budget surpluses to offset against the current accumulated deficit or alternatively, one can generate seigniorage revenue to cushion the deficit. The equation to reflect this is as follow:

$$D_t = (1+i)D_{t-1} - S_t - (M_t - M_{t-1})$$

In the real term we have

$$d_t = (1+r)d_{t-1} - s_t - (M_t - M_{t-1}) / P_t$$

Rearranging it yields

$$P_t(d_t - d_{t-1}) + M_t - M_{t-1} = P_t(rd_{t-1} - s_t).....(2.7)$$

Where

- D = government debt
- i = nominal interest rate
- S = Fiscal surplus
- r = real interest rate
- M = Monetary base
- P = Price index
- and small letter denotes real variables

The equation (2.7) above neatly explains the necessary financing and type of financing that is employed by the government. The equation allows us to see the

quantum of financing that a government need while at the same time shows us the mix of such financing, or the source of the financing. Starting from the right hand side, it is essential to highlight that rd_{t-1} is an exogenous variable and s_t is what is reflected by the fiscal authority's action. The left hand side of equation (2.7) determines the choice of financing for the fiscal authority's action. The left hand side is essentially the monetary authority's role in the choice of financing mix. It can either borrow or issue money to finance the fiscal authority's action. The issue then is whether the choice of financing has any ramification on inflation.

Using Cagan money demand function, $\frac{M_t}{P_t} = Ay_t e^{-\eta i_t}$, where η represents the interest semi-elasticity of money demand and assuming that the transaction motive is constant, i.e. $y_t = y$ for all t. Also, rewriting nominal interest rate into $i_t = r + E_t \ln(P_{t+1} / P_t)$ and simplified $a = \ln(Ay) - \eta r$

$$\ln(M_t / P_t) = a - \eta E_t \ln(P_{t+1} / P_t)$$

Solving for $\ln P_t$ implies that

$$\ln P_t = -a + \frac{1}{1+\eta} \sum_{j=0}^{\infty} \left(\frac{\eta}{1+\eta}\right)^j E_t \ln M_{t+j} \dots \dots \dots (2.8)$$

Equation (2.8) says that the price level at period t depends on not only current money supply but also on the expected future money supply. If $\eta \rightarrow 0$, then $\ln P_t \approx -a + \ln M_t$. If $\eta \rightarrow$ large, then $\ln P_t \approx -a + E_t \ln M_t$ which means that the price level will rest on the expectations where the money supply will be going forward.

Equation (2.8) has implications about the effect of government's deficit on price inflation. Different financing obviously has different implications on inflation. Two extreme scenarios are drawn here. Scenario 1 assumes that government financing is solely through the issuance of debts. Scenario 2 assumes that financing are solely through printing of money and government never resort to debt financing

Scenario 1: Issuance of debt

$$M_t = M$$

inter-temporal budget constraint implies that in the above event, equation (2.4) can be simplified into

$$d_{t-1} = -\sum_{i=0}^{\infty} \frac{(s_t + 0)}{(1+r)^{(t+1)}}$$

the above suggests that the present value of future primary balance is simply the level of debt at the initial stage.

This has the implication that if a government runs a primary deficit in period t such that $s_t < 0$, then the fiscal dynamic requires that the future primary balance be forced to reverse such that the future primary surpluses in the present value term at period j be $\sum_t \frac{s_j}{(1+r)^{(t+1)}} > 0$. Simply put, if monetary condition is strict

and there is no room for government to pursue seigniorage, then loose fiscal policy today requires a tighter fiscal policy tomorrow if a balance is to be struck. There is also no risk of fiscal deficit today being translated into higher inflation

tomorrow as inflation in a theoretical sense is zero in this scenario. From the derivation above, we know that $P_t = e^{-a}M$ and for all t , $M_t = M$ which means that prices will remain the same for all t . The reason for this is that agents in the model knows that monetary policy has no room for maneuvering and hence primary fiscal deficit need not result in higher money supply and inflation.

Scenario 2: No debt issuance, seigniorage is used

This scenario made a reverse assumption from that of scenario 1. Where in scenario 1, it is assumed that government uses debt issuance as a mean to fund the primary deficit, under scenario 2 the deficit is financed by the issuance of money and no debt is issued.

This assumption invariably follows that

$$d_t = 0 \text{ for all } t$$

and the budget constraint above simply implies that

$$M_t - M_{t-1} = -S_t \dots \dots \dots (2.9)$$

or

$$M_t - M_{t-1} = -P_t s_t \dots \dots \dots (2.10)$$

It is quite telling that equations (2.9) and (2.10) show the linkages between the two variables. An increase in the primary deficit invariably increases the base money by a corresponding amount. From equation (2.8) and assuming the extreme case where the interest rate elasticity $\eta = 0$, it can be shown that

$$\begin{aligned}
\ln P_t &= -a + \ln M_t \\
P_t &= e^{-a} M_t \\
P_t &= e^{-a} (M_{t-1} - P_t s_t) \\
P_t &= e^{-a} M_{t-1} - e^{-a} P_t s_t \\
P_t (1 + e^{-a} s_t) &= e^{-a} M_{t-1} \\
P_t &= e^{-a} M_{t-1} / (1 + e^{-a} s_t)
\end{aligned}$$

The equation above shows the inverse relationship between price level and amount of the primary deficit given the value of M_{t-1} .

Here, the salient point is that under the scenario where seigniorage is used to fund the primary deficit, the short term supply of money will translate into inflation. This is completely different from the conclusion we draw from scenario 1.

In real life, the government financing mix is likely to be the hybrid of the two extreme cases. It is also very difficult to find a correlation between deficit and inflation as the cyclical nature of business cycle and the lag effect will likely to make it hard to establish the causal relationship, more so if government adopts a different mix of funding at different point in time. However, as Burnside (2004) puts it, the lack of correlation between deficits and inflation cannot be naively interpreted as indicating that somehow inflation is driven by something other than government's fiscal policy and it is important that policy makers should not be misled into believing this (Burnside, Craig, 2004, Chapter 2, Pg 8). If fiscal

policy makers are irresponsible, monetary authority cannot stop inflation from occurring in the long run.

In an idea case of independent central banking, fiscal deficits of the government need not necessarily translate into inflation if the monetary authority is independent and chooses to stick to the constant money supply growth rule. But in most instances, it is often the fiscal authority that overpowered the monetary authority especially in developing countries. In this instance, it would be tempting for the fiscal authority to pursue an expansionary money growth and high deficit if that serves it political objective well. But such a short sighted action often leads to an inflationary trend in the longer term. It is therefore crucial that such coordination exists.

The choice of fiscal authority on the path of its fiscal position determines the direction of money supply and inflation in the long run but in the short run, it is the coordination of the two authorities that decide the two variables. Here, if the fiscal authority is credible, it will aim to target inflation and sets its fiscal gap consistent with that of the pre-determined inflation rate - this is the policy stance of the EU. On the other hand, if the fiscal authority is pre-occupied with the short term cyclical forces, it will conduct its policy by expanding its fiscal gap with disregard to the consequences of long term inflationary pressure. The monetary authority is then left to juggle to maintain money supply growth rate consistent with target inflation. Unless, the monetary authority is able to balance the money

supply growth, the target inflation rate will be breached and eventually force a tightening cycle to set in. It is clear therefore, that a coordination effort is to choose to meet the target inflation at the expense of growth while the non-coordination effort is to choose growth at the expense of inflation.

If both authorities coordinate and set a desired inflation target of say, π_t , then the role of the fiscal authority is reduced to ensure that the path of the primary gap is consistent with the set inflation and the monetary authority role is simplified to ensure that the money supply growth achieve the credible inflation target. In another extreme, when the authority is not coordinated, fiscal authority will choose $\{S_t\}_{t=0}^{\infty}$, the fiscal surplus or deficit, at a level that suits its objective disregard to any policy goal with respect to inflation. In a situation like this, the central bank's mandate of fighting inflation will be dominated by the fiscal authority and eventually money growth will surpass the set range. The results of the analysis (see Appendix II for the mathematical derivation) imply two salient implications:-

1. The more rigid the monetary authority is in fighting inflation in the initial stage i.e. pursuing policies geared towards the target inflation rate for a longer period, the higher will be the inflation eventually. This is because when the central bank finally eases its stance of inflation and print money, the stock of debt level would have grown much bigger.

2. Fiscal and monetary authority coordination is needed if the aim is to achieve a stable inflation.

2.3 Medium Term Risk of Fiscal Sustainability: Indicators of Fiscal Sustainability

This section looks at some of the recently developed fiscal indicators that aimed to test the medium term risk of fiscal sustainability. Some literature argued that the empirical test in section 2.2 is very sensitive to the statistical test conducted and different studies yield different results on the basis of different assumption. They proposed to look at how much the fiscal policy has deviated from what is required for sustainability (Horne, Jocelyn, 1991 "Indicators of Fiscal Sustainability," IMF Working Paper 00/52). The proponents of the development of these indicators among others are Olivier Blanchard of MIT (Blanchard, Olivier J, 1990, "Suggestions for a New Set of Fiscal Indicators," OECD Working Paper No. 79) and Willem H. Buiter of Cambridge (Buiter, Willem H, 1995, Mimeo, "Measuring Fiscal Sustainability", Cambridge). The indicators are developed to seek to determine the path that these indicators must follow in order for the fiscal policy to be deemed sustainable. Blanchard (1990) gives a concise definition of what these indicators must encompass. "In thinking about indicators of fiscal policy to be used by an international organization, the following rules seem reasonable: An indicator, if it is going to be used at all, must be simple, or at least look simple...an indicator which requires as few explicit forecasts as possible in its construction is more likely to be used".

Buiter (1985) suggested that the ratio of public sector net worth to output is key to the sustainable analysis, whereby government must maintain the primary gap necessary to achieve this. He calculated this as:

$$d_t = (r_t - n_t)w_t \dots \dots \dots (2.11)$$

$$d_t = \frac{D_t}{Y_t} \text{ and } w_t = \frac{W_t}{Y_t}$$

where n_t is the growth rate and r_t is the real interest rate. D_t is debt and W_t is net worth and Y_t is gross national output. However, equation (2.11) has some shortcomings and the most notable is the difficulty of ascertaining the true net worth of governments. Blanchard (1990) on the other hand looked at the necessary change in fiscal policy in order to maintain the debt-to-GDP ratio.

Detragiache and Spilimbergo (2001) linked debt crises with external liquidity by using sample of 69 countries over the period between 1970-1998. This study was later adopted by IMF in assessing fiscal sustainability. The Detragiache and Spilimbergo (2001; D&S) index suggests that when debt crises or corrections occur, they would often occur when the debt ratios below 50-60% of GDP.

2.3.1 Debt-To-GDP Ratio

Although theory would argue that an unbounded debt-to-GDP ratio are not necessarily an indication of an unsustainable fiscal policy so long as the real debt grows more slowly than the real interest rate. The No-Ponzi Game condition would suggest that private lenders would prohibit a government from borrowing perpetually to pay for its entire interest rate obligation. But in practice, private

lenders are also concerned with whether a government can service its principal repayment of its old debts. Therefore, practical considerations often view the debt-to-GDP ratio as a basis for evaluating the fiscal sustainability.

IMF provides a general framework of assessing this ratio. The fund analysis suggests that the useful benchmark for assessment of external debt-to-GDP ratio is 40%. If a country external debt-to-GDP ratio is below 40%, then the likelihood of debt crisis or “correction” is between 2-5%. On the other hand, if the ratio exceeds 40%, this probability rises to 15-20%. It further stressed that the benchmark is by no means necessarily implies a crisis in the making and that the framework need to be assessed in the context of the structure of the debt, specifically the maturity of such debts and the currency denomination of the debts (Geithner, Timothy, 2002, “Assessing Sustainability,” IMF Policy Development and Review Department SM/02/166, Pg 42 -44).

The IMF establishes a formal threshold for assessing the external Debt-to-GDP ratio using what is known as binary recursive tree (BRT) method. The BRT method is used to determine a threshold value of debt (\hat{d}), that best set the demarcation between crisis and non-crisis cases in the overall sample countries in the analysis. In the statistical way, the threshold is set at a point where Type I and Type II errors are minimized. In the full sample analysis for the Fund with 508 observations and 53 crises cases, it is found that the unconditional probability of debt crisis is 10.4%. At the estimated threshold of $\hat{d}=44.7\%$, there are 233

observations with $d \leq \hat{d}$ and 14 out of the 233 observations developed into debt crisis. This gives us the conditional debt crisis for the case of the threshold at 44.7% is 6%. In the case where actual $d > \hat{d}$, of which there are 275 observations, 39 cases eventually developed into crisis. This gives us the conditional probability of 14%. Simply put, at a threshold of external debt-to-GDP ratio of 45%, the probability of a country developing into crisis surged from 6% to 14%. The Fund highlighted that although the debt/GDP ratio ranges widely from 10% to 150%, almost 2/3 of the observations are below the threshold limit of 60% and almost 3/4 are below 70%.

The above analysis by the IMF focuses on the external debt-to-GDP, but it is also important to analyze the total public debt-to-GDP. It was said that the difficulty of obtaining comparable cross-country data on public debt has deterred the setting of benchmark for the use of total public debt-to-GDP for analysis. Here, we adopt a different approach in dealing with the total public debt-to-GDP analysis and set out our methodology of analysis in Chapter 3.3.1 of the Methodology section.

Antonio (2000) suggest that we look at the total derivative of the ratio (Afonso, Antonio, 2000, "Fiscal Sustainability: Some Unpleasant European Evidence", MMF Research Group Conference, No. 57). The derivation gives us the following:

$$\partial \left(\frac{D}{Y} \right) = \frac{1}{Y} \partial D + \left(-\frac{D}{Y^2} \right) \partial Y \quad \text{or in a simpler notation}$$

$$\partial \left(\frac{D}{Y} \right) = \frac{\partial D}{Y} - \frac{D}{Y} \frac{\partial Y}{Y}$$

let the small cap represents the ratio to GDP, we have

$$\partial d = \frac{\partial D}{Y} - dg$$

also, $\partial D = E - R + iD - \partial M$ and replacing into the above yields

$$\partial d = \frac{E + iD - R}{Y} - \frac{\partial M}{Y} - dg$$

defining $e = E/Y$ and $\rho = R/Y$, $m = M/Y$ and $\lambda = \Delta M/M$

$$\partial d = e + id - \rho - \frac{\partial M}{Y} - dg$$

and replacing $\frac{\partial M}{M} \frac{M}{Y} = \lambda m$ derived

$$\partial d = e + id - \rho - \lambda m - dg$$

The budget constraint requires that $\partial d = 0$ gives us

$$dg = e + id - \rho - \lambda m$$

Where:

$$g = \frac{\Delta Y}{Y}$$

$$d = \frac{D}{Y}$$

i = nominal interest rate

M = nominal monetary base

E = government expenditure

R = government revenue

$e = E/Y$

$\rho = R/Y$

$m = M/Y$

$\lambda = \Delta M/M$

The equation says that the long run deficit is a function of the level of public debt with the economy nominal growth rate as the factor.

The above equation is useful to ascertain the potential dynamic of government's deficit position on the assumption of a stable debt-to-GDP ratio and various growth rate. The deficit position as given by the formula above is simply the multiplication of the two factors. From a different perspectives

$$dg + \lambda m = e + id - \rho$$

and for a balanced budget $e + id - \rho = 0$ and assuming a stable Debt-to-GDP condition

$$\begin{aligned} dg &= \lambda m \\ g &= \lambda m / d \dots \dots \dots (2.12) \end{aligned}$$

Equation (2.12) is the economic growth rate required to achieve a balanced budget with a stable Debt-to-GDP ratio.

2.3.2 Primary Gap Ratio

Government budget constraint in period t is given by (Buiter, Willem H, 1995, "Measuring Fiscal Sustainability," mimeo, Cambridge University, Pg 2)

$$C_t + A_t - T_t - E_t N_t^* - F_t - V_t + i_t D_{t-1}^* + i_t^* E_t D_{t-1}^* = D_t^* - D_{t-1}^* + E_t (D_t^* - D_{t-1}^*) \dots \dots \dots (2.14)$$

where

- C_t = government consumption spending at period t
- A_t = government investment at period t
- T_t = tax revenue net of transfer at period t
- E_t = exchange rate in RM/USD at period t

N_t = dollar value of foreign aid at period t
 F_t = cash flow value of government capital stock at period t
 V_t = privatization revenue at period t
 i_t = nominal interest rate for domestic debt at period t
 \hat{D}_t = face value of domestic debt at period t
 i_t^* = nominal interest rate for foreign debt at period t
 D_t^* = face value of foreign debts at period t

Equation (2.14) implies that the shortfall in the government's fiscal position at period t is finance by the issuance of domestic and foreign debt, whereas a surplus would indicate a reduction in debts.

In the same formulation it can be shown that primary surplus is given by

$$S_t = T_t + E_t N_t^* + F_t + V_t - C_t - A_t \dots \dots \dots (2.15)$$

where S_t = primary surplus at period t

and the outstanding bond at period t is given by

$$D_t = \hat{D}_t + E_t D_t^* \dots \dots \dots (2.16)$$

By replacing equation (2.15) and (2.16) into (2.14), the equation simplified to become

$$D_t = (1 + i_t) \hat{D}_{t-1} + (1 + i_t^*) E_t D_{t-1}^* - S_t$$

dividing the equation by nominal GDP which is given by $P_t Y_t$ to arrive at debt-to-GDP ratio

$$\frac{D_t}{P_t Y_t} = (1 + i_t) \frac{\hat{D}_{t-1}}{P_t Y_t} + (1 + i_t^*) \frac{E_t D_{t-1}^*}{P_t Y_t} - \frac{S_t}{P_t Y_t} \dots \dots \dots (2.17)$$

and let the followings represent

$$g_t = \frac{(Y_t - Y_{t-1})}{Y_{t-1}} \text{ real GDP growth rate at period } t$$

$$\pi_t = \frac{(P_t - P_{t-1})}{P_{t-1}} \text{ inflation at period } t$$

$$\varepsilon_t = \frac{(E_t - E_{t-1})}{E_{t-1}} \text{ rate of depreciation of domestic currency at period } t$$

from the above it can be shown that $Y_t = Y_{t-1}(1 + g_t)$, $P_t = P_{t-1}(1 + \pi_t)$,

$E_t = E_{t-1}(1 + \varepsilon_t)$ and replacing these into equation (2.17) yields

$$\frac{D_t}{P_t Y_t} = \frac{(1 + i_t)}{(1 + \pi_t)(1 + g_t)} \frac{\hat{D}_{t-1}}{P_{t-1} Y_{t-1}} + \frac{(1 + i_t^*)(1 + \varepsilon_t)}{(1 + \pi_t)(1 + g_t)} \frac{E_{t-1} D_{t-1}^*}{P_{t-1} Y_{t-1}} - \frac{S_t}{P_t Y_t}$$

by allowing the lower case letter to denote the ratio to GDP we derived

$$d_t = \frac{(1 + i_t)}{(1 + \pi_t)(1 + g_t)} \hat{d}_{t-1} + \frac{(1 + i_t^*)(1 + \varepsilon_t)}{(1 + \pi_t)(1 + g_t)} d_{t-1}^* - s_t \dots \dots \dots (2.18)$$

using $1 + r_t = \frac{(1 + i_t)}{(1 + \pi_t)}$ and $\hat{d}_{t-1} = d_{t-1} - d_{t-1}^*$, equation (2.18) can be rewritten as

$$d_t = \frac{(1 + r_t)}{(1 + g_t)} \hat{d}_{t-1} + \frac{(1 + i_t^*)(1 + \varepsilon_t)}{(1 + \pi_t)(1 + g_t)} d_{t-1}^* - s_t \text{ and further abbreviated to}$$

$$d_t = \frac{(1 + r_t)}{(1 + g_t)} \hat{d}_{t-1} - \tilde{s}_t \dots \dots \dots (2.19)$$

The objective is to find the primary surplus-to-GDP ratio that will allow the debt-to-GDP ratio to remain constant. The assumptions made here are that both the rate of r and g is constant.

From equation (2.19) and let 0 and 1 denote the initial period and period 1 respectively.

$$d_1 = \frac{(1+r)}{(1+g)} d_0 - \tilde{s}$$

For debt-to-GDP ratio to remain the same in period 0 as in period 1, we have

$d_1 = d_0$ which gives us

$$d_0 = \frac{(1+r)}{(1+g)} d_0 - \tilde{s} \dots \dots \dots (2.20)$$

solving for \tilde{s} yields

$$\tilde{s} = \frac{(r-g)}{(1+g)} d_0$$

Call this required primary surplus and let z be the gap between the required primary surplus and the actual primary surplus as given by

$$z = \tilde{s} - s$$

This is the one period primary gap. If $z > 0$, the required primary surplus is more than the actual primary surplus, then fiscal policy must gear towards increasing the primary surplus (either through hike in tax rate or cut in spending) in order for the fiscal policy to be sustainable going forward. On the contrary, if $z < 0$, then the debt-to-GDP ratio will shrink overtime.

In the case where seigniorage is included, equation (2.20) will be translated into

$$\tilde{s} = \frac{(r-g)}{(1+g)} d_0 - \sigma_0$$

where

\tilde{s} = primary surplus/deficit

r = real interest rate

g = GDP growth rate

d = debt-to-GDP ratio

$$\delta = \frac{\pi + g + \pi g}{(1 + \pi)(1 + g)} \tilde{m}$$

The advantage of working with the one-period primary gap indicator is that it provides certainty as there is no need to make projection of the future path of the fiscal position. However, it is constrained by the fact that the rate of r and g are required to be assumed constant over time. This primary gap indicator imposes a stricter condition than the PVBC requirement. This is because under the PVBC method, fiscal sustainability need not require the debt-to-GDP ratio be bounded nor does it require it to be constant over time. Hence imposing the condition $d_1 = d_0$ would certainly meet the requirement of the PVBC method, but it is not a requirement that the gap indicator must be satisfied in order for the PVBC method to be fulfilled. In defense of the stricter condition imposed under the one-period primary gap indicator, Chalk and Hemming (2000) highlighted that the indicator is a way to force prudence into fiscal policy approach for the test of fiscal sustainability.

2.3.3 Financial Sector Stability

The section discusses the impact of Financial Sector Stability Indicators on fiscal sustainability. There is a close interlink between stability of the financial system and the sustainability of public and external debts as the financial system tends to

be the pillar of the economy and government often act as the guarantor to its health. On the other hand, a massive government and external debts may cause broader financial instability. (Geithner, Timothy, 2002, IMF, Pg 22)

An irresponsible fiscal authority with large fiscal gap, often resorts to the banking system to finance their ill-founded expansion, and such action more often than not lead to a weakened financial system. On the other hand, failure of domestic banking entities to assess credit risk profile often leads to an excessive maturity and currency mismatches. These mismatches proliferated into a widespread outstanding offshore loans that are not backed by international reserves, and to the extent that it influences the ability of the fiscal authority to borrow from outside the country to fund its fiscal objectives. When confronts with a shock of a significant magnitude, the stability of the financial system gives way and lead to a full-blown crisis. These shocks tend to manifest in the form of currency crisis. This argument put forth the necessity to evaluate the financial system stability as part of the assessment of the fiscal structure sustainability.

Here, the purpose is to examine whether the financial sector of a country is sound to withstand a weaker fiscal position. A weak financial sector often cannot support a deteriorating fiscal position and give way to a potential correction. In other words, a weak financial sector heightens the risk of fiscal instability everything else equals. This is obvious in the case of Malaysia prior to the Asian financial crisis where the government was running fiscal surplus but due to the

weaker financial sector which gave way to correction, government subsequently have to run years of fiscal deficits to reinstate the economic health. That is to say, when financial sector is weaker, fiscal position will be weakened.

Two alternative cases clearly reflect the relevancy of assessing financial sector stability as a test of fiscal sustainability. In the U.S., despite the weak fiscal position, the market driven financial sector with an appropriate risk management process has been credited as one of the reasons to support the otherwise questionable fiscal position over the years. On the other hand, in Japan, the weaker financial sector with mounting bad debts and failure of financial institution intermediation has been the reasons why investors think that the government fiscal position is increasingly vulnerable. This has led to two rating downgrade in the past years.

The cornerstone for this analysis is IMF/World Bank's Financial Sector Assessment program ("Summing Up by the Acting Chairman: Financial Sector Assessment Program-A Review-Lessons from the Pilot and Issues Going Forward," 2000, Executive Board Meeting 00/123, IMF/World Bank, issued as BUFF/00/190). The program aims is on "financial stability and understanding the vulnerabilities and development challenges facing the financial system, with the ultimate objective of reducing the likelihood and severity of financial crisis. It propounded to use the Financial Soundness Indicators ("FSI") as the measures of this likelihood. Also, as part of the assessment, the FSI will include measures that

gauge the changes in the macroeconomic environment and expected development within the sector in the economy and how these changes and expected development impact the FSI. In this assessment, we focus only on the core FSI. Among the ratios of interest are:

1. Banking Sector Financial Strength

- Capital Adequacy
- Earnings and Profitability

The financial sector strength is assessed on the level of backing of capital the financial institutions have. Each level of capital is viewed and gauged based on the quality of the capital. A strong level of capital backing signifies the ability of the financial system to absorb shocks.

The assessment is based on the tier 1 capital which only includes capital that is available to compensate creditors. The capital included here are shareholder equity, realized reserves and retained earnings and do not include tier 2 capital.

2. Banking Sector Vulnerability

- Asset quality
- Liquidity

The asset quality and liquidity in the banking system are also assessed. The asset quality is reflected by way of the level of non-performing loans in the banking system, both gross and net of provisions. The higher the NPLs level the lower the

quality of the banking sector assets. NPLs net of provision allow an assessment of the potential bad loans that have not been made into NPLs. This amount of provisions could still result in the reduction of capital in the event of shocks and hence its effect may also be relevant in consideration.

For the liquidity measures, they reveal how vulnerable the banking system is to the shock on liquidity. They assess the balance sheet effect of a liquidity crisis as a result of unplanned withdrawal or market funding limitations of banks arising from shocks. Liquid asset is defined to include only cash and near cash short term instruments for this purpose.