CHAPTER 4: RESULTS OF STATISTICAL TEST

4.1 Introduction

This chapter looks at the results of the empirical test of government's debt, revenue, expenditure and fiscal position. All the four series are tested for unit root. Section 4.2 deals with stationary test while section 4.3 proceed to test for co-integration of the government's revenue and expenditure series where it has been highlighted in Chapter 3 that if all the series are stationary but if the revenue and expenditure series are cointegrated, it can still satisfy the inter-temporal budget constraint requirement and that the government's fiscal policy can still be sustainable.

4.2 Stationary Test

In performing the statistical test of unit root/stationary, both the nominal and real series are tested and reported accordingly in section 4.2.1 and section 4.2.2 while the results of co-integration are reported in section 4.3. Charts are also included to show the trend of various series and to further reaffirm the non-stationary of the series. The series are group under three sub-group, namely pre-crisis, post-crisis and the combined series. Pre-crisis series are series from 1970-1997 while the combined series are from 1970-2003 annual frequency. The post crisis series is based on a rolling quarterly series between 1998-2003. This is done by adjusting the quarterly series for the period using 4-quarter moving average.

4.2.1 Stationary Test of Government Finance in Nominal Term

Figure 1 below depicts the trend for the Government finances and the debt level. Clearly, they show a non-stationary series for the debt, government revenue and expenditures. Henceforth, we perform unit root test for the three series:

FIGURE 4.1: Trend of Government Finance In Nominal Term

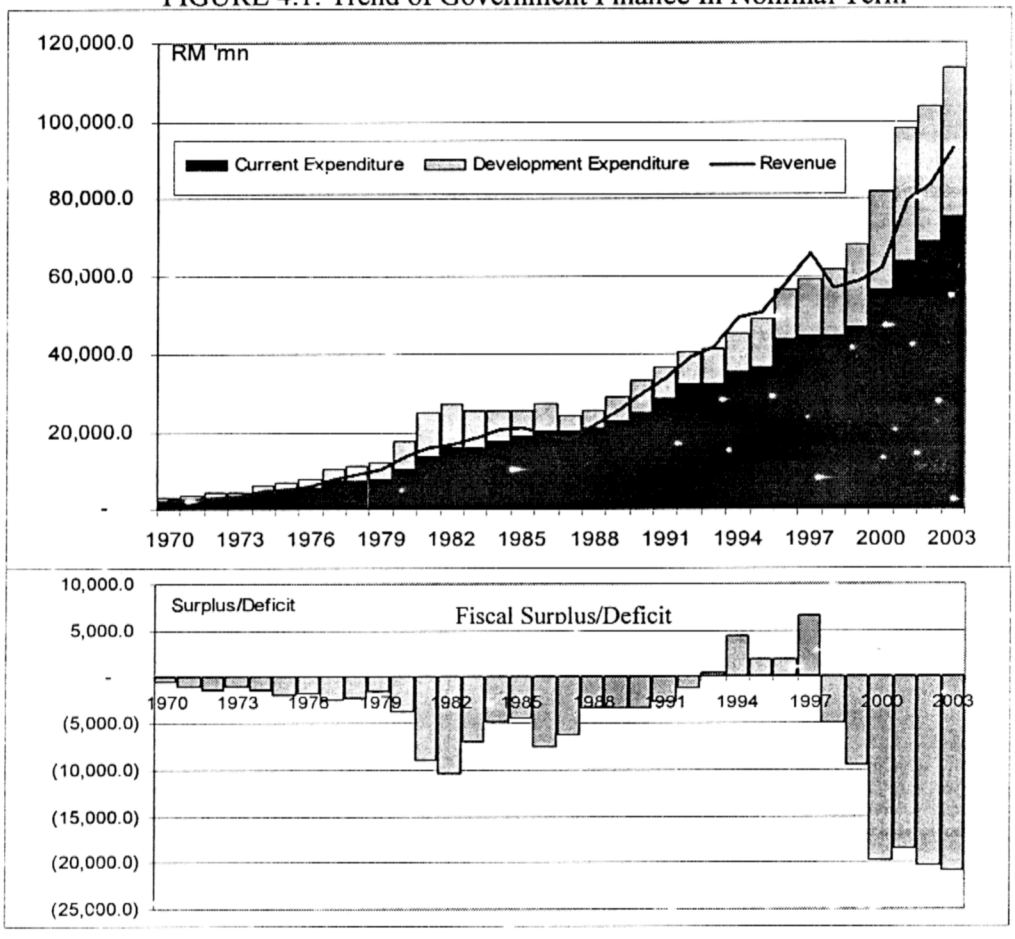


FIGURE 4.2: Trend of Federal Government Debt In Nominal Term

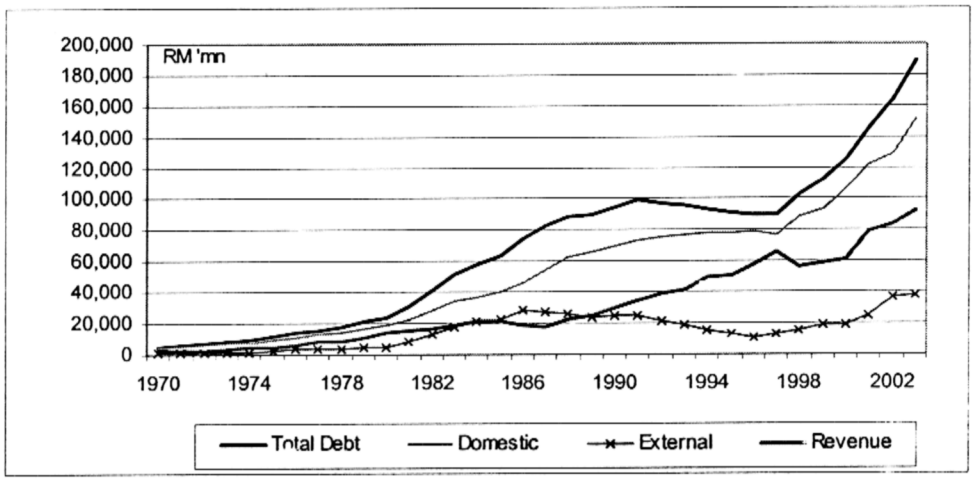


TABLE 4.1: Results of Stationary Test On Nominal Series

Variable	Period	ADF Test	1%	5%	10%	Order of Integration	Model lags
D_t (Federal Govnt Debt)	1970-1997	-1.404	-3.708	-2.980	-2.629	I(2)	1
	1998-2003	1.146	-3.767	-3.004	-2.642	I(1)	1
	1970-2003	0.905	-3.650	-2.956	-2.616	I(2)	1
G_t (Federal Govnt Expenditure)	1970-1997	0.623	-3.708	-2.980	-2.629	I(1)	1
	1998-2003#	-0.055	-3.767	-3.004	-2.642	I(1)	1
	1970-2003	2.323	-3.650	-2.956	-2.616	I(2)	1
R_t (Federal Govnt Revenue)	1970-1997	3.232	-3.708	-2.980	-2.629	I(2)	1
	1998-2003#	-0.414	-3.767	-3.004	-2.642	I(1)	1
	1970-2003	2.202	-3.650	-2.956	-2.616	I(2)	1
S_t (Federal Govnt Surplus/Deficit)	1970-1997	-0.842	-3.708	-2.980	-2.629	I(1)	1
	1998-2003#	-2.088	-3.650	-2.956	-2.616	I(1)	1
	1970-2003	-0.850	-3.767	-3.004	-2.642	I(1)	1

- Series
  1970-1997: Pre-crisis series
  1998-2003: Post-crisis series
  1970-2003: Combined series
- H_0: the series is non-stationary
  H_1: the series is stationary
- $^{10\%}$, $^{5\%}$ and $^{1\%}$ indicate the t-statistic at these significant levels

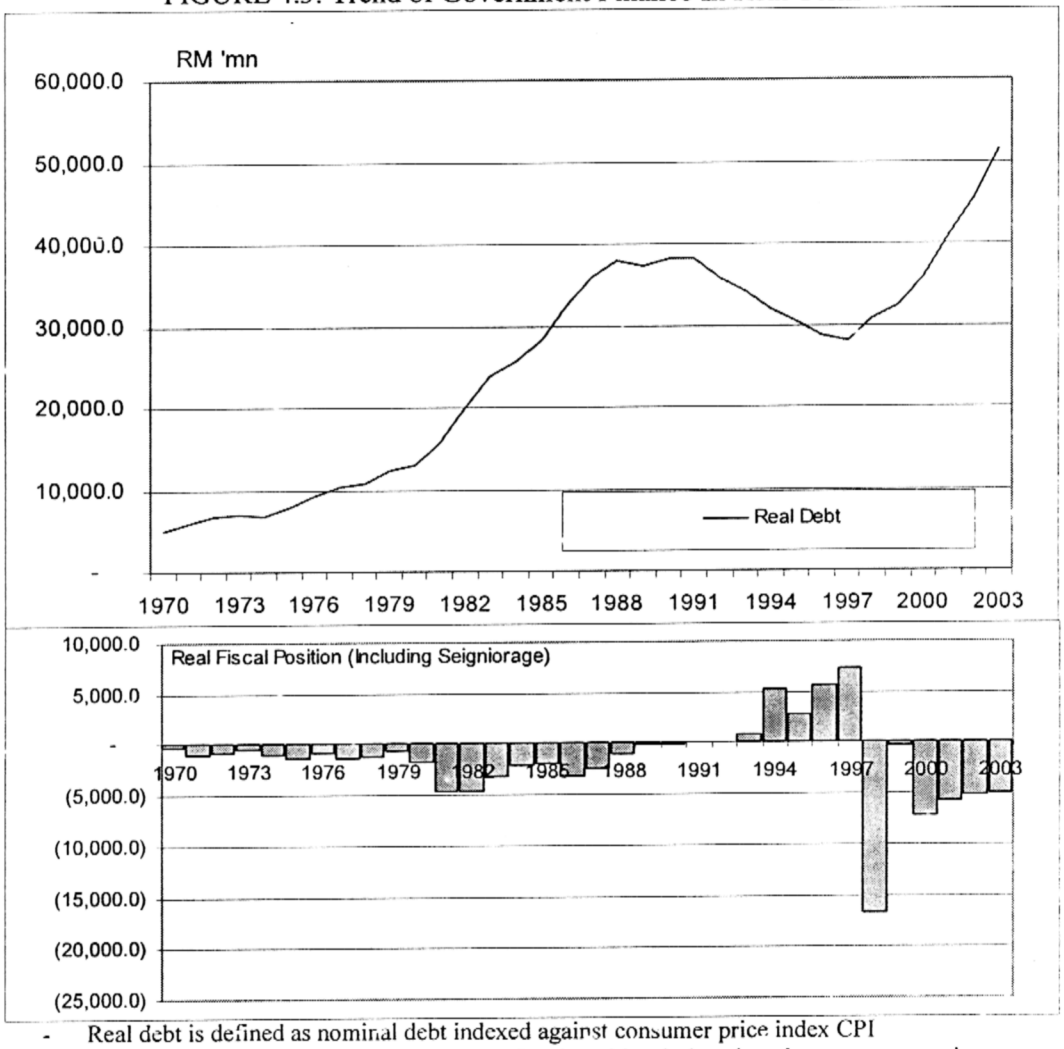
- model lag denotes the number of lag dependent variable in the lag operator used, It is derived base on AIC.
- # quarterly data on a rolling basis
- Order of integration denotes the I(Order) of integration for the series. I(1) for order 1 and I(2) for order 2

The first series in Table 1 is the test of the data prior to the Asian financial crisis and is set for the annual series from 1970-1997. The second series is post-crisis period between 1998-2003 and for this period, we use quarterly data that is made available. However, due to the seasonality of the quarterly data where government revenue and spending tended to skew towards the 2nd half of the year, we adopted a 4 quarters rolling basis. In so doing, we have smoothened the seasonal effect of the quarterly data and at the same time preserving the trend in the series. The third series is a combined annual series for the period from 1970-2003. The data for all the periods are obtained from Bank Negara.

Clearly, the ADF test of stationarity reveals that we cannot reject the null hypothesis at 1% level, indicating that they are non-stationary. Interestingly, most of the series are integrated of order 2 [I(2)] with the exception of quarterly series for Expenditure from 1998-2003. Annual series for Expenditure from 1970-1997 was significant at 5% for the 1st difference, suggesting that the series is integrated of order 1 at this significant level. The quarterly series for debt and revenue between 1998-2003 also have similar results where both are significant at 5% for the 1st difference but not at level. Nonetheless, the deficit series are all integrated of order 1.

4.2.2 Stationary Test of Government Finance in Real Term

FIGURE 4.3: Trend of Government Finance In Real Term



- Real debt is defined as nominal debt indexed against consumer price index CPI
- Real fiscal position is defined as nominal fiscal position indexed against consumer price index CPI

However, in most instances, we are not interested in the evolution of the nominal variables but rather on the real variables. In this case, the variables are indexed against the price level. This is done thorugh indexing of the nominal series against the consumer price index. Here, we also performed the ADF test on the

real debts, government's revenue, expenditure and government's fiscal position. The results are shown in Table 2.

TABLE 4.2: Results of Stationary Test On Real Series

Variable	Period	ADF Test	1%	5%	10%	Order of Integration	Model lags
D_t (Federal Govnt Debt)	1970-1997	-1.626	-3.708	-2.980	-2.630	I(2)	1
	1998-2003	1.048	-3.767	-3.004	-2.642	I(1)	1
	1970-2003	-0.258	-3.650	-2.956	-2.612	I(2)	1
G_t (Federal Govnt Expenditure)	1970-1997	-0.598	-3.708	-2.980	-2.630	I(1)	1
	1998-2003	-0.072	-3.767	-3.004	-2.642	I(1)	1
	1970-2003	1.098	-3.650	-2.956	-2.612	I(1)	1
R_t (Federal Govnt Revenue)	1970-1997	1.823	-3.708	-2.980	-2.630	I(2)	1
	1998-2003	0.137	-3.767	-3.004	-2.642	I(2)	1
	1970-2003	0.794	-3.650	-2.956	-2.612	I(1)	1
S_t (Federal Govnt Surplus/Deficit)	1970-1997	-1.196	-3.708	-2.980	-2.630	I(1)	1
	1998-2003	-2.192	-3.650	-2.956	-2.612	I(1)	1
	1970-2003	-1.626	-3.767	-3.004	-2.642	I(1)	1

- Series
  1970-1997: Pre-crisis series
  1998-2003: Post-crisis series
  1970-2003: Combined series
- H_0: the series is non-stationary
  H_1: the series is stationary
- $^{10\%}$, $^{5\%}$ and $^{1\%}$ indicate the t-statistic at these significant levels
- model lag denotes the number of lag dependent variable in the lag operator used, it is derived base on AIC.
- $^{\#}$ quarterly data on a rolling basis
- Order of integration denotes the I(Order) of integration for the series. I(1) for order 1 and I(2) for order 2

The results of the real variable series are similar to the nominal variables with the exception of the difference in the level of integrations. Conclusively the test confirmed the existence of unit root and we proceed to test for co-integration.

4.3 Co-Integration Test

The results of the co-integration test for Government's revenue ("R") and expenditure ("G") for both the nominal and real terms are shown in Table 3:-

TABLE 4.3: Results of Co-integration Test

		Number of co-integrating equations				
		Lag 1	Lag 2	Lag 3	Lag 4	Remarks
Nominal Co-integration Test for Govnt Revenue (R) and Expnditure (G)	1970-1997	2	0	1	1	At least 1
	1998-2003	0	0	0	1	None
	1970-2003	0	0	0	0	None
Real Co-integration Test for Govnt Revenue (R) and Expnditure (G)	1970-1997	0	0	2	2	Inconclusive
	1998-2003	0	0	0	0	None
	1970-2003	0	0	0	0	None

The test is extended for a maximum of 4 lags. The results are tabulated to show the number of co-integrating equations for different lag orders used in performing the test.

The test results show an inconclusive evidence of co-integration. For the nominal series only the 1970-1997 series indicate a co-integrating relationship with one co-integrating equations. The other two series for 1998-2003 quarterly series and 1970-2003 series do not seem to have a strong convincing case for co-integration. More telling is that when the real variables are tested none of the series give a conclusive evidence of co-integration. The series 1970-1997, which shows one co-integrating equation under the nominal series, do not appear to give the same assurance under the real series.

4.4 Concluding Remarks

The results show that the time series for government's debt, revenue, expenditure and fiscal position are non-stationary. Non-stationarity of these series implied that the PVBC condition does not hold and hence past Malaysia's fiscal policy is unsustainable. Trehan and Walsh (1991) pointed out that if the unit root test of government's fiscal position cannot be rejected, then the PVBC condition can only hold if the debt series is stationary. In the case of Malaysia, the results showed that both the fiscal and debt series are not stationary and hence conclusively support the view of the empirical test that the past fiscal policy is not sustainable going forward.

Hakkio and Rush (1991) also indicated that if government's revenue and expenditure is co-integrated of the same order, it may still satisfy the inter-temporal budget constraint in the long run. Nonetheless, the empirical test of co-integration cannot conclusively support the co-integration of the government's revenue and expenditure and hence, suggests that the past fiscal policy of Malaysia is unsustainable.