AN ANALYSIS OF SAVING DETERMINANTS IN MALAYSIA

HOO HEAP KGEEN

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Name of Candidate: Hoo Heap Kgeen (I.C. No.: 770603-14-6094)

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ABSTRACT

The economic growth rates in Malaysia were relatively higher among Asian countries, especially in the 1990s. Malaysia is also a high savings country in the world, with the savings rates above 25 percent consistently from 1970s to 2000s. This study attempts to examine the relationship and causality between savings and its determinants using annual data from years 1970 to 2010 for Malaysia. The results of Johansen Cointegration test show that savings and its determinants, namely real income, dependency ratio, interest rates and foreign savings are cointegrated. There are two long-run cointegrating relationships exist among the variables. Vector Error Correction Model (VECM) approach is employed to estimate the savings equation. In the long run, savings in Malaysia is negatively related to dependency ratio and foreign savings while positively related to real income. On the other hand, short-run savings is negatively related to dependency ratio and interest rates. Therefore, the phenomenon of declining dependency ratio and high economic growth in Malaysia are said to be the main determinants of high savings in Malaysia in the long run. The Granger causality test results reveal that there is a bilateral causality between savings and economic growth, and also between savings and dependency ratio. Nevertheless, interest rates and foreign savings are found to Granger cause savings, and not vice versa. Thus, this study supports both savings-led growth and growth-led savings hypotheses. Based on the stronger causality found from economic growth to savings, Malaysian government should implement more policies to accelerate economic growth rather than policies to stimulate savings in the country.

ABSTRAK

Kadar pertumbuhan ekonomi Malaysia adalah lebih tinggi secara bandingan di kalangan negara Asia, terutamanya pada tahun 1990an. Malaysia juga merupakan negara dengan tabungan yang tinggi di dunia, iaitu dengan kadar tabungan melebihi 25 peratus secara berterusan dari tahun 1970an hingga 2000an. Kajian ini bertujuan untuk menyelidiki hubungan dan pergantungan antara tabungan dan faktor penentunya dengan menggunakan data tahunan dari tahun 1970 hingga 2010 di Malaysia. Keputusan ujian Kointegrasi Johansen menunjukkan bahawa tabungan dan faktor-faktor penentunya, iaitu pendapatan benar, nisbah tanggungan, kadar faedah dan tabungan asing adalah bersepadu. Dua hubungan jangka panjang didapati wujud antara pembolehubah-pembolehubah tersebut. Pendekatan Model Pembetulan Ralat Vektor (VECM) digunakan untuk menganggar persamaan tabungan. Dalam jangka masa panjang, tabungan di Malaysia berhubungan secara negatif dengan nisbah tanggungan dan tabungan asing manakala ia berhubungan secara positif dengan pendapatan benar. Sebaliknya, tabungan jangka pendek berhubungan secara negatif dengan nisbah tanggungan dan kadar faedah. Oleh itu, fenomena di mana nisbah tanggungan yang semakin menurun dan pertumbuhan ekonomi yang tinggi di Malaysia diperkatakan sebagai penentu utama bagi tabungan yang tinggi di Malaysia dalam jangka masa panjang. Keputusan ujian Kausaliti Granger memaklumkan bahawa terdapatnya pergantungan secara dua hala antara tabungan dan pertumbuhan ekonomi, dan juga antara tabungan dan nisbah tanggungan. Walaupun demikian, didapati bahawa kadar faedah dan tabungan asing masing-masing mempengaruhi tabungan, dan bukan sebaliknya. Oleh itu, kajian ini menyokong kedua-dua hipotesis pimpinan tabungan terhadap pertumbuhan dan pimpinan pertumbuhan terhadap tabungan. Berdasarkan

pergantungan yang lebih kuat daripada pertumbuhan ekonomi kepada tabungan, kerajaan Malaysia harus melaksanakan lebih banyak polisi yang mempercepatkan pertumbuhan ekonomi berbanding dengan polisi yang merangsang tabungan di dalam negara.

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LIST OF ABBREVIATIONS

ADB	Asian Development Bank
ADF	Augmented Dickey-Fuller
ADR	age dependency ratio
AIC	Akaike Information Criterion
ARCH	Autoregressive Conditional Heteroscedasticity
ARDL	Autoregressive Distributed Lag
BG	Breusch-Godfrey
BNM	Bank Negara Malaysia
CAB	Balance on Current Account
CNLRM	Classical Normal Linear Regression Model
DF	Dickey-Fuller
DOS	Department of Statistics
ECM	error correction model
ect	error correction term
FCI	foreign capital inflows
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GDPS	Gross Domestic Private Savings
GDS	Gross Domestic Savings
GNI	Gross National Income
GNP	Gross National Product
GNS	Gross National Savings
H_a	alternative hypothesis

H_0	null hypothesis
I	investment expenditure
i.i.d.	independently and identically distributed
IMF	International Monetary Fund
INT	interest rates
JB	Jarque-Bera
KPSS	Kwiatkowski-Phillips-Schmidt-Shin
LCH	Life Cycle Hypothesis
LM	Lagrange Multiplier
MDR	modified version of dependency ratio
MPS	Marginal Propensity to Save
OADR	old-age dependency ratio
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Squares
PDF	probability density function
PIH	Permanent Income Hypothesis
PP	Phillips-Perron
RINT	real interest rates
S	savings
SBC	Schwartz Bayesian Criterion
s.e.	standard error
TYDL	Toda & Yamamoto and Dolado & Lütkepohl
VAR	Vector Autoregression
VECM	Vector Error Correction Model
YADR	young-age dependency ratio
Y_D	disposable income

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CHAPTER 1 - INTRODUCTION

1.1 Background of the Study

Rapid economic growth is always one of the crucial macroeconomic objectives to be achieved by every country in this world. This is because of economic growth is one of the most important determinants for standards of living and quality of life for the people in a country. Therefore, in the past, there are many studies and research works have been carried out to explore the factors leading to higher economic growth in a country.

In the process of economic development for a country, high savings rates and investment rates are needed to ensure its sustained and high rates of economic growth. This is according to the growth theories for example, proposed by Solow (1956) and Romer (1986) who stated that higher economic growth in a country can be caused by high savings rates through the impact on capital formation in the country. However, Lin (1992) mentioned that economic growth can be sustained only if the resources such as savings are mobilized efficiently and translated effectively into the productive activities in the country [cited in Tang (2008)]. Thus, there is a possibility for higher savings rates to lead to high economic growth provided that the condition of optimal mobilization of resources is fulfilled.

Asian region had experienced rapid economic growth in the past three decades especially in the early of 1990s. It has been a focus for many foreign investors by way of attracting almost half of the capital flows from developed nations. However, the Asian financial crisis that attacked Thailand in July 1997 and then spread to most of the Asian countries had changed the scenario stated before this. As a result of the 1997 financial crisis, most of the Asian currencies had suffered from sharp depreciation and thereafter, this triggered a massive outflow of capital from the Asian region. As the foreign capital is highly mobile in the international markets, it is crucial for every government to understand the close relationship between national savings and foreign savings, and then make use of its national savings to develop the economy and not just rely on foreign savings or capital in this matter.

Based on the World Bank data from 1980s onwards, most of the countries (including Malaysia) in East Asian and Southeast Asian regions have shown higher savings rates and economic growth rates compare with other countries in the world. Thus, Malaysia is suitable to be studied for analysis of relationship between savings and growth in a country. In fact, this analysis has gained much attention in the theoretical literature and past empirical research. If high savings can be proven to Granger-cause to high growth in Malaysia, this empirical finding can be used to explain the relatively higher growth rates for the East Asian and Southeast Asian countries.

1.2 Savings in Malaysia: An Overview from World Perspective

Despite the declining world's average savings rate in the past four decades since the early 1970s throughout the late 2000s, there are few countries in this world which have consistently achieved and managed to sustain their savings rates to be above 25 percent of the country's Gross Domestic Product (GDP) for at least three decades in the past.

By using the World Development Indicators from World Bank as a source, with the cut-off of an average Gross Domestic Savings (GDS) rate of 25 percent to GDP of a country, Table 1.1 summarizes the high savings countries in the world for the time period of 1970s to 2000s.

Table 1.1: High Savings Countries in the World, 1970s – 2000s
(with percentage of average GDS to GDP > 25%)

Country	1970s	1980s	1990s	2000s
Algeria	35.17	31.49	30.14	49.15
Botswana	21.12	35.27	38.83	36.48
Brunei Darussalam		45.19	35.86	49.90
China	30.42	35.45	41.15	45.82
Congo, Rep.	12.01	31.94	28.82	48.27
Finland	28.34	27.25	24.61	26.82
Gabon	54.29	44.27	43.63	53.28
Hong Kong	30.78	33.67	31.90	31.21
Indonesia	24.97	31.59	30.17	30.46
Iran, Islamic Rep.	33.90	16.80	35.92	39.27
Japan	35.40	31.61	30.57	24.61
South Korea	22.12	30.87	36.30	31.59
Kuwait	59.40	33.07	10.40	43.70
Luxembourg	35.22	30.63	39.81	47.40
Macao		45.99	52.10	60.46
Malaysia	***27.10***	***30.25***	***40.66***	***42.23***
Netherlands	26.09	24.63	26.89	27.16
Norway	30.50	31.31	28.63	36.31
Oman	50.52	39.70	24.98	43.22
Panama		28.57	27.72	27.15
Russian Federation		34.73	31.48	33.11
Saudi Arabia	59.34	26.46	27.53	43.81
Singapore	29.13	42.39	48.67	47.57
Switzerland	31.00	29.01	28.70	29.42
Thailand	22.26	26.47	35.26	31.64
Trinidad and Tobago	35.27	24.20	27.98	39.61
Turkmenistan		28.08	28.90	42.25
Venezuela	37.82	25.02	26.50	34.50
World as a whole	*24.64*	*22.83*	*22.51*	*21.39*

Source: Computed from annual data in World Development Indicators 2011, World Bank.

From the total of 216 countries in the World Bank's 2011 database, 28 countries are categorized as the consistent high savers, of which 12 of them had shown the average GDS rate above 25 percent for all the four decades. From the 28 countries, there are ten countries (including Malaysia) come from either East Asian or Southeast Asian region. Besides, there are only five countries (including Malaysia) which able to achieve an upward trend for its savings rates throughout the four decades. For instance, the average GDS rate of Malaysia had increased from 27.10 percent in the 1970s, 30.25 percent in the 1980s, 40.66 percent in the 1990s, to 42.23 percent of GDP in the 2000s.

The relatively high savings rates of the East Asian and Pacific region are shown in a global comparative context in Table 1.2.[1] From the seven world geographical regions, the East Asian and Pacific region (in which Malaysia is grouping in) is the only region which can sustain the average GDS above 25 percent of GDP continuously for all the four decades. For instance, the average savings rates for the East Asian and Pacific region was in the range of 28 percent to 33 percent while the Europe and Central Asian region and also the Latin American and Caribbean region have been around 22 percent. In the case of Sub-Saharan African region, the savings rates had been declining from the 1970s to 1990s and achieved the average of 16 percent in the 2000s.

Table 1.2: Average GDS as Percentage of GDP by World Regions, 1970s – 2000s

Geographical Region	Number of Countries	1970s	1980s	1990s	2000s
East Asia and Pacific	36	32.37	31.66	31.97	28.84
Europe and Central Asia	58	24.10	21.30	21.85	21.79
Latin America and Caribbean	41	21.84	22.77	19.36	21.33
Middle East and North Africa	21	34.55	22.51	22.63	33.21
North America	3	20.01	18.26	17.15	14.75
South Asia	8	15.09	17.36	20.77	25.61
Sub-Saharan Africa	49	22.81	20.12	15.40	16.05
Total	216				
World as a whole		*24.64*	*22.83*	*22.51*	*21.39*
Malaysia		***27.10***	***30.25***	***40.66***	***42.23***

Source: Computed from annual data in World Development Indicators 2011, World Bank.

[1] Refer to Appendix A for the name list of countries in the world categorized into the seven world geographical regions defined by the World Bank.

Table 1.3 summarizes the savings rates (share of average GDS in GDP) achieved by the five country income groups.[2] It can be seen that besides the high income: non-OECD income group, the upper middle income group (in which Malaysia is grouping in) is the only income group in which the average savings rate was above 25 percent of GDP for all the four decades since 1970s. Furthermore, the upper middle income group is the only group which showed an upward trend in the average savings rates for the four decades (i.e. increased from 25.05 percent in the 1970s to 29.85 percent of GDP in the 2000s).

Table 1.3: Average GDS as Percentage of GDP by Country Income Groups, 1970s – 2000s

Income Group	Number of Countries	1970s	1980s	1990s	2000s
High income: non-OECD	39	38.25	33.19	29.99	35.33
High income: OECD	31	24.45	22.07	21.66	19.52
Upper middle income	54	25.05	26.93	27.25	29.85
Lower middle income	56	17.50	18.86	19.76	23.22
Low income	36	7.27	8.26	9.64	10.12
Total	216				
World as a whole		*24.64*	*22.83*	*22.51*	*21.39*
Malaysia		***27.10***	***30.25***	***40.66***	***42.23***

Source: Computed from annual data in World Development Indicators 2011, World Bank.

1.3 Savings in Malaysia: An Overview from Asian Region

The economy of Asian region is one of the most successful regional economies in the world because this region consists of quite a number of large and prosperous economies located either in East Asian, Southeast Asian or South Asian region. For examples, there are China, Hong Kong, Japan, South Korea and Taiwan located in the East Asian

[2] Refer to Appendix B for the name list of countries in the world categorized into the five country income groups defined by the World Bank.

region. Besides, there are Singapore, Indonesia, Malaysia, Thailand and the rest of eight countries located in the Southeast Asia.[3]

Table 1.4 shows a comparative picture of the Malaysian real GDP per capita (2000 = 100), real GDP growth rates and ratio of GDS to GDP with the corresponding data of selected Asian countries from Southeast Asia, East Asia and South Asia. It is observed that in 1980, Malaysia was one of the highest real GDP per capita countries, after Brunei, Japan, Hong Kong, Singapore and South Korea. This ranking remained unchanged over the next three decades until 2010.

Besides, real GDP growth rates of Malaysia were averaged at 7.7 percent in the 1970s, 5.9 percent in the 1980s and 7.3 percent in the 1990s, which were above the performance of many Asian developing countries. Somehow, Malaysian growth rates of real GDP had declined to average 4.8 percent in the 2000s prior to the global economic crisis in 2008. Over the three decades from 1970s to 1990s, the average real GDP growth rate of Malaysia was relatively higher than the Philippines, Japan, Bangladesh, India and Sri Lanka, but lower than that of the rest of countries listed in the Table 1.4.

In contrast, besides Singapore and China, Malaysia is the only Asian country which has shown not only high, but at an upward trend for the savings rates where the average GDS rate was above 25 percent of GDP since the 1970s throughout the four decades. The savings rate of Malaysia is relatively higher than many other Asian countries in the world, especially all the South Asian countries and most of the Southeast Asian countries.

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[3] Refer to Appendix C for the name list of Asian countries according to six geographical locations, i.e. East Asia, Southeast Asia, South Asia, West Asia, North Asia and Central Asia.

Table 1.4: Real GDP per Capita, Average Real GDP Growth Rates and Average GDS as Percentage of GDP for Selected Asian Countries, 1970s – 2000s

Region / Country	GDP per capita (constant 2000 US$)				Real GDP growth (%)				GDS (% of GDP)			
	1980	1990	2000	2010	1970s	1980s	1990s	2000s	1970s	1980s	1990s	2000s
<u>Southeast Asia</u>												
Brunei	30,504	19,075	18,350	n.a.	12.2	(2.4)	2.1	1.4	n.a.	45.2	35.9	49.9
Indonesia	390	592	773	1,144	7.8	6.4	4.8	5.1	25.0	31.6	30.2	30.5
Malaysia	***1,910***	***2,593***	***4,006***	***5,174***	***7.7***	***5.9***	***7.3***	***4.8***	***27.1***	***30.2***	***40.7***	***42.2***
Philippines	1,098	991	1,048	1,383	5.8	2.0	2.8	4.5	24.7	20.6	15.9	16.0
Singapore	9,275	15,483	23,414	31,990	9.4	7.8	7.3	5.2	29.1	42.4	48.7	47.6
Thailand	785	1,391	1,943	2,712	7.5	7.3	5.3	4.1	22.3	26.5	35.3	31.6
Vietnam	n.a.	227	402	723	n.a.	4.5	7.4	7.3	n.a.	4.4	16.0	28.3
<u>East Asia</u>												
China	186	392	949	2,423	7.4	9.8	10.0	10.3	30.4	35.4	41.2	45.8
Hong Kong	11,880	20,188	25,374	35,537	9.6	7.4	3.6	4.2	30.8	33.7	31.9	31.2
Japan	22,590	33,595	36,789	39,733	4.6	4.4	1.5	0.6	35.4	31.6	30.6	24.6
South Korea	3,358	6,895	11,347	16,372	8.3	7.7	6.3	4.4	22.1	30.9	36.3	31.6
<u>South Asia</u>												
Bangladesh	254	280	364	557	1.5	3.2	4.8	5.8	1.9	7.7	13.3	17.6
India	229	318	453	830	2.9	5.7	5.6	7.2	17.7	19.9	22.6	28.7
Pakistan	339	449	512	670	4.8	6.9	4.0	4.6	8.2	8.3	15.1	15.1
Sri Lanka	432	567	871	1,296	4.2	4.1	5.3	5.0	13.7	12.9	16.0	16.5

Source: Computed from annual data in World Development Indicators 2011, World Bank.

1.4 Savings and Economic Growth Rates in Malaysia

Malaysia can be said as one of the fast-growing economies in the Southeast Asia due to its high real GDP growth rates, especially from the 1970s to 1990s. Besides, real GDP per capita of Malaysia is the third highest among the Southeast Asian countries, followed after Singapore and Brunei (see Table 1.4).

The relatively high economic growth rates in Malaysia are always linked to the intensive flows of Foreign Direct Investment (FDI) especially in the 1980s and 1990s. Furthermore, with the rapid expansion of international trades at the same time, this further aid to the achievement of high economic growth rates. Besides, the relatively high savings rates could be one of the factors or determinants of high economic growth in Malaysia since the Malaysian savings rate is the third highest among the Southeast Asian countries, followed after Singapore and Brunei (see Table 1.4).

Figure 1.1 depicts the GDS rates (as a percentage of GDP) and the real GDP growth rates in Malaysia from 1970 to 2009. In overall, the savings rate shows an upward trend in which it had increased from 24.3 percent in 1970 to 36.0 percent in 2009. In 1998, the savings rate achieved its highest rate in the history, i.e. 48.7 percent. However, it started to fall dramatically from 1998 to 2002. This could be resulting from the Asian financial (or currency) crisis which attacked some of the Asian countries (including Malaysia) from mid of 1997 to end of 1998.

During 2001 to 2008, the savings rates seem to be constant and floated within the range of 41 to 44 percent of GDP. However, there is a sharp fall again in 2009 where the savings rate fell from 42.3 percent in 2008 to 36.0 percent in 2009. This could be due to the global financial crisis which was started with the subprime mortgage crisis in the United States. Despite the dwi-crisis in the 1990s and 2000s, Malaysia is still able to sustain its high level of savings rate until nowadays.

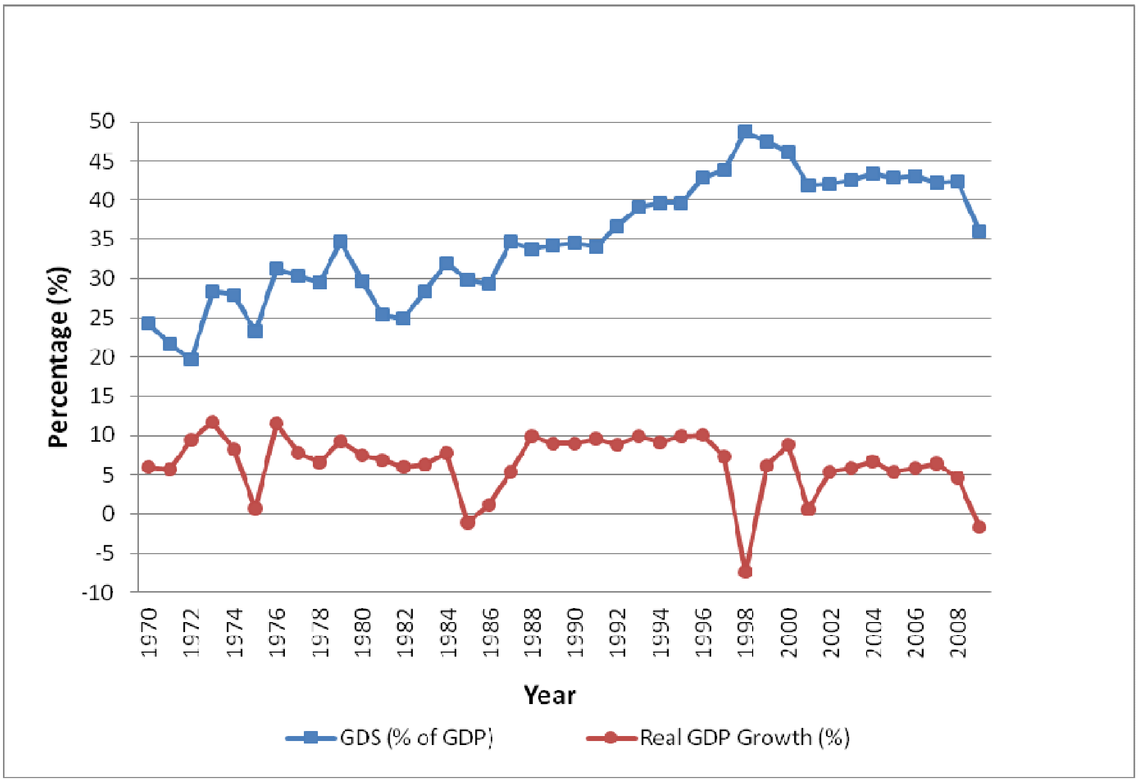

Figure 1.1: GDS as Percentage of GDP, and Real GDP Growth Rates in Malaysia, 1970 – 2009

Source: World Development Indicators 2011, World Bank.

On the other hand, Malaysian real GDP growth rate shows a constant trend throughout the period of this study but relatively high economic growth rates among the Southeast Asian countries, especially from 1988 to 1996 where the growth rates were floated in the range of 8.9 percent to 10.0 percent. There are four structural breaks in the trend due to different causes.

In the 1970s, Malaysia had achieved an average annual rate of 7.7 percent for its economic growth (see Table 1.4). Such a high growth rate was achieved from the result of significant improvement in the performance of manufacturing sector where this sector managed to grow by an average annual rate of 22.9 percent during 1971–1980 and furthermore contributed to 21.6 percent of Malaysian GDP in 1980 (Ang, 2009). Besides, Yusof et al. (1994) highlighted that the high growth rates in the 1970s was also due to the government efforts where the government had aggressively promoting its export-oriented industries through the establishment of free trade zones since early of the 1970s [cited in Ang (2009)]. As a result, Malaysia enjoys a success in export-oriented and labor-intensive industries, for examples, textiles, electronics and wool products.

However, there was the first time for the Malaysian growth rate to fall sharply from 8.3 percent in 1974 to only 0.8 percent in 1975 due to the oil crisis which had led to the world recession in 1975. The Malaysian government had responded to the crisis by increasing government spending largely on public investment projects (Ang, 2009). As a result, the growth rate of real GDP started to increase and achieved 11.6 percent (which was also the second highest growth rate in the past decades) in 1976.

In the 1980s, Malaysian average annual rate of growth was 5.9 percent (see Table 1.4), slightly lower than the previous decade. According to Ang (2009), this relatively lower growth rate was mainly caused by two reasons. Firstly, there was a prolonged global economic recession in the early 1980s caused to a dramatic fall in commodity prices. Secondly, the collapse of several main export commodity prices in 1985 had led to the economic recession again. Figure 1.1 shows that the real GDP growth rate in 1985 was –1.1 percent (the first time for Malaysian growth rate to be negative). However, the economy started to recover and managed to achieve and sustain an annual growth of 9.0 to 10.0 percent from 1988 to 1996, as a result of external conditions which led to a spectacular performance in the export sector during 1988–1990, active contribution of private sector in developing the economy and furthermore, the massive increase of FDI into Malaysia during 1991–1996 (Ang, 2009).

As shown in Figure 1.1, there was another and also the most serious breakpoint occurred in 1998 as the outcome of the Asian financial crisis started in mid of 1997. In 1998, Malaysian real GDP growth rate had recorded the lowest rate in the four decades, i.e. –7.4 percent. However, Malaysian economy had recovered from the crisis and achieved the growth rate within the range of 5.3 to 8.9 percent for 1999–2007, with the exception of year 2001. The growth rate was only 0.5 percent in 2001 due to the world trade recession (Ang, 2009). Lastly, Malaysia recorded –1.7 percent for the growth rate in 2009 due to the global economic crisis in 2008.

1.5 Statement of Research Problem

Since the 1980s, there are many research publications which discussed about the high economic achievements among most of the Asian countries such as China, Hong Kong, Singapore, Taiwan, South Korea, Malaysia, Indonesia and Thailand. The databank of World Bank had revealed that the average annual growth rate of GDP for these countries was two times higher as compared to other developing countries in the same region.

The Malaysian economy is focused in this study because Malaysia exhibits among the higher savings and growth rates in the Southeast Asian region. Thus, Malaysia is particularly suitable to be used for an analysis of the relationship between savings and economic growth in a country. Besides that, the direction of causation between savings and growth will be investigated in this study as well.

The empirical findings and evidence found from the previous research works are still unclear and ambiguous about the relationship between savings and its determinants, and also the direction of causation between savings and growth in a country. Furthermore, the empirical works have derived different results and conclusions subject to the country and time period used in the study.

In this study, the determinants of savings in Malaysia will be examined and Granger causality between savings and its determinants (especially economic growth) in Malaysia will be analyzed.

1.6 Significance of the Study

From the previous studies and research, savings in a country is found to be significant and closely related to its economic growth. This makes our study on savings behavior in Malaysia and the causality between its savings and growth become crucial and meaningful. However, there are not many studies being carried out in the past to study about this matter for the case of Malaysia. Thus, the present study will be able to fill the gap and to complement the previous studies.

In this study, a comprehensive set of data using domestic data statistics, together with some other relevant explanatory variables which are expected to be the main determinants of savings in Malaysia will be used. This study also provides an estimated long-run domestic savings equation over a relatively longer time period than most of the previous studies on Malaysia.

The study conducted is important to the policymakers of Malaysia because the results obtained will be useful for macroeconomic analysis. Malaysian government has to ensure that the economy can sustain high economic growth rates in the forthcoming decades in order for Malaysia to become a developed and high-income nation, as proposed by the seventh Prime Minister, Dato' Sri Mohd Najib bin Tun Abdul Razak in the year of 2010.

If savings is proved to be a factor Granger cause to high economic growth in the country, one of the main goals and objectives of government policies set by the government is to encourage savings. In contrast, if growth results less from savings but more from other factors such as human capital, technological innovation and advancement, and trade policy, the government can set these targets for the government policies.

1.7 Objectives of the Study

In general, this study attempts to study empirically the relationship between savings and economic growth in Malaysia using a relatively longer time period from 1970 to 2010. Following from this, the specific objectives of the study are:

i) To examine the relationship between savings and its determinants in Malaysia in both short run and long run.

ii) To investigate the direction of causality between savings and its determinants (especially economic growth).

1.8 Research Organization

This study consists of five chapters. Chapter one provides an introduction and illustration for the statement of research problem, significance and objectives of the study. The savings and growth in various countries around the world and the relative performance of Asian countries including Malaysia are discussed briefly.

Chapter two reviews the determinants of savings and provides certain definitions of how these variables are measured. This chapter also reviews the extant empirical literature on savings model across many dimensions and countries.

Chapter three highlights the sources of data used. In addition, the research methodology about econometric procedures used to estimate the savings function in Malaysia and the analysis for direction of causality between savings and growth will be explored.

Chapter four presents and discusses the empirical results obtained from the study.

Chapter five concludes the thesis with a review of the main findings of the study and highlights some implications that arise from them. The chapter also discusses the limitations of the study and identifies issues for future research.

CHAPTER 2 - LITERATURE REVIEW

2.1 Introduction

In the previous chapter, an overview about savings and economic growth rates in Malaysia, statement of research problem, significance and objectives of the study have been presented. In this chapter, Section 2.3 reviews the determinants of savings. Review of the literature related to the causality between savings and economic growth will be presented in Section 2.4.

2.2 Theoretical Framework

Based on the objectives of the study, a theoretical framework showing the relationship among the variables used in this study was constructed and depicted by Figure 2.1. The study attempts to identify the determinants of savings in Malaysia. Besides, direction of causality between savings and its determinants will be examined too.

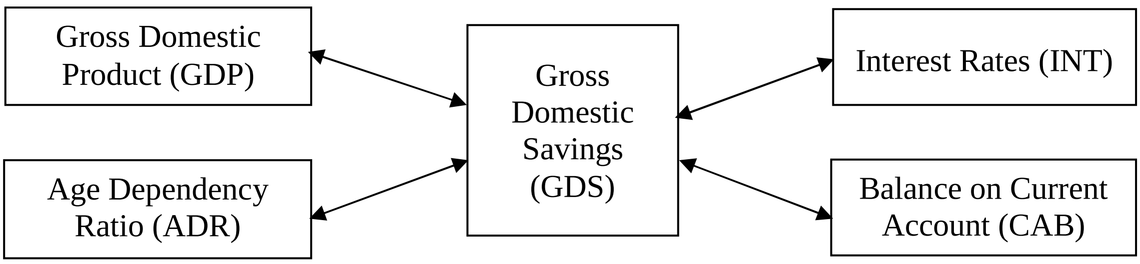

Figure 2.1: Theoretical Framework Describing the Relationship between All Variables Used in the Study

A multivariate model will be used to estimate the savings function as follows.

$$LRGDS_t = \alpha_0 + \beta_1 LRGDP_t + \beta_2 LADR_t + \beta_3 INT_t + \beta_4 CAB_t + \varepsilon_t \quad .... (2.1)$$

where L denotes natural logarithm (ln)

RGDS is real Gross Domestic Savings

RGDP is real Gross Domestic Product

ADR is age dependency ratio

INT is interest rates

CAB is Balance on Current Account (as a proxy for foreign savings)

α_0 is the intercept parameter

β_1, β_2, β_3 and β_4 are the slope coefficients

ε_t is the error term which is assumed to be white noise and in normal distribution (with zero mean and constant variance)

2.2.1 Operational Definition of Variables

A set of definition and brief notes for the variables used is as follows. These definitions are widely used and taken mostly from the source of Department of Statistics (DOS), Malaysia, Bank Negara Malaysia (BNM) and International Monetary Fund (IMF).

Gross Domestic Savings (GDS) refer to the difference between GDP and total consumption, where total consumption is the sum of private consumption and government consumption. In this study, GDS is derived by subtracting final consumption expenditure from GDP at purchasers' value.

Gross Domestic Product (GDP) refer to the total value of producing all final goods and services in a country within a calendar year, before deducting allowances for consumption of fixed capital. GDP can be measured in three but equivalent ways, i.e. the sum of value added, sum of final expenditures and sum of incomes. GDP based on expenditure approach, i.e. the total final expenditure at purchasers' values, subtract the free on board (f.o.b.) value of imports of goods and services is used in this study.

Age Dependency Ratio (ADR) is the ratio of unproductive or non-working age population (below 15 and above 65 years old) to the productive or working age population (15 to 64 years old).

Interest rates (INT) used in this study is proxy by the fixed deposit interest rates which refer to the average fixed deposit rates of commercial banks, finance companies and merchant banks for maturities of 12 months.

Balance on Current Account (CAB) is the sum of the sub-components balance on goods, services, income, and net current transfers. Current account (which is one of the accounts in the Balance of Payments) records all transactions other than those in financial and capital items. CAB is used as a proxy for foreign savings in this study.

2.3 Determinants of Savings

In general, the more significant and common determinants of savings found from the literature review are economic growth, dependency ratio, interest rates and foreign savings.

2.3.1 Economic Growth

The concept of a simple savings function was first explained by John Maynard Keynes in the early of 1930s under his demand-determined model of output and employment. (Begg, Fisher, & Dornbusch, 2003). According to Keynes, the simplified savings function is given as

$$S = -a + (1 - b)Y_D \qquad (2.2)$$

A savings function shows the relationship between savings (S) and disposable income (Y_D) level. S is a function of Y_D indicates that income variable is a determinant of savings. S is the sum of autonomous dissavings ($-a$) and income-induced savings [$(1 - b)Y_D$]. $-a$ is always constant while $(1 - b)$ is the Marginal Propensity to Save (MPS), i.e. the proportion of any increase in Y_D that is saved.

Figure 2.2 shows a savings function where savings is positively related to disposable income. It can be said that the higher is the economic growth (and therefore income), the higher is the savings in an economy.

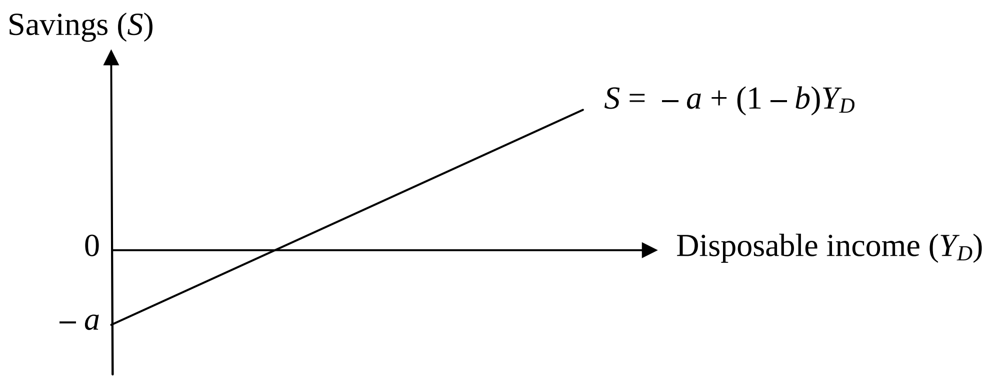

Figure 2.2: Keynes' Simplified Savings Function

From the literature review, there are variety of variables have been used as a proxy to measure the economic growth in a country. For instance, real income per capita was used by Leff (1969), Collins (1991), Edwards (1996), Loayza et al. (2000), Agrawal (2001) and Agrawal et al. (2009). Besides, real GDP was used by Mohan (2006), Sajid and Sarfraz (2008), Tang (2008, 2009, 2010), Tang and Chua (2009), AbuAl-Foul (2010) and Tang and Tan (2011). Baharumshah et al. (2003), Sajid and Sarfraz (2008) and Tang and Lean (2009) had chosen Gross National Product (GNP) in their studies while Anoruo and Ahmad (2001), Thanoon and Baharumshah (2005), Waithima (2008) and Abu (2010) had used GDP growth rate. Furthermore, growth rate of GDP per capita was used by Edwards (1996), Attanasio et al. (2000) and Agrawal et al. (2009). Similarly, growth rate of GNP per capita was used by Agrawal (2001) while growth rate of income per capita was used by Deaton and Paxson (1997), Faruqee and Husain (1998) and Ang (2008). From the empirical testing, there is a positive coefficient of growth found in the savings function from almost all the studies done, irrespective of which variable is used as the proxy for growth. In this study, real GDP is used to measure the economic growth rate.

The relationship between savings and economic growth will be further discussed in Section 2.4.

2.3.2 Dependency Ratio

Besides economic growth, dependency ratio is also an important explanatory variable in influencing the savings. There were many researchers who have been tried to study the relationship between savings and demographic factor of a country or region, such as Leff (1969), Hamid and Kanbur (1993), Edwards (1996), Muradoglu and Taskin (1996), Faruqee and Husain (1998), Loayza et al. (2000), Agrawal (2001), Baharumshah et al. (2003), Thanoon and Baharumshah (2005), Ang (2008), Tang (2008), Agrawal et al. (2009), Tang and Tan (2011) and many more. In understanding the relationship between these two variables, the Life Cycle Hypothesis (LCH) proposed by Modigliani (1970) plays an essential role here. The LCH is a theory explaining consumption (and therefore savings) behavior according to an individual's position in the life cycle.

The LCH states that besides affected by income growth and population growth, savings in a country affected by the population age structure (or dependency ratio) as well. Dependency ratio is defined as the ratio of non-working age population to the working age population. It was noted that the non-productive population, which refers to the young (i.e. below 15 years old) and elderly or retired group (i.e. 65 years old and above) tend to have dissavings or negative savings, while there will be positive savings for those who are during their productive or working years (i.e. 15 - 64 years old).

According to the LCH, individuals will have dissavings when they are young, have zero or low income. During the productive or working years, they will manage to save as the income earned is higher than the consumption spending. Thus, they will start to accumulate savings. However, the savings will become negative again when they are old or have retired. This results in a hump-shaped savings profile over the lifetime of an individual, as shown by Figure 2.3.

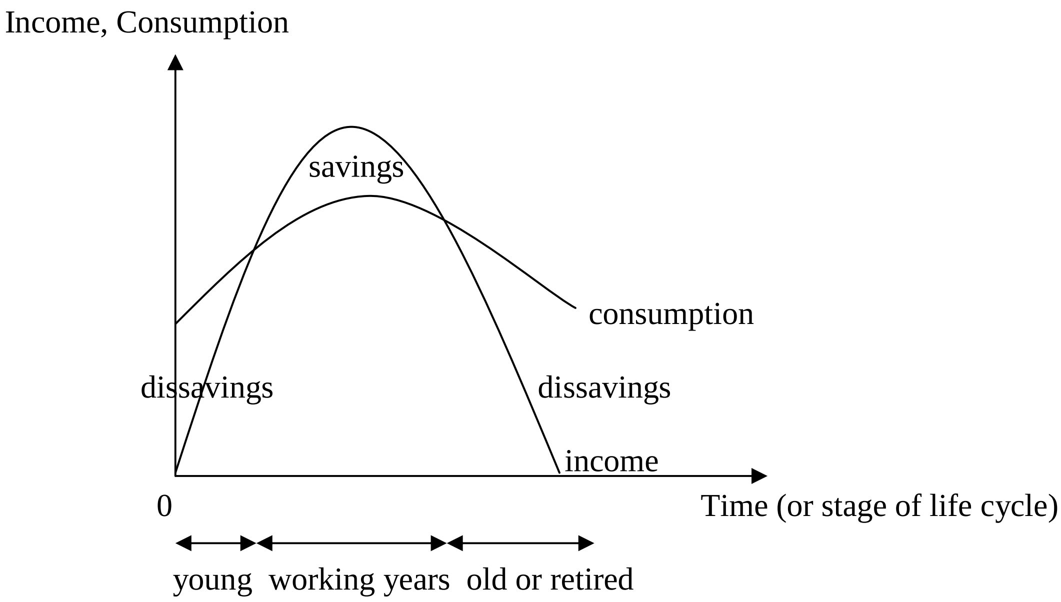

Figure 2.3: Income and Consumption Age Profiles Corresponding Savings over the Household Life Cycle

Source: modified from Mason (1988).

It was noted that consumption and income vary in response to the changing demographic characteristics of the household. However, the proportionate change in consumption is always smaller than the proportionate change in income due to the pension motive of households as they have to continue to spend (by using their savings during the working years) after their retirement (Mason, 1988).

In conclusion, savings rate will be higher if the dependency ratio is lower (meaning a larger working population relative to the non-working population). Furthermore, declining fertility rate and smaller aging population will help to increase savings rate of a country as well. Thus, according to Lahiri (1989), Loayza et al. (2000), Agrawal (2001) and Agrawal et al. (2009), the sign of estimated coefficient of dependency ratio in a savings equation is expected to be negative.

Mason (1988) was in opinion that in looking at the relationship between aggregate savings and population growth rate of a country, it depends on the relative strength between the dependency effect (which states that rapid population growth discourages savings) and the rate of growth effect (i.e. rapid population growth encourages savings).

In the context of a household, savings by a household can be influenced by the number of children in the household. It is logical to say that the higher is the number of children, the higher is the household consumption spending and thus, the lower is the savings. There is an inverse relationship between dependency ratio and savings in a household. However, according to Fry (1994), household with more children may tend to have higher savings due to the positive bequest motive. There is a possibility to have positive relationship between savings and dependency ratio in this case. Thus, we can conclude that the effect of dependency ratio on savings is ambiguous.

From the previous empirical studies, it was found that the influence of dependency ratio on savings can be positive or negative and it varies according to country and time frame used. However, most of the empirical studies found a negative effect of dependency ratio on savings. For instance, Leff (1969), Hamid and Kanbur (1993), Agrawal (2001), Thanoon and Baharumshah (2005) and Tang and Tan (2011) found a negative coefficient of dependency ratio in the Malaysian savings equation. In other words, there is an inverse relationship between dependency ratio and savings in Malaysia.

Besides, Rossi (1989) in her study on developing countries found a significant negative effect of dependency ratio on savings rate. Similarly, Loayza et al. (2000) agreed that an increase in the young-age dependency ratio (YADR) and old-age dependency ratio (OADR) tend to reduce the private savings rate in which this is in line with the LCH. They pointed out that private savings rates will fall about 1 percentage point as the YADR rises by 3.5 percentage points. Furthermore, the negative impact on savings is double-up if the OADR increases. In opposite, a country with declining YADR may enjoy the increases in savings rate in the short run. However, this savings rate will start to fall when the country faces increasing OADR in the next stage of demographic maturity. China is an example to explain this scenario. It was noticed that the age structure is likely to change as a country develops.

Edwards (1996) in his study on 36 Latin American countries for period 1970–1992 and Agrawal et al. (2009) in their study on five South African countries also found significant negative result for almost all countries involved in their respective studies. Agrawal et al. commented that one of the factors for the increasing rates of savings in South Asia is due to the declining dependency rates.

Conversely, the empirical studies which found a significant positive coefficient of dependency ratio include Fry (1994), Faruqee and Husain (1998), Baharumshah et al. (2003) and Tang (2008). Baharumshah et al. argued that the positive coefficient found for ADR could be due to the desire to leave a larger bequest for the dependent as the dependent ratio in a household become larger. Tang further commented that this scenario may occur due to the existence of precautionary savings behavior in Malaysia.

Nevertheless, there are empirical studies which found that dependency ratio does not play any significant role in explaining the savings behavior of a country, such as the study on savings in the low income per capita countries by Gupta (1971) and the study on growth, demographic structure and national savings in Taiwan by Deaton and Paxson (2000b). Deaton and Paxson stated that there is no overall correlation between age structure and savings rates in Taiwan and thus, the life cycle model cannot be used to explain about the savings rate.

In conclusion, the effect of dependency ratio on savings is ambiguous and mixed. Thus, empirical study on Malaysia can be done to re-examine this relation using longer span of data set.

From the literature review done, instead of using ADR as one of the explanatory variables, Tang (2008) and Tang and Chua (2012) had proposed and used a new self-designed variable, i.e. modified version of dependency ratio (MDR). MDR is measured as the ratio of total unemployed labor force and non-labor force to the total population of a country. Tang argued that ADR has ignored the existence of unemployed labor force who is also a dissavings population in a country.

ADR is the most appropriate proxy and commonly used as an explanatory variable in a savings equation to capture the influence of demographic factor to the savings in a country. In contrast, other proxy measures such as MDR is not a common proxy as it had been used only by Tang (2008) and Tang and Chua (2012). Besides, Agrawal (2001) pointed out that the share of labor force or number of employed in total population is also not appropriate to be used as proxy due to the incomplete data collection on those self-employed and also labor who are working in the informal sectors and rural areas. Horioka (1997) mentioned that it is possible and necessary to segregate the ADR into YADR and OADR since these two ratios may further explain the savings behavior in a country [cited in Ang (2008)]. However, from the literature review, YADR and OADR are not frequently to be used in a study. Thus, ADR will be used in our study as one of the explanatory variables.

2.3.3 Interest Rates

In layman's term, interest refers the reward to a person who saves money in a financial institution. The higher is the interest rates, the higher will be the savings. Besides, interest rates can be the cost of capital paid by a borrower for the use of money borrowed from a lender as well. The higher is the interest rates, the higher is the cost of borrowing money and thus, the lower the investment (I) firms will tend to make. According to the theory of loanable funds supported by the monetarists, interest rate is determined by demand for and supply of loanable funds, which are the funds available to borrowers and are generally supplied by banks and other financial institutions. The determination of interest rates according to this theory is shown by Figure 2.4.

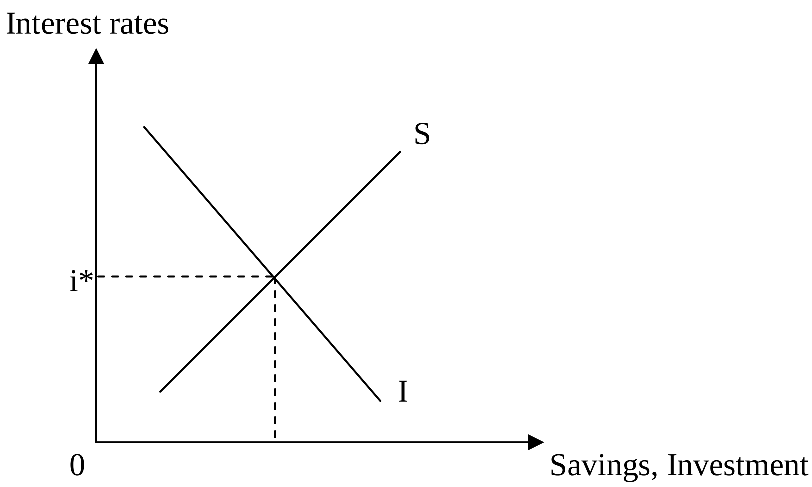

Figure 2.4: Determination of Interest rates According to the Theory of Loanable Funds

Besides economic growth and dependency ratio, another important determinant of savings is interest rates. It is believed that higher interest rates will encourage savings. However, from the literature review, the effect on savings from a change in interest rates is ambiguous and subject to uncertainty as a rise in interest rates may increase or reduce the savings. As interest rates increases, current savings may increase due to the increased return on savings and also because of the higher price of present consumption relative to the future price (substitution effect). However, current savings may fall when interest rates rises because of the higher return received by the person if he is a net lender and thus, he may decide to save lesser (income effect). Thus, the interest rates elasticity of savings can be a positive or negative value subject to the relative strengths of substitution effect and income effect from a change in interest rates. In this case, substitution effect is a scenario where current savings is increasing as the rising of interest rates and therefore, consumption is postponed to the future. In contrast, income effect is a scenario in which current consumption increases at the expense of savings (due to the increased real returns on saved wealth) as interest rates rises.

In conclusion, an increase in interest rates will increase the savings if the substitution effect outweighs the income effect, and vice versa. The net effect of interest rates on savings depends on the offset from the two effects.

Raut and Virmani (1989) had examined the determinants of consumption and savings using data from 23 developing countries. They found that despite the real interest rates has a positive effect on consumption (meaning a negative effect on savings), the nominal interest rates and inflation rates have negative effects on consumption (meaning positive effects on savings) where the effect of inflation is significantly greater than the effect of the nominal interest rates because of the uncertainty arises from higher inflation.

Empirical past studies had derived different results for the effect of interest rates on savings in different countries. For examples, by using seven Asian countries, Agrawal (2001) found a positive coefficient of real interest rates for Thailand and Malaysia, a negative coefficient for Indonesia, and insignificant coefficient for Singapore, Korea, Taiwan and India. Besides, Baharumshah et al. (2003) had studied on the savings dynamics in five of the fast growing Asian countries. The interest coefficient was found to be positive and significant for Singapore and Korea, negative but insignificant for Thailand, and positive but insignificant for Malaysia. Thanoon and Baharumshah (2005) in their study on five Asian countries (including Malaysia) realized that the real interest rates has a small negative effect on savings, for both short run and long run.

Waithima (2008) found a positive but insignificant coefficient in the private savings function for Kenya for the period of 1960–2005. From the studies on savings behavior in five South Asian countries, Agrawal et al. (2009) found a positive and significant coefficient for Bangladesh and Nepal, negative and significant coefficient for India and Pakistan, but insignificant coefficient for Sri Lanka. The coefficients found are relatively low for these South Asian countries except for Bangladesh.

The recent empirical studies on Malaysian savings behavior which include the re-investigation on the influence of interest rates on savings in Malaysia were done by Tang (2008) and Tang and Tan (2011). By using annual data from 1970 to 2004, Tang found that the coefficient of real interest rates in real GDS function is negative and significant in the short run, but is positive and insignificant in the long run. The effect of real interest rates on Malaysian savings is small as the coefficients were only 0.006 and 0.011 for short run and long run respectively. Lastly, from the study by Tang and Tan on seven East Asian countries, the long-run coefficient of real interest rates was negative for China, Hong Kong and Japan while positive for Indonesia, Malaysia, South Korea and Thailand using the quarterly data from 1970 to 2008.

In overall, it can be concluded that interest rates plays a significant role in affecting the savings only in certain countries. Besides, the mathematical sign for the estimated coefficient of interest rates remains ambiguous and it can be varied from country to country. Nevertheless, from the previous studies, the interest rates was found to have little impact on savings rate in Malaysia in the long run.

2.3.4 Foreign Savings

In the concept of national income accounting, by definition, the savings-investment identity states that the amount saved in an economy will be the amount invested in that economy as well. For an open economy, the total amount saved (i.e. the total of private savings and foreign savings) must be equal to the total amount invested (i.e. the total of private investment and government borrowing). Hence, investment in an economy will be financed by private domestic savings, government savings (refer to budget surplus) and foreign savings (or known as foreign capital inflows). In this scenario, domestic savings and foreign savings (or capital) can be either complements or substitutes to each other in financing the investment in an economy.

In the process of economic growth and development, external resources which include foreign capital flows play a crucial role either as complement to or substitute for domestic savings in the country, especially to the underdeveloped and developing countries. Chenery and Elkington (1979) stated that national savings and foreign savings are complements in the short run but substitutes in the long run [cited in Tan (2004)]. Thus, these two forms of savings can be in positive or negative relationship.

In the past decades especially the 1990s, the rapid growing Asian countries rely heavily on foreign capital flows in financing the investment in the country. In looking for the determinants of savings in Malaysia, foreign savings should be taken into consideration as one of the explanatory variables since it is a commonly used variable. Furthermore, the study will be able to examine whether the foreign savings crowded out the savings in Malaysia. The slope coefficient of foreign savings in the savings equation is the measurement for the degree of substitutability between foreign savings and domestic savings (Edwards, 1996; Thanoon & Baharumshah, 2005). Foreign savings will have negative effect on domestic savings if the foreign savings crowd out domestic savings.

Hamid and Kanbur (1993), Agrawal (2001), Thanoon and Baharumshah (2005) and Agrawal et al. (2009) stated that greater availability of foreign savings which will increase the supply of resources in a country may increase consumption spending and thus, lead to a lower national savings. In this case, foreign savings and national savings are likely to be substitutes and a negative estimated coefficient of foreign savings should be found in the savings equation.

In fact, in the study of Agrawal (2001) and Baharumshah et al. (2003) using Malaysian data, foreign savings was found to have a significant negative impact on national savings. Agrawal et al. (2009) again found that foreign savings rate has a significant negative impact on domestic savings rate in South Asia (e.g. India, Sri Lanka and Nepal).

By using annual data from 1970 to 1990, Hamid and Kanbur (1993) found a significant positive relationship between national savings and foreign savings in Malaysia. They explained that although there is an inflow of capital, foreign savings do not substitute domestic savings since the level of national savings is still high in Malaysia. Thanoon and Baharumshah (2005) also found a significant positive coefficient of foreign savings in their domestic savings model when they studied the determinants of savings rate in five Asian countries (including Malaysia) for the 1970–2000 period.

By using a trivariate causality model, Odhiambo (2009) conducted a study which incorporate foreign capital inflows to examine the direction of causality between savings and economic growth in South Africa for the period 1950–2005. He was in opinion that with a low domestic savings rate, in order to sustain a 6 percent of GDP growth, the country will need to sustain the level of foreign capital inflows. His study found bidirectional causality between foreign capital inflow and savings in which the economic growth Granger causes the foreign capital inflow.

In conclusion, the previous studies attempted to establish the relationship between national savings (or domestic savings) and foreign savings failed to reach to an agreement for the empirical findings whereby the sign for the coefficient of foreign savings remains ambiguous. It is of interesting to re-examine the above stated relation using longer span of Malaysian data. In this study, Current Account Balance (CAB) as the broadest measure of foreign savings (or capital inflows) will be used.

2.4 Causality between Savings and Economic Growth

Besides determine the factors affecting savings in a country, the direction of causality between savings and its determinants (especially economic growth) is also important to be examined as the empirical findings may help the government in carrying out the appropriate development policies.

Generally, there is existence of four types of causality between savings and economic growth in which the first two types refer to the unidirectional causality either from savings to growth, or vice versa due to the controversy among two leading schools of thought. The causality from savings to growth is supported by the "growth theorists" who assume that savings are invested and translated to growth through effect on capital accumulation or investment (see Section 2.4.1 for details) whereas the "consumption theorists" argued that the level and growth of income determine consumption (and therefore, savings), thus growth leads to savings (see Section 2.4.2 for details). According to the modern savings theory, there is bidirectional causality where growth and savings Granger cause each other (see Section 2.4.3 for details). In contrast, there are cases to certain countries where there is no significant relationship and causality exists between the savings and growth (see Section 2.4.4 for details).

2.4.1 Standard Growth Models

In the past history, there were many economists and researchers attempted to look for the reasons leading to high economic growth of a country. In general, savings in a country is found to be one of the main factors leading to economic growth in the country. In this case, these economists and researchers support the capital fundamentalists' point of view that capital formation and accumulation through savings is the main driving force for high growth. They concluded that savings induces growth.

The earliest growth model was proposed by Roy Harrod in England and Evsey Domar in the United States who explained the one-factor growth model. Harrod (1939) and Domar (1946) implied that growth rate of output in a country would be proportional to the investment and savings rate of the country. Savings is the main source of funds available for investment purposes. Higher savings will automatically increase the investment and thus, triggers the economy to grow.

Solow (1956) had further discussed about the growth model. In his neoclassical growth model, Solow assumed that there are diminishing marginal returns to capital and diminishing returns to scale. Besides, he assumed that technological progress is exogenous. Savings is an important factor leading to economic growth through capital formation. However, he explained that higher savings rates will manage to lead to higher level of income (or output) per capita in the short run, but not the higher level of growth of income (or output) per capita in the long run. This problem is mainly due to the marginal returns to capital which will eventually become zero. In this case, the equilibrium rate of growth will eventually stops and does not affected by the higher savings rate anymore.

In contrast, the endogenous growth model which was supported by economists such as Romer (1986) and Lucas (1988) has different point of views with the neoclassical growth model. By assuming that there are constant returns to capital, technological progress is determined endogenously, and the increasing returns to scale, higher savings rates will lead to higher levels of growth of income (or output) per capita in the long run, through the higher capital formation.

In conclusion, neoclassical growth model states that higher savings leads to higher temporary growth whereas endogenous growth model argues that permanent higher growth rates of output can be achieved through higher savings rates and hence, higher capital formation.

2.4.2 Keynesian Savings Theory

In the past empirical studies, direction of causality from growth to savings was found in certain countries. Keynesian consumption and savings theories, such as Life Cycle Hypothesis (LCH) and Permanent Income Hypothesis (PIH, or also known as permanent income model of consumption) play a crucial role here. The LCH was initially proposed by Modigliani and Brumberg (1954) and then by Ando and Modigliani (1963) while the PIH was proposed by Friedman (1957) [cited in Raut and Virmani (1989)].

Based on the LCH, besides the demographic structure (or more specific, age structure of population, as this has been discussed under Section 2.3.2), economic growth or income growth (or more specific, growth rate of real income per capita) is also an important determinant of savings rate in a country. When there is a higher economic growth rate or a higher number of young population relative to the elderly population, the savings rate in a country will increase. The consequence from these two causes will be almost the same, i.e. the increase of the lifetime wealth (and savings) of the younger-age group relative to the older-age group (Deaton & Paxson, 1997, 2000a). In conclusion, there is causality from both population growth and income growth to savings rate in a country and they are positively related to each other.

According to the LCH, consumption and savings are affected by the current and expected future income levels. Modigliani (1970) in his simplified version of LCH highlighted the positive relation between savings and income growth. Savings rate and aggregate savings will increase if there is higher income growth because this increases the savings of the young to be relatively greater than the dissavings of the old.

Carroll and Weil (1994) and Carroll et al. (2000) added that as income rises, if there is habit formation in consumption, the consumption will respond slowly to the increase in income and lead to a smaller proportionate increase in consumption. As a result, a larger fraction of increased income can be saved. Thus, there is positive correlation between income growth and savings in which income growth Granger causes savings.

However, there are certain circumstances for income growth to be negatively related to savings. Carroll and Weil (1994) commented that households may feel wealthier as their income growth increases. This may lead to higher consumption and thus, lower savings. Besides, anticipated growth in earnings over the life cycle or in the future may also tend to increase current consumption and reduces savings (Bosworth, 1993; Deaton & Paxson, 1997).

On the other hand, if the borrowing constraint is less stringent causes the young has the ability to borrow, this may increase current consumption and reduce the savings. However, Modigliani (1986) argued that this scenario may not easily occur as the younger group of population may find it difficult to get the borrowing in large amount to support their current consumption.

In looking at the relation between savings and growth, the PIH focuses on permanent income and expected future income. This hypothesis states that consumption is proportional to permanent income. People will tend to consume more (and thus save lesser) when their current income is relatively lower but they expected their future income to rise. In contrast, people will tend to save more (and thus spend lesser) if they rationally anticipate their permanent income or future income to fall. This scenario is known as “savings for a rainy day” (Campbell, 1987). There is negative correlation between income growth and savings in which growth Granger causes savings.

In conclusion, the PIH states that higher growth (or higher future income) leads to lower current savings. However, the effect of growth on savings is ambiguous and uncertain according to the LCH. Therefore, it is necessary to re-examine this issue for the case of Malaysia using longer span of data in this study.

Carroll et al. (2000) concluded that savings and growth have strong positive correlation across countries and high growth will lead to high savings, not vice versa. They had used the concept of habit formation in consumption in their paper to prove that increases in growth can cause to increases in savings. The evidence of growth-to-savings causality is consistent with the findings presented by Carroll and Weil (1994) and Edwards (1995). According to Carroll et al., habit formation in consumption can lead to a positive short-run response of savings to a favorable shock. In other words, if consumption is habit-based and changes in a smaller proportionate increase in response to an increase in income, then savings rate will increase when income increases, due to a larger fraction of increased income may be saved. As a result, this leads to a positive correlation between savings and growth along transition path to the steady growth rate.

According to Rodrik (2000), savings transitions is defined as sustained increase in the savings rate of 5 percentage points or more. He found that the countries which experienced savings transitions do not necessarily experience sustained increases in their Gross National Product (GNP) growth rates. However, the countries which have enjoyed for growth transitions (due to some other reasons other than higher savings rates) will lead to permanent increases in savings rates. In conclusion, increases in savings tend to be one of the outcomes of economic growth, but not one of the determinants of growth.

2.4.3 Bidirectional Causality

According to the Keynesian savings theory as was discussed in Section 2.4.2, economic growth is an essential determinant of savings in a country. Rapid growth rate of real income per capita may increase the savings rate in a country. From the traditional growth models, high level of savings is needed to sustain the high economic growth through the process of capital accumulation and savings-investment link. Thus, the combination of these two schools of thought formed the modern savings theory which explains the virtual cycle between economic growth and savings. Economic growth (G) rate plays two important roles here. Firstly, it determines savings (S) and therefore links savings to investment (I). Secondly, growth is partly determined by investment level in the country.

$$G\uparrow \;\Rightarrow\; S\uparrow \;\Rightarrow\; I\uparrow \;\Rightarrow\; G\uparrow$$

In conclusion, there is a possibility to have bidirectional causality between savings and economic growth in a country in which these two variables Granger cause each other.

The key findings of selected empirical studies on causality between savings and economic growth are summarized in Table 2.1. Most of the past empirical studies showed that there is at least unidirectional causality between savings and growth. In addition, the summary of selected empirical studies on the relationship and causality between savings and economic growth in Malaysia is presented in Table 2.2. In conclusion, a bidirectional causal relationship between savings and economic growth in Malaysia was found by almost all researchers, irrespective of the research period and econometric methodology used in their study.

2.4.4 No Causality

Although most of the past studies had found a direction of causality between savings and economic growth in the country studied, there were few researchers did not get evidence of causality between savings and growth in the country they studied. For example, Baharumshah et al. (2003) had studied empirically the savings behavior in five fast growth Asian economies, namely Singapore, South Korea, Malaysia, Thailand and the Philippines using annual data of 1960–1997. They did not get any evidence of causality between savings and economic growth in the short run for all the countries examined, except for Singapore. It can be said that savings in the country may not an important determinant of economic growth, and vice versa.

Table 2.1: Summary of Selected Empirical Studies on Causality between Savings and Economic Growth

Study	Country(ies) to be Studied	Research Period	Methodology used	Type of Causality	Key Findings
Collins (1991)	10 Asian developing countries	1960 – 1984 (Annual)	OLS	G → S	From the study on 10 Asian developing countries with savings rates range from 12% to 24% while the real economic growth rates range from 4% to 10%, the countries with the higher savings rates in the 1980s are also found to be the countries with the faster real economic growth rates. There is strong positive correlation between savings and real economic growth rates in countries such as Singapore, Hong Kong and Malaysia.
Saltz (1999)	18 Latin American and East Asian developing or Newly Industrialized Countries	1960 – 1991 (Annual)	Engle-Granger ECM	G → S	Higher growth rates of real GDP causes higher growth rates of savings in 10 out of the 18 countries analyzed.
Agrawal (2000)	5 South Asian countries	1960 – 1998 (Annual)	VAR	S → G	Savings rates Granger causes growth rates of real GNP in Bangladesh and Pakistan. Thus, the low growth rates in these two countries could be due to their low savings rates.

(Continued Overleaf)

Table 2.1, continued

Study	Country(ies) to be Studied	Research Period	Methodology used	Type of Causality	Key Findings
Deaton and Paxson (2000b)	Taiwan, Thailand	1976 – 1995 [Taiwan], 1976 – 1992 [Thailand] (Annual)	Method for estimating individual age-saving profiles using household data	G → S	By using individual age-savings profiles estimated from household data, increases in growth lead to large increases in savings rates in Taiwan, especially when there is low population growth rate. However, the empirical finding for Thailand was reverse whereby the relation is negative because of the increases in growth raise the wealth of the very young individuals who are dissavers. Thus, the aggregate savings rates is reduced.
Agrawal (2001)	7 Asian countries	1960 – 1994 (Annual)	VAR, VECM	G → S	High savings rates in East Asian are mainly due to the high growth rates of income per capita and rapidly declining age dependency ratio. High real income per capita or high growth rate do Granger cause the savings rate to be high in six of the seven countries studied, except for Korea.
	– Indonesia, Malaysia, Taiwan			G ↔ S	There is evidence of simultaneous reverse causality from savings to growth for Indonesia, Malaysia and Taiwan. However, the causality from growth to savings is stronger than from savings to growth.
Anoruo and Ahmad (2001)	7 African countries	1960 – 1997 (Annual)	VECM		
	– Congo			S → G	Growth rate of domestic savings in Congo is found to Granger cause its growth rate of GDP.
	– Ghana, Kenya, Nigeria,Zambia			G → S	Economic growth Granger causes growth rate of domestic savings in Ghana, Kenya, Nigeria, and Zambia.
	– Cote d'Ivoire, South Africa			G ↔ S	There is a bidirectional causality between savings and growth.

(Continued Overleaf)

Table 2.1, continued

Study	Country(ies) to be Studied	Research Period	Methodology used	Type of Causality	Key Findings
Mavrotas and Kelly (2001)	India and Sri Lanka	1960 – 1999 (Annual)	Toda and Yamamota Granger non-causality test		
	– India			G ↮ S	There is no causality between GDP growth and private savings in India.
	– Sri Lanka			G ↔ S	There is a bidirectional causality between private savings and growth.
Baharumshah and Thanoon (2003)	Malaysia	1960 – 2000 (Annual)	Toda and Yamamota Granger non-causality test	G ↔ S	Bidirectional causality is detected between savings ratio and GNP growth in Malaysia. It can be concluded that economic growth plays an important role in explaining the high savings ratios in the past decades.
Alguacil et al. (2004)	Mexico	1970 – 2000 (Annual)	Toda and Yamamota Granger non-causality test	G ↔ S	There is a bidirectional causality between savings and economic growth provided that the influence of foreign capital inflows is taken into consideration in the study.

(Continued Overleaf)

Table 2.1, continued

Study	Country(ies) to be Studied	Research Period	Methodology used	Type of Causality	Key Findings
Mohan (2006)	25 countries with different income levels	1960 – 2000 (Annual)	VAR, VECM	G → S	The income class of a country is a crucial determinant of the direction of causality although there is no firm conclusion to be drawn for low-income countries. However, most of the low-middle income countries show that economic growth rate Granger causes growth rate of savings. Lastly, there is causality from economic growth to savings growth for all high-income countries except for Singapore and the United States.
Sajid and Sarfraz (2008)	Pakistan	1973:Q1 – 2003:Q4 (Quarterly)	VECM	G ↔ S	The findings suggest a bidirectional long-run relationship between savings and output level. However, there is a unidirectional causality from public savings to both GNP and GDP, and also from private savings to GNP in the long run.
Tang (2008)	Malaysia	1970 – 2004 (Annual)	Toda and Yamamota – Augmented VAR model	G ↔ S	There is a bilateral causal relationship between savings and income growth in Malaysia. This supports savings leads economic growth through the impact of capital formation. The savings is mobilized and financed into the productive activities.
Waithima (2008)	Kenya	1960 – 2005 (Annual)	VECM	G → S	GDP per capita Granger causes private savings in Kenya.

(Continued Overleaf)

Table 2.1, continued

Study	Country(ies) to be Studied	Research Period	Methodology used	Type of Causality	Key Findings
Lean and Song (2009)	China	1955 – 2004 (Annual)	VECM	S → G	China's economic growth is found to have a long-run relationship with household savings and enterprise savings. A bilateral causality exists between the domestic savings growth and economic growth in the short-run. In the long-run, a unidirectional causality exists running from domestic savings growth to the economic growth.
Odhiambo (2009)	South Africa	1950 – 2005 (Annual)	VECM	G → S	There is a bidirectional causality between savings and economic growth in the short run while a unidirectional causality from economic growth to savings in the long run. Furthermore, foreign capital inflows (FCI) and savings are found to be Granger-cause each other, and economic growth Granger causes FCI.
Tang (2009)	Malaysia	1991:Q1 – 2006:Q3 (Quarterly)	VAR, Modified Sim test, Cheng test, Augmented VAR, Multiple Rank F-test	G ↔ S	There is a bilateral causality between savings and GDP growth in Malaysia. Furthermore, the empirical results suggest that the causal relationship between savings and economic growth remains unchanged irrespective to the causality test used.
Tang and Chua (2009)	Malaysia	1991:Q1 – 2006:Q3 (Quarterly)	Multiple Rank F-test	G ↔ S	There is a bilateral causality between savings and economic growth in Malaysia in the long run.

(Continued Overleaf)

Table 2.1, continued

Study	Country(ies) to be Studied	Research Period	Methodology used	Type of Causality	Key Findings
Tang and Lean (2009)	Malaysia	1961 – 2000 (Annual)	Generalized forecast error variance decomposition within VAR	S → G	GNP growth in Malaysia is more dominated by domestic savings than its foreign savings. Thus, Malaysian government should adopt more policies to promote domestic savings rather than foreign savings because domestic resources and capital accumulation are more effective to enhance economic growth in Malaysia.
AbuAl-Foul (2010)	2 Middle East and North Africa countries				
	– Turnisia	1961 – 2007 (Annual)	VAR	S → G	There is a unidirectional Granger causality from growth of real GDS to growth of real GDP.
	– Morocco	1965 – 2007 (Annual)	VAR	G ↔ S	There is a bidirectional causality between economic growth and savings growth in the long run.
Oladipo (2010)	Nigeria	1970 – 2006 (Annual)	TYDL Granger causality test	S → G	The results revealed a unidirectional causality from both real GDS and foreign direct inflow to real GDP in Nigeria. Hence, the Nigerian government should formulate policies which will enhance savings and also improve the confidence of foreign investors.
Shahbaz and Khan (2010)	Pakistan	1971 – 2007 (Annual)	VAR	G → S	There is unidirectional causality from economic growth to domestic savings in Pakistan.
Tang (2010)	Malaysia	1970:Q1 – 2008:Q4 (Quarterly)	TYDL Granger causality test	S → G	Real GDS is found to affect real GDP in Malaysia in the long run.

Table 2.2: Summary of Selected Empirical Studies on the Relationship and Causality between Savings and Economic Growth in Malaysia

No.	Study	Research Period	Econometric Methodology		Variable for Savings	Variable for Growth	Empirical Results
			Cointegration	Causality test			Causality
1	Agrawal (2001)	1960 – 1994	–	Granger (1969) – VAR	savings rate (= nominal GNS / nominal GNP)	growth rate of RGNP per capita	Savings ↔ Growth (positive)
2	Baharumshah et al. (2003)	1970 – 1998	Johansen and Juselius (1990)	Granger (1988) – VECM	LGNS	LGNP	Savings does not ↔ Growth
3	Baharumshah and Thanoon (2003)	1960 – 2000	Johansen and Juselius (1990)	Toda and Yamamoto (1995) – Augmented VAR model	GNS ratio (= GNS/GNP)	Growth rate of GNP	Savings ↔ Growth (positive)
4	Tang (2008)	1970 – 2004	Pesaran, Shin and Smith (2001) – ARDL	Toda and Yamamoto (1995) – Augmented VAR model	LRGDS	LRGDP	Savings ↔ Growth (positive)
5	Tang (2009)	1991:Q1 – 2006:Q3	–	Granger (1969) – VAR	LRGDS	LRGDP	Savings ↔ Growth (positive)
				Geweke, Meese, and Dent (1983) – Modified Sims test	LRGDS	LRGDP	Savings ↔ Growth (positive)
				Cheng (1981) test	LRGDS	LRGDP	Savings ↔ Growth (positive)
				Toda and Yamamoto (1995) – Augmented VAR model	LRGDS	LRGDP	Savings ↔ Growth (positive)
				Holmes and Hutton (1990) – Multiple Rank F-test	LRGDS	LRGDP	Savings ↔ Growth (positive)

(Continued Overleaf)

Table 2.2, continued

No.	Study	Research Period	Econometric Methodology		Variable for Savings	Variable for Growth	Empirical Results
			Cointegration	Causality test			Causality
6	Tang and Chua (2009)	1991:Q1 – 2006:Q3	Bierens (1997) Nonparametric Cointegration test	Holmes and Hutton (1990) – Multiple Rank F-test	LRGDS	LRGDP	Savings ↔ Growth (positive)
7	Tang (2010)	1970:Q1 – 2008:Q4	–	Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996) – TYDL Granger causality test	LRGDS	LRGDP	Savings → Growth (positive)
8	Tang and Tan (2011)	1970:Q1 – 2008:Q4	Johansen (1988)	Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996) – TYDL Granger causality test	LRGDS	LRGDP	Savings ↔ Growth (positive)
9	Tang and Chua (2012)	1970:Q1 – 2008:Q4	Pesaran, Shin and Smith (2001) – ADRL	Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996) – TYDL Granger causality test	LRGDS	LRGDP	Savings ↔ Growth (positive)

Source: modified from Tang and Chua (2012).

Sinha (1996) also did not get any causality between savings and growth in India using annual data of 1950–1993 in his study. He found that there is no causality between the growth rates of GDP and GDS, as well as between the growth rates of GDP and gross domestic private savings (GDPS) in India. He commented that this could be due to the savings not being channeled into productive investment in the country causing to the insignificant relationship between savings and growth. These empirical results were confirmed by Mavrotas and Kelly (2001) when they carried out a study on India.

The study on India was once again done by Sinha and Sinha (2007) when they carried out a study to examine the relationship between per capita savings and per capita GDP in India, which is one of the countries in the world with high savings rate, using data of 1950–2004. They distinguished the savings into three types, i.e. household savings, corporate savings and public savings. By using Toda and Yamamota Granger causality test which is seldom to be applied by researchers, they found that there is no evidence of causality between per capita GDP and per capita corporate savings for India. The only finding found from their study is that there is a bidirectional causality between per capita household savings and per capita corporate savings.

2.5 Conclusion

This chapter has discussed the empirical works on the savings model and its derivatives across many dimensions. The determinants of savings have been discussed. Empirical works on causality between savings and economic growth has also been discussed. The following chapter discusses the data sources, the variables and the econometric techniques used in the empirical chapter.

CHAPTER 3 - ECONOMETRIC METHODOLOGY

3.1 Introduction

The previous chapter introduced the savings function by outlining its theoretical background and empirical studies. In this chapter, Section 3.2 discusses the sample and variables used while Section 3.3 explains the econometric techniques employed to test the savings function in Malaysia.

3.2 Data Sources

The study examines the savings-led growth theory for Malaysia using multivariate framework which consists of total five variables in estimating a savings equation. The five variables are savings, income, age dependency ratio (ADR), interest rates (INT) and Balance of Current Account (CAB) where CAB is as a proxy for foreign savings. From the literature review, there are different measures used for savings and income (or economic growth) in which the most common measures are either domestic data statistics or national data statistics. For instance, Gross Domestic Savings (GDS) and Gross Domestic Product (GDP) were used by Sinha (1996), Saltz (1999), Anoruo and Ahmad (2001), Mohan (2006), Sajid and Sarfraz (2008), Tang (2008, 2009, 2010), Tang and Chua (2009), AbuAl-Foul (2010), Oladipo (2010) and Tang and Tan (2011) to estimate the savings equation in their studies.

On the other hand, Gross National Savings (GNS) and Gross National Product (GNP) were used by Baharumshah et al. (2003) and Sajid and Sarfraz (2008). Despite domestic savings is more common to be used, Agrawal (2001) stated that national savings is a more appropriate measure of savings because it takes into consideration of the net factor income from abroad, whereby the domestic savings does not. This net factor income from abroad forms part of the savings in a country and is available to finance domestic investment which will lead to higher growth of a country. In other words, national savings reflects the total amount of resources available for domestic investment in a country (Mason, 1988).

An annual data set consists of GDS, GDP, ADR, INT and CAB for the period from 1970 to 2010 is used in this study to estimate the GDS equation.[4] Annual data is used because of quarterly data is unavailable for certain variables such as ADR, INT and CAB. The advantage of using annual data is it can avoid the seasonal bias problem (Tang, 2008; Tang & Lean, 2008). Furthermore, Hakkio and Rush (1991) stated that since cointegration is a long-run phenomenon, using longer span of data to give more power to the cointegration test is better than merely increasing the data frequency but shorter span of data [cited in Tang (2008)]. In conclusion, the span of data is more important than the number of observations used in a study, as far as the ability of cointegration is concerned [(Campbell & Perron, 1991; Hakkio & Rush, 1989; Hendry, 1987) cited in Thanoon and Baharumshah (2005)]. Arize and Shwiff (1998) argued that data set containing fewer annual observations over a longer time period is preferable than data set with more observations over a shorter time period for cointegration analysis since increasing the sample size by time disaggregation may not likely to reflect the long-run cointegrated relationship.

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[4] Instead of using GNS and GNP, GDS and GDP are used in this study because of domestic data statistics are commonly used in the previous studies for the causal relation between savings and economic growth in a country. In fact, Malaysian government adopts GDP in measuring the economic growth. Gross data rather than net data is used due to the availability of data and also because of the arbitrary nature of capital consumption allowances. However, Mason (1988) was in opinion that Net National Savings (NNS) is more ideal than GNS as NNS measures the total amount of resources from citizens of a country used for increasing the physical plant of that country whereas GNS may overestimate the actual increase in real wealth of a country.

In the past studies, real interest rates (RINT) is the variable which was more frequently to be used for interest rates. However, from the unit root tests done in this study, RINT was found to be stationary in level and cannot be used to proceed to cointegration analysis. Thus, interest rates (INT) is used to substitute the RINT in this study.

The data of GDS, GDP, INT and CAB are extracted from Bank Negara Malaysia publication, Monthly Statistical Bulletin while ADR is calculated using the data from population statistics reports of Department of Statistics, Malaysia. The GDP deflator [5] (2000 = 100) is used to deflate GDS and GDP from nominal into real terms. To avoid fluctuations in the data, all variables are transformed into natural logarithm (ln) terms (except for INT and CAB). The empirical analyses are conducted by using Eviews 6.0 software. The notation of variables used is presented in Table 3.1.[6]

Table 3.1: Notation of Variables Used

Notation	Variable
LRGDS	Real Gross Domestic Savings
LRGDP	Real Gross Domestic Product
LADR	Age dependency ratio
INT	Interest rates
CAB	Balance on Current Account

Notes: All variables are expressed in natural logarithm (ln) form except for INT and CAB.

The data used with the source of data for selected empirical studies on savings and economic growth in Malaysia are summarized in Table 3.2.

[5] Data extracted from World Development Indicators, World Bank.
[6] Refer to Appendix D for the summary statistics of variables used.

Table 3.2: Summary of Data Used in Selected Empirical Studies on Savings and Economic Growth in Malaysia

No.	Study	Data type	Period	Variables used	Source of Data
1	Collins (1991)	Annual	1960 – 1985	ratio of GNS to GNP, real per capita income, real economic growth rate, young-age dependency ratio.	IMF; World Bank.
2	Hamid and Kanbur (1993)	Annual	1970 – 1990	real GNS, gross real disposable income, real interest rates, dependency ratio, inflation rate, Balance on Current Account (as a proxy for foreign savings).	BNM; World Bank.
3	Faruqee and Husain (1998)	Annual	1970 – 1992	ratio of private savings to private disposable income, working-age population ratio, growth in real private disposable income per capita, ratio of money plus quasi-money to private disposable income (as proxy to financial deepening), ratio of provident fund savings to private disposable income.	IMF; World Bank.
4	Agrawal (2001)	Annual	1960 – 1994	ratio of GNS to GNP, real GNP per capita, growth rate of GNP per capita, age dependency ratio, foreign savings (measured by Current Account Balance) as share of GNP, provident fund rate, real interest rates (on one year bank deposits).	World Bank; SEACEN Research & Training Centre, Malaysia.
5	Baharumshah and Thanoon (2003)	Annual	1960 – 2000	ratio of GNS to GNP, growth rate of GNP, interest rates, tax rate, exports rate, dependency ratio, Foreign Direct Investment.	ADB; World Bank; *Key Indicators of Developing Asian and Pacific Countries, 2001*, Vol XXXI, Oxford University Press, New York.

(Continued Overleaf)

Table 3.2, continued

No.	Study	Data type	Period	Variables used	Source of Data
6	Baharumshah et al. (2003)	Annual	1970 – 1998	GNS, GNP, interest rates, dependency ratio, current account.	IMF; BNM.
7	Thanoon and Baharumshah (2005)	Annual	1970 – 2000	ratio of GDS to GDP, age dependency ratio, rate of growth of GDP, per capita income, interest rates, ratio of Current Account Balance to GDP, export ratio to GDP, M2/GDP (as a proxy to degree of financial development.	*Key Indicators of Developing Asian and Pacific Countries, 2002*, Vol XXXI, Oxford University Press, New York.
8	Mohan (2006)	Annual	1960 – 2001	GDS, GDP.	World Bank
9	Tang (2008)	Annual	1970 – 2004	real GDS, real GDP, modified version of dependency ratio, real interest rates.	World Bank; IMF; BNM.
10	Tang (2009)	Quarterly	Jan 1991 – Sept 2006	real GDS, real GDP.	IMF; BNM.
11	Tang and Chua (2009)	Quarterly	Jan 1991 – Sept 2006	real GDS, real GDP.	IMF; BNM.
12	Tang and Lean (2009)	Annual	1961 – 2000	real GNP, real disaggregate domestic & foreign savings.	IMF; ADB; BNM; Malaysian Economic Report.
13	Tang (2010)	Quarterly	Jan 1970 – Dec 2008	real GDS, real GDP, real foreign capital inflow, real money supply M2 (as a proxy to financial development indicator).	World Bank; BNM.
14	Tang and Tan (2011)	Quarterly	Jan 1970 – Dec 2008	real GDS, real GDP, real interest rates, dependency ratio, current account (as a proxy for foreign savings).	World Bank; United Nations (UN), Statistical Yearbook for Asia and the Pacific.
15	Tang and Chua (2012)	Quarterly	Jan 1971 – Dec 2008	real GDS, real GDP, real interest rates, modified version of dependency ratio, real foreign savings.	World Bank; IMF; BNM.

3.3 Econometric Techniques

There are two main objectives for this empirical study. The first objective is to estimate the savings function for Malaysia while the second objective is to examine the direction of causality between savings and its determinants (see Section 1.7 for details). In achieving these objectives, the econometric testing procedure involves four main steps.

The first step is to check for the stationary properties of every variable using unit root test(s). This step is crucial as it will examine the order of integration for the variables and decide which appropriate procedure to be used in estimating the savings function.

The second step is to employ the cointegration analysis to examine whether there is existence of long-run equilibrium relationship between savings and its determinants. If cointegration is detected (meaning the variables are cointegrated and having a common trend), it can be said that there is existence of Granger causality between variables at least in one direction. However, the cointegration analysis did not manage to indicate the direction of causality.

To investigate the direction of causality between savings and its determinants, the following step is to obtain a long-run model using an unrestricted error correction model (ECM). This model is namely Vector Error Correction Model (VECM) as it was derived from the long-run cointegrating vector(s).

Various diagnostic tests on the estimated savings function are carried out to check on the white noise property of residuals and to see whether the residuals are well-behaved.

Figure 3.1 depicts a flow chart as the summary for the flows of testing procedures involved in this empirical study.

3.3.1 Stationary Tests – Unit Root Tests

In any empirical study or analysis using time series data, test of data stationarity (which is a prerequisite for cointegration analysis) must be done first to check whether the time series data used are individually stationary and also to avoid spurious regression. The problem of spurious regression may occur when a time series variable is regressed on another time series variable which does not have any logical relationship between them. According to Granger and Newbold (1974), spurious or nonsense regression will exist when there is presence of non-stationary variables [cited in Enders (2004)]. As a result, spurious regression model tends to have a high R^2, significant *t*-statistics, a high degree of autocorrelation for its estimated residuals, and the assumption of the classical regression model is violated (due to the variance found is heteroscedastic i.e. non-constant and could be explosive). The results found from a spurious regression are unreliable and without any economic meaning.

A stochastic process is said to be stationary if it fulfills the following requirements simultaneously. The mean and variance are constant across time. Furthermore, the value of the covariance between two time periods does not depend on the actual time at which the covariance is computed, but depends only on the lag (or distance) between two time periods (Gujarati, 2003).

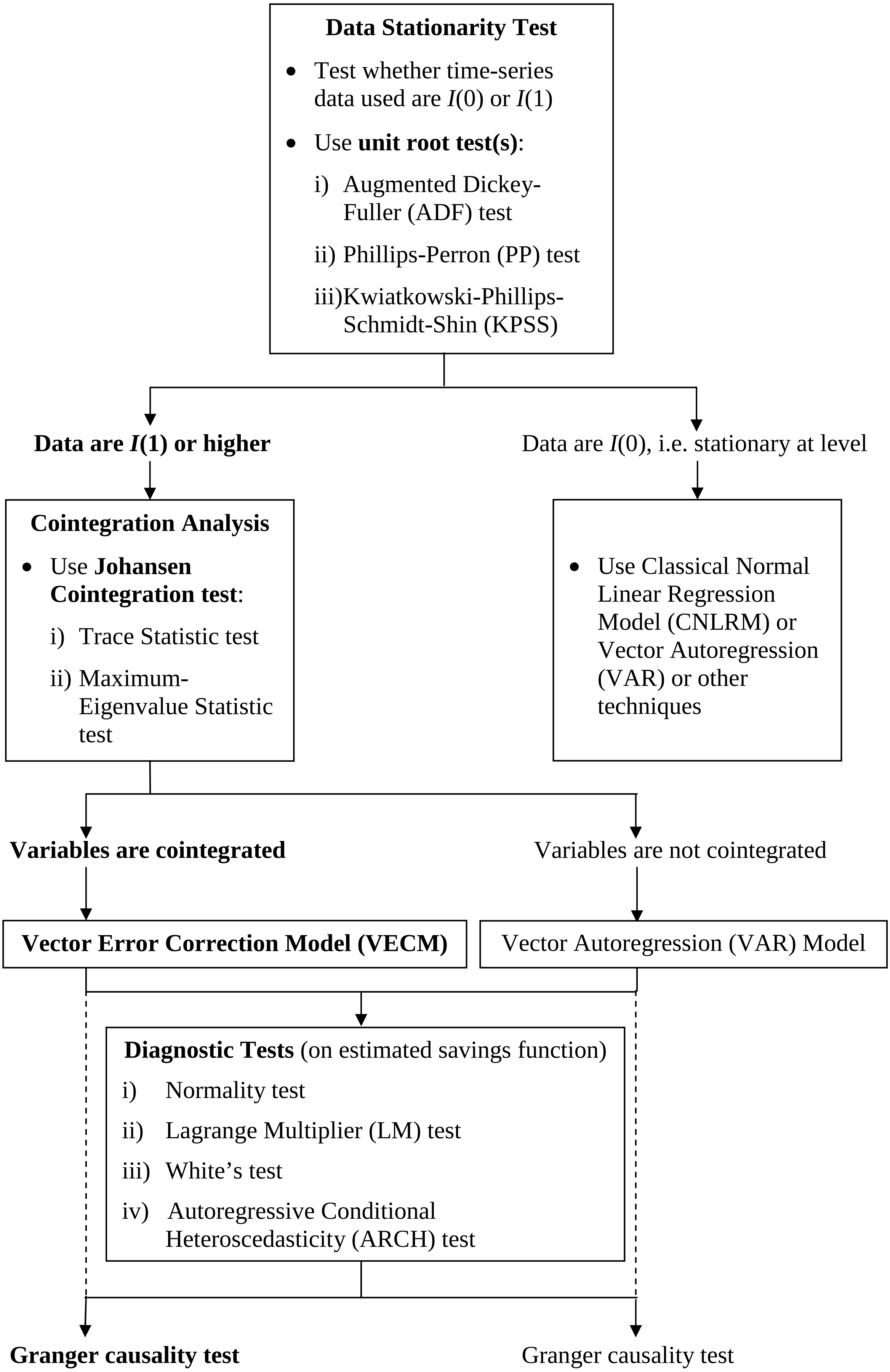

Figure 3.1: Flows of Testing Procedures Involved in this Empirical Study

To determine the order of integration of all the variables used (or to test for the presence of stochastic non-stationarity in the data used), three types of unit root tests, namely Augmented Dickey-Fuller (ADF) test, Phillips-Perron (PP) test, and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test will be employed. For these three unit root tests, model with intercept and time trend will be chosen. The optimal lag length will be decided by Akaike Info Criterion (AIC) for ADF test, while PP test and KPSS test will be based on Newey-West Bandwidth with Barlett Kernel estimation method.

3.3.1.1 Augmented Dickey-Fuller (ADF) Test

Among the various unit root tests, ADF test is the most commonly used test. ADF test was originated from the Dickey-Fuller (DF) test which can be employed if the error terms (u_t) are uncorrelated [i.e. independently and identically distributed (i.i.d.)]. However, DF test cannot be used if the error terms are correlated. In this case, the ADF test should be used as this test is conducted by "augmenting" the equation of DF test by adding the lagged difference terms of the dependent variable, so that the u_t is serially uncorrelated [(Dickey & Fuller, 1979, 1981) cited in Gujarati (2003)].

The regression (for a model with a drift and deterministic time trend) for ADF test is as follows:

$$\Delta y_t = \mu + \beta_t + \delta y_{t-1} + \sum_{i=1}^{p} \alpha_i \, \Delta y_{t-i} + u_t \text{ .... (3.1)}$$

where Δ is the difference operator, t is the time or trend variable. u_t is a pure white noise error term, $\Delta y_{t-1} = (y_{t-1} - y_{t-2})$, $\Delta y_{t-2} = (y_{t-2} - y_{t-3})$ and so on. The drift or intercept (refers μ) and the deterministic time trend (refers β_t) terms are retained if they are significantly different from zero. The optimal lag length (p) will be determined by choosing the value that minimizes the AIC.

The null hypothesis is that y_t series is non-stationary (i.e. contains a unit root) which implies that the δ in equation (3.1) equals zero whereas the alternative hypothesis states that the series is stationary which implies δ is smaller than zero.

The test statistic used is the τ (tau) statistic computed using the following formula:

$$\tau = \frac{\hat{\delta}}{s.e.(\hat{\delta})} \quad \text{.. (3.2)}$$

where *s.e.* is standard error. The test statistic is then compared with the critical values tabulated by MacKinnon (1996). The null hypothesis of non-stationary is rejected if the δ is negative and statistically significant (when the computed test-statistic value is smaller than the critical value). Thus, there is evidence to conclude that y_t series is a stationary process. In contrast, if the null hypothesis is not rejected, this process is repeated with the next higher order of differencing, until a rejection of null hypothesis is found.

A variable or series without unit root is said to be stationary or integrated of order zero [denoted by $I(0)$]. Thus, a series (for example, y_t) which is stationary after being differenced once is said to be integrated of order one [i.e. $y_t \sim I(1)$ and $\Delta y_t \sim I(0)$]. Most of the time series data are found to be non-stationary in the level form but is stationary in the first-difference form.

3.3.1.2 Phillips-Perron (PP) Test

The ADF test assumes and ensures that the error terms are uncorrelated in its regression. However, the alternative unit root test, i.e. Phillips-Perron (1988) test can be used if the residuals of a unit root process are weakly dependent or heterogeneous, since the PP test allows for mildly correlated and heteroscedastic error terms (Enders, 2004).

The regression (for a model with a drift and deterministic time trend) for PP test is as follows:

$$\Delta y_t = \mu + \beta_t + \delta y_{t-1} + u_t \quad \text{.. (3.3)}$$

where the only difference between the regression of ADF and PP tests is that PP test does not consider the augmented term (i.e. the lagged difference terms of the dependent variable).

The null hypothesis against alternative hypothesis, the critical values, and the procedure used to reject a null hypothesis are the same as the ADF test.

A non-parametric correction to the *t*-test statistic is undertaken in the PP test to consider for the possibility of the existence of serial correlation. Thus, the asymptotic distribution of the test statistic will not be affected by the problem of serial correlation (Ang, 2009).

3.3.1.3 Kwiatowski-Phillips-Schmidt and Shin (KPSS) Test

For the ADF and PP tests, the null hypothesis is that a series is non-stationary (i.e. there is existence of a unit root). Thus, rejection of the null hypothesis is necessary to support stationarity of a series. However, according to Kwiatowski, Phillips, Schmidt and Shin (1992), the tests designed on the basis of the null hypothesis that a series is non-stationary (such as the ADF and PP tests) have low power to differentiate between unit root and a near unit root stationary process and therefore, unable to reject the null hypothesis. Thus, it is necessary to perform the KPSS test as well to confirm the order of integration for all the variables used [cited in Ang (2009) and Tang (2009)].

The model with a drift and time trend for the KPSS test is based on a time series as given in equation (3.4).

$$y_t = \mu + \beta_t + \rho y_{t\text{-}1} + u_t \quad \text{...} \quad (3.4)$$

where μ is a drift or constant, β_t is the deterministic time trend term, $\rho y_{t\text{-}1}$ refers to a random walk process, and u_t is an error term. Because of a random walk process can be represented by the sum of all past errors, equation (3.4) can be written as follows:

$$y_t = \mu + \beta_t + \phi \sum_{i=1}^{t} u_{t-i} + \varepsilon_t \quad \text{.......................................} \quad (3.5)$$

where u_t is assumed to follow i.i.d. (0, 1), and ε_t is a stationary process.

As inverse to the ADF and PP tests, the null hypothesis of KPSS test states that the y_t series is trend stationary (i.e. stationary around a deterministic trend) which implies that the ϕ in equation (3.5) equals zero while the alternative hypothesis states that the series is not trend stationary which implies that ϕ does not equal to zero.

The test statistic used can be computed as follows:

$$LM = T^{-2} \sum_{t=1}^{T} S_t^2 / \sigma^2(p) \quad \text{...} \quad (3.6)$$

where T refers the number of observations, S_t^2 is the partial sum process of the residuals from a regression of y_t on an intercept and time, $\sigma^2(p)$ is a consistent estimate of the error variance from the same regression, and p represents the lad truncation parameter (Ang, 2009).

The *LM*-test statistic is then compared with the critical values provided by Kwiatkowski et al. (1992) based on Monte Carlo simulation. The null hypothesis is rejected when the

LM-test statistic is larger than the critical value. In this case, there is evidence to say that the y_t series is a non-stationary time series.

3.3.2 Cointegration Analysis

Despite the regression of a non-stationary variable on another non-stationary variable may produce the problem of spurious regression, according to Engle and Granger (1987) who introduced the methodology of cointegration, a linear combination of two non-stationary variables must be stationary if the error term (from the combination of these two series) is stationary, i.e. $u_t \sim I(0)$. This is because of the underlying stochastic trend in the two series will 'cancel out' one another when the cointegration takes place. In this case, the two variables are said to be cointegrated and there will be existence of a long-run equilibrium relationship among them. Granger (1986) stated that cointegration test can be used to avoid spurious regression situations [cited in Gujarati (2003)].

Engle and Granger (1987) further highlighted that cointegration refer to a linear combination, the variables which are cointegrated must be non-stationary variables with the same order of integration, and there may be as many as $(n - 1)$ linearly independently cointegrating vectors for a vector y_t which have n non-stationary components (or variables). The number of cointegrating vectors is the cointegrating rank of y_t as well which tells us the number of linear relationship that exist in the model.

Engle and Granger (1987) mentioned that the existence of cointegrating relationship between two variables also implies for the existence of a valid error-correction model (ECM) between the two variables in which the data are generated according to a partial adjustment or error-correction mechanism. After short-run deviations from the equilibrium, the error term (which is known as equilibrium error) will ensure the system to return to its long-run equilibrium. The linkage between concept of cointegration and ECM is the essence of Granger Representation Theorem. In conclusion, besides short-run dynamic relationship between the variables in a model, the error correction term (ect) in the ECM incorporates the long-run information about the variables as well. The ect tells us the speed for the model to return to its equilibrium following an exogenous shock. A negative ect indicates a move back towards equilibrium, and vice versa.

All the non-stationary variables used must be first-differenced (in order to produce stationary variables) because an ECM is derived based on $I(0)$ variables only.

When the sample size of a study grows larger, or when there are more than two variables used which may lead to multiple cointegrating vectors, Engle-Granger methodology (which assumes that there is only one cointegrating vector) is not appropriate to be used anymore. Methodology such as Johansen (1988) Cointegration test can be employed as it is able to test for presence of multiple cointegrating vectors by determining the cointegrating relationship among a set of integrated variables and then incorporating then into an empirical model namely VECM.

3.3.2.1 Johansen Cointegration Test

The cointegration test which was developed by Johansen (1988) and then extended by Johansen and Juselius (1990) will be used in this study to assess the existence of a long-run relationship between savings and its determinants in Malaysia.

After examined the order of integration using unit root test(s), the next procedure is to estimate a VAR model using the undifferenced data. As similar to the ADF test, a multivariate model can also be generalized to allow for a higher-order autoregression process (Enders, 2004). Assume that y_t is a (n x 1) vector of I(1) variables, i.e. $y_t = (y_{1t}, y_{2t}, \ldots\ldots, y_{nt})'$, and y_t is non-stationary, i.e. $y_t \sim I(1)$, we can estimate the following VAR(p) model for y_t:

$$y_t = A_0 + A_1 y_{t-1} + A_2 y_{t-2} + \ldots\ldots + A_p y_{t-p} + u_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.7)$$

where y_t = (n x 1) vector of variables

A_0 = (n x 1) matrix of intercept terms [i.e. $(a_{01}, a_{02}, \ldots\ldots, a_{0n})'$]

A_i = (n x n) matrices of coefficients (or parameters)

p = lag length

u_t = an independently and identically distributed n-dimensional vector with zero mean and variance matrix Σ_u

n = number of endogenous variables

Lag length (p) can be determined by using the multivariate generalizations of the AIC or Schwartz Bayesian Criterion (SBC). Enders (2004, p. 358) stated that 'most researchers would begin with lag length of approximately $T^{1/3}$' where T refers the number of observations used in a study.

Equation (3.7) can be re-written in the form of a VECM as follows: [See Enders (2004, p. 352) for the mathematical manipulations]

$$\Delta y_t = A_0 + \pi y_{t-1} + \sum_{i=1}^{p-1} \pi_i \Delta y_{t-i} + u_t \quad \ldots\ldots\ldots\ldots\ldots (3.8)$$

Form of matrix: (n x 1) (n x 1) (n x n) (n x 1) (n x n) (n x 1) (n x 1)

where $\pi = -(I - \sum_{i=1}^{p} A_i)$ and $\pi_i = -\sum_{j=i+1}^{p} A_j$ in which π = (n x n) matrix $-(I - A_i)$,

I = an (n x n) identity matrix, and π_{ij} denotes the element in row i and column j of π.

From equation (3.8), π refers to the rank of the matrix. The rank of π is equal to the number of the independent cointegrating vectors (which is same number as the cointegrating rank (r) of y_t). The cointegrating rank will tell us whether the variables in the model are cointegrated and also the number of long-run cointegrating relationship which exist in the estimated model. The Granger Representation Theorem stated that the rank (π) has a reduced rank where $0 < \pi < n$. This is because if the rank (π) equals zero (meaning no integration is found among the variables), the matrix will become null and equation (3.8) will become $\Delta y_t = A_0 + \sum_{i=1}^{p-1} \pi_i \Delta y_{t-i} + u_t$ (which is actually a usual VAR model in first differences). Thus, we have to use the approach of VAR instead of VECM to estimate the regression.

In contrast, if π equals n (in other words, π has full rank), the model given by equation (3.8) can be reduced to equation (3.7), showing that all variables are stationary and thus, a VAR model in y_t (levels) should be used. This is a trivial case of cointegration. In intermediate case, if rank (π) equals one, there will be only one single cointergrating vector and the expression πy_{t-1} in equation (3.8) is the ect of the model. In conclusion, there will be multiple cointegrating vectors if the rank (π) is in between l and n, i.e. $1 < \pi < n$.

In order to test other restrictions on the cointegrating vector, Johansen defines the two matrices α and β, both of dimension (n x r) where r is the rank of π (Enders, 2004). The properties of α and β are such that

$$\pi \quad = \quad \alpha \beta' \qquad \text{...} \ (3.9)$$

Form of matrix: (n x n) (n x r) (r x n)

in which α is the matrix of weights with which each cointegrating vector enters the n equations of the VAR model while β is the matrix of cointegrating parameters. By substituting equation (3.9) into equation (3.8), we get

$$\Delta y_t = A_0 + \alpha\beta' y_{t-1} + \sum_{i=1}^{p-1} \pi_i \Delta y_{t-i} + u_t \quad \text{.............................} \quad (3.10)$$

where α = (n x r) matrix of the speed of adjustment parameters

β' = (r x n) matrix of cointegrating vectors, in which r refers to the row, and n refers to the column of the matrix

$\beta' y_{t-1}$ = error correction term(s) which is (are) stationary

The vector α in the equation (3.10) measures how fast the deviations from equilibrium move back into the system. A negative α indicates a move back towards equilibrium, and vice versa. The larger the α, the faster for the convergence to take place towards the long-run equilibrium when there are short-run deviations from its equilibrium (Ang, 2009). Besides, the β' is actually the long-run coefficients in the VECM. The existence of $\alpha\beta' y_{t-1}$ leads to the main difference between a VAR model and VECM.

3.3.2.1.1 Trace Statistic Test

It is crucial to know how many cointegrating or long-term relationship (r) exist in a model before we can estimate a VECM. Thus, Johansen proposes two likelihood ratio statistic tests, namely the Trace Statistic test and the Maximum-Eigenvalue Statistic test to test for the rank of the long-run information rank.

According to the Trace Statistic test, the null hypothesis (H_0) which states that the number of cointegrating relationship is less than or equal to r is tested against the alternative hypothesis (H_a) which states that the number of cointegrating relationship is greater than r. For example, H_0: $r = 0$ is tested against H_a: $r > 0$; H_0: $r \leq 1$ against H_a: $r > 1$; H_0: $r \leq 2$ against H_a: $r > 2$, and so on.

The test statistic used is as follows:

$$\lambda_{\text{trace}}(r) = -T \sum_{i=r+1}^{n} \ln (1 - \hat{\lambda}_i) \quad (3.11)$$

where T = the number of observations used in the study

$\hat{\lambda}_i$ = the estimated values of the characteristic roots (also called eigenvalues) obtained from the estimated π matrix [See Enders (2004, p. 386) for details]

The computed test statistic, λ_{trace} is then compared with critical values tabulated by Osterwald-Lenum (1992) using Monte Carlo approach. The null hypothesis will be rejected if the test statistic is greater than the critical value. If so, this process is repeated with the next higher number of cointergrating relationship (r) until there is no more rejection of null hypothesis. At the end of the process, y_t is said to be cointegrated with r cointegrating relationship (and there will be r cointegrating vectors(s) for the VECM). In this case, there will be $(n - r)$ common stochastic trends for y_t. In contrast, if H_0: $r = 0$ is not rejected, there is evidence to say that there is no cointegrating relationship exists in the model being tested.

3.3.2.1.2 Maximum-Eigenvalue Statistic Test

Maximum-Eigenvalue Statistic test can complement the Trace Statistic test in looking for the number of cointergrating relationship (r) of a model, besides verifying the r found using the Trace Statistic Test. In this statistic test, the null hypothesis (H_0) which states that the number of cointegrating relationship equals r is tested against the alternative hypothesis (H_a) of $r + 1$. For example, H_0: $r = 0$ is tested against H_a: $r = 1$; H_0: $r = 1$ against H_a: $r = 2$, and so on.

The test statistic is computed as follows:

$$\lambda_{max}(r, r+1) = -T \ln (1 - \hat{\lambda}_{r+1}) \text{ ....} (3.12)$$

where T = the number of observations used in the study

$\hat{\lambda}_i$ = the estimated values of characteristic roots obtained from estimated π matrix

The computed test statistic, λ_{max} is then compared with the critical values tabulated by Osterwald-Lenum (1992) as well. The procedure used to reject a null hypothesis and the implications of the result found are the same as the Trace Statistic test.

Maximum-Eigenvalue test has a specific or sharper alternative hypothesis, if compare with the Trace Statistic test, An example used by Enders (2004) in his book had proven that 'Maximum-Eigenvalue test is usually preferred for trying to pin down the number of cointegrating vectors' (Ender, 2004, p. 354) meaning the Maximum-Eigenvalue test will sometimes suggest for a smaller number of long-run relationship.

3.3.2.1.3 Vector Error Correction Model (VECM)

According to Engle and Granger (1987), a model with cointegrated variables must have an error correction representation in which an ect is incorporated into the model. This finding is then lead to the formation of VECM which incorporate the long-run equilibrium as well as short-run dynamics in a model, so that the long-run information is not lost during the differencing process.

Once the number of cointegrating relationship (r) is determined by using the Trace and/or Maximum-Eigenvalue Statistic test(s), a VECM [refer to equation (3.10)] can be estimated based on Ordinary Least Squares (OLS) method. Since the ect (i.e. $\beta' y_{t-1}$) and all values of Δy_{t-i} from equation (3.10) are stationary, we can inference on any variables (except those appearing within the cointegrating vectors) using the usual test statistics.

In this study, to estimate a VECM for domestic savings in Malaysia, five variables are used (n = 5), namely LRGDS, LRGDP, LADR, INT and CAB. Assuming there are two cointegrating relationships (r = 2) exist in the domestic savings model, and two lags (p = 2) are used in the VECM. Thus, $y_t = (y_{1t}, y_{2t}, y_{3t}, y_{4t}, y_{5t})'$ becomes

$$y_t = (LRGDS_t, LRGDP_t, LADR_t, INT_t, CAB_t)' \text{ [7]} \quad \ldots\ldots (3.13)$$

In the Johansen test, all the variables used are treated as endogenous variable in a VAR framework. From the VAR(2) model for y_t, the respective VECM for domestic savings and GDP can be written as follows:

$$\begin{aligned}\Delta LRGDS_t = {} & a_0 + \alpha_{11}(\beta_{11}LRGDS_{t-1} + \beta_{12}LRGDP_{t-1} + \beta_{13}LADR_{t-1} + \beta_{14}INT_{t-1} + \beta_{15}CAB_{t-1}) + \\ & \alpha_{12}(\beta_{21}LRGDS_{t-1} + \beta_{22}LRGDP_{t-1} + \beta_{23}LADR_{t-1} + \beta_{24}INT_{t-1} + \beta_{25}CAB_{t-1}) + \\ & \sum_{i=1}^{2} a_{1i}\,\Delta LRGDS_{t-i} + \sum_{i=1}^{2} a_{2i}\,\Delta LRGDP_{t-i} + \sum_{i=1}^{2} a_{3i}\,\Delta LADR_{t-i} + \sum_{i=1}^{2} a_{4i}\,\Delta INT_{t-i} \\ & + \sum_{i=1}^{2} a_{5i}\,\Delta CAB_{t-i} + u_{1t} \quad \ldots\ldots (3.14)\end{aligned}$$

$$\begin{aligned}\Delta LRGDP_t = {} & b_0 + \alpha_{21}(\beta_{11}LRGDS_{t-1} + \beta_{12}LRGDP_{t-1} + \beta_{13}LADR_{t-1} + \beta_{14}INT_{t-1} + \beta_{15}CAB_{t-1}) + \\ & \alpha_{22}(\beta_{21}LRGDS_{t-1} + \beta_{22}LRGDP_{t-1} + \beta_{23}LADR_{t-1} + \beta_{24}INT_{t-1} + \beta_{25}CAB_{t-1}) + \\ & \sum_{i=1}^{2} b_{1i}\,\Delta LRGDS_{t-i} + \sum_{i=1}^{2} b_{2i}\,\Delta LRGDP_{t-i} + \sum_{i=1}^{2} b_{3i}\,\Delta LADR_{t-i} + \sum_{i=1}^{2} b_{4i}\,\Delta INT_{t-i} \\ & + \sum_{i=1}^{2} b_{5i}\,\Delta CAB_{t-i} + u_{2t} \quad \ldots\ldots (3.15)\end{aligned}$$

[7] The number of variables to be included in the y_t vector is subject to the empirical results from unit root test(s). The y_t vector will include only $I(1)$ variables in estimating the VECM.

where the two error correction terms (ect) are:

$$ect_{1t\text{-}1} = \beta_{11}LRGDS_{t\text{-}1} + \beta_{12}LRGDP_{t\text{-}1} + \beta_{13}LADR_{t\text{-}1} + \beta_{14}INT_{t\text{-}1} + \beta_{15}CAB_{t\text{-}1} \quad \text{(3.16)}$$

$$ect_{2t\text{-}1} = \beta_{21}LRGDS_{t\text{-}1} + \beta_{22}LRGDP_{t\text{-}1} + \beta_{23}LADR_{t\text{-}1} + \beta_{24}INT_{t\text{-}1} + \beta_{25}CAB_{t\text{-}1} \quad \text{(3.17)}$$

The long-run relationship of a particular variable can be obtained by normalizing on that particular variable by making its coefficient equal to one. By setting $ect_{1t} = 0$ and $ect_{2t} = 0$, we get:

$$\beta_{11}LRGDS_t + \beta_{12}LRGDP_t + \beta_{13}LADR_t + \beta_{14}INT_t + \beta_{15}CAB_t = 0 \quad \text{or,}$$

$$LRGDS_t = -(\beta_{12}/\beta_{11})LRGDP_t - (\beta_{13}/\beta_{11})LADR_t - (\beta_{14}/\beta_{11})INT_t - (\beta_{15}/\beta_{11})CAB_t \quad \text{(3.18)}$$

$$\beta_{21}LRGDS_t + \beta_{22}LRGDP_t + \beta_{23}LADR_t + \beta_{24}INT_t + \beta_{25}CAB_t = 0 \quad \text{or,}$$

$$LRGDP_t = -(\beta_{21}/\beta_{22})LRGDS_t - (\beta_{23}/\beta_{22})LADR_t - (\beta_{24}/\beta_{22})INT_t - (\beta_{25}/\beta_{22})CAB_t \quad \text{(3.19)}$$

Equation (3.18) shows the long-run domestic savings model when we normalize on $LRGDS_t$ by setting the ect_{1t} equal to zero. Similarly, we obtain the long-run GDP model as shown by equation (3.19) when we normalize on $LRGDP_t$ by setting the ect_{2t} equal to zero.

From the equation (3.14), α_{11} and α_{12} are speed of adjustment coefficients which measure how fast the $\Delta LRGDS_t$ will adjust to return to its long-run equilibrium.

3.3.3 Diagnostic Tests

The residuals in the estimated savings equation of the study are assumed to be independently and identically distributed (i.i.d.) and well-behaved. To verify this assumption and to check on the reliability of estimation and results found, various diagnostic tests should be carried out (see Section 3.3.3.1 to 3.3.3.4 for the details).

3.3.3.1 Normality Test

Normality test can be used to check for the normality of residuals of an estimated regression. Among several tests of normality, the more common methods of testing for normality of residuals are histogram of residuals, and Jarque-Bera (JB) test. A histogram of residuals is a simple graphic device used to show the shape of probability density function (PDF) of the estimated residuals from a regression. From a histogram, we can see whether the residuals are symmetrically distributed (Gujarati, 2003).

In this study, Jarque-Bera (JB) test of normality will be used. It is an asymptotic or larger-sample test based on the OLS residuals. The JB test will compute the skewness and kurtosis measures of the residuals first and then computes the test statistic using the formula as follows:

$$JB = n\left[\frac{S^2}{6} + \frac{(K-3)^2}{24}\right] \qquad (3.20)$$

where n = sample size, S = skewness coefficient, and K = kurtosis coefficient. The value of the JB test statistic is expected to be zero because for a normally distributed variable, S should be equal to zero, and K should be three (Gujarati, 2003).

The null hypothesis of the JB test states that the residuals are normally distributed. We will reject the null hypothesis if the value of JB test statistic is very different from zero, and its computed *p*-value is sufficiently low. In contrast, if the value of test statistic is close to zero, and a reasonably high *p*-value is found, we do not reject the null hypothesis that the residuals are normally distributed.

3.3.3.2 Lagrange Multiplier (LM) Test

Breusch-Godfrey (BG) Lagrange Multiplier (LM) test is used to test the residuals of the estimated savings equation for serial correlation. The advantage of this type of LM test is that this test of autocorrelation allows for higher-order autoregressive schemes (i.e. AR(1), AR(2), and so on), simple or higher moving averages of white noise error terms (i.e. ε_t in $u_t = \rho u_{t-1} + \varepsilon_t$ where $-1 < \rho < 1$), and also non-stochastic regressors, such as the lagged values of the dependent variables (Gujarati, 2003).

The test statistic used is $(n - p)R^2$ where n is the sample size, p is the order of autoregressive scheme, and R^2 is R-square value obtained from the auxiliary regression (of estimated residuals) follows the chi-square distribution with p degree of freedom.

The null hypothesis which states that there is no serial correlation of any order is tested. If the computed test statistic value exceeds the critical chi-square value, in other words, the p-value is statistically significant at a chosen level of significance, we will reject the null hypothesis, and vice versa.

3.3.3.3 Heteroscedasticity Test

Heteroscedasticity refers a systematic pattern in the errors of a regression model where the variances of the error are not constant. As the consequences of heteroscedasticity, the OLS estimators are no longer best linear unbiased estimator (BLUE) and will be inefficient. Thus, the forecasts will also be inefficient (Gujarati, 2003).

White's general heteroscedasticity test will be used to detect the problem of heteroscedasticity since this test is easy to be implemented and it does not rely on the normality assumption.

The test statistic used is nR^2 where n is the sample size, and R^2 is the R-square value obtained from the auxiliary regression asymptotically follows the chi-square distribution with degree of freedom equals the number of regressors (excluding the constant term) in the auxiliary regression.

The null hypothesis which states that there is no heteroscedasticity is rejected if the computed test statistic value exceeds the critical chi-square value, or the p-value is statistically significant at a chosen level of significance. In such a case, we have evidence of heteroscedasticity.

3.3.3.4 Autoregressive Conditional Heteroscedasticity (ARCH) Test

For modeling conditional mean of a random variable, the variance of the process is assumed to be constant. However, there are many time series data in which the volatility is not constant overtime. Thus, ARCH-type models are useful to model volatility, to obtain more efficient estimators by handling heteroscedasticity in errors properly, and to obtain more accurate confidence intervals for forecast purpose.

Autoregressive Conditional Heteroscedasticity (ARCH) test developed by Engle is a specification of heteroscedasticity where the variance of u_t at period t depends on the squared error term of the past periods. The null hypothesis, alternative hypothesis and the formula used to compute the test statistic value in the ARCH test are the same as the White's heteroscedasticity test (in Section 3.3.3.3).

The null hypothesis of there is no autoregressive conditional heteroscedasticity is rejected if the computed test statistic value exceeds the critical chi-square value, or the *p*-value is statistically significance. Rejection of H_0 is indicative of presence of ARCH. Thus, the ARCH(q) model is suitable for modeling the conditional variance, where q refers the order of first partial autocorrelation coefficient which is significant, found from the Correlogram of Residuals Squared in Eviews.

3.3.4 Granger Causality Test

According to Granger (1969), an explanatory variable (X) is said to Granger cause a dependent variable (Y) if and only if the past values of X can be used to explain Y more accurately than just use the past values of Y (Abu, 2010). To investigate the causal relationship between domestic savings and economic growth in Malaysia, Granger (1988) Causality test is employed on the estimated VECM found for GDS [i.e. equation (3.14)] and GDP [i.e. equation (3.15)] respectively. The causality from economic growth to savings can occur in two ways, either through the impact of lagged changes in economic growth, or through the lagged ect term(s) in the VECM of savings.[8]

The null hypothesis (H_0) which states that an explanatory variable (X) does not Ganger cause the dependent variable (Y) is tested against the alternative hypothesis (H_a) of the X does Granger cause the Y. As an example, we use VECM of GDS, i.e. equation (3.14) to test whether GDP Granger causes GDS in Malaysia. The H_0: $a_{21} = a_{22} = \alpha_{11} = \alpha_{12} = 0$ is tested against H_a: at least one of the restrictions is not true. From H_0, although all the coefficients of the lagged differences of the explanatory variable and the coefficient of lagged ect term(s) have to be equals zero, VECM can reject H_0 and allows for existence

[8] In contrast, savings Granger causes economic growth can occur in two ways, either through the impact of lagged changes in savings, or through the lagged ect term(s) in the VECM of economic growth.

of causality even if the coefficients stated in H_0 are not jointly significant. Another advantage of Granger causality test is that the cause of causality can be identified either due to short-run dynamics or disequilibrium adjustment (Agrawal, 2001).

From the unrestricted model, i.e. equation (3.14), the restricted model is given as:

$$\Delta LRGDS_t = a_0 + \sum_{i=1}^{2} a_{1i}\, \Delta LRGDS_{t-i} + \sum_{i=1}^{2} a_{3i}\, \Delta LADR_{t-i} + \sum_{i=1}^{2} a_{4i}\, \Delta INT_{t-i} + \sum_{i=1}^{2} a_{5i}\, \Delta CAB_{t-i} + u_{1t} \quad (3.21)$$

By using Wald test, the F-test statistic can be computed as follows:

$$F = \frac{(RSS_R - RSS_U) / z}{RSS_U / (n - mp - 1 - r)} \quad (3.22)$$

where RSS is residual sum of squares, R is restricted model, U is unrestricted model, z is the number of restrictions under H_0, n is number of observations used in the study, m is number of variables used, p is number of lags, and r is number of ect. The H_0 is rejected if the F-test statistic exceeds the critical value, $F_{\alpha;\, z,\, n\text{-}mp\text{-}1\text{-}r}$ at α level of significance. Thus, there is evidence to say that GDP Granger causes GDS.

By the way, in equation (3.14), the H_0 that GDP does not Ganger cause GDS is rejected if any of a_{2i} or α_{11} or α_{12} is statistically and significantly different from zero but neither the b_{1i} or α_{21} or α_{22} from equation (3.15) is statistically significant. Similarly, in equation (3.15), the H_0 that GDS does not Ganger cause GDP is rejected on the condition that any of b_{1i} or α_{21} or α_{22} is statistically and significantly different from zero but neither the a_{2i} or α_{11} or α_{12} from equation (3.14) is statistically significant. Table 3.3 summarizes the possible causal relationships which can be derived between domestic savings (S) and economic growth (G), based on equations (3.14) and (3.15).

Table 3.3: Four Types of Causality between Savings and Economic Growth

Types of Causality	Any One of the Conditions
Unidirectional causality from growth to savings: $G_t \rightarrow S_t$	$a_{2i} \neq 0$; $\alpha_{11} \neq 0$; $\alpha_{12} \neq 0$.
Unidirectional causality from savings to growth: $S_t \rightarrow G_t$	$b_{1i} \neq 0$; $\alpha_{21} \neq 0$; $\alpha_{22} \neq 0$.
Bilateral causality: $S_t \leftrightarrow G_t$	$a_{2i} \neq 0$; $\alpha_{11} \neq 0$; $\alpha_{12} \neq 0$; $b_{1i} \neq 0$; $\alpha_{21} \neq 0$; $\alpha_{22} \neq 0$.
No causality: $S_t \nleftrightarrow G_t$	$a_{2i} = 0$; $\alpha_{11} = 0$; $\alpha_{12} = 0$; $b_{1i} = 0$; $\alpha_{21} = 0$; $\alpha_{22} = 0$.

3.4 Conclusion

This chapter explains the data sources and methodology used. Firstly, three unit root tests, namely ADF, PP and KPSS tests are used to check for the stationarity of variables used. Secondly, Johansen methodology which considers only the stationary variables at the same order of integration is used to examine the existence of long-run relationship between savings and its determinants. The Trace and Maximum-Eigenvalue statistic tests will indicate the number of cointegrating relationship(s) among the variables in the savings function. A VECM is estimated to derive the long-run and short-run savings functions in Malaysia. Next, various diagnostic tests are employed to verify the reliability of estimation and results found. Lastly, Granger causality test on the estimated VECM is applied to investigate the causal relationship between savings and its determinants.

CHAPTER 4 - EMPIRICAL RESULTS AND ANALYSES

4.1 Introduction

In the previous chapter, the data sources and econometric methodology used have been discussed. This chapter reports and interprets the results obtained from the whole econometric testing procedures involved. To avoid spurious regression, the results of unit root tests in Section 4.2 are very crucial to determine which variables to be used for the Johansen cointegration analysis. After decided for the lag length to be used, the results of Trace and Maximum-Eigenvalue Statistic tests which examine the number of long-run cointegrating relationship exists between the variables used are explained in Section 4.3. Following this, an error correction model (ECM) will be formed for domestic savings in Malaysia. Section 4.4 presents the estimated long-run domestic savings model in Malaysia, together with its short-run dynamic model and the diagnostic test results. Lastly, the results for Granger causality between savings and its determinants in Malaysia are highlighted in Section 4.5. Section 4.6 concludes the chapter.

4.2 Unit Root Test Results

To assess the order of integration for all the variables used, three unit root tests, namely ADF test, PP test, and KPSS test are employed in this study. The ADF and PP tests are used to test for the null hypothesis of a unit root against the alternative of stationarity. In contrast, the KPSS test is used to test the null hypothesis of stationarity against the alternative of a unit root. For all these three unit root tests, the model with a drift and deterministic trend is chosen to test all the variables.

For a model with intercept and a trend with zero lag length, for both ADF and PP tests, the critical values, in level, are –4.2050, –3.5267 and –3.1946 at the 1%, 5% and 10% levels of significance, respectively while the critical values, in first difference, are –4.2119, –3.5298 and –3.1964 at the 1%, 5% and 10% levels of significance, respectively. In contrast, for the KPSS test, the critical values, for both in level and first difference, are 0.2160, 0.1460 and 0.1190 at the 1%, 5% and 10% levels of significance, respectively.

The results of the unit root tests are presented in Table 4.1.[9] In the level data, since the test statistics of the ADF and PP tests are higher than the critical values, the null hypothesis that the respective series contains a unit root cannot be rejected. However, there is no evidence to support the existence of a unit root in first difference of all the variables tested. Thus, the null hypothesis of a unit root in first difference is rejected at the 1% level of significance for all the variables (except for ADR), and at the 5% level of significance for ADR. Besides, the results of the KPSS test indicate that the null hypothesis that the respective series is a stationary process in the level is rejected, at either 5% or 10% level of significance, but is not rejected in the first difference, for all variables tested.

Figure 4.1 shows the annual time series plots for the five variables used in this study. All the variables suggest a linear trend in their series (except for INT and CAB which are unclear for their linear trend). The variables are said to be not stationary in level due to their non-constant mean. However, from the plots of the first difference for the variables, they show stationarity due to the constant mean.

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[9] The results based on a model with a drift but no deterministic trend are not shown in this paper due to the similar results found from the use of a model with a drift and a deterministic trend in this study.

Table 4.1: Results of Unit Root Tests

Variable	ADF		PP		KPSS		Conclusion
	Level	First Difference	Level	First Difference	Level	First Difference	
$LRGDS_t$	–2.6234	–8.1652***	–2.3607	–9.3745***	0.1733**	0.0210	$I(1)$
$LRGDP_t$	–1.9381	–6.6809***	–1.7972	–6.7814***	0.1693**	0.0475	$I(1)$
$LADR_t$	–1.5223	–4.1254**	–1.1718	–4.1254**	0.1210*	0.0951	$I(1)$
INT_t	–1.6377	–4.7959***	–2.4933	–8.7715***	0.1412*	0.0805	$I(1)$
CAB_t	–1.5706	–5.0887***	–1.6514	–4.8364***	0.1842**	0.0787	$I(1)$

Notes: ***, ** and * denote rejection of the corresponding null hypothesis at the 1%, 5% and 10% levels of significance, respectively. The ADF test is conducted with the optimal lag length chosen using AIC while the PP test and KPSS test are conducted with the optimal bandwidth chosen using Newey-West bandwidth with Barlett kernel estimation method respectively. The critical values for ADF and PP tests are obtained from MacKinnon (1996) while the asymptotic critical values for KPSS test are obtained from Kwiatkowski et al. (1992). Both of the ADF and PP tests examine the null hypothesis of a unit root against the stationarity and the KPSS test examines the null hypothesis of stationarity against the alternative of a unit root.

Figure 4.1: Time Series Properties

Figure 4.1a: *LRGDS*

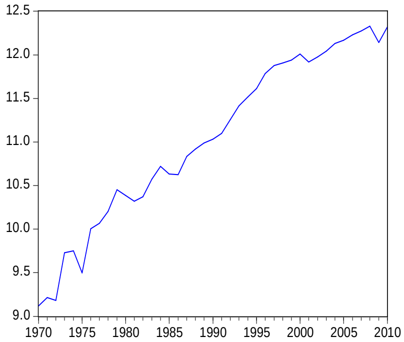


Figure 4.1b: Change in *LRGDS* (Δ*LRGDS*)

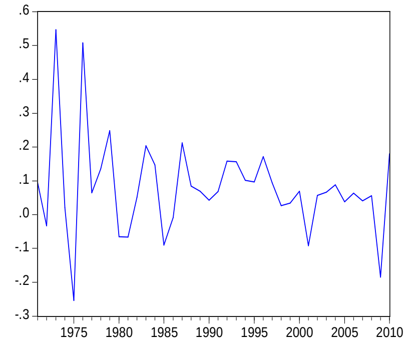


Figure 4.1c: *LRGDP*

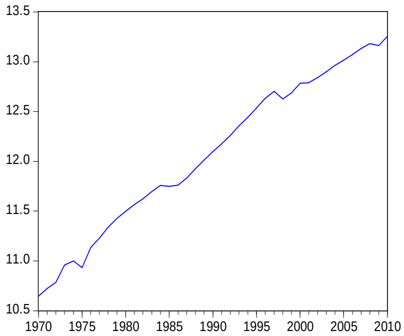


Figure 4.1d: Change in *LRGDP* (Δ*LRGDP*)

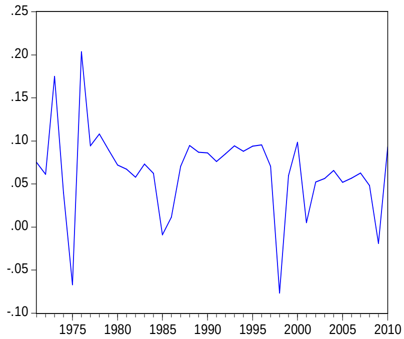


Figure 4.1e: *LADR*

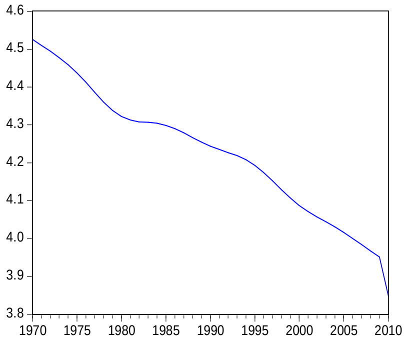


Figure 4.1f: Change in *LADR* (Δ*LADR*)

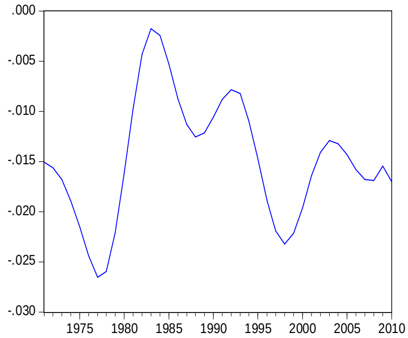


Figure 4.1g: *INT*

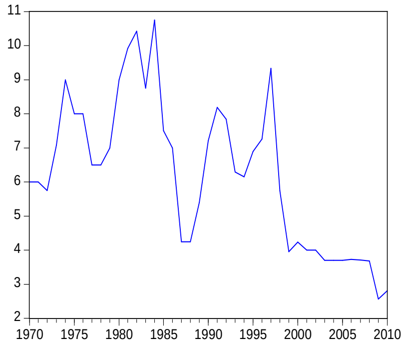


Figure 4.1h: Change in *INT* (Δ*INT*)

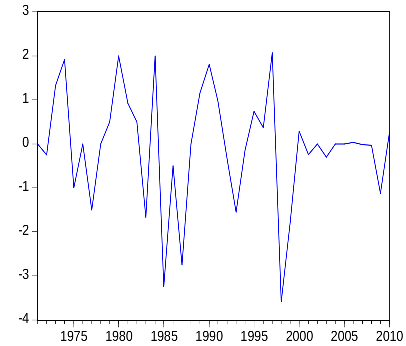


Figure 4.1i: *CAB*

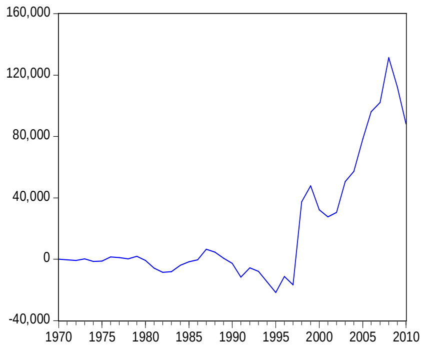
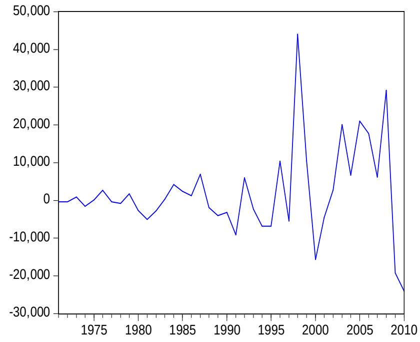


Figure 4.1j: Change in *CAB* (Δ*CAB*)



In conclusion, all the five variables used are not stationary in the level form of the variable, but they are stationary after taking the first difference. They are said to be integrated of order one *I*(1) process. This result is consistent with the findings of Nelson and Plosser (1982) who stated that most of the macroeconomic series which are non-stationary in level will become stationary after their first differencing. Since all these seven series are individually integrated of order one (and furthermore, at the same order of integration), it is necessary to proceed to the next step, i.e. cointegration analysis to test whether the variables are cointegrated in the long run.

4.3 Cointegration Test Results

The cointegration test which was developed by Johansen (1988) and then extended by Johansen and Juselius (1990) was used in this study to examine the existence of long-run cointegrating relationship(s) between savings and its determinants in Malaysia.

The first step in the cointegrating test is to determine the lag length for the savings model. For a study uses annual data and the variables become stationary after their first differencing, Sinha (1996) was in opinion that lag length of one can be used. He also claimed that the number of lags used by applied researchers is up to two if their studies use annual data. Furthermore, Mohan (2006) highlighted that the optimal lag length should be smaller than three for a study uses annual data because a larger lag length in a small sample will waste the degree of freedom. Besides, Enders (2004) mentioned that lag length up to four can be used if the sample size is small and quarterly data set is used. Thus, a lag of one is chosen for this study since the sample size is small and annual data set is used. After decided for the lag length, it is then followed by the Trace and Maximum-Eigenvalue Statistic tests to examine whether the variables used are cointegrated.

The results of cointegration test produced by the Trace and Maximum-Eigenvalue Statistic tests are summarized in Table 4.2.

Table 4.2: Results of Johansen Cointegration Test

Variables: $LRGDS_t$, $LRGDP_t$, $LADR_t$, INT_t , CAB_t

Hypothesis		Trace Statistic Test		
H_0	H_a	Trace Statistic	5% Critical Value	*p*-value
$r = 0$	$r > 0$	83.94423***	69.81889	0.0025
$r \leq 1$	$r > 1$	49.70706**	47.85613	0.0331
$r \leq 2$	$r > 2$	19.15351	29.79707	0.4819
$r \leq 3$	$r > 3$	8.11809	15.49471	0.4529
$r \leq 4$	$r > 4$	0.90179	3.84147	0.3423
Hypothesis		**Maximum-Eigenvalue Statistic Test**		
H_0	H_a	Maximum-Eigenvalue Statistic	5% Critical Value	*p*-value
$r = 0$	$r = 1$	34.23717**	33.87687	0.0453
$r = 1$	$r = 2$	30.55355**	27.58434	0.0202
$r = 2$	$r = 3$	11.03542	21.13162	0.6438
$r = 3$	$r = 4$	7.21631	14.26460	0.4639
$r = 4$	$r = 5$	0.90179	3.84147	0.3423

Notes: r denotes the number of cointegrating vectors. ***, ** and * denote rejection of the corresponding null hypothesis at the 1%, 5% and 10% levels of significance, respectively. The *p*-values are obtained from MacKinnon, Haug & Michellis (1999).

For the first round, if the computed values of the Trace statistic and Maximum-Eigenvalue statistic are less than their corresponding critical values at the 5% level of significance, then the null hypothesis of no cointegration (r = 0) cannot be rejected. However, since the statistic values are greater than their critical values and show significant results, we then proceed to the next higher cointegrating rank. This process is continued until the null hypothesis cannot be rejected.

In the first round, the Trace and Maximum-Eigenvalue statistic values reveal that the null hypothesis of no cointegrating relation (r = 0) can be rejected at the 1% and 5% levels of significance by the Trace and Maximum-Eigenvalue Statistic tests, respectively. It is possible to accept the alternative of one or more cointegrating relations. In the second round, the null hypothesis of one cointegrating relation is rejected at the 5% level of significance by both of the tests. However, the two tests fail to reject the null hypothesis of two cointegrating relations in the next round. Thus, at the 5% level of significance, both of the Trace and Maximum-Eigenvalue Statistic tests confirm that there are two cointegrating relations (and vectors) exist among the domestic savings, GDP, dependency ratio, interest rates and foreign savings in Malaysia.

In conclusion, the variables used in this study are cointegrated. There is existence of two cointegrating relations (and vectors) in the five-dimentional vector [*LRGDS*, *LRGDP*, *LADR*, *INT*, *CAB*] of *I*(1) variables. The long-run relationships found between domestic savings and its explanatory variables indicate that there must be causality in at least one direction among the variables. However, the direction of causality can only be detected through the Vector Error Correction Model (VECM) which is derived from the two cointegrating vectors in this study.

4.4 Long-run Equilibrium Estimates of Savings Equation

As the variables used are cointegrated, the long-run equilibrium domestic savings equation can be estimated by using the VECM approach. Table 4.3 depicts the long-run relationships exist in the domestic savings equation, by normalizing the cointegrating vectors on savings and interest rates, respectively. The estimated long-run domestic savings function in Malaysia, obtained from the first cointegrating vector of the domestic savings equation is given by equation (4.1) whereas the second cointegrating vector of the domestic savings equation is shown by equation (4.2).

$LRGDS_t = 1.0073 LRGDP_t^{***} - 1.5850 LADR_t^{**} - 0.000003 CAB_t^{***} + 5.6416$ .....(4.1)

$INT_t = -15.0401 LRGDP_t^{*} - 70.9504 LADR_t^{*} - 0.00016 CAB_t^{***} + 491.0515$ ....(4.2)

Table 4.3: Normalized Cointegrating Vectors

Variable	First Cointegrating Vector	Second Cointegrating Vector
$LRGDS_t$	1.0000	0.0000
$LRGDP_t$	1.0073*** (0.1162)	–15.0401* (7.5733)
$LADR_t$	–1.5850** (0.6415)	–70.9504* (41.8036)
INT_t	0.0000	1.0000
CAB_t	–0.000003*** (0.0000006)	–0.00016*** (0.00004)
constant	5.6416	491.0515

Notes: The estimated coefficients were obtained by normalizing the savings and interest rates variables, respectively from the domestic savings equation. ***, ** and * denote significance at the 1%, 5% and 10% levels of significance, respectively. Figures in parentheses are the standard errors.

Since all the variables used are in natural logarithm (ln) term (except for interest rates and foreign savings), the estimated coefficients in equation (4.1) can be interpreted as long-run elasticities of domestic savings with respect to the particular variable (except for interest rates and foreign savings).

From the long-run domestic savings equation, the results show that savings in Malaysia is positively related to income in the long run, with an estimated long-run elasticity of savings with respect to GDP equals 1.0073 and it is statistically significant at the 1% significance level. Empirically, a one percent increase in GDP leads to 1.0073 percent increase in domestic savings. The finding of a positive and significant role of income variable on savings in Malaysia is consistent with the results from past studies, such as Baharumshah and Thanoon (2003), Baharumshah et al. (2003), Thanoon and Baharumshah (2005), Tang (2008, 2009), Agrawal et al. (2009), and Tang and Chua (2009, 2012). Besides, the empirical result found supports the Life Cycle Hypothesis (LCH) as was discussed in Section 2.4.2 which states that higher economic growth or income growth raises the savings in a country. In reality, high economic performance of Malaysia is one of the main determinants of high savings rates in the country.

On the other hand, the coefficient of age dependency ratio (ADR) is found to be negative and statistically significant at the 5% significance level in the savings equation, with an estimated long-run elasticity of savings with respect to dependency ratio equals –1.5850. With the highest magnitude (if compare with other variables) in the savings equation, age dependency ratio (i.e. demographic or age structure of the population) seems to be the most important determinant of savings in Malaysia in the long run. This result implies that a one percent decline in dependency ratio in the long run increases domestic savings in Malaysia by 1.5850 percent. The importance of demographic variable supports the LCH (discussed in Section 2.3.2) proposed by Modigliani (1970) and is consistent with the previous studies by Leff (1969), Edwards (1996), Loayza et al. (2000), Agrawal (2001), Baharumshah and Thanoon (2003), Thanoon and Baharumshah (2005), Agrawal et al. (2009), Tang and Tan (2011), and Tang and Chua (2012).

Similarly, the coefficient of foreign savings (CAB) in the domestic savings equation is statistically significant at the 1% significance level with a negative sign, indicates that in the long run, foreign savings (or foreign capital inflows) tend to be a substitute to domestic savings in Malaysia (see Section 2.3.4 for details). Singer (1950) claimed that foreign savings may not enhance the savings in a country if the host country does not enjoy much benefits from the foreign capital inflows, and furthermore, these capital inflows may eventually reduce the growth rate of this host country due to the price distortion and misallocation of resources [cited in Tang and Chua (2012)]. Although a negative relationship between foreign savings and domestic savings is established, the impact of foreign savings on savings in Malaysia is relatively small in the long run, as a RM1 million increases in foreign savings will lead to a 0.0003 percent decrease in domestic savings. The finding suggests that foreign savings do not appear to be important in determining savings in Malaysia also found by Baharumshah and Thanoon (2003) and Baharumshah et al. (2003). Furthermore, negative coefficient of foreign savings was also found by Agrawal et al. (2009) in their study on five main South Asian countries (India, Bangladesh, Pakistan, Sri Lanka and Nepal).

In the study of Baharumshah et al. (2003) and Tang (2008) on savings behavior in Malaysia, they found that the interest rates coefficient is positive but carries a very small value and it is not significant in the long-run savings equation. Furthermore, Ang (2009) was in opinion that the low degree of responsiveness of savings in Malaysia with respect to the interest rates implies that liberalizing the interest rates is only a moderately effective tool to influence and stimulate the savings in Malaysia. Thus, in this study, the coefficient of interest rates for the long-run domestic savings equation is unable to be derived from its first cointegrating vector.

In conclusion, with regard to long-run equilibrium level, all determinants of savings (except for interest rates) are statistically significant and have the correct coefficient sign predicted by the theory. In the long run, the most important determinant of savings in Malaysia is dependency ratio, followed by economic growth (or income variable) of the country. Hence, Agrawal (2001) commented that the high savings rates in East Asian countries (including Malaysia) are mainly due to the high economic growth rates and a rapid decline in the age dependency ratio of the country.

The results of Vector Error Correction Model (VECM) for domestic savings with its determinants, together with the diagnostic test results are reported in Table 4.4. The result shown in panel A of Table 4.4 is the long-run equilibrium domestic savings equation in Malaysia whereas the result shown in panel B of Table 4.4 is the short-run dynamic model for domestic savings.

From the short-run domestic savings model, the estimated coefficient of constant term is –0.1091 and it is significant at the 1% significance level. This negative coefficient sign is consistent with the concept of simple savings function explained by Keynes (as was presented in Section 2.3.1 and Figure 2.2). Keynes stated that the constant term in a savings function should be negative as it is the autonomous dissavings (or autonomous consumption) when disposable income equals zero.

The estimated coefficient of first error correction term (ect) in the short-run savings equation appears to be negative i.e. –1.4982, and statistically significant at the 1% significance level. With the significant lagged residual in the VECM, it validates the significance of the cointegrating relation between variables used in this study (as reported earlier in Section 4.3) and suggests for existence of an error-correction

Table 4.4: Estimated Long-run and Short-run Domestic Savings Equations Using the VECM Approach

A. The long-run equilibrium level relationship

Independent Variable	First Cointegrating Vector (Dependent variable: $LRGDS_t$)		Second Cointegrating Vector (Dependent variable: INT_t)	
	Coefficient	Standard Error	Coefficient	Standard Error
constant	5.6416		491.0515	
$LRGDP_t$	1.0073***	0.1162	–15.0401*	7.5733
$LADR_t$	–1.5850**	0.6415	–70.9504*	41.8036
CAB_t	–0.000003***	0.0000006	–0.00016***	0.00004

B. The short-run dynamic model

Independent Variable	Domestic Savings Equation (Dependent variable: $LRGDS_t$)	
	Coefficient	Standard Error
constant	–0.1091*	0.0594
$ect1_{t-1}$	–1.4982***	0.2640
$ect2_{t-1}$	–0.0062	0.0044
$\Delta LRGDS_{t-1}$	0.2875	0.2641
$\Delta LRGDP_{t-1}$	–0.0653	0.7464
$\Delta LADR_{t-1}$	–10.9582***	3.1734
ΔINT_{t-1}	–0.0415***	0.0144
ΔCAB_{t-1}	0.000002	0.000002
Diagnostic Checks	Test Statistic	*p*-value
X^2_{NORMAL}	0.9846	0.6112
$X^2_{SERIAL}(10)$	18.0338*	0.0544
X^2_{WHITE}	35.7758	0.4318
$X^2_{ARCH}(2)$	1.2450	0.5366
R^2	0.6389	
Adjusted R^2	0.5574	

Notes: ***, ** and * denote significance at the 1%, 5% and 10% levels of significance, respectively. X^2_{NORMAL} refer to the Jarque-Bera statistic of the test for normal residuals. $X^2_{SERIAL}(10)$ refer to the Breusch-Godfrey LM test statistics for no tenth order serial correlation. X^2_{WHITE} denotes the White's test statistic to test for homoscedastic errors. X^2_{ARCH} refer to the Engle's test statistic for no autoregressive conditional heteroscedasticity.

mechanism. The coefficient of ect carries the correct sign (i.e. negative) as it measures the speed of adjustment for the domestic savings to restore back to its own long-run equilibrium level. The result shows that the speed of adjustment towards equilibrium at 149.82 percent a year is considered quite high. Empirically, the domestic savings takes approximately 0.667 year or 8.0 months to restore and achieve its long-run equilibrium whenever there is a deviation or shock from its first long-run cointegrating relationship. It is not surprising that the adjustment process is fast since this reflects the stage of development of financial markets in Malaysia (Thanoon & Baharumshah, 2005).

Similarly, the estimated coefficient of second ect in the short-run savings equation appears to be negative as well, i.e. –0.0062 but it is statistically insignificant. Besides, the empirical results show that the past savings is also not significant in affecting the current savings in Malaysia.

From the short-run savings model in Malaysia, economic growth (or income variable) carries a negative coefficient sign indicates that income variable is inversely related to short-run savings in Malaysia, but it is found to be statistically insignificant. This result is similar to the finding of Ang (2009) who found that economic growth (or income growth) has no impact on the evolution of short-run savings behavior in Malaysia.

Among the four determinants of savings in Malaysia, dependency ratio (ADR) is the only determinant which carries the same coefficient sign and being statistically significant, in both short-run and long-run domestic savings equations. Furthermore, the coefficients are quite large, so changes in ADR are predicted to have a major impact on savings. From the results found, in the short run, a one percent increase in dependency ratio may lead to approximately ten percent fall in domestic savings, and vice versa. This can be explained by looking at the context of a household where the savings of a household may tend to fall in the short run when the ratio of dependent family members relative to working family members increases. Similarly, the savings in the whole economy may be lower if the dependent (or non-productive) population increases faster relative to the increase in working population. This explanation is consistent with the LCH and the same empirical result was found by Baharumshah and Thanoon (2003) and Ang (2009) in their studies about short-run savings behavior in Malaysia.

In addition, interest rates is another important determinant of short-run savings in Malaysia. Similar to the dependency ratio, interest rates bears a negative coefficient sign and it is statistically significant at the 1% significance level in the short-run savings equation. From the negative interest rates elasticity of savings i.e. –0.0415, it suggests that income effect outweighs substitution effect (see Section 2.3.3 for details). As interest rates rises, short-run savings may fall, and vice versa. The impact from a change in interest rates on savings in Malaysia is small, i.e. a one percent increase in interest rates may reduce savings by about 0.05 percent. Our results are consistent with Baharumshah and Thanoon (2003) , Thanoon and Baharumshah (2005) and Tang (2008) findings as these authors also found a significant, negative and small effect on savings. Thus, Tang (2008) highlighted that tightening or contracting monetary policy in Malaysia (such as increase of real interest rates) may bring an inverse effect on savings in the short run. In reality, it is seldom for a government or central bank to change the interest rates by more than one or two percent since the interest rates does not significantly influence the savings in the country due to its low coefficient in the savings model (Agrawal et al., 2009).

Lastly, a positive but statistically insignificant coefficient is found for foreign savings in the short-run domestic savings equation. Although a positive relationship between capital inflows and savings in Malaysia can be established (indicates that they are likely to be complement in the short run), the impact of foreign capital inflows on our country is small due to its low estimated coefficient in both short-run, and even long-run savings equations. According to Lipsey (2000), this is true and may happen if the Foreign Direct Investment (FDI) inflows are a minor part of the country's capital formation. Thus, it is not surprising that FDI brings a small effect on savings in Malaysia since the average share of FDI in total gross domestic capital formation of Malaysia was only 13 percent per year over the period of 1960–2005 (Ang, 2009). Our finding is consistent with Chenery and Elkington (1979) who stated that national savings and foreign savings are complements in the short run but substitutes in the long run. Besides, it also support the statement made by Griffin and Enos (1970) where 'not all foreign capital inflows are helpful, and not all foreign aids actually assist' [cited in Tang and Lean (2009), p8].

In conclusion, with regard to short-run dynamic, the regression results from the conditional error correction model (ECM) of domestic savings in Table 4.4 show that among the four determinants of savings, dependency ratio plays the most important and significant role in influencing the savings behavior in Malaysia, followed by the interest rates in the country.

There are four diagnostic tests being conducted on the full estimation of domestic savings equation to check on the reliability of the estimation and results found in the study. The results for the diagnostic tests are reported in Table 4.4. Specifically, the null hypothesis of the Jarque-Bera normality test for the normality of residuals cannot be rejected at the 1% level of significance indicates that the residuals are normally distributed in the domestic savings equation.

On the other hand, the domestic savings equation does not pass the Breusch-Godfrey Lagrange Multiplier (LM) test for serial correlation, implies that the estimated residuals are serially correlated because the LM test rejects the null hypothesis of no tenth order residual serial correlation at the 10% level of significance, shows evidence of serial correlation up to order ten for the residuals in the savings equation.

The White's heteroscedasticity test and Engle's ARCH test fail to reject the null hypothesis of no heteroscedasticity and ARCH in the residuals, due to their insignificant chi-square test statistics in the respective test. Thus, the residuals are found to be homoscedastic in the savings equation.

Despite the relative short lag length used in this study, in general, the diagnostic test results support the estimated savings equation to be well specified as the conditions of normal distributed, absence of autoregressive conditional heteroscedasticity, and homoscedastic residuals are fulfilled by the savings equation. Thus, the estimated savings model formed in this study can be adopted to explain the savings behavior in Malaysia.

4.5 Granger Causality Test Results

The causal relationship between savings and its determinants (especially economic growth) in Malaysia is examined using Granger causality test, based on the VECM of domestic savings. The idea of testing the Granger causality for the long-run relations between two variables is the same as for the short-run dynamics (under VAR), except that we must test the significance of the ect(s) as well when we carry out a causality test.

The results of causality test on different null hypothesis are summarized in Table 4.5. Both of the null hypotheses of GDP does not Granger cause domestic savings (GDS), and GDS does not Granger cause GDP are rejected at the 1% level of significance since their respective *p*-value is smaller than 0.01. Thus, there is evidence to say that domestic savings and economic growth in Malaysia Granger cause each other in the long run. The empirical finding of bilateral causality between domestic savings and economic growth in this study is consistent with the studies by Tang (2008, 2009), Tang and Chua (2009, 2012) and Tang and Tan (2011). Furthermore, Tang (2009) highlighted that the empirical finding of bilateral causality between domestic savings and GDP in Malaysia remains unchanged regardless of the causality tests he employed (see Table 2.2). This finding agrees with the capital fundamentalists' views where capital formation and accumulation through savings in the country is the main driving force for the higher economic growth, as was discussed by the standard growth models (see Section 2.4.1). Simultaneously, higher economic growth (or income growth) can induce higher savings in a country, as explained by Keynesian savings theory (see Section 2.4.2).

Table 4.5: Granger Causality Test Results based on VECM

Null Hypothesis (H_0)	*F*-statistics	*p*-value	Result
GDP does not Granger cause GDS	12.9536***	0.0000	Reject H_0
GDS does not Granger cause GDP	5.5343***	0.0037	Reject H_0
ADR does not Granger cause GDS	12.9509***	0.0000	Reject H_0
GDS does not Granger cause ADR	8.6860***	0.0002	Reject H_0
INT does not Granger cause GDS	6.1736***	0.0055	Reject H_0
GDS does not Granger cause INT	0.8821	0.4241	Do not reject H_0
CAB does not Granger cause GDS	14.0582***	0.0000	Reject H_0
GDS does not Granger cause CAB	1.2200	0.3189	Do not reject H_0

Notes: Entries are *F*-test statistic for testing if the respective dependent variable is Granger caused by the respective independent variable, by taking both short-run and long-run relationships into consideration, i.e. tests the joint significance of the lagged value(s) of the independent variables and the error correction term(s). ***, ** and * denote rejection of the corresponding null hypothesis at the 1%, 5% and 10% levels of significance, respectively.

Similarly, both of the null hypotheses of age dependency ratio (ADR) does not Granger cause GDS, and GDS does not Granger cause ADR are rejected at the 1% level of significance indicate that domestic savings and dependency ratio in Malaysia also

Granger cause each other in the long run. The empirical finding of bilateral causality between domestic savings and dependency ratio in this study is consistent with the studies by Baharumshah et al. (2003) and Tang and Chua (2012).

On the other hand, about the other two determinants of savings [i.e. interest rates (INT) and foreign savings (CAB)], only the null hypothesis of INT does not Granger cause GDS, and CAB does not Granger cause GDS are rejected at the 1% level of significance, but not the other two null hypotheses. Hence, it reveals that interest rates and foreign savings Granger cause domestic savings in Malaysia in the long run, but not the other way round. This finding is consistent with the notion that interest rates and foreign capital inflows manage to influence savings in a country in which they are the determinants of savings, and not determined by the savings.

In conclusion, in the long run, there are bilateral (or bidirectional) causality between savings and economic growth, and also savings and dependency ratio while only unidirectional causality from interest rates to savings, and also from foreign savings to savings in Malaysia.

4.6 Conclusion

This chapter presents the empirical results and findings obtained from the various econometric techniques used. From the results of unit root tests, all variables used in this study are found to be stationary after taking their first difference and said to be integrated of order one, $I(1)$ process. Next, the results of Johansen Cointegration test show that the variables are cointegrated and there are two cointegrating relationships exist among the variables in the domestic savings equation.

From the VECM analysis, the findings suggest that in the long run, savings in Malaysia is determined by dependency ratio, followed by income variable and then foreign savings (or foreign capital inflows). Dependency ratio and foreign capital inflows are inversely related to savings while economic growth (or income growth) influences savings positively. Besides, interest rates does not play any role and is insignificant to the long-run savings behavior in Malaysia.

Among the four determinants of savings, only dependency ratio can remain its coefficient sign and significant role to the short-run savings behavior in Malaysia. The results reveal that dependency ratio, followed by interest rates are the two most important and significant determinants of savings in the short run where these two variables are inversely related to savings. In contrast, income variable (which is inversely related to savings) and foreign savings (which is positively related to savings) play insignificant role to short-run savings behavior in Malaysia.

The estimated domestic savings equation passed three (out of the four) diagnostic tests against non-normality, heteroscedasticity, and autoregressive conditional heteroscedasticity. It fails only in the LM test for serial correlation.

Lastly, the Granger causality test results reveal that in the long run, there is bilateral causality between domestic savings and GDP growth, and also between domestic savings and dependency ratio, respectively. However, there is only unidirectional causality from interest rates to domestic savings, and also from foreign savings to domestic savings in Malaysia.

CHAPTER 5 - CONCLUSION

5.1 Introduction

This study explores the relationship and causality between savings and its determinants in Malaysia using a cointegration framework. The results are estimated using a sample of annual observations that covers the period from 1970 to 2010. Section 5.2 summarizes the main findings in empirical chapter. Section 5.3 highlights the policy implications and makes recommendations in accordance to the findings that shed new light on this study. Lastly, Section 5.4 gives the limitations of this study and recommendations for future research.

5.2 Summary

Among the twelve Southeast Asian countries, Malaysia is one of the rapid growing countries with relatively high economic growth rates. Furthermore, Malaysia is also one of the twelve high savings countries in the world which had achieved savings rate above 25 percent consistently for all the four decades from 1970s to 2000s. From the previous empirical studies, savings and economic growth in a country are found to be closely related to each other. Thus, rapid growth in Malaysia in the past decades may due to the high savings in the country and/or vice versa.

The unit root tests employed reveal that all the five variables (i.e. domestic savings, GDP, dependency ratio, interest rates and foreign savings) used in this study are integrated of order one. Besides, all the variables are found to be cointegrated, by using the Johansen Cointegration test. There are two cointegrating relationships exist among the variables in the long-run estimated domestic savings equation (which can be formed by the use of Vector Error Correction Model (VECM) approach). Lastly, the Granger causality test results suggest that there is bilateral causality between savings and economic growth in Malaysia in the long run. This finding supports the traditional growth models and the Keynesian savings theory. Thus, savings-led growth and growth-led savings policies are appropriate to be implemented by the Malaysian government.

The empirical results of the study are crucial to the Malaysian government and future researchers in understanding the determinants of savings in Malaysia. Malaysian government should set the economic policies which will enhance savings in the country if higher savings is proved to Granger cause to higher economic growth in Malaysia.

Among the four determinants of savings, dependency ratio remains its (negative) coefficient sign and being statistically significant in both short-run and long-run savings equations whereas the short-run parameter for the other three determinants of savings (i.e. income, interest rates and foreign savings) is differ from the long-run parameter not only in terms of their magnitude, but also their coefficient sign and level of significance to savings in Malaysia (see Table 4.4).

The inverse and significant relationship between savings and dependency ratio in both short run and long run implied that the smaller is the non-productive population (relative to the productive population), the higher is the savings in Malaysia. This finding supports the Life Cycle Hypothesis (LCH) proposed by Modigliani (1970). Furthermore, dependency ratio is said to be the most important determinant of savings in both short run and long run due to its large coefficient in the savings equations.

Income variable shows significant positive effect on long-run savings but insignificant negative effect on short-run savings. The positive impact from economic growth (or income growth) on long-run savings supports the prediction of LCH.

Interest rates enters only in the short-run savings equation but not in the long-run equation. This implies that savings is more responsive to interest rates changes in the short run than in the long run. With the negative and significant impact on short-run savings, this suggests that income effect outweighs substitution effect. However, the impact of interest rates changes on short-run savings is small due to the low or inelastic interest rates elasticity of savings.

Foreign savings shows significant negative effect on long-run savings but insignificant positive effect on short-run savings. This indicates that domestic savings and foreign savings are complements in the short run but substitutes in the long run. The effect of foreign savings on savings in Malaysia is very small due to its low estimated coefficient in both short run and long run saving equations.

In conclusion, the empirical findings reveal that dependency ratio, followed by income variable are the two main determinants of long-run savings. It is proven that the declining dependency ratio and high economic growth (or income growth) in Malaysia are the main factors leading to the high savings in the country. On the other hand, dependency ratio followed by interest rates are the two most significant determinants of short-run savings in Malaysia.

In the long run, there is bilateral causal relationship between savings and economic growth (or income growth) in Malaysia. This supports the capital fundamentalists' views where savings leads to higher economic growth through the capital formation and accumulation in the country. Tang (2008) further commented that the savings in Malaysia is mobilized and financed into the productive activities. Simultaneously, higher economic growth leads to higher savings in the country, as explained by Keynesian. The causality from growth to savings is stronger and larger if compare to the causality from savings to growth (see Table 4.5). Besides, there is also bilateral causality between savings and dependency ratio in the long run. In contrast, interest rates and foreign savings Granger cause savings, but not the other way round.

5.3 Policy Implications

In view of policy implications, since there is bilateral causal relationship between savings and economic growth in Malaysia, the policymakers should set high savings as one of its target variables in order to sustain the high growth rates in the long run. Tang and Chua (2009) highlighted that savings should be seen as an engine to boost an economy, rather than 'freezing' the economy.

To achieve for higher savings in Malaysia, the government can implement growth-enhancing policies, such as trade policy, tax concessions and subsidies to investors, policies to encourage human capital investment and technological innovation. Nevertheless, policies that encourage savings should be implemented as well to foster the economic growth. For example, a well-developed financial sector and financial system will enable the savings to mobilize and being transformed into capital formation for the use in productive sectors, such as education sectors and export-orientated industries (Tang & Lean, 2009).

On the other hand, the negative effect of dependency ratio in savings in Malaysia is elastic and significant in both short run and long run. This implies a fall in dependency ratio will lead to a larger proportionate increase in savings. Thus, the government can extend the mandatory retirement age of the working population from 55 to 60 years old (Baharumshah & Thanoon, 2003).

Although the empirical finding shows that interest rates Granger cause savings, the negative and significant effect of interest rates on short-run savings is inelastic implied that monetary policy may not playing an effective and essential role to influence the savings in Malaysia.

Similarly, the negative and significant impact from foreign savings (or foreign capital inflows) on long-run savings is very small. If the government would like to impose capital control, Baharumshah and Thanoon (2003) suggested the last type of capital control is to control Foreign Direct Investment (FDI) into Malaysia.

The policymakers should implement more policies which focus on accelerating growth rates rather than policies promoting savings because of the stronger causality from growth to savings compare to causality from savings to growth. Furthermore, policies to stimulate economic growth will enhance the national savings as well. A country with sustained high growth rates will able to increase the investors' confidence, and also to improve its international prestige and power. The best example is China's rapid economic growth since the 1990s.

5.4 Limitations of the Study

This study uses annual data for the time period from 1970 to 2010 due to the availability of data. However, this may cause the sample size rather small. Thus, longer time period or the use of quarterly data (subject to the variables used) can be considered for future studies. Besides, this study focuses on the saving determinants in Malaysia only due to the time constraint in carrying out the study. Future research could be conducted by making comparison between few countries from the same or different regions in order to obtain more empirical findings.

This study mainly focuses on the four determinants of savings, i.e. income, dependency ratio, interest rates and foreign savings since they are the most commonly used variables by the researchers in past studies. However, there are some other determinants of savings which can be taken into consideration, such as inflation rate, financial liberalization, pension savings [refer to Employees Provident Fund (EPF) in Malaysia] to examine whether these variables are important in influencing the savings in Malaysia.

Horioka (1997) highlighted that age dependency ratio should be segregated into young-age and old-age dependency ratios because these two ratios may cause different bearing or effects on savings behavior in a country. Thus, future studies can consider this suggestion in their study.

After investigated the causality between savings and its determinants, this study (and also most of the past studies) did not assess the stability of the causal relationships found. Tang and Tan (2011) and Tang and Chua (2012) highlighted that the causal relationships between two variables may not be stable over time due to certain reasons such as changing economic environment. To overcome this issue, they suggested the use of rolling regression technique which is applied to the Toda & Yamamoto and Dolado & Lütkepohl (TYDL) Granger causality test. However, this is subject to the type of causality test employed in a study.

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APPENDICES

Appendix A: Name List of Countries Categorized into the World Geographical Regions Defined by the World Bank

i) East Asia and Pacific Region

Number	Country Name
1	American Samoa
2	Australia
3	Brunei Darussalam
4	Cambodia
5	China
6	Fiji
7	French Polynesia
8	Guam
9	Hong Kong
10	Indonesia
11	Japan
12	Kiribati
13	North Korea
14	South Korea
15	Laos
16	Macao
17	**Malaysia**
18	Marshall Islands
19	Micronesia, Fed. Sts.
20	Mongolia
21	Myanmar
22	New Caledonia
23	New Zealand
24	Northern Mariana Islands
25	Palau
26	Papua New Guinea
27	Philippines
28	Samoa
29	Singapore
30	Solomon Islands
31	Thailand
32	Timor-Leste
33	Tonga
34	Tuvalu
35	Vanuatu
36	Vietnam

ii) Europe and Central Asia Region

Number	Country Name	Number	Country Name
1	Albania	30	Kosovo
2	Andorra	31	Kyrgyz Republic
3	Armenia	32	Latvia
4	Austria	33	Liechtenstein
5	Azerbaijan	34	Lithuania
6	Belarus	35	Luxembourg
7	Belgium	36	Macedonia
8	Bosnia and Herzegovina	37	Moldova
9	Bulgaria	38	Monaco
10	Channel Islands	39	Montenegro
11	Croatia	40	Netherlands
12	Cyprus	41	Norway
13	Czech Republic	42	Poland
14	Denmark	43	Portugal
15	Estonia	44	Romania
16	Faeroe Islands	45	Russian Federation
17	Finland	46	San Marino
18	France	47	Serbia
19	Georgia	48	Slovak Republic
20	Germany	49	Slovenia
21	Gibraltar	50	Spain
22	Greece	51	Sweden
23	Greenland	52	Switzerland
24	Hungary	53	Tajikistan
25	Iceland	54	Turkey
26	Ireland	55	Turkmenistan
27	Isle of Man	56	Ukraine
28	Italy	57	United Kingdom
29	Kazakhstan	58	Uzbekistan

iii) Latin America and Caribbean Region

Number	Country Name	Number	Country Name
1	Antigua and Barbuda	22	Haiti
2	Argentina	23	Honduras
3	Aruba	24	Jamaica
4	Bahamas	25	Mexico
5	Barbados	26	Nicaragua
6	Belize	27	Panama
7	Bolivia	28	Paraguay
8	Brazil	29	Peru
9	Cayman Islands	30	Puerto Rico
10	Chile	31	Sint Maarten (Dutch part)
11	Colombia	32	St. Kitts and Nevis
12	Costa Rica	33	St. Lucia
13	Cuba	34	St. Martin (French part)
14	Curacao	35	St. Vincent and the Grenadines
15	Dominica	36	Suriname
16	Dominican Republic	37	Trinidad and Tobago
17	Ecuador	38	Turks and Caicos Islands
18	El Salvador	39	Uruguay
19	Grenada	40	Venezuela
20	Guatemala	41	Virgin Islands (U.S.)
21	Guyana		

iv) Middle East and North Africa Region

Number	Country Name
1	Algeria
2	Bahrain
3	Djibouti
4	Egypt, Arab Rep.
5	Iran, Islamic Rep.
6	Iraq
7	Israel
8	Jordan
9	Kuwait
10	Lebanon
11	Libya
12	Malta
13	Morocco
14	Oman
15	Qatar
16	Saudi Arabia
17	Syrian Arab Republic
18	Tunisia
19	United Arab Emirates
20	West Bank and Gaza
21	Yemen

v) North America Region

Number	Country Name
1	Bermuda
2	Canada
3	United States

vi) South Asia Region

Number	Country Name
1	Afghanistan
2	Bangladesh
3	Bhutan
4	India
5	Maldives
6	Nepal
7	Pakistan
8	Sri Lanka

vii) Sub-Saharan Africa Region

Number	Country Name	Number	Country Name
1	Angola	26	Malawi
2	Benin	27	Mali
3	Botswana	28	Mauritania
4	Burkina Faso	29	Mauritius
5	Burundi	30	Mayotte
6	Cameroon	31	Mozambique
7	Cape Verde	32	Namibia
8	Central African Republic	33	Niger
9	Chad	34	Nigeria
10	Comoros	35	Rwanda
11	Congo, Dem. Rep.	36	Sao Tome and Principe
12	Congo, Rep.	37	Senegal
13	Cote d'Ivoire	38	Seychelles
14	Equatorial Guinea	39	Sierra Leone
15	Eritrea	40	Somalia
16	Ethiopia	41	South Africa
17	Gabon	42	South Sudan
18	Gambia	43	Sudan
19	Ghana	44	Swaziland
20	Guinea	45	Tanzania
21	Guinea-Bissau	46	Togo
22	Kenya	47	Uganda
23	Lesotho	48	Zambia
24	Liberia	49	Zimbabwe
25	Madagascar		

Appendix B: Name List of Countries Categorized into the Country Income Groups Defined by the World Bank

Notes: The World Bank has divided the economy of all countries in this world into five country income groups, according to their Gross National Income (GNI) per capita of the year 2010, calculated using the World Bank Atlas method. The range of GNI per capita for the five respective income groups is as follows:

	Income Group Classification	GNI per capita (US$)
i)	High income group: non-OECD	12,275 or more
ii)	High income group: OECD	12,275 or more
iii)	Upper middle income	3,976 – 12,275
iv)	Lower middle income	1,006 – 3975
v)	Low income	1,005 or less

i) High income group: non-OECD

Number	Country Name	Number	Country Name
1	Andorra	21	Kuwait
2	Aruba	22	Liechtenstein
3	Bahamas	23	Macao
4	Bahrain	24	Malta
5	Barbados	25	Monaco
6	Bermuda	26	New Caledonia
7	Brunei Darussalam	27	Northern Mariana Islands
8	Cayman Islands	28	Oman
9	Channel Islands	29	Puerto Rico
10	Croatia	30	Qatar
11	Curacao	31	San Marino
12	Cyprus	32	Saudi Arabia
13	Equatorial Guinea	33	Singapore
14	Faeroe Islands	34	Sint Maarten (Dutch part)
15	French Polynesia	35	St. Martin (French part)
16	Gibraltar	36	Trinidad and Tobago
17	Greenland	37	Turks and Caicos Islands
18	Guam	38	United Arab Emirates
19	Hong Kong	39	Virgin Islands (U.S.)
20	Isle of Man		

ii) High income group: OECD

Number	Country Name
1	Australia
2	Austria
3	Belgium
4	Canada
5	Czech Republic
6	Denmark
7	Estonia
8	Finland
9	France
10	Germany
11	Greece
12	Hungary
13	Iceland
14	Ireland
15	Israel
16	Italy
17	Japan
18	Korea, Rep.
19	Luxembourg
20	Netherlands
21	New Zealand
22	Norway
23	Poland
24	Portugal
25	Slovak Republic
26	Slovenia
27	Spain
28	Sweden
29	Switzerland
30	United Kingdom
31	United States

iii) Upper middle income group

Number	Country Name	Number	Country Name
1	Albania	28	Libya
2	Algeria	29	Lithuania
3	American Samoa	30	Macedonia
4	Antigua and Barbuda	**31**	**Malaysia**
5	Argentina	32	Maldives
6	Azerbaijan	33	Mauritius
7	Belarus	34	Mayotte
8	Bosnia and Herzegovina	35	Mexico
9	Botswana	36	Montenegro
10	Brazil	37	Namibia
11	Bulgaria	38	Palau
12	Chile	39	Panama
13	China	40	Peru
14	Colombia	41	Romania
15	Costa Rica	42	Russian Federation
16	Cuba	43	Serbia
17	Dominica	44	Seychelles
18	Dominican Republic	45	South Africa
19	Ecuador	46	St. Kitts and Nevis
20	Gabon	47	St. Lucia
21	Grenada	48	St. Vincent and the Grenadines
22	Iran, Islamic Rep.	49	Suriname
23	Jamaica	50	Thailand
24	Jordan	51	Tunisia
25	Kazakhstan	52	Turkey
26	Latvia	53	Uruguay
27	Lebanon	54	Venezuela

iv) Lower middle income group

Number	Country Name	Number	Country Name
1	Angola	29	Moldova
2	Armenia	30	Mongolia
3	Belize	31	Morocco
4	Bhutan	32	Nicaragua
5	Bolivia	33	Nigeria
6	Cameroon	34	Pakistan
7	Cape Verde	35	Papua New Guinea
8	Congo, Rep.	36	Paraguay
9	Cote d'Ivoire	37	Philippines
10	Djibouti	38	Samoa
11	Egypt, Arab Rep.	39	Sao Tome and Principe
12	El Salvador	40	Senegal
13	Fiji	41	Solomon Islands
14	Georgia	42	Sri Lanka
15	Ghana	43	Sudan
16	Guatemala	44	Swaziland
17	Guyana	45	Syrian Arab Republic
18	Honduras	46	Timor-Leste
19	India	47	Tonga
20	Indonesia	48	Turkmenistan
21	Iraq	49	Tuvalu
22	Kiribati	50	Ukraine
23	Kosovo	51	Uzbekistan
24	Lao PDR	52	Vanuatu
25	Lesotho	53	Vietnam
26	Marshall Islands	54	West Bank and Gaza
27	Mauritania	55	Yemen
28	Micronesia, Fed. Sts.	56	Zambia

v) Low income group

Number	Country Name	Number	Country Name
1	Afghanistan	19	Kyrgyz Republic
2	Bangladesh	20	Liberia
3	Benin	21	Madagascar
4	Burkina Faso	22	Malawi
5	Burundi	23	Mali
6	Cambodia	24	Mozambique
7	Central African Republic	25	Myanmar
8	Chad	26	Nepal
9	Comoros	27	Niger
10	Congo, Dem. Rep.	28	Rwanda
11	Eritrea	29	Sierra Leone
12	Ethiopia	30	Somalia
13	Gambia, The	31	South Sudan
14	Guinea	32	Tajikistan
15	Guinea-Bissau	33	Tanzania
16	Haiti	34	Togo
17	Kenya	35	Uganda
18	North Korea	36	Zimbabwe

Appendix C: Name List of Asian Countries According to Geographical Location

i) East Asia

Number	Country Name
1	China
2	Hong Kong
3	Japan
4	Macau
5	Mongolia
6	North Korea
7	South Korea
8	Taiwan

ii) Southeast Asia

Number	Country Name
1	Brunei
2	Burma
3	Cambodia
4	East Timor
5	Indonesia
6	Laos
7	**Malaysia**
8	Papua New Guinea
9	Philippines
10	Singapore
11	Thailand
12	Vietnam

iii) South Asia

Number	Country Name
1	Afghanistan
2	Bangladesh
3	Bhutan
4	India
5	Maldives
6	Nepal
7	Pakistan
8	Sri Lanka

iv) West Asia

Number	Country Name
1	Armenia
2	Azerbaijan
3	Bahrain
4	Cyprus
5	Georgia
6	Iran
7	Iraq
8	Israel
9	Jordan
10	Kuwait
11	Lebanon
12	Oman
13	Qatar
14	Saudi Arabia
15	Syria
16	Turkey
17	United Arab Emirates
18	Yemen

v) North Asia

Number	Country Name
1	Russia

vi) Central Asia

Number	Country Name
1	Kazakhstan
2	Kyrgyzstan
3	Tajikistan
4	Turkmenistan
5	Uzbekistan

Appendix D: Summary Statistics of Variables Used

Variable	Number of Observations	Mean	Median	Standard Deviation	Min.	Max.
LRGDS	41	11.0384	11.0318	0.9803	9.1212	12.3269
LRGDP	41	12.0780	12.0988	0.7888	10.6470	13.2572
LADR	41	4.2268	4.2438	0.1705	3.8480	4.5256
INT	41	6.2378	6.2900	2.1990	2.5600	10.7500
CAB	41	19,145.8049	246.0000	39,448.4540	(21,647.0000)	131,413.0000

Notes: All variables are expressed in natural logarithm (ln) form except for INT and CAB.