Savings Mobilization, Financial Development and Liberalization: The Case of Malaysia

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SAVINGS MOBILIZATION, FINANCIAL DEVELOPMENT AND LIBERALIZATION: THE CASE OF MALAYSIA

Abstract. This paper attempts to identify the key factors behind Malaysia's remarkable savings performance. Drawing on the life cycle theory, the saving function is estimated by incorporating other relevant structural features and institutional settings of the Malaysian economy into the specification. Particular emphasis has been placed on the roles of financial factors in mobilizing funds in the private sector. The results suggest that financial deepening and increased banking density tend to encourage private savings. Development of insurance markets and liberalization of the financial system, however, tend to exert a dampening effect on private savings.

Key words: private savings; financial development; Malaysia; ARDL bounds test.

JEL classification: E21; O16; O53

1. Introduction

Although the relationship between finance and growth has been actively debated in the literature,[1] the impact of finance on domestic resource mobilization has not been adequately explored (Mavrotas, 2008). This issue has recently become the focus of policy debate, given the important role of domestic resource mobilization in facilitating pro-poor growth (Guha-Khasnobis and Mavrotas, 2008b).[2] The need to enhance domestic resource mobilization arises from the fact that external finance, particularly in the form of financial capital flows and foreign aid, has been rather ineffective in reducing credit constraints faced by developing countries (Addison, 2007). Moreover, global savings over the last decade have largely been channeled to advanced countries rather than the developing world where finance is most needed for achieving development goals (Bernanke, 2005).

However, it is widely recognized that developing countries often lack appropriate financial systems, ones that efficiently pool the savings of diverse households to make them available to borrowers. This issue therefore deserves more attention given that a better understanding of the way finance affects saving performance allows policy makers to evaluate the costs and benefits associated with liberalizing and deepening financial systems, thus enabling the formulation of effective policies. This understanding is critical for achieving the development goals of promoting financial stability and strengthening growth, as has recently been highlighted in the policy discussions for the attainment of the Millennium Development Goals (Mavrotas, 2008).

In principle, financial development can strengthen the overall savings mobilization process and channel financial resources to fuel economic development, as highlighted recently by Kelly and Mavrotas (2008) and Maimbo and Mavrotas (2008). There is, however, a lack of consensus regarding the theoretical role of financial liberalization in inducing domestic resource mobilization. While financial sector policies targeted at promoting domestic saving are critical for resource mobilization, financial deregulation also eases credit constraints and may thus weaken the incentives for individuals to save (Bayoumi, 1993; Jappelli and Pagano, 1994; Bandiera *et al.* 2000). In the absence of proper prudential regulation and supervision, financial liberalization may trigger instability in financial systems (Aghion *et al.*, 2004), thereby dampening the mobilization of savings. Further empirical evidence is therefore desirable to shed more light on this issue.

Moreover, it has often been argued in the literature that life cycle factors are the key drivers for savings mobilization (see, e.g., Attanasio and Brugiavini, 2003; Modigliani and Cao, 2004; Ang,

[1] For a review of the literature, see Levine (1997) and Ang (2008b). See also Demirguc-Kunt and Levine (2001) for a collected volume of empirical evidence and a discussion on data and measurement issues on this topic.

[2] For recent studies on finance and poverty reduction, see Honohan (2004), Guha-Khasnobis and Mavrotas (2008a) and Ang (2010b), among others.

2009). The response of private saving to financial factors has, however, received relatively little attention, particularly in the context of developing countries. Empirical research on the determinants of savings has also been dominated by cross-country studies due largely to the lack of sufficient time series data for developing countries. While providing useful insights into general empirical regularities, these studies are unable to capture and account for the complexity of the financial environment and the economic history of each country (Ang and McKibbin, 2007). Against this backdrop, this paper provides some case study evidence, drawing on the experience of Malaysia, to complement the widely available cross-country analyses. It is hoped that its findings will be useful for informing research and policy design in Malaysia, as well as other developing countries with similar institutional and historical settings that desire to improve their savings performance.

Malaysia appears to be an excellent case study for this subject due to several unique features. First, it is widely observed that economic growth in Malaysia has been very impressive over the past few decades, with an average annual growth rate of 6.3% for the period 1960-2007. This strong growth record has been accompanied by a surge in savings rates, which have increased from an average of 23% to more than 40% since the early 1990s, enabling Malaysia to become one of the top savers in the world in recent years. Second, the presence of a broad-based forced saving scheme in Malaysia provides an opportunity to examine whether the requirements of mandatory savings affect the way savers respond to various policy and non-policy factors, and whether expected pension benefits at the point of retirement have any impact on current savings. Third, although some repressionist policies remain in place, Malaysia has undergone a series of financial sector reforms and achieved rapid deepening of its financial system. It is likely that one of the key indicators of the impact of these changes has come in the form of a significant rise in private saving. These unique features provide an ideal testing ground to examine the factors behind Malaysia's high savings rates in general, and whether these improvements in saving have been driven significantly by changes in the financial environment. Finally, as an added advantage, the database for Malaysia is considered relatively good by developing country standards. The use of annual data covering the period 1960-2007 is sufficiently long to allow for a meaningful time series investigation.

The main objective of this paper is to examine long-run saving behavior in the private sector of Malaysia. Particular emphasis has been placed on the roles of financial deepening, financial reforms, accessibility to banking services and development of the insurance market in mobilizing funds in the private sector. After verifying the integration properties of private saving and its potential determinants, the impact of these variables on private saving is estimated using annual data spanning almost half a century. The principal finding of this study is that income growth and shifts in the demographic structure of the population appear to be the key factors explaining the sustained increase in private saving in Malaysia, providing strong support for the use of a life-cycle

framework in the analysis. While financial deepening and an increase in banking density are associated with higher private savings, financial liberalization seems to retard the mobilization of domestic resources. Development of the insurance market is negatively related to private savings since it reduces the need for precautionary savings. The results are robust to the consideration of other financial factors such as financial volatility and real interest rates.

The remainder of the paper is organized as follows. The next section provides an overview of the trends and patterns of saving behavior in Malaysia over the last few decades. A brief discussion of the policy environment governing saving behavior in Malaysia is also provided. Section 3 discusses the long-run determinants of private saving. The empirical estimates are provided and analyzed in Section 4. Some robustness checks on the model specification are also provided. The last section concludes.

2. Saving in Malaysia: An Overview

2.1 Trends and Patterns

Malaysia can be characterized as a high growth economy. The average annual GDP growth during the period 1961-1980 was 7.2%, as depicted in Figure 1. The average growth rate was marginally higher at 7.4% for the period 1981-1996. This was underpinned by an impressive investment rate, which increased from an average of 20% of GDP to 34% of GDP during these two periods. Rapid capital formation, however, did not exert excess pressure on the balance of payments due to the impressive saving record of the country. Gross domestic investment was primarily funded by domestic saving (which includes private and public saving) and supplemented by foreign saving. It is evident that Malaysia has been very successful in mobilizing domestic saving, as reflected by a rise in the saving rate from just 24% in 1960 to 43% in 1996, before the onset of the Asian financial crisis. Both saving and investment rates were severely affected following the Asian financial crisis in 1997-98. These events resulted in a corresponding decline in the growth rates of GDP. Despite these setbacks, Malaysia remained one of the top savers in the world.

Figure 2 shows the relative contribution of private and public saving to total domestic saving. Private saving accounted for more than three quarters of total domestic saving in the 1960s. This share declined steadily over the next three decades, to about 50% by 2007. Since the mid-1980s, the relative contribution of public saving to total domestic saving has been steadily increasing. Much of this increase in public saving is achieved through cutting government consumption rather than increasing taxes. This pattern of change highlights the importance of treating private and public saving separately when examining the determinants of saving, since the analysis of total saving *per se* may be subject to aggregation bias.

Figure 1: Trends of domestic saving, investment and GDP growth rates (1960-2007)

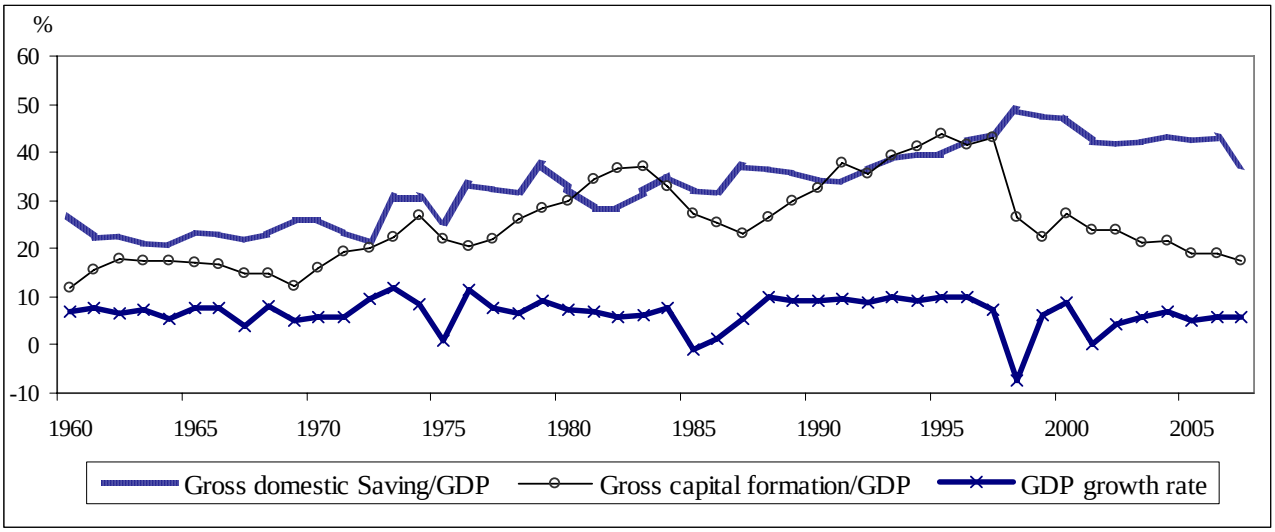
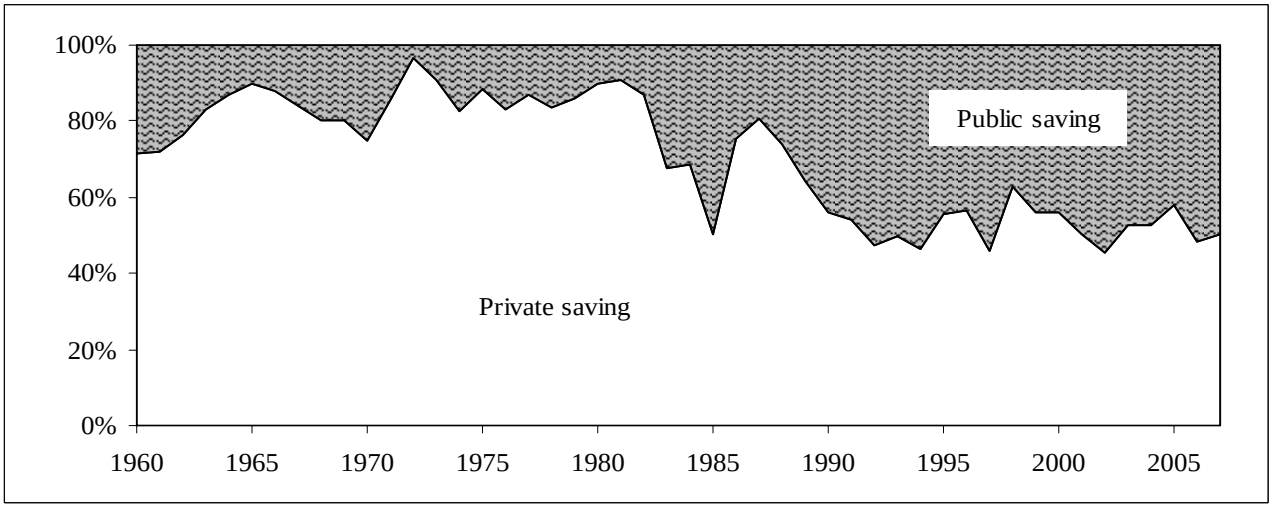


Figure 2: Composition of total saving in Malaysia (1960-2007)



2.2 Policy Environment

The Malaysian government has adopted a prudent macroeconomic policy over the last few decades. Inflation has always been very well-managed since price stability is essential in ensuring sustained economic growth, and the lack of it may retard efficient mobilization and allocation of resources in the financial system. The average change in the general price level was just 3.2% with only minor fluctuations over the period 1960-2007.

The Central Bank of Malaysia has actively pursued interest rate liberalization, with the objective of developing a more market-driven financial system. The Bank followed a gradual approach to interest rate reform, beginning in the 1970s by cautiously liberalizing interest rates. The major phase of liberalization occurred in 1978 when commercial banks were allowed to set deposit and lending rates freely. However, the market-determined interest rate mechanism was interrupted in 1985, when controls were imposed to mitigate the impact of the world economic recession on

Malaysia. These controls were removed in 1991, when all banks were allowed to set their own deposit and lending rates.

The government has consistently promoted high savings as part of its national development policy. Over the past four decades, it has introduced various *ad hoc* saving schemes at attractive interest rates to promote savings. These include the *Amanah Saham National* in 1979, the *Amanah Saham Bumiputra* in 1991, the National Saving Campaign in 1996, and the *Amanah Saham Vision 2020* in 1996. The two schemes implemented in 1996 are significantly larger in scale compared to the others. All these schemes may have been particularly influential in mobilizing private domestic saving in the economy.

With respect to institutional settings, the mandatory contribution of the labor force to the Employee Provident Fund (henceforth, EPF) may be another important factor which accounts for the high saving record in Malaysia. The EPF, set up in 1951 to serve as a nation-wide old age retirement scheme for employees, is the largest compulsory saving institution operating in Malaysia. In the past, this forced saving scheme has been able to mobilize a considerable pool of funds, providing substantial resources to finance economic development. As we can see from Table 1, the ratio of cumulative EPF contributions to total income has increased rapidly over time. The share of EPF savings in private savings has also increased by more than threefold over the last few decades. Hence, it appears that one probable explanation for the high saving rate observed in Malaysia has been the presence of an effective forced saving policy in the form of the broad-based EPF scheme.

Malaysia has a relatively well-developed banking system, comprising commercial banks, finance companies, merchant banks, and other smaller banking institutions. Of these, commercial banks are the most crucial deposit-taking institutions. They have served as an effective vehicle for deposit mobilization in the past few decades. Another important development was the establishment of the Post Office Savings Banks (POSB) in 1948, which were created in order to provide adequate banking facilities and promote saving, particularly among small savers in both urban and rural areas. A large number of bank branches ensure basic banking facilities reach a majority of the general public. Banking density, measured by the number of bank branches per million of population, increased from an average of 27 in the 1960s to 73 in recent years.

The 1970s and 1990s were characterized by rapid development in the financial sector due to strong economic performance and the implementation of various effective financial sector policies, as shown by the empirical findings of Ang and McKibbin (2007) and Ang (2008a). These changes have had a significant impact on the functioning of financial institutions and financial markets, and led to the emergence of a variety of financial products and services. During the period 1960-1999, credit to the private sector as a share of GDP deepened rapidly from 6% to 142%. Moreover, stock market activities gained significant momentum in the 1990s. This increased level of financial

development and the proliferation of financial instruments may have provided more incentives to save. Measured by the ratio of private credit to GDP, Malaysia had achieved one of the highest levels of financial deepening in the world by 2000, after the United States, Japan, Cyprus, Switzerland and Hong Kong.

Table 1: Variables used in the analysis (annual averages)

Variable	1960-69	1970-79	1980-89	1990-99	2000-07
Real private saving (RM million)	2,840	7,504	15,642	27,346	46,108
Real voluntary private saving (RM million)	2,562	6,809	12,957	20,097	31,495
Real public saving (RM million)	622	1,122	4,670	24,136	43,081
Per capita private income growth rate (%)	6.5	7.4	4.9	6.4	6.1
Age dependency ratio (%)	96.2	84.8	73.3	65.9	56.7
Domestic credit to private sector / GDP (%)	10.9	28.5	70.0	113.9	119.1
M2 / GDP (%)	25.5	39.3	63.5	87.4	113.9
Value of shares traded / GDP (%)	2.6	5.5	8.9	72.1	44.7
No. of bank branches / million population	26.5	33.7	47.1	66.6	72.9
Insurance assets / GDP (%)	1.7	2.7	4.5	7.7	14.4
Cumulative EPF contributions	12.0	16.6	27.9	44.0	43.8
Financial liberalization (Index, 1960=100)	99.1	103.2	57.2	28.7	23.0
Real interest rate (%)	4.2	1.5	4.2	2.7	1.8

Notes: see Appendix I for details on data construction and sources.

Besides analyzing the implications of these policy changes on saving behavior, it is also essential to consider the effect that demographic transition has had on private saving in Malaysia. While the ratio of old age dependency (the number of people over 64 as a proportion of the working age population, ages 15-64) has remained more or less unchanged over the last few decades, young age dependency (the number of people under 15 as a proportion of the working age population, ages 15-64) has declined significantly. This has led to a dramatic fall in the overall age dependency ratio from 95% to 54% over the period from 1960 to 2007. This reflects a significant decline in the population growth rate, which is likely to have a significant impact on saving in the private sector.

3. Analytical Framework

The empirical specification of the saving model draws upon the life cycle model (henceforth LCM). This model is augmented to take into consideration the key macroeconomic features and institutional settings of Malaysia. According to the LCM, one of the key determinants of saving is the growth rate of per capita income (Modigliani and Brumberg, 1954). As income grows, the life earnings and consumption of each successive age group will be larger than for the preceding group. If each successive age group is aiming at a higher level of consumption in retirement, the aggregate

saving of those working relative to those not earning income would increase. Therefore, saving will tend to rise with income growth, given that the higher the growth rate of income, the greater the gap between the targeted levels of consumption of the workers in the current generation and the dissaving of retirees from a less well-off generation. Examining the effect of the rate of economic growth on saving is particularly relevant in this context since the Malaysian economy has experienced an impressive growth performance over the last few decades.

Another key feature of the LCM is the pre-eminent role of age structure in influencing saving behavior. The consideration of age dependency is particularly important for Malaysia given that its demographic structure has changed significantly over the last few decades, as discussed in the preceding section. In principle, individuals will have negative saving when they are young and when they are old, whereas positive saving occurs during their productive years. That is, saving follows a hump-shaped pattern over an individual's lifetime. At the aggregate level, one might expect aggregate saving to be lower when there are more dependents in an economy. Hence, higher age dependency in the population tends to reduce saving.

The structuralist view of Goldsmith (1969) proposes that the incentives to save may increase with the proliferation of financial instruments, which can satisfy the diverse needs and portfolio preference of various savers. Similarly, Shaw (1973) argues that the existence of a sophisticated and liberalized financial system enhances the incentives to save since an efficient financial system effectively reduces risk and information costs, which could increase net real returns to savers. While the basic objective of financial reform is to improve the extent and efficiency of the financial system, which in principle may lead to higher saving, the impact of financial liberalization cannot be determined *a priori* since financial deregulation also eases borrowing constraints and may therefore reduce the incentive to save (see Bayoumi, 1993; Jappelli and Pagano, 1994; Bandiera *et al.* 2000). Furthermore, the "investment-motivated saving hypothesis" of Liu and Woo (1994) postulates that an insufficient level of financial development would induce individuals to save more in order to undertake self-financed investment projects. Hence, the theoretical prediction of the influence of financial development and liberalization on saving is ambiguous.

In line with the Central Bank's effort to deepen the financial system, the banking sector in Malaysia has also expanded vigorously. The development of banking institutions can play an important role in affecting private saving through efficient regulation and the provision of post office saving banks to instill confidence in small savers. As Lewis (1954) remarks, "if they [saving institutions] are pushed right under the individual's nose … people save more than if the nearest saving institution is some distance away". Thus, the number and proximity of banking institutions serving the diversity of needs of savers may crucially affect the willingness to save. The

consideration of banking density captures the breadth of the financial system, which provides a measure of financial access, whereas other standard indicators reflect its depth.

Models of precautionary saving suggest that agents in the private sector will tend to hold more financial assets when faced with greater uncertainty. Empirical evidence, however, has often produced mixed support for the precautionary saving hypothesis (see Loayza *et al.* 2000 for a survey). This ambiguity may in part be due to the difficulty associated with measuring uncertainty. The most common measure of uncertainty is the rate of inflation or its variation. In the context of Malaysia, the use of this measure is inappropriate because inflation tends to be administered, and therefore observed inflation rates do not reflect the true level of price pressure. Consequently, we use the total assets of life insurance funds relative to GDP to capture the effect of precautionary savings. The provision of adequate insurance coverage is expected to effectively smooth consumption and therefore has a significant bearing on saving mobilization.

In the Malaysian context, it is also important to understand the dynamic interaction between private and public saving given that the share of public saving in total saving has been increasing consistently since the 1980s. The Ricardian Equivalence proposition of Barro (1974) suggests that an increase in government saving will have no effect on total saving, since it will be met by an equal reduction in private saving. That is, when government runs a budget deficit, the private sector will respond by saving more to offset any undesirable effect on future generations. Hence, any change in public saving will be fully offset by an equal change in private saving.

The above theoretical considerations provide a basis for the formulation of the empirical saving models given in Eqs. (1) and (2). We estimate for both real private saving (PRS_t) and voluntary real private saving ($VPRS_t$) using the same set of regressors, where the latter is defined as real private saving net of annual EPF contributions. The separation of provident fund contributions from private saving is necessary, since the proportion of compulsory saving is determined by government policy.

$$\text{Model A} : PRS_t = f_A(IG_t, AGE_t, FD_t, BD_t, INS_t, FL_t, PUS_t) \quad (1)$$

$$\text{Model B} : VPRS_t = f_A(IG_t, AGE_t, FD_t, BD_t, INS_t, FL_t PUS_t) \quad (2)$$

We postulate that the growth rate of per capita real private income (IG_t) and banking density (BD_t) have a positive effect on private saving. Age dependency (AGE_t), insurance market development (INS_t) and real public saving (PUS_t) are hypothesized to have a negative impact. The effects of financial development (FD_t) and financial liberalization (FL_t) cannot be determined *a priori*.

Financial development (FD_t) is measured by bank credit to the private sector as a ratio of GDP, M2 over GDP, the value of shares traded over GDP, and their first principal component (see, e.g., Ang and McKibbin, 2007 and Mavrotas and Son, 2006, 2008 for a similar approach).[3] The latter provides an overall measure of development in the financial system. The consideration of several indicators is necessary in order to check the robustness of the results since the literature has not identified a satisfactory measure for financial development (Levine, 1997; Ang, 2008b). Furthermore, we use a broad-based measure of financial liberalization (FL_t) compiled by Abiad *et al.* (2010). Their measure considers seven policy dimensions, providing an adequate coverage of the key changes in the financial policy environments (Ang, 2010b).

While the literature has focused on either the effect of financial development or financial liberalization on savings, so far there has been no attempt to consider both factors under an integrated framework. A more satisfactory approach to assessing the effect of finance on savings should explicitly account for both the effect of deepening in the financial systems and the policies pursued. This would provide a more complete analysis of the role of finance in mobilizing savings. A recent contribution by Ang (2010b) focusing on India shows that while financial development helps to reduce income inequality, financial liberalization has the opposite effect. The results of this study highlight that focusing on the effects of financial development on savings without taking into account the policies that are being pursued can produce misleading conclusions. Annual data covering the period 1960-2007 are used in the analysis. Data sources and discussion of variable construction are given in Appendix I.

4. Results

4.1 Integration and cointegration analyses

A battery of unit root tests is used to assess the order of integration of the variables. This includes the conventional Augmented Dickey-Fuller and Phillips-Perron tests as well as the Zivot and Andrews (1992) and Lee and Strazicich (2003) tests, where the latter two procedures allow for the presence of endogenous structural breaks in the series. As would be expected, the results (not reported) show a mix of $I(0)$ and $I(1)$ variables, suggesting that the widely used Johansen cointegration technique is inappropriate in this context. We therefore employ the ECM test of Banerjee *et al.* (1998) and the ARDL bounds procedure of Pesaran *et al.* (2001), which are designed

[3] The existing approach differs from theirs in the sense that the value of shares traded over GDP is used as the third measure of financial development rather than the ratio of commercial bank assets divided by commercial bank plus central bank assets. This is motivated by the consideration that previous studies have found the link between finance and growth to be considerably weaker when the relative asset ratio is used (see, e.g., McCaig and Stengos, 2005; Ang and McKibbin, 2007), and the fact that the stock market in Malaysia has played an increasingly important role in financial intermediation.

to deal with this scenario, to test for the presence of a cointegrated relationship (see Appendix II for details). The choice of these techniques also provides a convenient step to derive the long-run estimates. It is important to note that none of the variables appears to be integrated at an order higher than one. This allows legitimate use of the proposed cointegration techniques since in the presence of *I*(2) variables, the critical values are no longer valid.

Table 2: Cointegration tests

	Model A (Dep. Var. = $\Delta \ln PRS_t$)				Model B (Dep. Var. = $\Delta \ln VPRS_t$)			
	(1a) FD = PCY	*(2a) FD= M2Y*	*(3a) FD= VST*	*(4a) FD= PCA*	*(1b) FD = PCY*	*(2b) FD= M2Y*	*(3b) FD= VST*	*(4b) FD= PCA*
I. Test statistic								
ARDL bounds test (Pesaran *et al.*, 2001)	3.52^{+}	3.15*	5.04$^{\#}$	6.35$^{\#}$	4.14^{+}	4.37$^{\#}$	4.33$^{\#}$	5.35$^{\#}$
ECM test (Banerjee *et al.*, 1998)	-4.93^{+}	-4.38*	-4.67^{+}	-5..77$^{\#}$	-5.44$^{\#}$	-5.51$^{\#}$	-4.46*	-5.51$^{\#}$
II. Diagnostic check								
χ^2_{NORMAL}	0.81 [0.67]	1.34 [0.51]	0.61 [0.73]	0.29 [0.86]	1.19 [0.55]	0.89 [0.64]	0.93 [0.63]	1.76 [0.41]
χ^2_{SERIAL}	1.79 [0.18]	0.25 [0.62]	1.67 [0.20]	3.36* [0.07]	1.51 [0.22]	1.91 [0.17]	0.02 [0.88]	1.04 [0.31]
χ^2_{ARCH}	0.14 [0.71]	0.01 [0.91]	1.50 [0.22]	0.02 [0.87]	0.03 [0.86]	0.05 [0.82]	0.08 [0.78]	0.17 [0.68]
χ^2_{WHITE}	25.35 [0.33]	25.27 [0.34]	21.95 [0.52]	24.93 [0.41]	23.89 [0.41]	23.43 [0.44]	16.08 [0.85]	19.14 [0.74]
χ^2_{RESET}	1.60 [0.21]	0.02 [0.89]	0.00 [0.97]	0.05 [0.83]	0.58 [0.45]	0.02 [0.89]	0.02 [0.89]	0.01 [0.90]

Notes: the lag length is chosen to be one. The cointegration test statistics are compared against the critical values reported in Pesaran et al. (2001). Specifically, the 10%, 5% and 1% critical value bounds for the *F*-tests are (2.03, 3.13), (2.32, 3.50) and (2.96, 4.26), respectively, and for the *t*-tests (-2.57, -4.23), (-2.86, -4.57) and (-3.43 -5.19), respectively. χ^2_{NORMAL} refers to the Jarque-Bera statistic of the test for normal residuals, χ^2_{SERIAL} is the Breusch-Godfrey LM test statistics for no first order serial correlation, χ^2_{ARCH} is the Engle's test statistic for no autoregressive conditional heteroskedasticity, χ^2_{WHITE} denotes the White's test statistic to test for homoskedastic errors, and χ^2_{RESET} is the Ramsey's test statistic for no functional misspecification. Figures in the brackets are *p*-values. *, + and # indicate 10%, 5% and 1% levels of significance, respectively.

Table 2 gives the *t*-statistics for the ECM test and *F*-statistics for the ARDL bounds test. We allow for only one lag in the estimation in order to conserve the degrees of freedom. In this connection, model selection criteria, such as the AIC and SBC (note reported), also prefer a more parsimonious specification. The results indicate that the null hypothesis of no long-run relationship between private saving or voluntary private savings and all its determinants is rejected at the conventional levels of significance for both Model A and Model B (panel I). Moreover, diagnostic

checks reveal that these estimates are not subject to any normality, serial correlation, heteroskedasticity and functional specification problems, at the 5% level of significance (panel II).

4.2 Long-run run estimates of the private saving function

Table 3 reports the long-run estimates of the private saving equation, derived using the ARDL procedure advanced by Pesaran and Shin (1998) and Pesaran *et al.* (2001). The regressions fit remarkably well and pass the diagnostic tests against non-normality, serial correlation, heteroskedasticity, autoregressive conditional heteroskedasticity, and the regression specification error test (or Ramsey's RESET test), at the 5% level of significance (see panel III). Structural stability of the models is examined using the cumulative sum and cumulative sum of squares tests on the recursive residuals. The results, which are available upon request, indicate no structural instability in the residuals of the private saving equations.

Panel I in Table 3 show that Model A and Model B generally yield quite similar long-run results, although on average, voluntary savings tend to be more responsive to changes in financial factors. All variables enter the long-run equations significantly. The signs and magnitudes of the coefficients also appear reasonable. The estimates are not sensitive to the way financial development is measured. In particular, an increase in income growth, financial deepening or banking density has a favorable impact on private saving whereas an increase in the age dependency ratio, insurance market development, the extent of financial liberalization or public savings does the opposite. The results highlight a number of interesting points discussed in the following.[4]

The analysis suggests that private saving rises with the growth rate of per capita private income. Thus, growth-enhancing policies that result in higher productivity or capital deepening may also contribute to higher savings through increasing overall growth. The results are consistent with the findings of Ang (2009) for the Chinese and Indian experience. This finding is also broadly consistent with the cross-country results of Masson *et al.* (1998) and Loayza *et al.* (2000b). However, the magnitude of the coefficient of private income growth is rather small. The semi-elasticity of private saving with respect to income growth is found to be, on average, 0.02. Private saving is less sensitive to income growth in Malaysia probably because its economy has maintained a stable, high growth rate, except during periods of economic crisis, throughout the last few decades.[5]

[4] The parameter estimates are insensitive to the inclusion of two dummy variables to capture the effects of macroeconomic shocks due to the global economic recession in 1985 and the 1997-98 Asian financial crisis.

[5] Neoclassical growth models suggest that private saving may also affect private income growth and thus bias our results. To address the concern of endogeneity bias, we have attempted to use private income growth as the dependent variable. However, no evidence of cointegration is found, suggesting that private income growth can be interpreted as one of the long-run forcing variables explaining the evolution in private saving where a reverse causation is absent (see Pesaran *et al.* (2001) and Ang (2010a, b, c) for this approach).

Table 3: The ARDL estimates of the private saving equation

	Model A (Dep. Var. = $\Delta\ln PRS_t$)				Model B (Dep. Var. = $\Delta\ln VPRS_t$)			
	(1a) FD = PCY	*(2a) FD= M2Y*	*(3a) FD= VST*	*(4a) FD= PCA*	*(1b) FD = PCY*	*(2b) FD= M2Y*	*(3b) FD= VST*	*(4b) FD= PCA*
I. The long-run estimate								
Intercept	-22.36$^{\#}$	-23.44$^{\#}$	-25.55$^{\#}$	-20.13$^{\#}$	-22.89$^{\#}$	-26.58$^{\#}$	-29.98$^{\#}$	-25.32$^{\#}$
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
IG_t	0.02$^{\#}$	0.02$^{\#}$	0.01$^{\#}$	0.02$^{\#}$	0.02$^{\#}$	0.03$^{\#}$	0.02$^{\#}$	0.02$^{\#}$
	[0.00]	[0.00]	[0.00]	[0.00]	[0.06]	[0.00]	[0.00]	[0.00]
$\ln AGE_t$	-6.73$^{\#}$	-6.11$^{\#}$	-7.14$^{\#}$	-6.96$^{\#}$	-6.65$^{\#}$	-6.58$^{\#}$	-7.64$^{\#}$	-7.36$^{\#}$
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
$\ln FD_t$	0.16^{+}	0.58*	0.07^{+}	0.21$^{\#}$	0.18^{+}	0.65*	0.06	0.21^{+}
	[0.04]	[0.06]	[0.04]	[0.00]	[0.04]	[0.08]	[0.14]	[0.04]
$\ln BD_t$	1.67$^{\#}$	1.73$^{\#}$	1.83$^{\#}$	1.48$^{\#}$	1.65$^{\#}$	1.87$^{\#}$	2.04$^{\#}$	1.79$^{\#}$
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
$\ln INS_t$	-0.72$^{\#}$	-0.84$^{\#}$	-0.79$^{\#}$	-0.89$^{\#}$	-0.86$^{\#}$	-1.05$^{\#}$	-0.98$^{\#}$	-0.97$^{\#}$
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
$\ln FL_t$	-0.25^{+}	-0.31$^{\#}$	-0.39$^{\#}$	-0.35$^{\#}$	-0.42$^{\#}$	-0.38$^{\#}$	-0.48$^{\#}$	-0.46$^{\#}$
	[0.03]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
$\ln PUS_t$	-0.25$^{\#}$	-0.23$^{\#}$	-0.23$^{\#}$	-0.16$^{\#}$	-0.21$^{\#}$	-0.29$^{\#}$	-0.29$^{\#}$	-0.28$^{\#}$
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
II. The short-run estimate								
Intercept	0.09^{+}	-0.03	0.02	-0.02	-0.02	0.04	0.11^{+}	0.04
	[0.04]	[0.51]	[0.71]	[0.59]	[0.74]	[0.43]	[0.04]	[0.44]
ECT_{t-1}	-0.79$^{\#}$	-0.79$^{\#}$	-0.76$^{\#}$	-0.83$^{\#}$	-0.80$^{\#}$	-0.79$^{\#}$	-0.75$^{\#}$	-0.78$^{\#}$
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
ΔIG_t	0.02$^{\#}$	0.02$^{\#}$	0.01$^{\#}$	0.02$^{\#}$	0.02$^{\#}$	0.02$^{\#}$	0.02$^{\#}$	0.02$^{\#}$
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
$\Delta\ln AGE_t$	-7.52$^{\#}$	-7.27$^{\#}$	-5.80^{+}	-6.48$^{\#}$	-7.25^{+}	-8.35$^{\#}$	-6.99^{+}	-6.85^{+}
	[0.00]	[0.00]	[0.01]	[0.00]	[0.01]	[0.00]	[0.01]	[0.01]
$\Delta\ln BD_t$	1.13$^{\#}$	1.10$^{\#}$	1.13$^{\#}$	0.54*	1.01^{+}	1.16^{+}	1.22$^{\#}$	1.06^{+}
	[0.00]	[0.00]	[0.00]	[0.08]	[0.02]	[0.01]	[0.00]	[0.01]
$\Delta\ln INS_t$	-0.89^{+}	-0.89$^{\#}$	-1.20$^{\#}$	-1.04$^{\#}$	-1.47$^{\#}$	-1.03^{+}	-1.33$^{\#}$	-1.33$^{\#}$
	[0.01]	[0.00]	[0.00]	[0.00]	[0.00]	[0.01]	[0.00]	[0.00]
$\Delta\ln PUS_t$	-0.09^{+}	-0.09^{+}	-0.10^{+}	-0.07*	-0.11^{+}	-0.12^{+}	-0.12^{+}	-0.13^{+}
	[0.04]	[0.03]	[0.02]	[0.08]	[0.03]	[0.02]	[0.02]	[0.01]
III. Diagnostic check								
χ^2_{NORMAL}	0.95	0.84	1.04	1.19	0.04	1.09	1.65	2.38
	[0.62]	[0.66]	[0.59]	[0.55]	[0.98]	[0.58]	[0.44]	[0.30]
χ^2_{SERIAL}	0.12	0.58	0.21	0.19	0.15	0.36	0.01	0.11
	[0.73]	[0.45]	[0.65]	[0.67]	[0.69]	[0.55]	[0.91]	[0.75]
χ^2_{ARCH}	0.58	0.83	0.66	0.03	0.06	0.36	1.36	2.36
	[0.45]	[0.36]	[0.42]	[0.87]	[0.80]	[0.55]	[0.24]	[0.12]
χ^2_{WHITE}	0.96	1.68	0.79	1.29	0.00	1.04	0.22	0.04
	[0.33]	[0.19]	[0.37]	[0.26]	[0.99]	[0.31]	[0.64]	[0.85]
χ^2_{RESET}	0.34	0.45	2.95*	0.00	0.03	0.01	1.27	0.18
	[0.56]	[0.50]	[0.09]	[0.98]	[0.87]	[0.91]	[0.26]	[0.67]

Notes: see notes to Table 2. *, + and # indicate 10%, 5% and 1% levels of significance, respectively.

The results indicate that the private sector tends to save less with the increase of dependent population relative to working population, consistent with the prediction of the LCM. Specifically,

the average elasticity of private saving with respect to age dependency is found be -6.74 for Model A and -6.81 for Model B. The results provide some support for the view that demographic factors are crucial in explaining the variations in private saving across time, as suggested by the previous findings of Ang (2009) and Loayza *et al.* (2000b), among others. Thus, it appears that Malaysia's demographic transition has contributed significantly to the increases in private saving given that the latter moves in the same direction as the proportion of the working age population. However, given the significant role of demographic structure in stimulating private saving, the declining rate of young age dependency in Malaysia may be a concern for future saving rates. If this trend persists, private saving may fall in the next phase of demographic transition.

Financial deepening is found to have played a beneficial role in the accumulation of private saving. While the results contrast with those of Sarantis and Stewart (2001) who report significant negative effects of financial deepening on private saving for a panel of 20 OECD countries, they are in line with Edwards (1996), Ozcan *et al.* (2003) and Kelly and Mavrotas (2008) for the developing countries' experience. Among the three individual indicators considered, the effect of financial development is found to be most significant when it is measured by the ratio of private credit to GDP. Overall, the long-run elasticity derived from the coefficient of the first principal component of the three financial development indicators suggests that a 1% increase in financial deepening yields approximately a 0.21% increase in private saving or voluntary private saving. This positive elasticity is consistent with the view that saving rises with the availability of risk-sharing financial instruments and an improvement in the financial system. A key policy implication emerging from the results is that it is critical for the government to develop the financial sector since financial deepening facilitates the mobilization of savings.

The number of bank branches per million of population is found to have a pronounced effect on private saving, with an average long-run elasticity of 1.76. This provides some support for the proposition that the provision of more financial institutions and financial services, which enhances financial inclusiveness, spurs private saving. Therefore, rapid expansion of bank branches in Malaysia observed over the past few decades, which may have resulted in improved accessibility of banking services and lower banking transaction costs, seems to have increased the willingness of individuals to save. The introduction of the postal saving system in Malaysia during the early stages of economic development has also significantly mobilized savings from small savers. The results are consistent with Gupta (1987) for the Asian experience. Development of the insurance market exerts a large significant negative effect on private saving, with an average long-run elasticity of about 0.81**.** As would be expected, changes in voluntary private saving appear to be more responsive to deepening in the insurance market, with an average elasticity of 0.97. The results suggest that better insurance coverage, as experienced by Malaysia over the last few decades, has significantly reduced

the need for precautionary savings and thereby tends to discourage thrift. The results are consistent with the precautionary saving models.

Consistent with the predictions of Bayoumi (1993) and Jappelli and Pagano (1994), financial liberalization is found to exert a negative influence on private saving. Our results corroborates the cross-country findings of Bandiera *et al.* (2000) and Hermes and Lensink (2008), and in particular the findings of Ang and Sen (2010) for Malaysia, that financial liberalization is more closely associated with a fall in saving. Hence, it appears that the newly liberalized financial system has not been able to effectively mobilize domestic resources. As Stiglitz and Uy (1996) note, government intervention in the financial systems of the East Asian economies (including Malaysia), as opposed to financial reforms, has contributed to their exceptional savings performance through enhancing financial stability, correcting market failures, ensuring the solvency of financial institutions, and creating better institutions. Ang and Sen (2010) also argue that the extent of directed credit controls has increased significantly over the years since the inception of the program in 1975. Households and firms that do not benefit from the programs may have tended to save more. As such, financial liberalization may result in lower saving in the private sector.

In terms of fiscal policy, the estimates suggest that a rise in government saving leads to a reduction in private sector saving. The results are significant at the 1% level. The negative elasticity of public saving is found to be about 0.24, providing no full empirical support for the Ricardian Equivalence hypothesis. Its effect is found to be larger on voluntary private saving. Hence, it appears that the privatization policy that helped promote the private sector as the key engine of economic growth, adopted by the Malaysian government in the 1980s, has had a detrimental effect on private saving.

4.3 Short-run run estimates of the private saving equation

To obtain the short-run results, an error-correction model (ECM) is formulated where the error-correction term (*ECT*) is obtained by rearranging the long-run relationship obtained above with PRS_{t-1} as the normalized variable. The general-to-specific modeling approach is then adopted to derive a satisfactory short-run dynamic model. This involves testing down the general model by successively eliminating statistically insignificant regressors and imposing data acceptable restrictions on the parameters to obtain the final parsimonious dynamic equation. The ECM regressions associated with the level relationship in panel I are reported in panel II of Table 3.

In general, the coefficients of the short-run variables have expected signs, consistent with their long-run counterparts. As is evident, the estimated results are remarkably similar across all equations. Both financial development and liberalization, however, are found to have no statistically significant long-run impact and are therefore dropped from the estimation. Moreover, the

coefficients associated with ECT_{t-1}, which measure the speed of adjustment back to the long-run equilibrium value, are statistically significant at the 1% level and correctly signed (negative). This statistical significance provides further evidence against no cointegration between private saving and its determinants. The estimates suggest that the economy of Malaysia adjusts at an average rate of 78.6% per year to achieve the steady state when there is a deviation from equilibrium.

4.4 DOLS estimates

While the ARDL approach is used to derive the main results of this paper, we also consider another widely used single-equation estimator to provide a sensitivity check of the results, namely the DOLS procedure of Stock and Watson (1993). This procedure involves regressing one of the *I*(1) variables on the remaining *I*(1) variables, the *I*(0) variables, leads and lags of the first difference of the *I*(1) variables, and a constant. By doing so, it corrects for potential endogeneity problems and small sample bias, and provides estimates of the cointegrating vectors which are asymptotically efficient.

Table 4: The DOLS estimates for the private saving equation

	Model A (Dep. Var. = $\Delta\ln PRS_t$)				Model B (Dep. Var. = $\Delta\ln VPRS_t$)			
	(1a) FD = PCY	*(2a) FD= M2Y*	*(3a) FD= VST*	*(4a) FD= PCA*	*(1b) FD = PCY*	*(2b) FD= M2Y*	*(3b) FD= VST*	*(4b) FD= PCA*
Intercept	-25.55$^{\#}$ [0.00]	-25.15$^{\#}$ [0.00]	-27.86$^{\#}$ [0.00]	-25.21$^{\#}$ [0.00]	-28.21$^{\#}$ [0.00]	-27.10$^{\#}$ [0.00]	-33.26$^{\#}$ [0.00]	-27.70$^{\#}$ [0.00]
IG_t	0.02^{+} [0.03]	0.03^{+} [0.04]	0.02^{+} [0.00]	0.02^{+} [0.04]	0.03$^{\#}$ [0.00]	0.03^{+} [0.04]	0.02$^{\#}$ [0.00]	0.03^{+} [0.02]
$\ln AGE_t$	-6.48$^{\#}$ [0.00]	-5.72$^{\#}$ [0.00]	-7.05$^{\#}$ [0.00]	-6.81$^{\#}$ [0.00]	-6.78$^{\#}$ [0.00]	-5.64$^{\#}$ [0.00]	-7.20$^{\#}$ [0.00]	-7.03$^{\#}$ [0.00]
$\ln FD_t$	0.17^{+} [0.04]	0.67^{+} [0.04]	0.07^{+} [0.04]	0.22$^{\#}$ [0.00]	0.19^{+} [0.04]	0.82^{+} [0.03]	0.09^{+} [0.04]	0.26^{+} [0.02]
$\ln BD_t$	1.81$^{\#}$ [0.00]	1.79$^{\#}$ [0.00]	1.92$^{\#}$ [0.00]	1.80$^{\#}$ [0.00]	1.93$^{\#}$ [0.00]	1.88$^{\#}$ [0.00]	2.25$^{\#}$ [0.00]	1.90$^{\#}$ [0.00]
$\ln INS_t$	-0.81$^{\#}$ [0.00]	-0.88$^{\#}$ [0.00]	-0.90$^{\#}$ [0.00]	-0.82$^{\#}$ [0.00]	-1.01$^{\#}$ [0.00]	-1.02$^{\#}$ [0.00]	-0.91$^{\#}$ [0.00]	-1.05$^{\#}$ [0.00]
$\ln FL_t$	-0.42$^{\#}$ [0.00]	-0.48$^{\#}$ [0.00]	-0.44$^{\#}$ [0.00]	-0.51$^{\#}$ [0.00]	-0.45$^{\#}$ [0.00]	-0.63$^{\#}$ [0.00]	-0.69$^{\#}$ [0.00]	-0.57$^{\#}$ [0.00]
$\ln PUS_t$	-0.19^{+} [0.02]	-0.18$^{\#}$ [0.00]	-0.20$^{\#}$ [0.00]	-0.22$^{\#}$ [0.00]	-0.23^{+} [0.01]	-0.21^{+} [0.04]	-0.29$^{\#}$ [0.00]	-0.24$^{\#}$ [0.00]

Notes: estimates are based on one lag. *, + and # indicate 10%, 5% and 1% levels of significance, respectively.

In general, this procedure yields very similar results compared to those estimated using the ARDL approach. As we can see from Table 4, all variables enter the long-run equation significantly at the conventional levels. Although the magnitude of the coefficients shows some small variations,

the qualitative aspects of the results are, by and large, consistent with those obtained using the ARDL estimator. The main theme is that the finance-related variables continue to be highly significant with expected signs. Hence, we conclude that our main results are insensitive to the choice of estimator.

4.5 Further robustness checks

Next, we address the issue regarding whether the previous results are robust to the inclusion of control variables, especially those that may have a crucial effect on private saving in Malaysia. The following control variables are considered. First, there is now an established literature showing that, with few exceptions, financial development tends to stimulate saving. The negative effect of financial development is mainly found in more advanced economies, which typically have more developed financial systems. This intriguing observation leads us to hypothesize that the relationship between financial development and saving resembles an inverted U-curve. That is to say, saving initially rises with the level of financial development, and then falls after a certain threshold level of financial development is reached. Thus, financial development may exert a non-linear effect on saving.

Second, volatility in the financial system (FV_t) may induce instability and tamper with consumption smoothing, thereby exerting an adverse effect on private saving. However, it may also encourage individuals to save more. It is measured by the standard deviations of the growth rate in the first principal component of the three indicators of financial development over 5-year overlapping periods. This variable captures the adverse impact of speculative lending and may also reflect the extent of financial regulations on speculative lending. Third, an important policy determinant of saving implied by the LCM is the real interest rate. The way real interest rates (RI_t) affect saving is unclear in the model since it depends on the relative magnitude of the substitution and income effects. An increase in the interest rate may induce more saving due to the higher price of present consumption relative to the future price (substitution effects); but it may also reduce saving if the individual is a net lender (income effects). These two effects may offset each other.

Fourth, the presence of a large forced saving scheme is a unique feature of the Malaysian economy, as highlighted previously. However, this feature is not captured in the traditional LCM since the model assumes that individuals are able to make rational decisions in developing a lifetime plan of consumption and saving. In practice, many workers are unable to enter retirement with sufficient financial resources. This was the main reason for the introduction of the social security program in Malaysia. The importance of social security for saving behavior has been highlighted by Feldstein (1974), who shows that through the ability to provide income during retirement, the presence of a sound social security framework effectively weakens the precautionary motive for

saving. The expected pension benefits (PEN_t) is measured using accumulated EPF contributions over GDP, following the approach of Ang (2009). Finally, a dummy variable (NSS_t), which takes the value of 1 in 1996 and 1997, is included in the specifications to capture the effect of the introduction of the national saving schemes in 1996.

These variables are entered separately in the regressions to minimize any potential econometric problems associated with multicollinearity. Since our results so far are not sensitive to the way financial development is measured, we only report estimates based on the first principal component of the three financial development indicators. The estimates reported in Table 5 show that our core results remain robust to the inclusion of these control variables. In nearly all regressions, we continue to find rather strong evidence of cointegration. Interestingly, all these control variables are found to have no statistically significant impact on private saving or voluntary private saving.

Table 5: Robustness checks

	Model A (Dep. Var. = $\Delta\ln PRS_t$)					Model B (Dep. Var. = $\Delta\ln VPRS_t$)				
	(1a)	*(1b)*	*(1c)*	*(1d)*	*(1e)*	*(2a)*	*(2b)*	*(2c)*	*(2d)*	*(2e)*
Intercept	-15.58^{+}	-11.99^{+}	-22.45$^{\#}$	-22.15$^{\#}$	-21.76$^{\#}$	-13.16$^{\#}$	-14.96^{+}	-16.90^{+}	-18.51^{+}	-24.73^{+}
IG_t	0.01$^{\#}$	0.02$^{\#}$	0.01$^{\#}$	0.01^{+}	0.01^{+}	0.02$^{\#}$	0.02$^{\#}$	0.03$^{\#}$	0.02$^{\#}$	0.02$^{\#}$
$\ln AGE_t$	-6.95$^{\#}$	-6.76$^{\#}$	-6.70$^{\#}$	-6.74$^{\#}$	-6.79$^{\#}$	-7.08$^{\#}$	-7.17$^{\#}$	-6.71$^{\#}$	-6.43$^{\#}$	-6.99$^{\#}$
$\ln FD_t$	0.26^{+}	0.23^{+}	0.14*	0.16*	0.15*	0.35^{+}	0.34^{+}	0.23^{+}	0.29$^{\#}$	0.19^{+}
$\ln BD_t$	1.22$^{\#}$	0.99$^{\#}$	1.59$^{\#}$	1.58$^{\#}$	1.56$^{\#}$	1.01^{+}	1.13^{+}	1.22$^{\#}$	1.33$^{\#}$	1.68$^{\#}$
$\ln INS_t$	-0.86$^{\#}$	-0.84$^{\#}$	-0.94$^{\#}$	-0.93$^{\#}$	-0.94$^{\#}$	-1.06$^{\#}$	-1.06$^{\#}$	-1.05$^{\#}$	-0.96$^{\#}$	-1.15$^{\#}$
$\ln FL_t$	-0.27^{+}	-0.29^{+}	-0.32$^{\#}$	-0.31$^{\#}$	-0.31$^{\#}$	-0.41$^{\#}$	-0.49$^{\#}$	-0.43$^{\#}$	-0.39^{+}	-0.39$^{\#}$
$\ln PUS_t$	-0.14$^{\#}$	-0.09*	-0.13^{+}	-0.13$^{\#}$	-0.13$^{\#}$	-0.10*	-0.13^{+}	-0.09*	-0.11*	-0.16^{+}
$\ln FD_t$ x $\ln FD_t$	0.04					0.04				
$\ln FV_t$		0.02					-0.03			
RI_t			-0.01					-0.01		
$\ln PEN_t$				-0.02					-0.19	
NSS_t					0.01					-0.03
ARDL bounds test	4.90$^{\#}$	5.05$^{\#}$	5.09$^{\#}$	4.81$^{\#}$	6.21$^{\#}$	4.45$^{\#}$	4.43$^{\#}$	4.84$^{\#}$	4.92$^{\#}$	5.30$^{\#}$
ECM test	-5.03^{+}	-5.08^{+}	-5.54$^{\#}$	-4.82*	-4.66*	-4.93*	-4.51*	-5.61$^{\#}$	-4.99^{+}	-3.94

Notes: Financial development (*FD*) is measured by the first principal component of *PCY*, *M2Y* and *VST*. *, + and # indicate 10%, 5% and 1% levels of significance, respectively.

5. Summary and Conclusions

Maintaining adequate levels of saving has always been a central policy concern, particularly for developing countries. This paper focuses on analyzing the determinants of private saving in

Malaysia – a country that has one of the highest saving rates in the world. This high saving record, together with other unique features of the economy, including high economic growth rates, high financial development indicators, a rich history of financial sector reform and the presence of a broad-based forced saving scheme, provides an interesting setting to analyze the determinants of private saving in Malaysia.

Our results highlight the role of policies pursued by the Malaysian government in influencing private saving. The findings are summarized as follows. First, the predictions of the life cycle hypothesis are supported by the findings of a positive impact for income growth and a negative effect for the age dependency ratio on private saving. The finding of a positive effect for income growth suggests that the high growth rates maintained by Malaysia over the last few decades have facilitated sustained high private savings**.** In terms of age structure, the dramatic increase in the proportion of the population of working age has significantly raised private savings. The persistent decline in age dependency, however, poses challenges to the government since private saving may fall in the next phase of demographic transition.

Second, with reference to financial factors, financial development is found to have a favorable impact on private saving. Hence, it is important for the government to further develop the financial system in order to facilitate the mobilization of savings to achieve its long-term development goals. This is further supported by the finding that the expansion of bank branches has contributed to the accumulation of private saving. On the other hand, development of the insurance market, which reduces the need for precautionary saving, is negatively associated with private saving. Financial repression, rather than liberalization, appears to promote more savings in the private sector. Finally, in terms of fiscal policy, the results do not fully support the Ricardian Equivalence hypothesis, given that public saving tends to crowd out private saving by a factor significantly less than one.

There are several avenues where future research can be directed. A useful exercise would be to examine how the operation of the Employee Provident Fund (EPF) impacts on the Malaysian economy. How the accumulated pension savings are invested, along with their national gains or losses, may be of significant interest to researchers and policy makers. Furthermore, the analysis carried out in this study is at the macro level. Undertaking an in-depth micro level analysis would be a worthwhile effort to supplement the findings of this study. This paper has focused on policy changes relating to the domestic financial sector. The impact of capital account restriction or deregulation on domestic saving is an interesting topic that requires more research. Finally, Islamic banking has become increasingly important in the Malaysian financial system. Its modalities, operation and development, and their implications on domestic savings, make it another possible candidate for future research.

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Appendix I: Data Sources and Construction of Variables

Sources of Data:
Annual data covering the period 1960-2007 were used in the analysis. Most of the data series were directly obtained or compiled from domestic sources. This includes several publications by *Bank Negara Malaysia* (i.e., Central Bank of Malaysia) such as the *Annual Reports*, *Money and Banking in Malaysia (1994)*, and *Monthly Statistical Bulletin*. Some series were obtained from World Development Indicators (2009) and International Financial Statistics (2009). Except for the real interest rates (RI_t) and private income growth (IG_t), which were in percentages, all data series were measured in natural logarithms.

Construction of variables:
Saving series*:* Private saving (PRS_t) is derived by taking gross national saving minus public saving (PUS_t), where the latter refers to total public sector current surpluses or deficits. That is, it is defined as government revenue minus operating expenditure plus non-financial public enterprise surpluses. $VPRS_t$ is voluntary real private saving, defined as real private saving net of annual contributions of EPF flows. These saving variables are measured in real terms using the GDP deflator.

Private income growth: Private income is the difference between GNP and government revenue, where the latter refers to the sum of public saving and public consumption. Private income growth (IG_t) refers to the changes in per capita private income deflated by the private consumption deflator.

Age dependency: young dependents refer to population with ages 0-14 and old age dependents are the population with ages 65 and above. Age dependency (AGE_t) refers to the number of young and old dependents to working-age population with ages 15-64.

Financial deepening: FD_t is measured by bank credit to the private sector as a ratio of GDP (*PCY*), M2 over GDP (*M2Y*), the value of shares traded over GDP (*VST*), and their first principal component. Data for value of shares traded before 1966 are extrapolated.

Banking density: BD_t provides an indication of the extent to which the general public can access banking services. It is measured by the sum of commercial bank branches and finance company offices per million of population.

Insurance market development: INS_t is measured by the ratio of life insurance fund assets to GDP.

Financial liberalization: we use a broad-based measure of financial liberalization (FL_t) compiled by Abiad *et al.* (2010). Seven policy dimensions are considered: 1) credit controls and reserve requirements; 2) interest rate restraint; 3) entry barriers in the banking sector; 4) prudential regulations and supervision; 5) privatization in the financial sector; 6) restrictions on international capital flows; and 7) securities market policy. Along each dimension, a score of zero, one, two or three is assigned, indicating fully liberalized, partially liberalized, partially repressed, and fully repressed, respectively. The aggregation of these seven components is used to obtain an overall measure of financial liberalization. The data are available from 1973-2005. Missing data are constructed using data from Ang and McKibbin (2007) following the same methodology described above.

Financial volatility: FV_t is measured by the standard deviations of the growth rate in the first principal component of the thee indicators of financial development over 5-year overlapping periods, following the approach of Bekaert *et al.* (2006).

Real rate of interest: RI_t is defined as commercial bank 12-month deposit rates minus the current rate of inflation. The rate of inflation is constructed using the CPI.

Expected pension benefits: we use the cumulative contributions of employee provident funds relative to private income to measure expected benefit of pension saving (PEN_t). It is a stock variable of provident funds with adjustments for withdrawals.

Real rates of interest: RI_t is defined as commercial bank 12-month deposit rates minus the current rate of inflation. The rate of inflation is constructed using the CPI.

Appendix II: Estimation Techniques

The dynamic adjustment of the savings mobilization process can be characterized by a conditional ECM, which can be used to test for the existence of a long-run relationship using the ARDL bounds test developed by Pesaran *et al.* (2001) and the ECM test of Banerjee *et al.* (1998). The former involves a standard *F*-test whereas the latter is a simple *t*-test. Accordingly, the underlying error-correction model can be formulated as:

$$\Delta \ln Y_t = \alpha_0 + \beta_0 \ln Y_{t-1} + \sum_{j=1}^{k} \beta_j DET_{j,t-1} + \sum_{i=1}^{p} \gamma_{0i} \Delta \ln Y_{t-i} + \sum_{i=0}^{p} \sum_{j=1}^{k} \gamma_{ji} \Delta DET_{j,t-i} + \varepsilon_t , \qquad \text{(A1)}$$

where Y_t is the dependent variable (in this case, PRS_t or $VPRS_t$) and DET_t is a vector of the determinants of innovative activity, which includes IG_t, $\ln AGE_t$, $\ln FD_t$, $\ln BD_t$, $\ln INS_t$, $\ln FL_t$ and $\ln PUS_t$.

The above can be estimated by OLS. Pesaran and Shin (1998) show that the OLS estimators of the short-run parameters are consistent and the ARDL based estimators of the long-run coefficients are super-consistent in small sample sizes. Hence, valid inferences on the long-run parameters can be made using standard normal asymptotic theory. The main advantage of this approach is that it can be applied to the model regardless of whether the underlying variables are *I*(0) or *I*(1).

Specifically, two separate statistics are employed to test for the existence of a long-run relationship in Eq. (A1): 1) an *F*-test for the joint significance of coefficients of lagged level terms of the conditional ECM ($H_0 : \beta_0 = \beta_1 = ... = \beta_k = 0$), and 2) a *t*-test for the significance of the coefficient associated with $\ln Y_{t-1}$ ($H_0 : \beta_0 = 0$). The test for cointegration is provided by two asymptotic critical value bounds when the independent variables are either *I*(0) or *I*(1). The lower bound assumes all the independent variables are *I*(0), and the upper bound assumes they are *I*(1). If the test statistics exceed their respective upper critical values, the null is rejected and we can conclude that a long-run relationship exists. The above ARDL model also provides a convenient step to derive the long-run estimates and short-run dynamics for the ideas production function, as discussed by Pesaran and Shin (1998).