SAVING, INCOME, FERTILITY AND LONGEVITY LINKAGES IN THAILAND

SUPACHET CHANSARN

School of Economics, Bangkok University, Thailand
E-mail: supachet.c@bu.ac.th

Abstract- Saving is considered as one of the most important factors which determine Thailand's economic opportunity in ageing society because it is a key determinant of wealth accumulation of elderly people which enables them to have significant economic contribution after retirement, turning them into an economic active population. Therefore, the appropriate policies to promote saving of Thai people are needed to handle ageing society. That is, the greater saving will lead to the greater wealth accumulation to finance elderly people's consumption after retirement, leading to the constant economic growth in ageing society. Consequently, this study aims to examine the causal relationships among saving, income, fertility and longevity in Thailand during 1960 – 2012 by employing Vector Error Correction (VEC) analysis and Granger Causality test. VEC analysis is chosen since it can examine the causal relationships among these factors in both short and long run. The findings reveal that, in short run, there is a uni-directional causality from income to saving but no causality from saving to income. There is also the uni-directional causality from fertility and longevity to saving but no causality from saving to either fertility or longevity. Moreover, there is a bi-directional causality between income and longevity. There is the uni-directional causality from fertility to income but no causality from income to fertility. Furthermore, there is the bi-directional causality between fertility and longevity. Additionally, in long run, there are the causal relationships from saving, income and longevity altogether to fertility and from saving, income and fertility to longevity. However, there is no long run causality from income, fertility and longevity to saving or from saving, fertility and longevity to income.

Keywords- Saving; Income; Fertility; Longevity; Causality; Thailand

I. INTRODUCTION

Thailand is currently confronting a challenge of ageing society where old age population (65 years old and over) grows faster than working age population (15 – 64 years old). Its proportion of working age population is expected to decrease from 72.1 percent of total population in 2015 to 63.8 percent in 2035, whereas the proportion of old age population is expected to sharply increase from 10.4 percent in 2015 to 22.9 percent in 2035 (United Nations, 2015). Such a demographic shift may cause a detrimental impact on Thailand's economic development since elderly people are normally considered as dependent population who is not likely to have enough wealth to finance its consumption after retirement.

Under this circumstance, saving is considered as one of the most important factors which determine Thailand's economic opportunity because it is a key determinant of wealth accumulation of elderly people which enables them to have significant economic contribution after retirement, turning them into an economic active population. Therefore, the appropriate policies to promote saving of Thai people are needed to handle ageing society. That is, the greater saving will lead to the greater wealth accumulation to finance elderly people's consumption after retirement, leading to the constant economic growth in ageing society.

Based on the literature review, there are several previous studies which examine causality between saving and other related factors. Many of them found that saving was determined by income as generally measured by GDP per capita (Kwack and Lee, 2005; Gu and Tam, 2013; Ismail and Rashid; 2013). However, some studies found a bi-directional causality between saving and income (Cardenas and Escobar, 1998; Singh, 2010). Additionally, Kwack and Lee (2005) and Kinugasa and Mason (2007) found that saving was determined by fertility while Park and Rhee (2005), Li et al. (2007) and Kinugasa and Mason (2007) found that it was also determine by longevity as measured by life expectancy at birth.

Additionally, there are several studies which found causality among income, fertility and longevity. For instance, Hansen (2012) and Pop et al. (2013) found the relationship between income and longevity while Hafner and Mayer-Foulkes (2013) and Bandyopadhyay and Green (2013) found the relationship between income and fertility. Furthermore, the relationship between fertility and longevity was also found by Blackburn and Capriani (2002) and Mitteldolf (2010). According to the literature review, the studies of the causality among saving, income, fertility and longevity in Thailand are very limited. Moreover, the findings from previous studies are different for different countries, causing the difficulty for Thailand to utilize these study results.

Consequently, this study aims to examine the causal relationships among saving, income, fertility and longevity in Thailand during 1960 – 2012. Understanding the causal relationships among these factors will be useful for formulating and implementing the appropriate policies to promote saving of Thai people.

II. ECONOMETRIC MODEL

Based on the literature review, there appears to be the causality among saving, income, fertility and longevity. Therefore, Vector Error Correction (VEC) analysis and Granger Causality test are employed to examine the causal relationship among these four factors in this study. VEC analysis is chosen since it can examine the causal relationships among these factors in both short and long run. However, the primary condition of VEC analysis is that all variables in the model are integrated of the same order and are cointegrated. Hence, the analytical method in this study has four steps as the following.

Step 1: Augmented Dickey-Fuller (ADF) Test is performed to test whether each variable in the model is stationary and integrated of the same order.

Step 2: Johanson Test of Cointegration is performed to examine whether all variables in the model are cointegrated and have long run relationships.

Step 3: The causal relationships among saving, income, fertility and longevity are examined by employing VEC analysis. The VEC model in this study can be expressed as the following.

$$\Delta save_t = \alpha_1 + \sum_{i=1}^{n} \beta_{1i}\Delta save_{t-i} + \sum_{i=1}^{n} \gamma_{1i}\Delta gdp_{t-i} \quad (1)$$
$$+ \sum_{i=1}^{n} \lambda_{1i}\Delta tfr_{t-i} + \sum_{i=1}^{n} \delta_{1i}\Delta long_{t-i} + \omega_1 ECM + \mu_{1t}$$

$$\Delta gdp_t = \alpha_2 + \sum_{i=1}^{n} \beta_{2i}\Delta save_{t-i} + \sum_{i=1}^{n} \gamma_{2i}\Delta gdp_{t-i} \quad (2)$$
$$+ \sum_{i=1}^{n} \lambda_{2i}\Delta tfr_{t-i} + \sum_{i=1}^{n} \delta_{2i}\Delta long_{t-i} + \omega_2 ECM + \mu_{2t}$$

$$\Delta tfr_t = \alpha_3 + \sum_{i=1}^{n} \beta_{3i}\Delta save_{t-i} + \sum_{i=1}^{n} \gamma_{3i}\Delta gdp_{t-i} \quad (3)$$
$$+ \sum_{i=1}^{n} \lambda_{3i}\Delta tfr_{t-i} + \sum_{i=1}^{n} \delta_{3i}\Delta long_{t-i} + \omega_3 ECM + \mu_{3t}$$

$$\Delta long_t = \alpha_4 + \sum_{i=1}^{n} \beta_{4i}\Delta save_{t-i} + \sum_{i=1}^{n} \gamma_{4i}\Delta gdp_{t-i} \quad (4)$$
$$+ \sum_{i=1}^{n} \lambda_{4i}\Delta tfr_{t-i} + \sum_{i=1}^{n} \delta_{4i}\Delta long_{t-i} + \omega_4 ECM + \mu_{4t}$$

Where

save = saving as measured by real gross domestic saving per capita (2005 constant US dollar)

gdp = income as measured by real GDP per capita (2005 constant US dollar)

tfr = fertility as measured by total fertility rate (births per a woman)

long = longevity as measured by life expectancy at birth (years)

ECM = error correction term which is equal to $save_{t-1} - \theta_0 - \theta_1 gdp_{t-i} - \theta_2 tfr_{t-i} - \theta_3 long_{t-i}$

Note that the coefficient of ECM indicates the speed of adjustment of a dependent variable to its long run equilibrium. Additionally, all variables are in natural logarithm form and Δ indicates first difference. Akaike's Information Criterion (AIC), Schwarz's Baysian Information Criterion (SBIC) and Hannan–Quinn Information Criterion (HQIC) are employed to choose the optimal number of lags.

Step 4: Granger Causality Test is performed to examine the causal relationships among saving, income, fertility and longevity in short and long run. The statistical significance of ECM indicates the long run relationship between dependent variable and all other explanatory variables. Moreover, the jointly statistical significance of each explanatory variable in the model indicates the short run relationship between dependent variable and a certain explanatory variable.

Additionally, this study relies on the time-series data of Thailand during 1960 – 2012, obtained from the World Bank.

III. RESULTS

Table 1 presents the results from the ADF Test for unit root. The findings reveal the existence of unit root in each variable, implying that all the time series are non-stationary. However, after first differencing, there appears to be no significant evidence of unit root. Therefore, it is sensible to state that each variable in the model is non-stationary and integrated of order one.

The results from Johansen Test for Cointegration are presented in Table 2. The findings reveal that saving, income, fertility and longevity are cointegrated and have long run relationships. Specifically, there is evidence suggesting that there are at least three cointegrating relationships among these variables.

Table 1: Results from Augmented Dickey-Fuller (ADF) Test for unit root

Level	*save*	*gdp*	*tfr*	*long*
Intercept	-1.640	-1.144	-2.951**	-2.132
Intercept & Trend	-2.321	-2.649	-1.296	-1.495
First Difference	**Δ*save***	**Δ*gdp***	**Δ*tfr***	**Δ*long***
Intercept	-5.923***	-4.505***	-4.333***	-4.707***
Intercept & Trend	-5.954***	-4.460***	-5.274***	-7.704***

Remarks: Figures in the table present the ADF Test statistics for unit root problem in each variable. Moreover, *, **, and *** indicate statistical significance at 10, 5 and 1 percent level, respectively.

Table 2: Results from Johansen Test for Cointegration

Maximum Rank	Trace Statistics	Critical Value	Max Eigenvalue Statistic	Critical Value
r = 0	163.940*	42.21	107.951*	27.07
r = 1	55.990*	29.68	38.970*	20.97
r = 2	17.019*	15.41	14.462*	14.07
r = 3	2.557	3.76	2.557	3.76

Remarks: Column 1 presents cointegration ranks. Column 2 and 4 present Trace Statistics and Maximum Eigenvalue Statistics while column 3 and 5 present critical values at 5 percent significance level. Moreover, * indicates statistical significance at 5 percent level.

Because all variables in the model are integrated of order one and cointegrated, VEC analysis can be performed (results are not presented). Thereafter, Granger Causality Test is performed. Table 3 reveals that, in short run, there is a uni-directional causality from income to saving but no causality from saving to income. These findings are complied with Ismail and Rashid (2013). There is also the uni-directional causality from fertility and longevity to saving but no causality from saving to either fertility or longevity. These findings are consistent with Kinugasa and Mason (2007). Moreover, there is a bi-directional causality between income and longevity. These findings are consistent with Hansen (2012). Additionally, there is the uni-directional causality from fertility to income but no causality from income to fertility. These findings are complied with Bandyopadhyay and Green (2013). Furthermore, there is the bi-directional causality between fertility and longevity, consistent with the findings from Mitteldolf (2010).

Table 3: Results from Granger Causality Test

Dependent variables	Explanatory variables				
	Short-Run				Long-Run
	$\Delta save$	Δgdp	Δtfr	$\Delta long$	ECM
$\Delta save$	-	13.98***	6.67*	22.25***	-0.0094
Δgdp	1.90	-	13.14***	16.13***	-0.1172
Δtfr	2.25	3.68	-	21.49***	-0.0015***
$\Delta long$	5.68	8.95**	30.43***	-	-0.0005***

Remarks: Figures in the table present test statistics from Granger Causality Test with the null hypothesis that there is no Granger cause between endogenous variables. Moreover, *, **, and *** indicate statistical significance at 10, 5 and 1 percent level, respectively.

Additionally, in long run, there are the causal relationships from saving, income and longevity altogether to fertility and from saving, income and fertility to longevity. However, there is no long run causality from income, fertility and longevity to saving or from saving, fertility and longevity to income.

Based on the estimated coefficients from VEC analysis, the causal relationships among saving, income, fertility and longevity in Thailand can be illustrated by Figure 1.

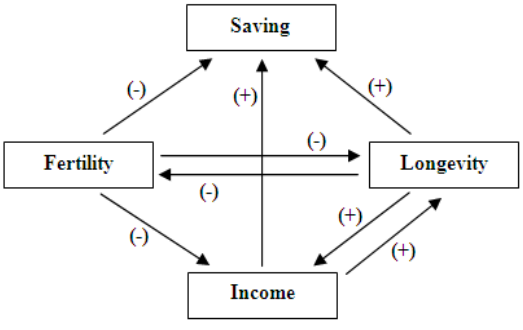


Fig. 1: Causal relationships among saving, income, fertility and longevity in Thailand

CONCLUSION AND BEYOND

Based on the study results, income has both direct positive influence and indirect positive influence through longevity on saving in Thailand during 1960 – 2012. Similarly, longevity also has direct positive influence and indirect positive influence through income on saving.

Nevertheless, fertility has both direct negative impact and indirect negative impact through income and longevity on saving.

Consequently, Thailand has a good opportunity to promote saving in the country thanks to the fact that income and longevity of Thai people have exhibited an upward trend while fertility has been low for decades.

However, in order to efficiently capitalize on this opportunity to promote saving, the national compulsory fully-funded pension system and the effective public campaign to promote Thai people's realization of the necessity of saving for their retirement are extremely needed.

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