Malaysian Journal of Economic Studies 53 (1): 69- 85, 2016 ISSN 1511-4554

Do Savings Matter for Economic Growth? A Meta-Analysis

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Abstract: In existing studies on causal relationships between savings and economic growth, the direction of causality remains unclear. This study surveyed empirical literature on the causal relationship between savings and economic growth from 1992 to 2014. A meta-analysis was performed on 214 sets of results extracted from 48 independent research articles published from 1992 to 2014 to examine the major factors for conflicting causality outcomes. These results were combined for analysis using a logistic regression model. The results revealed that model specification, the level of financial development, and the level of foreign capital inflows affect the savings-led growth (SLG) outcomes, while income level does not affect the outcomes. The Asian financial crisis was found to have reduced the likelihood of SLG.

Keywords: Economic growth, logit model, savings-led growth hypothesis
JEL classification: E21, O4

1. Introduction

Economists and policymakers seek to accelerate economic growth and maintain macroeconomic stability. This means that exploring the catalysts of growth is important for the design of appropriate growth policies. Savings constitute an important catalyst of growth. Lewis (1955), Solow (1956) and Romer (1986), among others, emphasise the role of savings in economic growth. They maintain that a higher savings rate allows a higher rate of investment, leading to higher economic growth through capital accumulation. Although the causal relationship between savings and economic growth has been extensively studied in economic growth and development literature, the relationship of savings and economic growth is debated. On one side of the spectrum, Cullison (1993), Katircioglu and Naraliyeva (2006), Looney (1996), Sinha (1998a), Tang (2008) and Tang and Chua (2009; 2012) find savings to be an engine of growth. Others, however, caution that economic growth is not a result of savings because it is a leakage from the economy (Agrawal, Sahoo, & Dash, 2010; Mavrotas & Kelly, 2001; Shahbaz & Khan, 2010; Sinha, 1996; Sinha & Sinha, 1998). Practically, knowledge of the direction of causality between savings and economic growth is necessary for modelling effective growth policies. If savings do indeed represent an engine of growth, a development policy that encourages savings should be implemented. On the other hand, if savings do not Granger-cause economic growth, a policy that discourages savings or encourages consumption can be implemented without deleterious side effects on the country's economic growth and development.

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This study surveyed the empirical literature on the causal relationship between savings and economic growth, and employed binomial logistic regression to identify the causes for the conflicting results. Variations in the causality results may be attributed to the differences in country characteristics and model specifications (i.e., bivariate, trivariate, and multivariate models). A search of the literature showed that this study is the first attempt to apply the logistic regression method to a study on the savings-growth nexus.

The remainder of this paper is organised as follows. Surveys of the causality evidence on the savings-growth nexus is presented in the next section. The logistic regression procedure is shown in Section 3. The results of the meta-analysis are discussed in Section 4, whilst Section 5 concludes the study.

2. The Causality Literature on Savings-Growth Nexus

Understanding the causal relationship between savings and economic growth is key to the development of a successful growth policy Many empirical studies have investigated the relationship between savings and economic growth. This study compiled 214 observations from 48 research articles on the savings-growth nexus published from 1992 to 2014. The causal relationship between savings and economic growth is summarised in Table 1.

Using yearly data from 1955 to 1988, the World Bank (1993) examined the causal relationship between savings and economic growth in East Asian economies. With the bivariate Granger causality test, the World Bank (1993) found that growth-led savings rather than the other way round, except for Malaysia and Hong Kong. They argue that savings might not have been a major factor for the impressive growth record of the East Asian economies.

Sinha (1996) conducted an empirical study on savings and economic growth in India from 1960 to 1995 and notes that although the variables are cointegrated by using the Johansen and Juselius (1990) procedure, savings and economic growth do not Granger-cause each other in the short run. This finding is at odds with those of previous empirical studies perhaps due to the omission of some third variable that maintains the relationship between savings and economic growth both in the long and short run. Omitting relevant variables may cause model misspecifications and misleading causality results (Lütkepohl, 1982; Riezman, Whiteman, & Summers, 1996; Triacca, 1998). Sinha and Sinha (1998) found a cointegrating relationship between private savings and gross domestic product (GDP) in Mexico by using annual data from 1960 to 1996. In terms of direction of causation, they found that GDP growth Granger-causes growth of both private and public savings without any reverse causality. For Pakistan, Sinha (1998a) found that although total and private savings are positively related to GDP in the long run, the empirical evidence suggests that the growth rate of savings did not Granger-cause economic growth during the sampled period (1960 to 1995). Sinha (1999; 2000) found the direction of causality to be running from the growth rate of gross domestic savings to economic growth in Sri Lanka and the Philippines.

Agrawal (2001) conducted an aggregate time series data study of seven Asian countries (namely India, Indonesia, Korea, Malaysia, Singapore, Thailand, and Taiwan) using both the static ordinary least squares (OLS) and dynamic OLS procedures to estimate the cointegrating vectors and the vector error correction model (VECM) to determine the direction of causality. They found that the savings rate Granger-causes economic growth for Indonesia, Malaysia, and Taiwan. However, the converse was found to be true for the other countries.

Table 1. A summary of past studies on the causal relationship between savings and economic growth

Authors	Period	Countries	Methodology	Direction of Granger causality
Dhakal, Grabowski, & Shields (1992)	1929-1988A	United States of America (USA)	Granger causality	S ↔ G
	1946-1988A	USA		G → S
	1961-1986A	Japan		S → G
Cullison (1993)	1960-1981A	USA	Engle-Granger; Granger causality	S → G
	1960-1991A	USA		S – – G
World Bank (1993)	1950-1988A	10 countries	Granger causality	G → S (Indonesia, Japan, Korea, Philippines, Taiwan, Thailand) S ↔ G (Hong Kong, Malaysia, United States) S – – G (Singapore)
Looney (1996)	1973-1991A	Pakistan	Hsiao's version of Granger causality	S → G
Sinha (1996)	1950-1993A	India	Johansen-Juselius; Granger causality	S – – G
Sinha (1998a)	1960-1995A	Pakistan	Johansen-Juselius; Granger causality	S ↔ G
Sinha (1998b)	1950-1995A	Thailand	Johansen-Juselius; Granger causality	G → S
Sinha and Sinha (1998)	1960-1996A	Mexico	Johansen-Juselius; Granger causality	G → S
Saltz (1999)	1960-1991A	17 countries	Johansen-Juselius; Granger causality	S → G (Argentina, Taiwan) G → S (Bolivia, Costa Rica, Guatemala, Honduras, Hong Kong, Korea, Nicaragua, Panama, Thailand) S ↔ G (Dominican Republic, Mexico) S – – G (Colombia, Jamaica, Peru, Philippines)

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Table 1. From previous page

Authors	Period	Countries	Methodology	Direction of Granger causality
Sinha (1999)	1950-1994A	Sri Lanka	Johansen-Juselius; Granger causality	S ↔ G
Sinha (2000)	1957-1995A	Philippines	Granger causality	G → S
Agrawal (2000)	1960-1998A	5 countries	Granger causality	S → G (Bangladesh, Pakistan) G → S (Sri Lanka, India) S – – G (Nepal)
Agrawal (2001)	1960-1994A	7 countries	Engle-Granger; Granger causality	S → G (Malaysia) G → S (India, Singapore, Taiwan) S ↔ G (Indonesia) S – – G (Thailand, Korea)
Anoruo and Ahmad (2001)	1960-1997A	7 countries	Johansen-Juselius; Granger causality	S → G (Côte d'Ivoire) G → S (Kenya, Nigeria) S ↔ G (South Africa) S – – G (Congo Republic, Ghana, Zambia)
Mavrotas and Kelly (2001)	1960-1997A	2 countries	Toda-Yamamoto causality	G → S (India, Sri Lanka)
Sahoo et al. (2001)	1951-1999A	India	Engle-Granger; Granger causality	G → S
Chen (2002)	1952-1999A	China	Johansen-Juselius; Granger causality	G → S
Baharumshah et al. (2003)	1960-1997A	5 countries	Johansen-Juselius; Granger causality	G → S (Singapore) S – – G (Korea, Malaysia, Philippines, Thailand)
Boo and Normee (2004)	1970-1999Q	Malaysia	Johansen-Juselius; Granger causality	G → S

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Table 1. From previous page

Authors	Period	Countries	Methodology	Direction of Granger causality
Alguacil et al. (2004)	1970-2000A	Mexico	Toda-Yamamoto causality	S ↔ G
Adebiyi (2005)	1970-1998Q	Nigeria	Engle-Granger; Granger causality	G → S
Konya (2005)	1961-2000A	83 countries	Granger causality	S → G (Austria, Ireland, Netherlands, Trinidad and Tobago, Burundi) G → S (Finland, France, Japan, Sweden, Switzerland, Saudi Arabia, Niger) S – – G (Australia, Belgium, Canada, Denmark, Greece, Hong Kong, Iceland, Israel, Italy, Korea, Luxembourg, New Zealand, Norway, Portugal, Singapore, Spain, United Kingdom, United States, Algeria, Argentina, Barbados, Botswana, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Egypt, El Salvador, Fiji, Guatemala, Indonesia, Jamaica, Malaysia, Mauritius, Mexico, Morocco, Papua New Guinea, Paraguay, Peru, Philippines, South Africa, Thailand, Uruguay, Venezuela, Bangladesh, Benin, Bolivia, Burkina Faso, Central African Republic, Congo Republic, Côte d'Ivoire, Ghana, Guyana, Haiti, Honduras, India, Kenya, Lesotho, Madagascar, Malawi, Mauritania, Nicaragua, Nigeria, Pakistan, Rwanda, Senegal, Syrian Arab Republic, Togo, Zambia)
Katircioglu and Naraliyeva (2006)	1993-2002Q	Kazakhstan	Johansen-Juselius; Granger causality	S → G
Mohan (2006)	1960-2001A	22 countries	Johansen-Juselius; Granger causality	S → G (Indonesia, Singapore)

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Table 1. From previous page

Authors	Period	Countries	Methodology	Direction of Granger causality
				G → S (Senegal, Nigeria, Algeria, Thailand, G → S Colombia, Norway, Canada, Japan, Korea, United Kingdom, Finland, Iceland, Sweden) S ↔ G (Côte d'Ivoire, South Africa, Brazil, Argentina, Chile) S – – G (India, Ecuador)
Sinha and Sinha (2007)	1950-2004A	India	Toda-Yamamoto causality	S – – G
Verma (2007)	1951-2004A	India	ARDL bounds test; Granger causality	G → S
Agrawal et al. (2008)	1960-2005A	5 countries	ECM;DOLS;Granger causality	S ↔ G (Bangladesh) S – – G (India, Pakistan, Sri Lanka, Nepal)
Odhiambo (2008)	1969-2005A	Kenya	Johansen-Juselius; Granger causality	G → S
Sajid and Sarfraz (2008)	1973-2003:Q	Pakistan	Johansen-Juselius; Granger causality	S ↔ G
Sinha and Sinha (2008)	1950-2001A	India	Granger causality	G → S
Tang (2008)	1970-2007A	Malaysia	ARDL bounds test; Toda-Yamamoto causality	S ↔ G
Agrawal and Sahoo (2009)	1975-2004A	Bangladesh	ARDL bounds test; Granger causality	S – – G
Lean and Song (2009)	1955-2004A	China	Johansen-Juselius; Granger causality	S ↔ G
Mahmood and Chaudhary (2009)	1972-2005A	Pakistan	Johansen-Juselius; Toda-Yamamoto causality	S → G
Odhiambo (2009)	1950-2005A	South Africa	Johansen-Juselius; Granger causality	S ↔ G
Tang (2009a)	1991-2006Q	Malaysia	Granger causality Modified Sims causality Hsiao's version Granger causality	S ↔ G S ↔ G S ↔ G

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Table 1. From previous page

Authors	Period	Countries	Methodology	Direction of Granger causality
			Toda-Yamamoto causality Multiple rank causality	S ↔ G S ↔ G
Tang (2009b)	1970-2008Q	7 countries	ECM; Toda-Yamamoto causality	S ↔ G (China, Hong Kong, Japan, Korea, Malaysia, Singapore, Thailand)
Tang and Chua (2009)	1991-2006Q	Malaysia	Beirens cointegration; Multiple rank causality	S ↔ G
Abu (2010)	1970-2007A	Nigeria	Johansen-Juselius; Granger causality	G → S
Agrawal et al. (2010)	1960-2004A	India	ECM; DOLS; Granger causality	G → S
Dhanasekaran (2010)	1950-2002A	India	Engle-Granger; Granger causality	G → S
Mashkoor, Yahya and Ali (2010)	1973-2008	Pakistan	ARDL bounds test; Granger causality	S → G
Masih and Peters (2010)	1960-1996A	Mexico	Johansen-Juselius; Toda-Yamamoto causality	S ↔ G
Oladipo (2010)	1970-2006A	Nigeria	Johansen-Juselius; Toda-Yamamoto causality	S → G
Shahbaz and Khan (2010)	1971-2007A	Pakistan	ARDL bounds test; Johansen-Juselius; Toda-Yamamoto causality	G → S
Singh (2010)	1950-2002A	India	Johansen-Juselius; Granger causality	S ↔ G
Tang and Chua (2012)	1971-2008Q	Malaysia	ARDL bounds test; Toda-Yamamoto causality	S ↔ G
Tang and Tan (2014)	1971-2011A	Pakistan	Johansen-Juselius; ARDL bounds test; Toda-Yamamoto causality	S ↔ G

Notes: 'S' refers to savings, while 'G' refers to economic growth. → represents unidirectional causality; ↔represents bi-directional causality; -- represents non/neutral causality. ARDL is Autoregressive distributed lag; ECM is Error-correction model.

Mavrotas and Kelly (2001) conducted a study on India and Sri Lanka by using the time series data from 1960 to 1997. Due to stationarity and the cointegration constraints in employing standard Granger causality tests, they employed Toda and Yamamoto's (1995) causality test as they believed it would perform better than the usual Granger causality test. They found no causality between GDP growth and private savings in India. This is consistent with the findings of Sinha (1996). However, there is a bi-directional causality between GDP growth and private savings in Sri Lanka. Sahoo, Nataraj and Kamaiah (2001) re-investigated the savings-growth nexus for the Indian economy using residuals-based Engle-Granger cointegration and Granger causality tests covering the annual sample period from 1951 to 1999 (Engle & Granger, 1987). Their findings show that savings and economic growth are cointegrated in India, and that there is only unidirectional causality running from economic growth to savings. Anoruo and Ahmad (2001) investigated whether high domestic savings promoted economic growth in Congo, Côte d'Ivoire, Ghana, Kenya, South Africa, and Zambia by using time series data from 1960 to 1997. The Johansen-Juselius (1990) procedure was employed to identify the cointegrating vector if there was any. Interestingly, they found cointegration between the growth rate of savings and economic growth. Based upon the VECM, they discovered that the growth rate of domestic savings does not Granger-cause economic growth in Congo, Ghana, Kenya, and Zambia, but does so in Côte d'Ivoire, and South Africa.

Baharumshah, Thanoon and Rashid (2003) studied the savings behaviour in the fast growing Asian economies of Singapore, Malaysia, South Korea, Thailand, and the Philippines by using annual data from 1970 to 1997 and employing the Johansen-Juselius procedure to determine the cointegrating vector among variables. They found the variables to be cointegrated in all the countries. Based upon the VECM, they found that savings do not Granger-cause economic growth, except in Singapore. Boo and Normee (2004) found that higher growth precedes higher domestic savings rather than the other way round. Their finding is in line with Baharumshah et al. (2003). As Malaysian quarterly data for most of the macroeconomic variables such as savings and growth are only available from 1991, they employed Gandolfo's (1981) annual to quarterly interpolation technique to obtain the quarterly data. With this interpolation, their study covered the period from Q1 1970 to Q4 1999. Their findings suggest that in the long run, gross domestic savings (GDS) and real growth of GDP are negatively related. This contradicts earlier and more recent empirical studies on Malaysia (e.g., Baharumshah et al., 2003) to conclude that a mere increase in savings may not enhance economic growth unless it is productively utilised.

Alguacil, Cuadros and Orts (2004) presented an alternative perspective on the savings and economic growth relationship in Mexico from 1970 to 2000. They used Toda and Yamamoto's (1995) and Dolado and Lütkepohl's (1996) non-causality tests to re-investigate the causal link between savings and economic growth. They assert that the Granger non-causality test is highly sensitive to the number of variables included in a model. As such, the omission of relevant variables such as foreign direct investment (FDI) in the earlier empirical studies by Konya (2005) and Sinha and Sinha (1998) may contribute to misleading causality results. In fact, the consequences of omitted variables on Granger non-causality test are well discussed in previous studies (Lütkepohl, 1982; Riezman et al., 1996; Triacca, 1998). Alguacil et al. (2004) found that savings Granger-cause economic growth in Mexico, as did Masih and Peters (2010). These findings are in line with Solow's (1956) neoclassical and Romer's (1986) endogenous growth theories.

Tang (2008) proposed incorporating the modified dependency ratio into the savings-growth relationship for Malaysia. He also used a relatively new cointegration test developed by Pesaran, Shin and Smith (2001) called the bounds testing approach to examine the presence of long run relationships. The Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996) (TYDL) approach within the augmented-vector autoregressive (VAR) system was used to verify the causal relationship between savings and economic growth in Malaysia. Tang (2008) observed that savings and their determinants are cointegrated and that there is bi-directional causality between savings and economic growth over the sample period, 1970 to 2006. Tang (2009a) investigated whether the causal inference between savings and economic growth in Malaysia is sensitive to the particular causality tests employed to ascertain the causal relationships. To achieve the objective, the author employed five different causality techniques namely the Granger (1969), Geweke, Meese and Dent (1983), Hsiao (1981), Toda and Yamamoto (1995), and Holmes and Hutton's (1990) causality approaches. Interestingly, a bi-directional causality between savings and economic growth was found regardless of the causality technique employed. This finding shows that causality methods do not influence the causality results. Tang (2009b) further confirmed the savings-growth nexus in the case of the East Asian economies and found that savings and economic growth are cointegrated and Granger-cause each other. In a recent analysis using a non-parametric approach, Tang and Chua (2009) also found that savings and economic growth in Malaysia have a bi-directional causality. In response to this, a higher savings rate generates higher economic growth which in turn generates higher savings in Malaysia. In the case of Nigeria, Abu (2010) rejected the savings-led growth (SLG) hypothesis, whereas Oladipo (2010) supported it. In the case of India, Dhanasekaran (2010) found that growth drives savings rather than savings leading to growth. Recently, Tang and Chua (2012) analysed the savings-growth nexus in Malaysia using a multivariate model. Their study found that savings and economic growth have a bi-directional causality. They performed the time-varying causality test to check the stability of the SLG hypothesis and confirmed that savings have consistently been Granger-causing economic growth in Malaysia. Tang and Tan (2014) conducted an empirical analysis to study the savings-growth nexus in Pakistan using the neoclassical Solow (1956) growth model. They found that economic growth, savings, and other explanatory variables are cointegrated with savings and economic growth, and have a bi-directional causality.

As a summary, ample empirical studies have analysed the relationship between savings and economic growth in different countries using different model specifications (i.e., bivariate, trivariate and multivariate models). The methods and concept of Granger causality have been widely used in this context. Some studies have also taken into account the impact of structural breaks in analysing the relationship between savings and economic growth. Nevertheless, the direction of causality between savings and economic growth remains controversial. There has been no obvious agreement on the SLG hypothesis. In light of this, a meta-analysis is important to investigate the factors that influence the outcomes of the causality tests of past empirical studies on the SLG hypothesis as it has significant policy implications.

3. Methods

3.1 The Logit Model

Meta-analysis is typically an approach that uses statistical methods to combine the results from a group of related studies to identify their common characteristics. This paper em-

ploys the logistic regression method to analyse the factors that influence the variability of causality results among the past savings-growth studies. From the earlier survey of literature, the directions of causality between savings and economic growth can be synthesised into four testable hypotheses:

1. The unidirectional causality running from savings to economic growth. This is known as the *SLG hypothesis*
2. The unidirectional causality running from economic growth to savings which can be termed as the *growth-led savings hypothesis*
3. The bi-directional causality between savings and economic growth when savings and economic growth reinforce each other. This can be referred to as the *feedback hypothesis*
4. Savings and economic growth do not Granger-cause each other. This is known as the *neutrality hypothesis*.

The first driving issue in modelling the present study is the choice of the appropriate logistic regression method. As there are four plausible causality outcomes (i.e., polychotomous), multinomial logistic regressions may be suitable. Among the four plausible outcomes, only the SLG and feedback hypotheses support the notion that savings constitute the engine of growth, hence the call for formulation of economic growth policies that encourage savings. The four possible causality outcomes could be reduced into binary outcomes of 1 for those studies that support the SLG and feedback hypotheses, and 0 for the others. In this case where the dependent variable has a binary outcome, the logit model can be written as follows:

$$\log\left[\frac{P}{(1-P)}\right] = \beta_0 + \beta_1 Z_1 + \cdots + \beta_k Z_k + \varepsilon \tag{1}$$

where *P* is the probability that savings constitute a source of economic growth. The explanatory variables, Z_1, …, Z_k, determine the probability of savings being an engine of growth, and are identified from the literature and summarised in Table 1. The coefficients of the explanatory variables are denoted as β's, and ε represents the error term. The term *P/(1-P)* is the ratio of the probability that savings constitute the engine of economic growth to the probability that they do not. It is thus the odds that the SLG hypothesis would turn out to be true. The model is estimated using the STATA version 12 econometric package.

3.2 Data, the Definitions of Variables and the Survey Characteristics

As this study analysed the common characteristics of the past empirical studies on the relationship between savings and economic growth, 214 observations were extracted from a selected sample of 48 research articles on both single-country and multi-country analyses based upon time series techniques published from 1992 to 2014.

The definitions of variables used in this study are shown in Table 2. Given that this study used the logit model, the dependent variable is the dichotomous outcome of whether savings constitute the engine of growth (1) or not (0). The explanatory variables included the types of estimation models, a dummy if the analysis period covered the year 1997, the category of income level, the state of financial development (FD), and foreign

Table 2. Definitions of variables in the statistical model

Variable name	Description
Dependent variable:	
SLG	Savings Granger-cause economic growth (1 = Yes, 0 = No)
Explanatory variables:	
Bi-model#	Estimated model consists of two variables (1 = Yes, 0 = No)
Tri-model	Estimated model consists of three variables (1 =Yes, 0 = No)
Multi-model	Estimated model consists of four / more variables (1 =Yes, 0 = No)
Low-income#	Country's per capita GDP is USD995 (1 = Yes, 0 = No)
Low-mid income	Country's per capita GDP is USD996–USD3945 (1 = Yes, 0 = No)
Upper-mid income	Country's per capita GDP is USD3946–USD12195 (1 = Yes, 0 = No)
High-income	Country's GDP per capita is USD12196 (1 = Yes, 0 = No)
FD	Financial development indicator (% of money supply M2 to GDP)
FCI	Foreign capital inflows (USD million)
Y1997	1997 data is included in the study (1=Yes, 0 =No)

Notes: # refers to reference group. The income groups are based on the World Bank classification

capital inflows (FCI). The type of estimation model indicates whether bivariate, trivariate, or multivariate models were used by the earlier studies to examine the causality between savings and economic growth. The category of income level measures whether the countries of studies are from low, lower middle, upper middle, or high income groups. FD is measured by the percentage of money supply (M2) to GDP, while FCI is the amount of foreign capital entering the countries studied. The dummy variable Y1997 reveals whether the analysis period covered the year 1997. This explanatory variable is included to capture the plausible impact of the Asian financial crisis on the validity of the SLG hypothesis.[1]

The descriptive statistics of each explanatory variable are reported in Table 3. Out of all the causality studies surveyed, 27.1% (58 outcomes) of the causality studies support the hypothesis that savings constitute the engine of growth, while 72.9% (156 outcomes) do not. With respect to model specification, 78.9%, 1.8%, and 19.3% of the studies involved bivariate, trivariate, and multivariate models, respectively. From the perspective of the country characteristics, about 48.9%, 24.7%, 18.4%, and 8.1% of the studies were conducted on low, lower middle, upper middle, and high income countries, respectively. The tendency to support the SLG hypothesis for studies that focused on low, lower middle, and upper middle income countries ranged from 25.4% to 34.3%, while the tendency among studies on high income countries was nearly 6%. The averages for indicators of FD and FCI were USD 45.61 million and USD1.84 million, respectively. Finally, 77.57% of the past studies covered the year 1997 in their analysis.

[1] The Asian financial crisis in 1997 might generally affect the economies located in the Asian region. Nonetheless, more than 80% of the studies reviewed covered Asian economies. Therefore, the impact of the Asian financial crisis seems important in the context of the present study.

Table 3. Descriptive statistics of explanatory variables in the statistical model

Explanatory variables	SLG (n1 = 58) % / Mean#	Not SLG (n2 = 156) % / Mean#	Total sample (N = 214) % / Mean#
Bi-model	65.67	84.61	78.92
Tri-model	5.97	1.92	3.14
Multi-model	28.36	13.46	17.94
Low-income	34.33	55.13	48.88
Low-mid income	34.33	20.52	24.66
Upper-mid income	25.37	15.38	18.39
High-income	5.97	8.97	8.07
FD	59.1831	26.8648	45.6087
FCI	1.2166	7.8324	–1.8481
Y1997	80.13	70.69	77.57

Note: # For FD and FCI variables, the value refers to mean, whereas for other explanatory variables, the value refers to percentage.

4. Empirical Results

The results of the logit analysis are reported in Table 4. First, the goodness-of-fit of the logit model was investigated. The likelihood ratio (LR) statistic of the estimated logit model was 42.039 with a p-value of 0.0000, and the Hormes-Lemeshow (H-L) test statistic was 11.450. These tests suggest that our model fits the data well. Apart from that, the model also correctly predicted 77.1% of the outcomes in the sample, while the McFadden's R^2 is 0.17. In light of these, we conclude that our estimated logit model is statistically reliable for further interpretation. The following discussion focuses on the marginal effects of the individual explanatory variables. The results reveal that only four out of eight explanatory variables (i.e., the tri-model, FD, FCI and Y1997) are statistically significant in affecting the likelihood of the SLG hypothesis being found to be valid.

The tri-model variable was found to be significant at the 10% level, whilst the multi-model variable was insignificant. Specifically, the results reveal that the studies that adopted trivariate models are 34% more likely to support the SLG hypothesis compared with those using bivariate models. Therefore, the omission of a relevant variable is a potential explanation for the conflicting causality results between savings and economic growth. In fact, Lütkepohl (1982) and Triacca (1998) point out that causality tests with bivariate models are likely to be biased due to the omission of relevant variable(s). The results of this study also indicate that models with three variables seem sufficient to overcome any potential omitted variable bias that might lead to insignificant or conflicting results of the SLG hypothesis. However, multivariate models do not significantly impact the SLG outcomes compared to bivariate models. This is because including too many variables (over-parameterisation) causes a loss in the degrees of freedom, thus reducing the power of causality test to reject the null hypothesis that savings do not Granger-cause economic growth (Nelson & Schwert, 1982; Kim, 2001; Penm & Terrell, 2012).

Table 4. The results of the logit analysis

Explanatory variables	Estimated coefficient	Odds ratio	Marginal effect
Constant	–1.0242**	0.3591**	
	(0.4765)	(0.1711)	–
Tri-model	1.5192*	4.5685*	0.3399*
	(0.8344)	(3.8121)	(0.2034)
Multi-model	0.5455	1.7255	0.1039
	(0.4855)	(0.8377)	(0.1004)
High-income	–1.2836	0.2770	–0.1600
	(0.8111)	(0.2247)	(0.0691)
Upper-mid income	–0.0771	0.9258	–0.0131
	(0.5459)	(0.5054)	(0.0916)
Low-mid income	0.3870	1.4725	0.0704
	(0.4255)	(0.6265)	(0.0813)
FD	0.0131**	1.0132**	0.0023**
	(0.0064)	(0.0065)	(0.0011)
FCI	0.1498***	1.1616***	0.0258***
	(0.0430)	(0.0499)	(0.0069)
Y1997	–0.8055**	0.4469**	–0.1552**
	(0.3929)	(0.1755)	(0.0812)
Diagnostic tests			
Likelihood ratio (LR)		42.039***	
Probability (χ^2)		0.0000	
% Correct predictions		77.10%	
McFadden R^2		0.168	
Hosmer-Lemeshow (H-L)		11.450	
Probability (χ^2)		0.1774	

Notes: The asterisks ***, ** and * denote significance levels at 1, 5 and 10%, respectively. Figures in (.) are the standard errors.

With respect to income groups, it was found that none of the income groups were significant at the conventional significance levels (i.e., 1%, 5%, and 10%). Therefore, it was surmised that the inconsistent causality results between savings and economic growth among the different past studies are not related to the stage of development of countries under review. The variable Y1997 was shown to have a significant negative bearing on the likelihood of the SLG hypothesis to be found as true, meaning that the relationship between savings and economic growth is less likely to exist if a study includes the year 1997 in its analysis. The corresponding marginal effect was -15.52%. Therefore, the Asian financial crisis could have led to results that do not support the relationship between savings and economic growth.

The findings further showed that the state of FD of a country and the amount of foreign capital it receives determine whether savings would have contributed to its econo-

mic growth. The marginal effects show that the inclusion of financial development raises the likelihood of support for the SLG hypothesis by 0.23% while the inclusion of FCI raise it by 2.58%. Thus, the variation in the empirical outcome of the SLG hypothesis is explained by the variation in the state of FD, and the amount of FCI. This study's findings are in line with the assertion of Alguacil et al. (2004) that FCI are important and that its omission from the analysis will affect the relationship between savings and economic growth. Many developing countries normally face a shortage of domestic savings to finance domestic investment. In light of this, FCI are needed to overcome the savings-gaps problem. Therefore, countries with higher levels of FCI tend to find that savings can effectively stimulate economic growth. Lin (1992) adds that savings can stimulate economic growth if, and only if, savings can be mobilised and channelled to the productive sectors. As the development of the financial sector plays a crucial role in mobilising and transferring savings to the productive sectors of an economy, savings are more likely to stimulate economic growth in the countries with a higher level of FD.

5. Concluding Remarks

The objective of this paper is to resolve the empirical controversy on the relationship between savings and economic growth in countries using meta-analysis of past studies. Strong theoretical foundations support that savings can promote economic growth, and even vice-versa. However, empirical support for such theories is overwhelmingly mixed. Thus, this study examined the factors that plausibly explain the mixed empirical outcomes to establish whether savings could indeed lead to economic growth, dubbed the SLG hypothesis.

The results of the meta-analysis suggest that the SLG hypothesis could be upheld in country studies if they are conducted within a trivariate framework, and if factors such as the state of FD and FCI are controlled for. The 1997 Asian financial crisis could have upset the relationship between savings and economic growth and hence in any study, particularly related to Asian countries, data from 1997 should be treated as outliers. It was found that the income category of countries had no bearing on the likelihood of whether the SLG hypothesis would be upheld, or unsupported.

Based on the findings, we suggest future studies on the causal relationship between savings and economic growth give special reference to model specification, structural breaks, the stage of FD, and the FCI to the country. Further, Tang (2010) and Tang and Chua (2012) claim that the causal relationship in the analysis sample may change due to the frequent changes in the global economic and political environments. Therefore, the full sample Granger causality test is insufficient to provide a useful platform for policymakers to formulate effective growth policy. Future studies should therefore also consider the issue of stability of the causal relationship between savings and economic growth.

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