

ADB Economics Working Paper Series



Determinants and Long-term Projections of Saving Rates in Developing Asia

Charles Yuji Horioka and Akiko Terada-Hagiwara
No. 228 | October 2010



ADB Economics Working Paper Series No. 228

Determinants and Long-term Projections of Saving Rates in Developing Asia

Charles Yuji Horioka and Akiko Terada-Hagiwara

October 2010

Charles Yuji Horioka is Professor at the Institute of Social and Economic Research, Osaka University; Akiko Terada-Hagiwara is Economist in the Macroeconomics and Finance Research Division, Economics and Research Department, Asian Development Bank. The authors thank Kwanho Shin and the other participants of the workshops in Seoul, Republic of Korea and Hong Kong, China for their helpful comments; and Aleli Rosario and Shiela Camingue for their superb assistance. This paper was prepared under the Asian Development Bank's TA7470-REG: Long-term Projections of Asian GDP and Trade. The views expressed in this paper are those of the authors and do not necessarily reflect the views or policies of the Asian Development Bank or its Board of Governors or the governments they represent.

Asian Development Bank

Asian Development Bank
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
www.adb.org/economics

©2010 by Asian Development Bank
October 2010
ISSN 1655-5252
Publication Stock No. WPS102683

The views expressed in this paper
are those of the author(s) and do not
necessarily reflect the views or policies
of the Asian Development Bank.

The ADB Economics Working Paper Series is a forum for stimulating discussion and eliciting feedback on ongoing and recently completed research and policy studies undertaken by the Asian Development Bank (ADB) staff, consultants, or resource persons. The series deals with key economic and development problems, particularly those facing the Asia and Pacific region; as well as conceptual, analytical, or methodological issues relating to project/program economic analysis, and statistical data and measurement. The series aims to enhance the knowledge on Asia's development and policy challenges; strengthen analytical rigor and quality of ADB's country partnership strategies, and its subregional and country operations; and improve the quality and availability of statistical data and development indicators for monitoring development effectiveness.

The ADB Economics Working Paper Series is a quick-disseminating, informal publication whose titles could subsequently be revised for publication as articles in professional journals or chapters in books. The series is maintained by the Economics and Research Department.

Contents

Abstract	v
I. Introduction	1
II. A Survey of Previous Empirical Studies on the Determinants of Saving	2
III. Trends in Domestic Saving Rates in Developing Asia	3
IV. Estimation Results Concerning the Determinants of Domestic Saving Rates in Developing Asia	6
V. Projections of Domestic Saving Rates for 2011–2030 in Developing Asia	11
VI. Summary and Conclusions	16
Appendix Tables	17
References	19

Abstract

In this paper, we analyze the determinants of the domestic saving rate in developing Asia during 1966–2007 and find that the main determinants appear to be the aged dependency ratio, income levels, and level of financial development. We project future trends in domestic saving rates in developing Asia for 2011–2030 based on our estimation results, and find that the aging of the population will be the main determinant of future trends in domestic saving rates in developing Asia. However, we find that there will not necessarily be a sharp decline in saving rates in developing Asia as a whole, at least during the next 2 decades, inasmuch as there will be substantial variations across countries in the speed and timing of population aging.

I. Introduction

Developing Asia has been characterized by high domestic and national saving rates almost across the board in recent years, and these high saving rates have made possible not only high levels of domestic investment but also large capital outflows, i.e., current account surpluses (see, for example, the data presented in Park and Shin 2009). To put it another way, the developing economies of Asia have oversaved and underinvested, leading to large current account imbalances (surpluses), as asserted by Bernanke (2005) and others.

However, population aging is projected to occur at a rapid rate in developing Asia, which will presumably lead to a sharp decline in saving rates. If so, the large current account imbalances (surpluses) that currently exist will go away by themselves without any need for government intervention. However, if other factors, such as culture, financial sector development, or corporate sector saving are the dominant determinants of saving rates, it is possible that saving rates will remain high in developing Asia despite the rapid aging of its population.

The purpose of this paper is to present data on trends over time in domestic saving rates in 12 economies in developing Asia during 1966–2007, to analyze the determinants of those trends, and to project trends in domestic saving rates in these same countries during the next 20 years (2011–2030). The 12 economies included in our analysis include the People's Republic of China (PRC); Hong Kong, China; India; Indonesia; the Republic of Korea; Malaysia; Pakistan; the Philippines; Singapore; Taipei, China; Thailand; and Viet Nam, which comprise 95% of developing Asia.

This paper is organized as follows. In Section II, we survey previous empirical studies of the determinants of domestic saving rates, and in Section III, we discuss past trends and determinants of domestic saving rates in developing Asia. In Section IV, we present our empirical results concerning the determinants of domestic saving rates, while in Section V, we discuss our future projections of domestic saving rates in developing Asia. Section VI concludes.

II. A Survey of Previous Empirical Studies on the Determinants of Saving

There have been many previous empirical analyses of the determinants of saving rates using cross-section or panel cross-country data, or time series data for individual countries, among them Modigliani (1970), Feldstein (1977 and 1980), Modigliani and Sterling (1983), Horioka (1989), Edwards (1996), Dayal-Ghulati and Thimann (1997), Bailliu and Reisen (1998), Higgins (1998), Loayza et al. (2000), Chinn and Prasad (2003), Lührman (2003), IMF (2005), Bosworth and Chodorow-Reich (2007), Ito and Chinn (2007), Kim and Lee (2008), Park and Shin (2009), and Horioka and Yin (2010). The present study is based most closely on Higgins (1998), Bosworth and Chodorow-Reich (2007), and Park and Shin (2009).

These studies suggest an important role for demographic variables based on the life cycle model. Looking first at the impact of the age structure of the population, since the aged typically finance their living expenses by drawing down their previously accumulated savings, the aged dependency ratio (the ratio of the aged population to the working-age population) should have a negative impact on the saving rate; and similarly, since children typically consume without earning income, the child dependency ratio (the ratio of children to the working-age population) should also have a negative impact on the saving rate. Moreover, a higher child dependency ratio means more children to provide care and financial assistance during old age, and less need to save on one's own for old age, and hence the child dependency ratio could have a negative impact on the saving rate for this reason as well. Park and Shin (2009) and most other studies find that the aged dependency ratio and the youth dependency ratio both decrease the saving rate, as expected. Moreover, they also find that life expectancy has a positive impact on the saving rate because a lengthening of life expectancy increases people's retirement spans and necessitates more saving for retirement. The labor force participation rate of the aged has a negative impact on the saving rate because an increase in the labor force participation rate of the aged shortens people's retirement spans, and reduces the amount of saving needed for retirement.

A high growth rate of real gross domestic product (GDP) is another important factor, creating a virtuous cycle in which rapid income growth makes it easy to save, and high saving feeds back through capital accumulation to promote further growth. Bosworth and Chodorow-Reich (2007) as well as Park and Shin (2009) find that both contemporaneous and lagged real per capita GDP growth rates increase the saving rate. Moreover, Park and Shin (2009) also find that the level of per capita income has a significant nonlinear, or more precisely, convex relationship with the saving rate in Asia, but Bosworth and Chodorow-Reich (2007) do not find a significant effect.

Aside from demographic and GDP-related variables, financial development is also considered to be a crucial determinant of saving rates, but the direction of its impact is ambiguous theoretically as well as empirically. For example, Loayza et al. (2000) as well as Horioka and Yin (2010) find that it has a negative impact, while Park and Shin (2009) find that its impact is insignificant. Anecdotal evidence suggests that the relationship between financial development and the saving rate might be nonlinear depending on the level of financial development. For example, Jha et al. (2009) suggest that the greater availability of saving instruments and better accessibility to banks may promote *higher* saving, contrary to the negative impact found by Loayza et al. (2000) and Horioka and Yin (2010). This paper investigates this possible nonlinear relationship between financial development and the saving rate.

Others argue that many of the developing Asian countries have underdeveloped public pension systems—social insurance systems in general—which encourages precautionary saving by households. Jha et al. (2009) argue that the underdeveloped social insurance system is one of the factors that contributed to the recent rise in household saving in the PRC. Moreover, Horioka and Yin (2010) find evidence of a complementary relationship between the social benefit ratio and the level of financial development by analyzing the determinants of the household saving rate using panel data on 23 member countries of the Organisation for Economic Co-operation and Development (OECD) for 1995, 2000, and 2005, with a higher social benefit ratio reducing the negative impact of the level of financial development on the household saving rate.

Finally, the surge in corporate saving has gained increasing attention since the early 2000s, for example by ADB (2009) and others. Since households, particularly in Asia, have not reduced their saving enough to offset the increase in corporate saving, it has often been claimed that the increase in corporate saving has become an important determinant of private saving in recent years.

III. Trends in Domestic Saving Rates in Developing Asia

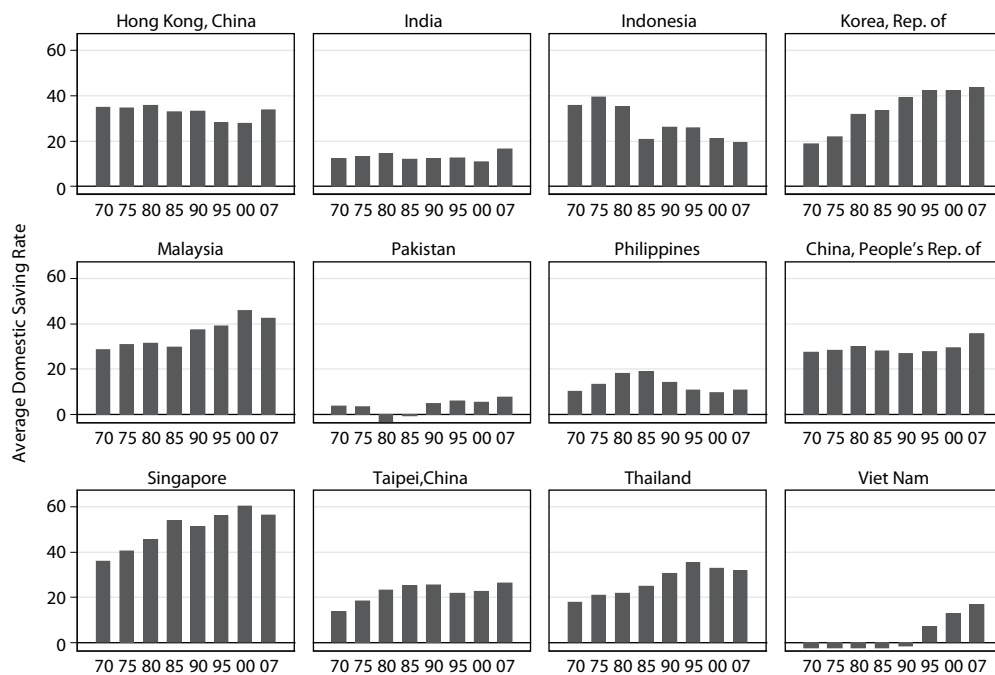
In this section, we discuss past trends and determinants in the domestic saving rate in developing Asia. Throughout this paper, we use real domestic saving rate, which is computed by subtracting the consumption and government shares of real GDP from 100.

Figure 1 shows trends over time in the domestic saving rate, and as can be seen from this figure, trends over time vary substantially among the 12 economies considered here, but most economies in the region have saved substantial amounts during the past 40 years. The Republic of Korea; Malaysia; Singapore; Thailand; and Taipei, China are the best examples. The domestic saving rates in these five economies rose sharply during the 1970s and 1980s, exceeding or reaching close to 40% of GDP by the early 1990s.

While the domestic saving rates of the economies of developing Asia declined in the late 1990s due to the Asian financial crisis, they then resumed their upward climb in the 2000s, reaching a new high except in Pakistan and the Philippines.

A milder but steady upward trend in domestic saving rates was observed in the PRC and India between 1970 and 2000, after which both countries experienced surges in their domestic saving rates, partially driven by soaring corporate savings.¹ The sharp increase in domestic saving rates, particularly in the PRC, in the 2000s has been blamed for the soaring global current account imbalances and hence for the global financial crisis that occurred in 2008. Meanwhile, a few economies in developing Asia (such as Hong Kong, China; Indonesia; and the Philippines) have shown a moderate downward trend in their domestic saving rates since the early 1980s. While domestic saving rates are still above 20% in Hong Kong, China and Indonesia, the already low saving rate in the Philippines declined to below 6% in 2003 before edging up slightly.² Moreover, a few countries with very low domestic saving rates are noteworthy. Viet Nam, for example, showed negative domestic saving rates throughout the 1970s and 80s, until the country transitioned to a market economy in the 1990s. Similarly, Pakistan's domestic saving rate was negative until the mid-1980s.

Figure 1: Real Domestic Saving Rates in Developing Asia, 1970–2007 (percent of GDP)



GDP = gross domestic product.

Sources: Penn World Table version 6.2; authors' calculations (see Appendix Table 1).

¹ The domestic saving rates of the PRC and India are greater in magnitude if one looks at a nominal measure such as that from World Development Indicators of the World Bank.

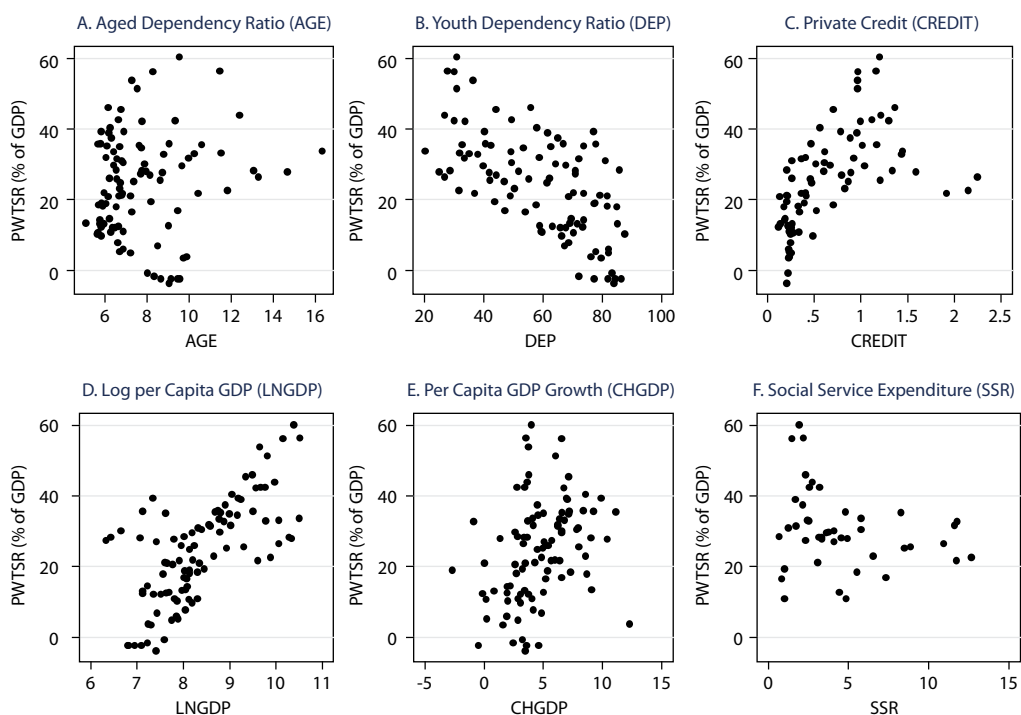
² This declining trend is reversed for Indonesia if we look at a nominal measure such as that from World Development Indicators. This is probably due to the high inflation rate Indonesia was experiencing during this period.

Various factors affected the trends in domestic saving rates described above. First of all, many of the economies in our sample experienced rapid demographic transition. Life expectancy rose sharply from an average of about 53 years in the early 1960s to 73 years in the late 2000s in the sample as a whole. Consequently, the aged dependency rate also increased from 6.5% to 10.2% on average during the same period. Population aging has been particularly significant in Hong Kong, China; the Republic of Korea; Singapore; and Taipei, China. Meanwhile, the aged dependency rate has been declining somewhat in Pakistan and Viet Nam. The youth dependency rate shows a uniform picture, declining in all of the economies in our sample, though to a lesser extent in Pakistan. The labor participation rate of the aged has generally been declining throughout the sample period while domestic saving rates have been increasing. While population aging has been progressing steadily, other factors have also come into play, obscuring the relationship between demographics and the domestic saving rate (see Figure 2, Panels A and B).

Financial sector development, in particular, played a significant role in developing Asia. James et al. (1989) discuss the role played by financial incentives such as raising interest rates on time and saving deposits in increasing the domestic saving rate when the financial system was still shallow in the 1970s in the Republic of Korea and Singapore, for example. Financial deepening accelerated after the mid-1980s, driven by financial liberalization in many economies. The developing Asian economies in our sample recorded deepening of their credit markets exceeding 100% of GDP except in India, Indonesia, Pakistan, the Philippines, and Viet Nam. As opposed to earlier financial incentives, financial deepening would be expected to contribute toward reducing the need for precautionary saving. Panel C in Figure 2 shows a possible nonlinearity. Moreover, these demographic and financial developments were accompanied by the continuing but uneven increase in per capita GDP and its growth rate, as shown in Panels D and E in Figure 2.

Government expenditure on social services and pensions are also important as a factor driving up precautionary savings if they are insufficient and households are worried about their future livelihoods. Government expenditure on social services including spending on pensions, education, and health services have generally been low in developing Asia, averaging less than 5% of gross national disposable income during the sample period, which is far lower than in the OECD countries where most economies spent more than 15% of GDP on social services and pensions as of 2005.³ Moreover, government expenditure on social services and pensions has not shown an obvious upward trend in most economies in developing Asia. Panel F in Figure 2 suggests that higher social services expenditures tend to be associated with lower domestic saving rates. The next section tries to disentangle the impact of these various factors driving domestic saving rates in developing Asia.

³ The sole exceptions are the Republic of Korea, Mexico, and Turkey, whose ratios of public expenditure on social services and pensions to GDP are roughly equivalent to those in developing Asia.

Figure 2: Domestic Saving Rates versus Its Determinants

Note: PWTSR = domestic saving rate, GDP = gross domestic product.

Source: See Appendix Table 1.

IV. Estimation Results Concerning the Determinants of Domestic Saving Rates in Developing Asia

In this section, we present our estimation results concerning the determinants of domestic saving rates in developing Asia during 1966–2007. We estimated both a country fixed effects model and a random effects model with robust standard errors. Following earlier studies such as Bosworth and Chodorow-Reich (2007) and Park and Shin (2009), the observations are 5-year averages except for the most recent period, which includes the years between 2001 and 2007. Thus, we have maximum of eight observations per country and a maximum of 78 total observations. The reduced form estimating equation is given by:

$$SR_{i,t} = \beta_{0,i} + \beta_1 * AGE_{i,t} + \beta_2 * DEP_{i,t} + \beta_3 * LNGDP_{i,t} + \beta_4 * CREDIT_{i,t} + \beta_4 * X_{i,t} + u_{i,t} \quad (1)$$

where

$i = 1, \dots, 12$ (1 = PRC (PRC); 2 = HKG (Hong Kong, China); 3 = INO (Indonesia); 4 = IND (India); 5 = KOR (Republic of Korea); 6 = MAL (Malaysia); 7 = PAK (Pakistan); 8 = PHI (Philippines); 9 = SIN (Singapore); 10 = THA (Thailand); 11 = TAP (Taipei, China); and 12 = VIE (Viet Nam)); and

$t=1, \dots, 8$ (1 = 1966–70, 2 = 1971–75, 3 = 1976–80, 4 = 1981–85, 5 = 1986–1990, 6 = 1991–1995, 7 = 1996–2000, and 8 = 2001–2007).

$SR_{i,t}$ represents the real domestic saving rate in country i at time t ; $AGE_{i,t}$ is the aged dependency ratio (the ratio of the population aged 65 or older to the population aged 15–64); $DEP_{i,t}$ is a youth dependency ratio (the ratio of the population aged 14 or younger to the population aged 15–64); $LNGDP_{i,t}$ is the log of per capita real GDP; $CREDIT_{i,t}$ is the ratio of private credit from deposit money banks and other financial institutions to GDP; and $X_{i,t}$ is a vector of the other explanatory variables included in the estimation model. Details concerning the variables used in our analysis can be found in Appendix Table 1.

Our estimation results are shown in Tables 1 and 2. The results are shown for seven specifications in Panels 1 through 7 for both the fixed and random effects models. While the results of standard tests such as the Hausman specification test suggest the use of random effects models, we show the results for both random and fixed effects models. This is because omitting country fixed effects seems to increase the residuals for some countries, such as the PRC, and because we are interested in knowing whether there are significant country fixed effects when explaining domestic saving rates. When a country fixed effects model is estimated, the reference country is PRC ($i = 1$).

All seven estimation models include the following six variables: AGE, DEP, per capita real GDP (LNGDP) and its squared term (LNGDPSQ), and CREDIT and its squared term (CREDITSQ). Other macroeconomic variables, such as the growth rate of per capita real GDP (CHGDP); the inflation rate (INFL); and the nominal interest rate (INT) (or the real interest rate, RINT); as well as government expenditure on social services and pensions as a percent of gross national disposable income (SSR) and fiscal balance as a percentage of GDP (FISC), are then added in Models (2)–(7).⁴

As the tables show, our results are satisfactory and broadly consistent with those of previous studies. Looking first at the basic models, i.e., Models (1)–(3) in Tables 1 and 2, the coefficient of AGE (the aged dependency ratio) is negative and significant, as expected (–0.83 to –0.95 in the fixed effects model and –1.55 to –1.69 in the random effects model). However, the sign of the coefficient of DEP (the youth dependency ratio) is not stable and is totally insignificant in both the fixed effects and random effects models.

⁴ Life expectancy was not included due to its high correlation with per capita real GDP, and the labor force participation rate was dropped because its estimated coefficient was not significant.

Turning to the GDP-related variables, the coefficient of LNGDP (the log of real per capita GDP) is negative and significant, as expected, with its square term being positive and significant, suggesting a nonlinear (convex) relationship with the domestic saving rate, as was also found by Park and Shin (2009).

Turning to the financial variables, the availability of private credit exhibits a concave relationship with the domestic saving rate, with the coefficient of CREDIT (the ratio of private credit to GDP) being positive and significant, and the coefficient of its squared term being negative and significant. This nonlinear relationship indicates that financial development leads to a higher domestic saving rate up to a point, after which it works to lower the domestic saving rate, consistent with anecdotal evidence reported in Jha et al. (2009) and Chinn and Prasad (2003).

As for the coefficients of CHGDP (the rate of change of real per capita GDP), INT (the nominal interest rate), INFL (the inflation rate), and RINT (the real interest rate), they are not significant in any model except that the coefficient of CHGDP is positive and significant in the random effects version of Model (5).

When FISC (the ratio of the fiscal balance to GDP) is added to the explanatory variables in Models (3), (4), (6), and (7), its coefficient is positive, as expected, but it is significant only in the random effects version, except for Model (6). Moreover, the coefficients of AGE and LNGDP become insignificant except for the coefficient of AGE in the random effects version of Model (3); and the coefficients of CHGDP, INT, INFL, and RINT remain insignificant except for the coefficient of INFL in the fixed effects and random effects versions of Model (3), and the coefficient of RINT in the fixed effects version of Model (6).

When SSR (the ratio of government expenditure on social services and pensions to gross national disposable income) is added to the explanatory variables in Models (4) and (7), only the coefficients of the two credit-related variables are significant in the fixed effects versions of Models (4) and (7); while only the coefficients of the two credit-related variables and the coefficients of FISC and SSR are significant in the random effects versions of Models (4) and (7), with the coefficient of FISC being positive and the coefficient of SSR being negative, as expected.

Finally, the results of the fixed effects models show that the country fixed effects are significant for most economies (except for the Republic of Korea, Malaysia, and Singapore) with a significant negative sign when the PRC is taken as the reference country, indicating a much higher domestic saving rate in the PRC than predicted by the other explanatory variables.

In sum, the main determinants of the domestic saving rate in developing Asia during the 1966–2007 period appear to be the age structure of the population (especially the aged dependency ratio), income levels, and the level of financial development, except as noted above. Moreover, the direction of impact of each factor is more or less as expected.

Table 1: Results of Fixed Effects Model

Model	AGE	DEP	LNGDP	LNGDPSQ	CREDIT	CREDITSQ	CHGDP	INT	INFL	FISC	SSR	RINT	R-squared	Obs
1	-0.95	-0.03	-43.13	2.92	14.48	-6.46							0.76	78
	0.41	0.07	8.82	0.53	5.17	1.87							1.00	
	-2.30	-0.41	-4.89	5.53	2.80	-3.46							0.97	
2	-0.89	0.06	-33.67	2.42	15.14	-6.26	0.13	-0.05	-0.02				0.69	70
	0.46	0.12	11.93	0.71	5.75	1.93	0.16	0.15	0.15				1.00	
	-1.92	0.51	-2.82	3.40	2.63	-3.25	0.85	-0.36	-0.16				0.97	
3	-0.57	0.05	-20.08	1.50	12.27	-4.50	0.17	0.16	-0.33	0.28			0.78	56
	0.43	0.09	13.09	0.76	6.29	2.12	0.20	0.17	0.14	0.21			1.00	
	-1.34	0.60	-1.53	1.96	1.95	-2.13	0.83	0.93	-2.37	1.31			0.98	
4	-0.18	-0.04	-23.60	1.46	19.19	-6.48	0.22	-0.30	-0.20	0.25	-0.67		0.82	35
	0.62	0.26	28.57	1.63	8.56	2.54	0.42	0.37	0.24	0.31	0.69		1.00	
	-0.29	-0.17	-0.83	0.90	2.24	-2.55	0.52	-0.79	-0.84	0.80	-0.97		0.99	
5	-0.83	0.05	-35.63	2.53	14.88	-6.25	0.16					0.03	0.69	70
	0.44	0.12	12.19	0.73	5.74	1.91	0.17					0.14	1.00	
	-1.88	0.41	-2.92	3.49	2.59	-3.27	0.93					0.21	0.97	
6	-0.40	0.05	-20.81	1.56	12.12	-4.58	0.23			0.26		0.30	0.77	56
	0.41	0.08	13.42	0.78	6.01	2.07	0.20			0.22		0.15	1.00	
	-0.99	0.60	-1.55	1.99	2.02	-2.21	1.13			1.20		1.96	0.98	
7	0.42	-0.03	-11.06	0.90	16.07	-6.22	0.04			0.38	-0.68	0.11	0.81	35
	0.67	0.25	25.29	1.49	7.62	2.53	0.33			0.33	0.67	0.26	1.00	
	0.62	-0.14	-0.44	0.61	2.11	-2.46	0.12			1.14	-1.02	0.44	0.98	

Note: The figures are the estimated coefficient (first row), the robust standard error (second row), and the z-value (third row). The first R-squared is within, the second R-squared is between, and the third R-squared is overall. The country fixed effects are not shown to save space.

Source: Authors' calculation.

Table 2: Results of Random Effects Model

Model	Constant	AGE	DEP	LNGDP	LNGDPSQ	CREDIT	CREDITSQ	CHGDP	INT	INFL	FISC	SSR	RINT	R-squared	Obs
1	203.20	-1.58	-0.08	-46.79	3.15	15.35	-6.71							0.75	78
	49.34	0.47	0.08	10.74	0.63	5.95	2.19							0.68	
	4.12	-3.39	-0.95	-4.36	4.98	2.58	-3.06							0.74	
2	156.49	-1.55	-0.03	-37.31	2.64	14.78	-6.12	0.24	-0.12	0.01				0.67	70
	63.70	0.51	0.10	14.30	0.84	6.08	2.11	0.19	0.18	0.17				0.73	
	2.46	-3.07	-0.27	-2.61	3.14	2.43	-2.90	1.28	-0.68	0.05				0.77	
3	96.11	-0.78	0.04	-23.12	1.70	12.40	-4.69	0.21	0.12	-0.30	0.30			0.78	56
	67.86	0.45	0.09	14.69	0.83	5.77	1.91	0.20	0.18	0.16	0.17			0.70	
	1.42	-1.73	0.45	-1.57	2.04	2.15	-2.46	1.06	0.66	-1.92	1.77			0.70	
4	31.08	-1.42	0.12	-2.93	0.34	31.88	-10.68	-0.03	-0.94	-0.22	1.02	-0.94		0.65	35
	189.00	1.14	0.19	40.26	2.29	9.98	3.34	0.61	0.71	0.72	0.38	0.50		0.87	
	0.16	-1.25	0.60	-0.07	0.15	3.19	-3.20	-0.05	-1.34	-0.30	2.71	-1.87		0.82	
5	171.93	-1.69	-0.06	-40.65	2.85	14.63	-6.15	0.31					-0.04	0.66	70
	64.89	0.54	0.10	14.36	0.84	6.23	2.20	0.18					0.18	0.75	
	2.65	-3.15	-0.64	-2.83	3.39	2.35	-2.80	1.70					-0.22	0.78	
6	104.21	-0.79	0.02	-25.93	1.91	12.63	-5.00	0.32			0.30		0.23	0.76	56
	78.37	0.52	0.10	17.08	0.98	5.88	2.01	0.23			0.19		0.19	0.70	
	1.33	-1.52	0.20	-1.52	1.95	2.15	-2.49	1.38			1.54		1.19	0.70	
7	-32.11	-0.91	0.23	4.96	0.03	34.87	-11.71	0.04			1.04	-0.99	-0.09	0.52	35
	188.66	1.16	0.16	41.26	2.38	8.15	3.09	0.61			0.38	0.58	0.87	0.89	
	-0.17	-0.79	1.39	0.12	0.01	4.28	-3.79	0.07			2.74	-1.73	-0.10	0.79	

Note: The figures are the estimated coefficient (first row), the robust standard error (second row), and the z-value (third row). The first R-squared is within, the second R-squared is between, and the third R-squared is overall.

Source: Authors' calculation.

V. Projections of Domestic Saving Rates for 2011–2030 in Developing Asia

Comparing out-of-sample projections based on the random effects and country fixed effects models suggests that the random effects model does not perform as well as the fixed effects model in fitting the domestic saving rate for a number of economies such as the PRC, the Republic of Korea, Singapore, Pakistan, and the Philippines. The projections from the random effects models underestimate the saving rates of the first three economies while overestimating those of the last two economies. This is consistently true for all seven random effects models. For the PRC, omitting the country fixed effect would yield a far lower saving rate of about 24% of GDP for 2001–2007—10 percentage points lower than the actual rate. A possible explanation for the case of the PRC is omitted factors such as the increase in the corporate saving rate during this period (IMF 2009), and/or the distorted sex ratio of those of marrying age (Wei and Zhang 2009). Another example of an obvious deviation of the fitted saving rate from the actual rate is the Philippines. The fitted saving rate based on the random effects model does not show the decline as observed in the actual rate. The rapidly increasing coverage of the social security system has been suggested as one of the explanations for this (Terada-Hagiwara 2009). However, if one views these factors as being of a cyclical or temporary nature, as was apparently the case in the recent past, the random effects model may in fact be a more suitable model for generating “long-term” projections. Thus, we generate projections using both models.

Our projections for the next 2 decades, 2011–2020 and 2021–2030, rely on projections of the United Nations (UN) on the age structure of the population (the aged and youth dependency ratios, median variant) and the GDP projections of Lee and Hong (2010). Since projections of financial development are not available, we assume that financial deepening progresses according to the level of per capita income. We first identify the income group of the 12 economies in the next 2 decades and then use the level of credit-to-GDP ratio for the corresponding income group in 2008.⁵ Saving rate projections are generated for the periods 2011–2020 and 2021–2030 using the coefficients in both the fixed and random effects variants of Model (1). Table 3 and Figures 3 and 4 show future projections of domestic saving rates for the 12 economies in our sample.

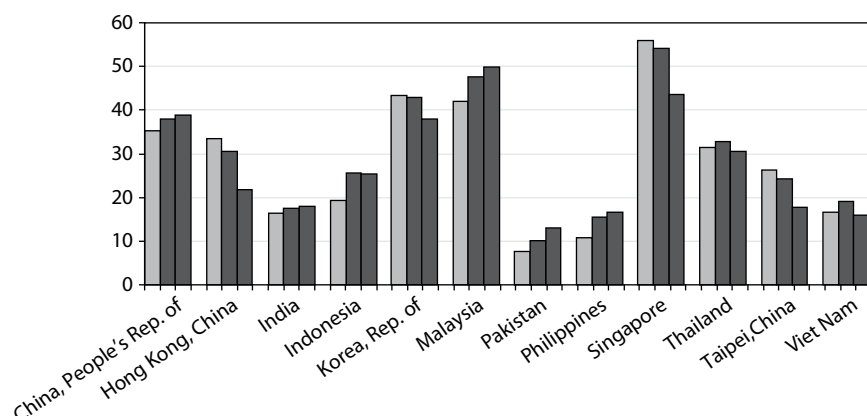
⁵ Based on this assumption, the credit-to-GDP ratio will deepen to 130% by 2021–2030 in the PRC inasmuch as this economy is projected to belong to the high income group by then. Likewise, the credit-to-GDP ratio is assumed to deepen in the Republic of Korea, Malaysia, and Singapore to 130% in the next 2 decades—a slight improvement relative to the recent past. The credit-to-GDP ratio is assumed to be 105% in the upper-middle-income group including Thailand; and 46% in the lower-middle-income group including India, Indonesia, Pakistan, and the Philippines.

Table 3: Past and Future Domestic Saving Rates in Developing Asia

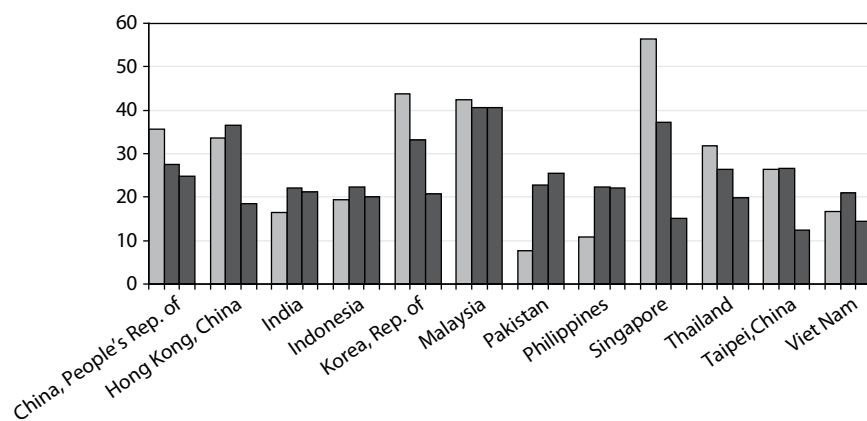
		China, People's Rep. of	Hong Kong, China	India	Indonesia	Korea, Rep. of	Malaysia	Pakistan	Philippines	Singapore	Thailand	Taipei, China	Viet Nam
Actual	1980-2007	30.0	31.5	13.0	22.6	40.1	38.8	4.5	12.9	55.4	30.7	24.4	6.8
FE, Model 1	2011-20	38.2	30.8	17.8	25.8	43.2	48.0	10.2	15.6	54.6	33.1	24.5	19.2
	2021-30	39.1	21.9	18.2	25.6	38.3	50.3	13.2	16.7	44.0	30.7	17.8	16.1
RE, Model 1	2011-20	27.5	36.5	22.1	22.4	33.1	40.6	22.9	22.4	37.2	26.5	26.6	21.0
	2021-30	24.7	18.4	21.2	20.1	20.7	40.7	25.6	22.2	15.1	19.8	12.3	14.4

FE = fixed effects; RE = random effects.

Sources: Authors' calculation; Lee and Hong (2010); World Population Prospects, The 2008 Revision (United Nations), available: esa.un.org/unpp, downloaded 4 May 2010.

Figure 3: Past and Future Domestic Saving Rates Based on the Fixed Effects Model

Note: 2001–2007 (left bar, actual); 2011–2020 (middle bar, projection); and 2021–2030 (right bar, projection).
Sources: Authors' calculation; Lee and Hong (2010); World Population Prospects, The 2008 Revision, (United Nations), available: esa.un.org/unpp, downloaded 4 May 2010.

Figure 4: Past and Future Domestic Saving Rates Based on the Random Effects Model

Note: 2001–2007 (left bar, actual); 2011–2020 (middle bar, projection); and 2021–2030 (right bar, projection).
Sources: Authors' calculation; Lee and Hong (2010); World Population Prospects, The 2008 Revision, (United Nations), available: esa.un.org/unpp, downloaded 14 May 2010.

The aging of the population appears to be the dominant determinant of future trends in domestic saving rates, with financial deepening also being of some importance. As expected, domestic saving rates are expected to show a downturn by 2030 in the countries in which the aging of the population is expected to proceed the most rapidly. The projections based on the fixed effects model show that the rapidly aging economies (Hong Kong, China; the Republic of Korea; Singapore; and Taipei, China), where the aged dependency ratio is projected to reach close to or above 40% by 2030, will show a 5–13 percentage point decline in their domestic saving rates during the next 2 decades. The domestic saving rate is projected to show a slight downturn by 2030 in countries in which the aging of the population is expected to proceed at a slower pace (Thailand

and Viet Nam), and it is projected to continue increasing or level off until 2030 in those countries in which the aging of the population is expected to proceed at the slowest pace (the PRC, India, Indonesia, Malaysia, Pakistan, and the Philippines).

There are two countries, the PRC and Malaysia, that show opposite trends depending on which model we use. The domestic saving rates of these two countries are projected to decline from the 2000s to the 2020s if a random effects model is used, but are projected to continue increasing if a fixed effects model is used. This is due to differences in the estimated coefficient of AGE, which is much larger in absolute terms when the random effects model is used even though the coefficients of the other explanatory variables are relatively similar. Thus, the increase in the aged dependency ratio in these two countries is projected to cause a much larger decline in their domestic saving rates when the random effects model is used than when the fixed effects model is used. The domestic saving rates of India and the Philippines will also start declining in the 2020s if a random effects model is used, even though they will remain higher than in the recent past.⁶

Moreover, the projected decline in domestic saving rates from the 2000s until the 2030s in the rapidly aging economies ranges from 5.4 percentage points (the Republic of Korea) to 12.5 percentage points (Singapore), which is about the same or larger than what other already aging economies such as Japan have experienced over the last 20 years. In Japan, the domestic saving rate declined from its peak of 39% in the late 1980s to 33% in the early 2000s, during which time the aged dependency ratio rose from 16% to 29%. The more pronounced decline in developing Asia's domestic saving rate might be due to the fact that aging is expected to progress more rapidly.

The dramatic differences among countries in developing Asia in projected future trends in their domestic saving rates are not surprising because there is a 40–50 year gap in the timing of population aging in the 12 countries in the sample, as can be seen from Table 4. As a result of these dramatic differences in the timing of the demographic transition in the coming decades, the decline in domestic saving rates will not occur simultaneously in the countries of developing Asia but will rather be spread out over close to half a century, with the decline in domestic saving rates in some countries being offset by the increase in domestic saving rates in other countries until at least 2040. The fact that more than half (seven) of the countries in developing Asia are projected to show increases in their domestic saving rates suggests that the decline in domestic saving rates in developing Asia as a whole will proceed only gradually.

⁶ Our projections are broadly similar even if we assume that financial deepening does not progress as assumed, which confirms the importance of the demographic variables. If financial deepening does not progress and remains at the average level of 2000–2007, the domestic saving rates of a number of countries such as Indonesia, India, Pakistan, and the Philippines will be higher than our projections by 1–3 percentage points, while the domestic saving rates in the PRC and Malaysia will be lower than our projections by 0.2 percentage points.

Table 4: Demographic Transition in Developing Asia and Japan

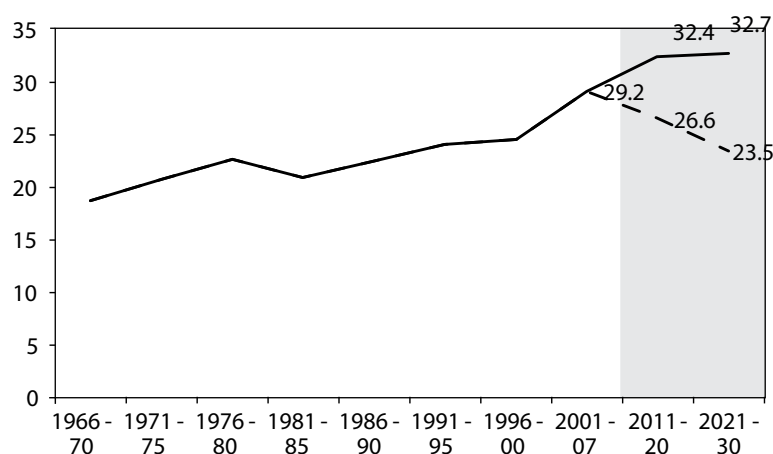
	Year in Which the Population Aged 65 or Older in the Total Population Reaches 14%	Year in Which the Demographic Bonus Ends
China, People's Rep. of	2020-25	2015
Hong Kong, China	2010-15	2010
India	2050-55	2035
Indonesia	2040-45	2030
Korea	2015-20	2015
Malaysia	2040-45	2020
Pakistan	After 2055	After 2055
Philippines	2050-55	2040
Singapore	2015-20	2010
Thailand	2020-25	2010
Taipei,China	2015-20	2018
Viet Nam	2030-35	2020
Japan	1990-95	1990

Note: Demographic bonus is the period during which the proportion of those aged 14 or younger falls below 30%, and the proportion of those aged 65 years or older remains below 15%.

Sources: United Nations projections, available: esa.un.org/unpp, downloaded 4 May 2010; for Taipei,China: Statistical Yearbook (available: www.cepd.gov.tw/encontent/m1.aspx?sNo=0000063).

To test this contention, we calculate the historical and projected domestic saving rates of developing Asia as a whole by weighting the domestic saving rates for each economy by its real GDP (see Figure 5). According to the fixed effects model (the solid line in Figure 5), the domestic saving rate in developing Asia will increase significantly from 29.2% in 2001–2007 to 32.4% in 2011–2020, and then increase a bit further to 32.7% in 2021–2030. According to the random effects model (the dotted line in Figure 5), however, the domestic saving rate in developing Asia will show a sharp downward trend, declining from 29.2% in 2001–2007 to 26.6% in 2011–2020 and further to 23.5% in 2021–2030. Thus, the fixed effects and random effects models yield diametrically opposed point estimates, and it is not clear whether the domestic saving rate in developing Asia as a whole will increase or decrease in the next 2 decades.

Figure 5: Past and Future Domestic Saving Rates in Developing Asia as a Whole (percent of GDP)



Note: This figure shows the domestic saving rate for developing Asia as a whole (calculated by weighting the domestic saving rates for each economy by its real GDP). The solid line shows projections based on the fixed effects model 1 and the dotted lines show projections based on the random effects model 1.

Sources: Authors' calculation; Lee and Hong (2010); World Population Prospects, The 2008 Revision (United Nations), available: esa.un.org/unpp, downloaded 4 May 2010.

The trajectory of the domestic saving rate in developing Asia as a whole appears to be heavily influenced by trends in the PRC, which will account for more than 50% of regional GDP in the next 2 decades, and on the coefficient of the aged dependency ratio. Thus, any new policy developments such as a worsening of the fiscal balance and/or increasing expenditures on social services and pensions affecting the domestic saving rate in the PRC and/or the speed of aging in general are of a great importance to developing Asia as a whole.

VI. Summary and Conclusions

In this paper, we conducted an econometric analysis of the determinants of domestic saving rates in developing Asia during 1960–2007 and found that the main determinants of the domestic saving rate in developing Asia during this period appear to be the age structure of the population (especially the aged dependency ratio), income levels, and the level of financial development. The direction of impact of each factor is more or less as expected.

We then projected future trends in domestic saving rates in developing Asia during the 2011–2030 period and found that the aging of the population will be the main determinant of future trends in domestic saving rates. However, we found that there will be substantial variation from country to country, with the rapidly aging countries showing a sharp downturn in their domestic saving rates by 2030 and the less rapidly aging countries showing only a moderate downturn or no downturn by 2030. Thus, there will necessarily be a sharp decline in saving rates in developing Asia as a whole, at least during the next 2 decades, meaning, for better or worse, that global imbalances are not likely to be eliminated any time soon.

Appendix Table 1: Data Sources

Variable		Data Source	Note
Real domestic saving rate	SR	Computed as $100 \cdot \text{kg} \cdot \text{kc}$. Heston et al., Penn World Table version 6.3 (PWT) ^{1/}	kg is government share of real GDP per capita; kc is consumption share of real GDP per capita (both from PWT)
Aged dependency ratio	AGE	"SP.POP.DPND.OL" from World Development Indicators (WDI) of the World Bank ^{2/} and the <i>Statistical Yearbook</i> for Taipei, China ^{3/}	Ratio of the population aged 65 or older to the population aged 15–64
Youth dependency ratio	DEP	"SP.POP.DPND.YG" from WDI and the <i>Statistical Yearbook</i> for Taipei, China	Ratio of the population aged 0–14 to the population aged 15–64
Real per capita GDP	LNGDP	"rgdpch" from Penn World Table version 6.3	Real GDP per capita (2005 constant prices: Laspeyres)
Real per capita GDP growth	CHGDP	"grgdpch" from Penn World Table version 6.3	Growth rate of real GDP chain per capita (rgdpch)
Private credit by deposit money banks and other financial institutions (percent of GDP)	CREDIT	"pcrdbofgdp" from Beck and Demircuc-Kunt (2009) and line 32D from International Financial Statistics (IFS) of the International Monetary Fund for the PRC	
Government expenditure on social services and pensions (percent of gross national disposable income)	SSR	CEIC Data Company Ltd., and Department of Budget and Management for the Philippines ^{4/}	
Fiscal balance (percent of GDP)	FISC	CEIC Data Company Ltd., <i>Asian Development Outlook Database and Key Indicators for Asia and the Pacific</i> (various issues) of Asian Development Bank ^{5/} , Bank of Thailand ^{6/} , and Bank Negara Malaysia ^{7/}	Positive when in surplus and negative when in deficit
Nominal interest rate	INT	IFS, and www.cbc.gov.tw/ct.asp?xltm=30010&CtNode=517&mp=2	Used data on the deposit rate (line 60L of IFS) except for India, the Republic of Korea, and Pakistan, for which we used the discount rate (line 60 of IFS)
Inflation rate	INFL	"NY.GDP.DEFL.KD.ZG" from WDI	
Real interest rate	RINT	IFS, WDI, and www.cbc.gov.tw	Computed as $\ln((1+\text{INT}/100)/(1+\text{INFL}/100))$

Note:

1/ Available: pwt.econ.upenn.edu/php_site/pwt_index.php.

2/ Available: devdata.worldbank.org/dataonline/.

3/ Available: www.cepd.gov.tw/encontent/m1.aspx?sNo=0000063.

4/ Available: www.dbm.gov.ph/index.php?id=32&pid=9.

5/ Available: www.adb.org/Statistics/ki.asp.

6/ Available: www.bot.or.th.

7/ Available: www.bnm.gov.my.

Appendix Table 2: Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
PWTSR	24.0	14.3	-8.4	61.9
AGE	7.8	2.2	3.8	16.7
DEP	60.5	19.4	17.7	91.3
CHGDP	4.4	4.2	-14.2	20.2
LNGDP	8.8	1.2	6.2	11.1
INFL	7.7	5.0	0.0	39.1
INT	7.8	5.2	0.0	39.1
CREDIT	0.6	0.5	0.1	2.4
FISC	-1.4	4.2	-16.7	16.1
SSR	4.8	3.4	0.7	16.9

References

- ADB. 2009. "Rebalancing Asia's Growth." In *Asian Development Outlook 2009*. Asian Development Bank, Manila.
- Bailliu, J., and Reisen, H. 1998. "Do Funded Pensions Contribute to Higher Savings? A Cross-Country Analysis." OECD Development Centre, Paris. Processed.
- Beck, T., and A. Demirgüç-Kunt. 2009. *Financial Institutions and Markets Across Countries and over Time: Data and Analysis*. World Bank Policy Research Working Paper No. 4943, The World Bank, Washington, DC.
- Bernanke, B. 2005. "The Global Saving Glut and the U.S. Current Account Deficit." Remarks made at the Sandridge Lecture, Virginia Association of Economics, Richmond, Virginia. Available: www.federalreserve.gov/boarddocs/speeches/2005/200503102/.
- Bosworth, B., and G. Chodorow-Reich. 2007. *Saving and Demographic Change: The Global Dimension*. CRR WP 2007-02, Center for Retirement Research, Boston College, Massachusetts.
- CEIC Data Company, Ltd.
- Chinn, M. D., and E. S. Prasad. 2003. "Medium-term Determinants of Current Account in Industrial and Developing Countries: An Empirical Exploration." *Journal of International Economics* 59(1):47–76.
- Dayal-Ghulati, A., and C. Thimann. 1997. *Saving in Southeast Asia and Latin America Compared: Searching for Policy Lessons*. IMF Working Paper WP/97/110, International Monetary Fund, Washington, DC.
- Edwards, S. 1996. "Why Are Latin America's Savings Rates So Low? An International Comparative Analysis." *Journal of Development Economics* 51(1):5–44.
- Feldstein, M. 1977. "Social Security and Private Savings: International Evidence in an Extended Life Cycle Model." In M. Feldstein and R. Inman, eds., *The Economics of Public Services* (An International Economic Association Conference Volume). London, Mcmillan.
- . 1980. "International Differences in Social Security and Saving." *Journal of Public Economics* 14(2, October): 225–44.
- Heston, A.; R. Summers, and B. Aten. 2009. Penn World Table Version 6.3. Center for International Comparisons of Production, Income and Prices, University of Pennsylvania.
- Higgins, M. 1998. "Demography, National Savings, and International Capital Flows." *International Economic Review* 39(2):343–69.
- Horioka, C. Y. 1989. "Why Is Japan's Private Saving Rate So High?" In R. Sato and T. Negishi, eds., *Developments in Japanese Economics*. Tokyo: Academic Press/Harcourt Brace Jovanovich.
- Horioka, C. Y., and T. Yin. 2010. "A Panel Analysis of the Determinants of Household Saving in the OECD Countries: The Substitutability of Social Safety Nets and Credit Availability." Institute of Social and Economic Research, Osaka University. Processed.
- Ito, H., and M. Chinn. 2007. *East Asia and Global Imbalances: Saving, Investment, and Financial Development*. NBER Working Paper No. 13364, National Bureau of Economic Research, Massachusetts.
- IMF. 2005. "Global Imbalances: A Saving and Investment Perspective." In *World Economic Outlook 2005*. International Monetary Fund, Washington, DC.
- . 2009. "Corporate Savings and Rebalancing in Asia." In *World Economic and Financial Surveys, Regional Economic Outlook, Asia and Pacific 2009*. International Monetary Fund, (Washington, DC).
- . Various years. *International Financial Statistics*. International Monetary Fund, Washington, DC.

- James, W. E.; S. Naya, and G. M. Meier. 1989. "Domestic Savings and Financial Development." In *Asian Development, Economic Success and Policy Lessons*. Madison: The University of Wisconsin Press, Ltd.
- Jha, S.; E. Prasad, and A. Terada-Hagiwara. 2009. Saving in Asia: Issues for Rebalancing Growth. ADB Economics Working Paper Series No. 162, Economics and Research Department, Asian Development Bank, Manila.
- Kim, S., and J-W. Lee. 2008. "Demographic Changes, Saving, and Current Account: An Analysis based on a Panel VAR Model." *Japan and the World Economy* 20(2, March):236–56.
- Lee, J-W., and K. Hong. 2010. Economic Growth in Asia: Determinants and Prospects." ADB Economics Working Paper Series No. 220, Economics and Research Department, Asian Development Bank, Manila.
- Loayza, N, K. Schmidt-Hebbel, and L. Serven. 2000. "What Drives Private Saving across the World?" *Review of Economics and Statistics* 82(2, May):165–81.
- Luhrman, M. 2003. Demographic Change, Foresight and International Capital Flows. MEA Discussion Paper Series 03038, Mannheim Institute of the Economics of Aging, University of Mannheim.
- Modigliani, F. 1970. "The Life-cycle Hypothesis and Intercountry Differences in the Saving Ratio." In W. A. Eltis, M. F.G. Scott, and J. N. Wolfe, eds., *Induction, Growth, and Trade: Essays in Honour of Sir Roy Harrod*. Oxford: Oxford University Press.
- Modigliani, F., and A. Sterling. 1983. "Determinants of Private Saving with Special Reference to the Role of Social Security: Cross Country Tests." In F. Modigliani and R. Hemming, eds., *The Determinants of National Saving and Wealth*. London, Macmillan.
- Park, D., and K. Shin. 2009. Saving, Investment, and Current Account Surplus in Developing Asia. ADB Economics Working Paper Series No. 158, Economics and Research Department, Asian Development Bank, Manila.
- Statistical Yearbook. Various years. Available: www.cepd.gov.tw/encontent/m1.aspx?sNo=0000063.
- Terada-Hagiwara, A. 2009. Explaining Filipino Households' Declining Saving Rate. ADB Economics Working Paper Series No. 178, Economics and Research Department, Asian Development Bank, Manila.
- United Nations. Various years. World Population Prospects, The 2008 Revision. Available: esa.un.org/unpp, downloaded 4 May 2010.
- Wei, C-J, and X. Zhang. 2009. The Competitive Saving Motive: Evidence from Rising Sex Ratios and Savings Rates in China. NBER Working Paper No. 15093, National Bureau of Economic Research, Massachusetts.
- World Bank. Various years. *World Development Indicators*. Washington, DC.

About the Paper

Charles Yuji Horioka and Akiko Terada-Hagiwara analyze the determinants of the domestic saving rate in developing Asia during 1966–2007 and find that the main determinants appear to be the aged dependency ratio, income levels, and level of financial development. Their projections of future trends in domestic saving rates for 2011–2030 suggest that the aging of the population will be the main determinant of future trends in developing Asia. However, they find that there will not necessarily be a sharp decline in saving rates in developing Asia as a whole, at least during the next 2 decades, inasmuch as there will be substantial variations across countries in the speed and timing of population aging.

About the Asian Development Bank

ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries substantially reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to two-thirds of the world's poor: 1.8 billion people who live on less than \$2 a day, with 903 million struggling on less than \$1.25 a day. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

Asian Development Bank
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
www.adb.org/economics
ISSN: 1655-5252
Publication Stock No. WPS102683



Printed in the Philippines