Time-Series Evidence on the Impact of the Age Structure of the Population on the Household Saving Rate in Korea and India*

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Abstract: In this paper, we present data on trends over time in household saving rates and the age structure of the population in Korea and India, and analyze the determinants of trends over time in the household saving rates of these economies using time-series techniques with emphasis on the impact of the age structure of the population. We find that the age structure of the population has the expected impact on the household saving rate in both Korea and India in the long run but that it does not have a significant impact in the short run. Our results suggest that the household saving rate in Korea will fall sharply in the coming years because the aging of the population is proceeding at a relatively rapid pace. By contrast, our results suggest that the household saving rate in India will remain high for the foreseeable future because the aging of the population is proceeding at a relatively slow pace.

Key words: Saving rate; household saving rate; life cycle model; life cycle hypothesis; age structure of the population; demographics; aging; population aging; time series econometrics; unit roots; cointegration; cointegrating vector; developing Asia; emerging Asia; Korea; India.
Journal of Economic Literature classification numbers: D12, D91, E21, J11, O53

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1. Introduction

Saving rates have been high in emerging Asia as a whole in recent years, but the economies of emerging Asia are not homogeneous with respect to their saving behavior. In fact, the economies of emerging Asia differ greatly with respect to the levels of their saving rates, trends over time therein, the determinants thereof, and future trends therein, due in large part to differences in demographic trends. In this paper, we conduct a detailed analysis of household saving behavior in Korea and India in order to show how much contrast there is between these two Asian economies in demographic trends and household saving behavior.

More specifically, the purpose of this paper is to present data on trends over time in household saving rates in Korea and India and to analyze the determinants of trends over time in the household saving rates of these economies using time-series techniques with emphasis on the impact of the age structure of the population. Most previous analyses of saving behavior in emerging Asia utilize either micro data from household surveys or cross-country panel data with the national saving rate as the dependent variable. Our analysis is relatively unique in that it conducts time series analyses of long-term national accounts data for individual economies and in that it focuses on household saving, which one would expect to be the component of national saving that is the most sensitive to the age structure of the population.

We chose to focus on Korea and India in this paper because these economies are very different in terms of their stage of economic development, the timing of population aging,

and trends over time in their household saving rates. As can be seen from Table 5, the ratio of the population aged 65 and older to the total population is projected to reach 14 percent in 2015-20 in Korea (making it one of the first major economies in emerging Asia to reach this threshold together with Hong Kong, Singapore, and Taipei,China), whereas this ratio is not projected to reach this threshold until 2055-60 in India (making it one of the last major economies in emerging Asia to reach this threshold together with Pakistan and the Philippines). Moreover, as discussed later, the two economies have shown very different trends over time in their household saving rates, with Korea showing a sharp downward trend from 1988 until 2002 but India showing a sharp upward trend from the early 1960s until 2010.

Horioka and Terada-Hagiwara (2012) project that Korea will show a sharp decline in its domestic saving rate in 2011-20, which will occur primarily because of the rapid aging of her population, followed by a slight uptick in 2021-30, which will occur because the downward pressure on her domestic saving rate caused by population aging will be more than offset by the upward pressure on her domestic saving rate caused by rapid increases in income levels. By contrast, they project that India's domestic saving rate will remain roughly constant over the next two decades because her population will age only slowly during this period, as a result of which the downward pressure on her domestic saving rate caused by population aging will be largely offset by the upward pressure on her domestic saving rate caused by rapid increases in income levels. One purpose of the present study is to see whether the household saving rates of Korea and India can be expected to show similar trends over time, whether projections based on long-term time series data for individual economies are similar to projections based on cross-country

panel data, and whether projections for household saving rates are similar to projections for domestic saving rates.

This paper is organized as follows: In section 2, we conduct a selective literature survey; in section 3, we present our estimation model; in section 4, we discuss our data sources; in section 5, we discuss trends over time in the household saving rate and the age structure of the population; in section 6, we present the estimation results; and in section 7, we conclude and explore the policy implications of our findings.

To summarize the main findings of this paper, we found that the age structure of the population has the expected impact on the household saving rate in both Korea and India in the long run but that it does not have a significant impact in the short run. Our results suggest that the household saving rate in Korea will fall sharply in the coming years because the aging of the population is proceeding at a relatively rapid pace. By contrast, our results suggest that the household saving rate in India will remain high for the foreseeable future because the aging of the population is proceeding at a relatively slow pace.

2. Literature Survey

In this section, we conduct a selective survey of the literature on the determinants of saving rates in emerging Asia.

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, 1980), Modigliani and Sterling (1983), Horioka (1989), Edwards (1996), Dayal-Ghulati and Thimann (1997), Horioka (1997), Bailliu and Reisen (1998), Higgins (1998), Loayza, et al. (2000), Chinn and Prasad (2003), Luhrman (2003), International Monetary Fund (2005), Bosworth and Chodorow-Reich (2007), Kim and Lee (2008), Park and Shin (2009), Hung and Qian (2010, and Horioka and Terada-Hagiwara (2012).

For example, Horioka and Terada-Hagiwara (2012) present data on trends over time in domestic saving rates in twelve economies in developing Asia during the 1966-2007 period and use these data to analyze the determinants of those trends and to project trends in domestic saving rates in these same economies during the next twenty years (2011-2030 period) based on their estimation results. The twelve economies included in their analysis are the People's Republic of China; Hong Kong; India; Indonesia; Republic of Korea; Malaysia; Pakistan; Philippines; Singapore; Taipei,China; Thailand, and Viet Nam, which comprise 95% of the GDP of emerging Asia.

To summarize the findings of the Horioka and Terada-Hagiwara (2012) study, they find that domestic saving rates in developing Asia have, in general, been high and rising but that there have been substantial differences from economy to economy, that the main determinants of the domestic saving rate in developing Asia during the 1960-2007 period appear to have been the age structure of the population (especially the aged dependency ratio), income levels, and the level of financial sector development, that the direction of impact of each factor has been more or less as expected, and that the impacts of income

levels and the level of financial sector development are nonlinear (convex and concave, respectively).

Horioka and Terada-Hagiwara (2012) also find that the domestic saving rate in emerging Asia as a whole will remain roughly constant during the next two decades because the negative impact of population aging thereon will be roughly offset by the positive impact of higher income levels thereon but that there will be substantial variation from economy to economy, with the rapidly aging economies showing a sharp downturn in their domestic saving rates by 2030 because the negative impact of population aging thereon will dominate the positive impact of higher income levels thereon and the less rapidly aging economies showing rising domestic saving rates, at least until 2020, because the positive impact of higher income levels thereon will dominate the negative impact of population aging thereon. These findings imply that dramatic rebalancing will not occur in emerging Asia as a whole, that the "saving glut" in emerging Asia will not be eliminated at least for the next two decades, and that policies to stimulate investment and/or to moderate saving may be warranted in emerging Asia in the short to medium run.

Thus, in our earlier work (Horioka and Terada-Hagiwara, 2012), we analyzed the determinants of the domestic saving rate in emerging Asia using cross-country panel data for 12 emerging Asian economies, but in this paper we analyze the determinants of the household saving rate for Korea and India using long-term time series data for each economy. Our objective is to see whether our earlier results are robust to the saving rate concept used and to see whether long-term time-series estimates for individual economies are consistent with cross-country panel estimates.

The present study is very similar in spirit to Horioka (1997), but Horioka (1997) uses Japanese data whereas we use data for Korea and India. Horioka (1997) found by applying cointegration techniques to time-series data on Japan for the 1955–1993 period that the age structure of the population strongly affects the household saving rate, even in a country like Japan, in which the life-cycle model is less likely to apply due to cultural peculiarities, such as the greater prevalence of intergenerational transfers. In particular, Horioka found that there is a cointegrating relationship among the household saving rate, the ratio of minors to the working-age population, and the ratio of the aged to the working-age population and that both demographic variables have a negative and significant impact on the household saving rate, regardless of which source of data on saving is used. Horioka then estimates an error-correction model (ECM) to determine the short-run dynamics of the system and finds that the coefficient of the error-correction term is negative and statistically significant in the household saving rate equation, meaning not only that the ECM is valid but also that there is a significant conservative force tending to bring the model back into equilibrium whenever it strays too far. These findings constitute strong evidence in favor of the life-cycle model and are consistent with other types of evidence concerning the applicability of the life-cycle model to Japan (see Horioka (1993) for a survey). Horioka's findings suggest that Japan's high household saving rate is indeed due at least in part to the young age structure of the population and that Japan's household saving rate will decline as her population ages.

3. Estimation Model

In this section, we discuss the estimation model we will use in our econometric analysis of the determinants of household saving rates in Korea and India. The estimation model we will use in our analysis is as follows:

(1) $$HHSR(t) = a0 + a1*DEP(t) + a2*AGE(t) + a3*RRATE(t) + a4*GROWTH(t) + e(t),$$

where HHSR = the household saving rate (defined as the ratio of net household saving to the net national disposable income of households)

DEP = the youth dependency ratio, defined as the ratio of the population aged 0 to 19 to the population aged 20-64

AGE = the aged dependency ratio, defined as the ratio of the population aged 65 and older to the population aged 20-64

GRINC = the average annual real growth rate of net household disposable income

RRATE = the real interest rate

e(t) is an error term at time t.

Looking first at the impact of the age structure of the population, since the aged typically finance their living expenses during retirement by drawing down their previously accumulated savings, the aged dependency ratio should have a negative impact on the saving rate, and similarly, since children typically consume without earning income, the youth dependency ratio should also have a negative impact on the saving rate (see Horioka (1997)). Moreover, a higher youth dependency ratio means more children to provide care and financial assistance during old age and thus less need to save on one's

own for old age, and hence the youth dependency ratio could have a negative impact on the saving rate for this reason as well.

A high growth rate of net household disposable income is another important determinant of household saving, creating a virtuous cycle in which rapid income growth makes it easier 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 national saving rate.

Finally, the real interest rate should, in theory, have an impact on the saving rate although the direction of its impact is theoretically ambiguous.

4, Data Sources

In this section, we describe the data sources from which our data were taken. The data on both the net saving and net disposable income of Korean households and non-profit institutions serving households were taken from OECD (available at http://stats.oecd.org/). The data for India were taken from CEIC. The net household saving rate was calculated as the ratio of net household saving to net household disposable income.

Data on DEP (the youth dependency ratio) and AGE (the aged dependency ratio) were calculated from the population data in the United Nations Population Statistics (available at http://esa.un.org/unpd/wpp/index.htm).

GRINC represents the average annual real growth rate of net household disposable income. The adjustment for price changes was done using the Consumer Price Index (CPI) taken from the *International Financial Statistics* of the International Monetary Fund for Korea and the Wholesale Price Index (WPI) taken from Haver Analytics for India.

Data on RRATE for both Korea and India were taken from *World Development Indicators (WDI)* of the World Bank (available at http://devdata.worldbank.org/dataonline/). Data on deposit rates were used for Korea, and data on lending rates were used for India because data on deposit rates were not available.

5. Trends over Time in Selected Variables

In this section, we present data on trends over time in household saving rates and the age structure of the population in Korea and India.

Data on trends over time in the net national and net household saving rates in Korea and India are shown in Figure 1, and as can be seen from this figure, in Korea, the household saving rate has been highly volatile over time, increasing from 7.5 percent in 1975 to 18.1 percent in 1978, falling to 8.6 percent by 1980, increasing to an all-time high of 26.0 percent by 1988, falling to an all-time low of 0.4 percent by 2002, increasing to 9.2 percent by 2004, falling to 2.9 percent by 2007-08, and fluctuating in the 2.9 to 4.6 percent range since then.

By contrast, the household saving rate in India has shown a long-term upward trend over time, increasing from 5 percent in the early 1960s to almost 27 percent in 2010 before declining slightly thereafter (see Figure 1).

Date on trends over time in the age structure of the population in Korea and India are shown in Figure 2, and as can be seen from this figure, there are significant differences between the two countries in trends over time in the age structures of their populations. In Korea, there has been a sharp decline in the youth dependency ratio due to the sharp decline in the total fertility rate, and there has been a sharp increase in the aged dependency ratio due to sharp increases in life expectancy.

In India, by contrast, the population is still young and the youth dependency ratio is still a full 0.70. Given that the total fertility rate is much higher in India than in Korea (2.6 children per woman in India vs. 1.2 children per woman in Korea), the decline in the youth dependency ratio has been much more moderate in India than in Korea. Moreover, given that life expectancy at birth is still much shorter in India than in Korea (65 vs. 85), population aging is progressing much more slowly in India than in Korea.

Differences between Korea and India in demographic trends appear to be capable of explaining differences between the two economies in trends over time in the household saving rate. In Korea, the downward pressure on the household saving rate caused by the increase in the aged dependency ratio presumably more than offset the upward pressure on the household saving rate caused by the decline in the youth dependency ratio

because rapid increases in life expectancy caused the aged dependency ratio to increase sharply, thereby causing Korea's household saving rate to decline. In India, by contrast, the upward pressure on the household saving rate caused by the decline in the youth dependency ratio presumably more than offset the downward pressure on the household saving rate caused by the increase in the aged dependency ratio because relatively slow increases in life expectancy caused the aged dependency ratio to increase only slowly, thereby causing India's household saving rate to increase.

6. Estimation Results

In this section, we present our estimation results.

The results of the unit root tests for Korea and India are shown in Table 1, and as can be seen from this table, we found that the household saving rate has a unit root, that the demographic variables are either I(0) or I(1), and that the growth rate and the real interest rate are stationary.

The results for the Engle-Granger test for cointegration are shown in Table 2, and as can be seen from this table, the results for Korea are mixed with the Dickey-Fuller test indicating the absence of cointegration but the Augmented Dickey-Fuller test indicating the presence of cointegration. Moreover, the results for the Johansen test for cointegration, which are shown in Table 3, are also mixed for Korea, suggesting that there is one cointegrating vector in the baseline model, two cointegrating vectors in the variant with the growth rate, and three cointegrating vectors in the variant with both the growth

rate and the real interest rate.

The results of the Engle-Granger cointegration tests for India are also mixed, with the Dickey-Fuller test indicating the presence of cointegration but the Augmented Dickey-Fuller test indicating the absence of cointegration. Moreover, the results of the Johansen test for cointegration for India are also mixed, suggesting that there is one cointegrating vectors in the baseline model and one or two cointegrating vectors in the variant with the growth rate only and the variant with both the growth rate and the real interest rate.

As for the estimated cointegrating vector, it is consistent with our prior expectations for both Korea and India, with both DEP and AGE (the ratios of the population aged 19 and under and the population aged 65 and older to the population aged 20-64) having a negative and statistically significant impact on the household saving rate in both the ordinary least squares and maximum likelihood estimates. Moreover, the absolute magnitude of the coefficient of DEP is much smaller than that of AGE, which is consistent with previous studies and also consistent with our prior expectations since the aged would be expected to consume more than minors, as a result of which their ratio to the working-age population should have a larger negative impact on the household saving rate than the ratio of minors to the working-age population.

Turning next to the error correction model, the estimation results are shown in Table 4. For Korea, the coefficients of the first difference of AGE is always negative but not statistically significant, and the coefficient of the first difference of DEP is negative but

not statistically significant in the baseline model and positive but not statistically significant in the variants with the growth rate and/or the real interest rate. The coefficients of the first differences of the growth rate and the real interest rate are both negative but not statistically significant, and the coefficient of the error correction term is negative but not statistically significant.

Turning next to the estimation results for the error correction model for Indian households, the coefficients of the first differences of AGE and DEP are always negative but not statistically significant, and the coefficients of the first differences of the growth rate and the real interest rate are negative but not statistically significant. Meanwhile, the coefficient of the error correction term is positive and statistically significant except for the baseline equation, suggesting the validity of the error correction model for India.

Thus, we found that the age structure of the population has the expected impact on the household saving rate in both Korea and India in the long run but that it does not have a significant impact in the short run.

Turning to the policy implications of our analysis, our results suggest that the household saving rate in Korea will fall sharply in the coming years because the aging of the population is proceeding at a relatively rapid pace. By contrast, our results suggest that the household saving rate in Indian will remain high for the foreseeable future because the population is aging at a relatively slow pace.

7. Summary and Conclusions

In this paper, we presented data on trends over time in household saving rates and the age structure of the population in Korea and India and analyzed the determinants of trends over time in the household saving rates of these economies using time-series techniques with emphasis on the impact of the age structure of the population. We found that the age structure of the population has the expected impact on the household saving rate in both Korea and India in the long run but that it does not have a significant impact in the short run. Our results suggest that the household saving rate in Korea will fall sharply in the coming years because the aging of the population is proceeding at a relatively rapid pace. By contrast, our results suggest that the household saving rate in India will remain high for the foreseeable future because the aging of the population is proceeding at a relatively slow pace.

Given the divergent trends in household saving rates among the economies of emerging Asia, it is not clear whether the household saving rate will increase or decrease in emerging Asia as a whole and whether or not global imbalances will be rectified in the near future.

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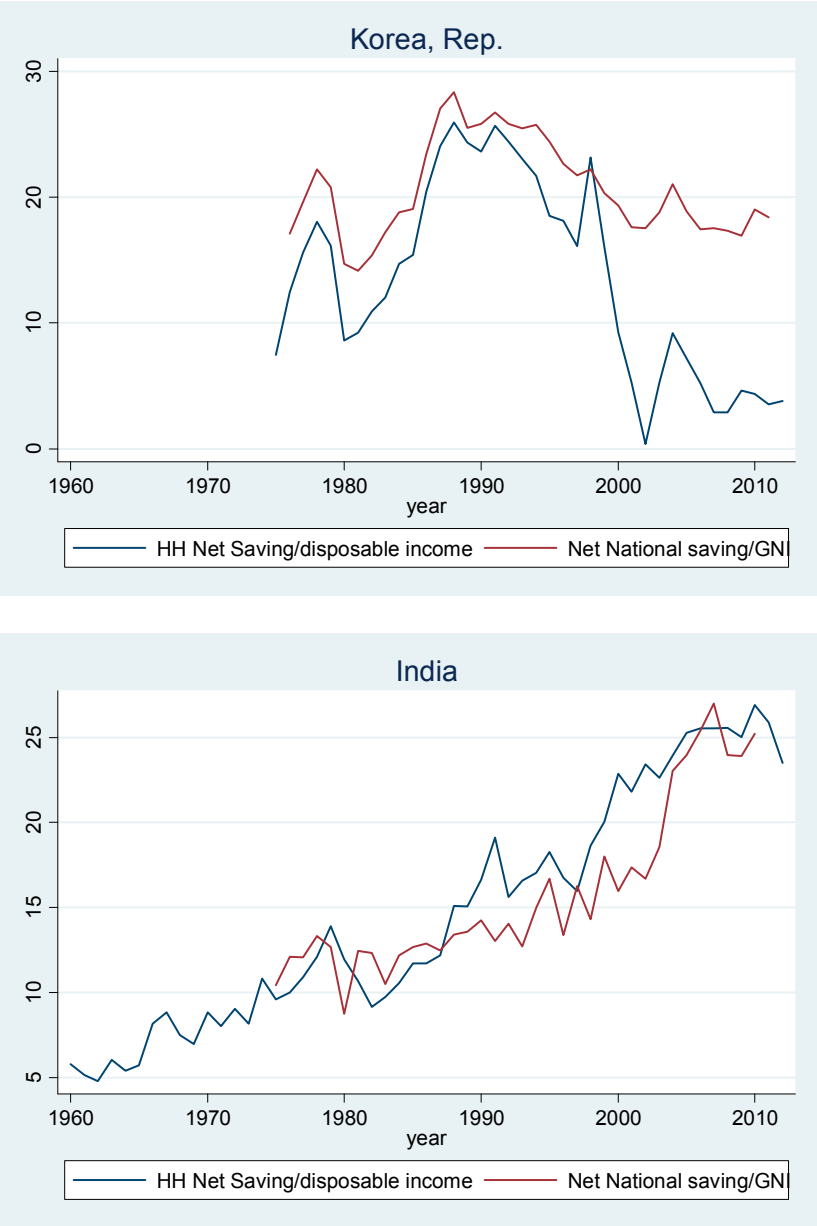
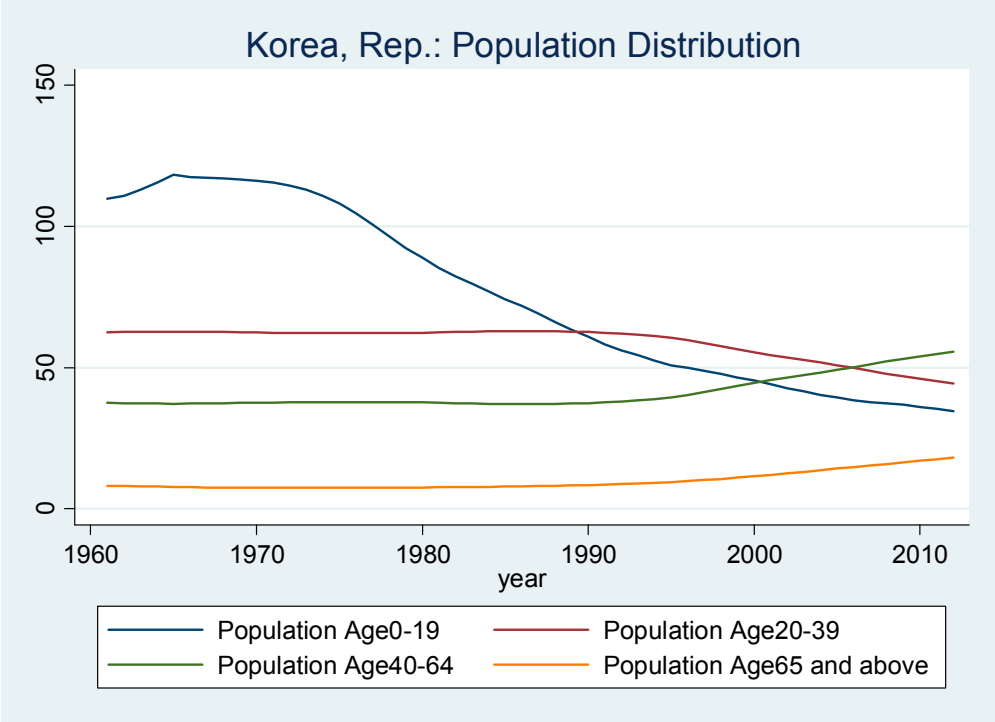
Figure 1: Net National and Household Saving rate (Percent of Disposable income)



Note: Net household saving rate is computed as percent of net disposable household income and net national saving rate is computed as percent of gross national income (GNI).

Figure 2: Population Distribution (Percent of Working Age Population of 20-64)



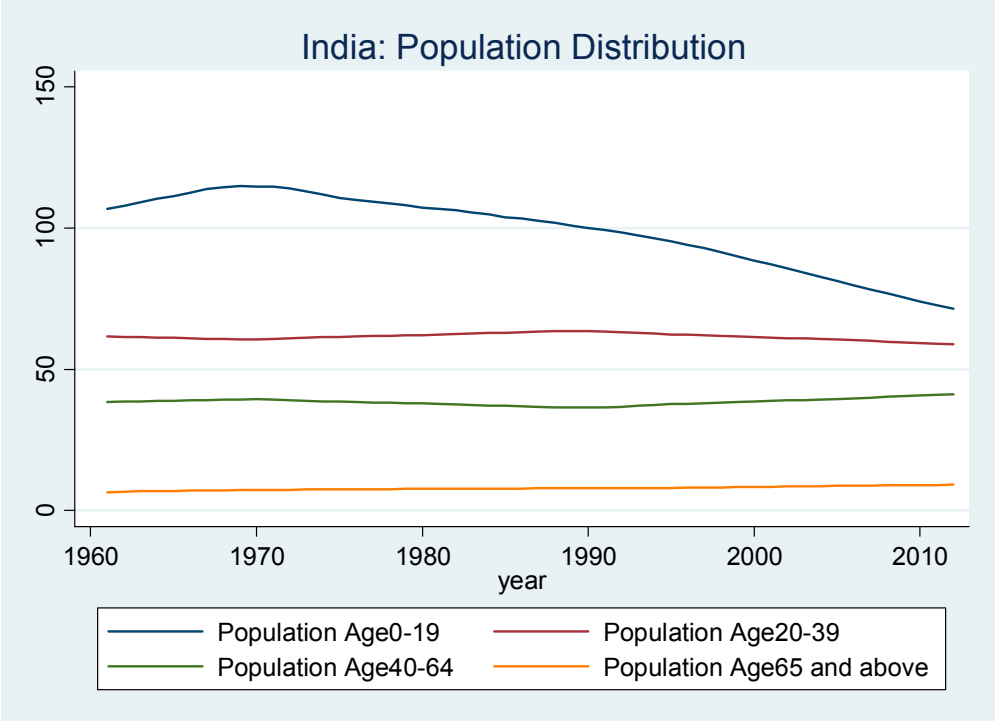


Table 1: Results of Unit-Root Tests

KOREA			
Results of Unit-Root Tests			
Variable	Type of Test	Without Time Trend	With Time Trend
HHSR	DF	-1.145	-2.061
	ADF(1)	-1.396	-2.013
	ADF(2)	-1.146	-1.728
D_HHSR	DF	-4.811***	-4.793***
	ADF(1)	-4.196***	-4.182**
	ADF(2)	-4.061***	-4.057**
DEP	DF	0.482	-1.956
	ADF(1)	-1.564	-2.749
	ADF(2)	-2.051	-2.132
S_DEP	DF	-1.944	-1.771
	ADF(1)	-2.555	-2.368
	ADF(2)	-3.128**	-3.155
AGE	DF	13.141***	4.043**
	ADF(1)	-0.265	-0.134
	ADF(2)	-0.446	-0.158
D_AGE	DF	-0.346	-2.607
	ADF(1)	-0.404	-2.268
	ADF(2)	-0.362	-1.633
RRATE	DF	-4.073***	-4.036**
	ADF(1)	-3.857***	-3.848**
	ADF(2)	-3.819***	-3.877**
GRINC	DF	-3.311**	-3.889**
	ADF(1)	-3.128**	-3.875**
	ADF(2)	-3.043**	-3.391*

INDIA			
Results of Unit-Root Tests			
Variable	Type of Test	Without Time Trend	With Time Trend
HHSR	DF	-0.755	-3.168
	ADF(1)	-0.700	-2.719
	ADF(2)	-0.694	-2.482
D_HHSR	DF	-8.148***	-8.041***
	ADF(1)	-5.581***	-5.464***
	ADF(2)	-4.789***	-4.702***
DEP	DF	6.047***	-7.234***
	ADF(1)	-0.080	-2.810
	ADF(2)	0.278	-2.337
S_DEP	DF	-2.207	-1.872
	ADF(1)	-2.574	-2.256
	ADF(2)	-2.511	-2.278
AGE	DF	-0.606	-1.633
	ADF(1)	0.297	-1.198
	ADF(2)	0.628	-0.680
D_AGE	DF	-5.086***	-4.997***
	ADF(1)	-5.002***	-4.930***
	ADF(2)	-4.014***	-4.010**
RRATE	DF	-4.803***	-4.757***
	ADF(1)	-5.377***	-5.311***
	ADF(2)	-3.600**	-3.556**
GRINC	DF	-7.943***	-8.362***
	ADF(1)	-5.945***	-6.560***
	ADF(2)	-4.354***	-4.909***

Table 2: Results of the Engle-Granger- Tests for Cointegration

KOREA						INDIA				
Results of Engle Granger Tests for Cointegration						**Results of Engle Granger Tests for Cointegration**				
Dependent variable: Household net saving / Household disposable income						**Dependent variable: Household net saving / Household disposable income**				
Specification	Type of Test	Time Period	Number of Obs	Statistics		Specification	Type of Test	Time Period	Number of Obs	Statistics
DEP and AGE	DF	1976-2012	36	-2.165		DEP and AGE	DF	1962-2012	50	-3.003**
	ADF(1)	1977-2012	35	-2.888*			ADF(1)	1963-2012	49	-2.759*
	ADF(2)	1978-2012	34	-2.686*			ADF(2)	1964-2012	48	-2.583
DEP, AGE, and GRINC	DF	1976-2012	36	-2.535		DEP, AGE, and GRINC	DF	1962-2012	50	-3.027**
	ADF(1)	1977-2012	35	-2.831*			ADF(1)	1963-2012	49	-2.558
	ADF(2)	1978-2012	34	-2.485			ADF(2)	1964-2012	48	-2.556
DEP, AGE, GRINC, and RRATE	DF	1976-2012	36	-2.485		DEP, AGE, GRINC, and RRATE	DF	1962-2012	50	-3.475**
	ADF(1)	1977-2012	35	-2.841*			ADF(1)	1963-2012	49	-2.541
	ADF(2)	1978-2012	34	-2.776*			ADF(2)	1964-2012	48	-2.349

Table 3: Results of the Johansen Tests for Cointegration

KOREA					
Dependent variable: HHSR					
Specification	**Null Hypothesis**	**Alternative Hypothesis**	**Statistic**	**5% Critical Value**	**1% Critical Value**
	Cointegration Likelihood Ratio Test Based on Trace of Stochastic Matrix				
AGE, and DEP	r=0	r=1	36.9278	29.68	35.65
	r<=1	r=2	14.9408*1*5	15.41	20.04
	r<=2	r=3	3.2228	3.76	6.65
	Cointegration Likelihood Ratio Test Based on Maximum Eigenvalue of Stochastic Matrix				
AGE, and DEP	r=0	r=1	21.9871	20.97	25.52
	r<=1	r=2	11.7179	14.07	18.63
	r<=2	r=3	3.2228	3.76	6.65
	Cointegration Likelihood Ratio Test Based on Trace of Stochastic Matrix				
AGE, DEP, and GRINC	r=0	r=1	58.5361	47.21	54.46
	r<=1	r=2	31.2954*1	29.68	35.65
	r<=2	r=3	12.3338*5	15.41	20.04
	r<=3	r=4	3.3315	3.76	6.65
	Cointegration Likelihood Ratio Test Based on Maximum Eigenvalue of Stochastic Matrix				
AGE, DEP, and GRINC	r=0	r=1	27.2407	27.07	32.24
	r<=1	r=2	18.9616	20.97	25.52
	r<=2	r=3	9.0023	14.07	18.63
	r<=3	r=4	3.3315	3.76	6.65
	Cointegration Likelihood Ratio Test Based on Trace of Stochastic Matrix				
AGE, DEP, GRINC, RRATE	r=0	r=1	94.9199	68.52	76.07
	r<=1	r=2	59.8341	47.21	54.46
	r<=2	r=3	36.6694	29.68	35.65
	r<=3	r=4	17.0983*1	15.41	20.04
	r<=4	r=5	6.1366	3.76	6.65
	Cointegration Likelihood Ratio Test Based on Maximum Eigenvalue of Stochastic Matrix				
AGE, DEP, GRINC, RRATE	r=0	r=1	35.0858	33.46	38.77
	r<=1	r=2	23.1648	27.07	32.24
	r<=2	r=3	19.5711	20.97	25.52
	r<=3	r=4	10.9617	14.07	18.63
	r<=4	r=5	6.1366	3.76	6.65

Table 3 (cont..): Results of the Johansen Tests for Cointegration

INDIA					
Dependent variable: HHSR					
Specification	**Null Hypothesis**	**Alternative Hypothesis**	**Statistic**	**5% Critical Value**	**1% Critical Value**
	Cointegration Likelihood Ratio Test Based on Trace of Stochastic Matrix				
AGE, and DEP	r=0	r=1	39.2625	29.68	35.65
	r<=1	r=2	10.9762*1*5	15.41	20.04
	r<=2	r=3	0.0284	3.76	6.65
	Cointegration Likelihood Ratio Test Based on Maximum Eigenvalue of Stochastic Matrix				
AGE, and DEP	r=0	r=1	28.2862	20.97	25.52
	r<=1	r=2	10.9478	14.07	18.63
	r<=2	r=3	0.0284	3.76	6.65
	Cointegration Likelihood Ratio Test Based on Trace of Stochastic Matrix				
AGE, DEP, and GRINC	r=0	r=1	78.874	47.21	54.46
	r<=1	r=2	38.3143	29.68	35.65
	r<=2	r=3	10.5826*1*5	15.41	20.04
	r<=3	r=4	0.0932	3.76	6.65
	Cointegration Likelihood Ratio Test Based on Maximum Eigenvalue of Stochastic Matrix				
AGE, DEP, and GRINC	r=0	r=1	40.5598	27.07	32.24
	r<=1	r=2	27.7317	20.97	25.52
	r<=2	r=3	10.4893	14.07	18.63
	r<=3	r=4	0.0932	3.76	6.65
	Cointegration Likelihood Ratio Test Based on Trace of Stochastic Matrix				
AGE, DEP, GRINC, RRATE	r=0	r=1	106.0026	68.52	76.07
	r<=1	r=2	56.9365	47.21	54.46
	r<=2	r=3	27.8753*1*5	29.68	35.65
	r<=3	r=4	11.5253	15.41	20.04
	r<=4	r=5	0.00008	3.76	6.65
	Cointegration Likelihood Ratio Test Based on Maximum Eigenvalue of Stochastic Matrix				
AGE, DEP, GRINC, RRATE	r=0	r=1	49.0661	33.46	38.77
	r<=1	r=2	29.0612	27.07	32.24
	r<=2	r=3	16.35	20.97	25.52
	r<=3	r=4	11.5227	14.07	18.63
	r<=4	r=5	0.0026	3.76	6.65

Table 4: Estimation Results of the Error-Correction Model

KOREA			
ESTIMATION RESULTS OF THE ERROR-CORRECTION MODEL			
	Dependent Variable		
Explanatory Variable	**D_SR**	**D_SR**	**D_SR**
Constant	0.3146833	2.942565	1.660482
	4.81247	4.709014	4.796664
	0.07	0.62	0.35
Z(-1)	-.1379595	-0.0030455	-0.0242623
	.1123939	0.0466735	0.0515436
	-1.23	-0.07	-0.47
D_SR(-1)	.3143705*	-0.0030455	0.1615812
	.1894662	0.0466735	0.2025214
	1.66	-0.07	0.80
D_AGE(-1)	-10.49291	-5.878152	-6.420083
	7.742441	7.528772	7.83754
	-1.36	-0.78	-0.82
D_DEP(-1)	-.5164403	0.7778258	.1998179
	1.65362	1.648926	1.666918
	-0.31	0.47	0.12
D_GRINC(-1)		0.786421	.0191122
		.1249964	.1351048
		0.63	0.14
D_RRATE(-1)			.2917068
			.26444
			1.10
Error correction terms	Z=SR + 1.085006 * DEP + 2.340217*AGE-113.4076	Z=SR + 1.86446 * DEP + 3.574872*AGE+2.846357 * GRINC-184.9201	Z=SR + 1.854008 * DEP + 2.808306*AGE + 2.090094 * GRINC + 0.644261 * RRATE- 179.0914
Number of obs	36	35	35
R-sq	0.1235	0.0843	0.1242
RMSE	3.36163	3.50806	3.49163
Diagnostic Tests			
LM test for autocorrelation: chi2 (2)	6.7908	23.4587	25.9086
Jarque-Bera Normality test: chi2	3.882	21.355	12.114

Table 4 (cont…): Estimation Results of the Error-Correction Model

INDIA			
ESTIMATION RESULTS OF THE ERROR-CORRECTION MODEL			
	Dependent Variable		
Explanatory Variable	**D_SR**	**D_SR**	**D_SR**
Constant	.0695568	.652842	-.2538532
	.591253	.4643773	.8020129
	0.12	1.41	-.44
Z(-1)	-.0470485	.0544832*	.218201**
	.0288494	.0312305	.0905532
	-1.63	1.74	2.41
D_SR(-1)	-.2221959	-.2306812	-.5205004
	.1486658	.1581127	.2285829
	-1.49	-1.46	-2.28
D_AGE(-1)	-6.575288	-.1013344	-16.98127
	6.079444	6.417223	9.22115
	-1.08	-.02	-1.84
D_DEP(-1)	-.547444	-.0630735	-2.066175
	.4272261	.266341	.8287845
	-1.28	-.24	-2.61
D_GRINC(-1)		-.0480506	-.0422498
		.0382369	.0551396
		-1.26	-.77
D_RRATE(-1)			-.0747314
			.101958
			-.73
Error correction terms	Z=SR + 2.52644 * DEP + 52.81833*AGE-690.164	Z=SR + 0.9726379 * DEP+2.934744*AGE+1.824857 * GRINC-147.9735	Z=SR + 1.15764 * DEP + 13.05947*AGE +.8632016 * GRINC +.5956766 * RRATE-245.162
Number of obs	50	50	32
R-sq	0.1558	0.1638	0.3851
RMSE	1.44553	1.45495	1.35883
Diagnostic Tests			
LM test for autocorrelation: chi2 (2)	12.8223	22.0383	17.8246
Jarque-Bera Normality test: chi2	10.307	16.872**	13.624

Table 5: Population Aging in Developing Asia

Economy	The Period during which the Population Aged 65 and Older Reaches 14 Percent the Total Population
PRC	2020-25
Hong Kong, China	2010-15
Indonesia	2040-45
India	2050-55
Korea, Rep. of	2015-20
Malaysia	2040-45
Pakistan	After 2055
Philippines	2050-55
Singapore	2015-20
Thailand	2020-25
Taipei,China	2015-20
Viet Nam	2030-35
Japan	1990-95

Data source: The United Nations' (U.N.) projections available at http://esa.un.org/unpp, and the Statistical Yearbook for Taipei, China, available at http://www.cepd.gov.tw/encontent/m1.aspx?sNo=0000063.