

**University of the Philippines School of Statistics (UPSS)**  
**Working Paper Series**

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An Econometric Approach**

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Working Paper 2008 – 01

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August 2008

# **The Link between Population Dynamics and Household Saving: An Econometric Approach**

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## **ABSTRACT**

One way of aiming for a higher economic growth path is by raising investments. Investments, however, require financing that will have to be generated from domestic or foreign sources. For the Philippines, whose economic performance in the last three decades is mediocre relative to its Asian neighbors, household saving is not so bright compared with other countries in East Asia. The triennial Family Income and Expenditure Survey (FIES) data from 1985 to 2003 indicate that the country's saving rate and levels of saving of households have consistently been decreasing with its saving rate reaching the lowest level of 16% in 2003. This paper looks at the determinants of aggregate household saving in the Philippines using panel data generated from the FIES (1985-2003). The econometric model is based on the augmented life cycle model. The results suggest that the country's population dynamics plays an important role in the aggregate household saving rate. A higher proportion of young dependents (ages 0 to 14 years) creates hindrance to the aggregate household saving. The Philippines with its rapid population growth over the years exhibits a big bulge in the lower portion of the age pyramid that resulted to a higher percentage of young dependents. This suggests that the country is paying a high price for its high population growth due to its low saving rate and consequently, low economic growth. The results also show that remittance from migrant workers is a major source of aggregate household saving.

*Key Phrases: Saving Rate, Population Dynamics, Demographic Dividend*

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## **I. Introduction**

The economic growth implications due to the changes in the nation's age structure, resulting from the demographic transition, have been substantial and are of the research interest in the last years. Studies, notably that of Bloom and Canning (2001) and Bloom and Williamson (1998), show that demographic factors have strong and significant effects on economic growth. The first two essays, using cross-country and intra-country econometric analysis, have shown that the Philippines has not benefited from the so-called demographic dividend that is a major contributor to the economic success experienced by East Asian countries from the 1960s to 1990s. In the course of the demographic transition, countries experience an increasing share of the working age population relative to the total population and this creates favorable effects on the per capita income. Mason and Lee (2006) refer to this effect of the demographic transition to income growth as the "first dividend." The changing age structure interacts with the life cycle of production and consumption. Young (those aged 0 to 14 years) and elderly (aged 65 and above) members of the population produce less than they consume while the working age adults (aged 15 to 64 years) produce more than they consume. The conclusion is that countries with a population structure with heavy concentration at the working-age have the advantage of producing high levels of per capita income, all things being the same. However, the impact of the first dividend is conditioned on policies related to the labor market, that is, how wages and labor force participation rates react to the rapid increase in the working-age population.

Mason (2007) discusses another form of dividend resulting from the changing age-structure of the nation's population and refers to it as the second demographic dividend. The second dividend results from the society's response to the prospect of an aging population, an outcome as the nation's age structure enters into the third phase of the demographic transition. The challenge face by societies (and governments) when there is a substantially percentage of the elderly population is how to support their consumption, given a reduction in their income. There are common approaches to this problem: (a) relying on public (or familial) transfer systems and (b) increasing saving rates and accumulating greater physical wealth or capital. Individuals accumulate saving in their working years and this serves as buffer during the retirement years. While accumulation of capital can be used to deal with the life-cycle deficit in the older ages, this capital also influences economic growth. As Mason points out, it is when society increases its saving rate that results to a more rapid economic growth – creating the second demographic dividend.

The link between saving, population and economic growth is inherent in the neoclassical growth model of Solow (1956) and Swan (1956). In the model, the output per worker is determined only by two variables: capital per worker and the level of technology. The production function is described by,  $Y_t = F[K_t, A_t L_t]$  where  $K_t$  is the physical capital,  $L_t$  is labor and  $A_t$  is the labor-augmenting technical progress. The constant return to scale assumption means that the production function can be expressed in intensive form (in per worker or per capita form),  $\frac{Y}{AL} = F\left[\frac{K}{AL}, 1\right]$  or that,  $y = f(k)$ ,

where  $k$  is the capital per worker and  $y$  is the output per worker. Labor and knowledge grow at constant exogenous rates,  $\dot{L}_t = nL_t$  and  $\dot{A}_t = gA_t$ . Capital accumulation is determined by savings,  $S_t = sY_t$  where  $s$  is fixed. The condition for a change in capital stock is that,  $\dot{K}_t = sY_t - \delta K_t$  where  $\delta$  is the depreciation rate. The fundamental result of the Solow-Swan model is that,

$$\dot{k}_t = sy_t - (n + \delta)k$$

the first term on the right hand side of the equation is the amount of new capital being provided each period by the average worker. The second term can be thought as the effective depreciation rate for the capital-labor ratio. If the saving rate is zero, then the capital per person will decline partly because of the depreciation of capital (at a rate  $\delta$ ) and partly due to an increase in the number of person (at the rate  $n$ ). If saving exceeds the necessary amount to equip new workers, then the capital-labor ratio increases and capital-deepening occurs (Lee, Mason and Miller (LMM), 2001).

The model yields three important implications that relates saving, population and economic growth. One, an increase in the saving rate or decrease in the population growth yields a higher equilibrium output per worker. Two, an increase in the saving rate or decrease in population growth produces a transitory increase in the growth rate of output per worker. And three, at the steady state neither saving rate nor population growth rate has impact on the rate of growth of output per worker.

The two sources of capital-deepening in the Solow-Swan model: (a) rise in saving rate and (b) decline in population growth have been observed in the East Asian economies (South Korea, Taiwan, Thailand, Singapore) that experienced high economic growth rates from the 1960s up to the 1990s (LMM, 2001). Using the cross-country data in the first essay, the average gross domestic saving ratio of the country during the period 1975 to 2000 for these countries are 28 percent for Thailand, 32 percent for South Korea and 44 percent for Singapore. The GDS of the Philippines for the same period is only 22 percent.

The third essay looks at the link between population dynamics or changing age structure and the saving rate in the Philippines using aggregate (regional) household panel data generated from the Family Income and Expenditure Survey (FIES) from 1985 to 2003. The third essay's motivation is show that because of the high fertility and population growth rates in the country, relative to its East Asian neighbors, the country has once again failed to benefit from the second demographic dividend, where high saving rate lead to an even higher economic growth. As in the tradition of the first two essays, this essay will make use of econometric models to explain the connection between the population dynamics and household saving rate using econometric models. The econometric model is based on the augmented life cycle model.

The remainder of the paper is organized as follows: Section 2 presents empirical studies and simulated results on the population dynamics-saving rate-economic growth nexus in the countries that experienced demographic transition. Section 3 presents the a

profile of household saving in the Philippines using data from the 1985, 1988, 1991, 1994, 1997, 2000 and 2003 Family Income and Expenditure (FIES). The theoretical framework of the econometric model for saving rate using panel data is discussed in section 4. Section 5 presents the empirical results and section 6 concludes.

## **II. Population Growth-Saving Rate-Economic Growth: Country Specific Studies**

The relationship between population dynamics and saving rate is integrated in the life-cycle model of consumption. Modigliani (1986) asserts “the self-evident proposition that the representative consumer will choose to consume at a reasonably stable rate, close to his anticipated average life consumption.” The life-cycle model predicts that both demographic variable and productivity growth will generate saving, young people saves while elderly dis-saves and if it is assumed that the population is stationary with incomes of the young the same as the income of the old, then saving and dis-saving will be equal and opposite (Deaton, 1991). However, a different picture is shown if a country enters into a demographic transition. During the first phase of the demographic transition the young dependent population (aged 0 to 14) is growing relative to the working-age population (aged 15 to 65) resulting in higher household consumption, which in turn diminishes the rate of saving (Coale and Hoover, 1956). During the second phase of the demographic transition, working-age population is growing relative to young dependent population and results to higher saving rate.

Series of empirical studies based on cross-country aggregate-level panel data conclude that demographic factors have a strong and statistically significant effect on aggregate saving (Bloom, Canning and Graham, 2003), Deaton and Paxson (2000) and Kelly and Schmidt (2007). Country-specific studies also validate the results of the cross-country studies. One such example is the series of studies done using the same data set for Taiwan. Williamson and Higgins (2001) and Kelly and Schmidt (1996) have shown that changes in the age structure over the demographic transition lead to a rise in the gross national saving rate of Taiwan by between 25 to 45 percentage points. Using the same data, LMM (2001) estimate only about 14.5 percentage points increase in saving rate due to age structure, while Deaton and Paxson (2000) estimate of the increase in household saving rate in Taiwan induced by the demographic transition to be only around 6.5 percentage points. While various researchers have varying estimates of the impact of the age structure on saving rate, the estimated rise in gross national saving rate accounted for by the demographic transition is economically significant.

LMM (2001) also made use of simulations to compare the impact of saving rate (due to the demographic factors) on the income per capita in Taiwan and a Latin America scenario. The comparison is relevant because while the fertility decline in Latin America begins in about the same year as in Taiwan, the transition to replacement fertility took 60 years for Latin America compared to Taiwan's 30 years. The simulation results show that the Latin America scenario produces the same per capita income as that of Taiwan but several decades late. The authors concluded that for countries that experience rapid



demographic transitions, the saving rates remain high for several decades and a corresponding rapid increase in the per capita growth.

Another simulation analysis of Mason (2001) using household data from Taiwan data shows that the higher rate of saving and investment resulting from the demographic transition accounts for 18 percent of the increase in the output per worker during the period 1960 to 1990, supporting the notion of the second demographic dividend (higher saving rate from the demographic transition). Combined with the first dividend (from the gap between population and labor force growth or the translation component), the combined demographics account for about 27.7 percent of the increase in the per capita output in Taiwan. In Mason's simulation, using the middle-of-the-road estimate of the saving effects, the second demographic dividend (18 percent) is even higher than the first demographic dividend (9.7 percent).

Mason (2007) uses simulations to estimate the wealth accumulation of three countries, United States, Japan and India during the course of the demographic transition. The countries are selected because they have experience demographic transitions in various periods: the United States during the period 1850 to 1940, Japan from 1950 to 1980 and India from 1975 to 2000. Noting that wealth is accumulated during the working years, Mason introduces the concept of total life-cycle wealth or the wealth held by all individuals older than the age at which the accumulation process begins which the author estimates to be at 50 years (Mason assumes that surplus at younger working age are transferred to children for their consumption and thus wealth accumulation starts at 50

years when the transfer to children stops). Mason's simulations show that by 1950 the United States life-cycle wealth relative to total income is 4 times that of India and about twice that of Japan. During this period, Japan's simulated life-cycle wealth begins to increase very rapidly and that by 1975, the ratio of life-cycle wealth to output is 6.0 in Japan and only 3.6 in the United States. For the case of India, the simulated life-cycle wealth increase very slowly until recently. The ratio of life-cycle wealth to income did not reach 1.0 until 1985 (Japan reached this milestone in 1940 and the United States in 1905).

In the same paper, Mason also provides estimates of the effects of the two demographic dividends on the average per capita GDP growth of the three countries. The first dividend is due to the translation effect on income growth (due to the faster rate of working-age population compared to the total population) and the second dividend (additional income growth due to capital accumulation). For Japan, during the period 1950 to 1980, the simulations show that of the average yearly per capita GDP growth rate of 6.23%, the first dividend accounts for 0.63% and the second dividend accounts for 1.72%. The two dividends due to demographic transition account for 37.3 percent of the yearly average per capita growth rate of Japan. Using the data from the United States from 1850 to 1940, the simulations show that the first dividend and the second dividend account for 0.27 percent and 0.62 percent, respectively, of the average yearly per capita GDP growth rate of 1.55 percent (57.6 percent of the actual). For India during the period 1975 to 2000, the simulations show that the first and second demographic dividends

account for 0.34 percent and 1.02 percent, respectively, of the yearly average per capita GDP growth rate of 2.98 percent.

In another cross-country analysis, using data from 112 developing economies and 22 industrial-economies for the period 1965 to 1995, the World Bank (1999) confirms that an increase in the share of the young dependents in the population tends to reduce private saving. The study pointed out that an increase in the young age dependency ratio of 3.5 percentage points leads to about a 1 percentage point decline in private saving. The study concluded that “developing countries undergoing a demographic transition, in which the working-age population is a large and growing share of the population, may witness a transitory increase in their savings rates.”

In the Philippines, Rodriguez and Meyer (1988) examined the saving behavior of 1000 rural households using data gathered by the Agricultural Credit Policy Council (ACPC) of the country in 1987. The authors found that factors such as income, household size and education of the household head, among others, played significant and positive roles in raising saving among rural households. Bautista and Lamberte (1990) analyzed the saving behavior of rural and urban households in the Philippines using data of 17495 households from the 1985 FIES and found that the marginal propensity to save of households in Metro Manila is lower than that of households in any other region (except Region 2). The study also showed that at a given income level, rural households generally save more than urban households. Moreover, the marginal saving rate of rural households increases more rapidly as they move up from low- and middle-income groups to the high-

income group compared to the urban households. Both studies did not include demographic variables in their econometric models.

### III. Household Saving Profile in the Philippines (1985 to 2003)

The saving patterns of household are obtained using the relevant data from the family income Family Income and Expenditure Survey (FIES) for the years 1985, 1988, 1991, 1994, 1997, 2000 and 2003. The number of households surveyed is presented in Table 3.1. Furthermore, the regional classification uses the fourteen regions (defined in the 1988 FIES) and is presented in Table 3.2.

**Table 3.1. Sample households by FIES year**

<b>FIES Year</b>	<b>Number of Sample Households</b>
1985	16,971
1988	18,922
1991	24,789
1994	24,797
1997	39,520
2000	39,615
2003	42,094

Source: Family Income and Expenditure Survey (FIES) Data

**Table 3.2. Regions in 1988 Family Income and Expenditure Survey (FIES)**

Region 1	Ilocos Region
Region 2	Cagayan Valley
Region 3	Central Luzon
Region 4	Southern Tagalog
Region 5	Bicol Region
Region 6	Western Visaya
Region 7	Central Visayas
Region 8	Eastern Visayas
Region 9	Western Mindanao
Region 10	Northern Mindanao
Region 11	Southern Mindanao
Region 12	Central Mindanao
Region 13	National Capital Region
Region 14	Cordillera Autonomous Region (CAR)

Source: Family Income and Expenditure Survey (FIES) Data

Households are also categorized by per capita income deciles at the national and regional levels in the case of regional profiles. Accordingly, households were first ranked nationwide according to their per capita income and then categorized into the income deciles. This classification was maintained even in the regional profiling of saving behavior. Household saving rather than aggregate saving is the focus of this paper. This treatment allows the analysis of saving behavior under the life cycle model and for the different per capita income deciles and by region. The FIES data supports these objectives. Aggregate saving computed from macro-economic data such as Gross Domestic Product (GDP), Regional GDP (RGDP) and the flow of funds data cannot provide micro-level data needed for such an analysis. This is the same reason for the use of Attanasio and Szekely (2001) of household saving rather than aggregate saving.

The following operational definition of household saving and saving rate, respectively, is used in the study:

$$1. \text{ Saving} = (\text{Aggregated income of all households} - \text{Aggregated expenditure of all households})$$

$$2. \text{ Saving rate} = \frac{(\text{Aggregated income of all households} - \text{Aggregated expenditure of all households})}{\text{Aggregated income of all households}} \times 100$$

Total Family Income and Total Family Expenditure of the FIES were used in computing saving and saving rate. Total Family Income includes total wages and salaries, pensions, dividend from investments, interests, rentals, cash receipts/gifts/support from

domestic and international sources, net share of crops, and income from family sustenance activities as well as receipts from others sources not elsewhere classified.

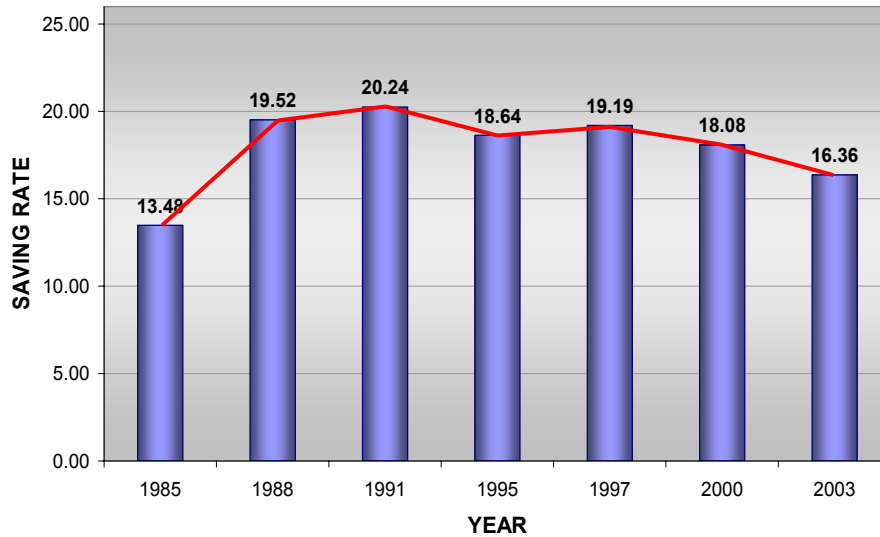
The definition of saving used in this paper has been fully discussed (e.g., Attanasio and Szekely, 2001). However, as in other studies, this definition of saving has been used due to the limitations in the collection of data of household consumption of durables. Another operational definition of saving is to take out from expenditures durables and other items which may be viewed as household investment. In the FIES questionnaire, however, no dis-aggregation of such items is done.

In order to compare savings across FIES years, the data was deflated using the consumer price index (CPI) (1997=100). Further, the Cost of Living Index (reference=NCR) developed by the Asia Pacific Policy Center was used to adjust savings to compare it across the regions.

### **A. Saving Rate**

Based on 2003 FIES, household saving rate nationwide is 16%. In 1997, it was 19%. This is lower than the recorded household saving rate of Thailand of 30% and Taiwan of 49% in 1996 (Attanasio and Szekely, 2001). Recent years' saving rates are higher than the 1985 level. However, from 1997, a downward trend is noted, as shown in Figure 3.1.

**Figure 3.1. National saving rate, FIES Years 1985 to 2003**



Source: Family Income and Expenditure Survey Data

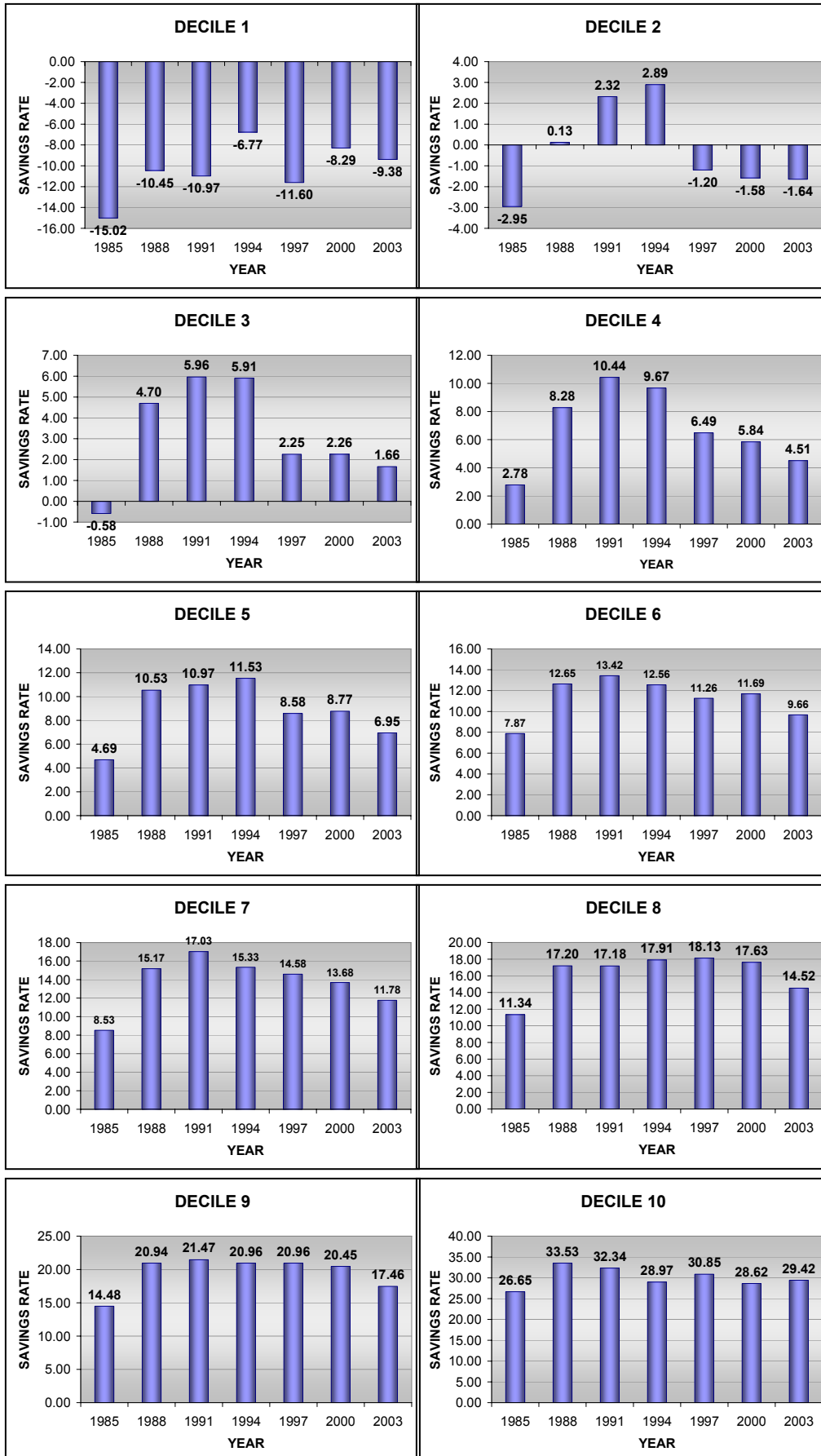
The downward trend in household saving is generally reflected by the saving rates across the different national per capita income deciles, except for the highest income decile, whose saving rate increased in 2003 from 2000. Table 3.3 further shows that the bottom 20% is dis-saving. It is also noted from this table that the top 10% saving rate is 1.7 times that of the second 10% and is more than twice that of the other income deciles. Table 3.3 and Figure 3.2 present the saving rates and visual illustration of the saving patterns, respectively.

**Table 3.3. Household saving rate by FIES year and national per capita income decile**

FIES Year	National Per Capita Income Decile									
	1	2	3	4	5	6	7	8	9	10
<b>1985</b>	-15.02	-2.95	-0.58	2.78	4.69	7.87	8.53	11.34	14.48	26.65
<b>1988</b>	-10.45	0.13	4.70	8.28	10.53	12.65	15.17	17.20	20.94	33.53
<b>1991</b>	-10.97	2.32	5.96	10.44	10.97	13.42	17.03	17.18	21.47	32.34
<b>1994</b>	-6.77	2.89	5.91	9.67	11.53	12.56	15.33	17.91	20.96	28.97
<b>1997</b>	-11.60	-1.20	2.25	6.49	8.58	11.26	14.58	18.13	20.96	30.85
<b>2000</b>	-8.29	-1.58	2.26	5.84	8.77	11.69	13.68	17.63	20.45	28.62
<b>2003</b>	-9.38	-1.64	1.66	4.51	6.95	9.66	11.78	14.52	17.46	29.42

Source: Family Income and Expenditure Survey Data

**Figure 3.2. Household saving rate by FIES year for different income deciles**





## **B. Life Cycle Profiles**

The FIES data collected by the National Statistics Office (NSO) is a pooled data of households where a sample of predetermined number of households is collected every three years. The FIES series does not collect genuine panel data of household, that is, following the same household through time. The lack of panel data creates a problem in the analysis of household saving since saving is a dynamic phenomenon. To prevent this problem, the researcher made use of the synthetic cohort techniques pioneered by Browning, Deaton and Irish (1985) and adopted by Attanasio and Szekely (2001) in their analysis of household saving in East Asia and Latin America.

The basic idea of the synthetic cohort analysis is to follow the average behavior of group of households, rather than the individual household. The group membership is assumed to be fixed over time. This strategy allows the author to study the dynamic behavior of the average household saving rates through time. In the study of the aggregate household saving, the synthetic cohort analysis is use, by grouping the different households, according to the age group of the household head, from different FIES years (1985 to 2003) and the average behavior of these groups are assumed representative of cohort behaviors through time. This type of analysis is, however, not immune to problems as pointed out by Attanasio and Szekely (2001), particularly the endogeneity of family formation and dissolution, differential mortality and migration rates across the different socio-economic groups.

Table 3.4 shows the national saving rate by age group. It is noted that those aged 85 and above are the ones with the higher saving rates. The regions with the highest saving rates in these age groups are Ilocos Region, Western Visayas, and Southern Luzon. Those aged 70 to 74 follow with a nationwide saving rate of 24.6%. The region having the highest saving rate for this age group is NCR. The next age groups with saving rate 20% or more are those within 50 to 64. The regions with the highest saving rates for these age groups are Southern Mindanao, NCR, and Northern Mindanao. In younger age groups, the regions with highest saving rates are Eastern Visayas, Ilocos Region, CAR, and NCR.

**Table 3.4. Nationwide Saving Rate, by Age Groups: FIES Years 1985-2003**

<b>Age Group</b>	<b>Average Saving Rate for all Regions</b>	<b>Highest Regional Saving Rate</b>	<b>Region with Highest Saving Rate</b>
<b>15-19</b>	11.1	30.1	Eastern Visayas
<b>20-24</b>	14.5	20.8	Ilocos Region
<b>25-29</b>	14.0	18.3	Cordillera Autonomous (CAR)
<b>30-34</b>	15.5	19.6	National Capital (NCR)
<b>35-39</b>	14.9	19.2	Cordillera Autonomous (CAR)
<b>40-44</b>	15.7	19.4	Eastern Visayas
<b>45-49</b>	17.4	20.7	Cagayan Valley
<b>50-54</b>	20.3	32.8	Southern Mindanao
<b>55-59</b>	21.8	26.0	National Capital (NCR)
<b>60-64</b>	22.0	32.2	Northern Mindanao
<b>65-69</b>	18.0	26.8	Cordillera Autonomous (CAR)
<b>70-74</b>	24.6	32.2	National Capital (NCR)
<b>75-79</b>	18.9	27.5	Central Mindanao
<b>80-84</b>	19.0	28.9	Western Mindanao
<b>85-89</b>	21.3	30.2	Ilocos Region
<b>90-94</b>	22.2	32.3	Western Visayas
<b>95-99</b>	28.7	37.2	Southern Luzon

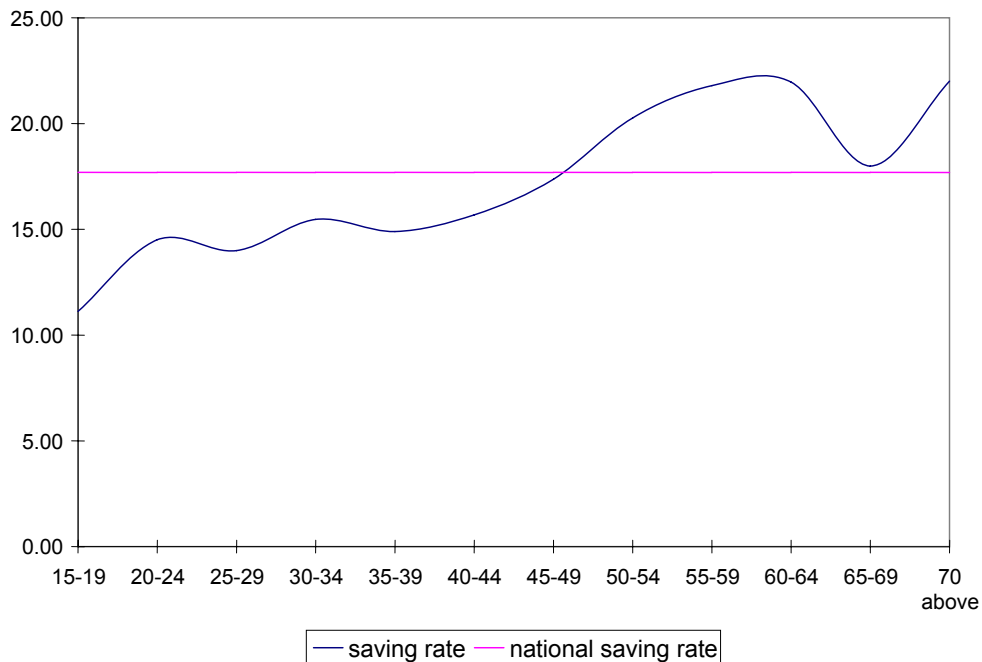
Highest Saving Rate = 28.7; Lowest Saving Rate = 11.1; Standard Deviation = 4.4; C.V. = 23.5

Source: Family Income and Expenditure Survey Data

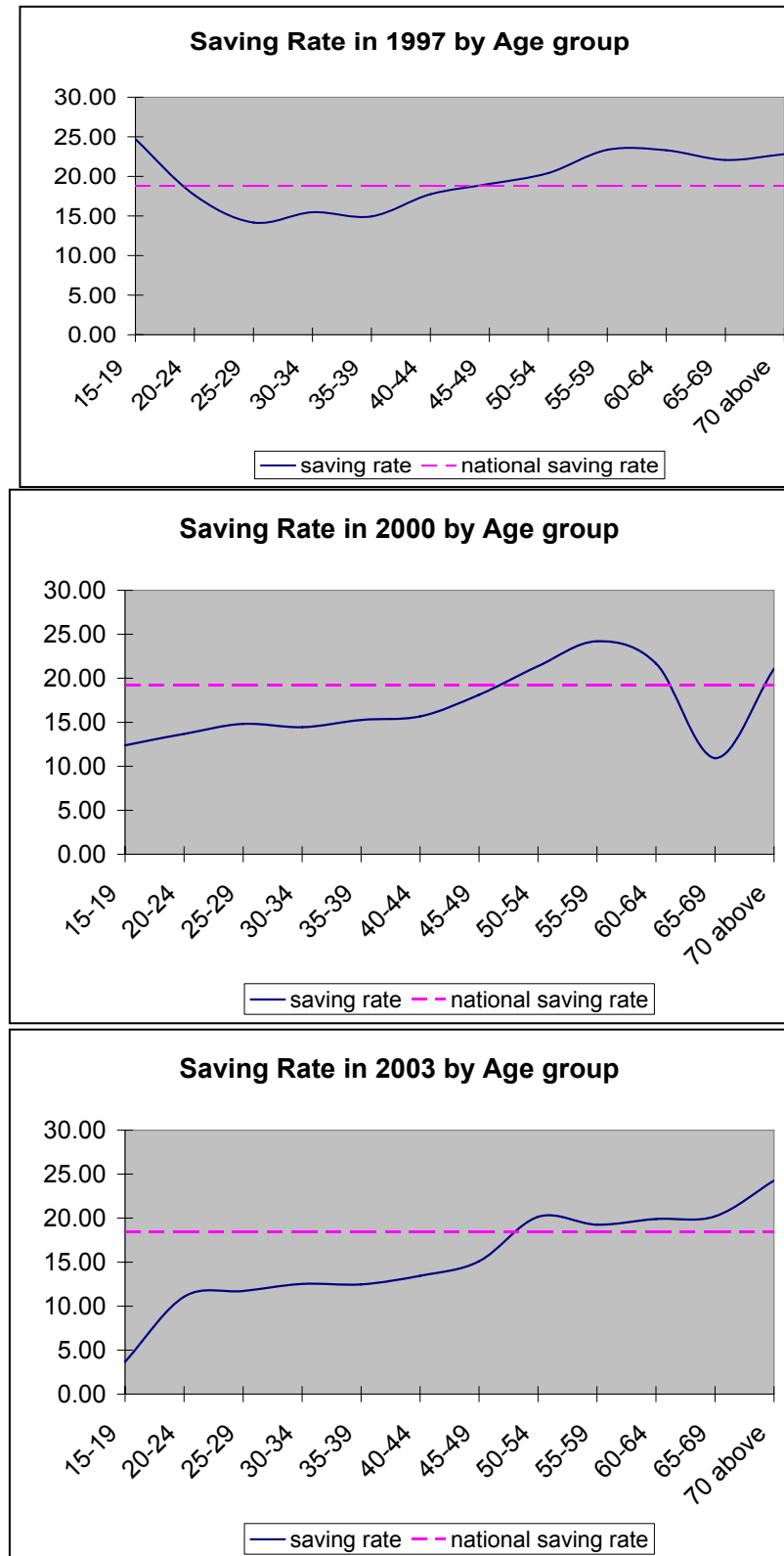
The life-cycle model was validated by the FIES data as shown in Figure 3.3, except for the age group 70 years and above, that failed to exhibit the expected dis-

saving. The information in this figure is derived from the data for the FIES years 1997 to 2003. It should be highlighted that the saving rate peaked at the age group 50 to 64 years, which is relatively late compared to Thailand and Taiwan. In both these countries, saving starts its peak at 40 to 44 years. The 2000 Census of Population and Housing revealed that seventy two per cent (72 per cent) of the Philippine population is aged 34 years and below, while only 8 per cent belonged to the age group, 50 to 64 years. Thus, the household saving rate was substantial at least for the years covered by this analysis.

**Figure 3.3. Household Saving Rate by Age Group of Head of Household (1997 to 2003)**



**Figure 3.4. Household Saving Rate by Age Group of Head of Household (by FIES Years, 1997, 2000, 2003)**



The upward blip of saving rate for age group 70 years and above appears to hold using annual data as shown in Figure 3.4. In 1997, the life-cycle pattern of saving peaked at age group 55 to 59 years. The other deviation of the 1997 data was that the age groups 15 to 19 and 20 to 24 years saved more compared to the older age groups. Except for this, the annual data for 2000 and 2003 had younger age cohorts saving less and older age groups having higher saving rates.

#### **IV. Econometric Models for Saving Rate**

This section discusses the theoretical framework of the econometric model for saving rate. The set of possible explanatory variables are identified, based primarily on the life cycle model, and augmented with other determinants of saving rate as suggested by the available literature on saving.

The standard theoretical model that explains much of household saving behavior is the so-called inter-temporal utility optimizing agent model (commonly known as the life-cycle model). In this model, the household chooses its current consumption and saving, and an asset portfolio, so as to smooth its utility over time. There are several representations of this standard theory and the one provided here follows that of Coleman (1998).

In this model, the household solves the following problem:

$$\begin{aligned} & \max_{C_t, A_t} E_t [U(C_t, C_{t+1}, \dots, C_T; B) | Z_t, Z_{t+1}, \dots, Z_T] \\ & \text{s.t.} \quad C_{t+s} + A_{t+s+1} = Y_{t+s} + (1 + r_{t+s})A_{t+s} \end{aligned} \quad (i)$$

where,  $C_{t+s}$  is the consumption at time  $(t + s)$ ;

$Y_{t+s}$  is the income at time  $(t + s)$ ;

$A_{t+s}$  is the asset held at the beginning of the period  $(t + s)$ ;

$Z_{t+s}$  are variables affecting utility of consumption such as household size;

$B$  is a bequest left to younger generation,  $B \geq 0$ ;

$r_{t+s}$  is the interest rate at time  $(t + s)$ ;

$U$  is the utility function; and,

$E_t$  is the expectation operator taken at time  $t$ .

The utility function  $U$  is assumed to be inter-temporally additive,

$$U((C_t, C_{t+1}, \dots, C_T; B) | Z_t, Z_{t+1}, \dots, Z_T) = \sum_{s=0}^T \beta^s v(C_{t+s}). \quad (ii)$$

This particular assumption means that consumption is enjoyed when it takes place and is independent of consumption at other times. The discount rate  $\beta$  indicates the patience of the consumer and is assumed to be less than 1 indicating that households prefer a marginal peso spent now than a marginal peso spent later.

The utility function  $v(C_t, Z_t)$  is assumed to be quadratic in which households are risk-neutral. The model is known as the certainty equivalence model (Hall; 1978). If we

let,  $v(C_t, Z_t) = v(C_t/\alpha(Z_t))$ , where  $\alpha(Z_t)$  is an equivalence scale for the demographics characteristics of the household, the solution to the maximization problem above equates marginal discounted marginal utility across time:

$$\frac{\partial v(C_t / \alpha(Z_t))}{\partial C_t} = E_t \left[ \beta(1+r) \frac{\partial v(C_{t+1} / \alpha(Z_{t+1}))}{\partial C_{t+1}} \right] \quad (\text{iii})$$

The equation above implies that optimal consumption depends solely on the person's level of impatience and lifetime resource, the marginal propensity to consume from current income is the same as the marginal propensity to consume from expected future income (for instance, young people expecting higher income later in life will borrow against this income). In each period, the household plans to equate discounted consumption over time and in making that decision, what is important is the household's lifetime income and not current income. Moreover, when  $\alpha(Z)$  varies over the lifecycle, consumption varies accordingly--rising when there are children and falling as children becomes independent.

There are several shortcomings of the model above. For one, the elderly do not seem to dis-save nearly as much as the model predicts. In fact, empirical evidence suggests that the elderly do save. Researches suggest that rising longevity plays an important role in determining national savings. Lee, Mason and Miller (1998, 2000) and Bloom, Canning and Graham (2003) argue that elderly do not dis-save that much as what the lifecycle model predicts, primarily because of the need to finance a longer period of retirement (the precautionary motive). These observations have been documented using

household data from East Asia. It is therefore important that empirical models of aggregate saving include longevity as determinant.

Moreover, there is evidence pointing that liquidity constraints matter. For example young people do not borrow against future income because they are concerned that they may not earn what they expect later in life (Coleman, 1998). Also, there is an important issue of the bequest motive for saving and accumulating wealth. It is also important to understand why bequests are made since empirical evidence suggests that a large portion of accumulated capital stock results from bequests.

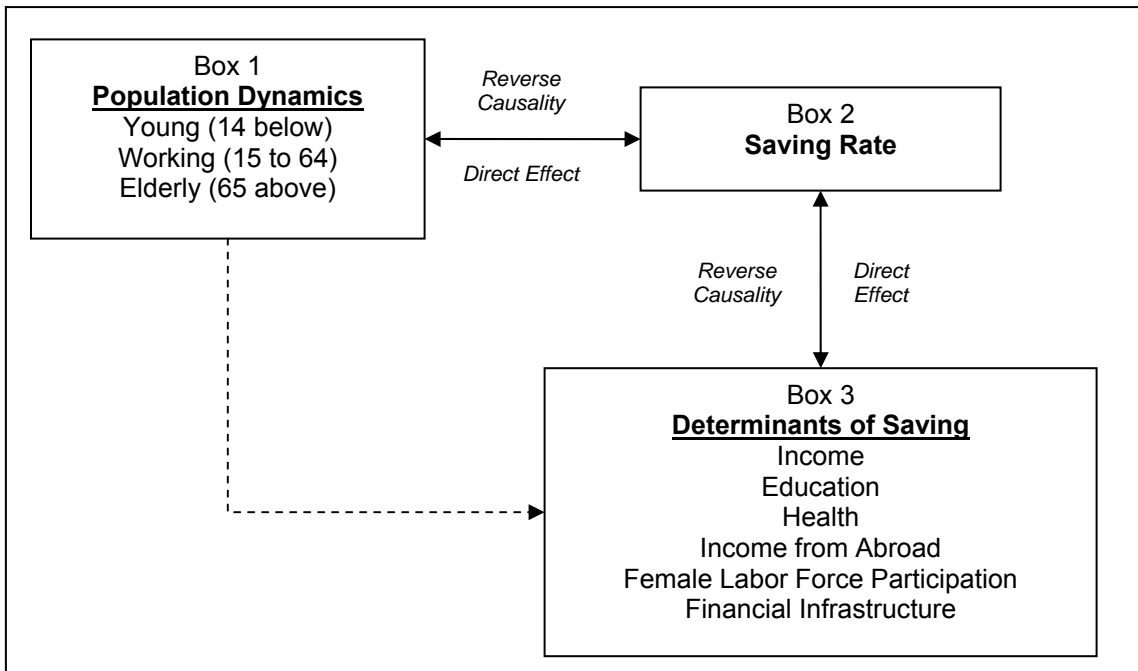
Despite the shortcomings of the life-cycle model of saving behavior, it is still useful in providing a picture as to why people save. It seems that many individuals, especially the better educated, tend to smooth their consumption over their lifetime. Moreover, people do partly save for retirement. However, augmentation of the model to capture some of its shortcomings is needed and might be useful from the point of view of policy.

The framework of the econometric model is given in Figure 3.5. The econometric model estimates the direct effect of the population dynamics, particularly the impact of the young population (0 to 14 years) and the elderly population, on the household saving rate (the impact of the first box on the second box). At the same time, the model also estimates the effects of other determinants of saving rate (the impact of box 3 on the second box). The reverse causality is represented by the arrow coming from growth (box



2) going to the population dynamics (box 1) and the other determinants of growth, notably education (lower box). This reverse causality creates a problem in the estimation of the regression model, resulting to biased and inconsistent estimates. This problem is remedied through the introduction of instrumental variables into the regression equation.

**Figure 3.5. Theoretical Framework of the Econometric Model**



The basic econometric model for aggregate saving is the two-way error component fixed effects model where,

$$y_{it} = \alpha_i + \lambda_t + \underline{x}_{it}' \underline{\beta} + \varepsilon_{it} \quad i = 1, 2, \dots, 14 \quad \text{and} \quad t = 1, 2, \dots, 6$$

In here,  $y_{it}$  is the saving rate of Region  $i$  in time  $t$ , the vector  $\underline{x}$  represents the determinants of saving discussed above,  $\underline{\beta}$  is the vector of coefficients,  $\alpha_i$  represents the

regional and unobservable fixed effect,  $\lambda_t$  denotes the unobservable time effect and  $\varepsilon_{it}$  is the random error term assumed to be normally distributed with mean 0 and constant variance  $\sigma_\varepsilon^2$ . The coefficient  $\beta$  is estimated using the Generalized Least Squares (GLS).

### A. Variable of Interest

The variable of interest in the econometric model of saving rate is the aggregate regional household saving rate from 1988 to 2003. The variable is defined as,

$$S_{it} = \left( \frac{I_{it} - C_{it}}{I_{it}} \right) * 100 \quad \begin{array}{l} i = 1, 2, \dots, 14 \\ t = 1, 2, \dots, 6 \end{array} \quad (iv)$$

where  $S_{it}$  is the aggregate household saving rate of the  $i^{\text{th}}$  region at time  $t$ ;

$I_{it}$  is the aggregate (total) household income of the  $i^{\text{th}}$  region at time  $t$ ; and,

$C_{it}$  is the aggregate consumption (expenditure) of the  $i^{\text{th}}$  region at time  $t$ .

The data source for the aggregate regional household saving rate is the Family Income and Expenditure Survey (FIES) done in 1988, 1991, 1994, 1997, 2000 and 2003 (time periods). The data set is a panel data with 6 time periods corresponding to the FIES years and 14 cross-sectional units equivalent to the 14 Regions as defined in 1988. Although there are currently 17 Regions, the geographical boundaries of the regions were kept constant throughout the period 1988 to 2003. The 14 Regions as defined in 1988 are as follows:

Ilocos Region	Eastern Visayas
Cagayan Valley	Western Mindanao
Central Luzon	Northern Mindanao
Southern Tagalog	Southern Mindanao
Bicol Region	Central Mindanao
Western Visayas	National Capital Region
Central Visayas	Cordillera Administrative Region

## B. Determinants of Aggregate Saving

In the construction of an econometric model for the saving rate, defined above, the following variables are identified as possible determinants.

### 1. Age Structure/Demographics

The average saving rate can be written as the sum of the savings rate of the different age groups in a population weighted by their income shares. That is, the average savings rate is,

$$\bar{s} = \sum_{i=0}^T s_i \frac{Y_i}{Y} = \sum_{i=0}^T s_i \frac{P_i}{P} \frac{y_i}{\bar{y}} \quad (v)$$

This decomposition suggests that the age structure of the population matters. In theory (in absence of a bequest motive), the dis-saving of the old should offset the saving of the young so that in a stable population there will be no aggregate saving. However, As argued by Bloom, Canning and Graham (2002), if the age structure of the population is unbalanced, which happens during a demographic transition, the saving behavior of the various cohorts does not cancel out and aggregate saving (or dis-saving) is expected.

The variables to be used to represent age structure (at the beginning of the period) are the youth share of the population and the elderly share of the population and are defined as follows:

- i. Percentage of Young Dependents (aged 0 to 14 years), over the total population, at the beginning of the period; and,
- ii. Percentage of the Elderly (aged 65 and above), over the total population, at the beginning of the period.

## **2. Level of Education**

Empirical evidence suggests that schooling transition towards higher levels is one reason for the diverging saving patterns between Latin American countries (Mexico and Peru) and East Asian countries (Thailand and Taiwan). More educated individuals usually have higher incomes, and thus, higher saving capacity and this may be the potential factor behind differences in domestic saving.

- iii. The percentage of household heads having at least high school diploma would be used to capture the effects of education to aggregate saving.

## **3. Female Labor Force Participation**

Fertility and female labor participation are usually jointly determined, and they have a double effect on saving behavior--lower fertility rates imply fewer children in the average household, while higher participation implies more household members in the work force and thus, more income.

- iv. To capture this effect, the percentage of women (15 years and above) in the labor force would be used.

#### **4. Longevity**

In addition, longevity raises the saving rates of every age group. This suggests that an addition of some function of life expectancy to the relationship is necessary.

- v. Life Expectancy (at birth) in years (at the start of the panel period) would, therefore, be added in the econometric model as a possible determinant of aggregate saving.

#### **5. Growth Tilting**

Economic growth increases the relative income of the young and it not only increases the average savings but also increases the effect of having a large young cohort. This leads to a phenomenon known as “growth tilting”, making the impact of a large young cohort on saving larger in a fast-growing economy.

- vi. To capture the effect of this determinant, annual average growth rate of per capita Gross Domestic Product (in 1985 prices) over the previous 5 years (in percent) of the period (example for 1988 panel, the average growth rate of GDP from 1983 to 1987 was used) will be used.

#### **6. Inflation**

Periods of high inflation tend to be associated with highly negative real rate of interest and may deter opportunities for saving.

- vii. Therefore, annual regional inflation rate (in percent) will be added in the econometric model as determinant of aggregate saving.

## **7. Presence of the Financial Infrastructure**

Presence of financial infrastructure in the regions, such as number of banks, investment houses and other financial institutions can promote saving among households. However, problems encountered by these financial institutions such as closed banks can create a negative perception among the households and may be a disincentive for saving. In the econometric models, the researcher use appropriate proxies to measure the presence of financial infrastructure in the regions.

- viii. The presence of financial infrastructure in the regions is measured using the average number of branches of banks in the region (using the average of three years: the FIES year, a year before and after the FIES year); and
- ix. The number of closed banks during the same three years was also included as a determinant of saving rate.

## **8. Initial Level of Income/ Initial Level of Income Growth**

The magnitude of life-cycle savings may depend on the region's income level (or initial income growth level) to capture the relationship of life-cycle saving with the level of regional development.

- x. The natural logarithm of the initial regional per capita GDP (measured in 1985 prices) shall be used to capture this relationship.

## **9. Remittance (Income transfer from abroad)**

The model is also interested in looking at the contribution of remittances to the saving of the households. The data source for income transfer is the FIES.

xi. Percentage of income from abroad defined as aggregated household income (assistance) from abroad over total household income would be included in the model.

## **10. Institutional and Cultural Differences**

The institutional and cultural differences across regions can be accounted for by allowing regional fixed effects in the estimation.

## **IV. Empirical Analysis of the Model**

The average regional household saving rate from 1988 to 2003 is 18.48% (Table 3.5). In 2003, the average household saving rate was even lower at 16.36%. The household saving rate of the Philippines pale in comparison with its neighboring countries in East Asia such as Thailand and Taiwan where the household saving rates were recorded at 30% for Thailand (in 1996) and 49% in Taiwan (in 1996).

**Table 3.5. Summary Statistics for the Variables in the Econometric Model**

VARIABLE	Mean	Maximum	Minimum	Std Dev.
Saving rate	18.48	25.72	9.4	3.46
Log of initial income	9.15	10.33	8.49	0.44
Education	36.37	62.14	22.82	9.05
Percentage of young dependents	39.2	45.43	32.06	3.24
Percentage of Elderly	4.54	6.61	2.2	1.17
Log of Life Expectancy	4.18	4.26	4.09	0.04
Female Labor Force Participation	49.46	64.86	34.94	5.92
Household Income from Abroad (in %)	7	15.16	1.21	3.45
Inflation Rate	7.81	16.43	0.7	3.45
Number of Banks	410	2651	65	526
Number of Closed Banks	3.34	3.83	0	19

To explain what drives household saving rate, an econometric model was built using panel data. The results of the two specifications using the Generalized Least Squares (GLS) are provided in Table 3.6.

**Table 3.6. Determinants of Regional Household Saving Rate (a)**

Dependent variable is aggregate regional household saving rate.  
(Panel Data; Fixed Effects Model).

Variable	MODEL 1		MODEL 2	
	Coefficient	s.e. <sup>α</sup>	Coefficient	s.e. <sup>α</sup>
Log of initial income	5.3985**	2.6732	6.9796*	2.8851
Education	0.2734*	0.153	0.2728	0.1643
Proportion of young dependents	-0.3645**	0.1743	-0.3747*	0.2078
Proportion of elderly	2.37989***	0.5592	2.1166***	0.6841
Female labor force participation	-0.0373	0.0933	-	-
Log of life expectancy	22.5994	22.8262	-	-
Percentage of Income from abroad	0.5559***	0.2306	0.4405**	0.1941
Inflation Rate	-	-	-0.1977	0.1957
Constant	-134.95	89.6475	-54.7563*	29.9182
N	84		84	
Adjusted R-squared	0.69		0.7	

\*\*\* significant at 1%; \*\* significant at 5%; \* significant at 10%;  
α: standard errors are White's heteroskedasticity consistent

In Model 1 (base model), the determinants include initial per capita GDP, level of education, the demographic variables, female labor force participation, longevity variable



(life expectancy), and the proportion of income from abroad. The two demographic variables have significant but opposite signs. On one hand, the percentage of young dependents has a negative and significant effect on saving rate which is consistent with the life cycle model and supports earlier studies that slowing population growth has been associated with high savings in East Asia (Harrigan, 1998). On the other hand, the percentage of the elderly population has a significant but positive effect on saving rate. Under the life-cycle model, in the absence of bequest motive, the elderly population should be dis-saving. However, the data from the regional panel say otherwise. The result for the elderly population in the model runs in contrast with the result of the cross-country saving rate regression where it was found that “presence of large proportion of elderly people in the population depresses saving rate, with the effect of the old being particularly large” (Bloom, Canning and Graham; 2002). The income and education variables have both positive and significant effects on saving rate which are consistent with the earlier studies. The percentage of income from abroad is also positive and significant driver of saving rate, while the female labor force participation and measure of longevity are not significant.

Another variation of the model is given in Model 2 where the inflation rate is incorporated into the regression model and the two insignificant variables (female labor force participation and life expectancy) excluded from the model. The results show that inflation rate does not play a significant role in determining aggregate saving rate.

A potential problem in the regression specification is the potential reverse causation from the saving rate to the level of income. Growth studies have shown that

saving rate is a key variable in determining the speed of economic growth and the steady state level of income. There is also potentially a feedback from saving to education, implying that higher saving may give rise to higher level of education. To solve the problem, we use instrumental variables, treating income and education as potentially endogenous. The instrumental variables used are initial geographical conditions (percentage of provinces in the region that are landlocked), percentage of households with access to electricity and measures of inequality.

Table 3.7 shows two specifications of the models using instrumental variable regression. In model 3, the number of closed banks is incorporated to include presence of financial infrastructure (other variants of the model which also included the number of bank branches in the region but was found to be insignificant).

**Table 3.7. Determinants of Regional Household Saving Rate (b)**

Dependent variable is aggregate regional household saving rate.  
(Panel Data; Fixed Effects Model, Instrumental Variable).

Variable	MODEL 3		MODEL 4	
	Coefficient	s.e. <sup>α</sup>	Coefficient	s.e. <sup>α</sup>
Log of initial income	6.9440**	2.711	6.9795**	2.8851
Education	0.2674*	0.1573	0.2703*	0.1508
Proportion of young dependents	-0.3322**	0.1626	-0.3406**	0.1395
Proportion of elderly	2.0694***	0.6106	2.0273***	0.5498
Percentage of Income from abroad	0.4727***	0.1744	0.5054***	0.1565
Inflation Rate	-0.2076	0.2001	-0.2001	0.1952
Number of Closed Banks	0.0015	0.0842	-	-
Constant	-53.93**	22.99	-53.9899**	25.2887
N	84		84	
Adjusted R-squared	0.7		0.7	

\*\*\* significant at 1%; \*\* significant at 5%; \* significant at 10%;  
α: standard errors are White's heteroskedasticity consistent

The results in models 3 and 4 are somewhat the same as the previous two models with level of income, education, percentage of young dependents, percentage of the elderly and percentage of income from abroad as being significant drivers of saving rate.

The econometric model suggests that average per capita income is positively and statistically related to saving rate, supporting the life-cycle hypothesis. The results from model 4 (the preferred model) shows that a 100-peso increase in the average per capita income leads to an increase in the estimated mean saving rate by about 0.67 percentage point, all things being the same.

Education is an important determinant of saving rate, supporting earlier studies in other East Asian economies. A one-percentage point increase in the proportion of household heads with at least high school diploma increases the estimated mean saving rate by about 0.27 percentage point.

The results of the study produces mixed results when it comes to the demographic variables, with the percentage of young dependents (aged 0 to 14 years) having a negative and significant impact on aggregate household saving rate while the proportion of the elderly (aged 65 years and above) has a positive and significant impact on the aggregate household saving rate. A one-percentage point reduction in the proportion of young dependents results to an increase in the average saving rate by 0.34 percentage point, while a one percentage point increase in the proportion of the elderly results to an estimated increase of 2.03 percentage points in the average saving rate, all things being the same.

The study also confirms that remittance is one major source of aggregate household saving. A one percentage point increase in income from abroad results to an increase in the estimated mean saving rate by about half-percentage point, *ceteris paribus*. However, neither the rate of inflation (included in models 3 and 4) nor the number of banks (included in model 3) in the region plays a significant role in determining the aggregate saving rate.

## **V. Concluding Remarks**

The results of the econometric model suggest that the Philippines' population dynamics play an important role in the aggregate household's saving rate. A higher proportion of young dependents (ages 0 to 14 years) creates hindrance to the aggregate household saving, supporting the life-cycle hypothesis on saving. The country, with its rapid population growth, over the years exhibited a big bulge in the lower portion of the age pyramid that resulted to a higher percentage of young dependents compared to the working population (ages 15 to 64). The swelling of the young dependency group also increases the demand for education and health which results to lower aggregate saving. This only suggests that the country pays a high price for its high population growth through lower saving rate and consequently, lower economic growth. Achieving a slower rate of population growth should be an explicit development objective of the country. Lower rates of childrearing will substantially increase the incentives for saving as experienced by East Asian countries like Singapore, South Korea, Taiwan and Thailand.

An interesting result from the econometric model is the fact that the older population (ages 65 and above) still saves, contrary to the expectation of the life-cycle model. This phenomenon has also been documented in studies by other Asian countries such as Taiwan and Thailand. Unfortunately, in the Philippines, as in other countries, there are cases where the elderly are being victimized by various forms of “investment scams”. This suggests that efforts should be made to create awareness among the elderly regarding proper investment. The financial institutions should provide financial instruments that will fit the needs of the elderly population.

Education is also vital to increasing aggregate household saving. Policy-wise, efforts should be made to reduce the gender gap in education. These policies should encourage women to participate in the labor force.

Remittance is a major source of aggregate household saving as the econometric model shows. However, remittances can be also a disincentive for saving as these are withdrawn immediately to settle bills and as payment for consumer goods. Policy-wise, efforts should be made to encourage both the migrants and recipients to save a portion of the remittances using the formal channel. Financial institutions should develop saving products that would target the needs of the lower market migrants.

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