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# EXPLAINING THE SAVING PUZZLES IN URBAN CHINA

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This paper identifies two saving puzzles obtained from the Chinese Urban Household Survey data from 1990 to 2006. The first saving puzzle is identified by the time trend of household saving rates, which were stable before 1998, but surged subsequently. The second saving puzzle is associated with the various age profiles of household saving rates, which are not only inconsistent with the prediction of the Life Cycle Hypothesis, but also different from the patterns observed in other economies. This paper constructs pseudo-panel data and empirically examines the applicability of the habit-formation model in solving the second saving puzzle through the existence of saving rates and the effects of income-related variables. On the other hand, the parametric changes of such variables help explain the first saving puzzle. The parametric changes possibly stem from the adjustment of habit stock, the rising transitory shocks of income, and the higher expenditure needs for housing.

**JEL Codes**: D12, D91

**Keywords**: cohort analysis, household saving rates, saving rates inertia, system GMM estimates

## 1. INTRODUCTION

The high and rising aggregate saving and the low and declining share of household consumption in the gross domestic product (GDP) constitute a central feature of the Chinese economy. For example, the aggregate saving rates in China hovered slightly above 35 percent in the 1980s, climbed to 41.5 percent in the 1990s, and increased significantly from 37.5 percent in 2000 to an unprecedented 54 percent in 2009 (Yang *et al.*, 2011). From an international comparison, China's saving rates are unusually high, even after controlling for some determinants of saving rates (Kraay, 2000; Kuijs, 2006). As one of the transition economies, China has not experienced a slump of the saving rates in the first half of the 1990s observed in many transition economies from Central and Eastern European counties and the successor states of the former Soviet Union.[1] Moreover, household consumption as a share of GDP declined significantly since 1978, although such shares are expected to rise with the reforms, which is identified as a consumption

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[1]According to Schrooten and Stephan (2005), the saving rates of these economies were among the highest in the world before the transition, averaging about 30 percent, experienced a slump in their saving rates in the early transition years, and increased slightly in the later years.

puzzle by Qi and Prime (2009).[2] Similarly, Modigliani and Cao (2004) propose a saving puzzle based on the historical trend of household saving rates from 1953 to 2000, stating that household saving rates were relatively low and stable before 1978, and the rates ballooned thereafter.

In explaining the uniqueness of Chinese savings, previous studies have conducted extensive investigations from various perspectives, such as income growth (Modigliani and Cao, 2004; Horioka and Wan, 2007), demographic factors (Modigliani and Cao, 2004; Horioka and Wan, 2007; Qi and Prime, 2009), sex ratio imbalance (Wei and Zhang, 2011),[3] saving rates inertia (Horioka and Wan, 2007), precautionary saving motives (Meng, 2003), financial sector weaknesses or financial market development (Hofman and Kujis, 2006; Aziz and Cui, 2007; Qi and Prime, 2009) and government spending on health and education (Qi and Prime, 2009). Although these studies have presented some insights on Chinese savings, some debates in a number of aspects still remain.[4] Specifically, some fundamental forces shaping the special saving patterns are still not well understood. For example, Modigliani and Cao (2004) consider that household saving rates probably passed the crest around 2000. However, both household saving rates and household savings in GDP have shown significant upward trends since the end of 1990s despite the declining share of household income in GDP (Yang *et al*., 2011).

The current paper enhances our understanding of the complexity and uniqueness of China's saving problems by identifying and explaining two puzzles, derived from the Chinese Urban Household Survey (CUHS) for the period 1990–2006, when China accelerated to reshape its economic regime toward a market economy. The first saving puzzle identified in the current paper is based on the time trend of household saving rates, which were relatively stable from 1990 to 1998, at approximately 13 percent, but steadily increased from 13 percent in 1998 to 22 percent in 2006. Therefore, urban household saving behavior has undergone a paradigm shift

[2]As noted by Qi and Prime (2009), in the last two decades, China's consumption share in GDP averaged 57 percent compared with India's 75 percent, and China's household consumption averaged only 43 percent compared with India's 64 percent.

[3]Unlike conventional views on savings behavior in the consumption theory, Wei and Zhang (2011) propose a competitive saving motive to explain the rising household saving rates inspired by the high correlation between the sex ratio and aggregate saving rates (the sex ratio and aggregate saving rates, rescaled by subtracting the mean and dividing by the standard deviation, are highly correlated, and the correlation coefficient is 0.822 from 1975 to 2005), that is, the sex ratio imbalance intensifies competition in the marriage market. Households with a son ratchet up their savings rates with the expectation of improving their son's odds of finding a wife. Meanwhile, it has a spillover effect on families with a daughter because a desire to avoid an erosion of bargaining power by their daughter after marriage may offset a desire to free ride on a future son-in-law's savings. With the robust evidence from both household level (including both urban and rural households) and provincial level data, they prove that the rising saving rates in China are substantially explained by the rising sex ratio imbalance triggered by the competitive savings.

[4]Wei and Zhang (2011) disregard the underdevelopment of credit market as the dominant factor contributing to the rising household saving rates in China because the financial system is most likely more efficient today than a few years ago. Furthermore, they also deny the role of precautionary saving motives stemming from the pension systems and public provision of healthcare, because they have been improved since 2003. In addition, although there were dramatic changes in the urban employment institution during China's economic transition, the precautionary saving motive stemming from unemployment risk does not seem to explain well the surge in household saving rates since 2000 because of the employment uncertainty associated with the reforms of state-owned enterprises, which reached its peak in the later 1990s (Yang *et al*., 2011).

since 1998, which has not been noticed by previous studies. The second saving puzzle to be addressed in the current research is related to the unique life cycle pattern of household saving rates, such as the cohort-specific age profiles, cross-sectional age profiles in some selected years, and the age effect profile estimated by the age–cohort–year decomposition, which is not only in conflict with the general prediction of standard consumption theories, such as the Life Cycle Hypothesis (LCH) or the Permanent Income Hypothesis (PIH), but also significantly differs from the patterns observed in some economies. For example, the cohort-specific age profiles of household saving rates have shown stable upward trends over years, even for the old cohorts; the cross-sectional age profiles do not consistently follow a humped-shaped pattern; and the age effect profile estimated by the age–cohort–year decomposition tends to be incremental with the age of household head.

Prior to analyzing household saving behavior, the current work presents the life cycle patterns of household demographic attributes and household income, considering that these factors are recognized as two important determinants of saving rates (Modigliani and Cao, 2004; Horioka and Wan, 2007). For demographic variables, their cohort patterns indicate significant demographic transition among cohorts. For household income, the current work conducts cohort analysis by two alternative econometric specifications, involving Deaton's specification and the specification without controlling for inter-cohort disparity, and presents the cross-sectional age profiles in some selected years. In the age–cohort–year decomposition, the cohort-specific age profile increases over the years for all cohorts, the age effect is incremental with the age of household heads, and the cohort effect increases with the birth year of household heads. For the alternative decomposition without controlling for inter-cohort disparity, the age effect profile then show a hump-shape, and the year effect tends to increase over years. For more information on household income, the three-year averaged age profiles of household income are presented at different quintiles, namely, the 25th, 50th, and 75th, and by the mean value, and their patterns change from being hump-shaped to being relatively flat. The change in the cross-sectional age profiles can be associated with the incremental economic returns to education in urban China.

For household saving rates, similar work is conducted as for household income. In the age–cohort–year decomposition, the cohort-specific age profile, the age effect, and the cohort effect show similar patterns to those in household income. For the alternative decomposition without controlling for inter-cohort disparity, the age effect declines before 45 and then shows a hump-shaped pattern thereafter, peaking at approximately 53; and the year effect is relatively flat before 1998, but has a steadily upward trend thereafter, consistent with the pattern of aggregate household saving rates, defined as the first saving puzzle. For the cross-sectional age profiles, their patterns also vary over years. From the various life cycle patterns of household saving rates, the household saving behavior in urban China does not conform to the general prediction of the LCH model, which proposes the second saving puzzle in this paper.

In explaining the two saving puzzles, the current paper constructs synthetic panel data and explores the saving determinants through a dynamic panel analysis considering the linkage of household saving rates and household income growth, which is observed in the cohort analysis. According to the System GMM estima-

tion, the second saving puzzle can be explained by the existence of saving rates inertia and the positive effect of income-related variables on household saving rates. For the first saving puzzle, the current paper tests the parametric changes in the effect of household income-related variables on household saving rates and the strength of saving rates inertia in two sub-periods, namely 1990–98 and 1998–2006. The empirical results show that the effect of income-related variables on saving rates and the strength of saving rates inertia are higher for the period 1998–2006, explaining the first saving puzzle. The current paper also provides tentative explanations for the parametric changes from the perspective of the adjustment of habit stock with income growth, the rising transitory variance of income after the significant reconstructing of state-owned enterprises (SOEs), and a higher housing expenditure need motivated by urban housing reforms.

The present paper is organized as follows. Section 2 introduces the data used in the current work. Section 3 presents the methodology of cohort analysis, as well as the results for the cohort patterns of household demographic attributes, household income, and household saving rates. Section 4 adopts a dynamic panel analysis to examine the existence of saving rates inertia and the relationship between household saving rates and household income, and also presents some tentative interpretations on the paradigm shift in urban household saving behavior in the context of China's economic reforms. Section 5 concludes.

## 2. Data

CUHS data used in the present paper are taken from 17 consecutive annual surveys of urban households conducted by China's National Bureau of Statistics from 1990 to 2006. The data were derived from six provinces that are broadly representative of China's rich regional variation, namely Beijing, Liaoning, Zhejiang, Sichuan, Guangdong, and Shaanxi.[5] The data only include observations of urban households with registrations (*hukou*). Migrant households living in urban areas are excluded from the survey. Despite this undesirable feature, the exclusion of migrants allows us to restrict our attention to a relatively stable group of households.[6] Zhang *et al.* (2005) confirm the representativeness of the data.

The information from the CUHS data is very comprehensive. The key variables used in this paper include demographic variables, household income, household consumption, and individuals' age and birth year. "Household income" refers to disposable household income, which is total household income less personal income tax. "Household consumption" includes all expenditures on food, clothing, transportation, communication, entertainment, education, medical care, and other miscellaneous items. The current research adopts a conventional method to

[5]Beijing is a rapidly growing municipality in the north and is also the capital of China; Guangdong and Zhejiang are dynamic, high-growth provinces in China's south and east coastal regions, respectively; Liaoning is located in the northeast, one of the industrial provinces in China; and Sichuan and Shaanxi are relatively less developed provinces located in the southwest and northwest, respectively.

[6]Compared with residents with urban *hukou*, migrants suffer disadvantages in accessing public services and the social security system, which are generally connected with the *hukou* system. Thus, migrants may have a different attitude toward risk compared with residents who have urban *hukou* because of these institutional factors.

TABLE 1
SUMMARY STATISTICS OF URBAN HOUSEHOLD SAMPLES, 1990–2006

| Year | Obs. | Household Income | Living Expense | Saving Rates |
|---|---|---|---|---|
| 1990 | 3,290 | 13,896 | 11,904 | 13.3 |
| 1991 | 3,339 | 14,726 | 12,762 | 11.8 |
| 1992 | 4,186 | 15,806 | 13,569 | 12.7 |
| 1993 | 3,852 | 17,987 | 15,173 | 13.3 |
| 1994 | 3,868 | 19,687 | 16,651 | 12.4 |
| 1995 | 3,880 | 20,105 | 17,138 | 12.0 |
| 1996 | 3,866 | 20,700 | 17,313 | 13.4 |
| 1997 | 3,874 | 21,529 | 18,234 | 11.9 |
| 1998 | 3,849 | 22,771 | 18,920 | 13.2 |
| 1999 | 3,761 | 23,616 | 19,480 | 14.6 |
| 2000 | 4,183 | 25,979 | 21,083 | 14.4 |
| 2001 | 3,747 | 28,324 | 22,440 | 15.7 |
| 2002 | 10,560 | 27,880 | 21,648 | 17.7 |
| 2003 | 11,973 | 30,285 | 22,981 | 17.5 |
| 2004 | 13,125 | 33,092 | 24,905 | 19.0 |
| 2005 | 15,096 | 36,610 | 26,998 | 20.0 |
| 2006 | 14,908 | 40,053 | 28,854 | 22.2 |

*Notes*: Household income and household consumption are measured in 2006 RMB.

define household saving rates. "Household saving rate" equals one minus the ratio of household consumption to household income.

Table 1 provides summary statistics of household income, household consumption, and household saving rates. Household income and household consumption are expressed in real terms and measured in 2006 RMB. As shown in Table 1, both household income and household consumption show an evident upward trend from 1990 to 2006, in line with the economic growth of China during this period. Similarly, household saving rates tend to increase for the entire period, but with distinct trends between the two sub-periods, namely 1990–98 and 1998–2006. Household saving rates were relatively stable from 1990 to 1998, ranging from 12 to 14 percent, but the rate surged from 13.2 percent in 1998 to 22.2 percent in 2006. Corresponding to the stable growth in household income, the surge in household saving rates since 1998 proposes one "saving puzzle" to be addressed in the present paper.

Aside from the time-trend of household saving rates, other countries can also be used as a basis for comparison. According to Paxson (1996), household saving rates in urban China cannot be considered salient compared with those of some developed countries (such as the United Kingdom) and developing economies (such as Taiwan and Thailand), although the gross domestic saving rates of China are high. For example, the household saving rates in the United Kingdom ranged from 11 to 16.5 percent from 1987 to 1991 (based on household survey), which is comparable with that of urban China in the 1990s, according to Table 1. Taiwan's household saving rates in the 1980s are higher than those of urban China in the 1990s, and only in 2005 did China's urban household saving rates reach the 1989 level of Taiwan's rates.[7] Therefore, the key to understanding the saving behavior of

[7]See Table 1 (Paxson, 1996).

urban households in China lies in the pattern over years, not in the absolute level, of saving rates.

## 3. Household Income and Household Saving Rates: A Cohort Analysis

### 3.1. *Methodology*

The cohort analysis method, proposed by Browning *et al.* (1985), is widely adopted in analyzing household saving behavior over a lifetime. A "cohort" is generally defined as a group with a fixed membership over time, and observations in a given cohort are considered to display similar features. In empirical studies, the conventional definition of a cohort is based on the birth year of individuals. For each wave of data, observations can be grouped into cells by year and cohort, and the pseudo-panel data can then be constructed. Empirically, although this method is formulated primarily as a response to the absence of genuine panel data, pseudo-panel data do not necessarily offer inferior results, and this technique has advantages in relation to problems on sample attrition, errors-in-variables, and bridging gaps in microeconomic and macroeconomic studies (Deaton, 1985). Using the pseudo-panel data, the age profiles of household attributes can be drawn for each cohort, such as household demographics, household income, and household saving rates.

Aside from constructing pseudo-panel data, the cohort analysis also involves the age–cohort–year effect decomposition, used to estimate the life cycle pattern of household economic behavior, such as household income and household saving rates, and their inter-cohort disparity among different cohorts. The inter-cohort disparity is defined as the cohort effect, and the life cycle pattern is defined as the age effect (Shorrocks, 1975; Attanasio, 1988; Attanasio *et al.*, 1999; Jappelli, 1999; Deaton and Paxson, 2000). The econometric model can be written as follows:

$$(1) \qquad Z_{i,c(k-j+1),t(k)} = \alpha_{c(k-j+1)} + \beta_{a(j)} + \delta_{t(k)} + B \cdot demo_{i,c(k-j+1),t(k)} + \varepsilon_{i,c(k-j+1),t(k)},$$

where $k$ is the survey year; $j$ is individual $i$'s age; $k - j + 1$ is individual $i$'s birth year; $Z_{i,c(k-j+1),t(k)}$ is the dependent variable, which can be the logarithm of household income or the household saving rates in the present study; $\alpha_{c(k-j+1)}$ is the cohort effect; $\beta_{a(j)}$ is the age effect, showing the life cycle feature of the variables of interest after controlling for cohort effect; $\delta_{t(k)}$ is year effect; $demo_{i,c(k-j+1),t(k)}$ is the vector variable for other control variables; and $B$ is the estimated coefficient of $demo_{i,c(k-j+1),t(k)}$.

In the current study, household income and household saving rates are decomposed according to equation (1). In accordance with different dependent variables, $demo_{i,c(k-j+1),t(k)}$ is specified as follows: $demo_{i,c(k-j+1),t(k)}$ is the logarithm of the number of household earners if the dependent variable is the logarithm of household income; when the dependent variable is household saving rate, $demo_{i,c(k-j+1),t(k)}$ includes the number of household earners and family size because they jointly determine the dependency ratio for households.

Econometrically, the decomposition also involves two assumptions on age, cohort, and year variables. The first assumption rules out the cross terms among

these variables. The second assumption involves an identification problem resulting from the fixed relationships among variables. On the identification problem, the current study adopts Deaton's specification based on two constraints: (1) growth is attributed to age and cohort effects; and (2) the year effect captures cyclical fluctuations or business cycle effects subsequently, which are assumed to be orthogonal to a time trend. If the year effect is defined as $\delta_t$, $t = 1, 2, \ldots, T$, Deaton's specification can be illustrated by the following mathematical language:

$$\sum_{t=1}^{T} \delta_t \cdot d_t = 0 \quad \text{and} \quad \sum_{t=1}^{T} \delta_t \cdot t \cdot d_t = 0, \tag{2}$$

where $d_t$ is the usual dummy equal to 1 if the year is $t$, and 0 if otherwise. From equation (2), the solutions for $\delta_1$ and $\delta_2$ can be derived as:

$$\delta_1 = \sum_{t=3}^{T} (t-2) \cdot d_t \cdot \delta_t \quad \text{and} \quad \delta_2 = \sum_{t=3}^{T} (1-t) \cdot d_t \cdot \delta_t. \tag{3}$$

Substituting $\delta_1$ and $\delta_2$ into equation (1) and rewriting the year effect terms by $\delta_t$, $t = 3, \ldots, T$, the modified year dummies from $t = 3, \ldots, T$ can be obtained as follows:

$$d_t^* = d_t - [(t-1) \cdot d_2 - (t-2) \cdot d_1], \tag{4}$$

where $d_t^*$ is the modified year dummy. The coefficients of $d_t^*$ ($t = 3, \ldots, T$) yield the year effect from the third through the final year. The year effect in the first and second years can be derived according to equation (3). In the regression analysis, dummy variables identified as independent variables include the following: (1) cohort dummy variables, excluding the oldest cohort or the reference cohort; (2) age dummy variables, excluding the youngest age or the reference age; and (3) a set of $T - 2$ year dummy variables that have been constructed according to equation (4).[8]

Aside from the aforementioned econometric specification, the present work also presents an alternative decomposition model, considering that the year effect of household income cannot capture the effect of growth under Deaton's specification. The alternative decomposition model drops the cohort variables and uses the unrestricted time dummies to identify year effects.[9] The decomposition equation is then revised as follows:

$$Z_{i,c(k-j+1),t(k)} = \beta'_{a(j)} + \gamma'_{t(k)} + B' \cdot demo_{i,c(k-j+1),t(k)} + \varepsilon'_{i,c(k-j+1),t(k)}, \tag{5}$$

[8]Deaton (1997) argues that when data are abundant, allowing the data themselves to choose the profiles is advisable. However, as Deaton comments, this method is dangerous when only a few years of surveys are used because separating the trend from the transitory shocks is difficult. Therefore, only when a sufficient number of years are available can the business cycle be separated from the time trend in the decomposition work with any confidence.

[9]I am grateful to one anonymous referee for suggesting this decomposition.

where $\beta'_{a(j)}$ is the age effect, $\gamma'_{t(k)}$ is the year effect, and $B'$ is the estimated coefficient of $demo_{i,c(k-j+1),t(k)}$.

Empirically, the current study classifies cohorts according to the birth year of household heads. A five-year bandwidth is used to construct the pseudo-panel data.[10] Household heads born from 1921 to 1980 and aged between 25 and 73 are selected, and observations with very old and very young household heads are excluded.[11] In addition, the present work only maintains cells with sizes greater than 50, and there are 176 cells in total. In the decomposition work, the independent variables include 59 cohort dummy variables, 48 age dummy variables, and 17 modified year dummy variables. Thus, age, cohort, and year effects are derived from the estimated coefficients of their respective dummy variables.

### 3.2. *Household Demographic Attributes*

The number of household earners and family size are chosen to be the control variables in the age–cohort–year decompositions of household income and household saving rates, and their cohort patterns are shown in Figure 1. The following key findings are as follows. First, by comparing the middle-aged cohorts born from the 1940s to the 1950s with other cohorts, a structural change can be seen in household demographic attributes. For example, family size and the number of household earners for the cohorts younger than the cohort of 1951–55 are significantly lower than those older than the cohort of 1941–45. The structural change among cohorts reflects a demographic transition toward a low fertility rate, which is closely related to China's fertility policy.[12] By the end of the 1970s, China began to strictly implement the one-child policy in urban areas. For the cohorts born after 1950, they only began bearing children by the end of the 1970s, accompanied by significantly limited levels of fertility. Second, for the middle-aged and old cohorts, given the age profiles of the demographic variables, their downward trend can be observed, reflecting a change in household composition over a lifetime (i.e., adult children leave their parents and establish their own families). Third, for the young cohorts, the number of household earners is approximately two, and family size is approximately three, which is in accordance with China's typical family composition after the implementation of the one-child policy.

[10]In computing the cohort mean value, if the cell size of cohort-year cells is too small, the age profiles by cohorts might be highly fluctuating and deviate greatly from their actual age profiles. Hence, the general method is to select a bandwidth for each cohort to increase their cell size. The bandwidth specification has to balance the average cell size and intra-cohort heterogeneity, given the sample size. Generally, the intra-cohort heterogeneity is significant if the bandwidth is too large, especially for developing countries with high economic growth rates. For example, observations born from 1941 to 1945 can be defined as one cohort, called cohort 1941–45.

[11]Wealthier household heads could possibly live longer than their poor counterparts (Shorrocks, 1975; Paxson, 1996).

[12]China began to encourage family planning programs in the 1970s. Between 1970 and 1979, the largely voluntary "late, long, few" policy, which called for later childbearing, greater spacing between children, and fewer children, had already resulted in the halving of the total fertility rate from 5.9 to 2.9 percent. The family planning policy has been taken as a basic national policy of the Chinese government in 1982. Subsequently, around that time, a gradual yet startling decline in birth rate was observed, which more or less stabilized at approximately 1.7 percent since then (Therese *et al*., 2005).

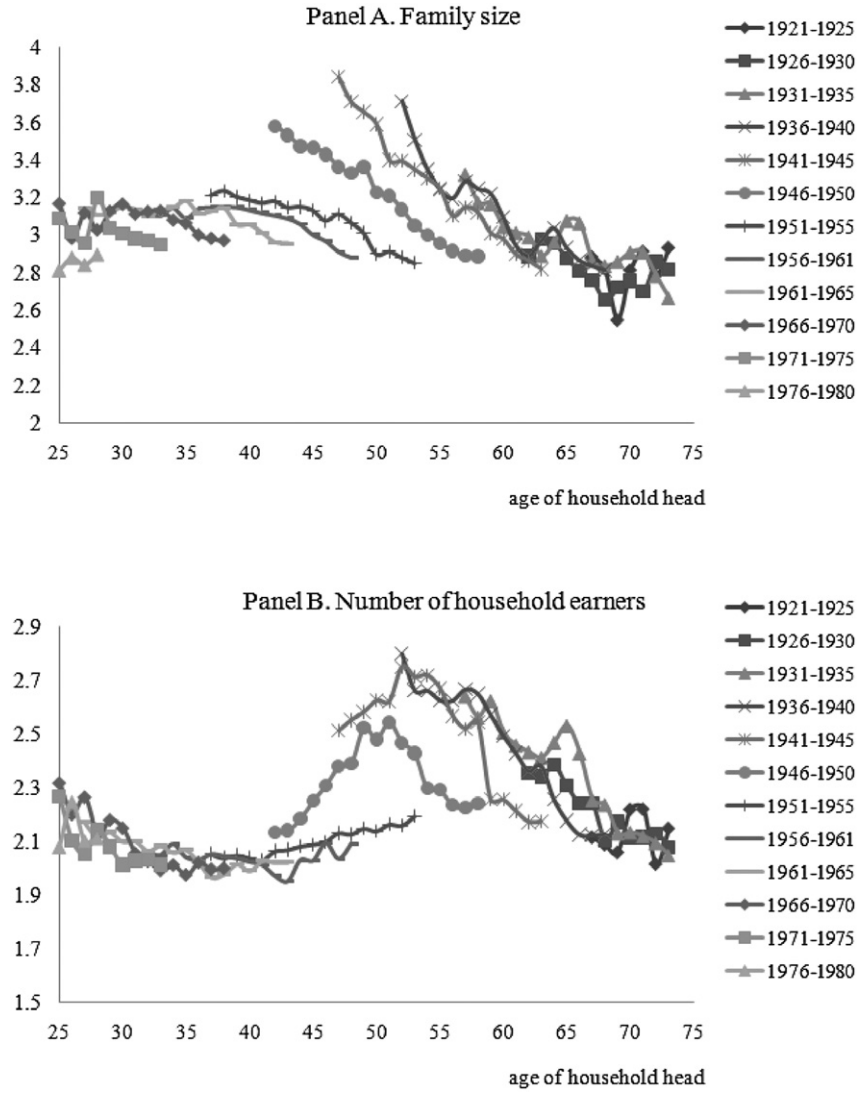


Figure 1. Household Demographic Attributes: Age Profiles by Cohorts

### 3.3. *Household Income*

#### 3.3.1. Results by Deaton's Specification

Figure 2 shows the results of the cohort analysis of household income. The cohort-specific age profiles are drawn by the logarithm value in real terms, as shown in Panel A of Figure 2. For all cohorts, household income increases steadily with household head age, indicating that urban household income continuously increases along with the economic growth in China. Specifically, the age profiles of the old cohorts, such as the cohorts of 1921–25, 1926–30, and 1931–35, do not

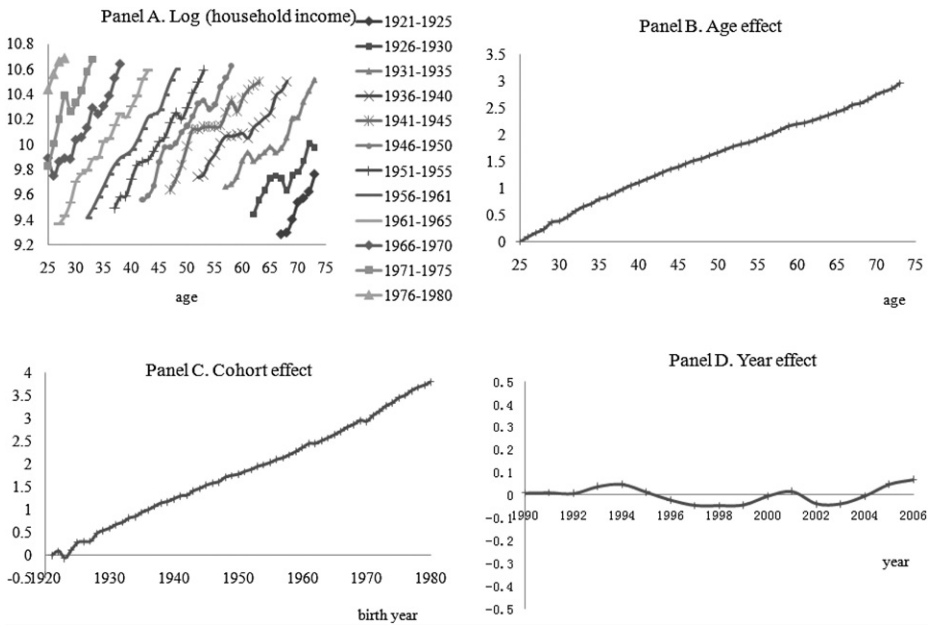


Figure 2. Household Income: Cohort Pattern and Decomposition

exhibit an obvious hump-shaped pattern, as shown in the United Kingdom, United States, Thailand, and Taiwan, according to the study of Paxson (1996). Specifically, although Taiwan has also experienced rapid economic growth in the 1970s, its household income does not exhibit an obvious increasing trend over years for old cohorts.

For the age–cohort–year decomposition results, as shown in Figure 2, the cohort effect significantly increases along with the birth year of household heads, implying that younger households are richer than their counterparts. Generally, the cohort effect of income is quantitatively related to productivity growth (Jappelli, 1999).[13] The rising cohort effect corresponds to the rising household income in urban China. The age effect tends to be incremental with the age of household heads, consistent with the rising cohort-specific age profiles, as shown in Panel A of Figure 2. Interestingly, China's case seems to be an exception compared with the cases of a number of developed countries, such as the United Kingdom (Attanasio and Browning, 1995; Paxson, 1996), United States (Paxson, 1996; Attanasio *et al*., 1999), and Italy (Jappelli, 1999), as well as several developing economies, such as Taiwan and Thailand (Paxson, 1996). For these economies, the age effects of household income generally have an inverted-U shape. The rising age effect after retirement age reflects the fact that household income, including

[13]It also has other contents from the perspective of generational disparity. For example, the social environment in which people grow up may well result in different attitudes toward risk, discount factors, and preference over the lifetime path of consumption (Ryder, 1965).

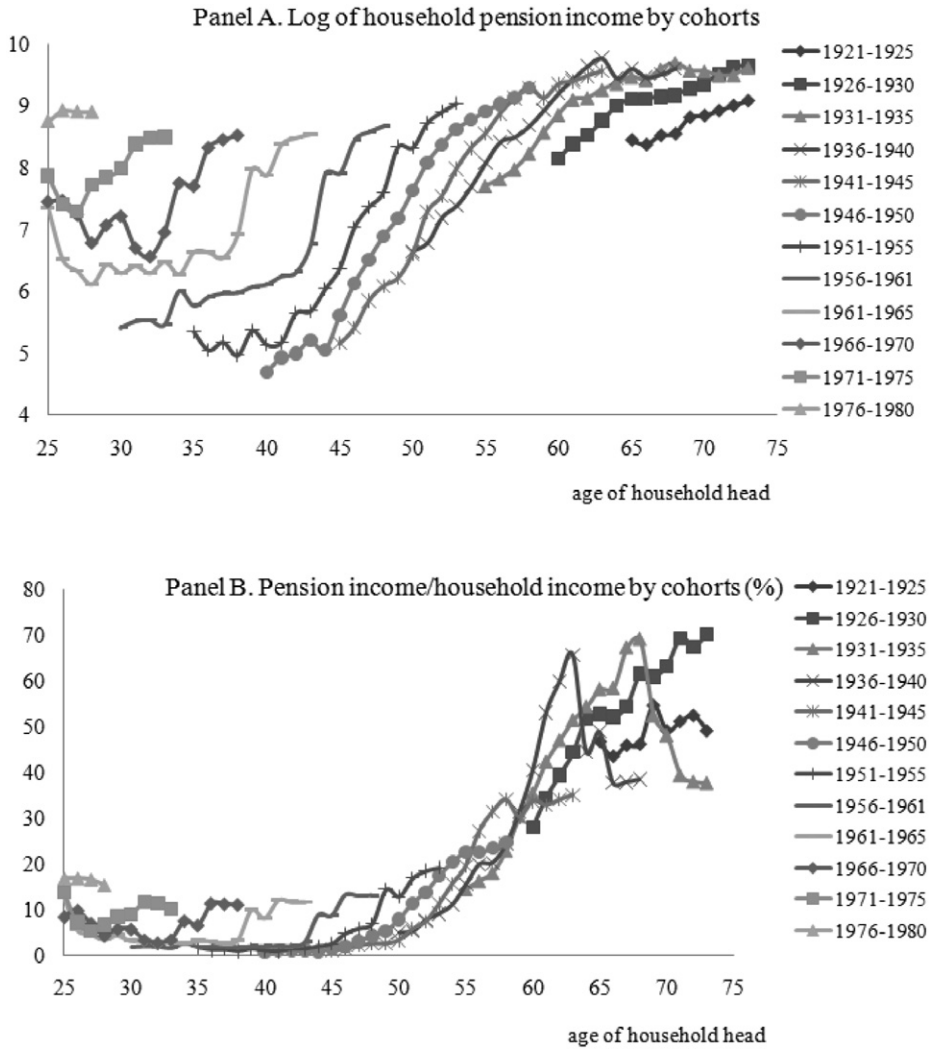


Figure 3. Pension Income/Household Income

pension income and labor income, continues to increase.[14] This finding can be explained by analyzing the structure of household income.

As illustrated in Panel A of Figure 3, household pension income shows a moderately upward trend for the old cohorts. The growth in pension income can be explained by pension institutions in China. Under a planned economy, China's pension institution is affiliated with "working unit" systems in urban areas. Moreover, the pension income of retirees is financed directly by their working units, such as SOEs and collectively owned enterprises (COEs). Under this institution,

[14]The retirement age in China is 60 for male employees and 50 for female employees (55 for female cadres).

the pension setting and adjustment for retirees are generally determined by their working years and pre-retirement wages.[15] With the reforms for SOEs, China's pension system has been reconstructed from the "working unit" to the social security system. Similar to other reforms characterized by a two-track approach, China implements differentiation policies for different cohorts. The state has built normal social security accounts similar to those in developed countries for young cohorts. For most of the old cohorts who have retired from the SOEs and COEs, the pension provision has been gradually transferred from the enterprises to the state. China has recently begun increasing pension payments to retirees.[16]

Labor income growth also contributed to household income growth for some old cohorts. In some old cohorts, whose household heads have retired, there are also adult children who earn labor income, which grows faster than pension income. For such households, the importance of pension income may decline if the labor income of adult children increases faster, causing the proportion of total household income which is pension income to decrease. In fact, the aggregate pension replacement rate, defined as the ratio of average pension per retiree to average wages per worker, declined from approximately 80 percent in the early 1990s to a range of 52–58 percent in 2007 (Yang *et al*., 2011). This also helps explain the declining proportion of pension income in total household income for the cohorts of 1931–35 and 1936–40 from 2001 to 2006, as shown in Panel B of Figure 3.

### 3.3.2. Alternative Specification

Figure 4 shows the alternative decomposition results for household income by dropping the cohort dummy variables altogether. The age effect profile shows a hump-shaped pattern from 25 to 65, but has not an obvious trend from 65 to 75, as shown in Panel A. This pattern is different from the previous one as shown in Panel B of Figure 2. The disparity in the age effect profile lies in the econometric specification. Without considering the inter-cohort disparity, the age effect profile can be considered as the average pattern of cross-sectional age profiles of household income over years. Correspondingly, the year effect reflects the trend of the mean value of household income over years. As shown in Panel B of Figure 4, the year effect consecutively increases over years, providing collaborative evidence that household income increases over years.

For more information on household income, the three-year averaged age profiles of household income are presented at different quintiles, namely, the 25th,

[15]In fact, under such a pension institution, retirees' pensions were not significantly less than their pre-retirement wages. Actually, the wage standard of employees in the planned economy had been set according to state plan, which generally tended to depress wages of employees to maintain enterprise profit for reinvestment under the strategy of national industrialization. Therefore, employees' wages could be lower under the support of the welfare system in a planned economy, and the gap between pension and pre-retirement wages was actually very small. In addition, pension adjustment was generally synchronized with the adjustment of employee wages.

[16]According to the *2007 China Statistical Yearbook*, fiscal expenditure on basic pension has grown by 17 percent in real terms from 1990 to 2006, approximately 8.7 percent per retiree. Therefore, the pension growth for retirees helps explain the upward age effect after retirement age.

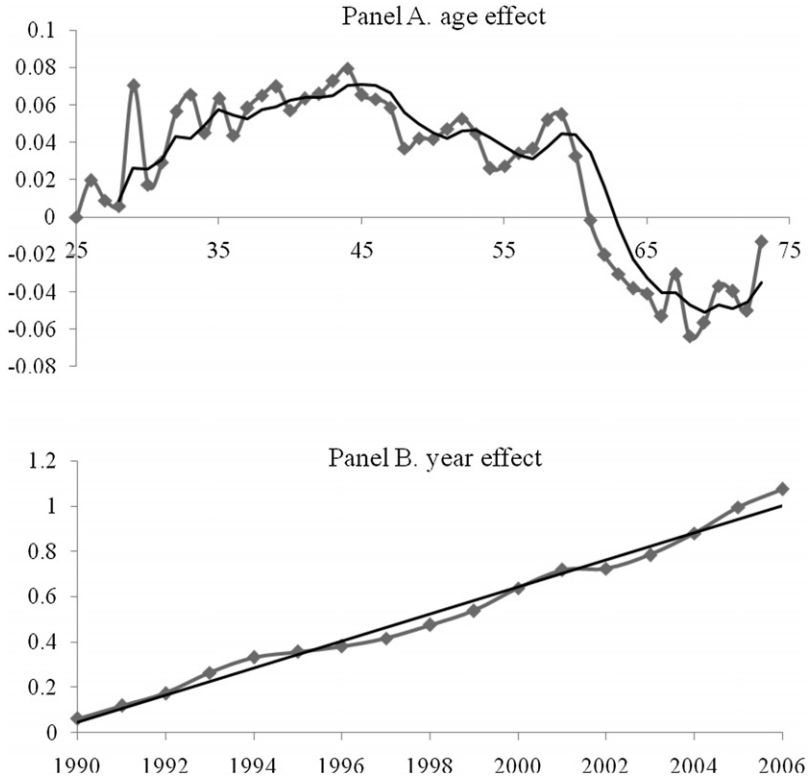


Figure 4. Household Income: Age Effect and Year Effect

50th, and 75th, and by the mean value.[17] As shown in Figure 5, the distribution of household income is significantly different over periods. The age profiles exhibit a familiar hump-shaped pattern in the periods of 1990–91 and 1995–96, with income initially increasing with age, but declining after peaking around 53. For the panel of 1990–91, the peaks of age profiles are in the range 50–55. For the panel of 1995–96, the peaks are different. For example, the age profiles at the 75th quintile and by mean value peak at 50–55, but seem to be flat at 53–57 at the 50th quintile and at 46–55 at the 25th quintile. For the panel of 2000–01, the age profiles are less hump-shaped compared with the panels of 1990–91 and 1995–96. For the panel of 2005–06, interestingly, the age profiles are relatively flat, and household income of young cohorts seems to be higher for each age profile. Moreover, the age profiles do not show an obvious decreasing trend when the age of the household head is greater than 65 as shown in the four panels, which explains the pattern of age effect profiles as shown in Panel A of Figure 4 when the age is greater than 65.

The change in the age profiles can be associated with the incremental economic returns to education in urban China. According to Zhang *et al*. (2005), the mean years of schooling in urban China increase from 10.4 years in 1990 to 11.8

[17]I am grateful to one anonymous referee for suggesting a verification of how the income is distributed among households.

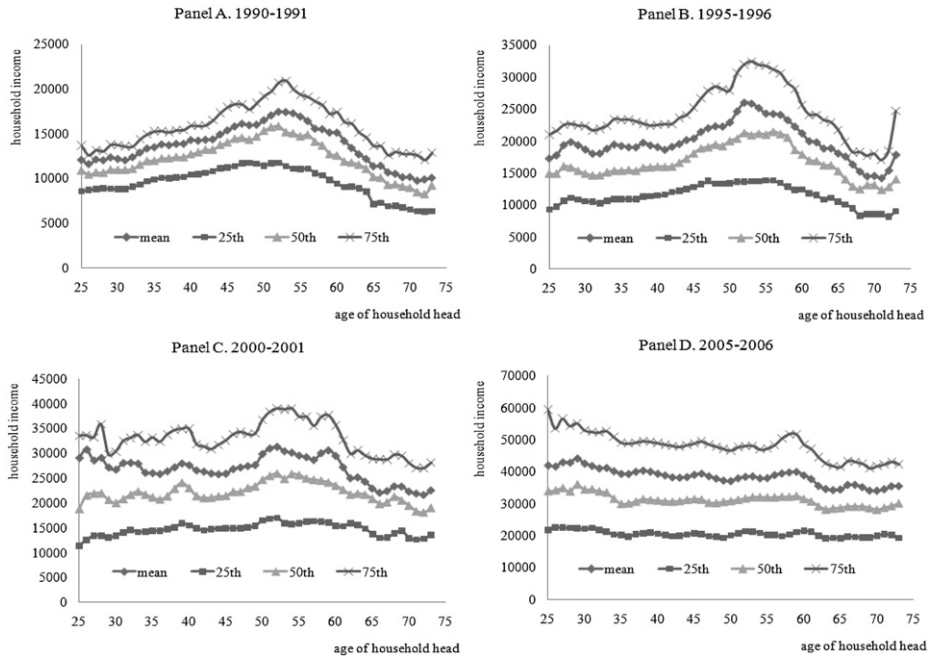


Figure 5. Age Profiles of Household Income

years in 2001. Despite this somewhat small increment, dramatic changes in the structure of education occurred. The most noticeable example is the more than doubling of the proportion of workers with college education (increased from 14.1 percent in 1990 to 28.1 percent in 2001) and the decline by two-thirds in the number of workers with primary school education or less (Zhang *et al.*, 2005). Meanwhile, the economic returns to education in urban China are also found to have dramatically increased from 1998 to 2001, and the returns for those with college education are significantly higher, along with the more efficient allocation of the labor force. The educational development is primarily contributed by the young individuals, as expected, because the schooling years of the old are generally fixed after they enter into the labor market. Therefore, the less steep pattern of age profile of household income over periods can be explained by the incremental economic returns to education and higher education achievement for the young.

### 3.4. *Household Saving Rates*

#### 3.4.1. Results by Deaton's Specification

Figure 6 shows the results of the cohort analysis of household saving rates. From the cohort-specific age profiles of household saving rates in Panel A, household saving rates can be seen to have a tendency to increase over the years for all the cohorts. Comparing the adjacent cohorts, the saving rates of the young cohorts are found to be usually higher than their counterparts at a given age, indicating that the young cohorts have higher saving propensity. Moreover,

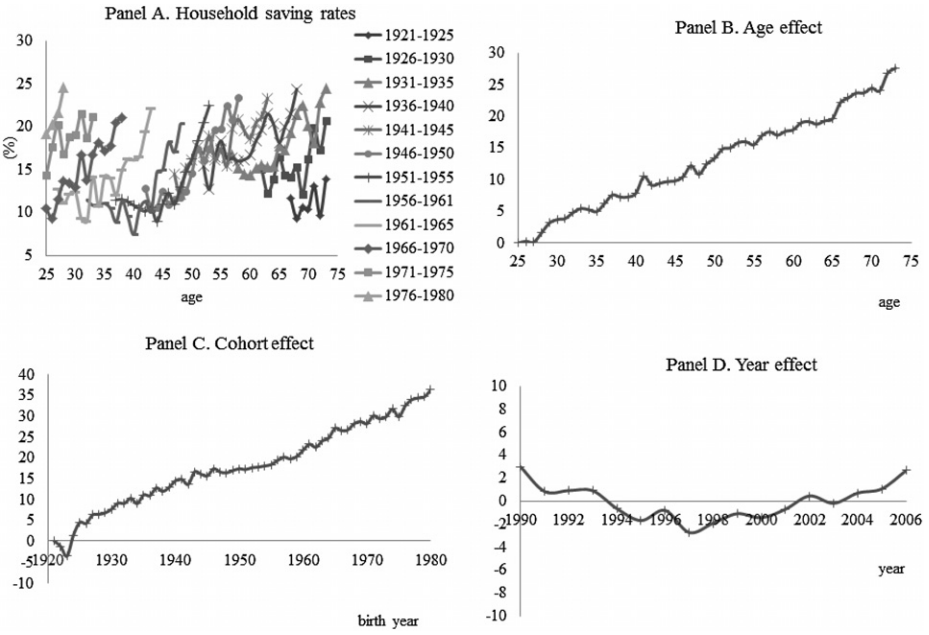


Figure 6. Household Saving Rates: Cohort Pattern and Decomposition

despite the significant differences in demographic attributes among cohorts, as shown in Figure 1, the cohort-specific age profiles actually follow a similar pattern over the years. This finding implies that demographic factors are not the primary reason behind the increase in household saving rates from 1990 to 2006.

With regard to the age–cohort–year decomposition for household saving rates, the key findings can be summarized as follows. First, the age effect profile significantly increases over the age of household head, but is not hump-shaped, even after the retirement age. In particular, consistent with the upward cohort-specific age profiles, the rising age effect confirms the inapplicability of the LCH model in interpreting the saving behavior in urban China. Previous studies have produced similar results, showing that saving behavior is inconsistent with the prediction of the LCH model. For example, Paxson (1996) finds that the age effects of household saving rates are at odds with the prediction of the LCH model in the United Kingdom, United States, Thailand, and Taiwan. However, the age effect profiles of saving rates in these economies are not increasing, implying the unique pattern of household saving rates in urban China. Second, the cohort effect shows an upward trend, indicating that household saving rates are higher for young cohorts at a given age. Theoretically, the LCH model does not predict any disparity in saving behavior among different cohorts. Combining the discussions above, the current work identifies the second saving puzzle through the rising cohort-specific age profiles and age effect of household saving rates.

### 3.4.2. Alternative Specification

As mentioned above, Deaton's assumption does not consider the time trend of household saving rates over years. An alternative decomposition is to omit the cohort effect by dropping the entire cohort dummy variables. Figure 7 shows that the age effect declines before 45 and then shows a hump-shaped pattern thereafter, peaking at approximately 53. Therefore, this age effect prolife is also not strictly consistent with the prediction of LCH. Without controlling for the cohort effect, the age effect in Panel A can be considered as the average pattern of the cross-sectional age profiles over years. Correspondingly, the year effect shows the time trend of the average of household saving rates over years. As shown in Panel B, the year effect is relatively flat before 1998, but shows a steady upward trend thereafter. This pattern is consistent with the trend of aggregate household saving rates, as shown in Table 1, defined as the first saving puzzle.

Similarly, for a better understanding of the age effect profile in Panel A of Figure 7, the current research also presents the cross-sectional age profiles of household saving rates in Figure 8 in some selected years. As shown in Panel A,

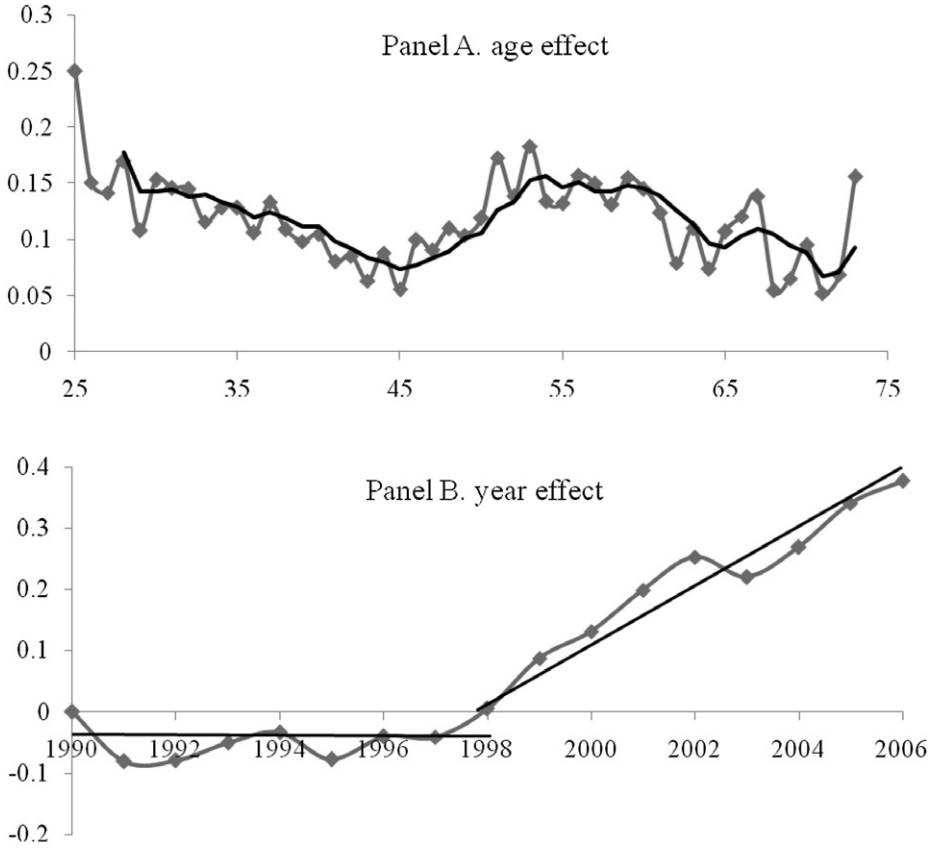


Figure 7. Household Saving Rates: Age Effect and Year Effect

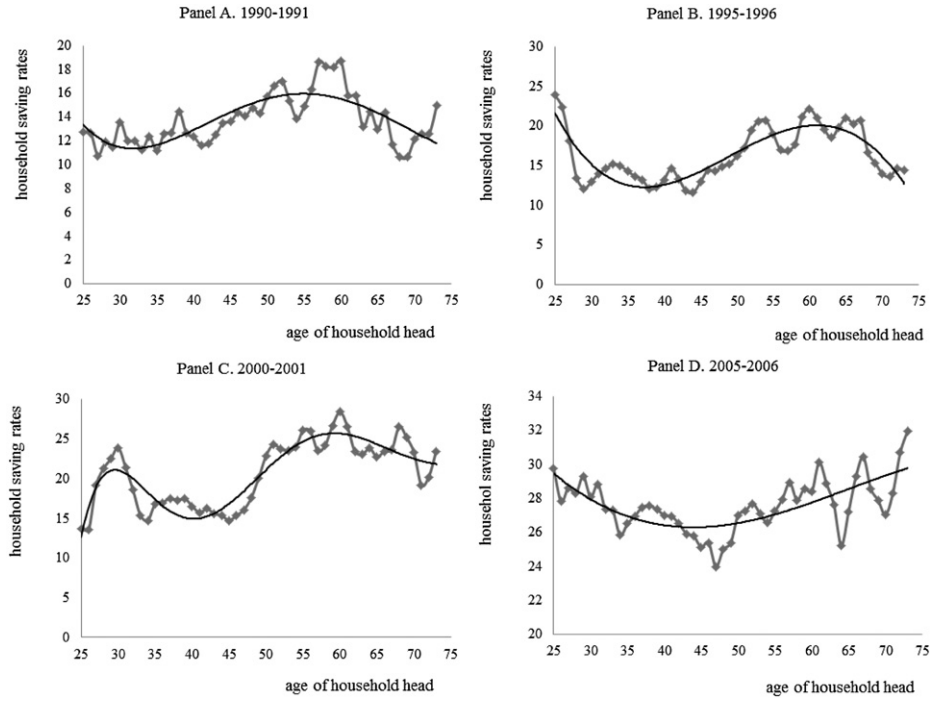


Figure 8. Age Profiles of Household Income

the age profile for 1990–91 exhibits a hump-shaped pattern, with household saving rates increasing with the age of household head, peaking at 55–60 and then declining in the 60s. After 70, the age profile tends to be incremental, which is contrary to the prediction of the LCH. For the panel of 1995–96 in Panel B, the age profile of household saving rates tends to decline before 45, subsequently showing a hump-shape, similar to the prediction of LCH. In the panel of 2000–01, the age profile of household saving rates has two peaks at 30 and 60, respectively. In the panel of 2005–06, the age profile shows a U-shaped pattern, with the rates declining with age before 45 and then increasing. Hence, the patterns of four cross-sectional age profiles also provide collaborative evidence that household saving behavior in urban China does not conform to the general prediction of the LCH model. Moreover, the changing patterns of the age profiles over periods also indicate a significant inter-cohort disparity in saving behavior.

In summary, from the cohort-specific age profiles in Figure 6, the age effect profiles in Figures 6 and 7, and the cross-sectional age profiles in Figure 8, the household saving behavior in urban China does not conform to the LCH model. Thus, the uniqueness in the saving behavior of urban households in China is shown. Specifically, from the cohort analysis of household income and household saving rates in Figures 2 and 6, similar patterns on the cohort-specific age profiles, age effect profiles, and cohort effect profiles can be observed, implying that a

systematic linkage may exist between household income and household saving rates. This finding also presents a promising explanation for the second saving puzzle.

## 4. Saving and Growth: A Dynamic Panel Analysis

Theoretically, the relationship between income and saving is ambiguous. For example, as the standard consumption theory with time-separable preference, the PIH model just predicts that income growth reduces current savings because current consumption is propelled by permanent income, which is higher than current income with income growth. Therefore, the PIH model is not applicable in explaining the simultaneous pattern between the household income and household saving rates observed in urban China. More recently, growing interest has been directed toward the implications of preferences that are not time separable, and numerous studies adopt the model of habit formation to explain why saving rates would increase during a period of rapid income growth (Carroll and Weil, 1994; Paxson, 1996).

Under habit formation, consumption depends not only on its level, but also on a "habit," which is related to past consumption. In a model considering habit formation, past consumption enters into utility function, and the utility function has the feature of time-non-separable preferences. For example, Deaton (1992) and Alessie and Lusardi (1997) set utility function as

$$u_t = u(c_t - \delta \cdot c_{t-1}), \tag{6}$$

where $\delta$ measures the strength of habit formation, and $c_t$ denotes consumption in period $t$. Borrowing from Paxson (1996), the utility maximization results for a consumption growth equation can be obtained under the assumptions of additive utility across periods and quadratic sub-utility functions,

$$\Delta c_t = \delta \cdot \Delta c_{t-1} + \varepsilon_t, \tag{7}$$

where $\Delta c_t$ is consumption growth from $t-1$ to $t$, and $\varepsilon_t$ denotes the effect on consumption of an innovation in earnings. Equation (7) shows that consumption growth is determined by the strength of habit formation and the effect of consumption innovation.

In the presence of habit formation, consumption responds slowly to unanticipated growth in earnings, thereby resulting in higher savings, at least in the short run (Deaton, 1992). Correspondingly, saving rates can be positively correlated with income growth under habit formation, and saving rates inertia surfaces directly from habit formation of consumption. Quantitatively, a higher strength of habit formation is associated with a higher saving inertia (Alessie and Lusardi, 1997). Therefore, habit formation is probably applicable in explaining the relationship between household income and household saving rates observed in urban China, subsequently resolving the second saving puzzle.

On the relation of income and saving rates in China, previous studies present mixed evidence. For example, using provincial level panel data (household survey-

based) from 1978 to 1995, Kraay (2000) finds that future income growth has a negative and significant effect on the saving rates of rural households, but the relationship is statistically insignificant for urban households. However, using China's aggregate data from 1953 to 2000, Modigliani and Cao (2004) provide robust evidence that income growth has a positive and significant effect on saving rates. Using provincial level panel data from 1995 to 2004 and considering the saving rates inertia, Horioka and Wan (2007) prove that income growth has a positive effect on household saving rates for both urban and rural households in China and that a significant saving rates inertia exists.

In the current paper, the relationship between household income and household saving rates is re-examined using the pseudo-panel data. Compared with the study of Horioka and Wan (2007), the present work has two advantages. First, the data period used ranges from 1990 to 2006, significantly longer than that of Horioka and Wan (2007). Second, the current research also compares the strength of saving rates inertia and the effect of income-related variables on saving rates over periods, which provide explanations for the rising household saving rates since 1998. To date, the present work is the first empirical study using pseudo-panel data to examine saving rates inertia.

### 4.1. *Econometric Specification*

Following Loayza *et al*. (2000) and Horioka and Wan (2007), the present paper adopts the following econometric model:

$$sr_{c,t} = \beta_0 + \beta_1 \cdot sr_{c,t-1} + \beta_2 \cdot income_{c,t} + \beta_3 \cdot demo_{c,t} + \varepsilon_{c,t} \tag{8}$$

where $sr_{c,t}$ refers to the household saving rate of cohort $c$ at year $t$; $\beta_0$ is constant; $sr_{c,t-1}$ is the lagged term of $sr_{c,t}$; $\beta_1$ measures the strength of saving rates inertia; $income_{c,t}$ includes income-related variables, such as the logarithm of household income and the growth rates of household income; $\beta_2$ measures the effect of income-related variables on saving rates; $demo_{c,t}$ involves demography-related variables, such as family size, the number of household earners, and household dependency ratio; $\beta_3$ is the estimated coefficient of $demo_{c,t}$; $v_c$ is the unobserved component, assumed to be cohort specific; and $\varepsilon_{c,t}$ is the error term.

The present research includes two sets of demographic controls: one including family size and the number of household earners and the other including only household dependency ratio. For household dependency ratio, old dependency ratio and young dependency ratio is not used in the current research, unlike Loayza *et al*. (2000) and Horioka and Wan (2007). The present work instead uses family size and the number of household earners to calculate the household dependency ratio (household dependency ratio = (family size – the number of household earners)/family size). The reason behind the use of this method is that retirees who earn pension are actually economically independent, and adult children in a family are probably earners or students.

Econometrically, the current paper adopts the "System GMM estimator" in the dynamic panel analysis proposed by Arellano and Bover (1995) and Blundell and Bond (1998). As suggested by Bond (2002), the Difference GMM could be

subject to the weak instrument and finite sample biases, whereas the System GMM estimator can combine the regression in differences with the regression in levels. In addition, following Loayza *et al*. (2000), the demographic variables are treated as strictly exogenous and included as instruments in the level equation, as well as in the first-difference equation. All other explanatory variables are regarded as weakly exogenous, and their lagged values are included as "internal instruments."

### 4.2. *Baseline Results and the Second Saving Puzzle*

Table 2 shows the descriptive statistics and Table 3 shows the baseline results for the period 1990–2006. Prior to the detailed discussion of the results, the specification tests generally support the systemic GMM panel estimates. In all specifications, the Hansen test of over-identification accepts the null hypothesis that the instruments are uncorrelated with the error term. Furthermore, from the

TABLE 2
DESCRIPTIVE STATISTICS

| Variable | Obs | Mean | S.D. | Min | Max |
|---|---|---|---|---|---|
| Saving rates | 170 | 0.1597 | 0.0414 | 0.0743 | 0.2588 |
| Log (household income) | 170 | 10.0567 | 0.3283 | 9.2853 | 10.6900 |
| Growth rates of household income | 170 | 0.0632 | 0.0617 | –0.1695 | 0.1929 |
| Family size | 170 | 3.0594 | 0.2137 | 2.5500 | 3.8420 |
| Number of household earners | 170 | 2.2192 | 0.2104 | 1.9507 | 2.7985 |

TABLE 3
THE DETERMINANTS OF HOUSEHOLD SAVING RATES

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Saving rates (–1) | 0.6266 | 0.4871 | 0.4901 | 0.4880 | 0.4908 |
| | (12.66)*** | (8.97)*** | (9.14)*** | (8.90)*** | (9.05)*** |
| Log (disposal income) | 0.0333 | 0.0424 | 0.0442 | 0.0415 | 0.0433 |
| | (5.27)*** | (6.81)*** | (7.09)*** | (6.55)*** | (6.81)*** |
| Growth rates of household income | | | | 0.0195 | 0.0205 |
| | | | | (0.98) | (1.04) |
| Family size | | –0.0338 | | –0.0345 | |
| | | (4.18)*** | | (4.21)*** | |
| Number of household earners | | 0.0353 | | 0.0364 | |
| | | (4.32)*** | | (4.37)*** | |
| Dependency ratio | | | –0.1227 | | –0.1262 |
| | | | (4.87)*** | | (4.91)*** |
| Constant | –0.2687 | –0.3139 | –0.3243 | –0.3072 | –0.3161 |
| | (4.63)*** | (5.03)*** | (5.93)*** | (4.84)*** | (5.66)*** |
| Observations | 170 | 170 | 170 | 170 | 170 |
| Number of groups | 12 | 12 | 12 | 12 | 12 |
| Hansen test of OID (p-value) | 0.995 | 0.939 | 0.952 | 0.988 | 0.992 |
| Test for 1st-order serial correlation (p-value) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Test for 2nd-order serial correlation (p-value) | 0.968 | 0.934 | 0.924 | 0.886 | 0.867 |

*Notes*: Absolute value of t statistics in parentheses.
*Significant at 10%; **significant at 5%; ***significant at 1%.

Arellano–Bond tests for the first-order and second-order serial correlations in the first-differenced residuals, the null hypothesis of no first-order serial correlation is rejected, but the null hypothesis of no second-order serial correlation is accepted, which is a necessary condition for consistent estimates. The empirical findings are summarized below.

First, the estimated coefficient of saving rates (–1) (the lagged household saving rate) in Table 3 is significantly positive, manifesting the existence of saving rates inertia. The estimated coefficient ranges from 0.48 to 0.63, implying that the long-term effects of other saving rates determinants are approximately 1.9 to 2.7 times as large as their respective short-term effects (one year), and the effects of changes in any saving determinants are thus fully realized only after a number of years. This result is notably very close to that of Horioka and Wan (2007), who use panel data on Chinese provinces for the 1995–2004 period from China's household survey, including both urban and rural households.

Second, income-related variables positively affect household saving rates in all specifications, as shown in Table 3, indicating that household saving rates increase as household income increases or grows faster. According to the estimated coefficients, an increase in household income of 10 percent increases the household saving rates by 0.4 percentage points on impact. The coefficients of annual growth rates of household income are positive, but insignificant.

Third, the coefficients of demography-related variables are significant with the expected sign. In Specifications (2) and (4) of Table 3, family size has a negative effect on household saving rates, whereas the number of household earners has a positive effect. Correspondingly, the dependency ratio is negatively related to household saving rates, as shown in Specifications (3) and (5). Comparatively, this result is at odds with that of Horioka and Wan (2007), who find that both young and old dependency ratios do not significantly affect saving rates in both urban and rural households.

From the baseline results, the first saving puzzle can be explained by the existence of saving rates inertia and the positive effects of income growth. Saving rates inertia also explains why the saving rates are tracked with income growth. Specifically, the saving rates inertia and the positive effect of household income on saving rates also imply that household saving rates could not go down sharply as long as the long-term growth rate of household income remains positive.

### 4.3. *Parametric Changes and the First Saving Puzzle*

Generally, the strength of saving rates inertia is assumed to be constant over years in previous studies. However, this assumption is probably not applicable in China because the "habit stock" of household consumption could not remain unchanged with the rapid income growth. Under lower household income and wealth levels, households are generally incapable of adjusting their "habit stock" to be consistent with the higher income and wealth levels, implying that the strength of habit formation is less than that when household consumption has adjusted even close to a high level of habit stock with income growth. Correspondingly, the strength of saving rates inertia tends to be larger with households being richer.

The effects of income-related variables on saving rates could also change with dramatic economic reforms in China, such as the evolving labor market with the SOEs reforms and the housing reforms in urban areas. With the SOEs reforms in China, a labor market suitable for a market economy was built gradually, and the proportion of employment in the state-owned and collective-owned units declined from 81.5 percent in 1990 to 25.4 percent in 2006 (NBS, 2010). With the decentralization of the labor market in China, earnings uncertainty for individuals tends to rise. Chamon *et al*. (2011) use a sample of urban households tracked by the China Health and Nutrition Survey (CHNS) conducted in 1989, 1991, 1993, 1997, 2000, 2004, and 2006 (i.e., the period covered by the CHNS data is very close to that by the CUHS data used in the current paper) to decompose the variance of income into components attributable to permanent versus temporary income shocks. They find that the variance of permanent shocks to household income has remained relatively stable, whereas the variance of transitory shocks trends upward. Furthermore, they find that the precautionary saving motives stemming from the rising transitory variance of income can substantially explain the rise in household saving rates with young household heads. Therefore, the precautionary saving motives induced by the rising transitory shocks of income can be expected to result in less translation of income growth into consumption growth, corresponding to a higher effect of income growth on propelling saving rates. Moreover, corresponding to the lower translation of income growth into consumption growth (i.e., the effect of $\varepsilon_t$ is smaller from equation (7)), the strength of habit formation is larger. Therefore, the strength of saving rates inertia is larger in the latter period under the effect of precautionary saving motive caused by the rising transitory shocks of income.

Urban housing reforms can also result in parametric changes in the effects of income-related variables on saving rates. With China's urban housing reforms from an in-kind housing provision to a developing housing market, homeownership rates increased dramatically from 16.2 percent in 1990 to 50.5 percent in 1998 and 84.5 percent in 2006, as derived from the dataset used in the present paper. Specifically, with the termination of welfare housing allocation in 1998, urban housing reforms were accelerated, and the commodity housing market became one important channel for housing allocation for individuals, aside from housing privatization and heritage housing. The percentage of households with commodity housing increased rapidly from 11 percent in 2002 to 27 percent in 2006, implying that approximately 15 percent of urban households bought a home during the period 2002–06. Moreover, housing has been regarded as one kind of lucrative investment with the booming housing price. Thus, the percentage of households with two or more homes increased from 6.5 percent in 2002 to 11.2 percent in 2006. Therefore, households have been motivated to allocate more wealth and income to housing assets with urban housing reforms, incurring the crowding-out effect on household consumption. Consequently, household income growth can be expected to be less translated into household consumption growth, and income-related variables impose larger effects on saving rates. Similarly, the strength of saving rates inertia could be larger with the rising expenditure needs for home purchase.

To validate the possible rise in the strength of saving rates inertia and the changing effects of income-related variables on saving rates over the period, the

TABLE 4
THE DETERMINANTS OF HOUSEHOLD SAVING RATES (1990–98)

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Saving rates (–1) | 0.5031 | 0.2397 | 0.2421 | 0.2374 | 0.2414 |
| | (7.28)*** | (3.14)*** | (3.21)*** | (3.07)*** | (3.16)*** |
| Log (disposal income) | 0.0152 | 0.0125 | 0.0231 | 0.0124 | 0.0231 |
| | (1.47) | (1.29) | (2.48)** | (1.27) | (2.46)** |
| Growth rates of household income | | | | 0.0063 | 0.0019 |
| | | | | (0.23) | (0.07) |
| Family size | | –0.0237 | | –0.0240 | |
| | | (2.81)*** | | (2.79)*** | |
| Number of household earners | | 0.0714 | | 0.0720 | |
| | | (6.83)*** | | (6.67)*** | |
| Dependency ratio | | | –0.1829 | | –0.1834 |
| | | | (6.01)*** | | (5.84)*** |
| Constant | –0.0805 | –0.1113 | –0.0756 | –0.1103 | –0.0752 |
| | (0.83) | (1.28) | (0.88) | (1.26) | (0.87) |
| Observations | 84 | 84 | 84 | 84 | 84 |
| Number of groups | 10 | 10 | 10 | 10 | 10 |
| Hansen test of OID (p-value) | 0.774 | 0.982 | 0.859 | 0.991 | 0.907 |
| Test for 1st-order serial correlation (p-value) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Test for 2nd-order serial correlation (p-value) | 0.752 | 0.885 | 0.608 | 0.922 | 0.578 |

*Notes*: Absolute value of t statistics in parentheses.
*Significant at 10%; **significant at 5%; ***significant at 1%.

present work conducts an inter-period comparison by dividing the entire sample into two sub-periods, with the empirical results shown in Tables 4 and 5, corresponding to the periods 1990–98 and 1998–2006, respectively. From Tables 4 and 5, the specification tests are shown to support the systemic GMM panel estimates through the Hansen test of over-identification and the Arellano–Bond tests for the first-order and second-order serial correlations in the first-differenced residuals. Comparing the coefficients for some key regressors in Tables 4 and 5, the following results are obtained.

First, the estimated coefficients of saving rates (–1) in the two periods reveal that the saving inertia is larger in the period 1998–2006 than that in the period 1990–98. For example, the estimated coefficient of saving rates (–1) is approximately 0.24 in Specifications (2)–(4) for the period 1990–98 and ranged from 0.46 to 0.61 for the period 1998–2006. This finding confirms the aforementioned hypothesis that the saving rates inertia tends to rise with the adjustment of habit stock of consumption and the effects of the rising variance of transitory income and expenditure needs for home purchase. In addition, one implication for the higher saving rates inertia is that the long-term effects of other regressors on saving rates are higher.

Second, income-related variables play more important roles in boosting household saving rates in 1998–2006 (Table 5) than in 1990–98 (Table 4). Log (disposal income) is significantly higher in the period 1998–2006 from the point estimate, as shown in Table 6. This result is also consistent with the finding of Alessie and Lusardi (1997) that the higher the strength of habit formation, the

TABLE 5
THE DETERMINANTS OF HOUSEHOLD SAVING RATES (1998–2006)

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Saving rates (–1) | 0.7361 | 0.4638 | 0.5938 | 0.4814 | 0.6090 |
| | (10.88)*** | (6.28)*** | (8.09)*** | (6.21)*** | (7.86)*** |
| Log (disposal income) | 0.0376 | 0.0496 | 0.0518 | 0.0454 | 0.0466 |
| | (3.33)*** | (4.89)*** | (4.67)*** | (4.20)*** | (3.90)*** |
| Growth rates of household income | | | | 0.0458 | 0.0555 |
| | | | | (1.73)* | (1.91)* |
| Family size | | –0.0979 | | –0.0968 | |
| | | (5.71)*** | | (5.43)*** | |
| Number of household earners | | 0.0432 | | 0.0453 | |
| | | (3.66)*** | | (3.68)*** | |
| Dependency ratio | | | –0.1428 | | –0.1499 |
| | | | (3.63)*** | | (3.61)*** |
| Constant | –0.3310 | –0.2091 | –0.4132 | –0.1806 | –0.3652 |
| | (3.01)*** | (1.88)* | (4.00)*** | (1.55) | (3.28)*** |
| Observations | 95 | 95 | 95 | 95 | 95 |
| Number of groups | 12 | 12 | 12 | 12 | 12 |
| Hansen test of OID (p-value) | 1.000 | 0.994 | 0.998 | 1.000 | 1.000 |
| Test for 1st-order serial correlation (p-value) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Test for 2nd-order serial correlation (p-value) | 0.822 | 0.924 | 0.844 | 0.881 | 0.784 |

*Notes*: Absolute value of t statistics in parentheses.
*Significant at 10%; **significant at 5%; ***significant at 1%.

TABLE 6
POINT ESTIMATE OF LOG (DISPOSAL INCOME)

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Log (disposal income) (in Table 6) | 0.038 | 0.050 | 0.052 | 0.045 | 0.047 |
| Log (disposal income) (in Table 5) | 0.015 | 0.013 | 0.023 | 0.012 | 0.023 |
| Difference | 0.022 | 0.037 | 0.029 | 0.033 | 0.024 |
| S.E. [sqrt(diag(V_b–V_B))] | 0.004 | 0.003 | 0.006 | 0.005 | 0.007 |
| Prob > $chi^2$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

higher the effect of income growth on saving. For growth rates of household income, the estimated coefficients are positive for the two periods, but only statistically significant in the period 1998–2006. Therefore, the income-related variables have larger effects on household saving rates in the latter period, resulting in a larger part of income growth being translated into savings. Therefore, the upsurge in household saving rates since 1998 can be explained by the larger strength of saving rates inertia and the higher effects of income-related variables on household saving rates. Particularly with the larger saving rates inertia, a higher proportion of income growth will also be translated into savings in the long run.

Third, the estimated coefficients of demographic variables are significant and also show their expected sign: family size plays a negative role in saving rates, the number of household earners plays a positive role, and dependency ratio is negative. However, their effects on saving rates vary over periods according Table 4 and Table 5, with a larger effect from family size, a smaller effect from the number

of household earners, and a smaller effect from dependency ratio in the later period. A tentative explanation for the parametric changes in the demographic variables over periods can be related to the imbalanced sex ratio, which is highlighted by Wei and Zhang (2011), because the sex ratio, defined as the ratio at birth 20 years earlier, was relatively stable in the 1990s, but has been surging since 2000.

In summary, the present work presents an explanation to enrich the empirical evidence on the rising urban household saving rates by examining the existence of saving rates inertia and the effect of income growth on saving rates, thereby helping resolve the second saving puzzle. Considering the adjustment of habit stock and the effects of the economic reforms, such as the evolving labor market and urban housing reforms, the current paper examines the parametric changes in the strength of saving rates inertia and the effects of income-related variables on saving rates over periods. According to their higher estimated coefficients in the period 1998–2006 than those in the period 1990–98, the current research provides a tentative explanation for the first saving puzzle, that is, the paradigm shift of household saving rates over time.

## 5. Conclusion

The high and rising saving rates in China have become a prominent feature of China's economy. The present paper used CUHS data (1990–2006) to identify two saving puzzles in urban China through the change in the time trend of household saving rates and the unique patterns of household saving rates. The first saving puzzle was identified through the time trend of household saving rates, which was relatively stable before 1998, but surged thereafter. The second saving puzzle emerged from the age profiles of household saving rates derived from their cohort analysis and cross-sectional patterns, which are not only inconsistent with the prediction of the LCH, but also different from the patterns observed in other economies.

In explaining the two saving puzzles, the present work borrowed from the habit-formation model to empirically examine the existence of saving rates inertia and the effects of income-related variables on saving rates through the System GMM estimation. The second saving puzzle was explained by the habit-formation model because the empirical results confirm the positive effects of income-related variables on household saving rates and the existence of saving rates inertia. The first saving puzzle was explained by the higher strength of saving inertia and the higher effect of income-related variables on saving rates in the period 1998–2006 than those in the period 1990–98. The current research presented tentative explanations for the parametric changes: the higher strength of saving inertia in the latter period is related to the adjustment of habit stock being consistent with the higher income and wealth levels, and the higher effects of income-related variables on saving rates may have stemmed from the rising transitory shocks of income and the higher housing expenditure with housing reforms.

Some policy implications can be derived from the empirical findings of the present paper. Although China's top political leadership advocated to fundamen-

tally alter the country's growth strategy by relying more on expanding domestic consumption in place of investment and export-led growth in recent years,[18] household consumption in GDP has continued to decline since 2000, caused by both the declining household income in GDP and the rising household saving rates.[19] From the empirical results in this paper, it seems likely that China encountered substantial difficulties in rebalancing the economy and altering the growth pattern through boosting household consumption because the strength of saving rates inertia and the effects of income growth on saving rates tend to be higher in the latter period. Although household income in GDP is expected to increase with the adjustment of the labor market in recent years (Yang *et al.*, 2011), household consumption in GDP might not increase substantially as long as households were still conservative in spending with income growth. Specifically, successful policies for boosting household consumption should rest with systematic structural adjustments to translate more income growth into consumption growth.

Finally, for the rising effects of income growth on saving rates, this paper just presents some tentative explanations from the precautionary saving motives stemming from the rising variance of transitory income with the evolving labor market and the rising expenditure needs for home purchase with the urban housing reforms, but does not provide robust econometric tests, which present the directions for further research on China's saving problems.

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[18]For example, China put itself forward to make efforts to expand the consumption demand in 2003 at the annual Central Economic Work Conference. Since then, the annual Central Economic Work Conference has emphasized the role of consumption in propelling economic growth.

[19]According to the data of Flow of Funds of China, household income in GDP declined significantly from 68.4 percent in 1998 to 57.1 percent in 2008, and household saving rates increased from 30.9 percent in 1998 to 40.1 percent in 2008 (NBS and PBC, 2008; NBS, 2010).

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