BREAKING THE "IRON RICE BOWL" AND PRECAUTIONARY SAVINGS: EVIDENCE FROM CHINESE STATE-OWNED ENTERPRISES REFORM

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Abstract. We use China's large-scale reform of state-owned enterprises (SOEs) in the late 1990s as a natural experiment to identify and quantify the importance of precautionary saving for wealth accumulation. Before the reform, SOE workers enjoyed similar job security as government employees. Since the reform, over 35 million SOE workers have been laid off, although government employees kept their "iron rice bowl." The change in unemployment risk for SOE workers relative to that of government employees before and after the reform provides a clean identification of income uncertainty that helps us estimate the importance of precautionary saving. In our estimation, we correct a self-selection bias in occupational choice and disentangle the effects of uncertainty from pessimistic outlook. We obtain evidence that precautionary savings account for at least 30 percent of the wealth accumulation for SOE workers between 1995 and 2002.

I. Introduction

China has experienced rapid economic growth in the past two decades. During the same period, the household saving rate has increased substantially. These observations appear

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to contradict the permanent income hypothesis (PIH) theory, which suggests that expected increases in wealth should result in households borrowing now to smooth consumption, rather than saving. Yet the Chinese data show the opposite pattern.[1]

One plausible explanation for the rising saving rate in China is precautionary saving. As the country goes through a transition from a central planning system to a market-oriented economy, large structural changes associated with policy reforms may lead to increases in economic uncertainty. All else equal, higher income uncertainty leads to more precautionary savings.

In practice, however, it is challenging to identify and quantify the importance of precautionary saving in the data. In particular, it is difficult to clearly identify observable and exogenous sources of income risks that vary significantly across households (Lusardi, 1998; Carroll and Kimball, 2006). Many studies use the cross-sectional variance of income as a proxy for income uncertainty (Carroll and Samwick, 1998). But this proxy may be subject to measurement errors and potential endogeneity bias (Kennickell and Lusardi, 2005).

To quantify the importance of precautionary saving also requires correcting self-selection bias. Theory implies that precautionary wealth accumulation depends not just on risk, but also on risk preferences (Caballero, 1990, 1991). An individual with high risk aversion has an incentive to choose a job with low income risk. Similarly, a worker with low risk aversion may want to choose a job with high income risk (with potentially high expected income). Failing to control for self-selection in occupational choice may lead to significant downward bias in estimating the importance of precautionary savings (Fuchs-Schündeln and Schündeln, 2005).

Partly reflecting the difficulties in measuring income uncertainty and correcting self-selection bias, the existing empirical literature obtains mixed evidence of precautionary saving. For example, some studies report weak or no evidence of precautionary saving (Skinner, 1988; Guiso, Jappelli, and Terlizzese, 1992), while some other studies attribute up to 50 percent of household wealth accumulation to precautionary saving (Carroll and Samwick, 1998).

In this paper, we present a new approach to identifying and quantifying the contribution of precautionary saving to wealth accumulation. We use the large-scale reform of state-owned enterprises (SOEs) in China in the late 1990s as a natural experiment to achieve identification. Before the reform, workers in SOEs and in the government sector (GOV) had similar lifelong job security, including guaranteed pensions and near-free health care and housing. In this sense, workers in both sectors held an "iron rice bowl" before the reform.

[1]Empirical studies find mixed evidence for the PIH theory using Chinese data. See, for example, Modigliani and Cao (2004) and Horioka and Wan (2007).

After the reform, however, over 35 million workers in the SOEs were laid off between 1995 and 2002. Those workers lost not just their jobs, but also the associated benefits. In contrast, workers in the government sector—where few layoffs occurred—were little affected by the reform; they were able to hold on to their iron rice bowl. The massive layoffs in the SOEs significantly changed the perceived income risk for the remaining SOE workers. The reform was exogenous and largely unexpected, and it created significant variations of unemployment risk for workers across the SOE and GOV sectors. Thus, the reform provides us with a clean identification of relative income risk and perceived job uncertainty.

To estimate the importance of precautionary saving, we use data from the Chinese Household Income Project (CHIP) survey. We focus on the years 1995 and 2002. The large-scale urban SOE reform started in 1997 and was gradually phased out by 2002. Our sample thus covers both the pre- and post-reform periods. To identify and quantify the contribution of precautionary saving to wealth accumulation, we exploit the differences in saving behavior both across sectors (SOE vs. GOV) and across time (before and after the SOE reform)—a difference-in-differences (DID) approach. The time variations (between 1995 and 2002) of the relative saving behavior of workers in the two sectors capture the magnitude of precautionary saving stemming from breaking the iron rice bowl.

To control for self-selection bias that may arise from the correlation between occupational choice and an individual's risk attitude, we use an important feature of the CHIP survey. The survey contains a question about how a worker obtained her current job. Some workers find jobs through a search and matching process; but in our sample, a majority of workers (over 70 percent) have jobs assigned by the government. For assigned jobs, the government has the final power to determine the worker's occupation and compensation. Thus, for those workers whose jobs are assigned by the government, the occupational choice is likely unrelated to worker preferences. We restrict our sample to include only those households whose jobs were assigned by the government. This restriction helps us control for the effects of self-selection in occupational choice.

The SOE reform might affect not only the perceptions of future income uncertainty, but also the expected future income growth rate. For example, SOE workers who experienced massive layoffs in the late 1990s might form the perceptions that not only will future income risk increase but their future income level might decrease as well. Declines in expected future income would also raise current saving. Such saving behavior is driven by the agent's desire for intertemporal consumption smoothing (i.e., the PIH effect), but not by precautionary motives. To isolate the effects of precautionary motives on saving from the PIH effects, we use a unique question in the 2002 CHIP survey that asks households about their expectations of income paths for the next five years. We restrict our sample to include only those workers

who do not expect future income to decline. This approach enables us to mitigate the effects of the PIH channel that could cause an upward bias in the estimation of precautionary saving.

By clearly identifying income uncertainty caused by SOE reform, correcting self-selection bias in occupational choice, and controlling for the PIH effects, we obtain estimates of precautionary savings that are significant both statistically and economically. We estimate that precautionary savings accounted for about 30 percent of total financial wealth accumulations for SOE workers for the period from 1995 to 2002. Our finding suggests that precautionary saving can be an important factor that drives the high and rising Chinese saving rate.

II. Related Literature

Our work contributes to a growing literature that attempts to quantify the importance of precautionary saving for explaining China's rising saving rate. Earlier studies obtain mixed evidence that supports the precautionary-saving view (Kraay, 2000; Carroll, Dynan, and Krane, 2003; Meng, 2003).

A more recent study by Chamon and Prasad (2010) uses the annual Chinese Urban Household Survey from 1995 to 2005 to disentangle different motives behind the rising urban household saving rate. Chamon and Prasad (2010) find that the increases in private burden of education, health and housing expenditures seem among the strongest candidates for explaining the increases in saving rates. Chamon, Liu, and Prasad (2013) document a sharp increase in income uncertainty associated with increases in transitory idiosyncratic shocks among Chinese urban households. They argue that rising income uncertainty induces younger households to raise their saving rate significantly.

An alternative explanation for the rising Chinese saving rate is provided by Wei and Zhang (2011), who present evidence that sex imbalances caused by China's one-child policy have induced a "competitive savings motive": with a shortage of girls, parents with a son save more to increase the relative attractiveness of their son in a tighter marriage market. They show that this competitive savings motive is empirically important.

Our study builds on this literature. The main contribution of our paper is that we use the large-scale SOE reform in China as a natural experiment to clearly identify and quantify the importance of precautionary saving. In our estimation, we exploit the microeconomic details of the CHIP survey data to correct self-selection bias in occupational choice and to disentangle the effects of uncertainty from pessimistic outlook.

Our approach to correcting self-selection bias is complementary to that used by Fuchs-Schündeln and Schündeln (2005), who use the event of the German reunification as a natural experiment to identify the presence of self selection. Before the reunification, civil servants

in East Germany had government-assigned jobs, while civil servants in West Germany were free to choose their occupations (and they chose to work in the government). Therefore, the occupational choices for civil servants in East Germany were not subject to self selection, but those in West Germany were. The reunification significantly increased income risks for all workers in the former East Germany but civil servants, most of whom were able to keep their jobs in the newly unified Germany. By comparing wealth holdings of civil servants with wealth accumulation of individuals in other occupations between East and West Germany, they identify the effects of self-selection bias on precautionary saving.

Our approach to controlling for self-selection bias is different. We focus our sample on workers whose jobs were assigned by the government. In our sample, about 83% of jobs were assigned by the government in 1995 and 72% in 2002. For assigned jobs, the government has the final power to determine the worker's occupation and compensation. Thus, for those workers whose jobs are assigned by the government, the occupational choice is likely unrelated to the risk attitudes of individual workers. Despite the differences in approach and the data set used, our results are similar to those obtained by Fuchs-Schündeln and Schündeln (2005), both indicating that self-selection can cause a significant downward bias for estimating the quantitative importance of precautionary saving.

III. Some Background of the SOE Reform

From 1949 to 1978, China's economy was under a central-planning regime. The government maintained tight controls over production and factor allocations. Most jobs were assigned by the government. To support the goal of industrialization, workers were paid subsistence wages and, in exchange, they were guaranteed life-time employment along with near-free housing, education, health care, and pension (Cai, Park, and Zhao, 2008). This cradle-to-grave regime is known as the "iron rice bowl," which has long been advocated as one advantage of China's socialist system.

The "open door" economic policy and nationwide reform initiated by Deng Xiaoping in the late 1970s initiated China's transition to a free-market economy. In the mid-1980s, the government introduced a labor contract system, under which workers were permitted to search for jobs and employers gained some flexibility in hiring (Meng, 2000). These reform policies led to a large-scale urban migration and increased competition facing SOEs. Following Deng Xiaoping's tour of the south in 1992, more liberalization policies were adopted by the government, leading to a boom in urban economies, which further intensified competition for SOEs. At that time, with soft budget constraints and the requirement to implement the government's goal of full-employment, the SOE sector had substantial redundant labor and many SOE firms were making losses. In 1995 and 1996, around 50% of the SOEs (mostly

small or medium sized) reported losses (Meng, 2003). The Asian financial crisis in 1997 exacerbated the situation.

The Chinese government was forced to take actions to improve efficiency of the SOEs and to stem losses. Specific actions were laid out at the Fifteenth Communist Party Congress held in September 1997. A central spirit of the restructuring policy was to "grasp the large and let go of the small." Large (and usually more profitable) SOEs in strategic sectors such as electricity, oil, raw materials, and telecommunications were corporatized and maintained under state controls, while smaller (and often loss-making) SOEs were either privatized or let go bankrupt (see Hsieh and Song (2013)). These policy changes led to a massive layoff (*xia gang* in Chinese) of SOE workers starting in 1997, the scale of which was unprecedented. In 1997, a cumulative of about 6.92 million SOE workers were laid off. The wave of layoffs reached a peak in 1999 and 2000, each year with over 6.5 million SOEs workers losing their jobs, and started to subside by 2002. During the 5-year period from 1997 to 2002, a remarkable total of 35.52 million SOE workers had been laid off (Cai, Park, and Zhao, 2008).

There is evidence that the SOE layoffs were concentrated in small and loss-making firms and in some demographic groups. For example, females, less educated, less skilled, less healthy workers, and non-members of the communist party were more likely to be laid off than others. Workers in SOEs owned by local governments were also more likely to be laid off than those in SOEs owned by the central government (Appleton, Knight, Song, and Xia, 2002). However, the scale and the breadth of the layoffs were largely unexpected by individual workers (see Appendix A for a case study of the SOE layoff experience). Thus, for the SOEs workers who were fortunate to keep their jobs, the reforms that broke the iron rice bowl had led to significant changes in their perceptions about future job security and substantially increased their perceived income uncertainty.

IV. Data and Empirical Strategy

IV.1. **Data.** The data that we use are taken from Chinese Household Income Project (CHIP) surveys. Those surveys were conducted by the Chinese Academy of Social Science (CASS) and National Bureau of Statistics (NBS) through a series of questionnaire-based interviews done in rural and urban areas in China in 1988, 1995, 2002 and 2007. The households in each survey are randomly selected following a strict sampling process so that they are nationally representative. The surveys cover a sample of about 15,000 to 20,000 households in about 10 provinces in China. The surveys contain detailed data on rural and urban households' economic status, employment, levels of education, sources of income, household compositions, household expenditures and wealth. The CHIP data have been frequently used in the empirical literature (e.g., Wei and Zhang 2011).

In this paper, we focus on the 1995 and 2002 CHIP data since the time span covers the period of massive SOE layoffs associated with the SOE reforms of the late 1990s. As we described in Section III, before the reform, workers in SOEs had similar life-long employment status as those in GOV sectors; in both sectors, workers faced little unemployment risks and income uncertainty. However, since the reform started in 1997, a large number of SOE workers were laid off while GOV workers were able to keep their iron rice bowl. The reform thus injected substantial unemployment risks to SOE workers relative to GOV workers. The different impact of the reform on workers across the two sectors provides an ideal "natural experiment" for us to identify precautionary saving due to a sudden and substantial increase in unemployment risks.

To estimate the quantitative importance of precautionary saving, we exploit changes in saving behaviors associated with the SOE reform between SOE workers and GOV workers. Thus, we restrict our sample to include only those households whose heads work in either the SOE sector or the GOV sector. The SOE sector includes firms that are directly owned by the government (including central, provincial, and local governments), those in which the government holds a controlling share of stocks, and those under collective ownership. The GOV sector includes all levels of government and public institutions.[2] We further restrict our sample to include prime-age workers, whose ages are between 25 and 55 years. This choice is partly driven by concerns of measurement errors in wealth and permanent income for younger workers. It is also driven by concerns that the saving behaviors of workers close to retirement ages change dramatically for reasons more closely related to life-cycle factor than to income uncertainty (Carroll and Samwick, 1998; Gourinchas and Parker, 2002).[3]

With these sample restrictions, we end up with 4390 household-level observations in 1995, consisting of 2977 SOE workers and 1413 GOV employees; and in 2002, we have 3027 observations consisting of 1702 SOE workers and 1325 GOV employees.

IV.2. **Construction of Variables.** In this subsection, we discuss the construction of all variables used in our empirical studies. Table 1 provides a brief description of these variables; and Table 2 reports their summary statistics based on the full sample.

[2]According to the *China Labor Statistics Year Book*, the SOE and the GOV sectors together employed about 94.1% of total urban workers in 1995. This share declined to 75.5% in 2002. During this period, however, the large-scale SOE reform has led to a substantial decline in the relative share of employment in the SOE sector from 70.5% to 42.4%. In contrast, the share of employment in the GOV sector has increased modestly.

[3]The normal retirement age for female workers in China is between 50 and 55; for male workers, it is between 55 and 60.

To estimate the quantitative importance of precautionary saving, we focus on the empirical relation between a measure of savings and a measure of income uncertainty, while controlling for a few demographic characteristics.

We measure household saving behavior by the ratio of financial wealth to permanent income (i.e., the W/P ratio; see Table 1 for a description of these variables).[4] We use the stock of financial wealth reported in the surveys instead of the flow of saving or the saving rate to measure an individual's saving behavior for two reasons. First, unlike the flow of saving, financial wealth is not influenced by high-frequency fluctuations in income and expenditures. Thus, it is better able to capture long-run (or average) saving behavior in which we are interested. Second, financial wealth is a direct measure of cumulative savings and is thus less subject to measurement errors than the flow of saving or the saving rate, which are indirectly calculated based on income and consumption expenditures. Moreover, our measure of financial wealth includes mostly liquid assets, which are relevant for studying precautionary saving (Carroll and Samwick, 1998).

We normalize financial wealth by permanent income to obtain a measure of average savings. We thus need to construct a measure of permanent income. In the CHIP datasets, survey participants report incomes earned by household heads during the current year and the recent past. In the 1995 survey, we observe household head earnings from 1990 to 1995; in the 2002 survey, we observe earnings from 1998 to 2002.[5] We use this information to construct a measure of permanent income following a similar approach used by Fuchs-Schündeln and Schündeln (2005). This is done in three steps. First, we calculate a household head's earnings relative to the average earnings of all households in each year with reported earnings. Second, we take the time-series average of the household relative earnings. Third, we multiply the household head's income in each of the survey years (1995 or 2002) by the average relative earnings to obtain an annual permanent income for the household in that year.[6]

To mitigate potential measurement errors introduced in the process of constructing permanent income, we follow Fuchs-Schündeln and Schündeln (2005) by instrumenting permanent

[4]We deflate all nominal variables in the sample by the urban household consumer price index (CPI), with 2002 as the base year.

[5]For a single-earner family, the household head is the bread winner. For a multiple-earner family, the head is the person with the highest income.

[6]We use box plot to detect possible outliers in the data of wealth measures and permanent income. We first determine the first and third quartiles (denoted by Q_1 and Q_3, respectively) for the data set. Define the interquartile range $IQR = Q_3 - Q_1$, which is a measure of noise or scale for the data set. Observations that are more than three IQR's are treated as potential outliers and excluded from the sample.

income using education dummies and interactions of education with age and age-squared as instruments in all the regressions.

We consider two types of income uncertainty. The first relates to the cross-sectional variance of the log income used in the literature (Carroll and Samwick, 1998). Since the average household income in our sample has grown from 1995 to 2002 and different demographic groups might have experienced different growth, directly using the cross-sectional variance of income would be inappropriate, especially for making cross-group comparisons. We thus use a unit-free measure, which is the coefficient of variation (CV) of log income, defined as the ratio of the standard deviation to the mean of log household head's income over the past six (or five) years as reported in the 1995 (or 2002) CHIP surveys.

The second type of income uncertainty that we consider captures the uncertainty stemming from unemployment risks specific to SOE workers. In particular, we include in the regression an SOE dummy variable, which takes a value of one if the household head works in the SOE sector and zero if the household head works in the GOV sector. If our hypothesis is correct, then we should expect SOE workers to increase their savings relative to GOV workers after the reform took place. We use this source of income uncertainty associated with the large-scale SOE reform as the key to identifying precautionary saving.

In our estimation, we control for the effects of a number of demographic characteristics of households, including the household head's age, age-squared, gender, marital status, education, occupation, the household size, status of children (the ages of children, the number of boys, and the number of children at school), health care (public health care, public health insurance, or own payments), home ownership status, and others. Table 2 shows some details of these demographic variables.

We categorize the education level of a household head into four groups: elementary school and below, junior middle school, senior middle school, and post-secondary (college). We take the first group as our reference group and construct four education dummies.

We also divide the occupations of the household heads into five groups: professional, director or manager, skilled or office workers, unskilled or service workers, and others. The group of "others" is our reference group in the regressions.

The health care reform enacted in 1998 significantly changed the share of household expenditures on health care. We categorize the types of health care that the households receive into three groups: public health care (almost free), public health insurance, and self-financing of health care. As shown in Table 2, in 1995, 71.3% of households in our sample had access to free public health care. This share was halved to about 35.0% in 2002, reflecting the impact of the health care reform on household health expenditures.

To control for the effects of rising education expenditure on households' saving rate, we include in the regressions the mean age of children and the number of children at school. To control for effects of potential competitive savings motive emphasized in Wei and Zhang (2011), we add the number of boys among children as an independent variable.

Purchasing a house is argued to be one of the major motives of saving for Chinese households (Wei and Zhang, 2011). The housing reform that started in 1998 has led to extensively privatized housing market. As shown in Table 2, the homeownership rate in our sample doubled over the seven year period, from 42.0% in 1995 to 80.4% in 2002. We control for the potential effects of saving for home purchases by including a housing dummy that takes a value of one if the household is a home owner and zero otherwise. We also include in our regressions an interaction term between the SOE dummy and non-homeownership to control for the effects of potential savings by SOE workers for home purchases rather than for precaution against future unemployment risks.

Finally, the SOE reform and the massive layoffs hit some industries and geographic areas more heavily than others. We therefore include in our regression two dummy variables that indicate the industries and provinces where the household head worked.

IV.3. **Empirical Strategies.** Following Lusardi (1998) and Carroll, Dynan, and Krane (2003), we estimate the importance of precautionary saving using the ratio of financial wealth to permanent income as the dependent variable. The estimation equation for each household i is given by

$$W_i/P_i = \beta_0 + \beta_1 SOE_i + \beta_2 RISK_i + \beta_3 \log(P_i) + \beta_4' Z_i + v_i, \tag{1}$$

where W_i/P_i is the ratio of financial wealth (W_i) to permanent income (P_i), SOE_i is a dummy variable, which takes a value of one if the household head works for an SOE and zero if the household head works for a government or public institution (GOV), $RISK_i$ denotes individual income risks measured by the coefficient of variations (CV) of log annual income of the household head for the past 5 or 6 years, Z_i is a vector of demographic characteristics, and v_i is the error term.

We choose financial wealth/permanent income (W/P) ratio as the dependent variable for three reasons. First, precautionary saving model predicts that W/P ratio should be a function of age and other household characteristics (Lusardi, 1998; Carroll and Samwick, 1998), and therefore using W/P ratio as the dependent variable is consistent with the theoretical framework. Second, as a normalized measure of wealth, W/P ratio makes wealth of households with different income levels comparable. Third, W/P ratio captures a household's cumulative savings, which helps to establish a natural link between wealth accumulation and saving behavior.

As we argue above, the SOE reform in the late 1990s mainly affected the job security for SOE workers, but not for GOV workers. Thus, the reform provides a natural experiment that helps identify changes in precautionary savings for SOE workers relative to GOV workers. This aspect of the data allows us to use a difference-in-difference (DiD) approach to identify changes in the relative precautionary savings across the two sectors before and after the reform.

To implement this idea, we estimate the regression equation (1) using the CHIP survey data for each of the two years in our sample, one before the reform (1995) and the other after (2002). The estimated coefficient (β_1) of the SOE dummy variable from each regression captures the excess savings by SOE workers relative to GOV workers. All else equal, changes in the estimated value of β_1 from 1995 to 2002 captures changes in the relative magnitude of precautionary savings of the SOE workers caused by increases in their unemployment risks following the breaking of the iron rice bowl.[7]

To estimate the quantitative importance of precautionary saving, it is necessary to correct a self-selection bias in occupational choices. An individual with high risk aversion has an incentive to choose a job with low income risk. Similarly, a worker with low risk aversion may want to choose a job with high income risk (with potentially high expected income). Failing to control for self-selection in occupational choice may lead to significant downward bias in estimating the importance of precautionary savings (Fuchs-Schündeln and Schündeln, 2005). We address the self-selection issue by restricting our sample to include only workers whose jobs were assigned by the government. For assigned jobs, the government has the final power to determine the worker's occupation and compensation; and thus, the worker's occupational choice is likely unrelated to her preferences.

The CHIP survey contains a question that asks an interviewee whether his current job was assigned by the government or found through a searching and matching process such as passing an exam, responding to a vacancy post, or referred by friends. We use answers to this question to identify the subsample of workers with government-assigned jobs. In the 1995 survey, 82.6% of workers had jobs assigned by the government. In the 2002 survey, this share declined substantially, but remains significant at 71.7% in our sample. With this restriction imposed, we obtain a somewhat smaller sample of 3627 in 1995 (with 2369 SOE

[7]Our approach is slightly different from the standard DiD approach, which pools data in all sample years and thus puts an implicit restriction that the coefficients on all variables but the SOE dummy should be identical across time. With our approach, we estimate a separate regression for each of the two sample years and thus we do not impose such restrictions. Since China has gone through large structural changes between 1995 and 2002, many demographic aspects of our sample are likely to have changed during that period. Thus, taking a more flexible DiD approach as we do here seems appropriate.

workers and 1258 GOV employees) and 2170 in 2002 (with 1171 SOE workers and 999 GOV employees).

It is important to recognize that, while the SOE dummy (SOE_i) in the regression equation (1) captures the effects of relative *systematic* risks of unemployment facing SOE workers on their saving behaviors, the $RISK_i$ variable reflects *idiosyncratic* income risks that are unrelated to the worker's occupation (SOE or GOV). These two variables are indeed uncorrelated in our sample, with a correlation coefficient of about -0.04 in each of the two sample years, consistent with our view that they capture different aspects of the risks for individual households.

In estimating the model, we also need to address the issue that arises with observations of zero wealth. In our sample, 11.3% of households have zero wealth in 1995 and this share declined to 4.5% in 2002. We treat this issue as a "censored data" problem. We address the issue by estimating an instrumental variable (IV) Tobit regression. In a robustness check, we also estimate the baseline model in equation (1) by eliminating the zero-wealth observations from our sample and then applying the standard two-stage least squares (2SLS) method (see Section VI.3).

V. Empirical Results

We now discuss the main empirical results and provide evidence of precautionary saving. We also examine the quantitative importance of the self-selection bias and disentangle the effects of permanent income effects from precautionary saving.

V.1. **Evidence of precautionary saving.** Table 3 shows the main results from our benchmark estimation with self-selection corrected. The parameter of interest is the estimated coefficient of the SOE dummy, β_1, which captures the difference in wealth accumulation between SOE and GOV workers when we control for the effects of all the demographic characteristics in the empirical model described by equation (1). The estimated value of β_1 is statistically insignificant in 1995 (column (i)), indicating that wealth accumulations of SOE workers and GOV workers were similar in 1995. By 2002, however, SOE workers had accumulated significantly more financial wealth than GOV employees (reflected by a much large estimate of β_1, see column (iii)). This evidence suggests that the relative saving behaviors of SOE workers has changed during that period. In particular, the difference between the two estimated values of β_1 is large ($0.723 - 0.09 = 0.633$) and statistically significant, with a p-value of 0.048. The substantial increase in β_1 reflects the effects of the large-scale SOE reform on workers' unemployment risks and thus captures the importance of precautionary saving.

We now discuss the interpretations of estimated coefficients for the control variables. The estimates of the coefficient β_2 of income uncertainty (CV) confirms the theoretical prediction of precautionary saving theory. They are all positive and significant at 1% level. The estimated coefficient β_3 of $\log(P)$ is positive and is significant only in 2002, implying a significant income effect in that year. A positive value of β_3 is consistent with nonhomothetic preferences.

The estimation for other control variables suggests that households with a female head accumulated more financial wealth than those with a male head in both 1995 and 2002.[8] All occupation dummy variables have significant coefficients in 2002 but not in 1995.

To control for the impact of health care spending on households' saving behavior, we include in the regression a dummy variable indicating public health care (mostly free) and another dummy indicating public health insurance. The coefficients of both dummy variables are small and insignificant in 1995 and become significantly negative in 2002. This result is intuitive. In 1995, most workers were covered under a near-free public health care system, so that the health care status did not impose any significant impact on households' saving behavior. However, after the health care reform that started in 1998, a significant fraction of health care spending was shifted to private households. Thus, households not covered by public health care or public health insurance had a strong incentive to save. This finding is consistent with that obtained by Chamon and Prasad (2010), who report that declining (near-free) public provisions of health care in the late 1990s in China created strong motives for precautionary saving against potential health shocks.

To control for the effects of education reforms on households' saving behavior and potential competitive saving motive in the marriage market emphasized by Wei and Zhang (2011), we include in our regression three additional variables: the mean age of children, the number of children enrolled in schools, and the number of boys in each household. Our estimation shows that the mean age of children does not explain wealth accumulation in both years. The number of children at school reduces wealth accumulation in both years, although the effects were significant only in 2002. Having more children at school requires more expenditure on education after the education reforms in the late 1990s, which led to lower disposable income and reduced wealth accumulation. The number of boys contributes positively to savings in 1995, consistent with the findings in Wei and Zhang (2011), although the estimated coefficient is insignificant for that year. In 2002, however, having more boys in the household actually reduced savings and the effect is significant at the 10% confidence level. A possible explanation lies in the reforms of social security and the pension system, which substantially weakened the public safety net for retirees. In the Chinese culture, sons are supposed to take

[8]Lusardi (1998) finds a similar result using U.S. data.

responsibility of taking care their elderly parents. Therefore, facing an uncertain future of safety net, more boys among children mean better insurance for their parents. Parents thus do not need to save that much for their old-age consumption.

Finally, to control for the effects of housing reform on saving, we include in the regression a home ownership dummy and an interaction term between a non-homeowner dummy and the SOE dummy. The coefficients for these two variables are not significant for both years. A possible explanation is back in 2002, the housing market was not fully developed and home purchases were heavily subsidized. This result indicates that the saving motive for home purchases was weak in both 1995 and 2002.

V.2. **Correcting the self-selection bias.** The literature shows that self-selection in occupational choices can lead to a substantial downward bias in the estimated magnitude of precautionary saving (Fuchs-Schündeln and Schündeln, 2005). An individual with high risk aversion has an incentive to choose a job with low income risk. Similarly, a worker with low risk aversion may want to choose a job with high income risk (with potentially high expected income). To correct the downward bias caused by self-selection, we restrict our sample to workers whose jobs were assigned by the government. To the extent that the government's job assignments are not systematically correlated with individual risk attitude, our sample restriction should minimize the bias caused by self-selection in occupational choices.

Our estimation results show that the downward bias caused by self-selection was insignificant in 1995 but became significant in 2002. This can be seen by comparing the estimated value of β_1 obtained from the subsample with government-assigned jobs with that from the full sample for each year (i.e., the difference between β_1 in columns (i) and (ii) for 1995 and in columns (iii) and (iv) for 2002). In particular, the downward bias from self-selection was $0.039 - 0.09 = -0.051$ in 1995, which is statistically insignificant; in 2002, the bias became statistically significant at $0.327 - 0.723 = -0.396$. Thus, without correct the self-selection bias, we would have under-estimated the importance of precautionary saving, especially for the post-reform period in 2002. The magnitude of the downward bias caused by self-selection in 2002 (0.396) is equivalent to a little under 5 months of permanent income.[9]

V.3. **Disentangle PIH Effects and Precautionary Savings.** Now we further discuss the implications of β_1^{1995} and $\beta_1^{2002} - \beta_1^{1995}$ based on the results without self-selection bias. To our knowledge, we have controlled all relevant variables except for three factors between SOE workers and GOV employees: first, different unemployment risk caused by the SOE reform; second, different income expectations as documented in Table 4 (call it PIH effect); and

[9]The dependent variable (W/P) is the ratio of financial wealth to annual permanent income. A value of $W/P = 0.4$, for example, is equivalent to $0.4 * 12 \approx 5$ months of permanent income.

different pension replacement ratios (call it pension effect) as in Table 5, in the equation (1). The estimated value of β_1 should be on average interpreted as an extra wealth accumulation of SOE workers due to those uncontrolled factors (such as their higher unemployment risk and lower pension replacement ratio). Note that prior to the SOE reform that SOE workers have no unemployment risk and they wouldn't expect their income to decrease. Therefore, $\beta_1^{1995} = 0.090$, i.e., SOE workers on average have higher W/P ratio by 0.090, should come from a pure pension effect since SOE workers had a 25 percent lower replacement ratio than GOV employees in 1995 (See Table 5). Later on we shall use this result to identify the effect of an expected lower pension wealth on SOE workers' wealth accumulation in 2002. If the replacement ratios had not changed from 1995 to 2002 and the PIH effect were able to be controlled, then $\beta_1^{2002} - \beta_1^{1995} = 0.633$ should only come from the impact of higher unemployment risk of SOE workers caused by breaking "iron rice bowl." However, due to the pension reform occurred in 1997, the replacement ratios decreased dramatically from 74% / 99% to 64% / 94% for SOE / GOV workers, and the difference of SOE and GOV replacement ratios has increased from 25% to 30%. The unparalleled fall in replacement ratios thus implies that $\beta_1^{2002} - \beta_1^{1995}$ also includes the impact of the pension reform.

As shown in Section 4.3, the SOE reform gives rise to not only a huge difference in unemployment risk but also a significant difference in future income expectation between the groups of SOE and GOV workers. The latter fact tells us that there should be a PIH effect in the estimate of β_1^{2002} for the regression equation (1). Keeping other things equal, the PIH theory predicts that workers who expect declining future income save more than workers who expect their future income will not decrease. We need to point out that the PIH effect in β_1^{2002} as well as $\beta_1^{2002} - \beta_1^{1995}$ could come from two different channels: one is through the household's income expectation, the other is through the expectation of future pension. In this subsection, we shall discuss how to eliminate the two parts of PIH effect in $\beta_1^{2002} - \beta_1^{1995}$.

The first part of PIH effect in β_1^{2002} can be eliminated by further restricting our sample to those SOE workers who expect their future income will not decrease. We are able to do so because it follows from the unique question in 2002 CHIP survey mentioned in Section 4.3 that in 2002 there are 76.2% of SOE workers who expect their future income will not decrease over the next five years (see Table 4. Among 2170 observations excluding employment self-selection, there are 1168 SOE workers. Among these workers, 880 expect their income over the next five years will not decline, while 288 expect their income will decline.) We run IV-Tobit 2SLS regression to each group separately, with our control group is still GOV employees as in Table 3; the results are reported in Table 6. We are especially interested in the results presented in column (ii) in Table 6, which teases out the income expectation

effect. Comparing with the results shown in column (iii) of Table 3, the estimated value of β_1^{2002} reduces from 0.723 to 0.603, though it is still significant at 5% level. The difference value $0.723 - 0.603 = 0.120$ can be thought of as the extra wealth accumulation of SOE workers in 2002 due to the first part of PIH effect.

An interesting thing is that as the PIH theory predicts, for the group of workers who expect future income to decline (see column (i) in Table 6), the estimated value of β_1^{2002} is much larger than that for the group in which workers expect future income not to decline. This is because on top of precautionary saving motive, the PIH effect also induces savings and hence reinforces the precautionary savings for the SOE workers who expect future income to decline; while for the SOE workers expecting future income not to decline, the impact of PIH effect on savings is opposite to precautionary saving motive.

To eliminate the pension effect in $\beta_1^{2002} - \beta_1^{1995}$, we need to correct the distortion of pension effect in β_1^{2002} from the unparalleled fall in replacement ratios between SOEs and GOV. Recall that $\beta_1^{1995} = 0.090$ is purely from a pension effect, that is, a 25.4 percent lower pension replacement ratio for SOE workers than GOV employees in 1995 (i.e., $(74.2\% - 99.5\%)/99.5\% = -25.4\%$) makes SOE workers accumulate more wealth by $\beta_1^{1995} = 0.090$, though it is insignificant. Now we need to estimate by how much a 31.9 percent lower replacement ratio that SOE workers expect (i.e., $(64.3\% - 94.4\%)/94.4\% = -31.9\%$) make them accumulate more wealth in 2002. It turns out that according to a linear approximation, there is an approximate pension effect of $(31.9/25.4) \times \beta_1^{1995}$ in β_1^{2002}, and thus we should subtract $31.9/25.4 = 1.26$ times β_1^{1995} from β_1^{2002}, i.e., $\beta_1^{2002} - 1.26 \times \beta_1^{1995} = 0.603 - 1.26 \times 0.090 = 0.490$, rather than $\beta_1^{2002} - \beta_1^{1995} = 0.603 - 0.090 = 0.513$.[10] By doing so, we tease out the second part of PIH effect.

By eliminating the income expectation and pension effect from the estimation, we provide a clean identification of precautionary saving motive of SOE workers due to the expected increase in unemployment risk caused *only* by breaking "iron rice bowl." We should also point out that it might be a lower bound of this precautionary saving motive.[11]

[10] we have constructed life-time pension wealth on individual level following Feng, He and Sato (2011) to control for pension effect. However, the construction is heavily based on the sector that one works for and also his current income level. Therefore, constructed pension wealth is highly correlated to the SOE dummy and constructed permanent income, which creates a severe multi-collinarity problem for estimation equation (1).

[11] Notice that $\beta_1^{2002} = 0.603$ might downward bias the estimation of precautionary savings due to the following two reasons. First, we do not exclude workers who expect their future income will increase, while for this group, the PIH channel induces them to save less. Second, workers who expect their future income fall might be the group also faces higher probability of being laid-off and hence higher future income uncertainty. Therefore their precautionary savings motive might be stronger than the group who expect their income at

V.4. **Importance of Precautionary Saving Motive.** In the above subsection, we have identified the effect of SOE reform on SOE workers' precautionary savings motive. How important is this motive quantitatively? Following the literature (Carroll and Samwick, 1998; Fuchs-Schündeln and Schündeln, 2005), in this subsection we will go through a simulation procedure to approximately quantify the amount of precautionary wealth as a percentage of overall financial wealth held by SOE households. For 1995, the simulation is based on the estimated result in column (i) of Table 3. The simulation for 2002 is based on the result in column (ii) of Table 6.

The detailed procedure is as follows: first, based on both the estimated results mentioned above, we give two sets of the predicted values of wealth for all SOE households and compute their average values, respectively, denoted by $\hat{W}_{SOE}^{2002}$ and $\hat{W}_{SOE}^{1995}$. Second, we assume that all these SOE workers had become GOV employees, that is, they kept all the other original characteristics unchanged, but had no unemployment risk and enjoyed GOV employees' pension replacement ratio, and then by using the same estimated coefficients as in the first step, we predict the wealth that they would accumulate in this counterfactual economy. Let $\tilde{W}_{SOE}^{1995}$ and $\tilde{W}_{SOE}^{2002}$ be the average predicted values of wealth for SOE households respectively in 1995 and 2002 counterfactual economies. Since SOE workers in 1995 have no unemployment risk, the difference $\hat{W}_{SOE}^{1995} - \tilde{W}_{SOE}^{1995}$ is the extra wealth accumulated by SOE households due to the fact that SOE workers have a 25.4 percent lower pension replacement ratio than GOV employees. However, the difference $\hat{W}_{SOE}^{2002} - \tilde{W}_{SOE}^{2002}$ as the extra wealth accumulated by SOE households is from not only the pension effect but also a higher unemployment risk of SOE workers caused by breaking "iron rice bowl." By using a similar method as in the subsection above, we can differentiate the precautionary savings due to the higher unemployment risk of SOE workers caused by breaking "iron rice bowl" as following

$$W_{SOE}^{PC} = (\hat{W}_{SOE}^{2002} - \tilde{W}_{SOE}^{2002}) - 1.26 \times (\hat{W}_{SOE}^{1995} - \tilde{W}_{SOE}^{1995}).$$

To quantify the importance of this precautionary saving motive, we define a measure as $W_{SOE}^{PC}/(\hat{W}_{SOE}^{2002} - \hat{W}_{SOE}^{1995})$, which is the ratio of the precautionary savings caused by the SOE reform to the increase in total wealth accumulation among SOE households from 1995 to 2002. It turns out that this measure is 29.5% with the standard error is equal to 0.169. In other words, the precautionary savings motive due to the SOE reform *alone* contributes about 29.5% (SE=0.169) of the increase in wealth accumulation among SOE households from 1995 to 2002. It should be emphasized that this is a lower bound for the actual contribution of the precautionary saving motive due to the SOE reform for that time period.

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least would not decline. By excluding the former group from the sample here, we might downward bias the actual magnitude of precautionary savings in the population.

In summary, through the simulation exercise in this subsection, we find that the precautionary saving motive due to increasing unemployment risk caused by the SOE reform in China is significant, and it contributes to more than one third of the increase of wealth accumulation among SOE workers from 1995 to 2002.

VI. Robustness Check

In this section, we run several experiments to check the sensitivity of our main empirical results. For each experiment, we eliminate workers whose jobs were not assigned by the government to control the self-selection bias in 1995 and 2002 sample and also remove SOE workers who expect their income will decline for the next five years in 2002 sample to control the PIH channel.

VI.1. **Large SOEs and Small SOEs.** As featured in the slogan "Grasp the Large, Let Go of the Small," during the SOE reform in the late 1990s and early 2000s, tens of thousands smaller SOEs have been shut down or privatized. In contrast, large SOEs have been corporatized or consolidated into large state-owned conglomerates (Hsieh and Song, 2013). These survived large SOEs often enjoy government protection and monopoly rights, which leads to higher profits than their privatized counterparts Li, Liu, and Wang (2012). Higher β_1 in 2002 in the regression results might be driven (at least partly) by the fact that workers in large SOEs become richer, while not because of precautionary saving motive.

To address this concern, we further divide SOEs in our sample into two groups: central or provincial SOEs (CSOE) vs. local SOEs (LSOE).[12] Our empirical model (1) thus become as follows:

$$W_i/P_i = \beta_0 + \beta_1^{CSOE} CSOE_i + \beta_1^{LSOE} LSOE_i + \beta_2 RISK_i + \beta_3 \log(P_i) + \beta_4' Z_i + v_i \qquad (2)$$

where $CSOE_i$ and $LSOE_i$ are two dummy variables for CSOEs and LSOEs. CSOEs have a bigger size than LSOEs, and employees in CSOEs also face a significantly lower unemployment risk than workers in LSOEs (Appleton, Knight, Song, and Xia, 2002). In 2002 sample, only 3.4% of workers in CSOEs had the experience of being laid-off, while this share was 7.4% for local SOE workers and 16.4% for workers in urban collective enterprises. Therefore, we would expect to see a significant higher precautionary saving motive among LSOE workers. This is exactly what we find in the regression results reported in Table 7. From 1995 to 2002, β_1^{CSOE} increases from 0.0001 to 0.088, but it is not significant in both years. In contrast, β_1^{LSOE} is 0.160 and it is not significant in 1995, while it increases dramatically to 1.082 and is significant with the p-value of 0.046 of the Chow test, implying that LSOEs workers have a much stronger precautionary saving motive than their counterparts in CSOEs.

[12]LSOE also includes urban collective enterprises.

VI.2. **Survival Bias.** In order to clearly identify the precautionary savings caused by the SOE reform, we would like to control the characteristics of SOE workers before and after the reform. In other words, except that they face a much higher unemployment risk in 2002, they should share the same characteristics as those of SOE workers in 1995, which means lay-off should be random. Although, the massive lay-off between 1995 and 2002 was mainly carried through large-scale shut down of SOEs (especially smaller SOEs), implying no serious sample selection problem. However, as in fact the lay-off was by no means purely random. When a SOE needs to lay off a part of its employees to reduce the burden, workers with older age, lower education attainment and lower skills might face a higher chance to be called (Appleton, Knight, Song, and Xia, 2002). Therefore, compared to SOE workers in 1995 before the reform, SOE workers in 2002 who survived after the reform might tend to have higher ability and hence higher income. Thus higher β_1 in 2002 might at least partly reflect this "survivor" bias.

To control the survivor bias, we extend the 2002 sample to not only include current SOE workers but also individuals who had once worked in SOEs.[13] Based on this extended sample, we then use a Probit model to estimate the probability of being laid-off for SOE workers. The dependent variable in the Probit model is a dummy variable which takes value 1 when an individual had been laid-off or currently is being laid-off and zero otherwise. The independent variables include an individual's age, gender, education level, occupation, and industry and province dummies. The Probit model is described as follows:

$$\Pr(\text{laid-off}_i = 1 \mid Z_i) = \Phi(Z_i\delta) \tag{3}$$

where Z_i is the individual i's characteristics. Based on the estimation results of the Probit model, we go back to the 1995 sample to predict each SOE worker's probability of being laid-off in the future (more precisely, the probability of being laid-off from 1995 to 2002). According to Giles, Park, and Zhang (2005), urban household unemployment rate reached 11.1% in 2002. This implies that for SOE workers in 1995, at least 10% of them would not survive until 2002. Therefore we eliminate the SOE workers in 1995 sample who have the top 10% probability of being laid-off in future. In other words, we keep the top 90% of SOE workers in 1995 sample and believe that they can survive the massive lay-off. By doing so, we make sure that SOE workers in both 1995 and 2002 are all survivors and hence share same characteristics.

Table 8 shows the estimated results of equation (1) for controlling "survivor" bias. Column (1) keeps all workers in 1995 sample. It just replicates the results in column (i) of Table

[13]Individuals who had worked in SOEs include currently laid-off SOE workers and workers who used to work for SOEs now are employed by other non-SOE firms.

3. Column (2) shows that if we eliminate SOE workers who have the top 10% probability of being laid-off in future, β_1 increases from 0.090 to 0.122. But it is not significant. As a further robustness check, we also eliminate SOE workers who have the top 20% and 30% probability of being laid-off in future in 1995 sample and report results in columns (3) and (4), respectively. Even when we only keep 70% SOE workers in original 1995 sample to control "survivor" bias, which means that 30% of SOE workers in 1995 sample would not appear in regression of column (4), β_1 is still not significant in 1995. These results show that the "survivor" bias would not significantly affect the identification of precautionary savings.

VI.3. **Excluding Zero Wealth Observations.** Recall that all the empirical results above are based on the sample including zero wealth observations and the estimations from the (IV) Tobit model. To test whether these results are driven by zero wealth observations, we exclude zero wealth observations from the sample and run the commonly used IV (2SLS) regression respectively for 1995 and 2002 data. Our sample size thus reduces to 3221 and 1807 observations for 1995 and 2002, respectively. The results are summarized in panel A of Table 9.

β_1 is 0.100 (not significant) in 1995 and 0.467 (significant at 10% level) in 2002. The adjusted difference is $0.467-1.26\times0.100 = 0.341$. Comparing to the adjusted difference in β_1 between column (i) in Table 3 and column (ii) in Table 6, which is $0.603-1.26\times0.090 = 0.490$, we can see that when excluding zero wealth observations from the sample, the effect of the SOE reform on precautionary wealth accumulation is weakened, implying that households with zero wealth have even stronger precautionary saving motive. However, the adjusted difference in β_1 from 1995 to 2002 is still significant enough to identify the precautionary saving motive caused by the SOE reform.

Based on the results, we also redo the simulation exercise in Section 5.3 to quantify the magnitude of precautionary savings motive. According to our calculation, the precautionary savings due to the SOE reform contributes to 21.8% (SE=0.133) of the increase in wealth among urban SOE households from 1995 to 2002. This is a magnitude that can not be ignored in any sense.

VI.4. **Conventional Risk Measure.** So far we keep using CV (ratio of the standard deviation to the mean) of the logarithm of a household head's labor income over the past five or six years to measure idiosyncratic income risk. An alternative measure of risk, which is also widely used in the literature, is the variance of the logarithm of permanent income (Carroll and Samwick, 1998; Fuchs-Schündeln and Schündeln, 2005). In this subsection, we check the sensitivity of our results to this conventional risk measure. More specifically, we follow Carroll and Samwick (1998) to divide our data sample into 20 subsamples corresponding to

the five occupation categories and four education groups (see Table 1) in both years. For each household, we calculate the log variance of log of annual income with respect to the mean income within the group that it belongs to. We use this within-group variance of income to proxy risk. The results are shown in panel B of Table 9.

As we can see from the table, the results are similar to those in Tables 3 and 6. The estimated value of β_1 increases from 0.083 (not significant) in 1995 to 0.713 (5% significant) in 2002. The adjusted difference is $0.713 - 1.26 \times 0.083 = 0.608$. The simulation exercise shows that the precautionary saving motive contributes 37.3% (SE=0.197) of the increase in wealth among urban SOE households from 1995 to 2002. Therefore, we conclude that using the conventional risk measure does not significantly change our conclusion.

VI.5. **Alternative Wealth Measures.** Some alternative measures of wealth such as very liquid assets and non-housing non-business wealth are also commonly used in the literature (Carroll and Samwick, 1998). We shall check the sensitivity of our empirical results to these alternative measures of wealth (see Table 1 for the construction of these variables in CHIP).[14]

Panel C of Table 9 presents the results using very liquid assets as wealth measure to construct the dependent variable in equation (1). The estimated value of β_1 increases from 0.062 (not significant) in 1995 to 0.439 (significant at 10% level) in 2002. Based on this empirical result, the simulation exercise shows that the precautionary savings due to the SOE reform contributes to 33.6% (SE=0.218) of the increase in very liquid assets among urban SOE households from 1995 to 2002.

Panel D of Table 9 shows the results employing non-housing non-business wealth to construct the dependent variable in (1). The estimated value of β_1 is 0.210 and insignificant in 1995 and it increases substantially to 0.632 (significant at 10% level) in 2002. The simulation exercise shows that the precautionary savings due to the SOE reform contributes to 29.5% (SE=0.210) of the increase in nonhousing nonbusiness wealth among urban SOE households from 1995 to 2002. In summary, we conclude that using alternative wealth measures do not significantly affect our standard result.

[14]Another widely used measure of wealth is total net worth, which is NHNBW plus estimated market value of owner-occupied housing and fixed assets of farms and business. Market value of owner-occupied housing accounts for a significant portion of total net worth. However, before 1998, housing in China was mostly assigned by the government. There was no housing market. The privatization of housing market began in 1998 and moved slowly until the mid 2000s. Therefore it is very hard to accurately estimate market value of owner-occupied housing back to the time period we consider in this paper. In addition, since housing market has not been fully established until recently, it is even harder to sell a house once one purchase it. This makes housing in China is extremely illiquid. In other words, precautionary saving is not the main reason why Chinese purchase house. Therefore, a caveat should be noticed for using total net worth as an appropriate measure for identifying precautionary wealth in Chinese economy.

VII. Conclusion

Using China's large-scale reform of the state-owned enterprises (SOEs) in the late 1990s as a natural experiment, we identify and quantify the importance of precautionary saving in a rapidly growing transition economy. With self-selection in occupational choices corrected and with expected income effects controlled for, we obtain significant evidence of precautionary saving stemming from sudden increases in unemployment risk for SOE workers relative to that for government employees. Our estimation suggests that precautionary saving can account for about 30 percent of the actual increase in wealth accumulation by urban SOE households in China for the period from 1995 to 2002. Thus, precautionary saving associated with large structural changes in the Chinese economy is an important contributor to the rising Chinese household saving rate.

Appendix A. A Case Study: Massive Lay-off in Fushun, Liaoning

Smyth, Zhai, and Wang (2001) demonstrate a case study of massive lay-off happened in Fushun, Liaoning. Fushun is a medium sized city located 45 kilometers northeast of Shenyang, the capital city of Liaoning. It was well known as a state-owned heavy industrial base in the "rust belt" of China. In 2000, nearly 91% of workers in Fushun were employed by SOEs. And SOEs produced 88.5% of gross industrial output.

The wave of layoffs (*xia gang*) hit Fushun very severely. In 2000, laid-off workers from SOEs accounted for about 42% of total workers in SOEs in Fushun, which was the highest in Liaoning. The industries saw largest number of laid-off workers were coal, textiles, light industry, electronics, machinery and chemicals. For example, of the 71000 workers in SOEs in the coal sector in Fushun, 35000 or 49.7% of workers were classified as *xia gang*.

What differentiates *xia gang* from official unemployment (known as "registered unemployment") is that *xia gang* workers still retain their ties with SOEs they used to work. In practice, there were different ways to lay off SOE workers. 1) *fang jia*, firms make workers on temporary leave; 2) *xia gang*, defined as those on long-term leave; 3) *tui yang*, which refers to workers who have taken voluntary early retirement. 4) *mai duan,* which refers to firms pay a lump-sum amount (usually not exceeding three year salary) to buy out or terminate the labor contract with workers.

Allowances were paid to *xia gang* workers by their former employer, the local government, and the central government, each was supposed to contribute one-third. However, many SOE firms had financial difficulties in making the payments to the laid-off workers. For example, of the 35,000 laid-off workers from state-owned coal mines in Fushun, 33,000 did not receive basic living allowances from their former employers.

In Fushun, the main avenue for laid-off workers to find new jobs was through re-employment centers sponsored by the local government. The re-employment centers offered various training classes. However, there are several problems hinder the effectiveness of government-sponsored re-employment structure. The majority of laid-off workers were middle-aged and female accounted for a high proportion. It is very hard for them to find a job given the discrimination against age and gender in Chinese labor market. And they were reluctant to take jobs in non-state-owned sector worrying that it is going to cut their ties with their original enterprises. Among the laid-off workers who have registered at re-employment centers in Fushun, 50% are middle-aged. Among them, only 50% of these middle-aged workers found jobs.[15]

[15]This is consistent with the official number of national reemployment rate, see Lee (2000). However, a survey of 54,000 workers carried out by the Chinese Federation of Labor Unions in 1997 reports that only about 18% of the laid off have found new employment. See Lee (2000) for details.

TABLE 1. Definition of variables

Variable	**Description**
Financial wealth (W)	Balances in checking accounts, saving accounts, CDs, bonds, stock holdings, etc.
Very liquid assets (VLA)	Financial wealth minus business investment, housing fund, etc.
Nonhousing, nonbusiness wealth (NHNBW)	Financial wealth plus estimated market value of durable cons. goods and other assets, minus total debt
Annual income	Annual income of household head and revenues from business, farming, fishing, gardening, livestock, non-retirement wages, retirement income, subsidies, and other income
Income risk	Coefficient of variation (CV) of log annual income of past 5 or 6 years
SOE	Dummy variable for employers of HH, 1 for State Owned Enterprises (SOE), 0 for Government & Institutions
Permanent income (P)	See text
W/P	Wealth / permanent income ratio
Age	Age of HH
Male	Dummy variable for the gender of HH, 1 for male, 0 otherwise
Married	Dummy variable for the marital status of HH, 1 for married, 0 otherwise
Education	Four dummy variables for college, senior middle school, junior middle school, and elementary school or below (see text)
Occupation	Five dummy variables for professional, director or manager, skilled or office workers, unskilled or service workers, and the others (see text)
Health care	Three dummy variables for public health care, public health insurance and own payment (see text)
No house owned	Dummy variable for housing ownership, 1 for no house owned, 0 otherwise
Age of children (mean)	Mean age of children in household
Num. of boys	Number of boys in household
Num. of children at school	Number of children at school in household

TABLE 2. Summary statistics of the full sample

Variable	**1995**			**2002**		
	Obs.	**Mean/%**	**SD**	**Obs.**	**Mean/%**	**SD**
Financial wealth (W)	4390	10042	10165	3027	32826	32140
Annual income	4390	7034	3349	3027	12985	6658
CV×100	4390	2.61	2.07	3027	2.9	7.67
Age	4390	40.91	7.37	3027	42.61	6.88
Age of children (mean)	4390	11.65	6.94	3027	12.5	7.58
Num. of boys	4390	0.57	0.58	3027	0.47	0.53
Num. of students	4390	0.65	0.48	3027	0.69	0.54
Household size	4390	3.18	0.68	3027	3.03	0.61
Male	4390	63.4%		3027	68.8%	
Married	4390	97.6%		3027	96.7%	
Education						
College	4390	24.6%		3027	37.2%	
Senior middle school	4390	39.5%		3027	38.8%	
Junior middle school	4390	30.8%		3027	21.5%	
≤Elemen. School	4390	5.1%		3027	2.4%	
Occupation						
Professional	4390	24.3%		3027	24.7%	
Director or manager	4390	14.3%		3027	15.3%	
Skilled worker	4390	44.7%		3027	44%	
Unskilled worker	4390	13.6%		3027	15%	
Other occupation	4390	3.1%		3027	0.9%	
Health Care						
Own payment	4390	9.9%		3027	23.1%	
Public health care	4390	71.3%		3027	35%	
Public health insurance	4390	8.8%		3027	41.9%	
Own house	4390	42%		3027	80.4%	
SOE	4390	67.8%		3027	56.2%	
Job assigned by Gov.	4375	82.9%		3018	71.9%	

Notes: Monetary values are in constant RMB Yuan, base year = 2002.

TABLE 3. IV-Tobit regressions, 1995 and 2002 sample

Dep. variable:	**1995**		**2002**	
W/P	**(i)**	**(ii)**	**(iii)**	**(iv)**
SOE	0.090	0.039	0.723**	0.327
	(0.117)	(0.114)	(0.298)	(0.221)
CV×100	0.111***	0.136***	0.124***	0.091***
	(0.040)	(0.038)	(0.045)	(0.028)
log(permanent income)	0.759	1.225	4.512***	3.533***
	(1.028)	(0.900)	(1.497)	(0.992)
Age	0.020	-0.020	0.028	0.240*
	(0.052)	(0.050)	(0.150)	(0.125)
Age squared(*100)	-0.030	0.019	-0.039	-0.274*
	(0.059)	(0.059)	(0.175)	(0.147)
Male	-0.362***	-0.463***	-1.180***	-1.176***
	(0.102)	(0.094)	(0.202)	(0.148)
Professional	0.102	0.031	4.776***	0.370
	(0.212)	(0.200)	(1.648)	(0.787)
Director	0.295	0.185	4.780***	0.183
	(0.214)	(0.208)	(1.636)	(0.800)
Skilled worker	0.042	0.004	4.993***	0.341
	(0.182)	(0.168)	(1.661)	(0.762)
Unskilled worker	-0.031	0.039	6.093***	0.981
	(0.201)	(0.179)	(1.770)	(0.767)
Public med service	0.047	0.036	-1.228**	-0.978***
	(0.192)	(0.166)	(0.501)	(0.362)
Public med insurance	0.031	0.102	-0.908**	-0.755**
	(0.166)	(0.150)	(0.434)	(0.318)
Married	0.520***	0.488***	0.637	0.406
	(0.192)	(0.161)	(0.429)	(0.363)
Age of children (mean)	0.008	0.005	0.004	-0.000
	(0.006)	(0.006)	(0.013)	(0.010)
Num. of boys	0.044	0.022	-0.253*	-0.198*
	(0.048)	(0.045)	(0.145)	(0.118)
Num. of children at school	-0.086	-0.035	-0.317*	-0.363***
	(0.066)	(0.063)	(0.176)	(0.140)
Household size	-0.037	-0.008	0.279	0.357***
	(0.051)	(0.048)	(0.171)	(0.136)
No house owned	0.080	0.138	-0.244	-0.221
	(0.101)	(0.097)	(0.264)	(0.228)
No house owned×SOE	-0.114	-0.106	0.356	0.300
	(0.109)	(0.104)	(0.376)	(0.300)
Industry & Province dummies	yes	yes	yes	yes
Log-Likelihood	-7167.03	-8875.88	-5803.38	-8240.22
p-value of Chow test for SOE			0.048	0.247
Number of observations	3627	4390	2170	3027

Notes: Results from instrumental variable Tobit regressions. Standard errors are in parentheses and are corrected for heteroskedasticity. Columns (i) and (iii) show the estimation results obtained from the subsample with government assigned jobs and thus correct for the self-selection bias in occupation choices. Columns (ii) and (iv) are obtained using the full sample and thus do not address the self-selection issue.

TABLE 4. Comparison between employees in GOV vs. SOEs

		1995			2002		
	Variable	**Obs.**	**Mean**	**SD**	**Obs.**	**Mean**	**SD**
GOV	Financial wealth (W)	1413	10457	10209	1325	34677	32351
	Annual permanent income	1413	7545	3215	1325	14752	6698
	W/P	1413	1.376	1.386	1325	2.559	2.36
	Non homeowners	1413	0.546	0.498	1325	0.165	0.372
	Job assigned by Gov.	1408	0.893	0.309	1319	0.757	0.429
	Expected income loss	N.A	N.A	N.A	1321	0.114	0.318
SOE	Financial wealth (W)	2977	9845	10140	1702	31386	31910
	Annual permanent income	2977	6791	3385	1702	11610	6294
	W/P	2977	1.382	1.448	1702	2.703	2.906
	Non homeowners	2977	0.597	.491	1702	0.220	.414
	Job assigned by Gov.	2967	0.798	0.401	1699	0.689	0.463
	Expected income loss	N.A	N.A	N.A	1699	0.238	0.426

Notes: Data are taken from CHIP surveys. Monetary values of financial wealth and permanent income are in constant Chinese Yuan units, with 2002 as the base year.

TABLE 5. Pension differences

	Variable	**1995**	**2002**
GOV	average pension income	5294	12706
	average current worker salary	5318	13460
	pension replacement ratio	99.5%	94.4%
SOE	average pension income	3976	7633
	average current worker salary	5358	11873
	pension replacement ratio	74.2%	64.3%

Notes: Data used in this table are available from China Labor Statistical Yearbook 2003. The average pension income and current worker salary for GOV are weighted by the number of employees in government and institutions.

TABLE 6. Regressions with 2002 sample: Controlling for PIH effects

Dep. variable:	**expected future income**	
W/P	**decline**	**non-decline**
SOE	1.257**	0.603**
	(0.531)	(0.305)
CV×100	0.120**	0.123***
	(0.061)	(0.046)
log(permanent income)	5.339**	4.681***
	(2.194)	(1.665)
Age	0.103	0.068
	(0.172)	(0.167)
Age squared(*100)	-0.150	-0.088
	(0.200)	(0.195)
Male	-0.955***	-1.161***
	(0.224)	(0.224)
Professional	1.123	5.386***
	(1.649)	(1.872)
Director	1.219	5.439***
	(1.668)	(1.856)
Skilled worker	1.799	5.554***
	(1.602)	(1.891)
Unskilled worker	2.755*	6.797***
	(1.661)	(2.017)
Public med service	-1.212*	-1.378**
	(0.632)	(0.571)
Public med insurance e	-0.595	-1.055**
	(0.463)	(0.507)
Married	0.399	0.590
	(0.525)	(0.441)
Age of children (mean)	0.011	-0.001
	(0.015)	(0.013)
Num. of boys	0.058	-0.266*
	(0.191)	(0.160)
Num. of children at school	-0.251	-0.281
	(0.231)	(0.193)
Household size	0.164	0.317*
	(0.184)	(0.181)
No house owned	-0.373	-0.234
	(0.282)	(0.267)
No house owned×SOE	-0.170	0.548
	(0.620)	(0.415)
Industry & Province dummies	yes	yes
Log-Likelihood	-3182.68	-4925.80
p-value of Chow test for SOE	0.032	0.116
Number of observations	1284	1876

Notes: Results from 2SLS regressions. Standard errors are in parentheses and are corrected for heteroskedasticity.

TABLE 7. Precautionary saving by workers in central vs. local SOEs

Dep. variable: W/P	**1995**	**2002**
CSOE	0.0001	0.088
	(0.146)	(0.294)
LSOE	0.160	1.082**
	(0.180)	(0.425)
CV×100	0.116***	0.127***
	(0.045)	(0.047)
log(permanent income)	0.893	4.930***
	(1.184)	(1.744)
Industry & Province dummies	yes	yes
Log-Likelihood	-7094.60	-4901.44
p-value of Chow test for CSOE		0.790
p-value of Chow test for LSOE		0.046
Number of observations	3627	1876

Notes: Results from instrumental variable Tobit regressions. Standard errors are in parentheses and are corrected for heteroskedasticity. "CSOE" denotes SOEs owned by the central and provincial governments and "LSOE" denotes those owned by local governments.

TABLE 8. Controlling for the survival bias

Dep. variable: W/P	**(1)**	**(2)**	**(3)**	**(4)**
Keep 1995 Sample	**100%**	**90%**	**80%**	**70%**
SOE	0.090	0.122	0.192	0.195
	(0.117)	(0.122)	(0.131)	(0.133)
CV×100	0.111***	0.123**	0.165***	0.175***
	(0.040)	(0.050)	(0.053)	(0.048)
log(permanent inc)	0.759	1.117	2.130	2.266**
	(1.028)	(1.335)	(1.358)	(1.129)
Industry & Province dummies	yes	yes	yes	yes
Log-Likelihood	-7167.03	-6703.03	-6209.17	-5746.92
p-value of Chow test for SOE	0.116	0.143	0.215	0.220
Number of observations	3627	3415	3198	2971

Notes: Results from IV-Tobit regressions. Standard errors are in parentheses and are corrected for heteroskedasticity. In column 2, we eliminate the top 10 percent SOE workers in 1995 sample who are more likely being laid-off in future; the top 20 percent in column 3 and the top 30 percent in column 4.

TABLE 9. Robustness Checks

Case	**1995**	**2002**	**Chow Test**
A. Eliminating zero wealth			
	0.100	0.467*	0.150
	(0.104)	(0.268)	
	[N=3221]	[N=1807]	
B. Conventional risk measure			
	0.083	0.713**	0.085
	(0.117)	(0.346)	
	[N=3627]	[N=1876]	
C. Very liquid asset			
	0.062	0.439*	0.168
	(0.114)	(0.248)	
	[N=3627]	[N=1876]	
D. Non-housing Non-business wealth			
	0.210	0.632*	0.243
	(0.159)	(0.355)	
	[N=3627]	[N=1876]	

Notes: Reported is the coefficient on the SOE dummy from different wealth/income ratio regressions. Results from IV-Tobit regressions. Other controls are the same with Table 3. Standard errors are in parentheses and are corrected for heteroskedasticity. Numbers of observations are in squared brackets.

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