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 the same 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 one-third 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 to contradict the permanent income hypothesis (PIH) theory, which suggests that expected

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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.

Identifying and quantifying the importance of precautionary saving in the data requires having a clean measure of uncertainty and controlling for potential self-selection bias. The empirical literature on precautionary saving typically uses income risk as a proxy for uncertainty. However, income risk is hard to measure. In particular, it is difficult to clearly identify observable and exogenous sources of risk that vary significantly across households (Lusardi, 1998; Carroll and Kimball, 2006). Most studies use cross-sectional income variance as a proxy for income uncertainty (Carroll and Samwick, 1998). But this 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).

Difficulties in measuring uncertainty and correcting self-selection bias make it challenging to identify precautionary saving. Partly reflecting these difficulties, 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

[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).

housing. In this sense, workers in both sectors held an "iron rice bowl" before the reform. 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 savings 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 a unique 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 preference. We restrict our sample to include only those households whose jobs were assigned by the government. This restriction helps us remove the effects of self-selection in occupational choice.

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 agents 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 36.6 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 savings for explaining China's rising saving rate. Earlier studies obtain mixed evidence that supports the precautionary-savings 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 rising urban household saving rate. Chamon and Prasad (2010) find that the increasing private burden of education, health and housing expenditures seems among the strongest candidates for explaining the increases in saving rates. Chamon, Liu, and Prasad (2013) document a sharp increase in income uncertainty, largely due to increase in transitory idiosyncratic shocks among Chinese urban households. They argue that rising income uncertainty leads to younger households raise their saving rates significantly. An alternative explanation for the rising Chinese saving rate is provided by Wei and Zhang (2011), who presents 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 savings. The microeconomic data in the CHIP survey that we use also enable us to correct self-selection bias in estimating the importance of precautionary savings.

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 savings.

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, 80% of jobs were assigned by the government in 1995 and 70% in 2002. Since the government makes the final decision on job assignments, worker occupations are probably unrelated to the risk attitudes of individual workers. Our results confirm the findings by Fuchs-Schündeln and Schündeln (2005) that the downward-bias caused by self selection is quantitatively important in estimating precautionary savings.

III. Background of SOE Reform

III.1. **Historical Background of SOE Reform.** From 1949 to 1978, China was under centrally planned economy regime. Maintaining workers' job security was one of the government's top policy priorities. Most jobs were assigned by the government. Workers were guaranteed life-long employment status and associated benefits in housing, education, health care, and pension. This system of cradle-to-grave wage, job and retirement security is called "iron rice bowl" and has long been viewed as an advantage of socialism system in China.

The "open door" policy and nationwide economic reform initiated by Deng Xiaoping since the late 1970s marked the new era of Chinese economy. In 1986, China started the first wave of urban labor market reform. For the first time, workers were permitted to seek their own employment positions rather than accept an assigned job. Furthermore, some underperformed SOE would be allowed to fail. Most importantly, jobs were no longer guaranteed. In 1991, the system of individual employment contracts was fully implemented nationwide. A primitive unemployment insurance system was established to cover the newly unemployed. This policy change, together with the contractionary fiscal and monetary policy conducted to cool down the heated economy starting from 1993, exacerbated the underperformance of SOEs. In 1995 and 1996, around 50% of the SOE were making losses (Meng, 2003). The Asian financial crisis in 1997 made things even worse, which urged Chinese government to take a radical action on SOE restructuring to resolve the inefficiency. The restructuring of

SOEs was endorsed at the Fifteenth Communist Party Congress held in September 1997. The spirit of the action was reflected on the slogan "Grasp the Large, Let Go of the Small." In other words, large SOEs in so-called strategic sectors were corporatized but remained under the state ownership, while small and medium sized SOEs were either privatized or let go bankrupt (see Hsieh and Song (2013)). This led to a massive layoff (*xia gang* in Chinese) among SOE workers since 1997 that has never been seen in the history. As shown in Table 1, the number of accumulative laid-off SOE workers by the end of 1997 was 6.92 million. The number of laid-off SOE workers reached peak in 1999 and 2000. Each year the number exceeded 6.50 million. From 1997 to 2002, totally 35.52 million SOE workers had been laid off. As a consequence, the effective unemployment rate among urban residents rose rapidly from about 6.8% in 1996 to 11.1% in 2002, as shown in the third column in Table 1.[2] After 2002, the major wave of SOE bankruptcy and layoffs of SOE workers started to subside.

Breaking the "iron rice bowl" has also been followed by a series of economic and social reforms that reduced the SOE workers' benefits such as social security, housing, health care, and education.[3] These reforms have significantly changed SOE workers' perceptions about future job security and substantially raised income uncertainty.

III.2. **Who Were Laid Off?** Although the lay-off was massive, sometimes the whole factory was shut down and all the workers were let go, by no means the lay-off was purely random. Using 1999 CASS Household Survey, Appleton, Knight, Song, and Xia (2002) document summary statistics for nonretrenched urban workers and retrenched urban workers. Table 2 shows the descriptive statistics of two types of urban resident workers who had *hukou* (residence registration): workers who were currently employed in the survey and have never been laid off since 1992 and workers in the sample who have been laid off since 1992. From the table, we can see women, less educated, nonparty members, less healthy workers were more likely to be laid off. Workers in SOEs owned by local government and urban collective enterprises are much more likely to be laid off than workers in SOEs owned by central government. Massive lay-off only occurred to SOEs, we do not see that occurred in urban private and individual enterprises as documented in the table. Finally, unskilled workers such as industrial workers, commercial staff and service workers were more likely to be laid off.

[2]Using the Urban Household Income and Expenditure Survey (UHIES) conducted by the Institute of Economics at the Chinese Academy of Social Sciences, Meng (2003) documents that the urban unemployment rate was 8.5% in 1995 and had increased dramatically to 17.3% by 1999.

[3]The essential spirit for all these reforms is the declining public provision and increasing private burden on all kinds of expenditures–housing, health, education and social security benefits. The education reform was initiated in 1994. The social security reform followed and began in 1997. The housing and health care reform were enacted in 1998. See Meng (2003) and Chamon and Prasad (2010) for more details.

III.3. **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, which is located 45 kilometers northeast of Shenyang, the capital city of Liaoning. Fushun has a total population size of 2.27 million people. It is well known to be one of heavy state-owned industrial bases in the "rust belt" of China. Back to 2000, nearly 91% of workers in Fushun were employed either by SOEs or collective-owned enterprises (COEs). And SOEs produced 88.5% of gross industrial output.

The wave of *xia gang* hit Fushun very severely. In 2000, laid-off workers from SOEs and COEs accounted for about 42% of total workers in SOEs and COEs 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 COEs in the coal sector in Fushun, 35000 or 49.7% of workers were classified as *xia gang*.

What differentiates *xia gang* from official unemployment is the *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 laid-off workers by SOEs, local and central government, each was supposed to contribute one-third. However, due to the financial difficulties, lots of SOEs could not meet the requirement. For example, Of the 35000 laid-off workers from state-owned coal mines in Fushun, 33000 did not receive basic living expenses from their enterprises.

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.[4]

[4]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.

IV. Data and Empirical Strategy

IV.1. **Data.** The data used in this paper are from Chinese Household Income Project surveys (CHIP), 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 the survey are randomly selected following a strict sampling process; they are nationally representative and cover 15,000 to 20,000 households from more than 10 provinces in China. The CHIP surveys cover the detailed data on rural and urban households' economic status, employment, level of education, sources of income, household composition, household expenditures and wealth and hence are widely used in research (e.g., Wei and Zhang 2011).

In this paper, we focus on the 1995 and 2002 CHIP data since the time span of 1995-2002 exactly covers the period of the large-scale urban SOE reform occurred in the late 1990s. As we described in Section 3, before the large-scale urban SOE reform, employees in both GOV and SOE almost had life-long employment status and literally no unemployment risk and income uncertainty. However, after the urban SOE reform, while employees in GOV were still able to keep their "iron rice bowl," about 17% of SOE workers in 2002 CHIP data had the experience of being laid-off, implying that workers in SOE faced much higher unemployment risk than their counterpart in GOV. The contrast brought by the SOE reform provides an ideal "natural experiment" for us to identify precautionary savings due to a sudden and substantial increase in unemployment risk.

In order to clearly compare the difference in the saving behavior between workers in SOE and GOV, we restrict the sample only to include the households whose head is working in either SOE or GOV. SOE is defined as the firms owned exclusively by the central, provincial, or local government, the firms that government holds majority of stocks and the enterprises under collective ownership. GOV is defined as all levels of government and public institutions.[5] Note that younger workers usually have much shorter working experience and face higher income uncertainty, implying that the measures for their wealth and permanent income may have larger measurement errors. Also note that due to closing to retirement, the saving behavior of older workers changes dramatically (Carroll and Samwick, 1998; Gourinchas and Parker, 2002).[6] We therefore exclude those much younger and older workers from

[5]According to *China Labor Statistics Year Book* 1996 and 2003, SOE and GOV employed about 94.1% of total urban labor force in 1995. This ratio decreased to 75.5% in 2002. From 1995 to 2002, the share of employment in SOEs in total urban labor force has decreased substantially from 70.5% to 42.4%. In contrast, employment share of GOV has increased from 23.6% to 33.1%.

[6]The normal retirement age for female workers in China is from age 50 to 55, for male workers is age 55-60.

our sample, and restrict our sample to include the households with their heads aged 25-55. The sample ends up with 4390 observations (consisting of 2977 SOE workers and 1413 GOV employees) in 1995 and 3027 observations (consisting of 1702 SOE workers and 1325 GOV employees) in 2002; with this sample, we provide summary statistics of all variables in Table 4 and a comparison between SOE and GOV in Table 5.

To avoid self-selection bias of estimation directly from the data, we shall further restrict our sample to a subsample in which the households head's jobs are assigned by the government. This subsample is separated out from the full sample by using a unique question in CHIP survey regarding the avenue of finding jobs. The question asks interviewees whether their current jobs were 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. It turns out that in 1995, 82.6% of workers had the jobs assigned by the government, and that in 2002 this percentage decreased significantly to 71.7%. In other words, there are more and more workers whose jobs are found by themselves rather than assigned by the government, implying a possible self-selection bias from the data. The sample size reduces from 4390 to 3627 (with 2369 SOE workers and 1258 GOV employees) in 1995 and from 3027 to 2170 (with 1171 SOE workers and 999 GOV employees) in 2002. We focus on this subsample in our paper; all empirical results except for illustrating the self-selection bias of estimation in Table 7 are based on this subsample.

IV.2. **Construction of Variables.** In this subsection, we discuss the construction of all variables used in our empirical studies. Table 3 provides a brief description of these variables; and Table 4 reports their summary statistics based on the full sample.

Following the mainstream empirical precautionary savings literature, we employ the households' financial wealth, not current savings or saving rate to be the measure of household saving behavior.[7] On the one hand, current year savings and saving rate, to a large extent, are affected by the fluctuations of current year income and expenditure, and therefore they might not well reflect the households' long-run saving behavior predicted by LCH/PIH; however, the households' financial wealth as a stock of their cumulative savings should be much better. On the other hand, the common approach to construct savings in the literature (e.g., Kraay (2000), Horioka and Wan (2007), Chamon and Prasad (2010)) is to calculate savings as household disposable income minus household consumption, which obviously introduces possible measurement errors through the construction, while financial wealth is a direct measure of cumulative savings, which avoids such measurement errors. In addition, comparing to housing and other illiquid assets, the financial assets, due to their degree of

[7]Financial wealth includes balances in checking accounts, saving accounts, certificate of deposit, bonds, stock holdings, business investment, housing fund, and etc.

liquidity, serve better as a safeguard against bad income shocks as well as negative expenditure shocks and hence are more suitable for precautionary savings (Carroll and Samwick, 1998). As a robustness check, we also use two alternative measures of wealth as in Carroll and Samwick (1998), namely very liquid assets and non-housing non-business wealth, and show their results later in Section 6.5.[8]

Permanent income, as an important variable in LCH/PIH theory, is generally difficult to construct in empirical studies. Fortunately, both the 1995 and 2002 CHIP datasets respectively report the past six year and five year labor income earned for household heads.[9] We can therefore construct the measure of permanent income following the procedure from Fuchs-Schündeln and Schündeln (2005). First, for each household head of the 1995 (or 2002) CHIP dataset, we divide his yearly labor income by the average labor income of all households in the sample over the past six (or five) years ending in the corresponding survey year. We then calculate the average of this ratio for each household head over all past six (or five) years. Finally, we multiply this average ratio by the average labor income for all households in the corresponding survey year to back up the annual permanent income of the household heads in that year. As Fuchs-Schündeln and Schündeln (2005) point out, this construction process obviously introduces measurement errors. We therefore follow their suggestion to instrument permanent income using education dummies (see below) and interaction terms of education with age and age squared as instruments in all the regressions.[10]

Income uncertainty is also an important variable in studies of precautionary saving motive. A popular candidate for measure of income uncertainty would be the one used in Carroll and Samwick (1998), namely the variance of logarithm of permanent income. However,

[8]Different from Carroll and Samwick (1998) and Fuchs-Schündeln and Schündeln (2005), we do not exclude zero financial wealth observations from the sample. We do so for two reasons. First, our main empirical specification uses financial wealth/permanent income ratio as the dependent variable, therefore zero wealth observations would not create mathematical problem for us. Second, CHIP data show that 2.9% of GOV employee households held zero financial assets in 1995. This percentage decreased to 1.9% in 2002. For SOE households, 8.4% of them did not accumulate any financial wealth in 1995. This ratio significantly decreased to 2.4% in 2002. This shows that the zero wealth observations account for a significant proportion in the data sample. And the trend indicates that precautionary savings due to increasing income risk might affect zero wealth accumulation as well.

[9]For the single-earner family, bread earner is the household head. For the double-earner household, the person with higher labor income is defined as the head.

[10]We use box plot to detect possible outliers in the data of wealth measures and permanent income. We first determine the quartiles Q_1 and Q_3 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. Points that are beyond the quartiles by three IQR's will be determined as potential outliers and excluded from the sample. We use this method to exclude outliers for the data of financial wealth, financial net worth, total net worth and permanent income.

households' income in our study had been growing dramatically from 1995 to 2002, and different educational and occupational groups might be subject to different growth trends in their income. In order to control the wealth effect in a rapid growing economy and also make the measure comparable across different categorized groups, we use a unit-free measurement, coefficient of variation (CV) of log income, to measure the income uncertainty in our study. More specifically, CV here is the ratio of the standard deviation to the mean of log household head's labor income over the past six (or five) years as reported in the 1995 (or 2002) CHIP dataset. We also use the conventional measure of income uncertainty (i.e. log variance of log income) to do a robust check in Section 6.4.

We control a series of characteristics of households in the empirical analysis, including household head's age, age^2, gender, marital status, education, occupation, household's size, children (age of children, number of boys, number of children at school), health care, housing, and others. 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. Table 4 shows some details of the education dummies in the full sample. We also categorize household heads by their occupation and divide them into five groups: professional, director or manager, skilled or office workers, unskilled or service workers, and the others. The group of the others is our reference group in the regressions. As mentioned above, the health care reform was enacted in 1998. Health care reform significantly affected the share of private provision of the health care service. Therefore, according to the degree of out-of-pocket expenditure in total health expenditure, we categorize the health care service that households receive into three groups: public health care (almost free), public health insurance and own payment. As shown in Table 4, in 1995, 71.3% of households in our sample enjoyed free public health care. This share decreased so dramatically to 35.0% in 2002, showing the impact from the health care reform. Considering the effect of rising education expenditure on households' saving rate, we also control the mean age of children and the number of children at school in the regressions. To control the possible competitive savings motive as emphasized in Wei and Zhang (2011), we add the number of boys among children as an independent variable. Although housing acts less effective as an avenue for precautionary wealth accumulation due to its illiquidity, purchasing a house is argued to be one of the major saving motives for Chinese households (Wei and Zhang, 2011). We therefore include a dummy variable of whether or not a household owns its house in the regressions. Due to the housing reform began in 1998 which extensively privatized housing ownership, as shown in Table 4, the percentage of households owning house almost doubled over seven years, from 42.0% in 1995 to 80.4% in 2002. Finally, as mentioned in Section 3.3, massive

lay-off was more severe in certain industries and certain provinces. We therefore also control industry and provincial dummies in the regressions.

Finally, all the nominal variables in the sample are corrected for inflation using urban household consumer price index (CPI) to the base year of 2002.

IV.3. **SOE vs. GOV.** To further justify the significant difference between employees in SOE and GOV, Table 5 shows the comparison between SOE and GOV in several variables we are interested. In 1995, employees in GOV accounted for about 32.2% (=1413/4390) of households in our full sample, while this ratio increased to 43.8% (=1325/3027) in 2002. This change is mainly due to the fact that the share of workers in SOE in total employment has decreased over time. Employees in GOV on average had higher annual permanent income and larger accumulated financial assets than SOE workers. Their ratios of financial wealth to annual permanent income in 1995, however, came very close to each other on average, while in 2002 this mean ratio for SOE workers was significantly higher than that for GOV employees with a difference of 5.6% (=(2.703-2.559)/2.559). In addition, we also note that this mean ratio has almost doubled from 1995 to 2002 in both GOV and SOE, implying fast economic growth makes people save more through the wealth effect.

For people who had experience of being laid-off, they were asked a question in 2002 CHIP survey: "Over the past three years, if you ever changed the job, what was the type of the ownership of your previous employer: government or public institution, SOEs, foreign-owned enterprises (FOEs), private-owned enterprises (POEs), or others?" From the responses to the question, 58.0% of them had worked in SOEs, 39.7% of them had worked in FOEs, POEs or other non-SOE sectors, and only 2.3% of recently laid-off workers had worked in GOV. This sharp contrast between SOE and GOV confirms that the SOE reform brought a substantial increase in unemployment risk to SOE workers, while employees in GOV were still able to keep their job security.

We can also see a substantial difference in future income expectation between employees in SOE and GOV from another question in 2002 CHIP survey about the expectation of household income path for the next five years among the three choices–"increase" or "keep the same" or "decline", which information will be used to disentangle PIH saving motive and precautionary saving motive later in Section 5.2. As shown in Table 5, only 11.4% of employees in GOV expected their future income will decrease over the next five years, while in SOE, this ratio doubles at 23.8%.

SOEs and GOV are also different substantially in terms of pension benefits of retired workers receive. The biggest pension reform in the nation was carried out in 1997, which coincided with the SOE reform. The reform aims to break "iron rice bowl" in pension system for SOE workers. The replacement ratio for social security benefits has been reduced

significantly. As Table 6 shows, for SOE workers, the ratio had been decreased from 74.2% in 1995 to 64.3% in 2002. Expected decline in pension income will also induce more household savings (Feng, He and Sato 2011). To provide a clear identification for precautionary savings due to only the SOE reform, we need to control the effect of changes in pension level on household saving behavior. We do so in Section 5.2.

IV.4. **Empirical Strategy.** Following Lusardi (1998) and Carroll, Dynan, and Krane (2003), we use the ratio of financial wealth to permanent income as the dependent variable in the main estimation equation below. 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 annual permanent income (P_i), SOE_i is a dummy variable, which is equal to one if the household head (i.e. the main income earner in household i) is an employee working for SOE, zero if the household head works for government or public institution (GOV), $RISK_i$ denotes individual income uncertainty, which is measured by coefficient of variation (CV) of log annual income of the household head for past 5 or 6 years,[11] Z_i is a vector of household characteristics and provincial dummies, 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 mimics accumulative saving rates, which helps to establish a natural link between wealth accumulation and saving behavior.

As we argue above, the SOE reform in the late 1990s, which exclusively affected workers in SOE, provides an ideal "natural experiment" for us to identify the increase in precautionary savings due to a sudden and substantial increase in unemployment risk, comparing to the employees in GOV who were not affected by the reform and were still able to keep their "iron rice bowl." Our basic empirical strategy is to estimate the regression equation (1) by using the 1995 and 2002 CHIP datasets respectively, getting two estimated coefficients of SOE dummy, denoted by β_1^{1995} and β_1^{2002}, and then to compare β_1^{2002} with β_1^{1995}. For each survey year, the coefficient of SOE dummy, β_1, captures the difference in wealth accumulation between the groups of workers in SOE and GOV, i.e. $\beta_1^{1995} = (W/P)_{SOE}^{1995} - (W/P)_{GOV}^{1995}$ and

[11] In Section 6.4, we show that using the conventional measure of income risk (i.e. log variance of log income) does not change our empirical results significantly.

$\beta_1^{2002} = (W/P)_{SOE}^{2002} - (W/P)_{GOV}^{2002}$, keeping other things equal; it could be explained as the effects of some common characteristics of SOE workers on their saving behavior, where these SOE workers' common characteristics such as having higher unemployment risk and lower pension replacement ratio compared with GOV employees are not controlled in the regression equation (1). The change in β_1 between 1995 and 2002, $\beta_1^{2002} - \beta_1^{1995}$, when those uncontrolled characteristics except for unemployment risk did not change from 1995 to 2002, should be attributed to the impact of an increase in unemployment risk of SOE workers caused by the SOE reform on saving behavior of SOE workers; actually, it should be able to predict the existence of precautionary savings due to the expected increase in unemployment risk caused *only* by breaking "iron rice bowl." Hence, in a certain sense, our empirical strategy is in the spirit of "difference-in-difference" (DID) method.

We want to emphasize that the SOE_i dummy and the $RISK_i$ variable in equation (1) capture different aspects of future uncertainty. The former is used to capture some *systematic* risks between the groups of workers in SOE and GOV through controlling other factors, for example, the expected higher job uncertainty of SOE workers relative to GOV employees. However, the latter is employed to measure one's own income variation, no matter she works for SOEs or GOV, which represents an *idiosyncratic* income risk. We can also observe that both the variables are almost uncorrelated in both years; their sample correlations are -0.0396 and -0.04 respectively in 1995 and 2002.

Note that the financial wealth distribution in our sample has a mass of probability at zero wealth; specifically, there are 11.3% (496/4390) and 4.5% (137/3027) of zero wealth observations in 1995 and 2002, respectively. Since the households with zero wealth are different from each other, we need to deal with this case as a "censored data" problem and thus, together with dealing with the measurement error problem of constructed permanent income, we need to estimate an instrumental variable (IV) Tobit model. As a robustness check, we also estimate the equation (1) by eliminating zero wealth and using the commonly used 2SLS method in Section 6.3.

V. Empirical Results

V.1. **Identify Self-selection Bias.** In this subsection, we present a benchmark result that is obtained by using the subsample in which all workers' jobs are assigned by government; this result is exhibited in columns (i) and (iii) of Table 7. Meanwhile, in order to identify self-selection bias of estimates, we also show the result with self-selection bias in columns (ii) and (iv) of Table 7, which is estimated by using the full sample adding back those workers who find their jobs not through government assignment.

We are most interested in the coefficient of the SOE dummy, β_1, which captures the difference in wealth accumulation between SOE and GOV workers after controlling all other variables considered in equation (1). From the results in Table 7, we can draw three conclusions about β_1. First, both the estimated values of β_1 in columns (i) and (ii) are not significant, but those in columns (iii) and (iv) are significant. This tells us that when keeping other things equal, on average, both the groups of workers in SOE and GOV have no significant difference in wealth accumulation in 1995; however up to 2002, the SOE workers have significantly accumulated more financial wealth than the GOV employees, implying an evident change in saving behavior of SOE workers compared with GOV employees from 1995 to 2002. Second, downward self-selection bias for the estimate of β_1 does exist significantly in 2002, though it is negligible in 1995. We identify the self-selection bias for the estimate of β_1 through comparing the estimated values of β_1 using the two samples including and excluding self-selection of employment. In 1995, we compare the value of β_1 in column (ii) with that in column (i) and find that there is an insignificant self-selection bias $-0.019-0.028=-0.047$; however in 2002, it follows from a comparison of the values of β_1 in columns (iv) and (iii) that we observe a significant self-selection bias $0.380-0.773=-0.393$. This result is consistent with the fact that much fewer workers found their jobs by self-selection in 1995 but more and more workers did in 2002. Third, there is a significant increase in the estimated values of β_1 from 1995 to 2002. Specifically, for the sample with self-selection bias, the value of β_1 increases from $\beta_1^{1995}=-0.019$ to $\beta_1^{2002}=0.380$ and the Chow test for the null hypothesis of $\beta_1^{2002}=\beta_1^{1995}$ is rejected at 10% level; for the sample without self-selection bias, the increase in β_1 from 1995 to 2002, $\beta_1^{2002}-\beta_1^{1995}=0.773-0.028=0.745$, is significant with the p-value of 0.018 of the Chow test. As discussed above, we attribute the significant increase in β_1 to the SOE reform as well as other associated reforms such as the pension reform occurred during the time period from 1995 to 2002.

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 5 (call it PIH effect); and different pension replacement ratios (call it pension effect) as in Table 6, 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, $\beta_1^{1995}=0.028$, i.e., SOE workers on average have higher W/P ratio by 0.028, should come from a pure pension effect since SOE workers had a 25 percent

lower replacement ratio than GOV employees in 1995 (See Table 6). 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 $\beta_1^{2002} - \beta_1^{1995} = 0.745$ 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.

We continue to focus on the results without self-selection bias shown in columns (i) and (iii) of Table 7 to discuss the interpretations of other 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 coefficient β_3 of $\log(P)$ has also positive estimated values as the theory predicted; and it is significant only in 2002, implying a significant income effect in 2002. Households with male heads accumulate significantly less wealth than those with female heads.[12] All coefficients of dummy variables on occupation are insignificant in 1995 but significant in 2002. The difference in coefficients between 1995 and 2002 is much higher for unskilled workers than skilled workers, which reflects the fact that unskilled workers are more likely to be laid off (see Table 2, and hence keeping other things equal, they tend to accumulate more precautionary wealth.

To control the impact of health care on households' saving behavior, we put public health care and public health insurance dummies in equation (1). The coefficients of both the dummies show a similar pattern. They are small and insignificant in 1995 and turn into significant negative numbers in 2002. In 1995, most of workers were still covered under an almost free public health care system; therefore it is not surprising to see that public health insurance status did not impose any significant impact on households' saving behavior. However, the health care reform, which began in 1998, significantly increased the private burden of health expenditure and hence gave people a stronger incentive to save if they were not covered any more by the public health care or public health insurance. Our results here confirm that the declining public provision of health care in the 1990s has created new motives for precautionary saving (Chamon and Prasad, 2010).

We employ three variables (mean age of children, number of boys among children, and number of children at school) to control the impact of the education reform on households'

[12]Lusardi (1998) finds a similar result. A possible exaplanation could be female household heads have significantly higher income than their male counterpart. Therefore they can save more.

saving behavior and the possible competitive savings motive as emphasized in Wei and Zhang (2011). The coefficient of number of children at school is negative in both years; and it is significant at 10% level in 2002. This shows that the privatization of education system leads to an increase in children's education expense. Higher education expenditure leads to lower disposable income and hence reduces wealth accumulation. The coefficient of number of boys shows an interesting pattern: it is 0.045 and not significant in 1995, whereas it declines to -0.252 in 2002 and becomes significant at 10% level. An increase in number of boys actually decreases the motive for savings in 2002. A possible explanation is that SOE reform also triggered the reform in social security and pension system. In Chinese culture, sons are supposed to take 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 in the future. Parents thus do not need to save that much for their old-age consumption. Finally, to control for the saving motive of purchasing house, we include the home ownership dummy in the estimation equation. The coefficient however is not significant in both years. A possible explanation is back to 2002, housing market was not fully developed and house purchasing were heavily subsidized. Therefore the impact of housing reform on saving behavior is limited.

V.2. **Disentangle PIH Effects and Precautionary Savings.** 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 5. 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 7; the results are reported in Table 8. We are especially interested

in the results presented in column (ii) in Table 8, which teases out the income expectation effect. Comparing with the results shown in column (iii) of Table 7, the estimated value of β_1^{2002} reduces from 0.773 to 0.684, though it is still significant at 5% level. The difference value $0.773 - 0.684 = 0.089$ 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 8), 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 $\beta_1^{1995} = 0.028$ 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 $\beta_1^{1995} = 0.028$, 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., $\beta_1^{2002} - 1.26 \times \beta_1^{1995} = 0.684 - 1.26 \times 0.028 = 0.649$, rather than $\beta_1^{2002} - \beta_1^{1995} = 0.684 - 0.028 = 0.656$.[13] 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.[14]

[13]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).

[14]Notice that $\beta_1^{2002} = 0.684$ 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

V.3. **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 7. The simulation for 2002 is based on the result in column (ii) of Table 8.

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 36.6% with the standard error is equal to 0.167. In other words, the precautionary savings motive due to the SOE reform *alone* contributes about 36.6% (SE=0.167) of the increase in wealth accumulation among SOE households from

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 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.

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.

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).[15] 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 (see Table 2). 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 9. From 1995 to 2002, β_1^{CSOE} increases from -0.109 to 0.248, but it is not significant in both years. In contrast, β_1^{LSOE} is 0.111 and it is not significant in 1995, while it increases dramatically to 1.082 and is significant at 5%

[15]LSOE also includes urban collective enterprises.

level, implying that LSOEs workers have a much stronger precautionary saving motive than their counterparts in CSOEs.

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, which is also documented in Table 2. 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.[16] 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, and ε_i is the error term. 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 Table 1, 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.

[16]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.

Table 10 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 7. 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 0.028 to 0.052. 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 11.

β_1 is 0.058 (not significant) in 1995 and 0.518 (significant at 10% level) in 2002. The adjusted difference is $0.518-1.26\times0.058 = 0.445$. Comparing to the adjusted difference in β_1 between column (i) in Table 7 and column (ii) in Table 8, which is $0.684-1.26\times0.028 = 0.649$, 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 26.4% (SE=0.132) 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 3) 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 11.

As we can see from the table, the results are similar to those in Tables 7 and 8. The estimated value of β_1 increases from 0.012 (not significant) in 1995 to 0.824 (5% significant) in 2002. The adjusted difference is $0.824 - 1.26 \times 0.012 = 0.809$. The simulation exercise shows that the precautionary saving motive contributes 46.8% (SE=0.203) 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 3 for the construction of these variables in CHIP).[17]

Panel C of Table 11 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 -0.0003 (not significant) in 1995 to 0.457 (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 39.4% (SE=0.213) of the increase in very liquid assets among urban SOE households from 1995 to 2002.

Panel D of Table 11 shows the results employing non-housing non-business wealth to construct the dependent variable in (1). The estimated value of β_1 is 0.122 and insignificant in 1995 and it increases substantially to 0.705 (significant at 5% level) in 2002. The simulation exercise shows that the precautionary savings due to the SOE reform contributes to 38.5% (SE=0.204) of the increase in nonhousing nonbusiness wealth among urban SOE households

[17]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.

from 1995 to 2002. In summary, we conclude that using alternative wealth measures do not significantly affect our standard result.

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 at least one-third 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.

TABLE 1. Massive SOE layoffs in China

Year	**SOE layoffs (million)**	**Effective urban unemployment rate(%)**
1997	6.92	7.7
1998	5.95	8.5
1999	6.53	9.0
2000	6.57	10.8
2001	5.15	10.8
2002	4.10	11.1
2003	2.60	N.A.
2004	1.53	N.A.
2005	N.A.	6.7

Notes: Data for SOE layoffs are taken from Cai, Park, and Zhao (2008) and data for effective urban unemployment rate are from Giles, Park, and Zhang (2005)

TABLE 2. Urban workers: never-retrenched vs. retrenched

Head	**Never-retrenched worker**	**Retrenched worker**
No. of observations	5770	1159
Male (%)	56.8	38.7
Working experience (in years)	21.8 (9.83)	20.9 (8.55)
Education (in years)	11.4 (2.7)	9.96 (2.2)
Party membership (%)	28.8	9.3
Not generally healthy (%)	3.8	8.4
Ownership (%)		
State owned by central government	36.8	12.1
State owned by local government	40.9	47.8
Urban collective	9.9	31.1
Urban private	1.1	1.1
Urban individual	3.0	2.2
Occupation (%)		
Professional / technical	23.2	9.5
Administrative	13.5	4.5
Clerical	18.4	8.5
Industrial worker	33.0	59.1
Commercial staff	5.1	9.2
Service worker	4.9	7.3
Others	1.5	1.6

Notes: Replication of Table 1 in Appleton, Knight, Song, and Xia (2002), with standard deviations for continuous variables in brackets. Data source: CASS 1999 Household Survey.

TABLE 3. Definition of variables

Variable	**Description**
Financial wealth (W)	Balances in checking accounts, saving accounts, CDs, bonds, stock holdings, business investment, housing fund, 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)
Own house	Dummy variable for housing ownership, 1 for own house, 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 4. 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 5. 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 income	1413	7545	3215	1325	14752	6698
	W/P	1413	1.376	1.386	1325	2.559	2.36
	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 income	2977	6791	3385	1702	11610	6294
	W/P	2977	1.382	1.448	1702	2.703	2.906
	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

TABLE 6. 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 7. IV-Tobit wealth/income ratio regressions, 1995 and 2002 sample

Dep. variable:	**1995**		**2002**	
FW / per. inc	**(i)w/o sel.**	**(ii)w/ sel.**	**(iii)w/o sel.**	**(iv)w/ sel.**
SOE	0.028	-0.019	0.773***	0.380*
	(0.096)	(0.098)	(0.300)	(0.220)
CV×100	0.110***	0.135***	0.123***	0.091***
	(0.039)	(0.037)	(0.045)	(0.028)
log(permanent income)	0.732	1.196	4.450***	3.528***
	(1.019)	(0.894)	(1.475)	(0.991)
Age	0.021	-0.018	0.032	0.241*
	(0.051)	(0.050)	(0.149)	(0.125)
Age squared(*100)	-0.032	0.018	-0.044	-0.275*
	(0.059)	(0.059)	(0.174)	(0.147)
Male	-0.360***	-0.460***	-1.169***	-1.171***
	(0.101)	(0.093)	(0.200)	(0.148)
Professional	0.106	0.035	4.782***	0.375
	(0.212)	(0.200)	(1.653)	(0.785)
Director	0.296	0.187	4.793***	0.191
	(0.213)	(0.208)	(1.641)	(0.798)
Skilled worker	0.042	0.005	4.996***	0.348
	(0.181)	(0.168)	(1.666)	(0.760)
Unskilled worker	-0.032	0.038	6.093***	0.99
	(0.200)	(0.179)	(1.774)	(0.766)
Public med service	0.051	0.041	-1.209**	-0.974***
	(0.191)	(0.166)	(0.495)	(0.361)
Public med insurance	0.032	0.104	-0.888**	-0.749**
	(0.165)	(0.150)	(0.428)	(0.316)
Married	0.523***	0.492***	0.64	0.4
	(0.191)	(0.160)	(0.428)	(0.363)
Age of children (mean)	0.008	0.005	0.005	0
	(0.006)	(0.006)	(0.013)	(0.010)
Num. of boys	0.045	0.024	-0.252*	-0.199*
	(0.048)	(0.045)	(0.144)	(0.118)
Num. of children at school	-0.084	-0.034	-0.319*	-0.364***
	(0.065)	(0.063)	(0.176)	(0.140)
Household size	-0.038	-0.01	0.275	0.356***
	(0.050)	(0.048)	(0.171)	(0.136)
Own house	-0.005	-0.066	0.029	0.037
	(0.069)	(0.064)	(0.209)	(0.167)
Industry & Province dummies	yes	yes	yes	yes
Log-Likelihood	-7,167.80	-8,876.57	-5,804.04	-8,240.75
p-value of Chow test for SOE			0.018	0.097
Number of observations	3627	4390	2170	3027

Notes: Results from instrumental variable Tobit regressions. Instruments used for permanent income: education dummies and interaction terms of education with age and age squared. Standard errors are in parentheses and are corrected for heteroskedasticity.

TABLE 8. Regressions with 2002 sample: differentiate PIH

Dep. variable:	**expected future income**	
FW / per. inc.	**decline**	**non-decline**
SOE	1.233**	0.684**
	(0.530)	(0.310)
CV×100	0.120**	0.122***
	(0.061)	(0.046)
log(permanent income)	5.345**	4.546***
	(2.206)	(1.621)
Age	0.100	0.074
	(0.172)	(0.165)
Age squared(*100)	-0.146	-0.095
	(0.200)	(0.193)
Male	-0.960***	-1.145***
	(0.223)	(0.221)
Professional	1.161	5.409***
	(1.603)	(1.874)
Director	1.256	5.475***
	(1.624)	(1.858)
Skilled worker	1.838	5.576***
	(1.552)	(1.892)
Unskilled worker	2.791*	6.811***
	(1.607)	(2.019)
Public med service	-1.207*	-1.329**
	(0.638)	(0.556)
Public med insurance	-0.593	-1.007**
	(0.466)	(0.493)
Married	0.403	0.599
	(0.526)	(0.439)
Age of children (mean)	0.011	-0.001
	(0.015)	(0.013)
Num. of boys	0.058	-0.262*
	(0.191)	(0.158)
Num. of children at school	-0.250	-0.283
	(0.231)	(0.191)
Household size	0.163	0.309*
	(0.183)	(0.179)
Own house	0.412	-0.063
	(0.263)	(0.224)
Industry & Province dummies	yes	yes
Log-Likelihood	-3,182.96	-4,927.01
p-value of Chow test for SOE	0.025	0.043
Number of observations	1284	1876

Notes: Results from 2SLS regressions. Instruments used for permanent income: education dummies and interaction terms of education with age and age squared. Standard errors are in parentheses and are corrected for heteroskedasticity.

TABLE 9. SOEs differences: central vs. local SOEs

Dep. variable: FW / per. inc.	**1995**	**2002**
CSOE	-0.109	0.248
	(0.129)	(0.282)
LSOE	0.111	1.082**
	(0.155)	(0.433)
CV×100	0.115***	0.126***
	(0.044)	(0.047)
log(permanent income)	0.868	4.848***
	(1.175)	(1.719)
Industry & Province dummies	yes	yes
Log-Likelihood	-7095.93	-4904.19
p-value of Chow test for CSOE		0.249
p-value of Chow test for LSOE		0.035
Number of observations	3627	1876

Notes: Results from instrumental variable Tobit regressions. Instruments used for permanent income: education dummies and interaction terms of education with age and age squared. Standard errors are in parentheses and are corrected for heteroskedasticity.

TABLE 10. SOE worker differences: control "survivor" bias

Dep. variable: W/P	**(1)**	**(2)**	**(3)**	**(4)**
Keep 1995 Sample	**100%**	**90%**	**80%**	**70%**
SOE	0.028	0.052	0.106	0.121
	(0.096)	(0.101)	(0.112)	(0.114)
CV×100	0.110***	0.122**	0.163***	0.174***
	(0.039)	(0.050)	(0.053)	(0.048)
log(permanent income)	0.732	1.075	2.082	2.225**
	(1.019)	(1.322)	(1.365)	(1.133)
Industry & Province dummies	yes	yes	yes	yes
Log-Likelihood	-7,167.80	-6,703.71	-6,210.01	-5,747.59
p-value of Chow test for SOE	0.028	0.052	0.106	0.121
Number of observations	3627	3415	3198	2971

Notes: Results from IV-Tobit regressions. Instruments used for permanent income: education dummies and interaction terms of education with age and age squared. 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 11. Robustness Checks

Case	**1995**	**2002**	**Chow Test**
A. Eliminating zero wealth			
	0.058	0.518*	0.068
	(0.088)	(0.270)	
	[N=3221]	[N=1807]	
B. Conventional risk measure			
	0.012	0.824**	0.031
	(0.095)	(0.365)	
	[N=3627]	[N=1876]	
C. Very liquid asset			
	-0.0003	0.457*	0.086
	(0.095)	(0.249)	
	[N=3627]	[N=1876]	
D. Non-housing Non-business wealth			
	0.122	0.705**	0.098
	(0.132)	(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. Instruments used for permanent income: education dummies and interaction terms of education with age and age squared. Other controls are the same with Table 5. Standard errors are in parentheses and are corrected for heteroskedasticity. Numbers of observations are in squared brackets.

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