The Price of Growth: Consumption Insurance in China 1989-2009*

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Abstract

We exploit a novel and unique opportunity to document the transmission of income risks to consumption in a growing economy. Our laboratory is China, an economy that has witnessed enormous and sustained growth and for which we build a long panel of household-level consumption and income. We find that consumption insurance deteriorates along the growth process with a transmission of permanent income shocks to consumption that at least triples from 1989 to 2009. Although preliminary, our calculations suggest that the loss of consumption insurance has implications for the welfare assessment of economic growth.

JEL codes: O11, O12, E21, D12

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1 Introduction

China's phenomenal economic growth since 1978 has spurred much academic research (Zhu, 2012; Storesletten and Zilibotti, 2014; Yao, 2014). The reform and opening up policies recognized private ownership, introduced market forces and created economic opportunities for billions of Chinese. Following Deng's "letting some get rich first," those who seized the opportunities brought by the reforms got rich fast, others left behind, producing a widening gap between the haves and have nots. Though the rising income inequality during China's economic transformation is well-documented (Khan and Riskin, 1998; Benjamin et al., 2008), little is known about how the joint dynamics of consumption and income evolves along the growth process. This paper attempts to fill this gap. We exploit a novel and unique opportunity to document the transmission of income risks (i.e., unanticipated changes in income) to consumption in China from 1989 to 2009, building a long panel of household consumption and income from the publicly available China Health and Nutrition Survey (CHNS).

The core of our contribution is to uncover a new set of facts from a 20-year panel of household disposable income and consumption that we construct from the CHNS. First, within the rural or within the urban sample, the cross-sectional income and consumption inequality in China reflects largely the residual (within-group) inequality. Second, the decomposition of the residual income reveals that the permanent component of income risk increased substantially for both rural and urban China during the sample period. Third, we use a non-stationary version of an industry standard technique (Blundell et al., 2008) to measure the transmission of income risk to consumption along the growth process. We estimate that the transmission of permanent income risk to consumption increased from a low 10% (5%) in the 1990s to a much higher 28% (25%) in the 2000s in rural (urban) China. That is, consumption insurance, i.e., the ability of households to insulate their consumption from income shocks, deteriorates along the growth process. This negative relationship between economic growth and consumption insurance is consistent with the history of reforms in China, where the 1990s saw phasing-out of the rationing and state employment, which provided almost perfect insurance to Chinese households, and the 2000s saw much greater exposure to markets and trade, which eventually translated into lower consumption insurance.

Despite the common general trend in income growth, permanent income risk and its transmission to consumption, the rural and urban areas of China differ in important dimensions. The public transfers played a more prominent role in urban than in rural areas. The nature of the public transfers for urban households however changed dramatically during the 1990s. Up until mid-1990s, the state rationing of all key consumption goods was in effect. The bulk of public

transfers consisted of food coupons and in-kind subsidies from work units, which tend to co-vary positively with earnings. By 2000, the public transfers in urban areas have largely evolved towards providing social insurance in the form of pension, disability insurance etc. This means that including public transfers in the income measure under-states the increase in the income risk and over-states the increase in the transmission of risk to consumption. When we re-estimate the transmission parameters with an income measure excluding public transfers for the urban sample, the transmission parameters no longer vary significantly over time. It is in this sense that changes in the measured consumption insurance in urban China are closely related to changes in the provision of social insurance through public transfers. We do not observe much effect on consumption insurance from either public or private transfers in the rural sample.

To arrive at these findings, we need a panel of household consumption and income, a data requirement that is demanding even for the U.S. (Heathcote et al., 2010a; Carroll et al., 2014). In the case of China, the data limitations are also important (Ligon, 2007). Our first contribution is to construct such a panel for China. While household income is surveyed in great detail in the CHNS, we employ a novel approach to construct a measure of household consumption. We build the most important nondurable consumption item, food, from the Nutrition Survey, a core component of the CHNS that meticulously records the daily diet of all members in a household. We take care of the spatial and temporal differences in food prices by using local food prices from the Community Survey. Our benchmark consumption measure includes expenditures on food, utilities, health and semidurable supplies, which are the consumption items that are consistently surveyed in all waves of the CHNS. In the robustness analyses, we also impute measures of non-durable and total consumption from the food consumption of the CHNS observations, following an imputation procedure proposed by Blundell et al. (2008).

Our paper is related to previous work that documents the evolution of income inequality in China until early 2000s (Khan and Riskin, 1998; Meng, 2004; Meng et al., 2005; Ravallion and Chen, 2007; Benjamin et al., 2008). Cai et al. (2010) describes the evolution of both income and consumption inequality for urban China from 1992 to 2003. More recenlty, using the non-public Urban Household Survey, Ding and He (2016) give a detailed account on the changes in the income and consumption inequality for urban households from 1986 to 2009. Three main differences set us apart from the aforementioned studies. First, while most of the previous studies rely on cross-sectional data, our work is based on a long household panel of income and consumption. This allows us to estimate the transmission parameters of income risk to consumption as well as their evolution along the process of economic growth. To the best of our knowledge, our paper is the first that documents an empirical "trade-off" between economic growth and consumption insurance in the sense that as household income grew from 1989 to

2009, the consumption flow became less protected against unanticipated variations in income. While the Urban Household Survey in Ding and He (2016) has a short rotating panel of at most three waves, which the authors explore to estimate income dynamics, it is not sufficient to study the transmission of income shocks to consumption as we do, which requires at least four waves for identification. Second, while most recent studies on inequality in China focus on the urban areas due to data availability, we cover both rural and urban areas. This distinction is important, because, as we document, the set of public transfers available to rural and urban residents is different and it plays a different role in the evolution of consumption insurance in the two areas. Third, while most of these studies draw evidence from data sources without public access, our data are publicly available to any researchers.

A natural response upon learning the fact that economic growth goes hand in hand with a loss of consumption insurance is that the welfare gain from growing like China may be overstated if we did not take into account the increasing income risks and declining consumption insurance. We provide a tentaive welfare calculation based on the estimates of the income shocks and transmission parameters. Our results suggest that both the changes in the risk and in the transmission could impose significant welfare costs that cancel out or even reverse the welfare gain from growth. This is particularly relevant if a growth process is often coupled with heightened risk (Greenwood and Jovanovic, 1990; Greenwood et al., 2010; Cole et al., 2016).[1] While this paper is silent about the specific mechanisms that produce the observed deterioration in consumption insurance, it does point to the importance of the ability of any policy-relevant macro models for China to account for this observation.

The rest of the paper is organized as follows. Section 2 discusses the institutional background. Section 3 describes the data construction. Section 4 contains some cross-sectional facts about the distribution of consumption and income for rural and urban China. Section 5 concerns the estimation of income risks and their transmission to consumption. We present first the benchmark result for the rural and urban sample separately and then explore specifications with pre-transfer income measures as well as alternative consumption measures. In Section 6, we discuss the potential welfare consequences from recognizing the risk and insurance aspects of the growth process. Conclusion follows.

[1] A positive relationship between income risk and growth can arise from the choice of risky projects that are more likely to yield higher income growth (Greenwood and Jovanovic, 1990). Alternatively, it is the presence of risky income that accelerates the accumulation of capital for precautionary reasons, which in turn leads to higher income levels (Krusell and Smith, 1998). Interestingly, the sign of the relationship between growth and risk might depend on the stage of economic development. Indeed, Ramey and Ramey (1995) document a negative relationship between growth and volatility using a set of relatively rich OECD countries. Using micro-evidence for the US, Krueger and Perri (2006) find that an increase in income inequality can increase welfare by decreasing the probability of default and hence increasing the amount of credit in equilibrium for the U.S.

2 Some Institutional Background

We begin by describing, in a highly parsimonious way, the institutional background to China's growth from 1989 to 2009. After a brief experimentation with economic liberalism in the 1980s, in particular in the rural areas, the Chinese government embarked on a highly controlled growth process in which resources were mobilized from the subnational governments to the central government, from the rural areas to urban areas, and from the non-state to the state industrial sector. It channeled public resources away from the township and village enterprises (TVEs), popular in the 80s in the rural areas (Huang, 2008), and towards the state-owned enterprises (SOEs) in the cities (Song et al., 2011). Within the state sector in cities, to concentrate effort in modernizing industries, the government strengthened the large SOEs by offering them cheap loans and tax breaks and privatized a large number of small and effectively bankrupt enterprises to cut down loss. To facilitate the technological catch up, foreign investors with advanced technologies were let in (Reenen and Yueh, 2012; Holmes et al., 2015). Millions of migrant workers, usually rural labor seeking off-farm work bound to their rural origin by the *Hukou* registration system, kept the labor cost low. Overall, this centralized approach has led to capital misallocation (Bai et al., 2006; Dollar and Wei, 2007; Hsieh and Klenow, 2009) and income inequality (Benjamin et al., 2008; Park, 2008).

How did these development strategies shape the income environment and consumption insurance opportunities faced by rural households? By 1990, the agricultural output as a share of GDP had fallen from 40% in 1970 to 28%, while its employment share had fallen from 81% in 1970 to 60% (Huang et al., 2005). This means off-farm work was an important source of income for rural households since as early as 1989. In our sample, the agricultural income accounts for less than 50% of the total rural disposable income throughout the sample period (see Tables C-4 to C-11 in Appendix C.1). Apart from the risks inherent in agricultural production such as weather and input/output price risks, rural households were also, increasingly, subject to labor market and business income risks. If a member of a rural household sought employment from a local TVE, he may face even higher risks than an urban employer working for an SOE given the deteriorating business environment for TVEs after 1990. On the other hand, the local social safety net experienced severe deterioration during the sample period. The provision of the local public goods such as public education, health care, medical insurance, and infrastructure were largely in the hands of the local governments. After the 1994 Tax Reform, the central government re-centralized local tax revenues without much redistributive rebate, leaving the county and township governments paralyzed by fiscal imbalances (Bird and Wong, 2005). To solve their revenue problem, local governments turned to rural residents for extra budget fees and converted public assets and land to commercial uses, both of which essentially passed the financial burden onto rural households.

Even though since early 2000, pilot programs of the new medical insurance scheme, social security and pension scheme were rolled out, the scope and coverage of these pilot programs were too limited for us to observe any effect from the rural sample during the sample period.[2]

In contrast, urban households always enjoyed some forms of public social insurance, though the composition of the social safety net have changed during the period of investigation. Up until mid-1990, urban residents enjoyed a relatively stable state employment in a "work unit." The "work unit" provided a whole spectrum of services to the employees, ranging from housing, maternal care, child care, child education, and training to entertainment and health care. It distributed subsidies for food, commuting, heating (in winter seasons) and so on. The funding of the services and subsidies was partly from the work unit's revenue and partly from the government. Urban households faced relatively low income risks, and consumption was essentially guaranteed in an administrative process. The SOE reforms shook this old model of "enterprises running social programs" (*qi ye ban she hui*). To increase the profitability of the state sector, thousands of small loss-making SOEs were shut down or sold and their employees were laid off, and the remaining SOEs decreased their welfare spending on employees. Urban residents then not only faced higher unemployment and income risks, but also had to foot the bill for housing, child care, education and health service which had been given to them at low costs before. Meanwhile, the government started to build a social security system that includes unemployment insurance, health insurance, disability insurance and retirement pensions.

The changing institutions have impacted the household income structure, in particular, in terms of the components of the public transfers. We compute the components of public transfers (i.e. food coupons, subsidies from the work unit, subsidies from the government and pension income) and the private transfers as a fraction of total household income from our sample and document their evolution in Figure 1. First, urban areas benefited more from public transfers than rural areas. The public transfers account for about 30% of household income for urban households, whereas this number is only 10% for rural households (see the orange lines in both panels). In comparison, private transfers take up only a small percent of household income in either area. Second, the composition of public transfers changed over time. Among the urban households, the role of subsidies for food in the form of food coupons and subsidies from the work unit declined visibly (i.e. the purple and blue lines in the urban sample), while the pension income became the major component of public transfers (i.e. the olive line in the urban sample).

[2]The New Rural Cooperative Medical Scheme pilot program was rolled out in 2003 and achieved almost full coverage in rural China in 2010, though the effectiveness of the medical scheme is questionable. See for example, Wagstaff, A., Lindelow, M., Wang, S. and Zhang, S., "Reforming China's Rural Health System", World Bank, *Human Development* (2009). The New Rural Social Security and Pension Scheme pilot program started in 2009.

The SOE reforms that started in 1998 and the entrance to the WTO in 2001 form the most important collection of pro-market reforms implemented by the Chinese government in the 20-year period that we study. In our empirical analysis later, we will distinguish two subperiods, 1989-1997 and 1998-2009, that correspond to before and after the beginning of these reforms.

3 Panel Data Construction

Our source data is the China Health and Nutrition Survey (CHNS), an ongoing data project conducted jointly by the Carolina Population Center at the University of North Carolina at Chapel Hill and the National Institute of Nutrition and Food Safety at the Chinese Center for Disease Control and Prevention. It is a panel dataset that tracks about 4,000 households in rural and urban areas of China since 1989. The survey is done in nine provinces that are at different stages of economic development and with different natural endowments: Guangxi, Guizhou, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Liaoning and Shandong. In each province, a multistage random cluster process was used to draw the sample. Each year there are about 200 primary sampling units (PSUs), one third of which are in urban areas and two thirds in rural areas. In each PSU, around 20 households were interviewed. We use the eight waves of the CHNS, conducted in 1989, 1991, 1993, 1997, 2000, 2004, 2006 and 2009. To the best of our knowledge, this is the only publicly available household-level panel from China that spans a significant period of economic transition.[3]

To study consumption insurance of Chinese households, we construct a panel of household consumption and income (with or without transfers) from the CHNS. Here we briefly discuss the data construction. A step-by-step description is found in Appendix A.

3.1 Measuring Consumption

The most basic nondurable consumption item is food. We employ a novel approach to construct food consumption from the highly detailed dietary information from the Nutrition Survey, an integral part of the CHNS. In the Nutrition Survey, a participating household is tightly monitored over a three-day window to collect the food items that household members consume. The result is a highly detailed account of up to six hundred food items that are potentially consumed on a daily basis, whose precision is suitable for nutrition studies and medical research (Batis et al., 2014). This survey design minimizes recall and telescoping error and can be considered as close as it gets to a "gold standard" for measuring consumption (Deaton and Zaidi, 2002; Beegle et al.,

[3]The same data set has recently been used to study the effect of the housing reform—that privatized the housing market in China—on housing prices (Wang, 2011).

2012; Attanasio et al., 2014). With the quantity data in hand, we obtain the local food prices from the Community Survey of the CHNS. Harmonizing across the different categorizations used in the price and quantity data and across waves, we form the annualized value of the core diet of the households. We further supplement the information of the core diet with the consumption of alcohol, tobacco, coffee and tea, which are surveyed in the Household Survey but not in the Nutrition Survey. Our measure of food consumption matches well with the official statistics from the China Statistical Yearbooks (CSYBs) by year, province and urban or rural status.[4]

In addition to food, the CHNS also collects data on consumption items such as utilities, child care, health expenditures, education expenditures, housing rents, and semidurable supplies, with varying data availability (see Table A-3 in Appendix A.4). Our *benchmark consumption measure* includes the consumption of food, utilities, health service and semidurable supplies, all items that are consistently surveyed in all waves. Admittedly, the benchmark consumption measure lies somewhere in between nondurable consumption and total consumption, with it missing some components of nondurable consumption such as clothing, transportation and communication, but including some components of durable consumption such as electronics as part of the semidurable supplies.[5] In all, compared to a typical consumption basket reported in the CSYBs, we find that our benchmark consumption captures roughly 60-70% of a rural household's total consumption and roughly 50-60% of an urban household's total consumption (see Table A-4).

As a robustness check, we consider two alternative strategies to measure consumption. The first strategy entails imputing from the food consumption in the CHNS a measure of nondurable consumption and a measure of total consumption, using the estimates from a food demand system estimated on another data source where all consumption items are surveyed. This is essentially the strategy used by Blundell et al. (2008) to deal with the lack of complete consumption data in the Panel Study of Income Dynamics (PSID) for their sample period. The second strategy is to supplement the benchmark consumption measure with an imputed measure of the consumption of housing service a la Krueger et al. (2017). The implementation of these two strategies are detailed in Appendix F.2 and F.3.

[4] For a discussion on externally validating our food consumption measure with official statistics, see Appendix A.4.1. It is important to note that we focus on expenditure—also pricing home-produced food—and do not distinguish between expenditure and consumption (e.g. nutrient intake) as opposed to Aguiar and Hurst (2005).

[5] Our consumption measure consequently gives a disproportionately large weight to food consumption, since health and semidurable expenditures tend to occur less frequently. There are, however, two advantages from using a consumption measure largely based on food. First, it helps reduce potential measurement errors, a point that has been made to argue for the study of consumption insurance solely based on food (Attanasio et al., 2014). Second, to detect any changes in consumption insurance, we are stacking the cards against us in the sense that food is perhaps among the consumption items with the least income elasticity of demand and has lower inequality compared with other consumption items (Aguiar and Hurst, 2013).

3.2 Measuring Income

We construct measures of household income and transfers by source from the raw data. The household earnings measure is the sum of labor market income, agricultural income, business income, and capital income, all after tax. The household transfers received have a public and a private component. The public transfers consist of the value of food coupons (from 1989 to 1993 when the coupon system was in effect), subsidies from the work unit (such as grocery, haircut and housing subsidies), subsidies from the government (such as utility and one-child subsidies) and pension income. The private transfers consist of cash and in-kind gifts from family and friends. The *benchmark income measure* is the household disposable income, which is the sum of the earnings, public transfers and private transfers received.[6]

Monetary values, including all components of consumption and income measures, are deflated by the spatial deflator supplied by the CHNS. This deflator takes into account differences in the cost of living across provinces and across rural and urban areas, taking the price level in rural Liaoning in 2009 as the base. Compared with the official inflation numbers, the deflator we use implies slightly lower inflation from 1989 to 1997 and higher inflation from 1997 to 2009, which is consistent with the evidence in Nakamura et al. (2016). Lastly, for ease of interpretation, we convert the real values in Chinese *yuan* to U.S. dollars by dividing the deflated values by 6.83, the USD/CHY exchange rate in 2009. All monetary values in the tables and figures are reported in terms of 2009 USD.

3.3 Sample Selection and Summary Statistics

To form the analysis sample, we focus on households whose heads are from age 25 to age 65. This is to accommodate the fact that the rural households, or about 70% of our sample, do not have a well-defined retirement age. We further require the households to have at least 2 members and at most 6 members. This is to recognize the wide-spread co-residence while limiting the degree of heterogeneity (Rosenzweig and Zhang, 2014). We trim the top and bottom 1% of all sub-items of household consumption, income, and transfer measures and then the household-level aggregates. After the sample selection and trimming, we retain 78.5% of the observations from the original sample.[7] The summary statistics of the analysis sample are found in Table 1.

It's clear from Table 1 that our panel, with replacement, ages slightly from 1989 to 2009, with the average age increasing from 42 in 1989 to 48 in 2009. Households are predominantly headed

[6] It is worth noting that we did not use the imputed household income aggregates supplied by the CHNS, which have some serious data consistency issues, in particular in its non-retirement wage income. For a critique on the readily available household income aggregates, see Appendix A.2.1.

[7] See Appendix B for detailed documentation of the effect of the sample selection and trimming.

by a male, especially so in rural areas. The educational attainment of household heads improves over time, with the percentage of rural household heads with no schooling decreasing from 13% in 1989 to 3% in 2009 and the percentage of urban household heads going beyond middle school (or the 9th grade) increasing from 37% in 1989 to 55% in 2009. In terms of household structure, the average household size remains relatively constant among rural households and declines slightly for urban households. Consistent with the aging of the panel, the average weak dependency ratio, defined as the number of children (age below 15) over the number of adults (age above 15) decreases sharply from 0.48 in 1989 to 0.13 in 2009. The strong dependency ratio, defined as the number of children and old adults (age above 60) over all working-age adults (age between 15 and 60), also decreases from 0.65 to 0.31.

To control for changes in household composition, we divide the household aggregate of various measures of income and consumption by an adult equivalence scale. To compute the adult-equivalent income measures, we divide the household income measure by the number of working age adults in the household (i.e. those with age between 15 and 60). To compute the adult-equivalent consumption measures, we divide the household consumption measure by the equivalence scales in Krueger and Perri (2006), defined as follows:

$$KP = [(\#\text{ of adults age} \geq 15) + 0.7 \times (\#\text{ of children age} < 15)]^{0.7}.$$

4 Cross-Sectional Facts about Income and Consumption

In this section, we present some cross-sectional facts about the consumption and income growth as well as the evolution of the consumption and income inequality arising from the CHNS for the period 1989-2009. Our benchmark consumption measure includes expenditures on food, utilities, health and semidurable supplies, which is the largest set of consumption items that are consistently surveyed in all waves of the CHNS (Section 3.1). Our benchmark income measure is the household disposable income, which includes earnings, public and private transfers (Section 3.2).

(Food) expenditure and income growth. At a first pass, we construct measures of disposable income and strictly food expenditure from the CHNS according to the definitions adopted by the China Statistical Bureau, and check if they are consistent with the official statistics.[8] In

[8]We focus on food expenditure here. It is not only the main component of our benchmark consumption measure, but also the only consumption item in CHNS that can be made fully comparable to the tabulated official statistics from CSYB. From the food consumption measure in the CHNS, we subtract the value of food coupons and the food gifts to make it comparable to the official statistics. Likewise, from the disposable income measure in the CHNS, we subtract the value of food coupons and the in-kind gifts to make it comparable to official statistics. We apply the same deflator to both the CHNS and the CSYB series and normalize the values in 1989 to 1.

Figure 2, we plot the average household disposable income per capita and average household food consumption per capita by wave for rural and urban areas separately against their official counterparts. Both income and food expenditure grew more in urban areas than in rural areas. Household disposable income grew by a factor of 3.7 in rural areas and 4.3 in urban areas, while household food expenditure grew by a factor of 1.8 in rural areas and 2.3 in urban areas. The overall magnitude of the growth of income and food expenditure in our micro data align well with the official statistics, though our micro data seems to suggest a higher level of food expenditure in the urban areas throughout 1990s and early 2000s than the official statistics. It is note-worthy that household income per capita grows slower than GDP per capita (indicated by the dashed line in the top panels), an observation also made by Khan and Riskin (1998) using the China Household Income Project (CHIP) data. However, what matters to counteract the rising income risks, which we document next, is the growth in household income, not necessarily GDP per capita.

Consumption and income inequality. Going back to our benchmark consumption and income measures, in Figure 3, we show the evolution of the benchmark income and consumption inequality (in the leftmost panel) and the inequality measures adjusted for household composition (in the rightmost panel). The inequality is measured by the variance of logs. Adjusting for household composition or not, we find a noticeable increase in income inequality and a clear albeit smaller increase in consumption inequality. Before adjustment, the income inequality increased from 0.8 to 1.3 in the rural sample and from 0.35 to 1 in the urban sample over the sample period. The magnitude of the growth of the consumption inequality is about one-third of that of the income inequality in the rural sample and half of that of the income inequality in the urban sample. After adjustment, the increase in the income inequality is as evident, if not more. Especially for the urban sample, the increase in adult-equivalent income inequality reaches 0.8 log points. Given that the variance of the adult equivalent scales is flat over time, the heightened growth in income inequality, adjusting for household composition, is due to the fact that the covariance between income and the number of working adults declines visibly over time in the urban sample (see the middle panel).

Both the level of the income and consumption inequality as well as their growth are higher in China than those obtained for the U.S. using the Current Population Survey (CPS) data. Overall, the increase in the variance of the adult-equivalent income in China from 1989 to 2009 is about two times the increase of its counterpart in the U.S. from 1970 to 2005, while the increase in the variance of the adult-equivalent consumption is about three times its U.S. counterpart (see the top-left panel in Figure 13 in Heathcote et al. (2010b) and Figure C-3 in Appendix C.2).[9]

[9]In Appendix C.2, we report other inequality measures for our sample, such as the Gini Index, the mean-to-

Going beyond a single statistics for measuring inequality, we present an overview of how adult-equivalent consumption, earnings (i.e. income without transfers), and income vary over the distribution of adult-equivalent income for rural and urban areas in 1989 and 2009 in Table 2. In particular, we present the average adult-equivalent consumption, earnings, and income for all five quintiles of the distribution of adult-equivalent income in the middle part of the table, then we zoom in on the bottom (top) 10% and present the averages for the bottom (top) 1%, 1-5%, and 5-10%. Besides the averages, shares of the total consumption, earning, and income are reported for each segment of the income distribution as well. Over the sample period, all of the earnings, income and consumption distributions grew more skewed to the right in both rural and urban areas, while the consumption distribution remained less positively skewed than the earnings or income distribution throughout. These features are consistent with the evidence we mentioned before using the variance of logs and the Gini index.[10]

Residual (within-group) consumption and income inequality. To compute the residual (within-group) consumption and income inequality, we start from the log adult-equivalent consumption and income and remove from them the effects of household characteristics that are permanent or pre-determined before starting to work, such as sex, age, education, province of residence, and minority status, by wave and by urban/rural areas. We report the variance of the residual adult-equivalent consumption and income inequalities in Figure 4. Three main findings stand out from our analysis.

First, within the rural or urban areas, the residual inequality accounts for roughly 90% of the overall inequality (see the left column in Figure 4). In comparison, Krueger and Perri (2006) decompose the rise in U.S. consumption inequality and find that about half of the rise in consumption inequality is due to residual (within-group) inequality.

Second, residual income inequality grew more than residual consumption inequality from 1989

median ratio, and the 90/10 ratio among others (Table C-12). We find that the Gini of the adult-equivalent income increased from 0.41 in 1989 to 0.50 in 2009 in the rural areas and from 0.29 in 1989 to 0.43 in 2009 in the urban areas (Figure C-2). These numbers are similar to what Khan and Riskin (1998) and Li et al. (2013) find from the 1988 and 1995 CHIP surveys and what Li et al. (2013) find from the 2002 and 2009 CHIP surveys. We find that the Gini of the adult-equivalent consumption rose from 0.25 to 0.35 in rural areas , whereas that its urban counterpart rose from 0.27 to 0.30 over the sample period. These numbers are in line with the Gini of the consumption surveyed in the CHIP dataset reported by Liu and Li (2011). On average, the consumption inequality measured in Gini is about 2/3 that of income inequality. In contrast to these findings, Cai et al. (2010) report, using the Urban Household Income and Expenditure Survey (UHIES), consumption inequality that is similar or even somewhat higher than income inequality. This is due to the fact that their consumption measure include durables such as cars. Ding and He (2016) verify, with the same data source, that while the total consumption inequality is higher than income inequality, nondurable consumption inequality is lower.

[10] In Appendix C.2, we present the analog of Table 2 for the rest of the 1991-2006 waves (Tables C-1 to C-3). Moreover, in Tables C-4 to C-11, we further break the consumption, income, and transfers down in sub-components and document how these sub-components vary over the distribution of the disposable income.

to 2009. To see this, we normalize the residual inequalities in 1989 to zero (see the middle column in Figure 4). Over time, the residual income inequality rose by 0.5 log points in rural areas and 0.6 log points in urban areas, while the residual consumption inequalities rose by 0.25 log points in rural areas and 0.2 log points in urban areas. The fact that the residual income inequality kept rising indicates that both rural and urban households might be facing substantial permanent income shocks throughout the 20 years. The fact that the residual consumption inequality rose as well, but to a smaller extent, suggests that Chinese households have partial insurance, in the sense that they can smooth out some of the income shocks but not all.

Third, the covariance of residual consumption and income more than tripled over the span of 20 years (see the right column in Figure 4). While the covariance remained relatively constant for the first four waves, it kept rising in the last four waves of the CHNS. In 2009, the covariance of residual income and consumption was three times as high as the 1997 level in both rural and urban areas of China. In comparison, we show using the PSID data that the covariance between the residual consumption and income was fairly flat from 1972 to 1992 in the U.S. (Figure C-3 in Appendix C.2). This is the first evidence that Chinese households achieved less consumption smoothing despite the income growth, which our quantitative exercise will confirm next.

5 The Joint Dynamics of Income and Consumption

In this section, we estimate a partial insurance model with time-varying permanent and transitory income shocks and time-varying degree of transmission of those shocks to consumption. We motivate the model in Section 5.1 and present the benchmark results in Section 5.2. In Sections 5.3 and 5.4, we explore alternative income and consumption measures. Section 5.5 discusses.

5.1 Measuring Consumption Insurance

We estimate a partial insurance model à la Blundell et al. (2008) (henceforth, BPP). We regress the (logged) adult-equivalent income and the (logged) adult-equivalent consumption measure on dummies of sex, age, education level, province of residence and ethnic minority separately by rural/urban status and by year, and take the difference of the residuals. For each household, we have the history of the (unexplained) income and consumption growth as inputs for the estimation.

The econometric model is annual and standard in the literature. The log (unexplained) annual income y_t is the sum of a permanent component z_t and a transitory component ε_t,

$$y_t = z_t + \varepsilon_t, \tag{1}$$

where the permanent component z_t follows a random walk,

$$z_t = z_{t-1} + \zeta_t. \tag{2}$$

The shocks to the permanent component, ζ_t, as well as the transitory component, ε_t, are distributed *i.i.d.* across time and households: $\zeta_t \sim i.i.d.(0, \sigma^2_{\zeta_t})$ and $\varepsilon_t \sim i.i.d.(0, \sigma^2_{\varepsilon_t})$.

In this application, the assumption of *i.i.d.* transitory shocks is without loss of generality. Since household income is surveyed from waves that are at least two years apart, we would not be able to identify the persistence parameter the way BPP did for the U.S., had we adopted an MA(1) process for the transitory component. The assumption of a random walk in the permanent component requires some justification. The fanning out of the income and consumption distribution that we described in Section 4 suggests an uninsurable random walk component in income (Deaton and Paxson, 1994). To further confirm this intuition, in Appendix D, we estimate a more general version of the income process, where we allow for an AR(1) structure in the permanent component and show that we cannot reject the null that the persistence parameter in AR(1) is 1, which corresponds to a random walk.[11]

The measured log (unexplained) annual consumption growth Δc^*_t follows:

$$\Delta c^*_t = \psi_{\zeta,t}\zeta_t + \psi_{\varepsilon,t}\varepsilon_t + \xi_t + u^c_t - u^c_{t-1}, \tag{3}$$

where the preference shock ξ_t is distributed as $i.i.d.(0, \sigma^2_{\xi_t})$ and the measurement errors in consumption $u^c_t \sim i.i.d.(0, \sigma^2_{u^c_t})$. The loading factors $\psi_{\zeta,t}$ and $\psi_{\epsilon,t}$ measure the degree of transmission of the two types of income shocks to consumption. They are interpreted as the insurance parameters against the permanent and transitory income shocks respectively. The higher the loading factor or the transmission, the lower the insurance. We let the variance of the income shocks and the partial insurance parameters vary by time. This non-stationarity provides the flexibility to fit the data from the rapidly growing economy of China and allows us to study the joint dynamics between economic growth, risk and insurance.

Even though the model is cast in terms of annual income and consumption, the data points from the CHNS are not annual. To limit the number of parameters to be estimated, we restrict the loading factors $\psi_{\zeta,t}$ and $\psi_{\varepsilon,t}$ to vary from the first subperiod 1989-1997 to the second subperiod 1998-2009. As discussed in Section 2, the two subperiods represent drastically different economic environments. The subperiod of 1989 to 1997 is one in which urban households still enjoyed

[11] Chamon et al. (2013) use the same income process as our benchmark in their study on the household saving rates in urban China, using the same data source.

relatively stable state employment and (diminishing) benefits and rural households only saw the beginning of the local fiscal crisis. The subperiod of 1998 to 2009 captures the effects of the most important pro-market reforms which fundamentally changed the economic lives of billions of Chinese. Figure 4 further confirms that the relation between income and consumption is likely to be very different in the two subperiods. The variances of income shocks can vary fully with time, to the extent possible: we assume that the variance of the permanent and transitory shocks remain the same within the period between two consecutive waves of survey. To ensure stability of the estimation, we also restrict the variance of the permanent shock in 1989 (2006) to be the same as the variance of the permanent shock in 1991 (2009) and the variance of the transitory shock in 2006 to be the same as the variance of the transitory shock in 2009. The model is estimated by the Diagonally Weighted Minimum Distance Estimator and the standard errors are based on 50 replicas of bootstrapped sample.[12]

5.2 Benchmark Results

We estimate the partial insurance model using the household-level panel we constructed from the CHNS. The benchmark consumption includes food, utilities, health and semidurable supplies, all of which are consistently surveyed in all waves. The benchmark income, which is also the disposable income, includes agriculture income, labor market income, business income, capital income and public and private transfers. The headline result is that consumption insurance, or the extent to which consumption can be insulated from income risks, declined in both rural and urban areas over the sample period, while income risks themselves increased along the growth path. These findings are presented in the first two columns under the heading 'Disposable Income' in Tables 3 and 4.

To visualize the evolution of the income risks, we plot the point estimates of the variance of the permanent and transitory shocks, together with the standard errors bands, in Figure 5. Both rural and urban households saw a rapid increase in permanent income risks since 1998. For rural (urban) households, the annualized variance of permanent shocks has increased from an average of 0.084 (0.045) before 1997 to 0.111 (0.067) after 1997, implying a 32% (49%) increase. The evolution of the transitory risk follows an inverted U shape for both rural and urban sample. The transitory risk peaks in the rural sample in 2004 and in the urban sample in 2000. From before to after 1997, the average transitory risks increased from 0.410 (0.241) to 0.449 (0.275) in the rural (urban) areas, implying a 9.4% (13.8%) increase. Comparing across space, rural households consistently faced higher income risks than urban households throughout the sample period.

[12]We relegate the details of the identification and estimation to Appendix E.

In terms of the insurance against the permanent shocks, both rural and urban households experienced a worsening in insurance from before 1997 to after 1997. The loading factor $\psi_{\zeta,t}$, which captures the percentage of permanent risks that is transmitted to consumption, increased from 0.104 to 0.280 for rural households and from 0.049 to 0.244 for urban households (Table 4). This implies a roughly three-fold increase in the loading factor of permanent risks for rural households and a five-fold increase for urban households. As to the insurance against the transitory shocks, rural households achieve virtually perfect insurance throughout the sample period, whereas urban households' ability to insure improves from a $\psi_{\varepsilon,t}$ of 0.176 before 1997 to 0.062 after 1997. In sum, while the insurance against permanent risks evolved similarly in rural and urban areas, rural areas was able to insure significantly better against transitory risks.

Focusing on consumption insurance against permanent risk, the negative relation between growth and insurance that we document for the aggregate economy over time also holds in the cross section. In Appendix H, we explore the relationship between growth, risk and insurance cross-sectionally for rural communities with different income growth rates. Using the same benchmark income and consumption measures, we show that households residing in communities that display higher income growth also experienced a larger increase in the transmission of permanent income shocks to consumption.

5.3 The Role of Public and Private Transfers

To investigate the roles played by transfers in estimating the transmission parameters, we re-estimate the model with three alternative measures of income: earnings with public transfers, earnings with private transfers, and earnings only. The results are reported in the remaining columns in Tables 3 and 4. For the rural households, regardless of which income measure we use, the degree of transmission of permanent shocks shows similar deterioration over time, and the measured degree of transmission of transitory shocks is virtually nil throughout the sample period. The robustness of the benchmark result for the rural sample is not surprising given that transfers only account for a small share, 10%, of total income for rural households (Figure 1).

In contrast, for the urban households, public transfers were a significant component of income for urban households throughout the sample period. Moreover, the nature of the public transfers changed over time. Public transfers in the early 90s, especially the subsidies from the work unit, were essentially another form of earnings. Urban households whose wage income was higher were also more likely to receive a higher subsidy from their work unit, whether it be food coupons or subsidies for daily supplies or service. As the government function evolved, public transfers increasingly played the role of social insurance, such as pension and medical insurance, as well as welfare assistance (Section 2). As a result, the public transfers received by urban households

became less and less correlated with earnings over time or even negatively correlated with earnings by the end of the sample period (see Figure C-1 in Appendix C.2). This transformation has consequences for the estimates of the transmission parameters.

First, in terms of the measurement of permanent risks in urban areas, the exclusion of public transfers significantly increased the growth of the permanent income risk over time (see the "Urban" column under "Earnings + Private Transf." in Table 3). For a given consumption series, heightened growth in permanent risks implies lower growth in the transmission of the shocks to consumption. In fact, without public transfers, the urban households faced the same level of transmission of permanent shocks in the two subperiods, 0.078 and 0.074 respectively (see the "Urban" column under "Earnings + Private Transf." in Table 4). In sum, including public transfers in the income measure under-states the increase in income risk and over-states the increase in the transmission of risk to consumption.

Second, in terms of the transmission of transitory risks in urban areas, the result of a high pass-through in the 1990s is puzzling, but it holds only in the two specifications where the income measure includes public transfers (see columns under the headings of "Disposable Income" and "Earnings + Public Transf." in Table 4). To understand this result, recall that public transfers in the 1990s are akin to in-kind transfers, and hence cannot be effectively saved for future consumption. Specifically, food coupons could only be applied to the purchase of designated food items and were valid for one year and utility subsidies were deducted directly from the utility bill. This essentially imposed a savings constraint for households entitled to large public transfers in the 90s. As a result, consumption covaries positively and significantly with public transfers in the early 1990s (see Table G-1 in Appendix G). To put our intuition to the test, in Appendix G, we re-estimate the model with a measure of consumption that excludes the value of food coupons and the subsidy for utility as well as a measure of income that includes the earnings and the cash public transfers only, i.e. the welfare assistance and pension income. In this specification, the urban households achieved almost perfect insurance against transitory shocks before 1997.

5.4 Alternative Consumption Measures

One concern about the benchmark consumption measure is that, since its main component is food consumption, the measure captures a declining share of the total consumption. To correct for this, we construct alternative measures of consumption, following the imputation procedure proposed by BPP. The idea of the imputation is to first estimate a food demand system from a second dataset that surveys households' complete consumption bundles, then invert the demand function, and apply the inverted demand function on the food consumption in our main dataset to infer the level of total expenditure. To do that, we utilize the urban samples of the 1988, 1995,

2002, and 2007 waves of CHIP, which surveys the entire consumption basket.[13] Unfortunately, we have to focus on the urban sample, since some of the four waves of rural CHIP do not contain information critical for the imputation. Details of the imputation procedure are documented in Appendix F.3. In estimating the food demand function from the CHIP, we relate the food consumption to a measure of nondurable consumption in CHIP in one specification and to a measure of total consumption in CHIP in another specification. The nondurable consumption measure includes expenditures on food, clothing, transportation, communication and others. The total consumption measure includes the nondurable consumption as well as housing, household appliances, health and education expenditures.

The results are found in Table 5. In the first column, we reprint the benchmark CHNS result for easy comparison. The pattern of the estimates for the transmission parameters are very robust across specifications. With the imputed measures, the point estimates of the transmission parameters are higher than our benchmark, which is what we had expected. Our benchmark consumption measure is predominantly food consumption, which is arguably the most inelastic component of consumption with respect to budget. Imputing and including the more elastic components of consumption tends to increase the covariance between income changes and consumption changes. In particular, the transmission of the permanent shocks in the 1998-2009 subperiod is now higher with the imputed measures at 0.373 as compared to 0.244 in the benchmark, though the confidence intervals around the point estimates overlap and hence the difference is statistically insignificant. In Appendix F.1 and F.2, we report results from additional robustness analysis, where we consider subcategories of the benchmark consumption measure and where we add the imputed consumption flow of housing services (as in Krueger et al. (2017)). The general pattern of the evolution of the transmission parameters is preserved across all specifications.

5.5 Discussion

We document that Chinese households partially insure their consumption against permanent shocks, a finding consistent with the results in Attanasio and Davis (1996), Blundell et al. (2008), Kaplan and Violante (2010) and Heathcote et al. (2014) for the U.S., and they can insure better transitory shocks than permanent shocks, in particular if we remove the in-kind transfers from the income measure. What sets our results apart from the previous studies is that we show the ability to insure income shocks worsens considerably with economic growth. The transmission from permanent income shocks to consumption at least tripled from 1989 to 2009.

In the first subperiod, 1989 to 1997, the almost perfect insurance in rural and urban areas

[13] To our knowledge, CHIP is the only publicly available micro dataset that contains expenditure information and has a sample period that is comparable to that of the CHNS.

reflects the tight economic planning and rationing which directly manipulated one's consumption stream and was still wide spread in China then. However, to reach this conclusion, we need consumption data that is not just cash expenditures but includes in-kind transfers, as well as income data that is not just earnings but also includes all sorts of public transfers. The CHNS data are particularly suitable for this purpose. The level of transmission from permanent income shocks to consumption in the second subperiod, 1998-2009, is higher than that of the first subperiod. This is the main result of our paper. However, despite the deterioration in consumption insurance, the level of transmission in the second subperiod appears to be low, relative to what BPP found for the U.S. economy from 1979 to 1992, even after imputing total consumption for the urban sample as we do. Recall that BPP obtained a loading factor of 0.642 for the permanent shocks. It is worth pointing out, however, that after imputation, the 95% confidence interval of the permanent risk transmission we obtain for China, [0.120, 0.626], overlaps with the 95% confidence interval of the U.S. counterpart obtained by BPP, [0.456, 0.828]. That is, while it is true that our point estimate for China is lower than that of the U.S., they are not significantly different. At the same time, when BPP uses expenditures on food only as a consumption measure, they obtain a permanent risk transmission parameter of 0.29, with resembles our estimate with only food for post-reform urban China, 0.254 (see Appendix F). This way, as the share of food consumption declines over time and with the stage of development, the transmission from income risk to consumption in China is likely to increase to values that resemble the US level.

How do we interpret the transmission parameters? We interpret them quite literally. They measure the degree to which consumption varies with income shocks (i.e., unanticipated changes in income) of different durations. The macro literature, to which we perhaps speak more directly, has taken the view that the strategy proposed in Blundell et al. (2008) and that we use captures consumption insurance broadly, not only self-insurance but all forms of insurance (Kaplan and Violante, 2010).[14] We largely take this view as well. However, as BPP discussed in their original paper, we acknolwedge that these transmission parameters may be a compound of the true ability to insure and the advance information (p. 1899 in BPP). For example, if the social stratification becomes more tied to education so that income indifferences can be more explained

[14] Kaplan and Violante (2010) simulate an Aiyagari-Bewley-Hugget (ABH) economy (in which heterogeneous agents can only self-insure against income risk) and explore if it is able to reproduce its empirical counterpart (i.e., Blundell et al. (2008)). These authors find (and we quote): *Households in the data have access to more consumption insurance against permanent earnings shocks than in the model. BPP estimate that 36 percent of permanent shocks are insurable, whereas the model's counterpart of the BPP estimator varies between 7 percent and 22 percent.* Note that the 36 percent that Kaplan and Violante (2010) refers to equals to one minus the transmission parameter for the permanent shocks estimate in BPP (0.642). This means that ABH economies are able to reproduce some of the insurance captured in the data, but not all. Indeed, one can show in closed-form that BPP holds for the moral-hazard economy in Attanasio and Pavoni (2011) and the partial insurance economy in Heathcote et al. (2014).

by observables, then the advanced information component of the transmission parameters will be reduced and the parameters will be closer to the true ability to insure. Moreover, the increase in pass-through from income to consumption may simply reflect the change in the consumption bundle, with goods that have larger income elasticity of demand being added over time as part of the process of structural change linked to economic growth (Herrendorf et al., 2014). Finally, while the transmission parameters can reflect a household's ability to insure income shocks, it can also be an outcome of an optimization problem, where the household chooses how much liquid asset to hold for consumption smoothing purpose and how much iliquid asset to hold for investment purpose. This might be particularly relevant for China given the large homeownership rate (92% in our dataset), the large share of housing wealth in the household portfolio and the ever-rising housing price.[15] However, caution is in order, as all these interpretations are suggestive and may operate at the same time.

6 Welfare Calculations

As the Chinese households' income grew from 1989 to 2009, the risk environment and its impact on consumption underwent considerable changes as well. To the extent that higher income risk and higher transmission to consumption lead to a more volatile consumption path, there will be a negative impact on welfare. How large is this welfare cost compared to the welfare gain of an accelerated income growth? In this section, we present some tentative welfare calculations to illustrate that the welfare cost can be large.

We decompose the overall changes in welfare, measured in terms of consumption equivalent variations as in Lucas (1987), into welfare changes induced by changes in the income growth rate, changes in income risks, and changes in insurance parameters. We conduct this decomposition exercise along the time dimension, evaluating the welfare changes from moving from the economic environment of the 1990s to the 2000s, and along the spatial dimension, evaluating the welfare changes from moving from the rural environment to the urban environment.

6.1 A Welfare Decomposition of Growth, Risk, and Insurance

We first present the decomposition method. Consider a representative agent who has a time-separable constant-relative-risk-aversion period utility function. Let β is the discount factor and

[15] While in rural areas housing wealth has always been an important component of household wealth, the 1994 urban housing reform which privatized the state-owned housing and established private housing markets set in motion a rapid accummulation of housing wealth among urban households. Using the China Household Finance Survey (CHFS) we find that housing wealth (net of debt) accounts for 82.1% of total net worth in rural areas and 68.1% in urban areas in 2011. These shares are about three times larger than those obtained for the U.S. (see Table 7 in Díaz-Giménez et al. (2011)).

η is the risk aversion coefficient. Then ex ante welfare of this agent is

$$E\sum_{t=0}^{\infty}\beta^t u(C_t) = E\sum_{t=0}^{\infty}\beta^t\frac{C_t^{1-\eta}}{1-\eta},$$

where C_t is the consumption at time t.

Imagine an environment characterized by an income growth rate γ_y, income risks $\sigma = (\sigma_\zeta, \sigma_\varepsilon)$, and the transmission parameters $\psi = (\psi_\zeta, \psi_\varepsilon)$.[16] To tie the calculations to the econometric model, we let the period-t consumption to have a deterministic component ($\bar{c}_t$) and a stochastic component (c_t): $C_t = \bar{c}_t \cdot c_t$. The deterministic component of consumption is the solution to a savings problem with an exogenous interest rate r, an income growth rate γ_y, and no uncertainty. This model implies a smooth consumption path $\bar{c}_t$ with a growth rate $\gamma_c = [\beta(1+r)]^{\frac{1}{\eta}}$ and an initial consumption level $\bar{c}_0$ that depends (positively) on γ_y. To emphasize this dependence, write $\bar{c}_0(\gamma_y)$. The stochastic component of the consumption path follows the partial insurance model:

$$\Delta \ln c_t = \psi_{\zeta,t}\zeta_t + \psi_{\varepsilon,t}\varepsilon_t + \xi_t,$$

with an initial condition $\ln c_0$.

It is easy to show that the ex ante welfare of living in this environment for T periods is:

$$\begin{aligned} E\sum_{t=1}^{T}\beta^t u(C_t) &= \frac{(\bar{c}_0(\gamma_y))^{1-\eta}}{1-\eta}c_0^{1-\eta}\sum_{t=1}^{T}\left(\gamma_c^{1-\eta}\beta\right)^t \exp\left(\frac{1}{2}(1-\eta)^2(\psi_\zeta^2\sigma_\zeta^2 + \psi_\varepsilon^2\sigma_\varepsilon^2 + \sigma_\xi^2)t\right) \\ &\equiv E\sum_{t=1}^{T}\beta^t u(C_t;\gamma_y,\sigma,\psi), \end{aligned}$$

where the second line is just a notational change to highlight the dependence of the consumption path C_t on the parameters of the environment (see Appendix J for an explicit derivation).

Now consider two environments, A and B, characterized by different income growth rates, income risks and consumption insurance, $(\gamma_{y,i}, \sigma_i, \psi_i)$ for $i = A, B$. Define the total effect on welfare in consumption equivalent variation, $1+\omega_T$, from moving from environment A to B for T periods as

$$E\sum_{t=1}^{T}\beta^t u((1+\omega_T)C_t;\gamma_{y,A},\sigma_A,\psi_A) = E\sum_{t=1}^{T}\beta^t u(C_t;\gamma_{y,B},\sigma_B,\psi_B).$$

[16] We suppress the time dimension of these parameters to save space, but these parameters should be understood to be time-varying.

We can decompose the total effect, $1+\omega_T$, into a growth effect, a risk effect and an insurance effect. Define the consumption equivalent variation from comparing $(\gamma_A, \sigma_A, \psi_A)$ to $(\gamma_B, \sigma_A, \psi_A)$ as the growth effect, $(1+\omega_G)$:

$$E\sum_{t=1}^{T}\beta^t u((1+\omega_G)C_t;\gamma_{y,A},\sigma_A,\psi_A) = E\sum_{t=1}^{T}\beta^t u(C_t;\gamma_{y,B},\sigma_A,\psi_A).$$

The risk effect, $(1+\omega_R)$, is defined likewise as the consumption variation from comparing $(\gamma_B, \sigma_A, \psi_A)$ to $(\gamma_B, \sigma_B, \psi_A)$. So is the insurance effect, $(1+\omega_I)$, defined as the consumption variation from comparing $(\gamma_B, \sigma_B, \psi_A)$ to $(\gamma_B, \sigma_B, \psi_B)$. We show in Appendix J that:

$$1+\omega_T = (1+\omega_G)(1+\omega_R)(1+\omega_I).$$

This gives us a clean decomposition of the total welfare effect into a growth, a risk and an insurance effect.[17] In the next two subsections, we apply this decomposition to two welfare comparisons, across time and across space.

6.2 Welfare Comparison Across Time

As we show in Section 5.2, the economic environment has changed substantially from the 1990s to the 2000s. We illustrate here what these changes imply for welfare. We pick a β of 0.98 and an interest rate of 2%. We entertain two levels of risk aversion, 2 and 4.

We first focus on the 1989 to 1997 period, which is before major economic reforms took place. We start from the baseline scenario of a period of 9 years, characterized by the income growth rate, the average variance of income shocks, and the transmission parameter in this subperiod. Then we successively replace the income growth rate, the income shocks, and the transmission by their post-1997 counterpart. These steps in turn give us the growth effect, the risk effect and the insurance effect. The total effect describes the change in welfare, in consumption equivalent variations, from moving from the economic environment of the 1989-1997 period to that of the 1998-2009 period. We do this exercise for the rural and urban sample separately. The results are found in panel (a) of Table 6. For completeness, we also take the 1998-2009 as the baseline, and change the parameters in the same way to proxy the 1989-1997 environment. The findings

[17] This decomposition of welfare changes is inspired by Floden (2001), but our context differs from his. First, we do not study specific policies that can potentially improve efficiency, risk sharing and equity, instead we estimate the magnitude of income risks and the degree of transmission of those risks to consumption. When we assess the welfare change and its components between two economic environments, the interpretation is descriptive and does not imply causality. Second, due to the overwhelming importance of residual inequality in China, we focus on the ex ante welfare of a representative agent and as a result are silent on the issue of inequality.

are reported in panel (b) of the same table. The square brackets contain the 95% confidence intervals of the estimates based on 50 bootstrap replicas.

Clearly, higher income growth in the 2000s implies considerable welfare gains, amounting to 3.53% and 8.27% in annual consumption variation for rural and urban China. However, once we take into account the changes in risk levels and consumption pass-through, the welfare gain from such a growth acceleration looks less convincing. In the rural sample, higher risk and pass-through in the 2000s erode the welfare gain from growth alone. The insurance effect is unequivocally negative under either risk aversion. The total welfare gain is significantly lower than the growth effect alone. In the case of a risk aversion of 4, there is a significant welfare *loss* from moving from the rural economic environment in 1990s to that in 2000s. The picture looks different for the urban sample. The risk and insurance effects for the urban sample are close to zero. Though the pass-through of the permanent shocks increases from the 1990s to 2000s, the pass-through of the transitory shocks decreases. These two counteracting forces on balance cancel out, with the insurance effect being insignificantly different from zero. Therefore, the total welfare effect does not differ too much from the growth effect alone. The results where the 2000s are set as the baseline can be interpreted similarly.

6.3 Welfare Comparison Across Space

In this section, we compare the rural environment to the urban environment, for the 1989-1997 period and the 1998-2009 period separately. In either sub-period, we start from the baseline rural environment, and replace the parameters of income growth, risk and consumption transmission successively with their urban counterparts to isolate each of the growth, risk and insurance effect from a hypothetical move from rural to urban areas. The results are found in Table 7.

Household income growth in our rural and urban sample has diverged sharply over the sample period. From 1989 to 1997, the annual growth rate of disposable income for the rural households is 4.43% whereas that for the urban households is slightly higher at 4.96%. In contrast, from 1998 to 2009, the rural household income growth accelerated to 5.2%, but the urban counterpart reaches as high as 6.71%. This implies a much larger growth effect in the 2000s, 9.75%, compared to that in the 1990s, 2.42%. Perhaps more interestingly, the rural households faced higher income risks than the urban households throughout the sample period and the difference widened over time. This means that the gain from obtaining urban risks becomes larger in the 2000s than in 1990s. Finally, the insurance effect turned from negative to marginally positive over time, suggesting that the rural advantage of smoothing in particular transitory shocks in the 1990s is gradually lost. The results here portray a rural economy and an urban economy that are diverging in terms of welfare. The total welfare difference between the two is insignificant in the 1990s,

but in 2000s, an urban household enjoys a welfare advantage over a rural household of about 11 to 14% of the rural household's annual consumption.

Relatedly, an emerging development literature emphasizes the importance of risk and insurance for migration decisions (Bryan et al., 2014; Morten, 2013; Munshi and Rosenzweig, 2016). Our welfare calculations across space are in no position to measure the welfare effects of migration, as we do not model migration. Instead, our calculations suggests that, to the extent that economic growth is related to structural transformation and urbanization (Gollin et al., 2002, 2004; Herrendorf et al., 2014), risk and insurance considerations at the micro level can also have an impact at the macro level.

6.4 Summary

Our welfare analysis, undoubtedly subject to the Lucas critique, is meant to give a sense of magnitude of the different components of the welfare effect. If the rural China from 1989 to 1997 were a country and from 1998 to 2009 were another, then inferring welfare difference between the two countries from comparing their growth rates would be misleading. Likewise, think of a rural household in 1989 who could choose to become a fully qualified urban household for the next 10 years. The decision would be obvious if he only compared the income growth rates in the two areas, but much less if he took into account risk and insurance.

In the context of China, we have shown the welfare effects of risk and insurance can be as sizeable as the welfare effect of growth. However, absent of a theory that relates growth, risk and insurance, we take our results simply as tentative evidence. The point we want to make is that risk and insurance at the micro level could have an aggregate impact and macro models for developing countries can benefit from incorporating risk and insurance to match the joint dynamics of income and consumption along the growth process.[18]

7 Conclusion

Our main finding is that during the period of rapid economic growth from 1989 to 2009, the Chinese households faced an increasing level of income risks, especially in the permanent component, and experienced a deterioration in consumption insurance. We conclude by discussing the interpretations of this empirical observation and pointing to avenues of future research.

Within the context of China, the worsening in consumption insurance as the country transi-

[18] In the context of the US, DeSantis (2007) also illustrates the importance of matching the micro consumption distribution in the assessment of the welfare gains from removing business-cycle frequency aggregate risks.

tioned from a planned economy to a market economy is understandable. Yet how did the Chinese households manage to achieve the level of consumption insurance they did without adequate social insurance programs in the 2000s is somewhat puzzling. Was it because of an increase in precautionary savings due to the increase in income risk? The fact that a big part of the household saving went into investments in housing and education, which are not particularly liquid, casts some doubt on this argument. Indeed, the limitation to diversify a wealth portfolio can be considered a savings constraint in itself (Dupas and Robinson, 2013; Kaboski et al., 2014; deMagalhaes and Santaeulàlia-Llopis, 2015).[19] Also, beyond self-insurance, what were other informal insurance arrangements out there? Or does it simply reflect a persistent consumption habit focused on satisfying basic needs? These are all speculations that motivate future research.

While there is ample evidence of the remarkable ability to cushion consumption against income shocks in poor economies (Rosenzweig and Stark, 1989; Townsend, 1994), the deterioration in consumption insurance that we empirically document along the growth path is new. It is true that our results are strictly based on the China experience, but it leaves one wondering whether this empirical trade-off is specific to China or belies more fundamental economic forces during a growth process, an important topic for further research.[20] Moreover, our preliminary welfare calculations suggest that risk and insurance can have first-order welfare impact that is comparable to growth, a conclusion that is drawn for one of the fastest growing economies in the world. However, at present, the concepts of growth, risk, and insurance are almost invariably studied in isolation, with economic growth being usually explored at the aggregate or sectoral level (Herrendorf et al., 2014), while risk and insurance being usually explored at the household or village level (Karlan and Morduch, 2010). As per our findings on the two decades of successful Chinese economic growth, we believe that shifting the current macro paradigm to unified frameworks that jointly determine growth, risk and insurance can be an important avenue for the positive and normative analysis of growth and development.

[19] In our longer working paper version (Santaeulàlia-Llopis and Zheng, 2016), we show that households with high investments in housing and in children's education have less consumption insurance than their low investment counterparts. This suggests that in a country like China where the financial market is underdeveloped and households have limited options for storing wealth, a high savings rate is not necessarily the result of precautionary savings. To the extent that the alternative investments (in housing or children) entail transaction costs when cashing out and feature a high rate of return in growing China, households may behave as hand-to-mouth households that bear the loss of consumption insurance in exchange for higher future levels of consumption (Kaplan et al., 2014). However, absent of a model, in particular one in which wealth portfolios are optimally chosen, these empirical results and their interpretation remain simply tentative and open for future research.

[20] For example, the observed high insurance may be precisely caused by adopting low-risk low-return technologies that inhibit income growth (Morduch, 1995).

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Table 1: Sample Characteristics: A Cross-Sectional Snapshot, CHNS 1989 and 2009

	1989			2009		
	Total	Rural	Urban	Total	Rural	Urban
Age	41.6	40.2	44.5	48.4	48.0	49.0
Gender of Head (%)						
Male	83.6	87.9	75.1	86.2	89.1	80.3
Female	16.4	12.1	24.9	13.8	10.9	19.7
Education of Head (%)						
No schooling	13.0	13.1	12.9	2.5	3.2	1.2
1-9th grade	63.0	69.7	49.9	63.8	73.7	43.7
Above 9th grade	24.0	17.2	37.3	33.6	23.1	55.1
Household Structure						
Household size	4.00	4.07	3.86	3.84	4.03	3.46
Weak DR	0.48	0.55	0.35	0.13	0.15	0.11
Strong DR	0.65	0.68	0.57	0.31	0.30	0.31
Province (%)						
Liaoning	13.9	13.8	13.9	12.4	13.6	9.9
Heilongjiang	0.0	0.0	0.0	12.6	12.5	12.8
Jiangsu	12.1	12.5	11.3	11.7	12.2	10.9
Shandong	12.2	12.5	11.6	10.7	11.1	10.1
Henan	12.2	11.9	13.0	10.7	10.3	11.5
Hubei	12.5	12.5	12.4	10.3	10.0	11.0
Hunan	13.3	13.2	13.6	10.8	10.1	12.2
Guangxi	11.7	11.7	11.6	10.6	10.8	10.4
Guizhou	12.1	11.9	12.5	10.0	9.4	11.3
No. of Observations	3,090	2,049	1,041	3,111	2,089	1,022

Notes: This table shows the summary statistics of the household head's demographic and education characteristics as well as the household structure in the level-trimmed CHNS sample of all households who satisfy the sample selection criteria (see Section 3).

Table 2: Income Partition by Rural and Urban Residency, China CHNS 1989 and 2009: Real 2009 USD

(a) Rural, 1989

	Bottom (%)			Quintiles					Top (%)			All
	0-1	1-5	5-10	1st	2nd	3rd	4th	5th	10-5	5-1	1	0-100
						Averages, US$						
Consumption	414	383	371	379	401	426	432	493	475	537	527	426
Earnings	-10	37	71	81	206	341	503	885	871	1,196	1,709	403
Disp. Income	-7	40	82	94	228	378	577	1,039	1,019	1,406	2,002	463
						Shares of Total (%)						
Consumption	0.9	3.6	4.3	17.8	19.0	19.7	20.2	23.3	5.7	5.1	1.2	100
Earnings	-0.0	0.4	0.9	4.0	10.3	17.0	25.0	43.7	10.9	11.9	3.6	100
Disp. Income	-0.0	0.3	0.9	4.1	9.9	16.3	24.9	44.8	11.0	12.2	4.1	100

(b) Urban, 1989

	Bottom (%)			Quintiles					Top (%)			All
	0-1	1-5	5-10	1st	2nd	3rd	4th	5th	10-5	5-1	1	0-100
						Averages, US$						
Consumption	433	384	382	396	420	471	504	532	529	464	567	465
Earnings	98	113	172	188	308	375	479	816	775	1,126	1,803	442
Disp. Income	71	151	236	252	451	578	745	1,187	1,185	1,502	2,263	642
						Shares of Total (%)						
Consumption	1.1	3.4	3.7	16.8	18.0	20.3	21.8	23.0	5.9	3.8	1.1	100
Earnings	0.0	0.8	1.6	7.2	14.4	17.8	22.6	38.1	9.0	10.4	4.3	100
Disp. Income	0.1	0.9	1.8	7.9	14.1	18.0	23.2	36.8	9.1	9.3	3.5	100

(c) Rural, 2009

	Bottom (%)			Quintiles					Top (%)			All
	0-1	1-5	5-10	1st	2nd	3rd	4th	5th	10-5	5-1	1	0-100
						Averages, US$						
Consumption	651	473	416	480	580	674	774	918	892	1,042	1,090	686
Earnings	14	46	98	157	448	835	1,399	3,012	2,939	4,144	7,404	1,215
Disp. Income	14	51	119	160	488	884	1,503	3,353	3,238	4,700	8,287	1,277
						Shares of Total (%)						
Consumption	0.9	2.6	2.8	13.5	17.1	20.0	22.8	26.7	6.4	5.7	1.6	100
Earnings	0.0	0.1	0.3	2.2	7.5	14.5	24.1	51.7	13.1	13.7	6.0	100
Disp. Income	0.0	0.2	0.5	2.5	7.6	13.8	23.5	52.5	12.7	14.8	6.4	100

(d) Urban, 2009

	Bottom (%)			Quintiles					Top (%)			All
	0-1	1-5	5-10	1st	2nd	3rd	4th	5th	10-5	5-1	1	0-100
						Averages, US$						
Consumption	438	498	518	517	699	759	808	894	837	1,058	810	737
Earnings	36	149	263	390	874	1,394	2,024	3,693	3,739	4,846	9,916	1,747
Disp. Income	33	137	312	399	980	1,617	2,421	4,763	4,640	6,591	11,827	2,034
						Shares of Total (%)						
Consumption	0.6	2.6	3.4	13.6	19.2	21.1	21.7	24.4	5.5	5.7	1.1	100
Earnings	0.0	0.2	0.6	3.4	10.3	16.8	26.2	43.3	10.6	9.4	4.4	100
Disp. Income	0.0	0.3	0.8	3.9	9.7	15.9	23.9	46.7	11.3	13.1	5.4	100

Notes: This table shows how the adult-equivalent household consumption, earnings and disposable income are distributed over the distribution of the adult-equivalent household disposable income, for the waves 1989 and 2009 and for the rural and urban sample separately. All monetary values are in real 2009 USD. For a discussion, see Section 4.

Table 3: Minimum Distance Variance Estimates: Various Income Measures

	Disposable Income		Earnings + Public Transf.		Earnings + Private Transf.		Earnings Only	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Permanent shocks $\sigma^2_{\zeta_t}$								
1992-3	0.099	0.035	0.104	0.035	0.132	0.060	0.119	0.037
	(0.016)	(0.013)	(0.019)	(0.016)	(0.018)	(0.018)	(0.017)	(0.014)
1994-7	0.065	0.058	0.062	0.066	0.071	0.077	0.068	0.045
	(0.014)	(0.021)	(0.013)	(0.020)	(0.015)	(0.030)	(0.013)	(0.013)
1998-2000	0.082	0.035	0.070	0.044	0.092	0.026	0.077	0.032
	(0.020)	(0.023)	(0.015)	(0.029)	(0.021)	(0.027)	(0.017)	(0.017)
2001-4	0.105	0.047	0.094	0.086	0.108	0.149	0.092	0.045
	(0.015)	(0.017)	(0.016)	(0.029)	(0.015)	(0.032)	(0.013)	(0.014)
2005-6	0.132	0.103	0.117	0.058	0.155	0.239	0.092	0.078
	(0.020)	(0.030)	(0.024)	(0.024)	(0.022)	(0.043)	(0.019)	(0.028)
Transitory shocks $\sigma^2_{\varepsilon_t}$								
1991	0.295	0.122	0.283	0.133	0.292	0.142	0.291	0.146
	(0.024)	(0.019)	(0.025)	(0.020)	(0.025)	(0.027)	(0.022)	(0.024)
1993	0.397	0.248	0.385	0.237	0.353	0.183	0.354	0.172
	(0.039)	(0.038)	(0.031)	(0.041)	(0.038)	(0.043)	(0.037)	(0.033)
1997	0.478	0.296	0.448	0.259	0.490	0.372	0.467	0.172
	(0.050)	(0.082)	(0.046)	(0.075)	(0.047)	(0.103)	(0.046)	(0.046)
2000	0.476	0.357	0.466	0.401	0.478	0.389	0.401	0.245
	(0.049)	(0.066)	(0.037)	(0.067)	(0.045)	(0.066)	(0.047)	(0.046)
2004	0.499	0.304	0.418	0.323	0.460	0.272	0.423	0.289
	(0.035)	(0.047)	(0.043)	(0.051)	(0.035)	(0.078)	(0.039)	(0.032)
2006	0.393	0.202	0.390	0.249	0.386	0.224	0.383	0.165
	(0.029)	(0.041)	(0.031)	(0.041)	(0.029)	(0.062)	(0.035)	(0.040)
Observations	16,550	7,760	16,520	7,749	16,543	7,749	16,501	7,710

Notes: This table shows the estimation results of the income process for different measures of adult-equivalent household income. The estimation is done for the rural and urban sample separately. The variances of shocks respond to the annual model of the income process. We maintain the assumption that the permanent and transitory shocks within the time period between two consecutive surveys are the same (Figure 5). The standard errors are computed based on 50 bootstrap replicas. For details of the estimation procedure, see Appendix E. For a discussion of the estimation results, see Sections 5.2 and 5.3.

Table 4: Minimum Distance Partial Insurance Estimates: Various Income Measrues

	Disposable Income		Earnings + Public Transf.		Earnings + Private Transf.		Earnings Only	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Transmission parameters								
$\psi_{\zeta,pre97}$	0.104	0.049	0.107	0.098	0.073	0.078	0.080	0.174
	(0.050)	(0.118)	(0.057)	(0.100)	(0.040)	(0.098)	(0.040)	(0.145)
$\psi_{\zeta,post97}$	0.280	0.244	0.286	0.145	0.273	0.074	0.291	0.138
	(0.040)	(0.091)	(0.056)	(0.097)	(0.037)	(0.038)	(0.083)	(0.099)
$\psi_{\varepsilon,pre97}$	0.000	0.176	0.000	0.152	0.000	0.086	0.000	0.080
	(0.010)	(0.060)	(0.012)	(0.063)	(0.012)	(0.058)	(0.016)	(0.074)
$\psi_{\varepsilon,post97}$	0.023	0.062	0.043	0.065	0.004	0.095	0.036	0.147
	(0.028)	(0.050)	(0.035)	(0.047)	(0.024)	(0.048)	(0.036)	(0.053)
Taste shock, σ^2_ξ								
	0.017	0.016	0.017	0.018	0.018	0.019	0.018	0.018
	(0.003)	(0.006)	(0.003)	(0.005)	(0.003)	(0.005)	(0.003)	(0.004)
Measurement error in consumption, $\sigma^2_{u^c}$								
1991	0.116	0.125	0.116	0.124	0.117	0.125	0.116	0.126
	(0.006)	(0.010)	(0.005)	(0.011)	(0.006)	(0.009)	(0.006)	(0.009)
1993	0.120	0.086	0.120	0.088	0.120	0.092	0.120	0.094
	(0.009)	(0.015)	(0.011)	(0.012)	(0.009)	(0.015)	(0.011)	(0.015)
1997	0.160	0.149	0.160	0.150	0.160	0.150	0.160	0.153
	(0.014)	(0.022)	(0.015)	(0.027)	(0.014)	(0.021)	(0.013)	(0.018)
2000	0.200	0.151	0.200	0.148	0.200	0.145	0.199	0.140
	(0.015)	(0.018)	(0.015)	(0.024)	(0.014)	(0.017)	(0.016)	(0.024)
2004	0.174	0.159	0.174	0.159	0.174	0.158	0.174	0.157
	(0.013)	(0.019)	(0.012)	(0.017)	(0.013)	(0.017)	(0.014)	(0.013)
2006	0.173	0.144	0.173	0.147	0.171	0.144	0.175	0.145
	(0.009)	(0.012)	(0.011)	(0.015)	(0.009)	(0.016)	(0.010)	(0.015)
Observations	16,550	7,760	16,520	7,749	1,6543	7,749	16,501	7,710

Notes: This table shows the estimation results of the transmission parameters, the taste shock and the measurement errors in consumption for different measures of adult-equivalent household income. The estimation is done for the rural and urban sample separately. We allow the transmission parameters to vary from the subperiod 1989-1997 to the subperiod 1998-2009. For details of the estimation procedure, see Appendix E. For a discussion of the estimation results, see Sections 5.2 and 5.3.

Table 5: Consumption Transmission Parameters, Alternative Consumption Measures, Urban CHNS

	Benchmark	Imputed Nondurable	Imputed Total
	Urban	Urban	Urban
Transmission parameters			
$\psi_{\zeta,pre97}$	0.049	0.064	0.054
	(0.118)	(0.127)	(0.135)
$\psi_{\zeta,post97}$	0.244	0.288	0.373
	(0.091)	(0.100)	(0.129)
$\psi_{\varepsilon,pre97}$	0.176	0.163	0.211
	(0.060)	(0.066)	(0.072)
$\psi_{\varepsilon,post97}$	0.062	0.064	0.073
	(0.050)	(0.055)	(0.069)
Taste shock, σ_ξ^2			
	0.016	0.031	0.044
	(0.006)	(0.006)	(0.010)
Observations	7,760	7,769	7,769

Notes: This table shows the estimation results of the transmission parameters and the taste shock for different measures of adult-equivalent household consumption. The first column repeats the benchmark results for the urban sample. The second the third columns presents the results when we impute total nondurable consumption and total consumption for the urban households surveyed in the CHNS. The standard errors are computed based on 50 bootstrap replicas. For details of the estimation procedure, see Appendix F.3. For a discussion of the estimation results, see Section 5.4.

Table 6: Welfare Effects of Growth, Risk and Insurance: Comparison Across Time

(a) 1989 - 1997

Welfare gain	Rural		Urban	
	$\eta = 2$	$\eta = 4$	$\eta = 2$	$\eta = 4$
Growth effect $\{\gamma^{post}, \sigma^{pre}, \psi^{pre}\}$	3.53%	3.53%	8.27%	8.27%
Risk effect $\{\gamma^{post}, \sigma^{post}, \psi^{pre}\}$	-0.07% [-0.43 0.01]	-0.24% [-1.43 0.03]	-0.38% [-2.36 0.11]	-1.27% [-7.86 0.37]
Insurance effect $\{\gamma^{post}, \sigma^{post}, \psi^{post}\}$	-1.89% [-3.18 -0.99]	-6.22% [-10.16 -3.30]	0.90% [-1.07 5.04]	3.07% [-3.40 18.20]
Total effect	1.50% [0.25 2.27]	-3.13% [-6.96 -0.62]	8.83% [6.89 10.75]	10.17% [3.74 16.71]

(b) 1998 - 2009

Welfare gain	Rural		Urban	
	$\eta = 2$	$\eta = 4$	$\eta = 2$	$\eta = 4$
Growth effect $\{\gamma^{pre}, \sigma^{post}, \psi^{post}\}$	-4.58%	-4.58%	-10.21%	-10.21%
Risk effect $\{\gamma^{pre}, \sigma^{pre}, \psi^{post}\}$	0.69% [-0.16 1.15]	2.46% [-0.60 4.14]	0.48% [-0.23 1.08]	1.66% [-0.79 4.07]
Insurance effect $\{\gamma^{pre}, \sigma^{pre}, \psi^{pre}\}$	1.90% [1.00 3.70]	6.74% [3.49 13.34]	-1.14% [-3.26 0.92]	-3.91% [-10.74 3.40]
Total effect	-2.10% [-3.05 -0.53]	4.36% [0.80 10.11]	-10.81% [-12.80 -8.71]	-12.29% [-18.81 -4.91]

Notes: This table shows the effects on welfare, in annual consumption variations, from counterfactuals where we replace the income growth rate, the income risks, and the transmission parameters in one subperiod by the corresponding ones in the other subperiod. The welfare effects are reported for a constant relative risk aversion coefficient of 2 and 4. In panel (a), the 1989-1997 environment is taken as the baseline, to which we successively replace the income growth, the income risks, and the transmission parameters by their 1998-2009 counterparts, to give the growth effect, the risk effect and the insurance effect. In panel (b), the 1998-2009 environment is taken as the baseline, to which we successively replace the income growth, the income risks, and the transmission parameters by their 1989-1997 counterparts. The 95% confidence intervals are computed based on 50 bootstrap replicas. For details of the welfare decomposition methodology, see Section 6.1. For a discussion of the results, see Section 6.2.

Table 7: Welfare Effects of Growth, Risk and Insurance: Comparison Across Space

(a) 1989 - 1997

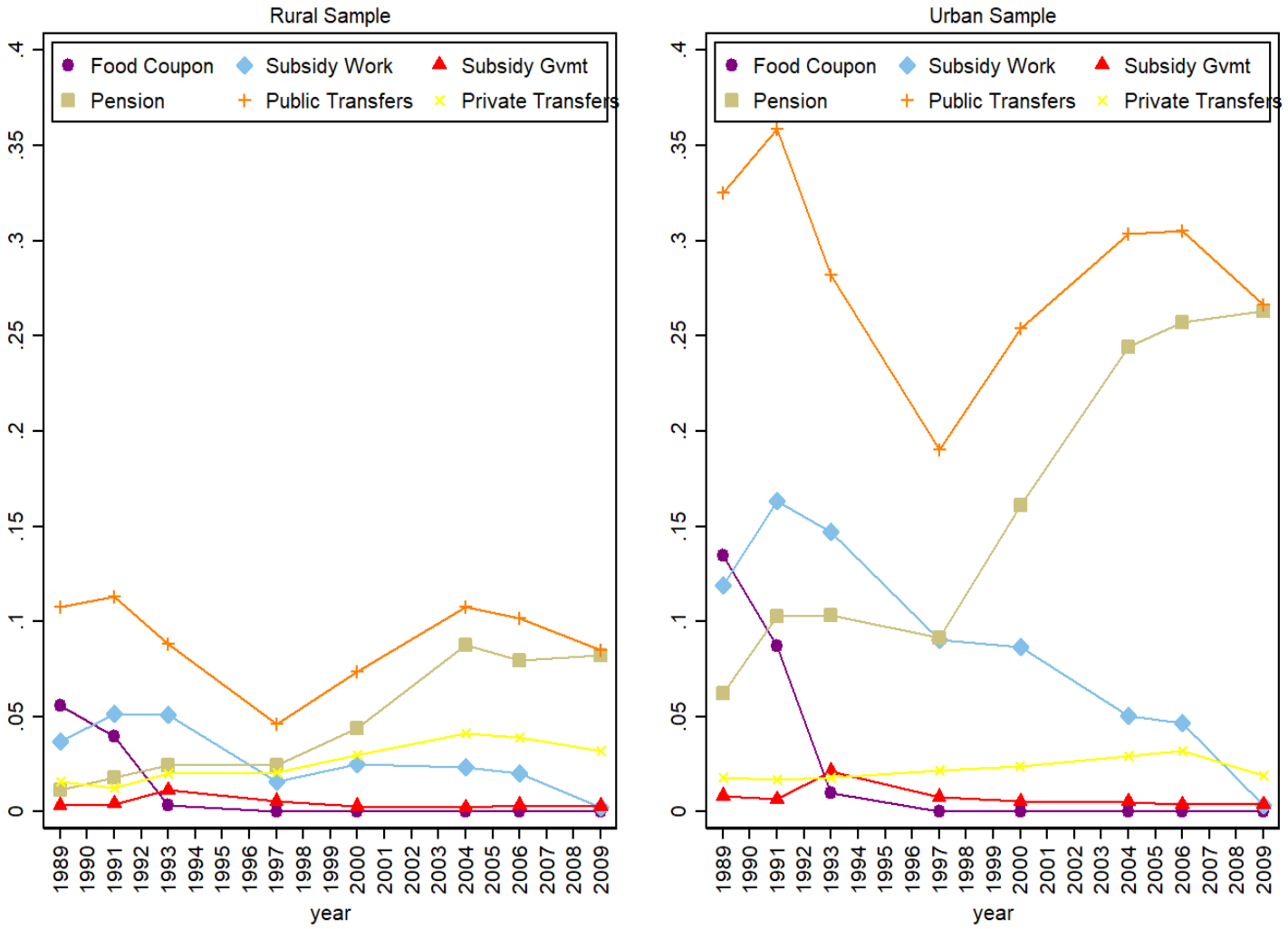
Welfare gain	$\eta = 2$	$\eta = 4$
Growth effect $\{\gamma^{urban}, \sigma^{rural}, \psi^{rural}\}$	2.42%	2.42%
Risk effect $\{\gamma^{urban}, \sigma^{urban}, \psi^{rural}\}$	0.10% [0.00 0.26]	0.31% [0.00 0.85]
Insurance effect $\{\gamma^{urban}, \sigma^{urban}, \psi^{urban}\}$	-1.88% [-3.54 -0.40]	-6.12% [-11.45 -1.31]
Total effect	0.59% [-1.11 2.09]	-3.55% [-9.06 1.36]

(b) 1998 - 2009

Welfare gain	$\eta = 2$	$\eta = 4$
Growth effect $\{\gamma^{urban}, \sigma^{rural}, \psi^{rural}\}$	9.75%	9.75%
Risk effect $\{\gamma^{urban}, \sigma^{urban}, \psi^{rural}\}$	1.14% [0.49 2.04]	4.08% [1.73 7.31]
Insurance effect $\{\gamma^{urban}, \sigma^{urban}, \psi^{urban}\}$	-0.06% [-2.05 1.62]	-0.17% [-7.01 5.79]
Total effect	10.93% [8.97 12.67]	14.00% [7.05 20.35]

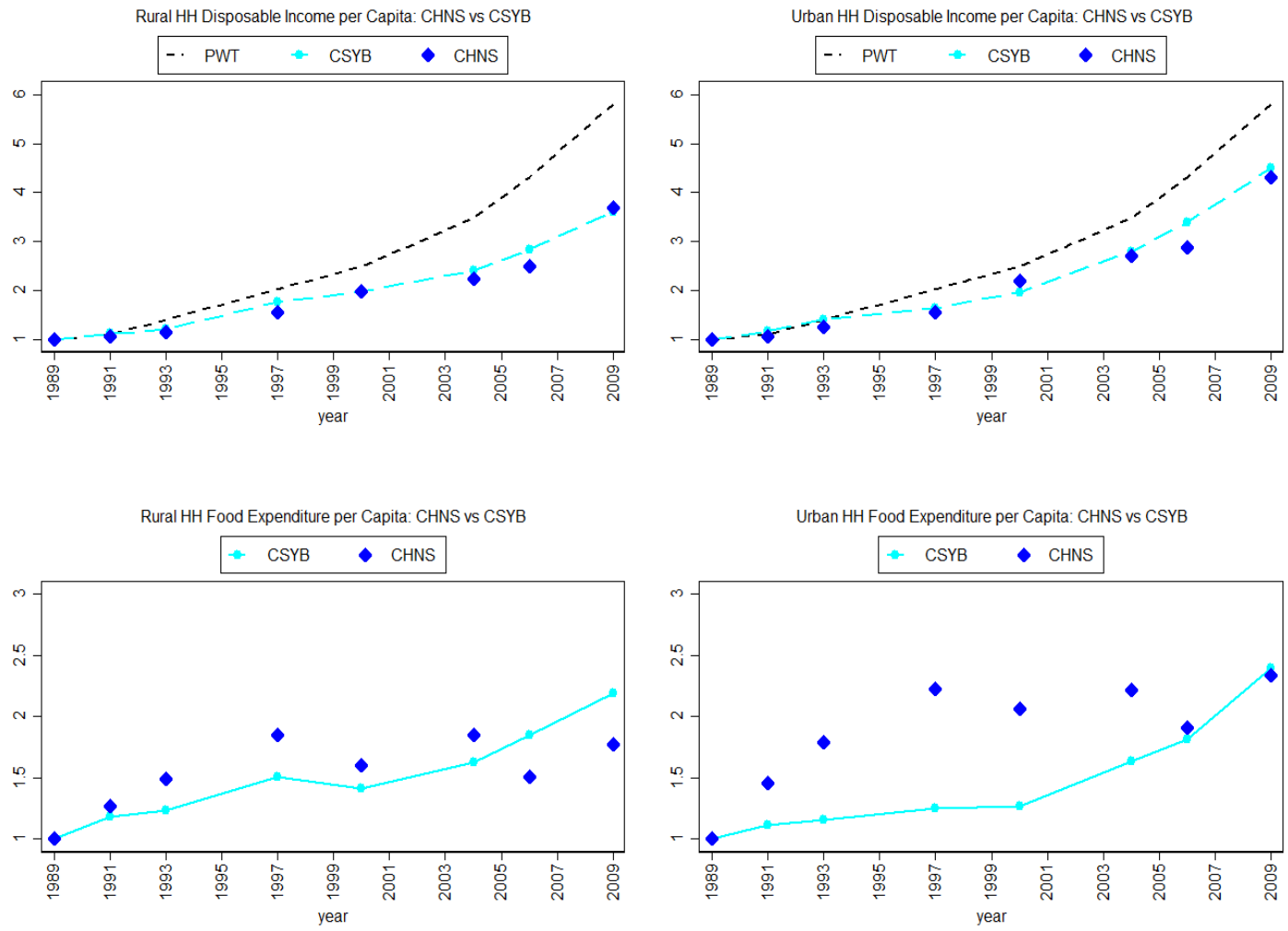
Notes: This table shows the effects on welfare, in annual consumption variations, from counterfactuals where we replace the income growth rate, the income risks, and the transmission parameters from the rural sample by the corresponding ones from the urban sample. The welfare effects are reported for a constant relative risk aversion coefficient of 2 and 4. In panel (a), we compute the wefare effects for the 1989-1997 subperiod, and in panel (b), we compute the welfare effects for the 1998-2009 subperiod. The 95% confidence intervals are computed based on 50 bootstrap replicas. For details of the welfare decomposition methodology, see Section 6.1. For a discussion of the results, see Section 6.3.

Figure 1: Public and Private Transfers (% of Income), CHNS, China 1989-2009



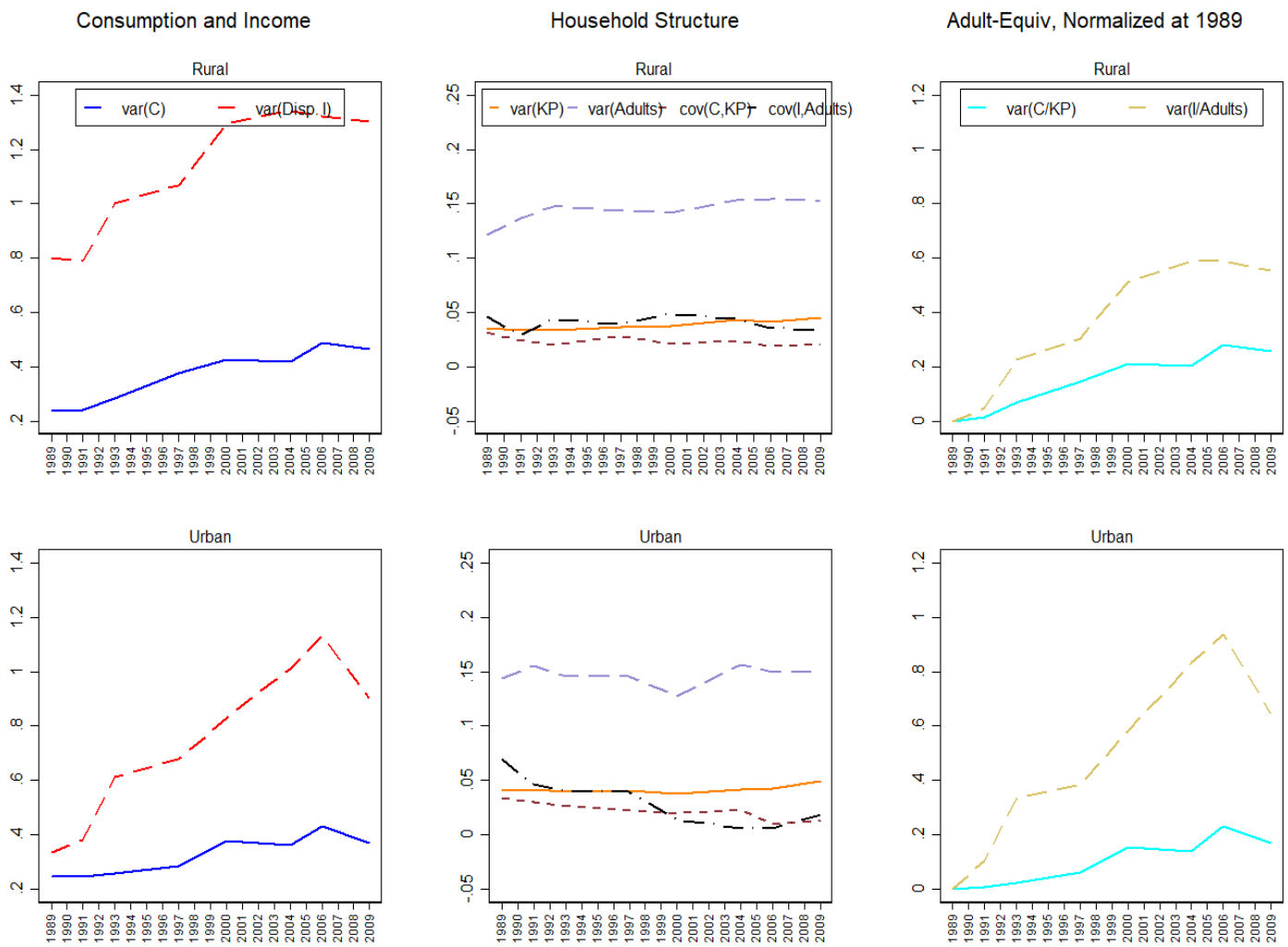
Notes: In this figure, we plot the evolution of the share of the aggregate transfers in the aggregate income by types of transfers, for the rural and urban CHNS sample separately. The public transfers are the sum of the food coupon, the subsidy from work, the subsidy from government and the pension. For the construction of the measures of transfers, see Section 3 and Appendix A.3. For a discussion of the transfers system in China, see Section 2. For a discussion of the role transfers play in consumption insurance in China, see Section 5.3.

Figure 2: Real Household Net Income and Food Expenditure Per Capita, CHNS and CSYB, China 1989-2009



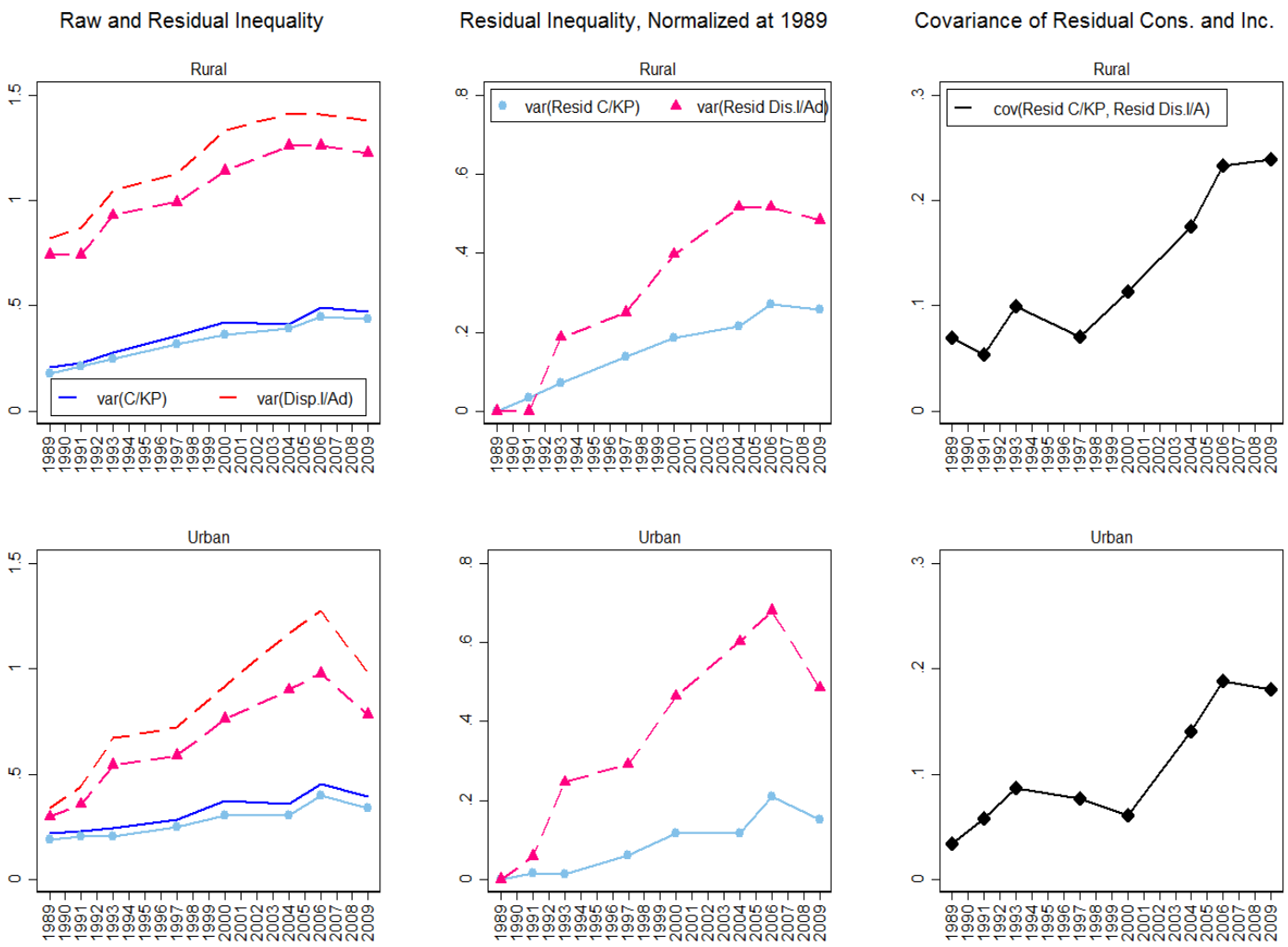
Notes: In this figure, we compare the real household net income per capita and the real household food expenditure per capita constructed from the CHNS sample to those reported in the China Statistical Yearbooks (CSYBs). We normalize the values in 1989 to 1. In the top two panels, we also plot the real GDP per capita from the Penn World Table (PWT). The construction of the statistics conform to the definitions given by the China Statistical Bureau. We construct the household net income from the CHNS by deducting from our benchmark household disposable income the value of in-kind transfers. We construct the food expenditure from the CHNS by deducting from the value of diet the value of food coupons and food gifts. The rural and urban household net income per capita and food expenditure per capita from the CYSBs are averages of the provincial statistics. For a discussion of the data construction, see Section 3. For a discussion of the facts, see Section 4.

Figure 3: Adult-Equivalent Consumption and Income Inequality, Variance of Logs, CHNS, China 1989-2009



Notes: In this figure, we plot the inequality of benchmark income and consumption, before and after adjusting for household composition. The adult-equivalent household income is obtained by dividing the benchmark income by the number of working age adults. The adult-equivalent household consumption is obtained by dividing the benchmark consumption by the equivalence scales advocated by Krueger and Perri (2006). The left column shows the evolution of the variance of logged household consumption and income from 1989 to 2009. The middle column shows the evolution of the variance of the adult-equivalence scale and the number of working age adults, the covariance of the former with consumption and the covariance of the latter with income. The right column shows the evolution of the variances of adult-equivalent household consumption and income, with the 1989 values being normalized to 0. For a discussion of the facts, see Section 4.

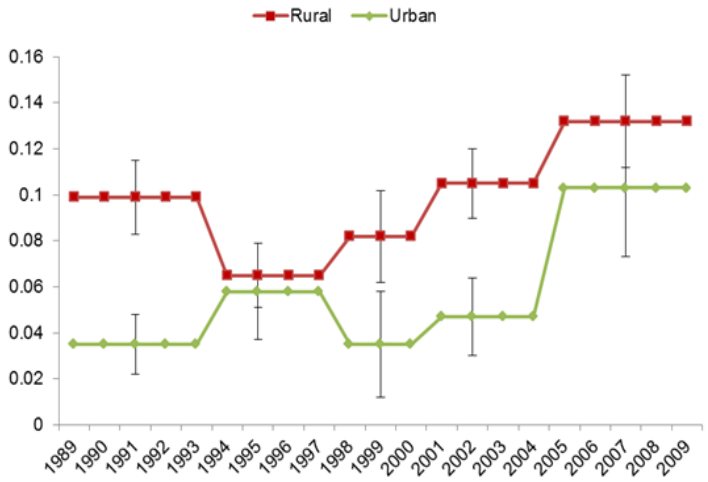
Figure 4: Residual Consumption and Income Inequality, Variance of Logs, CHNS, China 1989-2009



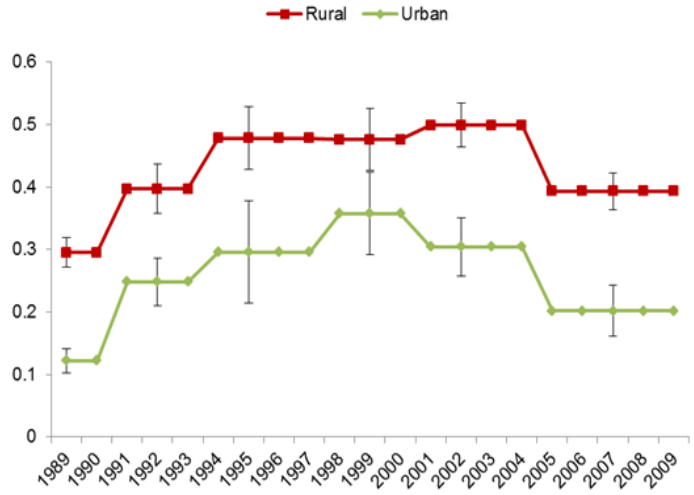
Notes: In this figure, we plot the evolution of the adult-equivalent household consumption and income inequalities as well as the evolution of the residual adult-equivalent household consumption and income inequalities. The left column shows the evolution of the raw and residual inequalities of the adult-equivalent consumption and income. The middle column shows the evolution of the residual inequality of consumption and income, with the 1989 values being normalized to 0. The right column shows the evolution of the covariance of residual adult-equivalent consumption and income. For a discussion on the facts, see Section 4.

Figure 5: Estimates of Annualized Variances of Permanent and Transitory Shocks with Standard Errors, CHNS 1989-2009

(a) Permanent Income Shocks



(b) Transitory Income Shocks



Notes: In this figure, we plot the evolution of the estimates of the income shocks from the benchmark partial insurance model. The error bands indicate the standard errors of the estimates, which are computed based on 50 bootstrap replicas. The step-function-like feature of the graphs reflect the identifying assumption that the permanent and transitory shocks within the time period between two consecutive surveys are the same. Recall the survey dates are 1989, 1991, 1993, 1997, 2000, 2004, 2006 and 2009. In addition, to ensure stability, the permanent shocks are constrained to remain the same from 1989 to 1993 and from 2005 to 2009 and the transitory shocks are constrained to remain the same from 2005 to 2009. For details of the estimation procedure, see Appendix E. For a discussion of the estimation results, see Sections 5.2.