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

Raül Santaeulàlia-Llopis
MOVE-UAB and Barcelona GSE

Yu Zheng
City University of Hong Kong

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Abstract

We exploit a novel and unique opportunity to document the transmission of income risk to consumption in a growing economy. Our laboratory is China, an economy that has witnessed enormous and sustained growth. We build a long panel of household-level consumption and income data. 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 results 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). Deng Xiaoping's reform and opening up policies recognized private ownership, introduced market forces, and created economic opportunities for billions of Chinese citizens. Following Deng's notion of "letting some get rich first," those who seized the opportunities brought by the reforms got rich fast, whereas others were left behind, producing a widening gap between the haves and have nots. Although the rising level of 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 evolve along the growth process. This study attempts to fill this gap. We exploit a novel and unique opportunity to document the transmission of income risk (i.e., unanticipated changes in income) to consumption in China from 1989 to 2009, building a long panel of household consumption and income data 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 data that we construct from the CHNS. First, within the rural or urban sample, the cross-sectional income and consumption inequality in China largely reflect the residual (within-group) inequality. Second, the decomposition of 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 the phasing out of 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.

Although they display common general trends in income growth, permanent income risk, and the transmission of income risk to consumption, the rural and urban areas of China differ in important dimensions. Public transfers have played a more prominent role in urban than in rural areas. The nature of public transfers for urban households, however, changed dramatically during the 1990s. Up until the mid-1990s, 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 tended to covary positively with earnings. By 2000, public transfers in urban areas had largely evolved towards providing social insurance in the form of pensions, disability insurance, etc. This change means that including public transfers in the income measure understates the increase in income risk and overstates the increase in the transmission of risk to consumption. When we re-estimate the transmission parameters for the urban sample with an income measure that excludes public transfers, 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 data, 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), so our first contribution is to construct such a panel for China. Whereas household income is surveyed in great detail in the CHNS, we must employ a novel approach to construct a measure of household consumption. We build panel data on 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 of a household. We account for 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 nondurable and total consumption from the food consumption observations from the CHNS, following an imputation procedure proposed by Blundell et al. (2008).

Our study is related to previous work that documents the evolution of income inequality in China until the 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 recently, using the non-public Urban Household Survey, Ding and He (2016) give a detailed account of changes in income and consumption inequality for urban households from 1986 to 2009. This study differs from the aforementioned studies in three main ways. First, whereas most of the previous studies rely on cross-sectional data, our analysis is based on a long panel of household income and consumption data. This panel allows us to estimate the transmission parameters of income risk to consumption as well as their evolution along the economic growth process. To the best of our knowledge, our study is the first to document 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. Although the Urban Household Survey used 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, whereas most recent studies on inequality in China focus on 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 plays a different role in the evolution of consumption insurance in the two areas. Third, whereas most previous studies draw evidence from data sources that are not publicly accessible, our data are publicly available to any researchers.

A natural response upon learning 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 do not take into account the increasing income risk and declining consumption insurance. We provide a tentative welfare calculation based on the estimates of the income shocks and transmission parameters. Our results suggest that changes in both the risk and the transmission could impose significant welfare costs that cancel out or even reverse the welfare gain from growth. This result 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] Although this study does not identify the specific mechanisms that produce the observed deterioration in consumption insurance, it does point to the importance of accounting for this observation in any policy-relevant macro models for China.

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 distributions of consumption and income for rural and urban China. Section 5 concerns the estimation of income risk and its transmission to consumption. We first present the benchmark results for the rural and urban samples 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. The 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, the presence of risky income 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 U.S., 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.

2 Institutional Background

We begin by describing, in a highly parsimonious way, the institutional background of China's growth from 1989 to 2009. After a brief experimentation with economic liberalism in the 1980s, particularly 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 the urban areas, and from the non-state industrial sector to the state industrial sector. This process channeled public resources away from the township and village enterprises (TVEs), popular in the 1980s in the rural areas (Huang, 2008), towards the state-owned enterprises (SOEs) in the cities (Song et al., 2011). To concentrate effort in modernizing industries, the government strengthened the large SOEs in the state sector in cities by offering them cheap loans and tax breaks, and it privatized a large number of small and effectively bankrupt enterprises to reduce 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 laborers seeking off-farm work but bound to their rural origins 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? Agricultural output as a share of GDP fell from 40% in 1970 to 28% in 1900, and its employment share fell from 81% in 1970 to 60% in 1990 (Huang et al., 2005). This decrease means that off-farm work has been an important source of income for rural households since as early as 1989. In our sample, agricultural income accounts for less than 50% of total rural disposable income throughout the sample period (see Tables C-4 to C-11 in Appendix C.1). In addition to 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 might have faced even greater risk than an urban employer working for an SOE did, 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 local public goods, such as public education, health care, medical insurance, and infrastructure, was largely in the hands of 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 pilot programs of the new medical insurance scheme, social security, and pension scheme have been rolled out since the early 2000s, the scope and coverage of these pilot programs are too limited for us to observe any effect on the rural sample during the sample period.[2]

In contrast, urban households have always enjoyed some forms of public social insurance, although the composition of the social safety net changed during the period of investigation. Up until the mid-1990s, urban residents enjoyed relatively stable state employment in a "work unit." The work unit provided a whole spectrum of services to its employees, ranging from housing, maternal care, childcare, child education, and training to entertainment and health care. It distributed subsidies for food, commuting, heating (in winter seasons), and so on. The funding for the services and subsidies was partly from the work unit's revenue and partly from the government. Urban households faced relatively low income risk, 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 risk but also had to foot the bill for housing, childcare, education, and health services, which had previously been given to them at low cost. Meanwhile, the government started to build a social security system that included unemployment insurance, health insurance, disability insurance, and retirement pensions.

The changing institutions have impacted the household income structure, particularly in terms of the components of 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 did. 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 comprise 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), and pension income became the major

[2]The New Rural Cooperative Medical Scheme pilot program was rolled out in 2003 and achieved almost full coverage in rural China in 2010, although 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.

component of public transfers (i.e., the olive line in the urban sample).

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. Later, in our empirical analysis, we will distinguish two sub-periods, 1989-1997 and 1998-2009, which correspond to the periods 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 has tracked about 4,000 households in rural and urban areas of China since 1989. The survey is conducted in nine provinces that are at different stages of economic development and have 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 of which are in rural areas. In each PSU, around 20 households are 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 the consumption insurance of Chinese households, we construct a panel of household consumption and income data (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 in 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 with a precision that is suitable for nutrition studies and medical research (Batis 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).

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., 2012; Attanasio et al., 2014). With this 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 an annualized value of the core diets of the households. We further supplement the information about the core diet with data on the consumption of alcohol, tobacco, coffee, and tea, which are included 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 data on food, the CHNS also collects data on consumption items such as utilities, childcare, 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 services, and semidurable supplies, all of which are consistently surveyed in all waves. Admittedly, the benchmark consumption measure lies somewhere in between nondurable consumption and total consumption, as it excludes some components of nondurable consumption, such as clothing, transportation, and communication, but it includes some components of durable consumption, such as electronics, as part of semidurable supplies.[5] In all, compared to a typical consumption basket reported in the CSYBs, we find that our benchmark consumption measure 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 a measure of nondurable consumption and a measure of total consumption from the food consumption in the CHNS, using estimates from a food demand system estimated on another data source in which all consumption items are surveyed. This strategy is essentially that used by Blundell et al. (2008) to deal with the lack of complete

[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—we also price home-produced food—and do not distinguish between expenditure and consumption (e.g., nutrient intake), which differs from the methodology of 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 to using a consumption measure largely based on food. First, doing so helps to 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, we stack the cards against detecting any changes in consumption insurance in the sense that food is perhaps among the consumption items with the least income elasticity of demand, and it has lower inequality as compared with other consumption items (Aguiar and Hurst, 2013).

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 services, as in Krueger et al. (2017). The implementation of these two strategies is detailed in Appendices F.2 and F.3.

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. 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. Private transfers consist of cash and in-kind gifts from family and friends. The *benchmark income measure* is household disposable income, which is the sum of earnings, public transfers, and private transfers received.[6]

Monetary values, including all of the components of the 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 ages 25 to 65. This focus is to accommodate the fact that rural households, which are about 70% of our sample, do not have a well-defined retirement age. We further require the households to have at least two members and at most six members. This requirement takes into account that co-residence is widespread 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

[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 for non-retirement wage income. For a critique on the readily available household income aggregates, see Appendix A.2.1.

of all 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 is 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 by a man, especially 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 ninth 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 (below age 15) divided by the number of adults (above age 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 (below age 15 or above age 60) divided by the number of all working-age adults (between ages 15 and 60), also decreases from 0.65 to 0.31.

To control for changes in household composition, we divide the household aggregates 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., household members between ages 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 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 household disposable income, which includes earnings and public and private transfers (Section 3.2).

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

(Food) expenditure and income growth. As a first pass, we construct measures of disposable income and expenditure strictly on food from the CHNS according to the definitions adopted by the China Statistical Bureau, and we check if they are consistent with the official statistics.[8] In Figure 2, we plot the average household disposable income per capita and the 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 of 4.3 in urban areas, whereas household food expenditure grew by a factor of 1.8 in rural areas and of 2.3 in urban areas. The overall magnitude of the growth of income and food expenditure in our micro data aligns well with the official statistics, although our micro data seems to suggest a higher level of food expenditure in urban areas throughout the 1990s and early 2000s than the official statistics do. It is noteworthy that household income per capita grows more slowly than GDP per capita (indicated by the dashed line in the top panels) does, an observation also made by Khan and Riskin (1998) using China Household Income Project (CHIP) data. However, what matters to counteract the rising income risk, which we document next, is the growth in household income, not necessarily the growth in 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). Inequality is measured by the variance of logs. Whether or not we adjust for household composition, we find a noticeable increase in income inequality and a clear, albeit smaller, increase in consumption inequality. Before adjustment, 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 in consumption inequality is about one-third of that in income inequality in the rural sample and half of that in income inequality in the urban sample. After adjustment, the increase in income inequality is at least as evident, if not more so. Especially for the urban sample, the increase in adult-equivalent income inequality reaches 0.8 log points. Given that the variance in 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

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

(see the middle panel).

Both the levels of income and consumption inequality in China as well as their growth rates are higher than those obtained for the U.S. using Current Population Survey data. Overall, the increase in the variance in adult-equivalent income in China from 1989 to 2009 is about two times the increase in its counterpart in the U.S. from 1970 to 2005, and the increase in the variance in adult-equivalent consumption is about three times that of 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]

Going beyond a single statistic 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 focus on the bottom (top) 10% and present the averages for the bottom (top) 1%, 1-5%, and 5-10%. In addition to the averages, the shares of total consumption, earnings, 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, but the consumption distribution remained less positively skewed than the earnings and income distributions were 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 with log adult-equivalent consumption and income and remove from them the effects of household characteristics that are permanent or pre-determined before the head of the household starts to work, such as sex, age, education,

[9] In Appendix C.2, we report other inequality measures for our sample, such as the Gini index, the mean-to-median ratio, and the 90/10 ratio, among others (Table C-12). We find that the Gini index of 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 the findings of Khan and Riskin (1998) and Li et al. (2013) from the 1988 and 1995 CHIP surveys and those of Li et al. (2013) from the 2002 and 2009 CHIP surveys. We find that the Gini index of adult-equivalent consumption rose from 0.25 to 0.35 in rural areas, whereas that of its urban counterpart rose from 0.27 to 0.30 over the sample period. These numbers are in line with the Gini indexes of consumption measured by the CHIP dataset reported by Liu and Li (2011). On average, consumption inequality according to the Gini index is about two thirds of that of income inequality. In contrast to these findings, Cai et al. (2010) report consumption inequality that is similar or even somewhat higher than income inequality using the Urban Household Income and Expenditure Survey. This result is due to the fact that their consumption measure includes durables, such as cars. Ding and He (2016) verify, using the same data source, that although 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 consumption, income, and transfers down into sub-components and document how these sub-components vary over the distribution of disposable income.

province of residence, and minority status, by wave and by urban/rural areas. We report the variances of the residual adult-equivalent consumption and income inequalities in Figure 4. Three main findings stand out from our analysis.

First, within both rural and urban areas, residual inequality accounts for roughly 90% of overall inequality (see the left column in Figure 4). In comparison, Krueger and Perri (2006) decompose the rise in consumption inequality in the U.S. 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 did from 1989 to 2009. To see this, we normalize the residual inequalities in 1989 to zero (see the middle column in Figure 4). Over time, residual income inequality rose by 0.5 log points in rural areas and 0.6 log points in urban areas, whereas residual consumption inequality rose by 0.25 log points in rural areas and 0.2 log points in urban areas. The fact that residual income inequality kept rising indicates that both rural and urban households might have been facing substantial permanent income shocks throughout the 20 year period. The fact that 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 but not all of the income shocks.

Third, the covariance of residual consumption and income more than tripled over the span of 20 years (see the right column in Figure 4). Although 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 its 1997 level in both rural and urban areas. In comparison, we show using PSID data that the covariance between 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 their income growth, which our next quantitative exercise will confirm.

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 a 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 as in 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 we take the difference in the residuals. For each household, we use the history of (unexplained) income and consumption growth as inputs for the estimation.

The econometric model is annual and is 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 those to the transitory component, ε_t, are independent and identically 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 that BPP did for the U.S. if 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 distributions 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 in which 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 one, 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 error in con-

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

sumption $u_t^c \sim i.i.d.(0, \sigma^2_{u_t^c})$. 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 permanent and transitory income shocks, respectively. The higher the loading factor or the transmission is, the lower the insurance is. We let the variance of the income shocks and the partial insurance parameters vary over 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 sub-period, 1989-1997, to the second sub-period, 1998-2009. As discussed in Section 2, the two sub-periods represent drastically different economic environments. In the sub-period of 1989 to 1997, urban households still enjoyed relatively stable state employment and (diminishing) benefits, and rural households only saw the beginning of the local fiscal crisis. The sub-period of 1998 to 2009 captures the effects of the most important pro-market reforms, which fundamentally changed the economic lives of billions of Chinese citizens. Figure 4 further confirms that the relationship between income and consumption is likely to be very different across the two sub-periods. The variances of income shocks can vary fully with time to the extent possible: we assume that the variances of the permanent and transitory shocks remain the same for all of the years between two consecutive waves of the 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 we restrict 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 using the diagonally weighted minimum distance estimator, and the standard errors are based on 50 bootstrap samples.[12]

5.2 Benchmark Results

We estimate the partial insurance model using the household-level panel of the benchmark income and the benchmark consumption measures we constructed from the CHNS. The headline result is that consumption insurance, or the extent to which consumption can be insulated from income risk, declined in both rural and urban areas over the sample period, whereas income risk itself 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 income risk, we plot the point estimates of the variances of

[12]The details of the identification and estimation are in Appendix E.

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

In terms of insurance against permanent shocks, both rural and urban households experienced a worsening in insurance after 1997. The loading factor $\psi_{\zeta,t}$, which captures the percentage of permanent risk 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 result implies a roughly three-fold increase in the loading factor of permanent risk for rural households and a five-fold increase in that for urban households. As for insurance against 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, although insurance against permanent risk evolved similarly in rural and urban areas, rural areas were significantly more able to insure against transitory risk.

Focusing on consumption insurance against permanent risk, the negative relationship 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 displayed 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 throughout the sample period. Moreover, the nature of the public transfers changed over time. Public transfers in the early 1990s, 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 was food coupons or subsidies for daily supplies or service. As the role of the government evolved, public transfers increasingly played the role of social insurance, such as pensions and medical insurance, as well as welfare assistance (Section 2). As a result, the public transfers received by urban households became less and less positively correlated with earnings over time or were 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 risk in urban areas, the exclusion of public transfers significantly increased the growth in 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 risk implies lower growth in the transmission of shocks to consumption. In fact, without public transfers, the urban households faced very similar levels of transmission of permanent shocks in the two sub-periods of 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 understates the increase in income risk and overstates the increase in the transmission of risk to consumption.

Second, in terms of the transmission of transitory risk in urban areas, the finding of a high pass-through in the 1990s is puzzling, but it holds only for the two specifications in which the income measure includes public transfers (see the 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 were akin to in-kind transfers and, hence, could not 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. These rules essentially imposed a savings constraint for households entitled to large public transfers in the 1990s. As a result, consumption covaried 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 utility subsidies as well as a measure of income that includes earnings and cash public transfers (i.e., welfare assistance and pension income) only. 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, it captures a declining share of total consumption. To correct for this issue, 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, finally, apply the inverted demand function to the food consumption in our main dataset to infer the level of total expenditure. To do so, we utilize the urban samples of the 1988, 1995, 2002, and 2007 waves of the CHIP, which surveys the entire consumption basket.[13] Unfortunately, we have to focus on the urban sample, since some of the four waves of the CHIP for rural areas 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 food consumption to a measure of nondurable consumption in the CHIP in one specification and to a measure of total consumption in the CHIP in another specification. The nondurable consumption measure includes expenditures on food, clothing, transportation, communication, and others. The total consumption measure includes nondurable consumption as well as housing, household appliances, and 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 is very robust across specifications. With the imputed measures, the point estimates of the transmission parameters are higher than our benchmark estimates, 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 a household's 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 permanent shocks in the 1998-2009 sub-period is 0.373 for the imputed measures, compared to a lower 0.244 in the benchmark, although the confidence intervals around the point estimates overlap, and, hence, the difference is statistically insignificant. In Appendices F.1 and F.2, we report results from additional robustness analysis, where we consider subcategories of the benchmark consumption measure and 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

[13] To our knowledge, the 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.

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 against transitory shocks better than they can against permanent shocks, in particular if we remove in-kind transfers from the income measure. What sets our results apart from those of previous studies is that we show that the ability to insure against 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 sub-period, 1989 to 1997, the almost perfect insurance in rural and urban areas reflects the tight economic planning and rationing that directly manipulated households' consumption streams and that were still widespread in China at that time. However, to reach this conclusion, we need consumption data that is not just cash expenditures but that also includes in-kind transfers, and we need income data that is not just earnings but that 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 sub-period, 1998-2009, is higher than that in the first sub-period. This finding is the main result of our study. However, despite the deterioration in consumption insurance, the level of transmission in the second sub-period appears to be low relative to BPP's findings 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 permanent shocks. It is worth pointing out, however, that, after imputation, the 95% confidence interval of the permanent risk transmission that 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, although it is true that our point estimate for China is lower than that for the U.S., the estimates 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, which resembles our estimate with only food for post-reform urban China of 0.254 (see Appendix F). Thus, 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 are more similar to the U.S. level.

We interpret the transmission parameters 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 used in this analysis captures consumption insurance broadly, including 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 study, we acknowledge 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 social stratification becomes more tied to education and income indifferences can be more explained by observables as a result, then the "advance 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 a 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, although the transmission parameters can reflect a household's ability to insure income shocks, they can also be the outcome of an optimization problem in which the household chooses the amount of liquid assets to hold for consumption smoothing purposes and the amount of illiquid assets to hold for investment purposes. This notion 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 prices.[15] However, caution is in order, as all of these interpretations are suggestive and may operate at the same time.

6 Welfare Calculations

As Chinese households' incomes 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

[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 whether this economy 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) refer to equals one minus the transmission parameter for the estimate of permanent shocks in BPP (0.642). This result means that ABH economies are able to reproduce some, but not all, of the insurance captured in the data. Indeed, one can show in a 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).

[15] Whereas, in rural areas, housing wealth has always been an important component of household wealth, the 1994 urban housing reform that privatized state-owned housing and established private housing markets set in motion a rapid accumulation of housing wealth among urban households. Using the China Household Finance Survey, 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)).

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 the income risk, 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 be the discount factor and η be 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 consumption at time t.

Imagine an environment characterized by an income growth rate γ_y, income risk $\sigma = (\sigma_\zeta, \sigma_\varepsilon)$, and the transmission parameters $\psi = (\psi_\zeta, \psi_\varepsilon)$.[16] To tie the calculations to the econometric model, we let period-t consumption 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, we 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 $\ln c_0$.

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

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

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

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 $i=A,B$. We define the total effect on welfare in consumption equivalent variation, $1+\omega_T$, from moving from environment A to B for T periods as

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

We can decompose the total effect, $1+\omega_T$, into a growth effect, a risk effect, and an insurance effect. We 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 $(\gamma_B,\sigma_B,\psi_A)$. The insurance effect, $(1+\omega_I)$, is 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 result 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

[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 risk and the degree of transmission of this risk to consumption. When we assess the welfare change and its components across 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, do not address the issue of inequality.

comparisons, across time and across space.

6.2 Welfare Comparison Across Time

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

We first focus on the period from 1989 to 1997, which is before the major economic reforms took place. We start from the baseline scenario of a period of nine years, characterized by the income growth rate, the average variance of income shocks, and the transmission parameter in this sub-period. Then, we successively replace the income growth rate, the income shocks, and the transmission with their post-1997 counterparts. 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 perform this exercise for the rural and urban sample separately. The results are found in panel (a) of Table 6. For completeness, we also take 1998-2009 as the baseline and change the parameters in the same way to proxy the 1989-1997 environment. The findings 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 led to 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 this 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 level of risk aversion. The total welfare gain is significantly lower than the growth effect alone. In the case of a risk aversion of four, 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. Although the pass-through of permanent shocks increases from the 1990s to the 2000s, the pass-through of transitory shocks decreases. These two counteracting forces cancel each other out on balance, and the insurance effect is insignificantly different from zero. Therefore, the total welfare effect does not differ too much from the growth effect alone. The results when 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 1989-1997 and 1998-2009 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 the growth, risk, and insurance effect of a hypothetical move from a rural to an urban area. 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 was 4.43%, whereas that for the urban households was slightly higher at 4.96%. In contrast, from 1998 to 2009, rural household income growth accelerated to 5.2%, but its urban counterpart reached as high as 6.71%. This result implies a much larger growth effect in the 2000s of 9.75%, compared to that in the 1990s of 2.42%. Perhaps more interestingly, the rural households faced higher income risk than the urban households did throughout the sample period, and the difference widened over time. This result means that the gain from taking on urban risk was 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 transitory shocks in particular 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 was insignificant in the 1990s, but in the 2000s, an urban household enjoyed 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, 2017; 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 suggest 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 magnitudes of the different components of the welfare effect. If rural China from 1989 to 1997 were one country and rural China from 1998 to 2009 were another country, then inferring welfare differences between the two countries by comparing their growth rates would be misleading. Likewise, consider a rural household in 1989 that could choose to become a fully qualified urban

household for the next ten years. The decision would be straightforward if the household only compared the income growth rates in the two areas, but it would be much less clear if the household took into account risk and insurance.

In the context of China, we have shown that 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 points we want to make are that risk and insurance at the micro level could have an aggregate impact and that 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, Chinese households faced an increasing level of income risk, 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 of consumption insurance as the country transitioned from a planned economy to a market economy is understandable. Nevertheless, how Chinese households managed to achieve their level of consumption insurance 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 portion of household savings 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 other informal insurance arrangements were used? Alternatively, does the degree of transmission simply reflect a persistent consumption habit focused on satisfying basic needs? These are all speculations that

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

[19] In our longer working paper (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 do. This result 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 a 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 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.

motivate future research.

Although 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 China, but it leaves us to wonder whether this empirical trade-off is specific to China or belies more fundamental economic forces during a growth process. This question is an important topic for further research.[20] Moreover, our preliminary welfare calculations suggest that risk and insurance can have a first-order welfare impact that is comparable to that of growth, even in 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. Economic growth is usually explored at the aggregate or sectoral level (Herrendorf et al., 2014), whereas risk and insurance are 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.

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[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 that 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 1989 and 2009 waves 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 performed 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 Measures

	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 sub-period 1989-1997 to the sub-period 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 and third columns present the results when we impute total nondurable consumption and total consumption, respectively 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 in which we replace the income growth rate, the income risk, and the transmission parameters in one sub-period by the corresponding ones in the other sub-period. The welfare effects are reported for constant relative risk aversion coefficients of 2 and 4. In panel (a), the 1989-1997 environment is taken as the baseline, and we successively replace the income growth, the income risk, and the transmission parameters with their 1998-2009 counterparts to find the growth effect, the risk effect, and the insurance effect. In panel (b), the 1998-2009 environment is taken as the baseline, and we successively replace the income growth, the income risk, and the transmission parameters with 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

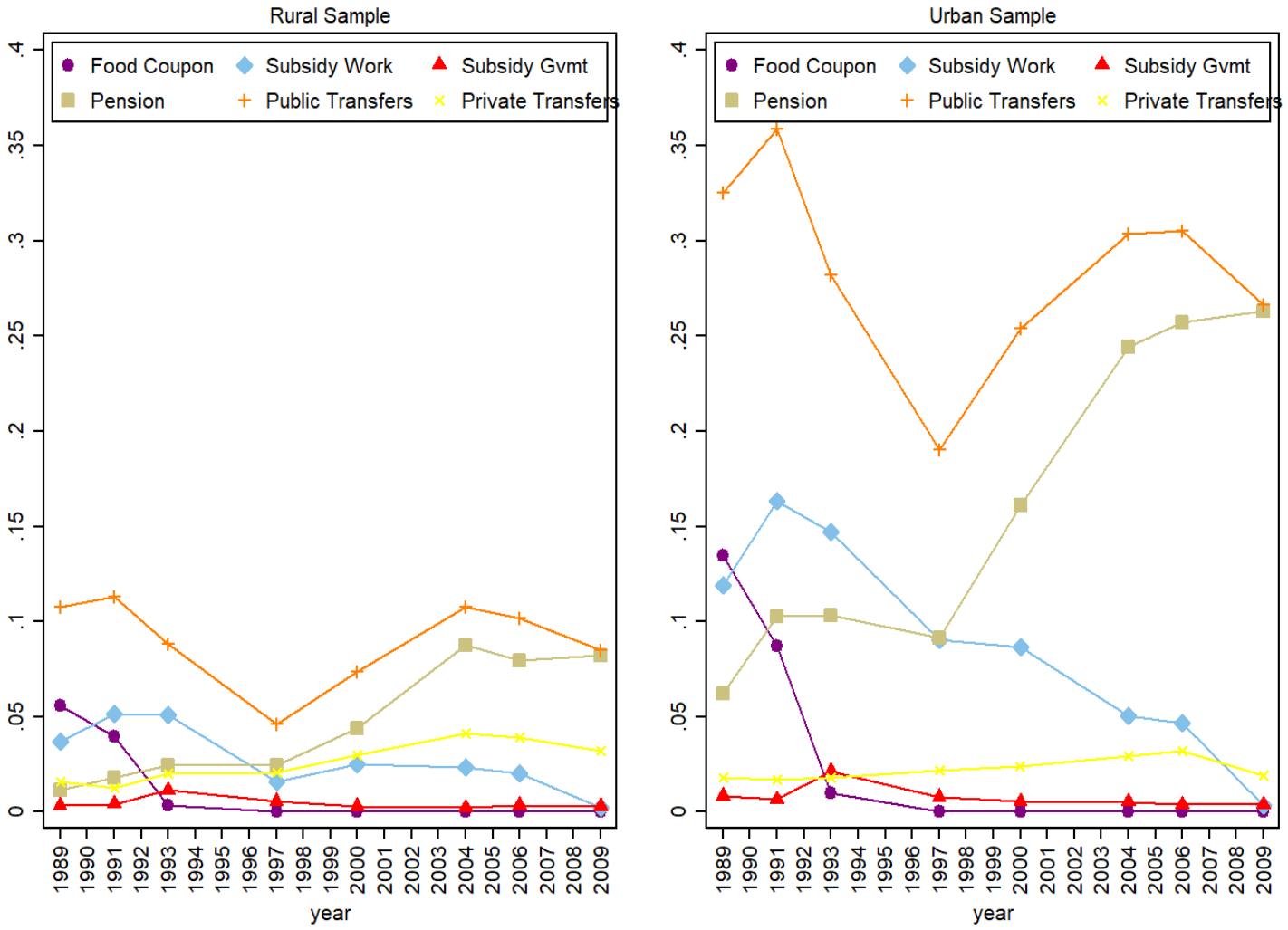
Welfare gain	$\eta = 2$	$\eta = 4$
Growth effect $\{\gamma^{urban}, \sigma^{rural}, \psi^{rural}\}$	2.42%	2.42%
Risk effect $\{\gamma^{urban}, \sigma^{urban}, \psi^{rural}\}$	0.10% [0.00 0.26]	0.31% [0.00 0.85]
Insurance effect $\{\gamma^{urban}, \sigma^{urban}, \psi^{urban}\}$	-1.88% [-3.54 -0.40]	-6.12% [-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]

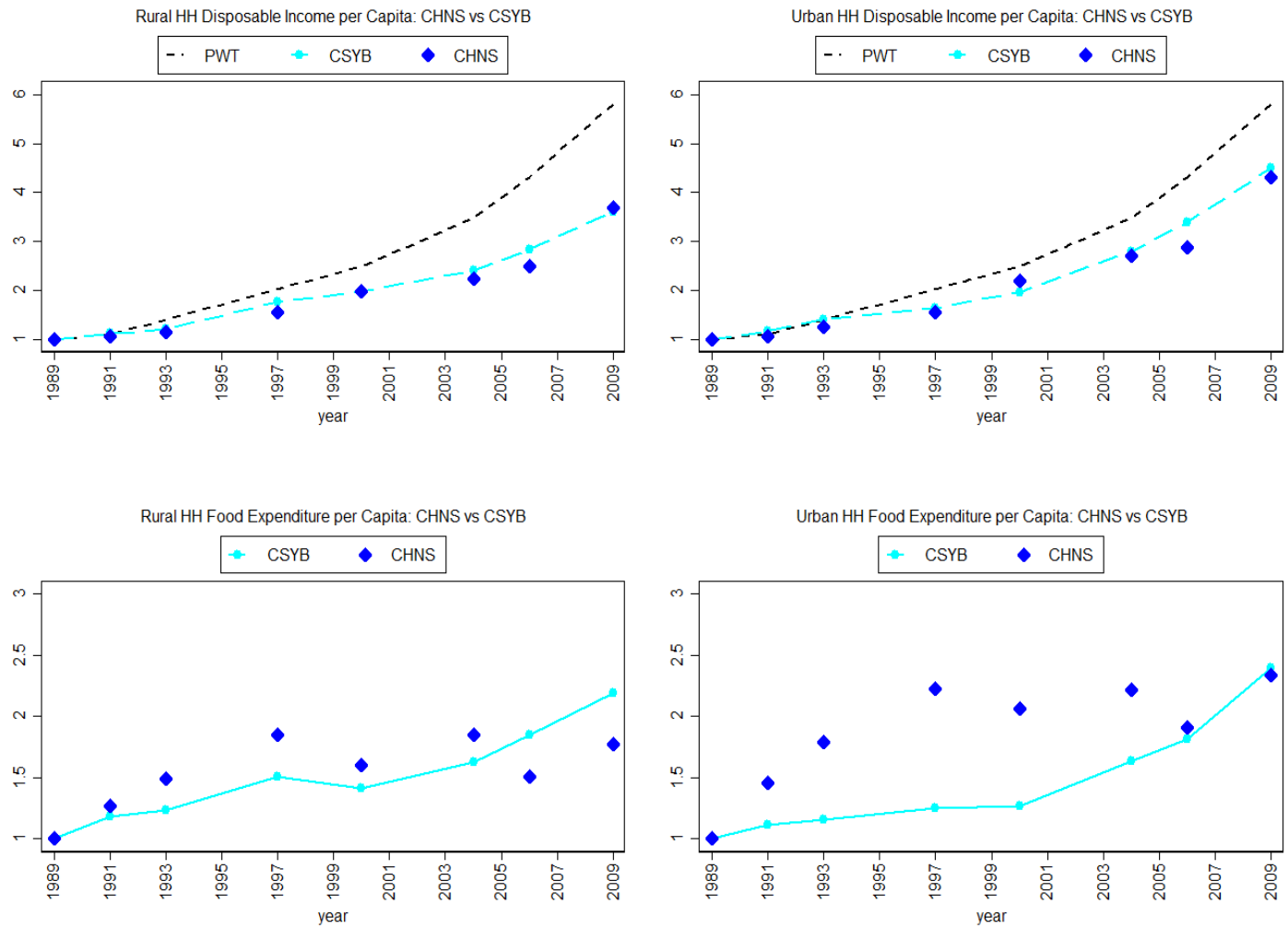
Notes: This table shows the effects on welfare, in annual consumption variations, from counterfactuals in which we replace the income growth rate, the income risk, and the transmission parameters from the rural sample with the corresponding parameters from the urban sample. The welfare effects are reported for constant relative risk aversion coefficients of 2 and 4. In panel (a), we compute the welfare effects for the 1989-1997 sub-period, and, in panel (b), we compute the welfare effects for the 1998-2009 sub-period. 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



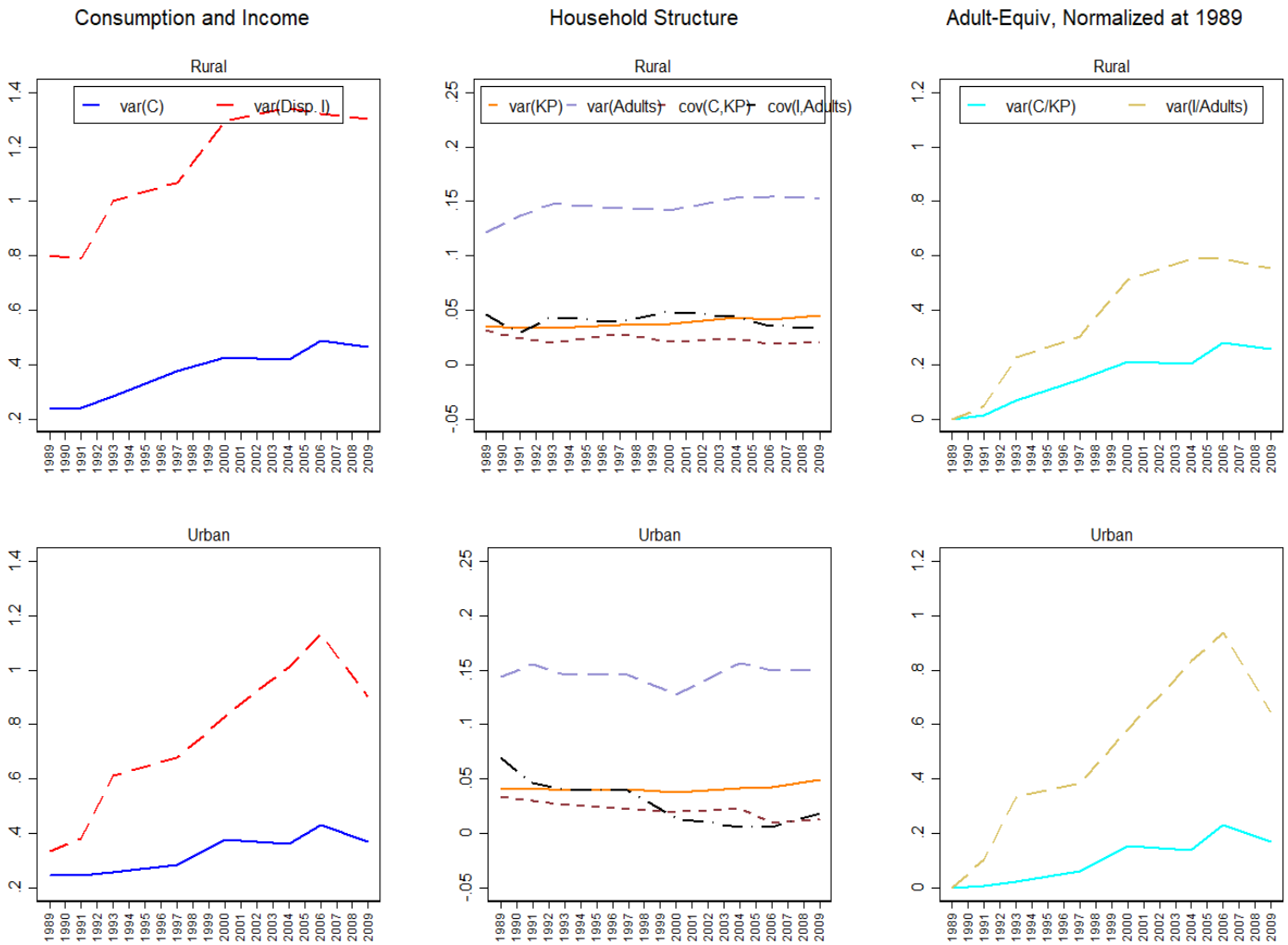
Notes: In this figure, we plot the evolution of the share of the aggregate transfers in the aggregate income by types of transfers for the rural and urban CHNS sample separately. The public transfers are the sum of the food coupon, the subsidy from work, the subsidy from government, and the pension. 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



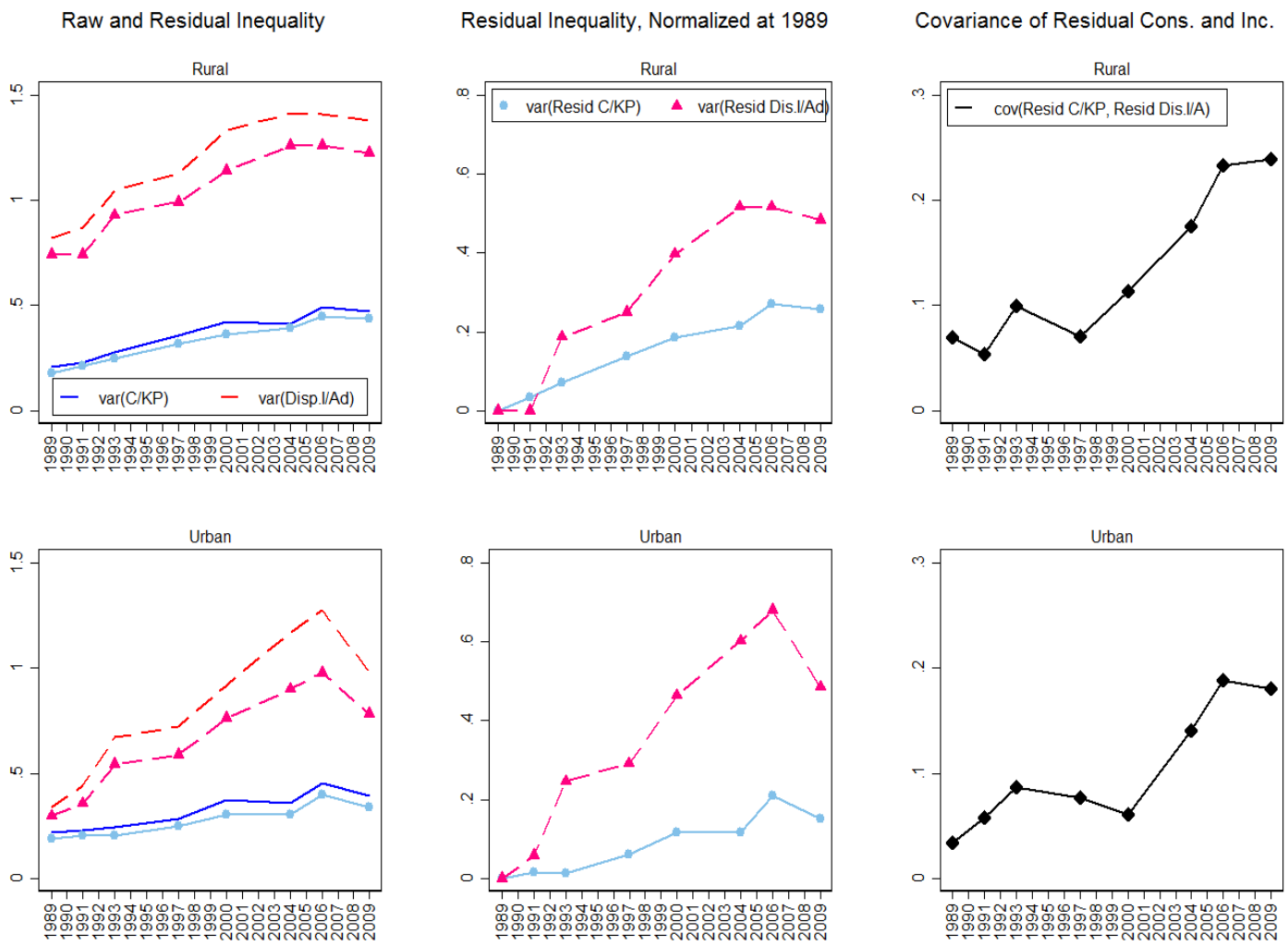
Notes: In this figure, we compare the real household net income per capita and the real household food expenditure per capita constructed from the CHNS sample to those reported in the China Statistical Yearbooks (CSYBs). We normalize the values in 1989 to one. In the top two panels, we also plot the real GDP per capita from the Penn World Table (PWT). The construction of the statistics conforms 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 the 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 zero. For a discussion of the facts, see Section 4.

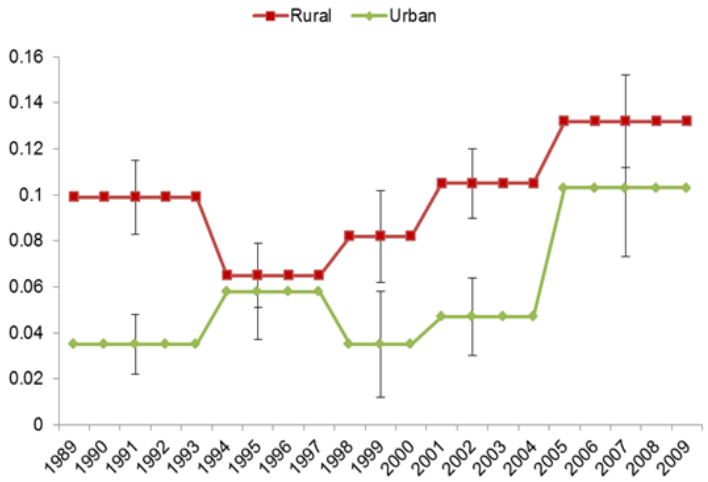
Figure 4: Residual Consumption and Income Inequality, Variance of Logs, CHNS, China 1989-2009



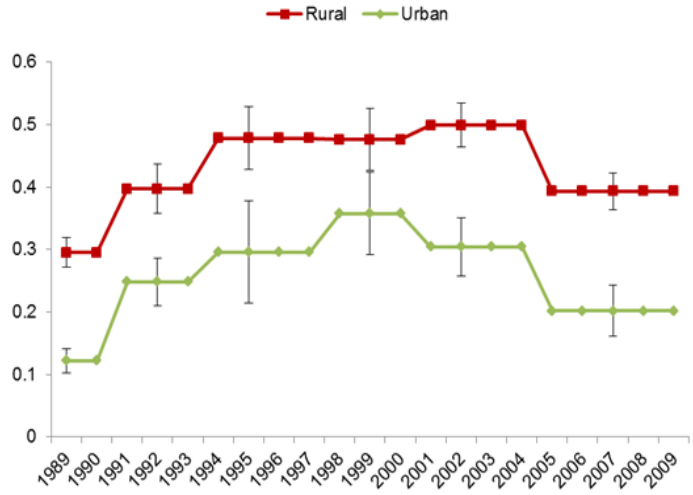
Notes: In this figure, we plot the evolution of the adult-equivalent household consumption and income inequalities as well as the evolution of the residual adult-equivalent household consumption and income inequalities. The left column shows the evolution of the raw and residual inequalities of the adult-equivalent consumption and income. The middle column shows the evolution of the residual inequality of consumption and income, with the 1989 values being normalized to zero. 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 the 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 reflects the identifying assumption that the permanent and transitory shocks remain constant for all of the years between two consecutive surveys. Recall that 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.