Can Growth Compensate Inequality and Risk?

—a welfare analysis for Chinese households

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—a welfare analysis for Chinese households*

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Abstract

It has been widely observed that China's break-neck growth has not been equally shared between rural and urban areas, with urban households enjoying a much larger proportion. To further test whether regional inequality exists within urban areas, we measure urban households' vulnerability in a risky environment and decompose this measure to quantify China aggregate risks, province-level risks and idiosyncratic risks faced by households situated in 31 provinces. Besides, under this framework of analysis, we are able to make welfare comparisons between growth, inequality and different risks. We find that inequality has very big negative effect on households' welfare, while growth is able to compensate nearly half of it; households seem to be able to smooth consumption against risk in both province and individual level, but unable to do so against China shocks, which affect all the households simultaneously.

1 Introduction

It has been widely observed that China's economy has been growing at a break-neck pace for the past quarter century since China's Reforms and

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Opening, and widely understood that most of this growth has occurred in urban areas. However, it is not well understood whether or not expenditures for all urban households have tended to rise together, or whether high rates of aggregate urban expenditure growth mask heterogeneous outcomes, with some households improving their well-being at an extraordinary pace, while others founder. Neither is it known whether the high levels of consumption growth experienced by at least some households are essentially deterministic, or whether these ex post successful households were simply the winners in what was ex ante a highly risky undertaking. In this paper we want to quantify the welfare costs of unequal distribution and risks faced by urban households and welfare gains from consumption growth.

Since 1978, "China has witnessed probably the most dramatic burst of wealth creation in human history. Its income per head has increased *sevenfold* in that time: more than $400m$ people have been lifted out of severe poverty."[1] Chen and Wang (2001) documents poverty trend in the period of $1990 - 1999$, which shows that the national poverty headcount index was nearly halved from 31.5 to 17.4 (using $\$1/day$ as the poverty line). This big reduction in poverty is mainly due to the growth in rural areas, which have most of the poor. In terms of urban areas, per capita consumption has been growing at almost 14% annually from 1990 to 2002.

However, at the same time inequality is also increasing rapidly, as documented in many papers. Chen and Wang (2001) also documents inequality trend in the same period with the national Gini index rising from 34.84 to 41.64, representing a nearly 20% increase. It is commonly understood that

[1] *The Economist*, Aug $19th$ 2004.

this increase in inequality mainly comes from two sources: the first is the increasing divide between rural and urban incomes; the second is the widening gap across regions (especially between coastal and interior provinces).

Khan and Riskin (1998) give evidence of the first source by comparing 1995 to 1988, showing that the great urban-rural gap is the dominant factor to the overall inequality and that previous and ongoing public policies seem to have unequal distributional consequences between rural and urban.

Yao and Zhang (2001) use provincial data and find evidence of increasing inequality between regions. Reaching similar conclusions, Jones, Li, and Owen (2003) use city-level data in $1989 - 1999$ and find larger regional inequality.

Although some papers like Kanbur and Zhang (2001) argue that most inequality come from rural-urban differences, rather than provincial-level differences, they still find a significant role for provincial differences even after controlling for rural-urban differences.

Being a transional developing economy, China has been undergoing a lot of domestic policy changes, while Chinese households are more and more integrated into the global economy. The individual exposure to all these shocks from different sources differs across individual households. In this paper we try to differentiate among 3 different categories of shocks to household consumption. First among them are China shocks, which may include China's accession to WTO with its gradual adjustment in corresponding domestic policies, SARS, deepening housing, pension and health care reforms, etc. Second are provincial shocks, which may include changes in provincial policies, natural disasters, implementation of national reforms, etc. Last but not least are idiosyncratic shocks, which may include changes in employment status, health status, etc. We try to quantify these risks and estimate the welfare costs associated with these risks, which hopefully will tell us how households are affected by them and to what extent they have important welfare effects relative to growth and inequality.

Our paper is also related with the empirical literature on economic growth and inequality. The majority of this vast macroeconomic literature focuses on channels where inequality affects growth, trying to understand the growth- inequality relationship such as Perotti (1996) and Barro (2000). Barro (2000) finds that higher inequality tends to retard growth in poor countries and encourage growth in richer places. In terms of within-country inequality, Chen and Ravallion (2004) finds no aggregate trade-off between growth and inequality in China; the periods of more rapid growth did not bring more rapid increases in inequality. Nor did provinces with more rapid rural income growth experience a steeper increase in inequality. However, growth and inequality may be simultaneously determined by some fundamental forces. Contrasting with these more macro level evidence, our paper uses micro-household level data on consumption and income distribution over time to measure the welfare gain/costs associated with growth, inequality and risk, both separately and jointly. Putting the joint determination of growth and inequality aside, we might be able to see more clearly how individual household's welfare has been affected by economic growth, increasing inequality and risk.

Thanks to the access to a comprehensive urban household survey from National Bureau of Statistics (NBS), we hope we can answer the questions put forward at the beginning of this paper. As the focus of this paper is on urban China, let us henceforth put aside the increasing overall inequality due to the differences between rural and urban China. Instead, let us ask what our urban data can tell us about the welfare loss due to risks faced by urban households, and whether regional/provincial difference, relative to China risk and idiosyncratic risk, is the dominant force in determining the risk borne by households situated in different regions. The main tool we are going to use is the vulnerability measure proposed by Ligon and Schechter (2003) and its decomposition. As this measure can be decomposed into a poverty (we will show later in this paper that this measure had better be termed as *inequality*.) measure and a risk measure, regional differences can be accounted for by further decomposing both of them. Please note that if there is a fixed (in terms of time) policy difference across regions, the households would not face any risk subsequent to the time being of this policy shift but simply different expected growth trajectories and this can be accounted for in our inequality measure, which is something deterministic. Only the time variation of regional differences is considered regional-level *risk* to these households and will be picked up by our risk measure. China's rapid income and consumption growth need a more dynamic framework, which this measure is not going to provide. So we will make some adaptations to it.

The remainder of this paper is organized as follows. In Section 2, we first introduce Ligon-Schechter measure of vulnerability and then we adapt this framework to measure inequality, growth and risk borne by households within a certain province. Section 3 describes the data on household consumption, income, demographic characteristics, etc. Then Section 4 reports the results of applying the methods described in Section 2 to the data described in Section 3. Finally Section 5 concludes.

2 Welfare Framework and Econometric Analysis

As we mentioned before, we are going to carry out our welfare analysis in the framework built by Ligon and Schechter (2003), with some adaptations and improvements.

2.1 Ligon-Schechter Vulnerability Measure

Ligon and Schechter (2003) take a utilitarian approach to defining vulnerability in a risky environment. To measure vulnerability, for each household they first choose some strictly increasing, weakly concave function $u^i : \mathcal{R} \rightarrow \mathcal{R}$ mapping consumption expenditures into the real line. Given the function u^i, they define the vulnerability of the household by the function

$$v^i = u^i(\bar{c}) - \mathrm{E}u^i(c^i). \tag{1}$$

Here $\bar{c}$ is expected per capita consumption; *if* household i had certain consumption greater than or equal to this number, the household wouldn't be regarded as vulnerable.

Then they decompose the measure into distinct components reflecting "poverty" and risk, respectively:

$$v^i(\bar{c}) = [u^i(\bar{c}) - u^i(\mathrm{E}c^i)] + [u^i(\mathrm{E}c^i) - \mathrm{E}u^i(c^i)]. \tag{2}$$

Note that the first bracketed term, which measures poverty, involves no random variables—it is simply the difference between a concave function evaluated at the "poverty line" $\bar{c}$ and at household i's expected consumption expenditure.

The second term of equation 2, which measures the risk faced by household i, is consistent with the ordinal measures of risk proposed by Rothschild and Stiglitz (1970).

Both poverty and risk measures can usefully be further decomposed to reflect poverty and risk at different levels of aggregation. In our paper's context suppose that household i is located in a village indexed by v_i, which in turn is located in a province p_{v_i}, which finally is located in China. We denote China-level aggregate variables by the vector $\bar{x}$, variables specific to the province p_{v_i} by $x^{p_{v_i}}$, variables specific to the village v_i by x^{v_i}, and variables specific to household i by x^i. Note that we regard, e.g., province level variables as characteristics of the villages within that province, so that these sets of variables are nested, with $\bar{x} \subset x^{p_{v_i}} \subset x^{v_i} \subset x^i$, for all $i = 1, \ldots, n$.

Let $\mathrm{E}(c^i|x)$ denote the expected value of consumption, c^i, conditional on knowledge of a vector of variables x, which will vary depending on the level of aggregation. Then we can rewrite, e.g., the risk facing household i as

$$\begin{aligned} R^i = {} & [u^i(\mathrm{E}c^i) - \mathrm{E}u^i(\mathrm{E}(c^i|\bar{x}))] + [\mathrm{E}u^i(\mathrm{E}(c^i|\bar{x})) - \mathrm{E}u^i(c^i|x^{p_{v_i}})] \\ & + [\mathrm{E}u^i(\mathrm{E}(c^i|x^{p_{v_i}})) - \mathrm{E}u^i(c^i|x^{v_i})] + [\mathrm{E}u^i(\mathrm{E}(c^i|x^{v_i})) - \mathrm{E}u^i(c^i|x^i)]. \quad (3) \end{aligned}$$

Here the first bracketed term expresses the risk facing the household purely as a consequence of variation in China-level aggregates, while the second filters out this aggregate component of risk to leave only risk associated with variation at the level of the province, the third delivers risk associated with village-level variation, and the final term only idiosyncratic risk. A similar decomposition can be done for the poverty component of household vulnerability.

In the presence of measurement error, to avoid the problem of confuting measurement error with idiosyncratic risk, Ligon and Schechter (2003) further decompose their measure of idiosyncratic risk into risk which can be attributed to variation in observed time-varying household characteristics x_t^i and a risk which can neither be explained by these characteristics, nor by aggregate variables, but which is due instead to variation in unobservables and to measurement error in consumption. Thus, rewriting the expression for vulnerability yields

$$
\begin{aligned}
v^i &= [u^i(\mathrm{E}c) - \mathrm{E}u^i(\mathrm{E}c_t^i)] \qquad \text{(Poverty)} && (4)\\
&+ [u^i(\mathrm{E}c_t^i) - \mathrm{E}u^i(\mathrm{E}(c_t^i|\bar{x}_t))] \qquad \text{(China risk)} && (5)\\
&+ [\mathrm{E}u^i(\mathrm{E}(c_t^i|\bar{x}_t)) - \mathrm{E}u^i(\mathrm{E}(c_t^i|x_t^{p_{v_i}}))] \qquad \text{(Province risk)} && (6)\\
&+ [\mathrm{E}u^i(\mathrm{E}(c_t^i|x_t^{p_{v_i}})) - \mathrm{E}u^i(\mathrm{E}(c_t^i|x_t^{v_i})] \qquad \text{(Village risk)} && (7)\\
&+ [\mathrm{E}u^i(\mathrm{E}(c_t^i|x_t^{v_i})) - \mathrm{E}u^i(\mathrm{E}(c_t^i|x_t^i))] \qquad \text{(Idiosyncratic risk)} && (8)\\
&+ [\mathrm{E}u^i(\mathrm{E}(c_t^i|x_t^i)) - \mathrm{E}u^i(c_t^i)]. \qquad \text{(Unexplained risk \& measurement error)} && (9)
\end{aligned}
$$

Assuming a stationary environment, Ligon and Schechter (2003) are led to estimate the unconditional expectation of household i's consumption by

$\mathrm{E}c_t^i = \frac{1}{T}\sum_{t=1}^{T} c_t^i$. They also try to optimally predict consumption c_t^i in a least-squares sense. Given their assumptions on the measurement error process(ϵ_t^i), $\mathrm{E}(c_t^i|x_t^i) = \mathrm{E}(\tilde{c}_t^i|x_t^i)$, where the observed consumption measure $\tilde{c}_t^i$ is assumed to be $\tilde{c}_t^i = c_t^i + \epsilon_t^i$, measurement error in consumption expenditures will influence only their measure of *unexplained* risk. This last measure will be incorrect by the difference $\mathrm{E}u^i(\tilde{c}_t^i) - \mathrm{E}u^i(c_t^i)$, while their measures of aggregate and explained idiosyncratic risk will not be biased by this sort of measurement error.

2.2 Adapting Ligon-Schechter Measure to A Dynamic World

First note the first bracketed term in equation (2). Instead of calling it "poverty", we found that it's better to call its population average — $u(\bar{c}) - \frac{1}{N}\sum_{i=1}^{N} u(\mathrm{E}c^i)$,"Inequality" (denoted as p), which has a one-to-one correspondence with Atkinson's index(Atkinson (1970)). To see this interesting correspondence, consider that we are in a hypothetical economic world with everyone's consumption being her stationary mean of her consumption process — $\mathrm{E}c^i = \frac{1}{T}\sum_{t=1}^{T} c_t^i$, and $\bar{c}$ being the population average of this hypothetical consumption level. Then p is exactly an estimator of Atkinson welfare gain if every one is distributed equally with $\bar{c}$. Recall Atkinson's term *equally distributed equivalent* level of consumption(income), denoted as c_{EDE} here, which is exactly equal to $u^{-1}(\frac{1}{N}\sum_{i=1}^{N} u(\mathrm{E}c^i))$. By some easy calculation, we find the following $1-1$ mapping between our measure and Atkinson Index, denoted as I: $p = \frac{\bar{c}^{1-\epsilon}}{1-\epsilon}[1-(1-I)^{1-\epsilon}]$. Obviously $\frac{\partial p}{\partial I}$ is positive.

Second, as this measure is purely a static one and Ligon and Schechter

(2004) show that in a non-stationary world the performance of this measure is not satisfactory. But it still has its merit in confining measurement error, which is obviously an important issue in the consumption literature. However, Chinese households have been experiencing amazingly rapid consumption growth, which might indicate a possible non-stationary consumption process. So in this paper we adapt this measure to this dynamic world by changing the way we estimate conditional expectations.

What do we mean by introducing some dynamics into this *static* measure? Consider that, for a household at time t, is it vulnerable to the risk next period? Using realized outcomes at time $t+1$, we would like to estimate her vulnerabilty at time t, when she is standing at time t. Instead of assuming a stationary consumption process, we assume consumption follows a difference-stationary stochastic process, which means that we can't estimate $\mathrm{E}c_t^i$ as $\frac{1}{T}\sum_{s=1}^{T} c_s^i$. But we can estimate a conditional expectation based on time t information set. So let us propose the following measure:

$$v_t^i = u^i(\mathrm{E}_t\bar{c}_{t+1}) - \mathrm{E}_t u^i(c_{t+1}^i). \tag{10}$$

Please note the time-index t of individual vulnerability, which means that, different from Ligon and Schechter (2003), each individual household has a vulnerability measure per period, except the last period. So we may call it "one-step forward" vulnerability measure. And we can redefine our individual-specific vulnerability measure as $v^i = \frac{1}{T}\sum_{t=1}^{T} v_t^i$. Instead of using $\bar{c}$, we use the expected aggregate consumption in period $t+1$(conditioned on time t information set) as our certainty-equivalent consumption in each period.

In practice, using the same trick of decomposition, our new measure of an individual's period t vulnerability will become:

$$
\begin{aligned}
v_t^i &= [u^i(\mathrm{E}_t\bar{c}_{t+1}) - u^i(\mathrm{E}_t c_{t+1}^i)] \qquad \text{(Inequality)} \\
&+ [u^i(\mathrm{E}_t c_{t+1}^i) - \mathrm{E}_t u^i(\mathrm{E}(c_{t+1}^i|\bar{x}^i))] \qquad \text{(Consumption growth)} \\
&+ [\mathrm{E}_t u^i(\mathrm{E}(c_{t+1}^i|\bar{x}^i)) - \mathrm{E}_t u^i(\mathrm{E}(c_{t+1}^i|\bar{x}_{t+1}))] \qquad \text{(China risk)} \\
&+ [\mathrm{E}_t u^i(\mathrm{E}(c_{t+1}^i|\bar{x}_{t+1})) - \mathrm{E}_t u^i(\mathrm{E}(c_{t+1}^i|x_{t+1}^{p_{v_i}}))] \qquad \text{(Province risk)} \\
&+ [\mathrm{E}_t u^i(\mathrm{E}(c_{t+1}^i|x_{t+1}^{p_{v_i}})) - \mathrm{E}_t u^i(\mathrm{E}(c_{t+1}^i|x_{t+1}^i))] \qquad \text{(Idiosyncratic risk)} \\
&+ [\mathrm{E}_t u^i(\mathrm{E}(c_{t+1}^i|x_{t+1}^i)) - \mathrm{E}_t u^i(c_{t+1}^i)]. \qquad \text{(Unexplained risk \& measurement error)}
\end{aligned}
$$

where $\bar{c}_{t+1} = \frac{1}{N}\sum_{i=1}^{N} c_{t+1}^i$ is the per capita consumption in period $t+1$ (an estimator of the mean of the cross-sectional distribution), and vectors of aggregate variables are denoted by $\bar{x}_t$ and $x_t^{p_{v_i}}$, for China-level and province level variables respectively. Compared with 4, we have a measure for *consumption growth*, which measures the average welfare gain/loss due to a change in individual consumption growth rate to population average growth rate.

2.3 Estimation

Two additional steps are required before one can actually use data to compute a household's vulnerability. First, one must choose the functions $\{u^i\}$. Second, one must devise a way to estimate the conditional expectations which figure in our vulnerability measure. Here, we assume that the $\{u^i\}$

take the simple form $u^i(c) = (c^{1-\gamma})/(1-\gamma)$ for some parameter $\gamma > 0$; as γ increases, the function u^i becomes increasingly sensitive to risk. In this paper we take γ equal to 2, which is in the reasonable range of values taken by relative risk aversion in the empirical literature. And it turns out later that this value also gives an easy transformation between our util measures and actual monetary value. We also choose units for c so that the average of predicted consumption over all households in *each* period equals 1. Under this parametrization, our vulnerability measure is equal to $\frac{\rho}{\mathrm{E}c-\rho}$ where ρ is defined as the household's willing to pay to get rid of next period's utility risk.

To measure vulnerability, Ligon and Schechter (2003) use the following parametrization to estimate conditional expectation of consumption:

$$\tilde{c}_t^i = \alpha^i + \eta_t + x_t^i \beta + v_t^i, \tag{11}$$

where c_t^i is household i's consumption in period t, α^i household fixed effects, η_t time fixed effects, x_t^i individual household's time-varying characteristics, v_t^i a disturbance term equal to the sum of both measurement error in consumption as well as prediction error, assumed to be orthogonal to all the right hand side variables, and where time fixed effects are restricted to sum to zero. We denote by Z_t^i the vector of variables $(\alpha^i, \eta_t, x_t^i)$. Obviously this may create problems if predicted consumption is negative. Furthermore, we would not be able to get a prediction of consumption levels like this in a world of CRRA preferences, which seem to be commonly accepted in the literature. So Ligon and Schechter (2004) use *logarithmic* consumption instead.

Then the conditional expectation of consumption, $E(c_t^i|Z_t^i)$ will be:

$$E(\tilde{c}_t^i|Z_t^i) = \exp^{\alpha^i+\eta_t+x_t^i\beta} E(\exp^{v_t^i}|Z_t^i), \tag{12}$$

where, in their estimation, they artificially restrict $E(\exp^{v_t^i}|Z_t^i)$ to be one. In this paper we will change this to something more general. Furthermore, to introduce dynamics into it, we assume the consumption process is first-difference stationary, rather than stationary. we give the same parameterization to $E(\exp^{v_t^i}|Z_t^i)$ as we give to consumption, avoiding the artificial construct in the original paper. These two changes will deliver the following parametrization:

$$\log \tilde{c}_t^i - \log \tilde{c}_{t-1}^i = \alpha + \alpha_i + \eta_t + \delta_t^{Pv} + (x_t^i - x_{t-1}^i)\beta + v_t^i, \tag{13}$$

where α is a constant representing the average growth rate, and α_i, η_t and δ_t^{Pv} (province-time dummies) are all restricted to sum to 0. This, in turn, gives our conditional expectation:

$$E(\tilde{c}_{t+1}^i|Z_{t+1}^i) = \tilde{c}_t^i \exp^{\alpha+\alpha_i+\eta_t+\delta_t^{Pv}+(x_{t+1}^i-x_t^i)\beta} E(\exp^{v_{t+1}^i}|Z_{t+1}^i), \tag{14}$$

where $E(\exp^{v_{t+1}^i}|Z_{t+1}^i) = \lambda + \lambda_i + \gamma_t + \phi_t^{Pv} + (x_{t+1}^i - x_t^i)\delta$ and $Z_{t+1}^i = (\alpha, \alpha^i, \eta_t, \delta_t^{Pv}, x_{t+1}^i - x_t^i)$.

So in equation (13), we only have to assume a minimal exclusion restriction in this least-squares environment as in equation (11): the error term is orthogonal to the explanatory variables. Of course ours is a prediction for differences in *logarithmic* consumption. However, it does not follow that the conditional expectation of $\exp^{v_{t+1}^i}$ in equation (14) is one. So we add another step of estimation of this exponential error term on the same set of explanatory variables and use predicted value as part of the consumption prediction.

If we look at equation (14) again, we run across another problem: the conditional expectation of consumption in period $t+1$ still contains period $t+1$ information, which requires another step of estimation to give us the conditional expectation of period $t+1$ utility. And in practice we just do another step of least-squares estimation of $t+1$ utilities, conditional on all the observed period t variables. So our unexplained risk measure will have an additional part, which is the prediction error from this extra step of estimation.

In our estimation, we can have two choices for $\tilde{c}_t^i$ in equation (14): the actual realized consumption lagged one period and the predicted consumption from equation 13. It is pretty clear that we should use the first one as we do not want to introduce more prediction errors into our prediction of time $t+1$ consumption. But measurement issues might be a potential problem again.

3 Data

The data we are going to use come from the Urban Household Survey Division in NBS (UHSD). Urban Household Survey started in 1984 and before 2002 it can only be used as cross-section although it was originally designed to be a three-year rotating panel, because they did not keep the household identification number over time. Since 2002 they have been keeping the same identification numbers for all the households so that we would be able to use the rotating panel in the future.

However here we still have a panel feature as they keep the monthly record since 2002. Due to NBS' rule 2002 is the most recent data available, which gives us a 12-month panel of household consumption, income, demographic information, etc. We have 4-province (Beijing, Sichuan, Henan and Jiangsu) in hand and UHSD allows us to run our programming code in the whole national sample, on which our results here are based. The whole sample includes all the 31 provinces, prefectures and autonomous regions. In terms of the data use, our paper is the first to have both the biggest coverage and the monthly panel feature.

For each household, there is rich information on all household members: age, sex, education level, employment status and enterprise ownership, occupation, years of work experience and monthly income from different sources, etc. And information on household's expenditures is also very detailed with total consumption expenditure being decomposed into 8 categories: food, clothing, durables, health care, transportation and communication, education, cultural and entertainment services, housing and miscellaneous commodities and services. We keep this measure of total consumption to be consistent with works in the literature on China's consumption growth and inequality as most of them use aggregate data from NBS. There is also useful information on households' savings and investment.

The consumption expenditure and income in this paper are all in per capita terms; the individual household time-varying variables in our estimation include the logarithm of per capita income and household size. The variation on them are considered as observed idiosyncratic risks.

4 Growth, Inequality and Welfare Costs of Risk in China

Summary statistics for the urban sample is included in Table 1. After dropping households who have non-positive consumption and/or income, and who do not exist in our sample for all 12 months, our sample size dropped from $43,800$ to $41,050$, throwing out approximately 90 households per province. Note that Tibet is dropped as we have very few observations.

From this table we can see that average household size is around 3 (due to China's one child policy) and average household monthly per capita income is 652 yuan (exchange rate is about 8 yuan/$), nearly 30% of which is spent on food and about 75% on total consumption. Slightly below 20% of household members are pensioners. We also see that most of the urban residents have at least primary education (above 83%)[2] but only 6% have ever studied in college. About 28% of household members do not earn more than 100 yuan every month.

In Table 2 and Table 3, we decompose average vulnerability for total consumption and food consumption respectively into measures of inequality, China-level aggregate risk, province-level risk, idiosyncratic risk and

[2]The education variable in our data asks, for each education level, whether the individual has ever be admitted, rather than a completion of the correspoding degree.

unexplained risk.

Let us look at total consumption first. Inequality is the largest component, accounting for almost 97% of total vulnerability. Recall our interpretation of this measure in Section 2: due to its position in the consumption distribution, an average household could gain 71% of its utils, or, put in another way, is willing to pay 41.2% of its mean consumption to get an equal share of the total pie; with constant relative risk aversion equal to 2 and mean consumption 500 *yuan*, this translates into about 200 *yuan*. On the other hand growth has a negative effect on households' vulnerability, which causes a welfare gain almost half the loss from an unequal distribution; this gain translates into 23% of mean consumption, approximately 110 *yuan*. In terms of different risks faced by these households, it's worth noting that only china shocks common to all households have significant welfare effects, causing an average welfare loss of 24 *yuan*. This suggests that chinese households, after possible risk management and sharing strategies including precautionary savings, are still affected by these risks. Contrary to this, neither province risk nor idiosyncratic risk has any welfare effects on average, which might suggest that chinese households are well prepared for and able to smooth consumption when facing these risks. But it may aslo be the case that our monthly variation within a single year is not enough to pick up provincial policy changes, which has to be answered after we use the whole 3-year panel.

Now we move to the correlates of these measures. To do this we regress every element of vulnerability for each individual household on a set of fixed household characteristics. For household characteristics that vary across month, we take the mean value of these characteristics as the explanatory variables. For the standard errors we use the bootstrap method. We can see that the correlates of vulnerability and those of inequality are extremely similar. We find that households with more mouths to feed (bigger household size) or having more unemployed tend to be more vulnerable and more negatively affected by unequal distribution; more educated household heads (having at least some secondary education) are less vulnerable and less negatively affected by inequality. Although the welfare effect of growth is significant, it doesn't seem to be correlated with any of the observed household characteristics, which might result from the fact that every one is experiencing some consumption growth, i.e., China's rapid economic growth is actually lifting all urban boats. But aggregate shock might tell a different story: it has significant consequences for households' welfare but none of the household characteristics protect them from from these shocks, or aggregate shock just affects every one in the same way.

Table 1: Summary statistics for urban households—national (# of hhs = $41,050$)

Variables	Mean	S.D.
Average Per Capita Food Consumption	188.93	(106.53)
Average Per Capita Consumption	500.01	(357.49)
Average Per Capita Income	652.08	(415.05)
Hh size	3.03	(0.81)
Prop. Retired	0.19	(0.30)
Prop. No Income	0.28	(0.197)
Hh Head Sex (Male$==1$)	0.717	(0.451)
Hh Head Age	47.8	(11.8)
Hh Head Educ (at least some secondary)	0.267	(0.443)
Prop. Primary	0.833	(0.373)
Prop. at least some college	0.063	(0.242)

Table 2: Inequality, Growth, Risk and their Covariates —measured in total consumption

Average Value (in utils)	Vuln 0.7305***= [0.6843, 0.7872]	Ineq 0.7120***+ [0.6681, 0.7631]	Growth −0.3202***+ [-0.3736, -0.2973]	Agg Risk 0.0469***+ [0.0215, 0.0884]	Prov Risk 0.0057+ [-0.2797, 0.0618]	Idio Risk 0.0159 + [-0.0444, 0.0596]	Unexp Risk 0.2703** [0.1957, 0.3770]
Variable	Coef	Coef	Coef	Coef	Coef	Coef	Coef
Hh size	0.1805***	0.1791***	−0.0147	0.0064	0.0026	−0.0093	0.0165
	(0.0438)	(0.0453)	(0.0299)	(0.0106)	(0.0546)	(0.1808)	(0.1770)
% retired	−0.0926	−0.0878	0.1129	0.0060	0.0074	−0.0091	−0.1220
	(0.1529)	(0.1553)	(0.1219)	(0.0104)	(0.4618)	(0.8958)	(0.8024)
% no income members	1.3707***	1.3546***	−0.1861*	0.0389	0.0115	−0.0210	0.1729
	(0.1515)	(0.1658)	(0.1044)	(0.0696)	(0.2167)	(0.6407)	(0.6302)
Head Male	0.1469*	0.1445*	−0.0231	0.0026	−0.0008	0.0082	0.0155
	(0.0843)	(0.0804)	(0.0676)	(0.0068)	(0.1118)	(0.1912)	(0.2019)
Head age	0.0038	0.0038	−0.0022	0.0004	−0.0002	−0.0006	0.0026
	(0.0041)	(0.0042)	(0.0032)	(0.0003)	(0.0110)	(0.0155)	(0.0113)
Head Secondary	−0.4210***	−0.4195***	0.0228	−0.0123	0.0020	−0.0191	0.0052
	(0.0891)	(0.0829)	(0.0764)	(0.0262)	(0.0916)	(0.2328)	(0.2388)
% Primary	−0.1556	−0.1555	0.0271	−0.0029	−0.0042	0.0065	−0.0266
	(0.1056)	(0.1007)	(0.0811)	(0.0086)	(0.1649)	(0.3008)	(0.3066)
% College	−0.0020	0.0014	−0.0084	−0.0005	−0.0003	−0.0021	0.0079
	(0.0945)	(0.0934)	(0.0708)	(0.0068)	(0.1080)	(0.2848)	(0.2893)
R^2	0.1494	0.1549	0.0247	0.0315	0.0232	0.0051	0.0096

- *** indicates 99% significance level, ** 95% and * 90%;
- numbers in parenthesis are bootstrapped standard errors.

When we apply the same methods to food consumption, we see similar results: education, household size and unemployment are all significantly associated with households' welfare changes from inequality and growth, and their effects are in the same directions as is the case for total consumption. It's worth noting that the welfare loss from aggregate shock is positively correlated with both household size and unemployment, which indicates that risks at national level are neither well shared among nor effectively buffered against by these households, although the same correlation doesn't exist between risk measured in total consumption and household characteristics.

Table 3: Inequality, Growth, Risk and their Covariates —measured in food consumption

Average Value (in utils)	Vuln	Ineq	Growth	Agg Risk	Prov Risk	Idio Risk	Unexp Risk
	0.5564***=	0.5052***+	−0.2122***+	0.0657***+	−0.0024+	0.0230* +	0.1771**
	[0.5199, 0.5969]	[0.4702, 0.5474]	[−0.2429, −0.1921]	[0.0560, 0.0759]	[0.0071, 0.0281]	[−0.0080, 0.0545]	[0.1321, 0.2515]
Variable	Coef	Coef	Coef	Coef	Coef	Coef	Coef
Hh size	0.1648***	0.1599***	−0.0103	0.0086***	0.0011	−0.0049	0.0105
	(0.0374)	(0.0358)	(0.0179)	(0.0030)	(0.1384)	(0.1716)	(0.1102)
% retired	−0.0824	−0.0963	0.0429	0.0013	0.0733	−0.0732	−0.0304
	(0.1120)	(0.1302)	(0.0956)	(0.0073)	(0.9633)	(1.0079)	(0.4348)
% no income members	1.0980***	1.0380***	−0.1283	0.0419***	0.0654	−0.0545	0.1355
	(0.1519)	(0.1805)	(0.1249)	(0.0125)	(0.5552)	(0.8094)	(0.7881)
Head Male	0.1022*	0.0973*	−0.0187	0.0045	0.0659	−0.0708	0.0240
	(0.0529)	(0.0517)	(0.0344)	(0.0039)	(1.2361)	(1.3752)	(0.2574)
Head age	−0.0049	−0.0052	0.0011	0.0001	0.0005	−0.0006	−0.0008
	(0.0033)	(0.0033)	(0.0019)	(0.0002)	(0.0163)	(0.0193)	(0.0093)
Head Secondary	−0.1545**	−0.1497**	−0.0011	−0.0052	0.0472	−0.0686	0.0229
	(0.0638)	(0.0621)	(0.0430)	(0.0054)	(0.6056)	(0.7988)	(0.5333)
% Primary	−0.0590	−0.0594	0.0039	−0.0023	0.0568	−0.0774	0.0194
	(0.0575)	(0.0548)	(0.0300)	(0.0044)	(0.8234)	(0.9531)	(0.3531)
% College	0.1408	0.1249	−0.0556	0.0001	−0.0368	0.0696	0.0387
	(0.1859)	(0.1700)	(0.1071)	(0.0090)	(0.4202)	(0.8548)	(0.6568)
R^2	0.1145	0.1208	0.0191	0.0536	0.0156	0.0094	0.0107

- *** indicates 99% significance level, ** 95% and * 90%;
- numbers in parenthesis are bootstrapped standard errors.

5 Conclusions

This paper explores a unique data set for urban Chinese households which is supposedly representative of all 31 provinces and has a unique 3-year rotating panel (with monthly frequency) feature to quantify the different risks faced by Chinese households. Based on the vulnerability measure developed by Ligon and Schechter (2003), we measure the welfare gains/costs associated with consumption inequality, consumption growth and risks. We find that both inequality and growth have significantly big effecs on households' welfare, with inequality reducing and growth increasing their welfare. And growth can compensate an average household for nearly half of its losses from inequality. We also find that the effect of aggregate risk which affects all the households, although small in magnitude, is significant.

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