

Evaluating the Welfare Gain of Economic Reform: Evidence from Chinese Provinces*

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Comments are Welcome

Abstract

This paper evaluates the welfare gain of Chinese economic reform, started in 1979, by exploiting the alternative paths of consumption resulting from the reform. Using the province-level consumption data from 1952 to 1998, we show that the welfare cost of consumption fluctuation in China varies across time (pre/post-reform) and space (provinces/regions). We find that 1) the welfare cost of volatility is reduced after the reform; 2) the relative welfare gain from removing volatility to that from receiving an extra percentage of consumption growth in perpetuity is higher in the post-reform period; 3) the growth and stabilization effects of the reform provide higher welfare gain to the coast.

Keywords: China, Consumption, Growth, Reform, Volatility, Welfare.

JEL classifications: C68, E21, R13.

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1 Introduction

China has experienced a fast economic growth since the economic reform in 1979. Maddison (1998) suggests an average 7.5% GDP growth rate for the period of 1978 – 1995. Moreover, Smyth and Inders (2004) and Li (2005) show that the trend of output exhibits structural changes during different phases of the reform. Using household survey data, Chen and Ravallion (2007) document that the poverty headcount ratio reduced from 53% in 1980 to 8% in 2001, in which most of the reduction was contributed by rising income in rural areas during early 1980s. However, the output growth does not necessarily translate to the well being of consumers because welfare gain is captured by the changes in consumption patterns.¹ The aim of this paper is to calibrate a dynamic model to compute the welfare changes in each province from 1952 to 1998 by employing the methodology proposed in Lucas (1987); furthermore, we analyze and compare the welfare gains of the reform from two perspectives: advancing the economic growth and promoting the risk sharing across the nation.

Although studies on the welfare analysis of consumption growth and volatility, which was initiated by Lucas (1987), have been conducted in various countries and regions (e.g., Lucas (1987), Jacob et al (2005) and Issler et al. (forthcoming) for U.S.; Robe and Pallage (2003) for Africa; Gomes and Nascimento (2004) for South America; Salvato et al (2005) for Europe), our study on China is of particular interest for two reasons. First, and foremost, China has an enormous population; if there are persistent differences in per capita consumption within the country, the overall consequences for human welfare are much greater than, say, for other large, but less populous countries (e.g. Canada); second, China's recent economic growth is taking place under a unique institutional setting in which a Communist Party-led government, that formerly implemented central planning, is now practicing market economy. This experience may therefore help to see whether the switch from central planning to market mechanism is making any difference with regard to people's welfare.

Instead of looking into consumption level, we assume people are forward looking and

¹Another disadvantage of using GDP data is that the reliability of GDP data in China is questionable and the output growth can be over-estimated, see Rawski (2001)

value their life time utility derived from consumption path. In this case, the growth and volatility of future consumption affect consumers' welfare. The improvements in market institutions provide more opportunities for insuring consumption risks. For example, the transportation infrastructures reduce transaction costs for tradable goods to across provinces, which, in turn, enhance risk sharing within the country.² We quantify the welfare gains from both the economic growth and the improvements in the regional risk-sharing caused by the reform. The empirical results indicate that the eastern region enjoys the highest welfare gain due to the high consumption growth; using utility as a welfare measure to account for both consumption growth and volatility, our results also suggest that the reform does not only improve the utility of all provinces, it also helps the provinces with low utility to catch up with those provinces enjoying utility in the medium range. However, there is a divergence in utility between the high utility provinces and the other provinces.

This paper will shed the light on the tradeoff of consumption growth and volatility in the transitional economies compared to other economies. We show that the welfare gain from eliminating consumption volatility or increasing growth in China are close to those of African countries found in Robe and Pallage (2003). Our work is also close to Jacob et al (2005) which calibrate the consumption process to match the state level data in U.S. directly and estimate the welfare changes of eliminating consumption volatility and promoting growth for states in U.S. The consumption series at state level include the consumption smoothing effect achieved by the household in each state, but there is still consumption risk cannot be shared by the households. It can be due to the transaction cost of entering into insurance contract or transportation cost of trading with distant states is too expensive high. Thus, consumption series at the state level involves more risk than the aggregate series in which state level idiosyncratic risk cannot be shared by the households is cancelled out at the national level. Comparing the average state level and the aggregate welfare cost can inform the welfare cost due to market incompleteness at the state level. They conclude that welfare cost of business cycle is higher at the states level than the national level due to market

²Asdrubali et al (1996) and Labhard and Sawicki (2006) show that intra-national component contributes a significant fraction of risk sharing in US and UK, respectively.

incompleteness of each local economy.³ Our paper adopts the methodology suggested in Jacob et al (2005) and draws a similar conclusion for China. However, the magnitude for welfare cost of consumption volatility in China is much higher than that in U.S. Our results quantify the cost of incomplete risk sharing in China and suggest stabilization policy has significant impacts on improving welfare.

The paper is organized as follow. The next section outlines the model used in this study. In section 3, we discuss the data and calibration. In section 4, we report the empirical results. We conclude in section 5.

2 Model

The basic model used in this paper is proposed in Lucas (1987) where the representative agent in each province or the country maximizes the utility over consumption for infinite-horizon. Suppose individuals' preferences over consumption streams are represented by

$$U = E \sum_{t=0}^{\infty} \beta^t \frac{c_t^{1-\gamma} - 1}{1-\gamma} \quad (1)$$

where β is the subjective discount factor and γ is the relative risk aversion coefficient. In this economy, the consumption process is trend stationary as follow

$$\ln c_t = \alpha + t \ln(1+g) - \frac{1}{2}\sigma^2 + \varepsilon_t \quad (2)$$

where g is the mean growth rate of real consumption per capita and $\varepsilon_t \sim N(0, \sigma^2)$ is the endowment shock. This process assumes that shocks to consumption level is temporary and have no impacts on consumption growth.

The measure of welfare change for risk sharing in this economy is the value of λ which equalize the actual consumption path in the data and its certainty equivalent

$$\sum_{t=0}^{\infty} \beta^t \frac{((1-\lambda)\bar{c}_t)^{1-\gamma} - 1}{1-\gamma} = E \sum_{t=0}^{\infty} \beta^t \frac{c_t^{1-\gamma} - 1}{1-\gamma} \quad (3)$$

³In their model, they assume a representative agent in each province. For heterogenous agents model, Krusell and Smith (1998) employ a model in which agents are subject to unemployment risks but are allowed to save to smooth income and hence consumption. Although there is no perfect unemployment insurance, the access to the capital market itself provide a very good (though not perfect) insurance to unemployment risk for most of the agents. Thus, the average welfare cost of business cycle in the is still not significant (indeed negative) which does not support stabilization policy.

where c_t is the actual consumption level in the economy with aggregate fluctuations, and \bar{c}_t is the unconditional mean of c_t . The welfare cost of consumption volatility is the fraction, λ , of unconditional mean of actual consumption path that an agent is willing to sacrifice for a hypothetical consumption path with no volatility. It is given by

$$\lambda = 1 - \exp\left(-\frac{\gamma\sigma^2}{2}\right) \approx \frac{\gamma\sigma^2}{2} \quad (4)$$

The expression shows that the larger is the variability of shocks to consumption, the more an agent finds these shocks costly, so the more it is willing to pay to eliminate consumption fluctuations. Moreover, a more risk averse agent perceives higher cost of consumption volatility on utility. The welfare gain of extra 1% of growth, η :

$$\eta = 1 - \left(\frac{1 - \beta(1 + g + 0.01)^{(1-\gamma)}}{1 - \beta(1 + g)^{(1-\gamma)}} \right)^{\frac{1}{1-\gamma}} \quad (5)$$

The lower the current consumption growth, the more an agent finds the consumption growth valuable.

A reduction in the welfare cost of business cycle after the reform means that the willingness to pay for an agent to avoid consumption fluctuation is decreased after the reform because the consumption fluctuation one need to face is reduced. It can due to the facts that the reform facilitates risk sharing through improving market institutions by promoting intra-regional trade or modernizing the financial institutions. From an indirect utility perspective, the welfare improvement is the saving from the less costly consumption insurance. Similarly, the welfare improvement through economic growth is the reduction of willingness to pay for 1% extra growth in consumption in the post reform era compare to the pre reform era. When consumption growth is high, the marginal utility of consumption is decreased. Thus, agents consume more and are less willing to forgone consumption to invest for higher growth. These two measures characterize the effectiveness of two policies, namely reducing consumption volatility and promoting 1% consumption growth. Using the post reform data, we suggest a more effective policy for improving welfare between these two alternatives.

In order to evaluate the overall welfare change before and after the reform, we compute

the lifetime utility by

$$U = \frac{\exp((1-\gamma)(\alpha - \frac{\gamma}{2}\sigma^2))}{(1-\gamma)(1-\beta(1+g)^{(1-\gamma)})} \quad (6)$$

and compare the value difference before and after the reform by $U_{post} - U_{pre}$. Furthermore, the welfare gain can be decomposed as

$$\% \Delta U = -\frac{\gamma(1-\gamma)}{2} \Delta \sigma^2 + \frac{\beta(1-\gamma)(1+g)^{-\gamma}}{1-\beta(1+g)^{1-\gamma}} \Delta g \quad (7)$$

The welfare gain is decomposed into the volatility effect in the first term and the growth effect in the second term. Therefore, we can determine whether the volatility reduction in consumption contribute to welfare gain by looking at the changes in consumption volatility.

2.1 Alternative Model

We employ another specification of the consumption process as a robustness check. In this economy, consumers have the CRRA utility and consumption process with an autoregressive process for the growth factor of real consumption per capita as follows

$$f_t = (1-\alpha)(1+g) + \alpha f_{t-1} + \varepsilon_t \quad (8)$$

where $f_t = c_t/c_{t-1}$ is the growth factor of real consumption per capita and $\varepsilon_t \sim N(0, \sigma^2)$. This process is also used in Robe and Pallage (2003) which allows us to compare our results to a larger set of countries. Using the CRRA utility with this consumption process, Dolmas (1998) shows the welfare implications of persistence in consumption series. The welfare gain is twice as much as the one derived from consumption process with independent shocks. With this model, we show that the life-time utility can be written recursively as

$$\begin{aligned} V(c_t, f_t) &= c_t W(f_t) \\ &= c_t \left\{ 1 + \beta E_t [f_{t+1} W(f_{t+1})]^{1-\gamma} \right\}^{\frac{1}{1-\gamma}}, \end{aligned} \quad (9)$$

where $W(f_t)$ is a stationary Bellman equation. We then use the solution strategy discussed in Jacobs et al (2005) to approximate $W(f_t)$ and define λ as:⁴

$$\lambda = \frac{W_d}{\sum_f \pi(f)W(f)} - 1 \quad (10)$$

where W_d is the life-time utility from consuming a consumption stream with deterministic growth rate at $(1 - \alpha)(1 + g)$, $\pi(f)$ is the unconditional probability of having growth rate f . To calculate the welfare from 1% extra growth, we solve life-time utility of the agent with a 1% extra trend growth rate process:

$$f_t = (1 - \alpha)(1 + g + 1\%) + \alpha f_{t-1} + \varepsilon_t \quad (11)$$

and then define the welfare gain of this 1% extra growth rate as

$$\eta = \frac{\sum_f \pi_g(f)W_g(f)}{\sum_f \pi(f)W(f)} - 1 \quad (12)$$

where π_g and W_g are correspondingly the unconditional probability vector and value under the 1% extra growth rate process.

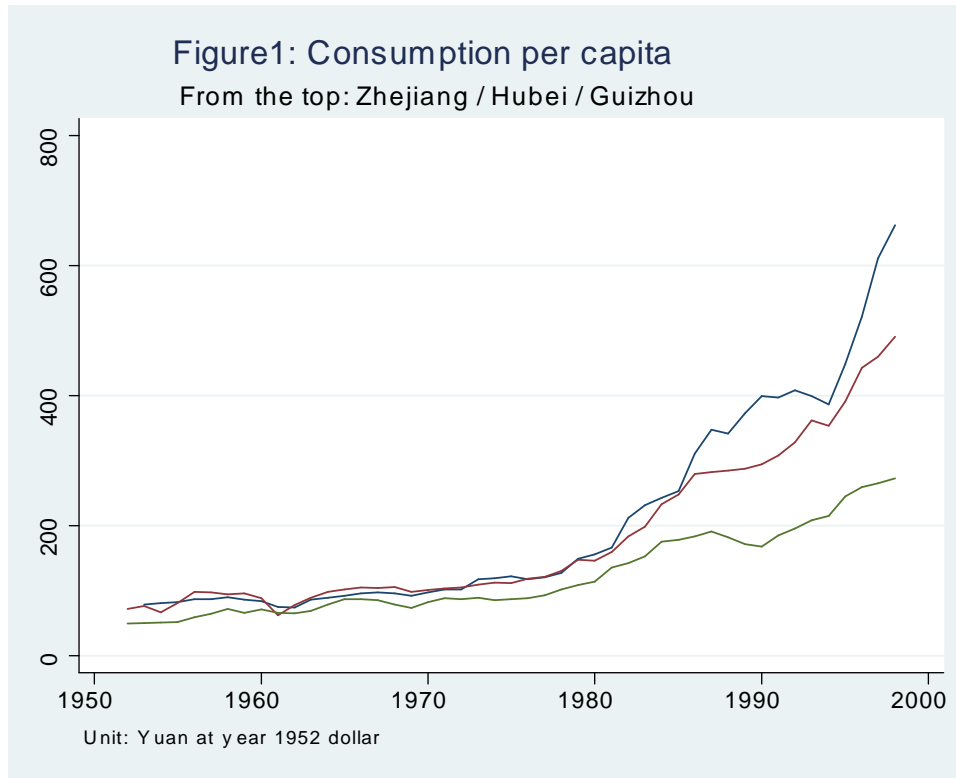
3 Data and Calibration

3.1 The Data

The data used in this study is obtained from the Comprehensive Statistical Data and Materials on 50 Years of New China. We use population, household consumption⁵ and CPI to compute the annual real consumption per capita for each province over the period of

⁴We first use Tauchen (1984) to obtain a finite states Markov-chain approximation to the consumption process and then we iterate W until converge. Details of the solution method can be found in Jacob et al (2005).

⁵Ravillion (2003) argues that the average consumption from income survey is significantly lower than the private consumption in national accounts, but it is not the case for consumption from expenditure survey. We employ data at provincial level to obtain more accurate information on household consumption, but try to minimize the measurement error from survey data.



1952–1998.⁶ Although there is not much debates on the consumption data, but researchers such as Rawski (2001) cast the doubt on the reliability of the GDP data after year 1998. In order to avoid the data problem and produce results comparable to the literature of output growth, we use data from the time period before year 1998. In order to facilitate comparison, we categorize the provinces into three groups, namely eastern, central and western regions. The development of Chinese economy start from the coastal area and then move to inland area, the grouping also represents the stages of development. Figure 1 depicts the consumption paths of a province with highest consumption growth in each region. It shows that Zhejiang in the eastern region have a higher growth than Hubei and Guizhou in the central and western regions, respectively. However, the consumption path of Zhejiang is more volatile than the other two provinces. The channels through which the reform affects consumption and hence welfare of each province are different.

⁶There are 23 provinces in the sample. For the provinces with data start from 1952, it includes Beijing and Tianjin in the east; Hebei, Hubei and Hunan in the central; Shanxi, Guizhou, Yunnan, Shaanxi, Gansu, Qinghai and Xinjiang in the west. For the provinces with data start from 1953, it has Liaoning, Jilin, Helongjiang, Shanghai, Jiangsu, Zhangjiang, Fujian and Shangdong in the east; Anhui and Henan in the central; Inner Mogolia in the west. All provinces with data ended in 1998.

3.2 Calibration

For computing the welfare cost of consumption volatility and welfare gain of extra 1% of consumption growth, it requires the parameter σ to capture the consumption volatility and g to captures the consumption growth in the sample period respectively. For each province, we apply the OLS estimation to the $\ln c_t$ on a constant and time trend to obtain the law of motion of consumption. The growth rate g is recovered from the coefficient of time trend and the σ is computed from the standard deviation of the regression residual. In Table 1, the aggregate growth rate is higher than the average provincial growth rate, it can be due to the missing data on provinces with higher growth such as Guangdong. In general, we observe the eastern and central regions have higher growth (at 3.9%) than the west (at 3.5%). On the other hand, the aggregate level volatility is lower than the provincial volatility due to the cancellation of idiosyncratic shocks from provinces. Moreover, the consumption volatility in the east is higher that in the central and western regions. For calculating the overall welfare, we use the coefficients of the constant term plus $\frac{\sigma^2}{2}$ to calibrate the parameter α .

The second law of motion of consumption is estimated by running an AR(1) regression for factor growth of consumption per capita. If the coefficient of lag consumption growth factor is not significant at 5% significance level. We then assume that it is zero and re-estimate the law of motion by running the growth factor on a constant. Using the coefficients of lag consumption growth factor and constant term, we recover the parameter of consumption growth and compute σ from the standard deviation of the regression residual. In Table 5, we observe the eastern and central regions have higher growth (at 4.4 and 4.3% respectively) than the west (at 4%). On the other hand, the aggregate level volatility is more than 40% lower than the provincial volatility and the volatility in the western region is higher that in the other regions.

For the parameters used in the CRRA utility, we use the parameters estimated from the literature. Following the literature, one of the common used discount factor β are 0.95 and 0.99. As suggested in Robe and Pallage (2003), we choose the one with more conservative value for discounting, due to the uncertainty in developing countries is usually higher than the developed countries. For the coefficient of relative risk aversion γ , we use the value 2

and 5 which are within the range of acceptable values as reported in Mehra and Prescott (1985). We aware that it may not be fit for matching the model to equity premium using the consumption based model since asset pricing literature have pursued γ even larger than 50, but we do not intend entering into the debate in this direction.

4 Empirical Results

We perform the welfare calculations for the calibrated Lucas (1987) economy using aforementioned parameterization. The effects at the aggregate and regional levels are shown in this section and the detailed analysis for provinces are shown in the Appendix.

4.1 Growth and Volatility

Using the data from the whole sample, we compare the welfare gain from eliminating consumption fluctuation and promoting additional 1% consumption growth in Table 1. Eliminating consumption fluctuation at aggregate level increases 2.2% and 5.4% of lifetime consumption for γ equal to 2 and 5, respectively. On the other hand, the corresponding welfare gain from extra 1% growth are 9.1% and 3.6%. Therefore, stabilization policy can be an effective tool to improve welfare in China.

Comparing the results to those in Robe and Pallage (2003), the welfare gain from stabilization for China is 50% of that for developing countries in Africa and 4 times larger than that for U.S. It suggests that the consumption patterns in China resemble those in developing countries. The similarities between the African countries and China are driven by the stages of economic development and institutions, i.e. low income countries with non-democratic regimes. Acemoglu and Zilibotti (1997) illustrate a positive relationship between initial income and volatility because poorer countries have less diversified sectoral distribution of output. Raddatz (2007) suggests that changes in commodity prices, climatic disasters⁷ and humanitarian disasters⁸ affect income in developing countries significantly and contribute to volatility.

⁷Including floods, droughts, extreme temperature, and wind storms

⁸Including famines and epidemics

In terms of institutional factors, Rodrik and Wacziarg (2005) document that non-democratic are more volatile than democratic regimes. Acemoglu et al (2003) argue that weak institutions⁹ are less able to handle state failure, such as revolution, because it cannot resist the powerful politicians to exploit their positions which may lead to disastrous consequences. Furthermore, Henisz (2004) shows that countries with less check and balanced political procedures are related to more uncertainty in government spending which leads to macroeconomic volatility.

TABLE 1: Welfare Gains - Full Sample

<i>Region</i>	<i>g</i>	<i>σ</i>	λ		η	
			$\gamma = 2$	$\gamma = 5$	$\gamma = 2$	$\gamma = 5$
<i>Nation</i>	4.1	14.7	2.2	5.4	9.1	3.6
<i>Median</i>	3.7	15.0	2.3	5.7	9.5	3.9
<i>Eastern Median</i>	3.9	15.9	2.5	6.3	9.2	3.8
<i>Central Median</i>	3.8	15.9	2.5	6.3	9.3	3.8
<i>Western Median</i>	3.6	14.0	2.0	4.9	9.6	4.0

Units for eliminating consumption volatility, λ , and promoting consumption growth, η , are: % unconditional mean of consumption

Units for g and σ : %

Source: Appendix 1

4.2 Risk Sharing

Table 1 show that the welfare gain from eliminating consumption volatility at provincial level is 0.1% (or 0.3%) higher than that at aggregate level for $\gamma = 2$ (or 5). It is consistent with the results in Jacob et al (2005) for U.S. Furthermore, the differential in welfare gain is more prominent in the eastern and central regions in which the growth and volatility are higher. The welfare implications of incomplete market is strong in China because there are idiosyncratic shocks cannot be shared by the households. Under the planned economy before the reform, the market integration was weak due to the limited trade within the country. Since the reform, the economy has relied more on the market mechanism to

⁹Defined as lack of constraints on executives and ineffective enforcement of property rights

allocate resources and promoted more specialization in production structure through inter-provincial trade.¹⁰

To assess the impacts of the reform on risk sharing, we compare the aggregate and provincial welfare gain from reducing consumption volatility before and after the reform in Table 2. There is a welfare loss of 0.1% (or 0.3%) of lifetime consumption at aggregate level due to higher consumption volatility in the post reform era whereas the provincial data suggests a welfare gain by 0.1% (or 0.2%) of consumption at $\gamma = 2$ (or 5). The contrasting results are due to the reduction of consumption volatility at provincial level but not at aggregate level. Consumption synchronization across provinces induces high aggregate volatility because the aggregate volatility takes the correlation of provincial consumption into account.¹¹ Furthermore, the western region enjoys more risk sharing effect than the other regions even though it has lower growth in consumption.

TABLE 2: Welfare Gain of Consumption Stabilization, λ

<i>Region</i>	<i>Pre Reform</i>			<i>Post Reform</i>			$\Delta\lambda$	
	σ	$\gamma = 2$	$\gamma = 5$	σ	$\gamma = 2$	$\gamma = 5$	$\gamma = 2$	$\gamma = 5$
<i>Nation</i>	4.2	0.2	0.4	5.4	0.4	0.7	-0.1	-0.3
<i>Median</i>	8.3	0.7	1.7	7.2	0.5	1.3	0.1	0.2
<i>Eastern Median</i>	7.9	0.6	1.5	7.7	0.6	1.5	0.1	0.2
<i>Central Median</i>	9.1	0.8	2.1	7.8	0.6	1.5	-0.1	-0.3
<i>West Median</i>	8.5	0.7	1.8	6.0	0.4	0.9	0.4	0.9

Note: $\Delta\lambda = -(\lambda_{post} - \lambda_{pre})$; *Unit for σ is %*

Source: Appendix 2

Although Boyreau-Debray and Wei (2005) document that variance ratio of consumption to output increases after the reform, the volatility ratio of provincial to aggregate consumption is reduced. It suggests that, in the post reform period, households share more risk by

¹⁰ Although the inter-provincial trade increases after the reform, the evidences on inter-provincial trade in the post-reform era are mixed. Naughton (2003) shows that the inter-provincial trade was large in China and increased during the period between 1987 and 1992. However, Poncet (2003) shows that the inter-provincial trade decreased from 1987 to 1997 whereas the foreign trade increased.

¹¹ Barthelemy and Poncet (2005) argue that trade integration and fiscal policy coordination synchronize business cycle across provinces. As a result, it can increase output volatility and hence increase consumption volatility at aggregate level.

trading with other provinces,¹² but subject to larger aggregate risk such as demand fluctuation of external trade. Moreover, the welfare gain from low consumption volatility can be induced by low output volatility due to the diversified sector distribution of output from non state-owned enterprises, management of external shocks such as natural disasters and inter-regional fiscal transfers (Tochkov, 2007).

TABLE 3: Relative Gain of Stabilization to Growth

<i>Region</i>	<i>Pre Reform λ/η</i>			<i>Post Reform λ/η</i>		
	<i>g</i>	$\gamma = 2$	$\gamma = 5$	<i>g</i>	$\gamma = 2$	$\gamma = 5$
<i>Nation</i>	2.2	1.6	8.1	6.3	4.0	28.8
<i>Median</i>	2.0	6.1	30.3	4.6	7.2	46.4
<i>Eastern Median</i>	1.9	5.3	27.7	5.3	8.3	57.0
<i>Central Median</i>	2.0	8.3	41.3	4.6	7.8	55.9
<i>West Median</i>	2.3	6.1	30.4	3.7	3.7	22.6

Unit for g and λ/η : %

Source: Appendix 3

The discrepancy between aggregate and provincial analysis also affects the comparison between the gains from stabilization and growth policies. Using the aggregate data, we would conclude that eliminating consumption fluctuation becomes more important to improve welfare after the reform. For instance, as shown in the first two rows of Table 3, the ratio λ/η increases from 1.6 to 4 for $\gamma = 2$. However, the provincial data show a milder change in which λ/η increases only from 6.1 to 7.2. Therefore, the provincial framework provides more accurate results than the aggregate framework in face of time varying correlation of provincial consumption.

The relative gain of stabilization to growth policy varies across regions. Before the reform, the ratio λ/η suggests stabilization policy is more effective in the central region. After the reform, in addition to the central region, the effect of stabilizing consumption is high in the eastern region. This recent phenomenon in the east is driven by the investment

¹²Young (2000) argues that the markets are not integrated within China due to the local protectionism. In contrast to higher trade barrier for production, our results suggests it does not greatly affect the household to share their consumption risks across provinces.

led growth which increases the volatility in consumption and output. For example, the ratios λ/η in Jiangsu, Zhejiang and Shangdong province in the east and Henan in the central become higher than 1 (see Appendix 3) after the reform. On the other hand, the consumption patterns in the west become more stable. It can due to the agricultural sectors are less subject to climatic shocks, the rural financial system is more capable to provide risk sharing contract and the transportation infrastructure is better developed for trading with other provinces. The empirical results suggest the current policy for the western region would focus on promoting consumption growth whereas stabilization policy have larger room to improve welfare in the eastern and central regions.

4.3 Overall Welfare

The eastern region is characterized by both high consumption growth and volatility. People in this region perceive high cost of consumption fluctuation despite its superior economic performance in growth. The consumption in the western region is smoother but the growth is slower than the eastern counterpart, thus it induces lower welfare gain of consumption growth but incurs lower welfare cost from volatility. From a welfare perspective, Chinese face a tradeoff of growth and volatility as advocated by Ramey and Ramey (1995). Therefore, we calculate the value of lifetime utility to examine the net effect in Table 4. The utility for the eastern region is higher than that for the other regions which suggests the growth effect dominates the volatility effect in evaluating overall welfare.

TABLE 4: Overall Welfare Analysis

<i>Region</i>	<i>Lifetime Utility</i>		<i>% ΔU</i>	
	$\gamma = 2$	$\gamma = 5$	$\gamma = 2$	$\gamma = 5$
<i>Nation</i>	-1.8	-91.3	67.9	97.3
<i>Median</i>	-2.0	-113	65.1	97.2
<i>Eastern Median</i>	-1.4	-29.7	66.8	96.8
<i>Central Median</i>	-2.1	-176	65.8	97.6
<i>West Median</i>	-1.9	-97.1	62.8	96.8

Unit: $\gamma = 2$ is $10e^{-1}$ and $\gamma = 5$ is $10e^{-9}$

Source: Appendix 4

Looking into the welfare improvements across regions, the improvements from the reform is higher in the eastern than the other regions. In particular, the gains for the eastern, central and western regions are 67%, 66% and 63%, respectively. The welfare gains at provincial level (see Appendix 4) illustrates the gains from the reform across provinces are unequal which range from 50% to 75% of the pre-reform lifetime utility for $\gamma = 2$. Moreover, it shows that the proportion of provinces in the western region enjoy welfare gain from the volatility reduction is higher than that in the eastern and central regions. It is also the reason that the welfare gain of the western region is higher than the central region if the consumers have stronger preferences on stable consumption, i.e. $\gamma = 5$.

TABLE 5: Transition Matrix

<i>Group</i>	<i>High</i>	<i>Medium</i>	<i>Low</i>	<i>Total</i>
<i>High</i>	6	1	0	7
<i>Medium</i>	0	3	4	7
<i>Low</i>	1	3	5	8

Note: $\gamma = 2$

Note: High = rank 1-7; Medium = rank 8-16; Low = rank 17-23

Even though the eastern region experiences higher welfare gain than the other two regions, it is informative to examine the intra-distribution dynamics of welfare at provincial level. According to the utility level, we rank the provinces in descending order (see Appendix 4) and then divide the provinces into three groups, namely high, middle and low welfare groups.¹³ As shown in Table 5, most of the mobility of provinces across welfare groups comes from the medium and low utility groups. After the reform, there is about 50% chance for a province to move from the medium to low utility group and vice versa. It shows the reform does not only improve the utility of all provinces, it also helps the provinces with low utility, such as Jiangsu and Zhejiang in the east, to catch up with those provinces enjoying medium level of utility. However, there is not much mobility between high welfare provinces and

¹³The high welfare group includes the provinces ranked 1 to 7; the middle welfare group includes provinces ranked 8 to 16; the low welfare group includes provinces ranked 17 to 23.

the provinces in the other two groups which suggests a divergence in utility between the provinces with high utility and the other provinces. Using utility as a summary measure of welfare from consumption growth and volatility, our results confirms the income divergence between coastal and other regions in Zhang et al (2001) and bimodal income distribution in Aziz and Duenwald (2003).

4.4 Alternative Model

We repeat the above experiment with persistent shock specification to the consumption process to check for the robustness of our result. With such specification, we generally have higher trend consumption growth rate and smaller variance in consumption. For example, in Table 5, the provincial median and aggregate trend growth rate are all slightly higher and the σ are all smaller than the corresponding measures under the previous specification in the whole sample, pre-reform sample and post-reform sample period.

TABLE 5: Descriptive Statistics for Alternative Model

<i>Persistent</i>	<i>g</i>	<i>σ</i>	<i>Pre Reform</i>		<i>Post Reform</i>	
			<i>g</i>	<i>σ</i>	<i>g</i>	<i>σ</i>
<i>Nation</i>	4.4	4.5	2.8	4.1	6.7	4.3
<i>Median</i>	4.2	6.6	2.9	6.6	5.7	6.1
<i>Trend Stationary</i>						
<i>Nation</i>	4.1	14.7	2.2	4.2	6.3	5.4
<i>Median</i>	3.7	15.0	2.0	8.3	4.6	7.2

Unit for g and σ: %

Source: Appendix 1, 2, 3, 5, 6, & 7

Focusing back to the welfare evaluation of the reform policy under this consumption specification in the last two columns of Table 6. We find that, as shown in Table 6, the welfare gain from reducing volatility at aggregate level is higher in this case—the gain is 0.6% for $\gamma = 2$ (or 1.3% for $\gamma = 5$) of lifetime consumption after the introduction of economic reform. Comparing these two numbers to the responding measures in the previous case, the welfare gain for stabilizing consumption is even larger if we employ this consumption

process specification. The welfare gain from eliminating consumption volatility at provincial level is 3.6% higher than that at aggregate level. The welfare implication of incomplete market is stronger under this specification where the consumption process is more persistent. As shown in Appendix 6, the consumption process is unit root as many of the α are 0. Therefore, with the same magnitude of shock, the consumption path is more volatile since the change in the consumption is perceived to be permanent. It implies that the gain from reducing the market incompleteness is more substantial than the benchmark case. On the other hand, as depicted in Appendix 3 and 7, the welfare gain from having extra 1% growth do not change significantly under this consumption specification. As a result, the relative gain of stabilization to growth policy is larger where Table 6 shows that the ratio $\lambda/\eta \approx 40\%$ for $\gamma = 2$ (or $\approx 100\%$ for $\gamma = 5$).

TABLE 6: Welfare Gain & Relative Gain

<i>Region</i>	$\Delta\lambda$		<i>Pre Reform</i> (λ/η)		<i>Post Reform</i> (λ/η)	
	$\gamma = 2$	$\gamma = 5$	$\gamma = 2$	$\gamma = 5$	$\gamma = 2$	$\gamma = 5$
<i>Nation</i>	0.6	1.3	16.5	42.1	16.9	46.2
<i>Median</i>	2.3	3.8	42.9	106	37.6	95.5
<i>Eastern Median</i>	2.5	3.9	40.7	95.3	42.1	104
<i>Central Median</i>	1.1	1.5	38.1	93.7	31.8	81.3
<i>West Median</i>	1.9	3.8	44.1	108	38.9	97.7

Unit of λ : % of unconditional mean of consumption; Unit of λ/η : %
Sources: Appendix 6 & 7

In summary, our results are robust to an alternative consumption process with higher persistence. Moreover, it is evident that a more persistent consumption process induces higher welfare gain from stabilization.

5 Conclusion

This paper finds that the welfare gain from eliminating consumption volatility or increasing growth in China are close to other developing countries. The welfare implications of

incomplete market are quantitatively important in where stabilization policy has significant impacts on improving welfare. Moreover, we show that the eastern region enjoys the highest overall welfare gain due to the high consumption growth. Furthermore, our results suggest that the current policy for the western region would focus on promoting consumption growth whereas stabilization policy have larger room to improve welfare in the eastern and central regions. Using utility as a welfare measure to account for both consumption growth and volatility, our results also indicates that the reform does not only improve the utility of all provinces, it also helps the provinces with low utility to catch up with those provinces enjoying utility in the medium range. However, there is a divergence in utility between the high utility provinces and the other provinces.

Further research can extend our research in two aspects. First, an reliable estimates of relative risk aversion is essential to produce accurate policy analysis. Estimation for this deep parameter is of policy interest. Second, we show that agents are costly to insure their consumption risks under incomplete market. Using individual level data in China to explore the implications of incomplete market at a more disaggregate level is another avenue for further research.

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Appendix 1: Welfare Analysis - Full Sample

<i>Region</i>	<i>g (%)</i>	<i>σ (%)</i>	Gain of λ		Gain of η	
			$\gamma = 2$	$\gamma = 5$	$\gamma = 2$	$\gamma = 5$
<i>Eastern</i>						
<i>Beijing</i>	3.0	28.8	8.3	20.8	10.2	4.6
<i>Tianjin</i>	4.1	12.6	1.6	4.0	9.0	3.6
<i>Liaoning</i>	3.7	15.1	2.3	5.7	9.5	3.9
<i>Jilin</i>	3.5	10.1	1.0	2.6	9.6	4.1
<i>Helongjiang</i>	2.7	11.1	1.2	3.1	10.6	4.9
<i>Shanghai</i>	3.6	28.0	7.9	19.7	9.5	4.0
<i>Jiangsu</i>	4.8	15.3	2.3	5.9	8.4	3.2
<i>Zhejiang</i>	5.0	21.8	4.7	11.8	8.3	3.1
<i>Fujian</i>	4.3	21.7	4.7	11.8	8.8	3.5
<i>Shangdong</i>	4.4	16.5	2.7	6.8	8.8	3.4
<i>Central</i>						
<i>Hebei</i>	3.5	15.9	2.5	6.3	9.7	4.1
<i>Anhui</i>	3.8	10.7	1.1	2.9	9.3	3.8
<i>Henan</i>	3.7	17.3	3.0	7.5	9.5	4.0
<i>Hubei</i>	4.2	18.7	3.5	8.8	8.9	3.5
<i>Hunan</i>	4.1	12.8	1.6	4.1	9.0	3.6
<i>Western</i>						
<i>Shanxi</i>	3.6	14.8	2.2	5.5	9.6	4.0
<i>Inner Mogolia</i>	3.6	14.9	2.2	5.5	9.6	4.0
<i>Guizhou</i>	3.7	11.5	1.3	3.3	9.5	3.9
<i>Yunnan</i>	4.1	12.1	1.5	3.6	9.0	3.6
<i>Shaanxi</i>	3.1	12.6	1.6	4.0	10.0	4.4
<i>Gansu</i>	3.7	27.6	7.6	19.0	9.5	3.9
<i>Qinghai</i>	3.2	13.2	1.7	4.3	10.0	4.4
<i>Xinjiang</i>	2.8	17.5	3.1	7.7	10.6	4.8
<i>Nation</i>	4.1	14.7	2.2	5.4	9.1	3.6
<i>Median</i>	3.7	15.0	2.3	5.7	9.5	3.9
<i>Eastern Median</i>	3.9	15.9	2.5	6.3	9.2	3.8
<i>Central Median</i>	3.8	15.9	2.5	6.3	9.3	3.8
<i>Western Median</i>	3.6	14.0	2.0	4.9	9.6	4.0

Unit for g and σ are: %

Units for eliminating consumption volatility, λ, and promoting consumption growth, η, are: % unconditional mean of consumption

Appendix 2: Welfare Gain of Consumption Stabilization, λ

<i>Region</i>	<i>Pre Reform</i>			<i>Post Reform</i>			$\Delta\lambda$	
	σ	$\gamma = 2$	$\gamma = 5$	σ	$\gamma = 2$	$\gamma = 5$	$\gamma = 2$	$\gamma = 5$
<i>Eastern</i>								
<i>Beijing</i>	22.1	4.9	12.3	9.4	0.9	2.2	4.0	10.1
<i>Tianjin</i>	9.0	0.8	2.0	7.1	0.5	1.3	0.3	0.8
<i>Liaoning</i>	7.1	0.5	1.3	4.3	0.2	0.5	0.3	0.8
<i>Jilin</i>	5.5	0.3	0.8	7.2	0.5	1.3	-0.2	-0.5
<i>Helongjiang</i>	7.8	0.6	1.5	6.6	0.4	1.1	0.2	0.4
<i>Shanghai</i>	16.2	2.6	6.6	8.2	0.7	1.7	2.0	5.1
<i>Jiangsu</i>	7.4	0.5	1.4	10.4	1.1	2.7	-0.5	-1.4
<i>Zhejiang</i>	7.9	0.6	1.6	10.5	1.1	2.8	-0.5	-1.2
<i>Fujian</i>	6.6	0.4	1.1	6.7	0.5	1.1	-0.0	-0.1
<i>Shandong</i>	9.0	0.8	2.0	11.6	1.3	3.3	-0.5	-1.4
<i>Central</i>								
<i>Hebei</i>	7.0	0.4	1.2	7.8	0.6	1.5	-0.1	-0.3
<i>Anhui</i>	9.1	0.8	2.1	11.1	1.2	3.1	-0.4	-1.1
<i>Henan</i>	10.4	1.1	2.7	11.7	1.4	3.5	-0.3	-0.7
<i>Hubei</i>	11.0	1.2	3.0	7.6	0.6	1.4	0.6	1.6
<i>Hunan</i>	5.8	0.3	0.8	6.6	0.4	1.1	-0.1	-0.3
<i>Western</i>								
<i>Shanxi</i>	8.6	0.7	1.8	5.7	0.3	0.8	0.4	1.0
<i>Inner Mongolia</i>	8.3	0.7	1.7	11.7	1.4	3.4	-0.7	-1.7
<i>Guizhou</i>	7.9	0.6	1.6	8.3	0.7	1.7	-0.1	-0.2
<i>Yunnan</i>	7.6	0.6	1.4	6.9	0.5	1.2	0.1	0.2
<i>Shaanxi</i>	8.1	0.7	1.6	6.0	0.4	0.9	0.3	0.7
<i>Gansu</i>	34.0	11.6	29.0	6.1	0.4	0.9	11.2	32.6
<i>Qinghai</i>	16.3	2.7	6.6	5.9	0.4	0.9	2.3	6.0
<i>Xinjiang</i>	9.5	0.9	2.3	4.4	0.2	0.5	0.7	1.8
<hr/>								
<i>Nation</i>	4.2	0.2	0.4	5.4	0.4	0.7	-0.1	-0.3
<i>Median</i>	8.3	0.7	1.7	7.2	0.5	1.3	0.1	0.2
<i>Eastern Median</i>	7.9	0.6	1.5	7.7	0.6	1.5	0.1	0.2
<i>Central Median</i>	9.1	0.8	2.1	7.8	0.6	1.5	-0.1	-0.3
<i>West Median</i>	8.5	0.7	1.8	6.0	0.4	0.9	0.4	0.9

Note: $\Delta\lambda = -(\lambda_{post} - \lambda_{pre})$

Units for eliminating consumption volatility, λ , is: % unconditional mean of consumption

Units for σ is %

Appendix 3: Welfare Gain of Growth, η , and Relative Gain

Region	Pre Reform					Post Reform				
	g	$\gamma = 2$	$\gamma = 5$	(λ/η)		g	$\gamma = 2$	$\gamma = 5$	(λ/η)	
				$\gamma = 2$	$\gamma = 5$				$\gamma = 2$	$\gamma = 5$
<i>Eastern</i>										
<i>Beijing</i>	-0.2	16.5	14.8	29.8	82.6	3.8	9.4	3.9	9.4	56.9
<i>Tianjin</i>	2.8	10.5	4.8	7.7	42.5	5.3	8.0	2.9	6.3	43.0
<i>Liaoning</i>	1.7	12.2	6.5	4.1	19.4	5.1	8.1	3.0	2.3	15.5
<i>Jilin</i>	2.3	11.1	5.4	2.8	14.3	4.3	8.8	3.5	5.9	37.4
<i>Helongjiang</i>	1.7	12.1	6.4	5.0	24.0	4.5	8.7	3.4	5.0	32.2
<i>Shanghai</i>	0.3	14.9	10.7	17.7	61.5	7.9	6.3	2.0	10.7	83.7
<i>Jiangsu</i>	2.9	10.4	4.7	5.2	28.8	5.9	7.5	2.7	14.4	102
<i>Zhejiang</i>	2.0	11.6	5.9	5.4	26.6	7.1	6.8	2.2	16.4	124
<i>Fujian</i>	1.6	12.3	6.6	3.5	16.3	8.0	6.3	2.0	7.2	57.1
<i>Shangdong</i>	2.4	11.1	5.3	7.3	37.9	5.4	7.9	2.9	16.8	115
<i>Central</i>										
<i>Hebei</i>	1.6	12.4	6.7	3.9	17.9	5.5	7.8	2.8	7.8	54.0
<i>Anhui</i>	3.2	10.0	4.4	8.3	47.4	4.2	8.9	3.5	13.9	87.9
<i>Henan</i>	1.6	12.3	6.6	8.9	41.3	4.5	8.6	3.3	16.0	103
<i>Hubei</i>	2.0	11.7	5.9	10.3	50.9	6.1	7.4	2.6	7.8	55.9
<i>Hunan</i>	2.5	10.9	5.2	3.0	16.0	4.6	8.5	3.3	5.1	33.0
<i>Western</i>										
<i>Shanxi</i>	1.7	12.1	6.4	6.1	28.8	4.1	9.0	3.6	3.7	22.9
<i>Inner Mongolia</i>	2.1	11.4	5.7	6.1	30.7	2.2	11.3	5.5	12.2	62.1
<i>Guizhou</i>	2.5	10.9	5.2	5.8	30.4	3.9	9.2	3.7	7.5	46.4
<i>Yunnan</i>	2.9	10.4	4.7	5.5	30.3	5.6	7.7	2.8	6.1	42.7
<i>Shaanxi</i>	1.7	12.2	6.5	5.3	25.0	3.4	9.8	4.2	3.7	21.4
<i>Gansu</i>	2.5	10.9	5.1	106	565	3.4	9.8	4.2	3.8	22.3
<i>Qinghai</i>	3.1	10.1	4.5	26.2	149	2.6	10.7	5.0	3.3	17.7
<i>Xinjiang</i>	0.1	14.3	9.5	6.3	23.8	4.6	8.5	3.3	2.3	14.8
<i>Nation</i>	2.2	11.3	5.5	1.6	8.1	6.3	7.3	2.5	4.0	28.8
<i>Median</i>	2.0	11.6	5.9	6.1	30.3	4.6	8.5	3.3	7.2	46.4
<i>Eastern Median</i>	1.9	11.9	6.1	5.3	27.7	5.3	8.0	2.9	8.3	57.0
<i>Central Median</i>	2.0	11.7	5.9	8.3	41.3	4.6	8.5	3.3	7.8	55.9
<i>West Median</i>	2.3	11.2	5.4	6.1	30.4	3.7	9.5	4.0	3.7	22.6

Units for eliminating consumption volatility, λ , and promoting consumption growth, η , are:

% unconditional mean of consumption

Unit for η : %

Appendix 4: Overall Welfare Analysis

<i>Region</i>	<i>Full Sample</i>		<i>Pre Reform</i>		<i>Post Reform</i>		$\Delta U(\sigma)$
	$\gamma = 2$	$\gamma = 5$	$\gamma = 2$	$\gamma = 5$	$\gamma = 2$	$\gamma = 5$	
<i>Eastern</i>							
<i>Beijing</i>	-0.9	-6.16	-0.95 (2)	-1.45 (2)	-0.35 (3)	-0.07 (2)	<i>Yes</i>
<i>Tianjin</i>	-1.1	-10.3	-1.05 (3)	-5.59 (4)	-0.35 (2)	-0.10 (3)	<i>Yes</i>
<i>Liaoning</i>	-1.3	-25.5	-1.35 (6)	-11.5 (6)	-0.55 (4)	-0.40 (4)	<i>Yes</i>
<i>Jilin</i>	-1.5	-33.8	-1.45 (8)	-21.3 (8)	-0.55 (8)	-0.62 (8)	<i>No</i>
<i>Helongjiang</i>	-1.1	-7.40	-1.05 (4)	-4.74 (3)	-0.55 (5)	-0.44 (5)	<i>Yes</i>
<i>Shanghai</i>	-0.8	-3.46	-0.75 (1)	-0.66 (1)	-0.35 (1)	-0.07 (1)	<i>Yes</i>
<i>Jiangsu</i>	-2.3	-268	-2.15 (18)	-11.3 (18)	-0.65 (9)	-1.12 (11)	<i>No</i>
<i>Zhejiang</i>	-2.2	-283	-2.05 (17)	-72.2 (16)	-0.55 (7)	-0.96 (10)	<i>No</i>
<i>Fujian</i>	-2.0	-172	-1.95 (12)	-48.8 (13)	-0.65 (11)	-2.07 (17)	<i>No</i>
<i>Shangdong</i>	-2.6	-406	-2.45 (21)	-163 (21)	-0.75 (18)	-2.32 (18)	<i>No</i>
<i>Central</i>							
<i>Hebei</i>	-1.8	-86.9	-1.85 (11)	-41.9 (11)	-0.75 (15)	-1.91 (16)	<i>No</i>
<i>Anhui</i>	-2.3	-205	-2.25 (19)	-139 (19)	-0.85 (20)	-2.44 (19)	<i>No</i>
<i>Henan</i>	-2.9	-604	-2.85 (23)	-245 (23)	-1.05 (23)	-6.72 (23)	<i>No</i>
<i>Hubei</i>	-2.1	-176	-2.05 (15)	-62.5 (15)	-0.65 (12)	-1.50 (14)	<i>Yes</i>
<i>Hunan</i>	-2.0	-140	-2.05 (16)	-75.8 (17)	-0.65 (13)	-1.12 (12)	<i>No</i>
<i>Western</i>							
<i>Shanxi</i>	-2.0	-113	-1.95 (14)	-56.6 (14)	-0.75 (16)	-1.58 (15)	<i>Yes</i>
<i>Inner Mogolia</i>	-1.8	-81.5	-1.85 (10)	-45.4 (12)	-0.65 (14)	-0.69 (9)	<i>No</i>
<i>Guizhou</i>	-2.6	-361	-2.65 (22)	-222 (22)	-0.95 (22)	-4.74 (22)	<i>No</i>
<i>Yunnan</i>	-2.3	-253	-2.35 (20)	-142 (20)	-0.75 (19)	-2.83 (21)	<i>Yes</i>
<i>Shaanxi</i>	-1.8	-65.9	-1.85 (9)	-39.2 (10)	-0.75 (17)	-1.44 (13)	<i>Yes</i>
<i>Gansu</i>	-2.4	-344	-1.95 (13)	-35.4 (9)	-0.85 (21)	-2.47 (20)	<i>Yes</i>
<i>Qinghai</i>	-1.4	-24.5	-1.35 (7)	-15.5 (7)	-0.65 (10)	-0.56 (7)	<i>Yes</i>
<i>Xinjiang</i>	-1.2	-12.6	-1.25 (5)	-6.24 (5)	-0.55 (6)	-0.52 (6)	<i>Yes</i>
<i>Nation</i>	-1.8	-91.3	-1.7	-44.2	-0.6	-1.20	<i>N/A</i>
<i>Median</i>	-2.0	-113	-1.9	-45.4	-0.6	-1.12	<i>N/A</i>
<i>Eastern Median</i>	-1.4	-29.7	-1.4	-16.4	-0.5	-0.53	<i>N/A</i>
<i>Central Median</i>	-2.1	-176	-2.0	-75.8	-0.7	-1.91	<i>N/A</i>
<i>West Median</i>	-1.9	-97.1	-1.9	-42.3	-0.7	-1.51	<i>N/A</i>

Unit for 2: $1e^{-1}$; Unit for 5: $1e^{-9}$; The bracket is the ranking of utility level among provinces
 $\Delta U(\sigma)$: Does volatility reduction contribute to overall welfare gain?

Appendix 5: Welfare Gain -Full Sample

<i>Region</i>	<i>a</i>	<i>g</i> (%)	σ (%)	Gain of λ		Gain of η	
				$\gamma = 2$	$\gamma = 5$	$\gamma = 2$	$\gamma = 5$
<i>Eastern</i>							
<i>Beijing</i>	0.0	3.1	10.2	13.3	23.7	13.2	11.6
<i>Tianjin</i>	0.0	4.5	6.8	4.5	4.8	10.0	4.4
<i>Liaoning</i>	0.0	4.2	5.6	3.1	3.4	10.3	4.4
<i>Jilin</i>	0.0	4.1	5.9	3.5	3.9	10.4	4.5
<i>Helongjiang</i>	0.0	3.7	8.8	8.6	11.5	11.6	6.8
<i>Shanghai</i>	0.0	4.1	8.0	6.6	8.0	10.8	5.5
<i>Jiangsu</i>	0.4	5.3	6.2	6.0	7.4	9.4	4.6
<i>Zhejiang</i>	0.0	5.1	7.7	5.4	5.7	9.5	4.2
<i>Fujian</i>	0.3	5.3	6.5	5.8	7.0	9.4	4.4
<i>Shandong</i>	0.0	4.9	7.8	5.6	6.1	9.7	4.4
<i>Central</i>							
<i>Hebei</i>	0.0	3.6	5.8	3.6	4.2	11.1	5.1
<i>Anhui</i>	-0.3	4.8	10.3	9.0	8.6	10.2	4.8
<i>Henan</i>	0.4	4.2	6.7	9.8	17.4	11.1	8.5
<i>Hubei</i>	0.0	4.7	9.2	8.4	10.0	10.3	5.4
<i>Hunan</i>	0.0	4.1	5.4	2.9	3.2	10.3	4.4
<i>Western</i>							
<i>Shanxi</i>	0.0	3.5	6.5	4.7	5.7	11.3	5.5
<i>Inner Mongolia</i>	0.4	3.7	6.0	7.8	13.2	11.5	7.7
<i>Guizhou</i>	0.0	4.0	6.5	4.4	5.0	10.6	4.9
<i>Yunnan</i>	0.0	4.5	6.6	4.2	4.5	10.0	4.3
<i>Shaanxi</i>	0.0	3.3	6.2	4.3	5.3	11.6	5.7
<i>Gansu</i>	0.3	5.3	21.4	.	.	54.3	23.4
<i>Qinghai</i>	-0.4	4.4	10.7	10.3	10.1	10.9	5.5
<i>Xinjiang</i>	0.0	3.3	5.8	3.8	4.6	11.5	5.5
<hr/>							
<i>Nation</i>	0.0	4.4	4.5	1.9	2.0	9.9	3.9
<i>Median</i>	<i>N/A</i>	4.2	6.6	5.5	5.9	10.6	5.1
<i>Eastern Median</i>	<i>N/A</i>	4.4	7.3	5.7	6.6	10.2	4.5
<i>Central Median</i>	<i>N/A</i>	4.2	6.7	8.4	8.6	10.3	5.1
<i>Western Median</i>	<i>N/A</i>	3.9	6.5	4.4	5.3	11.4	5.5

Unit for g and σ are: %

Units for eliminating consumption volatility, λ , and promoting consumption growth, η , are: % unconditional mean of consumption

Appendix 6: Welfare Gain of Consumption Stabilization, λ

Region	Pre Reform				Post Reform				$\Delta\lambda$	
	α	σ (%)	$\gamma = 2$	$\gamma = 5$	α	σ (%)	$\gamma = 2$	$\gamma = 5$	$\gamma = 2$	$\gamma = 5$
<i>Eastern</i>	0.0	10.9	22.0	.	0.0	8.8	7.1	7.8	14.9	.
<i>Beijing</i>	0.0	10.9	22.0	.	0.0	8.8	7.1	7.8	14.9	.
<i>Tianjin</i>	0.0	8.0	7.3	9.6	0.0	4.5	1.6	1.5	5.6	8.1
<i>Liaoning</i>	0.0	5.8	4.1	5.5	0.0	4.8	1.8	1.6	2.3	3.9
<i>Jilin</i>	0.0	6.2	4.7	6.1	0.0	5.3	2.3	2.2	2.4	3.9
<i>Helongjiang</i>	0.0	10.3	14.8	31.2	0.0	5.9	3.0	2.9	11.8	28.2
<i>Shanghai</i>	0.0	6.8	8.4	25.9	0.0	7.3	3.3	2.7	5.2	23.2
<i>Jiangsu</i>	0.0	5.9	4.0	5.0	0.6	5.5	6.7	7.1	-2.7	-2.1
<i>Zhejiang</i>	0.0	6.2	4.8	6.5	0.0	8.7	4.7	4.0	0.1	2.5
<i>Fujian</i>	0.0	6.0	4.6	6.6	0.0	6.1	2.2	1.7	2.5	4.9
<i>Shangdong</i>	0.0	6.6	5.2	6.9	0.0	8.7	5.2	4.6	0.0	2.2
<i>Central</i>										
<i>Hebei</i>	0.0	5.4	3.9	5.6	0.0	5.8	2.7	2.6	1.1	3.1
<i>Anhui</i>	-0.6	10.5	12.3	11.2	0.5	7.1	10.1	14.8	2.2	-3.6
<i>Henan</i>	0.0	6.2	5.1	7.4	0.5	7.3	11.3	19.2	-6.2	-11.8
<i>Hubei</i>	0.0	11.0	15.4	29.2	0.0	5.5	2.1	1.8	13.3	27.4
<i>Hunan</i>	0.0	5.3	3.2	3.9	0.0	5.6	2.6	2.4	0.7	1.5
<i>Western</i>										
<i>Shanxi</i>	0.0	6.8	5.8	7.9	0.0	6.3	3.8	4.2	1.9	3.8
<i>Inner Mongolia</i>	0.0	5.0	3.1	4.2	0.5	6.3	12.0	33.9	-8.9	-29.8
<i>Guizhou</i>	0.0	6.7	5.2	6.6	0.0	6.4	3.7	3.7	1.5	2.9
<i>Yunnan</i>	0.0	6.6	4.7	5.5	0.0	6.7	3.6	3.4	1.1	2.1
<i>Shaanxi</i>	0.0	6.9	5.9	8.1	0.0	5.2	2.7	2.9	3.2	5.2
<i>Gansu</i>	0.0	29.0	.	.	0.0	6.5	4.3	4.9	.	.
<i>Qinghai</i>	-0.4	13.4	15.9	15.7	0.0	4.4	2.2	2.7	13.7	13.0
<i>Xinjiang</i>	0.0	6.2	5.5	8.9	0.0	4.7	1.9	1.9	3.6	7.0
<i>Nation</i>	0.0	4.1	2.0	2.4	0.0	4.3	1.3	1.2	0.6	1.3
<i>Median</i>	<i>N/A</i>	6.6	5.2	6.9	<i>N/A</i>	6.1	3.3	2.9	2.3	3.8
<i>Eastern Median</i>	<i>N/A</i>	6.4	5.0	6.6	<i>N/A</i>	6.0	3.2	2.8	2.5	3.9
<i>Central Median</i>	<i>N/A</i>	6.2	5.1	7.4	<i>N/A</i>	5.8	2.7	2.6	1.1	1.5
<i>West Median</i>	<i>N/A</i>	6.8	5.5	7.9	<i>N/A</i>	6.3	3.7	3.6	1.9	3.8

Note: $\Delta\lambda = -(\lambda_{post} - \lambda_{pre})$

Units for eliminating consumption volatility, λ , is: % unconditional mean of consumption

Units for σ is %

Appendix 7: Welfare Gain of Growth, η , and Relative Gain

Region	Pre Reform						Post Reform					
	α	g	$\gamma = 2$	$\gamma = 5$	λ/η		α	g	$\gamma = 2$	$\gamma = 5$	λ/η	
					$\gamma = 2$	$\gamma = 5$					$\gamma = 2$	$\gamma = 5$
<i>Eastern</i>												
<i>Beijing</i>	0.0	1.3	18.7	.	118	.	0.0	5.2	9.6	4.5	74.0	173
<i>Tianjin</i>	0.0	3.4	11.8	6.6	61.9	146	0.0	5.9	8.4	3.0	19.0	50.0
<i>Liaoning</i>	0.0	2.7	12.6	6.6	32.5	83.3	0.0	6.0	8.3	2.9	21.7	55.2
<i>Jilin</i>	0.0	2.9	12.2	6.4	38.5	95.3	0.0	5.7	8.6	3.2	26.7	68.8
<i>Helongjiang</i>	0.0	2.7	14.1	15.4	105	203	0.0	5.4	8.9	3.5	33.7	82.9
<i>Shanghai</i>	0.0	0.6	18.3	23.4	45.9	111	0.0	8.6	6.7	2.2	49.3	129
<i>Jiangsu</i>	0.0	3.1	11.9	5.9	33.6	84.7	0.6	8.0	7.4	3.4	90.5	209
<i>Zhejiang</i>	0.0	2.7	12.7	6.9	37.8	94.2	0.0	8.7	6.7	2.4	70.1	167
<i>Fujian</i>	0.0	2.4	13.2	7.5	34.8	88.0	0.0	9.1	6.3	2.0	34.9	85.0
<i>Shangdong</i>	0.0	3.0	12.1	6.5	43.0	106	0.0	7.8	7.3	2.7	71.2	170
<i>Hebei</i>	0.0	2.1	13.6	7.7	28.7	72.7	0.0	5.9	8.5	3.2	31.8	81.3
<i>Anhui</i>	-0.6	3.7	12.0	6.5	103	172	0.5	6.5	8.9	6.0	114	247
<i>Henan</i>	0.0	2.3	13.4	7.9	38.1	93.7	0.5	5.7	9.7	7.8	117	246
<i>Hubei</i>	0.0	3.3	13.1	13.1	118	223	0.0	7.1	7.5	2.5	28.0	72.0
<i>Hunan</i>	0.0	3.2	11.6	5.5	27.6	70.9	0.0	5.6	8.7	3.3	29.9	72.7
<i>Shanxi</i>	0.0	2.8	12.6	7.1	46.0	111	0.0	4.4	10.1	4.4	37.6	95.5
<i>Inner Mongolia</i>	0.0	2.5	12.7	6.5	24.4	64.6	0.5	3.4	12.7	17.0	94.5	199
<i>Guizhou</i>	0.0	3.2	11.8	6.1	44.1	108	0.0	5.2	9.2	3.7	40.2	100
<i>Yunnan</i>	0.0	3.7	11.0	5.2	42.7	106	0.0	6.0	8.5	3.2	42.4	106
<i>Shaanxi</i>	0.0	2.9	12.5	7.0	47.2	116	0.0	4.1	10.3	4.3	26.2	67.4
<i>Gansu</i>	0.0	6.3	65.7	1.1			0.0	3.9	10.7	4.9	40.2	100
<i>Qinghai</i>	-0.4	5.2	10.6	6.0	150	262	0.0	3.0	11.8	5.4	18.6	50.0
<i>Xinjiang</i>	0.0	1.9	14.3	9.3	38.5	95.7	0.0	5.1	9.1	3.4	20.9	55.9
<i>Nation</i>	0.0	2.8	12.1	5.7	16.5	42.1	0.0	6.7	7.7	2.6	16.9	46.2
<i>Median</i>	<i>N/A</i>	2.9	12.6	6.6	42.9	106	<i>N/A</i>	5.7	8.7	3.4	37.6	95.5
<i>Eastern Median</i>	<i>N/A</i>	2.7	12.7	6.6	40.7	95.3	<i>N/A</i>	6.9	7.9	3.0	42.1	104
<i>Central Median</i>	<i>N/A</i>	3.2	13.1	7.7	38.1	93.7	<i>N/A</i>	5.9	8.7	3.3	31.8	81.3
<i>West Median</i>	<i>N/A</i>	3.1	12.6	6.3	44.1	108	<i>N/A</i>	4.3	10.2	4.4	38.9	97.7

Units for eliminating consumption volatility, λ , and promoting consumption growth, η , are:

% unconditional mean of consumption

Unit for η : %