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Regional Price Differences in Urban China 1986-2001: Estimation and Implication

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ABSTRACT

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Despite the intensive efforts made by economists to examine regional income inequality in China, limited attention has been paid to disentangle the contribution of regional price differentials. This paper examines regional price differential in urban China over the period 1986 to 2001. Spatial Price Index (SPI) is normally calculated using the Basket Cost Method, which defines a national basket and measures price variation of this common basket across different regions. The weakness of this method is that it arbitrarily assumes consumers' preferences and has a strong reliance on good regional level price data, which are often not available. This paper adopts the Engel's curve approach to estimate a Spatial Price Index for different provinces. The SPI obtained from the Engel's curve approach indicates larger regional price variations than those obtained from the Basket Cost method. Further, regional price variations in urban China increased significantly during the late 1980s to early 1990s, stabilized at a relatively high level during the mid to end 1990s. Adjusting for the regional price variations our finding suggests that regional income inequality increased the most between the late 1980s and early 1990s, and stabilized in the mid 1990s, which contradicts previous findings using unadjusted income.

JEL Classification: C43, E31, P36 D12

Keywords: spatial price index, Engel's curve, income inequality, China

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1. Introduction

A Spatial Price Index (SPI) reflects price differences across different regions at a point in time. Regional price differences or inter-area comparisons of the cost of living are very important in measuring poverty and income inequality, analyzing regional labor markets and comparing employee compensation cost, and for making location decisions for business and households (Kokoski, 1991, Moulton, 1995, Hayes 2005). Studies have found that measurement of poverty rates and regional income differentials are very sensitive to regional cost of living adjustments (Johnston, Mckinney, and Stark , 1995; Short, 2001; Slesnick, 2002; Jollife, Datt and Sharma, 2004; Brandt and Holz, 2007; Dalen, 2006; Roos ,2006; Jolliffe, 2006).

In the last two decades, China has experienced a significant increase in regional inequality of income and regional income disparity has become an important policy issue (Knight and Li, 1999; Khan and Riskin, 2001; Riskin, Zhao, and Li, 2001, Meng, 2004; Benjamin, Brandt, Giles, and Wang, 2005). The question naturally arises as to how much of the regional income inequality is due to an increase in real income inequality and how much is due to an increase in regional price variation. Despite the intensive effort made by economists to examine regional income inequality, limited attention has been paid to disentangling the relative contributions of real income inequality and regional price differentials.

Regional price differences are normally greater in a developing country with segmented markets than in a developed country where there exists a higher degree of market integration. China has had a long history of market segregation and the extent of its regional price differentials is widely recognized (Young, 2000; Fan and Wei, 2006; Braddon and Holz, 2005; Jiang and Li, 2005). Based on price data collected by the National Bureau of Statistics in 1997 a simple average of consumer prices for tradable goods in the province with the highest prices is 4 times that of the lowest price province. For the non-tradable goods and services the price ratio is 9 times

(NBS, 1998). [2] Such large regional price dispersion makes it difficult to study changes in regional inequality and poverty without adjusting for spatial price differentials.

In the economic literature, a "Spatial Price Index (SPI)" is often derived through specifying a basket of goods and services and pricing this basket in different localities (Sherwood, 1975; Kokoski, 1991, Deaton, 2003). This method is referred to as the Basket Cost method hereafter and it requires price data for the same bundle of same ***quality*** goods to be collected for different regions. Such data are normally not available. Many studies, therefore, use price data collected for constructing an inter-temporal Consumer Price Index. These price data are not directly comparable across regions because they are not specified as the same brand or quality across regions (Kokoski, 1991). In response to this shortcoming, Kokoski, Moulton, and Zieschange (1999) developed a hedonic regression method which adjust regional differences in quality of goods to derive a set of bilateral inter-regional price indices for each good and from which SPI may be derived (Koo, Phillips, and Sigalla ,2000 and Slesnick, 2002). In most developing countries, however, detailed price data are not available or only available for some years and not others. In the absence of detailed price data, Deaton (2003) developed a unit value approach to derive prices from household expenditure. This approach is also not ideal as unit values are often biased due to measurement error, quality inconsistency and unavailability of prices for non-purchased goods (Deaton, 1997; Gibson and Huang and Rozelle, 2002; Gibson and Rozelle, 2005; Dalen, 2006).

Recently, Hamilton (2001a) and Costa (2001) use cross-sectional household survey data and the Engel's Curve approach to estimate the CPI bias over time in the U.S. The basic idea is quite simple. Because Engel's law is regarded as the best established economic law, movements in the budget share of food could serve as an indicator of movement in real income. If real income as indicated by Engel's law is different from real income as measured by nominal income deflated by the CPI, one may be able to estimate the extent to which the CPI is biased. Hamilton (2001a) suggests that this method could be extended to estimate the movement in a true cost-of-living index for different races, age groups, geographic areas, and for developing countries with adequate household survey data.

[2] Data are reported in Appendix A.

There have been only a few studies on regional price differences in China due to lack of published regional price data (Young, 2000; Jiang and Li, 2005; and Brandt and Holz, 2007). To the best of our knowledge, Brandt and Holz (2007) is the only comprehensive study which derives a set of Spatial Price Indices for China. Using one of the few available provincial level price data, they calculated the SPIs for the year 1990 for rural and urban China across provinces and then adjusted these spatial price indices by regional inter-temporal changes in the CPIs for the years between 1984 and 2002. Due to data limitation, however, their estimation may suffer from various biases. These possible biases include: (1) the 1990 price data were collected for the purpose of calculating CPI, which have no quality adjustment across different regions; (2) the 1990 urban price data used only record provincial capital cities, rather than average price level in all cities in each province; (3) as there was no record of prices for non-tradable goods, average manufacturing wages were used as proxies; (4) the SPIs for years rather than 1990 were obtained from using provincial CPI to deflate 1990 SPI. However, CPI uses the *base* year *provincial* average consumption bundle as the weights while SPI is supposed to use *current* year *national* average consumption bundle as weights. In addition, CPI series itself may be biased (Erwin, 1996; Moulton, 1996; Boskin et al, 1998; Nordhaus, 1998; Lebow, 2001; Meng, Gregory, and Wang, 2005).[3]

In light with the problem associated with lack of proper price data, in this paper we follow Hamilton's suggestion to extend the Engel's curve approach to estimate a new series of Spatial Price Index for different provinces for urban China. The data used are from the China Urban Household Income and Expenditure Survey for the period 1986 to 2001. The Engel's curve approach may be considered as more appropriate than the Basket Cost method in estimating SPI for this period in urban

[3] Normally, the base year provincial level bundles differ considerably from the national current year bundle. The longer the time period the more they deviate from the national average current year bundle. Because of this deviation, SPI calculated using the base year SPI deflated by provincial level CPI will also deviate from the SPI series which is calculated using each year's price level and national consumption bundle. Appendix B presents some results from an exercise which uses the provincial level price data for the year 1991-1997 (NBS,1998) and the provincial CPI series over the same period to calculate two sets of SPI: one uses Brandt and Holz (2007) method which calculate the 1991 SPI and deflate it using provincial level CPI over time (noted as DSPI hereafter) and the other uses each year's price data to calculate SPI (noted as ASPI hereafter) separately. The results show that in 1992 (the first year of deflation) there are slight differences in the price ratio of for the highest and lowest provinces, standard deviations, and Coefficient of Variations, between DSPI and ASPI. The correlation coefficient for the two series in 1992 is 0.96. The discrepancy increases over time. By the end of the period, 1997, the correlation coefficient for the two series reduced to 0.60.
Using

China for the following reasons. First, the normal Basket Cost method superimposes a constant national basket on different regions. It does not take into account regional preference differences. For example, suppose that one region is dominated by Muslim who do not consume pork, but at the national level pork is one of the most commonly consumed meat and hence is included in the basket, the national cost of living basket will not be representing the Muslim region's preference. The Engel's Curve approach, on the other hand, infers cost of living directly from consumer's behaviour. Second, in a period of economic transition, the price of the national cost of living basket may not be straightforward. During the 1990s urban Chinese households experienced extraordinary changes in income, price and social welfare provisions. These changes were introduced at different points in time to different regions. These changes effectively changed people's true cost of living. The following example may explain this situation more clearly. Suppose that the price level of a certain medicine is 10 yuan in region one and 11 yuan in region two (10 per cent difference). If 80 per cent of consumers in region one has full public health cover while 50 per cent of consumers in region two has 40 per cent public health cover, the actual price difference of this medicine between region one (10 yuan times 20% equals 2 yuan) and region two (11 yuan times 50% time 40% plus 11 yuan times 50% equals 7.7 yuan) is not 10 per cent but 285 per cent. Normally price level data do not distinguish the extent to which the price of same medicine differs under different systems, whereas the Engel's curve approach take this into account by inferring the true cost of living directly from consumers' behaviour.

The paper is structured as follows. Section 2 describes the historical reasons for the existence of significant regional price differentials in China. Section 3 introduces the Engel's curve approach and the model used in this paper. Section 4 describes the data and summary statistics. Section 5 presents the main results from the Engel's Curve approach. Section 6 calculates SPI using the Basket Cost method with price data that are available for a few years and with unit values for the whole study period. Section 7 compares the SPI from different approaches. Section 8 investigates how regional income inequality may differ after adjusting SPIs estimated by the Engel's curve approach. Conclusions are given in section 9.

2. Background

There are significant price differences across Chinese regions. This is a widely accepted fact (Young, 2000; Fan and Wei, 2006; Braddon and Holz, 2007; Jiang and Li, 2005). Based on an internal publication on prices of 120 tradable and non-tradable goods (NBS, 1998),[4] Appendix A presents the ratio for the simple average of consumer prices of the tradable goods in a highest price province to that in a lowest price province and the same ratio for non-tradable goods between 1991 and 1997. It shows that in 1991 the ratio for tradable goods is about 3.5 times, it increased slightly in 1993, reduced somewhat in 1994, and finally reached 4.2 times in 1997. For non-tradable goods the ratio is much higher, ranging between 8.73 times in 1991 to 9.01 times in 1997. Although these data may not accurately reflect regional price differentials due to the fact that these data were collected for the purpose of constructing inter-temporal CPI and hence may reflect different quality of goods, they do provide an indication of the regional price variations. To better control for quality, table 1 presents data on selected goods which may subject to less quality variation. These data also show significant regional differentials.

What are the reasons for such a large regional price variation in China? In a study of international price deviations from purchasing power parity (PPP), Cecchetti, Mark and Sonora (2002) suggested the following reasons: (1) trade barriers; (2) bureaucratic difficulties; (3) local monopoly power; (4) transportation costs; (5) the failure of nominal exchange rates to adjust to relative price level shocks; (6) sticky nominal price-level adjustment because price changes are costly; (7) the presence of non-tradable goods and services and the potential for different growth level and efficiency of factors used in production. Although Cecchetti et al.'s (2002) summary is focused mainly on cross country price differentials, it is also applicable to regional price differentials within a particular country as long as these conditions exist, and more specifically, there exists regional protectionism. China's regional protectionism has long been recognized (Young, 2000; Bai, Du, Tao and Tong, 2003). Thus, these are all relevant reasons for large regional price differentials in China.

[4] Note that these are the only available data which provide information at provincial level with both prices for tradable and non-tradable goods.

In addition to the reasons listed above, China's special development strategy and its gradualist economic reform process may also have contributed to the large regional price variations. Below we outline some of the important reasons.

First, economic development in different regions varies considerably not only due to the unequal distribution of natural resources and regional difference in proximity to major markets, but also due to government deliberate policy initiatives. During the cold war era the government purposely established heavy industry in inland cities and light industry in coastal cities (Jian, Sachs and Warner, 1996). Later, at the earlier stage of economic reform, coastal regions received many preferential policies from the central government, which provided more opportunities for these regions to grow faster and further widened the economic growth gap between costal and inland regions (Cai and Wang, 2003). As a result, the coastal regions have higher labor productivity and per capita income, which has increased demand for consumer products and services, and generally increased the price level, especially for services.

Second, the imperfect mobility of labor and capital among regions can differentiate the returns to factors and cause regional price disparities. During the pre-reform era, labour mobility was strictly forbidden and implemented through the household registration and food ration systems. Individuals born in one area moved to another area who would not be registered and would not receive food coupons, and hence could not survive (Jian and Sachs and Warner, 1996; Meng, 2000; Whalley and Zhang, 2004). Capital allocation was controlled strictly by central government through the central planning system (Jian, Sachs and Warner, 1996). Since 1978, the introduction of the market-oriented reform and open-door policy has increased the movement of factors among regions, which is expected to narrow regional price disparities (Cai and Wang, 2003). However, large foreign investment entering into the eastern region has increased the capital-labor ratio in this region, and the household registration system still hampers nation wide labor market integration under the current "guest" working system (Meng and Zhang, 2001; Zhao, 1999; and Du, Gregory, and Meng, 2006). Consequently, regional prices may converge more slowly than expected.

Third, local protectionisms, including trade barriers, bureaucracy difficulties and local monopoly, play a unique role in regional price disparity in China through differential pricing to segmented markets and making trade and market entrance more

difficult. China's economic reform since 1978 has introduced fiscal decentralization, which provided local governments with a strong incentive to shield local firms and industries from interregional competition, especially for those industries that had high tax-plus-profit margins in the past. Meanwhile, there was no promulgation in the early years of economic reform, and no effective implementation in the later years, of central-government policies that prohibit trade barriers (Bai, Du, Tao and Tong, 2003). Therefore, local protectionism has a significant effect on the degree of regional price difference by introducing monopoly profits and additional costs into prices. Local protectionism in China includes numerous local standards, regulations and customs covering everything ranging from cars to construction materials, fertilizer to instant noodle and beer and even satellite television programs (People's Daily, July 01, 2000). "Silkworm cocoon war" and "car war"' are two typical interregional trade conflicts in raw materials and finished manufactured goods in the 1980s and 1990s (Young, 2000 and Bai, Du, Tao and Tong, 2003).

Finally, the dual track and gradual price reform affected regional prices through geographical difference in industrial structure. Before economic reform, most commodities in China were priced through the central planning system. After 1978, the State gradually allowed the market determination of prices (NBS Internal Statistic Report, 2000; Fan and Wei, 2006). From 1979 to1983, controls on prices of major agriculture goods and industrial inputs were gradually adjusted upwards to their market price levels. For instance, purchase prices of farming products increased by more than 20 per cent, which led to a 30 percentage point decrease in the price ratios of farming products to industry products. With the progressive price decontrol, the purchasing prices were completely decentralized by 1992, and by 1999, 95 percent of consumer goods and 80 percent of investment goods were priced by the market (NBS Internal Statistic Report, 2000; Fan and Wei, 2006). During the whole period of price reform, especially in the years with high inflation rates, the regional prices diverged significantly because of the regional difference in industrial structure.

3. Methodology

The most commonly used Basket Cost method, either with regional price data or unit values, suffers from two problems. First, it imposes a fixed basket on consumers from different regions and ignores differences in environment and preferences. Second, it has an extremely high requirement for price data (or unit value)

on a particular good to have a same quality across different regions. This requirement is often very difficult to satisfy. To mitigate these problems, this paper extents a newly developed Engle's Curve approach (Nakamura, 1996, Hamilton, 2001, Costa, 2001, and Gibson, Stillman, and Le, 2004) to estimate a new series of Spatial Price Index for urban China.

One of the most important generalizations about consumer behavior is that the fraction of income spent on food tends to decline as real income increases. This finding was first discovered by the Prussian economist, Ernst Engel (1821-1896), in the nineteenth century and has been known as Engel's Law. Engel's Law states that the food budget share is inversely related to household real income and food has positive income elasticity, which is less than 1. Engel's Law is probably one of the best economic laws observed in economic data and has been confirmed by recent consumer data of many countries (Houthakker, 1987; and Hamilton, 2001).

The basic idea of using Engel's Curve to estimate CPI bias is as follow. With proper model specification and reasonable assumptions, there should not be systematic movement in the Engel's curve over time (or across regions). If the Engel's curve moves, it implies that the real income is not measured correctly, which in turn indicates that the price index used to deflate real income is biased. However, Engel's Law can be used to infer the movement of real income only when other factors, such as changes of relative prices and household characteristics, are held constant.

Hamilton (2001) uses the single-good demand function in Almost Ideal Demand System (AIDS) developed by Deaton & Muellbauer (1980) as the theoretical platform for Engel's curve approach to estimate CPI bias. His approach is to estimate an augmented Engle's curve as follows:

$$\omega_{i,j,t} = c + \gamma[lnp_{f,j,t} - lnp_{n,j,t}] + \beta[lny_{i,j,t} - lnp_{j,t}] + X_{i,j,t}'\theta_x + \mu_{i,j,t} \qquad (1)$$

where $\omega_{i,j,t}$ is the food budget share of household i living in region j at time t; $p_{f,j,t}$, $p_{n,j,t}$, and $p_{j,t}$ are the unobserved true price indices for food, non-food, and all goods in region j in time t, respectively; $y_{i,j,t}$ is nominal expenditure of household i living in region j at time t; $X_{i,j,t}$ is a vector of household characteristics; while $\mu_{i,j,t}$ is the residual. The first item in equation (1), $\gamma[(\ln p_{F,j,t} - \ln p_{n,j,t}]$, can be treated as the

substitution effect between food and non-food, and the second term, $\beta[ln\, y_{i,j,t} - ln\, p_{j,t}]$, can be treated as the income effect. It is assumed:

(1) The price of all goods is a weighted average of the food and non food prices:

$$\ln p_{j,t} = \alpha \ln p_{F,j,t} + (1-\alpha) \ln p_{n,j,t} \tag{2}$$

(2) As the true prices are unobserved, the CPI series are used to proxy the true prices. Thus, all true prices $p_{f,j,t}, p_{n,j,t}$ and $p_{j,t}$ are measured with errors:

$$ln\, p_{j,t} = ln\, p_{j,0} + ln(1+\Pi_{j,t}) + ln(1+E_{j,t}), \tag{3a}$$

$$ln\, p_{F,j,t} = ln\, p_{F,j,0} + ln(1+\Pi_{F,j,t}) + ln(1+E_{F,j,t}) \tag{3b}$$

$$ln\, p_{N,j,t} = ln\, p_{N,j,0} + ln(1+\Pi_{N,j,t}) + ln(1+E_{N,j,t}) \tag{3c}$$

where Π is the cumulative increase in the *CPI* measured price (of food, nonfood, or all goods), and E_t is the year t percent cumulative measurement error in the *CPI* since year *0*. Substituting equations (3a) to (3c) into equation (2), gives:

$$ln(1+E_{j,t}) = \alpha\, ln(1+E_{F,j,t}) + (1-\alpha)\, ln(1+E_{n,j,t}) \tag{4}$$

Substituting equations (3a) to (3c) and (4) into Equation (1), gives

$$\begin{aligned}\omega_{i,j,t} = {} & \phi + \gamma[(ln(1+\Pi_{f,j,t}) - ln(1+\Pi_{n,j,t})] + \beta[ln\, Y_{i,j,t} - ln(1+\Pi_{j,t})] + X'\theta \\ & + \gamma[ln(1+E_{F,j,t}) - ln(1+E_{N,j,t})] - \beta\, ln(1+E_{j,t}) + \gamma(ln\, p_{F,j,0} - ln\, p_{N,j,0}) \\ & - \beta\, ln\, p_{j,0} + \mu_{i,j,t}\end{aligned} \tag{5}$$

Let:

$\delta_t = \gamma[ln(1+E_{F,t}) - ln(1+E_{N,t})] - \beta\, ln(1+E_t)$ and

$\delta_j = \gamma[ln(1+E_{F,j}) - ln(1+E_{N,j})] - \beta\, ln(1+E_j)$,

and assuming that the CPI bias does not vary geographically, equation (5) may be written as:

$$\begin{aligned}\omega_{i,j,t} = {} & \phi + \gamma[(ln(1+\Pi_{f,j,t}) - ln(1+\Pi_{n,j,t})] + \beta[ln\, Y_{i,j,t} - ln(1+\Pi_{j,t})] \\ & + X'\theta + \sum_{t=1}^{T} \delta_t D_t + \sum_{j=1} \delta_j D_j + \mu_{ijt}\end{aligned} \tag{6}$$

where, δ_t and δ_j are the coefficients of time and regional dummy variables D_t, and D_j, respectively. The parameter estimated from (6) can be used to identify the CPI bias as:

$$-E_t = 1 - exp(\frac{\delta_t}{-\beta - \frac{\gamma(1-k)}{1-\alpha(1-k)}}) \quad (7a)$$

where *k* is the relative bias between food and nonfood prices. Further assuming food and nonfood prices are equally biased, *k=1*, then $ln(1+E_{F,t}) = k\,ln(1+E_{N,t})$ and equation (7a) can be written as:

$$-E_t = 1 - exp(\frac{-\delta_t}{\beta}) \quad (7b)$$

Thus, under the assumptions that the demand function is properly specified, preferences are stable, there are no systematic errors in the variables, and food and nonfood prices are equally biased, the error in the CPI can be identified by coefficients, δ and β, obtained from estimated equation (6) using pooled repeated cross-sectional household expenditure survey data.

We can also use Engel's Curve Approach to derive SPI. To do so, we can estimate Equation (6) using one cross-sectional data at a time. Since the true food price ($p_{f,j}$) and non-food price ($p_{n,j}$) for each province are not available, we use aggregated unit values for food ($\Pi_{f,j}$) and non-food ($\Pi_{n,j}$) to proxy for the true prices, respectively with measurement errors. Assuming that the unit values of food and non food for each province at a point in time have the same level of measurement error, ($(ln\,E_{f,j,t} - ln\,E_{n,j,t}) = 0$), provincial dummy variables can be used to capture provincial general price effects. In order to more precisely capture substitution effects between food and non-food and to avoid multicollinearity between relative food/non-food prices and the general price effect (provincial dummy variables) in the model, we use aggregated unit values at city level for food ($\Pi_{f,c}$) and non-food ($\Pi_{n,c}$) instead of those at provincial level. Thus, the final estimated equation is specified as follow:

$$\omega_{i,j} = \phi + \gamma[(ln(\Pi_{f,c,j}) - ln(\Pi_{n,c,j})] + \beta[ln\,Y_{i,j}] + \delta_j D_j + X'\theta + \mu_{i,j} \quad (8)$$

In equation (8), the omitted province is Beijing, for which the general price effect ϕ_1 is captured in the constant term ϕ and cannot be identified directly. If we express the price of Beijing relative to the national average price level as $p_1 = exp(\frac{\phi_1}{-\beta})$, and the relative price of province *j* to the national average price

level as $p_j = exp(\frac{\phi_j}{-\beta}) = exp(\frac{\delta_j + \phi_1}{-\beta})$ as the difference between the general price of other provinces *j* and that of Beijing is ($\delta_j = \phi_j - \phi_1$), the relative price level of province *j* to Beijing can be calculated as:

$$SPI_j = exp(\frac{\delta_j + \phi_1}{-\beta}) / exp(\frac{\phi_1}{-\beta}) = exp(\frac{\delta_j}{\beta}) \quad (9)$$

To estimate equation (8), we use the budget share of food at home rather than that of all food as dependent variable. This is because that eating-out is expected to have different income elasticity from food at home and that food at home is mainly to satisfy the basic requirement of nutrition intake while eating out can be treated partially as luxurious consumption or recreation.

In the literature, *y* is either measured in terms of income or expenditure. Although we use both income and expenditure in our estimated model, it is worth noting that using expenditure may provide more stable results due to three reasons. First, annual household income can be erratic and unpredictable, especially for self-employed and family businesses. In the household survey data, some households are found to have income less than their food consumption or even negative annual income. Second, expenditure is typically a better guide to long-term wellbeing of the household as households will exercise some consumption smoothing through savings and dissavings (Deaton, 1997). Lastly, expenditure is often measured with less error than income in household surveys, although with the nature of the data used in this study, e.g. diary records, they both should be reasonably accurate.

One weakness of using coefficients on regional dummy variables to infer regional price variations is that other cross regional variations may confound the price effect (Hamilton, 2000a). To this end, inclusion of relative food/non-food price may pick up some of the cross-regional variations in the food budget share. Another important variable which affects individuals' food budget share is personal taste difference across regions. If there is no systematic preference variation across different provinces, ignoring preference differences may not bias our results. However, it is commonly known that Chinese provinces have considerable preference variations with regard to food. Although it is hard to capture regional taste difference empirically, health and nutrition literature has long established that weather,

especially temperature, has a significant impact on diet and food preferences (Stroebele and Castro, 2004; and Thompson and Wilson, 1999). In this paper, therefore, we use city level temperature and its squared term to capture possible dietary differences across regions.

Following the literature, other exogenous control variables in vector X include the age of household head and spouse, their education level, household size, and a group of variable indicating household composition, such as the female ratio of household members, the number of children between age 0-15, and the number of household members over 65. The share of eating out in all food expenditure is also included in the model.

Whether the Engel's curve approach is suitable for deriving the SPI in China depends on whether the assumptions made in deriving the result in equation (9) are reasonable. While four substantial assumptions are required to use the Engel's Curve Model to estimate CPI bias over time,[5] only one assumption is required to estimate the SPI. This assumption is that the proxies for food and non-food prices have constant measurement errors for each province and at a point in time. This assumption should be largely satisfied. Appendix C shows the possible bias it may bring to our estimation of the SPI if this assumption is violated.

4. Data and Summary Statistics

The data used in this study are from the China Urban Household Income and Expenditure Survey (UHIES) for the year 1986 to 2001. The surveys are conducted by the Urban Survey Organization of National Bureau of Statistics in China (USO, NBS). The UHIES covers 30 provinces. The survey samples households with urban household registration in each province.[6]

The sampling and survey methods of UHIES have been relatively consistent over time. The sample is selected based on PPS with several stratifications at the provincial, city, county, town, and neighborhood community levels. Households are randomly selected within each chosen neighborhood community. Each household is

[5] The assumptions are: 1. The structure of the model is stable over time so that cross-section data can be pooled. 2. Food and non-food CPI is biased constantly or equally over time. 3. CPI bias does not vary geographically. 4. There is no significant time trend in food consumption.

[6] Before 1988 there were only 29 provinces in China. In 1988 Hainan province was established and in 1997 Chongqing was established. Tibet is not included. Migrant workers who possess rural household registration and working in cities are not included in the survey.

designed to be in the sample for one to three years. All households are designed to have equal weights in each year.

The main data collecting method are diary records of income and expenditure, where households are required to record each item (disaggregated for hundreds of product categories) purchased or income received for each day for a full year. Enumerators visit sample households once or twice each month to review the records, assist the household with questions, and to take away the household records for data entry and aggregation to the annual data in the local Statistical Bureau Office (Han, Wailes, and Cramer, 1995; Fang, Zhang, and Fan, 2002; and Gibson, Huang, and Rozelle, 2003; Meng, Gregory and Wang, 2005). Only annual household aggregated data are used in this paper.

The total number of households in the survey ranges from 12,000 to 17,000 with around 47,000 to 53,000 individuals each year. Excluding missing values and incorporating a few sample restrictions the final samples used are between 11266 and 16121 households. Table 2 presents the sample size for the original total sample and the restricted sample for each year.[7]

UHIES collects data on income, expenditure, housing condition, durable goods possession and demographic characteristics. The UHIES questionnaire has changed twice during the data period from 1986 to 2001. The major changes in questionnaire occurred in 1988 and in 1992.[8] Consequently, some discontinuity in the data series may exist and may affect the estimation. In addition, UHIES do not provide information on self-produced goods for own consumption, gifts from others,

[7] The sample restrictions include: (1) Tibet is excluded from the data because only 100 households are included in a few years. Hainan and Chongqing provinces were established in 1988 and 1998 and the data were not available until 1990 and 1998, respectively. (2) households with negative values on food consumption, eating out, or consumer durables, or with outliers in income/expenditure and with more female members than total household members are excluded. (3) households in Wuwei city of Gansu province in 1986, Bijie city of Guizhou province in 1988, Shanggao city of Jiangxi province in 1988, and Si-Ping city of Jilin province in 1998 seem to have serious measurement errors on quantity data and are therefore excluded from the final sample. (4) households with their heads younger than 18 or with more than 8 individuals are excluded. These restrictions exclude between 4.2% to 9.4% of the total sample in each year. We also estimate the equations with the full sample and the results do not vary much. The full results of these tests are available upon request from the authors.

[8] The major changes made in 1988 are related to income sources. Before 1988, only total monthly wages for individuals are collected, while after 1988, individuals' income from different sources, such as wages, household business, property and transfers are collected. The main changes to the questionnaire made from 1992 are related to the consumption categories. Prior to 1992 there are 39 food goods, 39 non-food goods and 13 service categories are included in the UHIES surveys. Since 1992 the questionnaire includes 113 food, 131 non-food g, and 25 services categories.

state subsidies on various goods, and imputed rent for owner-occupied housing. The lack of the above information may also affect the calculation of SPI.

The mean and standard deviation of income, expenditure, food budget share, relative food price, and other variables used in our estimation for all years are presented in Table 3. On average the budget share of food at home reduced from 46 per cent in 1986 to 31 per cent in 2001, while the eating out budget share of the total food budget increased from 5.5 per cent to 13.9 per cent over the same period. In addition, Table 3 shows that household and individual characteristics have also changed. The average household size and the number of children aged between 0 and 15 fell which is consistent with the implementation of the one child policy. The average age of household head increased by almost 5 years, while years of schooling for husband and wife increased by 1.6 and 1.9 years, respectively. The summary statistics by provinces in all years, which are available upon request from the authors, indicate obvious regional variations of all variables, especially in income, expenditure, food budget share and eating out between rich provinces (e.g. Beijing or Guangdong) and poor provinces (Shanxi or Henan).

It is expected that at the same level of income/expenditure, different provinces should have a similar food budget share. However this does not hold in the data. Figure 1 shows the relationship between the budget share of food at home and log nominal expenditure for selected provinces and selected years. It indicates that at each expenditure level, the food budget share differs considerably among different provinces and the situation persists for all the years. This is a strong indication that price level differs considerably among provinces, and hence, real income/expenditure adjusted by spatial price differences differs considerably from the unadjusted income/expenditure.

5. Estimated results

5.1 Results

The results from estimated Equation (8) are presented in Table 4. The overall significance of the regression model is relatively high with the adjusted R-square ranging from 0.44 to 0.60.

Expenditure plays a significantly negative role in determining the food at home budget share. For each year the coefficient is statistically significant at the 1 per

cent level. This result is consistent with Engel's Law. Over time, however, we observe that the magnitude of the effect of expenditure on the food at home budget share decreased significantly, from 18.7 per cent in 1986 to 14.1 per cent in 2001. We also calculate the expenditure elasticity of food at home budget share for each year, which are presented in Table 5.[9] The elasticity falls from 0.59 in 1986 to 0.54 in 2001 as income rises, which means that in 1986, 1 percent increase in total expenditure generated a 0.59 percent increase in food at home, and this ratio reduced to 0.54 per cent in 2001. The reduction is not huge and even in 2001 the elasticity is far from zero and way above the elasticity for the U.S. for the year 1974, which is estimated to be 0.33 (Hamilton 2001). The relative food price plays a mixed role with some positive and some negative effects on food at home budget share over time. Eating out as the share of food budget contributes negatively and significantly to the food at home budget share.

The linear temperature variable plays a consistent important role in food budget share over the whole period, while its squared term is only statistically significant in some years. Most variables related to household characteristics and composition are statistically significant in most years. For example, the coefficients of family size are all positively significant implying the larger the household the higher the food budget share at home. Number of children aged 0 to 15 do not have a consistent impact on food at home budget share for reasons which are not clear to us. Households with more elderly aged over 65 consume more food at home, and age of household heads and spouses have positive effects on the food budget share at home. Finally, the years of schooling of both household heads and spouse have a negative and significant effect on food at home budget share. This could indicate both income effect (more educated people earn more) and/or a physical activity effect (educated people are more likely to have a sedentary job, which requires less energy consumption).

Turning to the most important results for this paper—the coefficients for provincial dummy variables and their implied spatial price indices for different years, we find that most coefficients are statistically significant at the 1 or 5 per cent levels. In the regression, Beijing is the omitted category. Thus, the calculated SPI is the relative price level of other provinces to Beijing. The calculated SPI for all the years

[9] The formula used to calculate the expenditure elasticity of food at home is $\eta_{y,F} = 1 + \beta/\omega$.

are reported in Table 6. At the bottom of the table the maximum, minimum, mean, standard deviation and coefficient of variation of the SPI are reported. In addition, the year to year correlation coefficients, and correlation coefficient of each year relative to the base year, 1986, are also reported.

Table 6 reveals several important findings. First, there is some persistence in the provincial relative price position over time. For example, the commonly observed high price provinces are Guangdong, Shanghai, Tianjin, Beijing and Fujian, while low price provinces include Shanxi, Shaanxi, Henan, Hebei, and Yunnan. This can also been observed in Figure 2, where rankings of the relative price position for 1986, 1995 and 2001 are presented. In addition, the year-to-year correlation coefficients and relative to base year correlation coefficients also show a relatively high correlation of the relative price position over time. The observed high price provinces seem to coincide with common knowledge that large cities and more economically advanced regions often have higher living costs. With regard to low price provinces it is unclear *a priori* whether they are reasonable or not.

Second, a few significant changes in the provincial relative price position over time are observed. For example, as indicated in Figure 2, at the beginning of the period Shandong province had a relatively high price level, while at the mid 1990s its relative price level reduced dramatically and stayed low until the end of the period. Such instability in the relative price position, fortunately, is rare.

Third, the trend of the dispersion of prices over the years seems to have changed. Figure 3 presents the mean and coefficient of variation of the SPI for the whole period. It indicates that at the beginning of the period, the dispersion was relatively low, but increases continuously until 1993, with exception of 1992, then after 1993, the dispersion seems to stablise at a relatively high level.[10]

The trend of price dispersion across provinces seems to suggest that between the late 1980s and the early 1990s price dispersion increased the most and during the period of the most significant economic reform (1993-1997) urban China actually experienced largest regional price variation. This, to some extent, seems in conflict with the objectives of the economic reform agenda. It is often considered that the real economic reform in urban China occurred after 1992, when Deng visited the South

[10] The reason for the significant reduction in price dispersion in 1992 is not entirely clear to us, except that both Young (2000) and Brandt and Holz (2007) find the same phenomenon.

China and the government announced that the market system was compatible with Chinese socialism (Jaggi, Rundle, Rosen, and Takahashi, 1996; Wu, 200?). Since then the private sector has grown significantly and foreign direct investment, exports, and GDP increased dramatically. One would think that the privatization process should have reduced regional protectionism, which, in turn, would reduce regional price differences.

How should we reconcile our findings of large regional price variations in the mid to late 1990s with the 1990s' economic reform agenda? Two possible explanations may be presented. First, Young (2000) also observed the highest industrial price variations during the mid to late 1990s. His explanation is mainly related to local officials' rent seeking behaviour. If local officials' promotion is related to their GDP level, which, in turn, is related to the development of some particularly profitable manufacturing goods, one would observe convergence in the structure of production. To protect local production from competition of similar products of other regions, local protectionism bound to rise, and hence, a high level of regional price variation would be observed. Anecdotal evidences as indicated in Young (2000), Bai, Du, Tao and Tong (2003) and numerous newspaper articles seem to support this explanation.

Another explanation, which may be more closely related to our finding of high spatial *consumer* price variations, is perhaps related to the intensive social welfare reforms introduced in the mid to late 1990s. In the pre-reform era and up until the late 1980s urban Chinese were largely covered by a cradle-to-grave welfare system, whereby education, health care, housing, and many other forms of services were provided free of charge or at highly subsidized prices. Starting from the early 1990s, schools began to charge fees, then health care, housing, and most other forms of former free services were subject to different forms of fee charging. Some were subject to public sector fee charges, while others were operated in the market places completely. Different regions had different levels and types of charges. This may explain, to a large extent, the high regional price variations during this period. By the end of 1990s, majority of these goods and services were provided in the market place, and consequently, regional price variations reduced slightly and stayed at that level.

5.2 Sensitivity tests

In the above analysis the food at home budge share is measured as food share in total expenditure while y in equation (8) is measured as log total expenditure. Regressions using food at home as share of total income as the dependent variable and log household income as the measure of y are also estimated for each of the survey years. In addition, we also use the unrestricted sample. In general, the results are quite consistent and the estimated SPI series has the same trend, though the magnitudes vary somewhat. Regressions using the budget share of all food (food at home plus eating out), disposable income, and regressions excluding families of single adult or single parent are also estimated and the estimated SPI do not change significantly.[11]

6. SPIs Calculated Using the Basket Cost Method with Prices level data and Unit Value Data

In addition to the SPI estimated from the Engel's curve approach, we also calculate two other SPI series, one using limited available provincial level aggregated price level data and the other using unit value data generated from UHIES 1986-2001.

6.1. Using Provincial Average Price Data

The provincial average retail price level data for 1991 to 1997 (PARP 1991-1997, hereafter) used in this study were aggregated by China's National Bureau of Statistics (NBS) using the original price data collected from 260 survey cities (NBS, 1998). The initial purpose to aggregate the price data is to compare CPIs calculated using two different methods—the chained Laspeyres CPI index implemented before 2001 and the new 5-year fixed bundle Laspeyres CPI used since 2001. The data set covers prices of 120 goods and service categories in food (without prices of vegetables and fruits), alcohol and tobacco, clothing and footwear, housing costs (electricity, house repairs and maintenance, self building materials, housing rent), household contents and services, health, transportation, communication, recreation and education. The list of these goods and service categories is listed in Appendix A.

The PARP 1991-1997 data are in many ways better than the price data used by Brandt and Holz (2007) and Jiang and Li (2005). First, these data are aggregated at provincial level from the original data of many cities within a province, which are more suitable for calculation of provincial spatial price index than prices of the

[11] All the results discussed in this sub-section are available upon request from the authors.

provincial capital cities, which are used in Brandt and Holz (2007) or Jiang and Li (2005). Second, the data are collected consistently over time from 1991 to 1997. Thus, there is no need to deflate the data using provincial level CPI as in Brandt and Holz (2007), at least not for the period 1991 to 1997. Third, our price data include prices for services while data used in Brandt and Holz (2007) do not. They assume that service prices can be proxied by manufacturing wages.

However, the PARP 1991-1997 also suffer from a few problems, of which, some are similar to the problems encountered by Brandt and Holz' (2007). The first problem is that the initial purpose of the data collection is to calculate a CPI instead of SPI. Although the goods and service categories in the price data were identical across provinces as they were identified by the National Bureau of Statistics, the quality standard of each good and service was decided independently by each province according to a common rule, which is the top 5 most commonly consumed brands in each goods or service for each province. Consequently, the quality standard is consistent in each province over time, but it is not necessarily so at a point in time across different provinces. Second, the data for housing rent is not market rent but a mixture of subsidized rent and market rent. In addition, they do not include the imputed rent for owner-occupied housing. Thus, the price for rent may underestimate the regional price difference due to the difference in the share of housing rented from the market across different provinces. Third, prices for fruit and vegetables are not available from this data set so that the average price relativities of rice and flour are used as proxies for price relativities of vegetables and fruits. Fourth, prices of housing purchase and financial or insurance services are not included. These problems may bring some bias into the calculation of SPI using the Basket Cost method.

Three steps are taken to calculate SPI using the Basket Cost method. First, national average prices of 120 categories of goods and services are calculated using the mean of provincial prices in each year weighted by provincial urban population. And then the relative prices of province *j* to the national average price for each of the 120 categories of goods are calculated.

Second, the 120 relative prices are then aggregated into relative prices of 40 categories. The reason for this aggregation is because not every province consumes all 120 goods and services due to difference in preference across regions. For example, some provinces are Muslin dominated and they hardly consume any pork, while Han

dominated provinces mainly consume pork. Given that the weights used to generate relative prices are derived from national basket it is likely that weight on pork is much higher. Applying this weight, Muslin dominated provinces will have biased consumption bundle. However, if detailed beef, lamb, and pork are aggregated into one category (meat), there will be less bias for both Muslin and non-Muslin provinces.

Finally, the relative prices for the 40 categories of goods and services are used to calculate the general spatial price indices for each year using (urban) national average consumption for the 40 categories as weights. The Laspeyres index is employed:

$$SPI_j = \sum_{k=1}^{n} \overline{w}_k (RP_{jk}) = \sum_{k=1}^{n} \frac{\overline{E_k}}{\sum_{k=1}^{n} \overline{E_k}} (RP_{jk}) = \sum_{k=1}^{n} \frac{\overline{P_k}\,\overline{Q_k}}{\sum_{k=1}^{n} \overline{P_k}\,\overline{Q_k}} \left(\frac{P_{jk}}{\overline{P_k}}\right) = \frac{\sum_{k=1}^{n} P_{jk}\overline{Q_k}}{\sum_{k=1}^{n} \overline{P_k}\,\overline{Q_k}} \qquad (12)$$

where, *k* refers to a aggregated good or service category, *j* indicates a province, and $\overline{w_k}$, $\overline{E_k}$, $\overline{Q_k}$ and $\overline{P_k}$ represent weight, expenditure, purchased quantity and price, respectively. RP_{jk} is relative price of province *j* to national average price for good *k*. The expenditure data used to generate weights are from UHIES. The potential bundle used in this calculation is the national average consumption bundle for each year.[12]

The calculated SPI using price data are reported in Table 7. The results show that the order of the relative price position among different provinces is similar to that found using the Engel's Curve approach. The price ratios of the highest to the lowest province in this period are between 1.5 and 1.7 and the standard deviations are between 0.1 and 0.15. These findings indicate that SPI calculated using absolute price level data has a narrower distribution than that using the Engel's Curve approach which for the same period has a ratio of maximum to minimum price between 1.83 and 3.12 and standard deviations between 0.12 and 0.25.

[12] There are some missing price data for some regions, most of which occur in Guizhou, Qinghai and Xinjiang. In order to reduce the distortion of missing values on calculated price indices, we impute them by setting the current price equal to the previous year's price, using prices of adjacent province as substitute, or applying the same price change over time of its substitute. For instance, prices of duck in Qinghai and Xinjiang are missing and they are imputed using prices of chicken for the same province at the same year. In additional, the price of housework is used to proxy price of eating out.

6.2. Using Provincial Unit Values from Household Survey

In this subsection we use unit values to proxy for prices and use the Basket Cost method to calculate the SPI. The unit value data are also from UHIES. In order to compare the results from different approaches, we calculate the unit value SPI and the price data SPI using the same price categories, consumption weights, and index formulas.

The unit values of 103 goods categories are first calculated using expenditure divided by quantity data. A few commonly consumed items in each good category are selected as representatives to calculate the unit value for that category at the provincial level for each year. Unit values for the 17 service categories cannot be calculated since quantity data are not collected. Following Brandt and Holz (2007) the average wages of employees at a city level are used to proxy prices for service items.[13] In the case of missing values for a particular item at provincial level the corresponding unit value at national level is used. If both provincial and national unit values are missing, that particular good or service category will be excluded from the calculation. Further, these unit values of 120 goods and services are aggregated into unit values of 40 categories using arithmetic means. The weights used to calculate unit value SPI are the same as those used to calculate the SPI with price level data. For year 1992 to 2001, weights of 40 categories are calculated from household data and used to calculate SPI. For year 1986 to 1991 an additional two weights on furniture and appliance are used.[14]

There are a few problems associated with using unit values as proxies for price: First, unit values may suffer from serious quality problems whenever the quality of the goods is extremely diverse in each sector or across regions (Gibson, 2002). Second, for some infrequently-consumed goods or services, the mean unit values may be zero at provincial level, and using national average unit values in place of provincial average unit value may underestimate the true regional price difference. Third, only 60% to 70% of the total budget has quantity data and for the rest of the budget share unit values cannot be derived. The use of average wages of employees at

[13] The reason for using average wages rather than average manufacturing wages as Brandt and Holz (2007) did is that the latter are normally lower than the wages in service sectors in urban China, especially in sectors such as education, recreation and health.

[14] The details 103 goods groups, the items used to represent those groups and the 17 service items and the weights used in calculating the final provincial unit value prices are available upon request from the authors.

city level as proxy price for services can only resolve this problem to some extent. It can by no means capture the true price disparities of services fully. Finally, just like in the method used for price data, the unit value and weight data do not cover all housing cost, such as imputed rents of owner-occupied housing, which may underestimate the regional price difference due to the largest price difference in housing purchase and housing market rents across regions.

The calculated SPIs using the unit value method are reported in Table 8. It shows that there is an increasing trend in regional price dispersion from 1986 to 2001. The price ratio of highest to lowest province in 1986 is 1.47, and it rose to 2.28 in 2001. The standard deviations increased continuously from 0.08 in 1986 to 0.21 in 1994, and then stabilized at a slightly lower level. By 2001 the standard deviation reduced to 0.18.

7. Comparison of the Results from Different Approaches

To what extent the SPIs calculated by the various methods differ?

One important finding is that the rank of different provinces seems to be quite consistent across methods for most years. In general, high income provinces such as Guangdong, Beijing, Shanghai, and Fujian are more likely to be ranked as high price provinces, while low income provinces such as Jiangxi, Shanxi, Shaanxi, are more likely to have low prices.

Another important finding is that the trend in price variation over time seems to be similar across different methods, especially between the Engel's Curve approach and Brandt and Holz (2007). Figure 4 presents coefficient of variations of SPI obtained using different methods. The figure shows that in general, price variations across provinces increased between the mid 1980s to the beginning of 1990s, remained at a relatively high level until around 1996, dropped slightly between 1997 and 1998 and then stablised at a relatively high level afterwards.

In addition, the Engel's curve approach seems to present much larger price variation across different provinces than those derived from various the Basket Cost methods, while the Brandt and Holz (2007) results present the lowest variations for almost all the years. A group of measures of price variations across different provinces for different methods presented in Table 9 indicates this pattern. One possible reason why Brandt and Holz (2007) generate the lowest price variation may

be that service prices are proxied by average manufacturing wages, which should have a lower variation across provinces than the average wages of all workers.

Further, the regional price variations obtained from different methods differs between earlier (the late 1980s and early 1990s) and later (the mid 1990s to 2001) periods. Figure 5 presents the SPI positions (relative to Beijing) for each province for the years 1986, 1991, 1997, and 2001, which is ranked by the Engel's curve SPI position. The figure shows that in the earlier period, for the majority of provinces the Engel's Curve SPI seems to be far below that of Beijing, whereas SPIs obtained from using the Basket Cost approaches suggest that most provinces' price levels were similar to that of Beijing (hovering around 1). In the later years, however, this pattern seems to have disappeared. This may be related to the fact that in the earlier years public provision of goods and services accounted for a larger share of household consumption than in the later years and these provisions varied across different cities. Using price data to calculate SPI cannot take into account goods and services provided free of charge by government, while the Engel's Curve approach recognizes these provisions from consumer behaviour. In the later period the public provision of goods and services reduced dramatically, though it still exist, thus, the calculated SPI from the Engel's curve approach is closer to that obtained from the Basket Cost approaches.

Finally, the Engel's Curve SPI correlates well with the Unit value and price data Basket Cost measured SPIs, but not very well with the Brandt and Holz (2007) Basket Cost SPIs, especially for the early period. The three Basket Cost method measured SPIs seem to correlate quite well except for the price data measured SPI and the Brandt and Holz (2007) SPI for 1996 and 1997. These correlations coefficients are presented in Table 10.

Are results generated from Engel's Curve approach more reliable? This is difficult to judge. However, from the point of view of methodology and data quality, the Engel's Curve approach has the following advantages over the Basket Cost approach:

First, the Engel's Curve approach estimates SPI as a true cost of living index directly from consumers' behavior, it reflects consumers' judgment on the price level, including everything consumers have to pay for (Hamilton, 2001).

Second, the Engel's curve model treats substitution effects between food and non-food as part of consumer behavior, rather than an arbitrary choice of researchers. In addition, it distinguishes regional preference differences from the regional price differences.

Third, the Basket Cost approach needs to use consumption weights to generate the SPI. These weights, although often generated from household expenditure surveys, are quite likely to be biased. The key issue in this regard is the treatment of housing costs. According to the Household Survey Scheme of UN, the treatment of non-owner occupied housing costs is quite straightforward, as they are defined primarily as rent and rates minus any subletting receipts. For owner occupied housing the costs are defined as an imputed rental value equivalent plus actual rates, repairs, insurance payments minus receipts for subletting. However, in China, the imputed rent data are not available from expenditure surveys. Thus, when the consumption weights are generated the housing share will be lower than it should be.

Fourth, currently in China the collected prices for services such as education and healthcare may not represent the true prices. For example, the price data on education only cover teaching materials and normal tuition fee in a public school, while most of schools require "voluntary donations" and an extra curriculum tuition fee. These latter costs are much higher than the former and vary significantly across regions. For the healthcare sector, the key problem is that the goods included in the basket have not been updated on time and many new medicines, equipments, and treatments with higher prices do not enter into the bundle. These inadequacies in price data collection may bias the SPI calculated using the Basket Cost method, but should have no effect on the SPI calculated using the Engel's curve approach.

Fifth, the basket cost method using either unit value or price data may suffer from inconsistent quality problem. As mentioned before, the price data used in calculating the SPI in China are often collected for the purpose of calculating the CPI, which do not require the quality of goods to be consistent across regions. For the unit value, Angus Deaton (1988) points out that consumers choose the quality of their purchases and unit values reflect this choice, furthermore, unit values may be contaminated by measurement errors in both expenditure and quantity. The issue of quality consistency should not play an important role in calculating SPI using Engel's curve approach.

8. How Does Income and Income Inequality Differ after SPI Adjustment?

The main purpose of calculating the SPI is to understand real living costs and wellbeing of households in different regions, as well as regional income inequality. Here, wellbeing is measured as nominal income adjusted by SPI.

Tables 11 and 12 report the correlation coefficients of the SPI and unadjusted income, unadjusted income and SPI adjusted income, and the Gini coefficients for unadjusted and SPI adjusted income and expenditure at provincial mean level and at household level, respectively.

The first column of table 11 presents the correlation coefficients between SPI and per capita unadjusted income, which ranges from the lowest 0.56 in 1991 to the highest 0.84 in 1996. In general, the two variables are always positively and statistically significantly correlated. The positive correlation implies that cost of living is correlated with the income level, and hence, the use of unadjusted income to measure the regional living standard or income inequality can be misleading.

The second column of Table 11 and the first column of Table 12 present the correlation coefficients of unadjusted and SPI adjusted income at provincial mean and household level, respectively. At provincial mean level, it is interesting to note that there is a change in the relationship between unadjusted and SPI adjusted income for the period 1991 and before and after 1991. In the early period, the correlation was quite low with exception of 1986. In the later period the correlation coefficient increased significantly. Further investigation reveals that the actual relationships between unadjusted and adjusted incomes for the early period are non-linear, with inversed U-shapes, while the relationships for the later period are always positive and almost linear. These relationships are presented in Figure 6. The correlation coefficients between the unadjusted and adjusted income at household level are very high, ranging between 0.74 and 0.90 (see second column in Table 13). The reason that SPI adjustment does not affect income variation to a significant degree at household level may be that at household level income variation is much larger across households within a region than that across regions.

The third to the seventh columns of Table 11 and Figure 7 present regional income inequality (Gini coefficients) measures for unadjusted and SPI adjusted provincial average per capita income/expenditure. It appears that the differences

between the Gini coefficient for unadjusted and SPI adjusted income and expenditure becomes quite large during the mid 1990s when economic reform intensified. Figure 7 shows that if we trace the Gini coefficient for the unadjusted income, the period where regional income inequality increased the most is between 1991 and 1994, whereas if we judge from the Gini coefficient for the SPI adjusted income the conclusion is different. The most significant increase in regional inequality occurred between 1986 and 1990. Since 1990, regional income inequality has stabilized. Thus, we may conclude that while in the early reform period (1986-1990) there was a genuine significant increase in regional income differentials, what appears to be the most significant increase in regional inequality period (1991 to 1994) is in fact the period of the most significant increase in regional price differentials.

At the household level the SPI adjustment does not make any difference to income inequality for the earlier period (1986 to 1992) but some difference in the later period, though at a less extent than the difference it makes to the regional income inequality (see columns 2 to 6 of Table 12 and Figure 8).

9. Conclusions

In this paper we employed the Engel's Curve approach to derive Spatial Price Indices for urban China during the period 1986 to 2001. Relative to early studies using the Basket Cost method, the Engel's curve approach takes into account substitution effects, regional preferences, and quality effect. The following conclusions are worth noting.

First, the regional price variations generated from this study are much larger than those obtained using the Basket Cost method with various available price or unit value data.

Second, the variation in regional prices was found to be not very high in the late 1980s. However, it increased significantly and stayed at a relatively high level during the mid to late 1990s, and dropped slightly and remained at that level after 1997. This pattern, in particular, the high regional price variations in the mid to late 1990s, may to a large extent related to the social welfare reform introduced in the mid 1990s.

Third, the SPI obtained from Engel's curve approach exhibits larger variations in the earlier period (before the 1990s) than those obtained from the Basket Cost

approach using different price or unit value data, whereas in the later period (after the early 1990s) the variations from the Engel's curve approach are closer to those obtained from the Basket Cost method. This may be related to the fact that the Basket Cost method does not take into account goods and services provided free of charge by the government, which comprised a larger proportion of the goods and services in the earlier period than in the later period.

Finally, due to the significant variation of regional price level and the change in regional price dispersion over time, using SPI adjusted income presents a very different regional inequality story than that using unadjusted income. With unadjusted income the common finding was that the mid 1990s saw the most significant increase in regional income inequality. Whereas using SPI adjusted income we find that regional income inequality actually increased the most in the late 1980s. During the mid 1990s regional income inequality stabilized.

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Table 1: Regional Average Consumer Prices and Price Differentials in Urban China, 1991-1997

Province	**Rice**		**Egg**	**Shirt**	**Colour TV**	**Rent**	**Hairdressing service**	**Child care**
Name	**kg**	**kg**	**kg**	**piece**	**unit**	**per squ. meter**	**once**	**per month**
Beijing	0.93	5.76	3.78	18.58	2145.95	0.13	1.69	27.00
Shanxi	1.04	5.33	4.59	27.25	2195.13	0.16	1.27	26.42
Shanghai	0.52	5.39	4.16	22.64	2230.00	0.36	1.55	40.75
Guangdong	0.92	8.05	5.49	18.82	2498.57	0.50	4.18	23.12
Sichuang	0.62	4.61	5.00	17.32	2202.47	0.12	1.34	12.25
Shaanxi	0.90	5.03	4.88	17.97	1965.51	0.23	1.19	26.11
Mean of all provinces	0.81	5.73	4.95	17.41	2288.30	0.20	1.59	20.10
Std.Dev.	0.30	0.77	0.55	3.12	283.94	0.09	0.71	10.12
Coeff. of variance	0.37	0.13	0.11	0.18	0.12	0.45	0.45	0.50
Beijing	1.05	6.04	3.92	18.60	1793.99	0.28	2.57	33.04
Shanxi	1.22	5.76	4.25	27.73	2029.78	0.16	1.45	27.76
Shanghai	0.85	6.30	4.43	25.41	2650.00	0.47	2.92	44.00
Guangdong	1.21	8.75	5.31	24.78	3055.51	0.88	5.95	32.38
Sichuang	0.77	5.16	5.13	19.81	1888.80	0.21	1.53	15.43
Shaanxi	1.15	5.44	4.74	19.12	1833.62	0.24	1.41	27.50
Mean of all provinces	1.00	6.20	4.97	19.11	2112.49	0.27	1.95	23.26
Std.Dev.	0.20	0.81	0.66	3.83	341.90	0.16	0.99	10.78
Coeff. of variance	0.20	0.13	0.13	0.20	0.16	0.58	0.51	0.46
Beijing	1.43	8.29	5.05	41.50	2444.17	0.42	5.17	50.00
Shanxi	1.50	6.24	4.98	38.10	2551.86	0.21	2.17	32.12
Shanghai	1.57	7.99	5.43	38.70	2517.50	0.47	5.16	62.00
Guangdong	1.54	9.94	6.53	25.55	3384.32	1.27	7.59	35.72
Sichuang	0.77	5.16	5.13	19.81	1888.80	0.21	1.53	15.43
Shaanxi	1.34	5.76	5.83	22.11	1759.08	0.29	1.82	42.65
Mean of all provinces	1.30	7.23	5.72	26.04	2336.35	0.35	2.72	29.50
Std.Dev.	0.21	1.36	0.72	9.55	624.11	0.22	1.45	14.44
Coeff. of variance	0.16	0.19	0.13	0.37	0.27	0.64	0.53	0.49
Beijing	2.13	12.49	5.60	54.33	2635.00	0.55	6.92	50.00
Shanxi	2.11	9.44	5.21	44.82	2783.44	0.34	2.83	39.19
Shanghai	2.41	12.14	6.41	46.97	2670.42	0.47	7.80	80.00
Guangdong	2.35	13.74	8.19	31.81	3346.28	1.46	11.40	42.75
Sichuang	2.03	9.49	7.37	48.46	2635.67	0.40	3.71	33.27
Shaanxi	2.33	8.88	6.27	37.37	1871.17	0.57	2.27	55.16
Mean of all provinces	2.13	10.59	6.69	42.86	2612.31	0.49	3.79	39.16
Std.Dev.	0.26	1.36	1.22	15.47	563.68	0.27	2.26	17.47
Coeff. of variance	0.12	0.13	0.18	0.36	0.22	0.55	0.60	0.45
Beijing	3.27	15.17	6.40	70.17	2645.83	0.76	8.33	50.00
Shanxi	3.45	11.84	5.94	48.60	2771.46	0.66	3.40	38.48
Shanghai	3.25	16.21	7.74	62.72	2675.00	0.64	9.28	102.92
Guangdong	2.94	16.53	9.01	34.07	3059.32	1.80	13.43	60.01
Sichuang	2.45	10.91	8.56	54.28	2644.37	0.50	4.31	41.07
Shaanxi	3.34	11.52	7.74	47.59	1854.73	1.09	2.75	62.89
Mean of all provinces	2.91	12.88	7.70	47.64	2572.34	0.61	4.68	45.58
Std.Dev.	0.48	1.68	1.50	13.90	495.10	0.30	2.75	23.06
Coeff. of variance	0.17	0.13	0.19	0.29	0.19	0.49	0.59	0.51
Beijing	3.60	15.43	7.52	79.67	2600.00	1.30	11.83	50.00
Shanxi	3.74	11.64	7.24	51.84	2562.84	0.58	4.53	47.29
Shanghai	3.40	16.94	9.67	65.68	2591.17	0.87	10.40	105.00
Guangdong	3.04	17.50	11.63	32.85	3054.05	1.50	10.71	73.49
Sichuang	2.61	11.35	9.43	69.68	2536.41	0.70	4.83	47.21
Shaanxi	3.47	11.45	9.34	53.03	1819.79	1.81	3.06	70.20
Mean of all provinces	3.02	13.31	8.92	57.38	2582.49	0.82	5.40	52.75
Std.Dev.	0.52	1.84	1.69	18.68	467.89	0.32	3.03	23.82
Coeff. of variance	0.17	0.14	0.19	0.33	0.18	0.39	0.56	0.45
Beijing	3.00	17.07	5.62	88.00	2163.33	1.30	12.00	60.00
Shanxi	2.96	14.07	5.46	53.38	2351.78	0.64	4.70	58.44
Shanghai	2.76	19.30	5.95	119.00	2317.71	1.21	9.70	134.17
Guangdong	2.63	18.10	9.48	33.81	2824.91	1.78	11.96	89.43
Sichuang	2.42	13.03	8.06	74.65	2306.00	0.88	5.58	51.07
Shaanxi	2.87	13.20	6.95	60.73	1626.81	2.52	3.44	77.28
Mean of all provinces	2.55	14.89	7.07	67.36	2389.43	1.04	5.82	60.66
Std.Dev.	0.40	1.92	1.86	23.45	493.68	0.46	3.09	26.99
Coeff. of variance	0.16	0.13	0.26	0.35	0.21	0.44	0.53	0.44

Note: Authors' own calculation based on Price Statistical Yearbook (NBS, 1998)

Table 2: Sample Size, 1986-2001

Year	Whole sample		Restricted sample	
	Households	Individuals	Households	Individuals
1986	12437	46983	11266	42938
1987	13200	49572	12266	46452
1988	13768	49419	12810	46657
1989	13112	46338	12364	44071
1990	13680	47673	12987	45683
1991	13798	46858	13217	45193
1992	16888	56080	16111	53934
1993	16723	54611	15903	52396
1994	16877	54453	16087	52271
1995	16888	54009	16088	51853
1996	16900	53754	16121	51642
1997	16849	53520	16026	51271
1998	17000	53370	15888	50261
1999	16900	52543	15962	50037
2000	16899	52449	15847	49612
2001	16999	52300	15816	49046

Table 3: Summary Statistics, 1986-2001

	1986		1987		1988		1989		1990		1991		1992		1993	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Per capita disposable Income	951.11	368.82	1047.60	400.25	1250.93	540.46	1442.43	647.84	1597.14	700.34	1772.46	761.73	2186.21	1082.26	2787.72	1522.98
Per capita expenditure	922.77	427.94	1014.97	467.29	1293.33	659.97	1418.13	764.92	1508.03	756.20	1720.13	876.13	2059.08	1129.08	2700.34	1676.31
Budget share of food at home in expenditure	45.57	12.28	46.14	12.66	45.68	14.06	47.70	14.23	47.22	13.96	45.52	13.49	43.40	14.09	40.83	15.01
Budget share of food at home in income	43.46	12.71	43.93	13.49	45.84	15.02	45.92	15.45	44.11	15.20	43.56	14.67	40.32	13.99	38.35	14.52
Share of eating out in all food	5.51	7.32	5.20	7.25	4.40	6.87	4.08	6.69	4.05	6.58	4.51	7.23	8.25	9.06	8.74	9.62
City level food price 1 (unit value)	306.85	56.13	337.03	87.21	692.30	133.48	795.61	180.62	846.52	189.33	933.05	226.41	1140.65	285.29	1329.61	355.71
City level non-food price 1 (unit value)	371.25	47.19	378.95	123.43	621.79	92.88	598.92	113.59	635.54	112.60	734.18	140.60	1051.14	251.30	1420.69	339.79
ln(relative food price 1)	-0.20	0.11	-0.12	0.19	0.10	0.13	0.28	0.13	0.28	0.13	0.23	0.15	0.08	0.22	-0.07	0.20
City level food price 2 (unit value & wage)	410.53	47.61	460.62	86.33	557.28	79.42	638.05	110.85	679.13	115.52	744.77	131.49	962.72	227.19	1115.95	274.98
City level non-food price 2 (unit value *wage)	446.64	51.94	454.66	135.42	597.51	87.82	598.03	110.52	633.03	104.02	731.68	128.56	921.44	158.58	1251.40	248.86
ln(relative food price 2)	-0.08	0.08	0.02	0.17	-0.07	0.12	0.07	0.12	0.07	0.12	0.02	0.13	0.03	0.19	-0.13	0.15
Household size	3.81	1.07	3.79	1.06	3.64	1.02	3.56	1.00	3.52	0.98	3.42	0.91	3.35	0.86	3.29	0.83
Husband age	43.56	10.73	44.25	10.48	44.08	10.91	44.62	10.95	45.00	10.96	43.89	11.03	44.83	11.18	45.45	11.21
Wife age	39.70	12.02	40.40	11.70	40.25	11.55	40.83	11.57	41.23	11.56	40.48	11.39	41.42	11.57	42.13	11.47
Husband schooling	10.58	3.45	10.77	3.47	10.93	3.48	11.06	3.49	11.26	3.47	11.50	3.41	11.82	3.38	11.89	3.37
Wife schooling	9.05	3.81	9.21	3.76	9.35	3.78	9.48	3.77	9.68	3.82	10.07	3.71	10.39	3.72	10.50	3.67
No. of children (0-15)child	0.98	0.80	0.92	0.76	0.89	0.73	0.83	0.70	0.79	0.68	0.79	0.64	0.72	0.60	0.68	0.59
No. of elderly (>=65)	0.17	0.46	0.16	0.45	0.14	0.41	0.15	0.42	0.15	0.44	0.14	0.41	0.15	0.44	0.16	0.46
Female Ratio (%)	50.35	18.17	49.73	17.92	49.24	16.84	48.89	16.59	48.90	16.39	49.09	16.36	49.08	16.46	49.12	16.24
Average temperature in January	-0.27	8.41	0.30	8.13	0.36	8.24	0.60	8.45	0.44	8.37	0.77	8.41	0.23	8.55	0.19	8.56
	1994		**1995**		**1996**		**1997**		**1998**		**1999**		**2000**		**2001**	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Per capita disposable Income	3806.46	2184.33	4606.67	2578.96	5182.13	2979.39	5560.68	3323.99	5818.58	3486.00	6217.43	3614.52	6735.73	4278.84	7350.23	4806.59
Per capita expenditure	3695.44	2414.87	4419.40	2806.24	4919.44	3104.19	5325.29	3569.13	5767.56	4448.89	6079.72	5110.18	6606.99	5555.05	6975.33	6740.17
Budget share of food at home in expenditure	41.91	16.12	42.89	15.54	41.02	15.25	38.85	14.95	36.06	14.78	34.06	14.32	31.72	13.89	30.84	13.55
Budget share of food at home in income	39.60	15.92	40.29	16.61	38.18	14.96	36.24	15.43	33.70	13.92	31.21	14.09	29.18	13.02	28.83	150.65
Share of eating out in all food	8.41	9.58	8.61	9.79	9.28	10.39	10.01	10.93	11.03	11.78	11.97	12.33	13.06	12.82	13.87	13.38
City level food price 1 (unit value)	1801.54	491.93	2251.64	546.30	2396.97	604.57	2423.35	579.52	2363.29	570.11	2381.76	578.83	2388.97	634.68	2468.19	627.04
City level non-food price 1 (unit value)	1922.64	585.48	2320.24	728.89	2686.38	913.92	2919.04	892.15	3179.74	1041.83	3497.78	951.43	3924.92	1329.87	4209.55	1468.10
ln(relative food price 1)	-0.07	0.21	-0.02	0.20	-0.11	0.19	-0.18	0.15	-0.28	0.16	-0.38	0.17	-0.48	0.16	-0.52	0.17
City level food price 2 (unit value & wage)	1535.46	423.62	1929.02	451.11	2038.97	495.05	2048.53	448.41	2035.04	432.65	2017.85	424.98	2053.19	465.04	2101.20	469.63
City level non-food price 2 (unit value *wage)	1675.94	385.47	2025.50	441.19	2308.27	567.48	2566.07	671.62	2805.56	770.69	3086.20	699.61	3484.45	1018.47	3765.45	1163.72
ln(relative food price 2)	-0.10	0.20	-0.06	0.16	-0.13	0.16	-0.22	0.12	-0.31	0.11	-0.42	0.11	-0.52	0.12	-0.57	0.12
Household size	3.25	0.83	3.22	0.81	3.20	0.79	3.20	0.80	3.16	0.77	3.13	0.75	3.13	0.79	3.10	0.77
Husband age	45.87	11.60	46.04	11.41	46.24	11.27	46.37	11.33	46.75	11.27	47.07	11.19	47.61	11.70	47.97	11.43
Wife age	42.52	11.87	42.77	11.74	43.02	11.64	43.22	11.63	43.69	11.54	44.01	11.53	44.31	12.22	44.69	12.06
Husband schooling	11.97	3.38	12.01	3.32	12.05	3.30	12.00	3.30	12.13	3.29	12.24	3.25	12.12	3.33	12.12	3.28
Wife schooling	10.62	3.72	10.69	3.65	10.81	3.60	10.75	3.58	10.92	3.55	11.05	3.56	10.90	3.69	10.98	3.63
No. of children (0-15)child	0.64	0.58	0.63	0.57	0.61	0.57	0.59	0.57	0.55	0.56	0.51	0.55	0.51	0.56	0.49	0.55
No. of elderly (>=65)	0.17	0.47	0.17	0.47	0.19	0.49	0.19	0.50	0.19	0.50	0.20	0.51	0.23	0.54	0.23	0.55
Female Ratio (%)	49.37	16.04	49.34	15.97	49.44	15.96	49.54	15.93	49.48	15.85	49.42	15.74	49.57	15.72	49.50	15.61
Average temperature in January	0.22	8.54	0.26	8.53	0.26	8.53	0.38	8.55	0.40	8.56	0.31	8.58	0.28	8.57	0.31	8.57

Note: Using restricted sample

Table 4: Engel's Curve Regression Results, 1986-2001

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
ln(total expenditure)	-18.68	-17.53	-19.38	-17.31	-17.29	-16.96	-18.06	-18.55	-19.68	-19.04	-18.90	-17.67	-17.06	-15.97	-14.76	-14.05
	[0.283]***	[0.285]***	[0.265]***	[0.307]***	[0.273]***	[0.302]***	[0.247]***	[0.204]***	[0.200]***	[0.198]***	[0.197]***	[0.195]***	[0.167]***	[0.160]***	[0.156]***	[0.154]***
ln(relative food price)	20.20	5.55	4.93	8.68	9.80	6.19	1.76	-0.40	-2.65	-1.17	-1.14	-3.60	-8.46	-9.49	-10.36	-7.86
	[1.079]***	[0.628]***	[0.952]***	[0.880]***	[1.057]***	[0.787]***	[0.467]***	[0.545]	[0.522]***	[0.541]**	[0.631]*	[0.713]***	[0.662]***	[0.693]***	[0.680]***	[0.596]***
Eatout	-0.49	-0.48	-0.48	-0.49	-0.51	-0.47	-0.45	-0.42	-0.43	-0.43	-0.39	-0.36	-0.32	-0.30	-0.28	-0.28
	[0.012]***	[0.012]***	[0.012]***	[0.014]***	[0.013]***	[0.012]***	[0.009]***	[0.009]***	[0.009]***	[0.009]***	[0.008]***	[0.008]***	[0.007]***	[0.006]***	[0.006]***	[0.005]***
Household size	2.20	1.65	1.56	1.06	1.06	0.87	1.17	1.31	1.70	1.48	1.74	1.83	1.69	1.60	1.73	1.56
	[0.105]***	[0.104]***	[0.116]***	[0.121]***	[0.117]***	[0.121]***	[0.112]***	[0.115]***	[0.115]***	[0.115]***	[0.116]***	[0.118]***	[0.117]***	[0.119]***	[0.112]***	[0.111]***
Husband age	0.17	0.15	0.14	0.15	0.16	0.20	0.15	0.16	0.17	0.18	0.19	0.17	0.17	0.15	0.14	0.10
	[0.017]***	[0.017]***	[0.017]***	[0.019]***	[0.018]***	[0.018]***	[0.016]***	[0.017]***	[0.017]***	[0.016]***	[0.017]***	[0.017]***	[0.016]***	[0.016]***	[0.015]***	[0.014]***
Wife age	0.01	0.03	0.11	0.11	0.11	0.11	0.13	0.11	0.11	0.09	0.10	0.09	0.08	0.05	0.05	0.07
	[0.014]	[0.015]*	[0.015]***	[0.017]***	[0.015]***	[0.017]***	[0.015]***	[0.016]***	[0.015]***	[0.015]***	[0.015]***	[0.015]***	[0.014]***	[0.014]***	[0.013]***	[0.012]***
Husband schooling	-0.11	-0.17	-0.28	-0.28	-0.33	-0.30	-0.27	-0.26	-0.36	-0.31	-0.29	-0.24	-0.27	-0.24	-0.18	-0.15
	[0.028]***	[0.028]***	[0.030]***	[0.032]***	[0.031]***	[0.029]***	[0.027]***	[0.028]***	[0.029]***	[0.028]***	[0.028]***	[0.028]***	[0.028]***	[0.027]***	[0.026]***	[0.026]***
Wife schooloing	-0.11	-0.19	-0.06	-0.14	-0.07	-0.08	-0.16	-0.13	-0.14	-0.12	-0.11	-0.17	-0.12	-0.09	-0.07	-0.12
	[0.029]***	[0.029]***	[0.030]*	[0.033]***	[0.032]**	[0.031]***	[0.028]***	[0.029]***	[0.030]***	[0.029]***	[0.030]***	[0.029]***	[0.029]***	[0.028]***	[0.026]***	[0.026]***
No. of children (0-15)	-1.05	-0.53	-0.72	-0.45	-0.51	0.13	-0.12	0.07	-0.06	-0.08	0.22	0.35	0.74	0.46	0.33	0.67
	[0.131]***	[0.138]***	[0.164]***	[0.181]**	[0.176]***	[0.177]	[0.172]	[0.183]	[0.180]	[0.179]	[0.174]	[0.168]**	[0.170]***	[0.167]***	[0.169]*	[0.168]***
No. of elderly (>65)	0.29	0.92	0.90	0.92	0.91	1.25	0.96	0.85	0.63	0.47	0.29	0.34	0.26	0.65	0.38	0.32
	[0.213]	[0.231]***	[0.253]***	[0.272]***	[0.256]***	[0.255]***	[0.223]***	[0.224]***	[0.226]***	[0.221]**	[0.216]	[0.202]*	[0.199]	[0.196]***	[0.177]**	[0.174]*
Fenale ratio	-0.01	-0.01	-0.01	0.01	-0.01	-0.01	-0.01	-0.02	-0.02	-0.03	-0.02	-0.02	-0.02	-0.02	-0.01	-0.02
	[0.005]**	[0.005]**	[0.005]**	[0.006]	[0.006]	[0.005]**	[0.005]**	[0.005]***	[0.005]***	[0.005]***	[0.005]***	[0.005]***	[0.005]***	[0.005]***	[0.004]***	[0.004]***
Temperature	0.22	0.33	0.38	0.30	0.36	0.39	0.44	0.45	0.36	0.39	0.28	0.33	0.44	0.28	0.42	0.37
	[0.083]***	[0.073]***	[0.064]***	[0.083]***	[0.077]***	[0.065]***	[0.057]***	[0.057]***	[0.057]***	[0.060]***	[0.059]***	[0.057]***	[0.059]***	[0.055]***	[0.057]***	[0.055]***
Temperature^2	0.02	0.01	0.00	-0.01	0.00	-0.02	0.01	-0.01	0.00	0.00	-0.01	0.00	0.01	0.00	0.00	0.00
	[0.005]***	[0.004]*	[0.004]	[0.005]*	[0.005]	[0.004]***	[0.003]	[0.003]***	[0.003]	[0.003]	[0.003]	[0.003]	[0.004]*	[0.003]	[0.003]	[0.003]
Tianjin	-3.13	-0.10	-3.13	0.30	0.12	0.42	0.52	0.58	-0.52	-2.10	-1.90	-2.57	-1.75	-1.57	-0.59	-1.39
	[0.652]***	[1.001]	[0.911]***	[1.352]	[0.924]	[1.132]	[0.613]	[0.618]	[0.690]	[0.649]***	[0.625]***	[0.612]***	[0.603]***	[0.574]***	[0.522]	[0.537]***
Hebei	-6.79	-7.56	-7.62	-4.05	-4.45	-8.77	-7.17	-8.65	-7.87	-10.38	-10.88	-9.37	-8.43	-9.08	-8.35	-7.26
	[0.679]***	[0.887]***	[0.814]***	[1.305]***	[0.861]***	[1.047]***	[0.601]***	[0.581]***	[0.595]***	[0.588]***	[0.574]***	[0.580]***	[0.574]***	[0.544]***	[0.515]***	[0.550]***
Shanxi	-9.35	-12.54	-14.27	-12.43	-12.83	-13.99	-11.65	-11.72	-13.78	-13.31	-12.23	-11.25	-8.47	-10.07	-9.66	-11.41
	[0.676]***	[0.879]***	[0.858]***	[1.324]***	[0.851]***	[1.062]***	[0.623]***	[0.640]***	[0.607]***	[0.636]***	[0.635]***	[0.627]***	[0.654]***	[0.600]***	[0.545]***	[0.546]***
Inner Mongolia	-5.84	-6.89	-9.08	-5.94	-6.92	-6.47	-10.34	-9.06	-10.53	-9.87	-11.85	-10.16	-8.59	-8.65	-6.82	-7.48
	[0.918]***	[1.003]***	[1.017]***	[1.419]***	[0.993]***	[1.172]***	[0.748]***	[0.759]***	[0.779]***	[0.794]***	[0.770]***	[0.728]***	[0.741]***	[0.712]***	[0.672]***	[0.661]***
Liaoning	-0.80	-1.74	-1.98	0.21	3.22	2.00	0.34	-1.40	-1.60	-3.22	-3.82	-3.41	-3.49	-3.78	-3.28	-3.44
	[0.652]	[0.889]*	[0.896]**	[1.351]	[0.883]***	[1.084]*	[0.659]	[0.626]**	[0.631]**	[0.633]***	[0.616]***	[0.615]***	[0.613]***	[0.585]***	[0.560]***	[0.574]***
Julin	-0.63	-2.74	-3.35	0.14	-1.67	-1.08	-5.47	-2.72	-3.94	-5.01	-6.51	-3.96	-2.87	-3.79	-2.84	-3.93
	[0.981]	[1.129]**	[1.146]***	[1.512]	[1.095]	[1.266]	[0.863]***	[0.876]***	[0.854]***	[0.863]***	[0.824]***	[0.867]***	[0.874]***	[0.799]***	[0.758]***	[0.764]***
Heilongjiang	-3.94	-2.44	-1.15	1.32	-1.17	3.13	-3.48	1.62	-1.49	-5.28	-5.55	-5.61	-3.56	-5.27	-1.81	-4.04
	[1.261]***	[1.392]*	[1.460]	[1.727]	[1.341]	[1.504]**	[1.099]***	[1.182]	[1.124]	[1.119]***	[1.080]***	[1.127]***	[1.108]***	[1.037]***	[0.972]*	[0.984]***
Shanghai	-0.72	-0.18	-1.88	0.78	2.68	-4.46	0.21	1.95	3.64	1.42	2.14	3.83	4.83	3.23	2.45	2.28
	[0.788]	[0.929]	[1.054]*	[1.508]	[1.112]**	[1.338]***	[0.724]	[0.718]***	[0.724]***	[0.748]*	[0.735]***	[0.736]***	[0.720]***	[0.664]***	[0.640]***	[0.631]***
Jiangshu	-2.13	-3.59	-5.27	-2.81	-0.98	-3.70	-4.64	-4.67	-3.08	-4.04	-3.49	-4.44	-2.57	-2.16	-3.21	-4.41
	[0.735]***	[0.917]***	[0.906]***	[1.416]**	[0.923]	[1.117]***	[0.659]***	[0.653]***	[0.651]***	[0.673]***	[0.663]***	[0.649]***	[0.659]***	[0.625]***	[0.597]***	[0.607]***
Zhejiang	-2.49	-4.14	-4.55	-1.65	-2.87	-3.37	-5.53	-4.50	-3.22	-4.57	-3.31	-3.37	-3.02	-2.51	-3.92	-4.64
	[0.897]***	[1.084]***	[1.014]***	[1.521]	[1.092]***	[1.184]***	[0.787]***	[0.776]***	[0.789]***	[0.823]***	[0.817]***	[0.767]***	[0.797]***	[0.749]***	[0.718]***	[0.736]***

	[0.805]***	[0.978]***	[0.902]***	[1.356]***	[0.929]***	[1.107]***	[0.706]***	[0.725]***	[0.722]***	[0.722]***	[0.702]***	[0.689]***	[0.676]***	[0.652]***	[0.624]***	[0.645]***
Fujian	-3.24	-2.71	-1.57	4.11	0.90	0.20	-3.12	-1.80	1.52	1.18	2.41	-3.05	-1.41	2.11	-1.19	-0.86
	[1.720]*	[1.589]*	[1.412]	[2.041]**	[1.662]	[1.539]	[1.157]***	[1.167]	[1.194]	[1.265]	[1.246]*	[1.204]**	[1.231]	[1.161]*	[1.160]	[1.124]
Jiangxi	-6.73	-8.02	-8.47	-3.51	-5.31	-7.35	-9.80	-9.51	-8.10	-7.86	-8.03	-7.73	-6.23	-7.00	-7.63	-9.17
	[0.990]***	[1.064]***	[1.025]***	[1.514]**	[1.114]***	[1.200]***	[0.850]***	[0.821]***	[0.855]***	[0.848]***	[0.889]***	[0.859]***	[0.854]***	[0.787]***	[0.750]***	[0.733]***
Shandong	-2.82	-4.27	-5.05	-3.49	-4.43	-4.29	-6.83	-8.57	-9.21	-10.72	-9.25	-8.67	-7.75	-7.43	-7.03	-8.21
	[0.593]***	[0.813]***	[0.834]***	[1.284]***	[0.818]***	[1.036]***	[0.630]***	[0.590]***	[0.614]***	[0.621]***	[0.596]***	[0.585]***	[0.581]***	[0.523]***	[0.499]***	[0.526]***
Henan	-9.88	-9.46	-11.04	-8.52	-7.53	-9.36	-9.32	-10.94	-9.79	-11.35	-10.75	-9.99	-10.12	-11.45	-12.80	-13.69
	[0.688]***	[0.858]***	[0.866]***	[1.316]***	[0.873]***	[1.054]***	[0.654]***	[0.620]***	[0.660]***	[0.688]***	[0.665]***	[0.630]***	[0.620]***	[0.587]***	[0.566]***	[0.603]***
Hubei	-5.22	-6.97	-8.41	-5.03	-5.08	-8.26	-8.79	-9.66	-8.78	-8.27	-7.54	-7.22	-7.06	-6.16	-7.49	-8.14
	[0.828]***	[0.944]***	[0.939]***	[1.417]***	[0.996]***	[1.122]***	[0.677]***	[0.682]***	[0.713]***	[0.719]***	[0.703]***	[0.692]***	[0.686]***	[0.639]***	[0.599]***	[0.610]***
Hunan	-6.47	-6.48	-7.93	-6.58	-7.18	-8.85	-10.48	-11.98	-8.64	-9.26	-8.43	-8.93	-8.44	-7.23	-7.94	-9.95
	[0.962]***	[1.021]***	[0.981]***	[1.461]***	[1.047]***	[1.157]***	[0.745]***	[0.753]***	[0.743]***	[0.767]***	[0.759]***	[0.743]***	[0.745]***	[0.709]***	[0.667]***	[0.680]***
Guangdong	1.44	-0.54	3.63	5.79	5.73	4.83	2.61	6.90	7.51	4.40	6.24	3.19	2.42	4.88	2.32	-0.47
	[2.178]	[1.898]	[1.659]**	[2.402]**	[2.025]***	[1.785]***	[1.425]*	[1.434]***	[1.438]***	[1.522]***	[1.478]***	[1.456]**	[1.500]	[1.400]***	[1.378]*	[1.360]
Guangxi	-3.14	-2.84	-2.41	-1.07	2.17	-0.87	-4.46	-2.60	-1.44	-3.07	-2.35	-4.11	-4.81	-1.76	-4.42	-5.94
	[2.125]	[1.792]	[1.575]	[2.352]	[1.912]	[1.694]	[1.207]***	[1.209]**	[1.216]	[1.289]**	[1.264]*	[1.222]***	[1.266]***	[1.181]	[1.169]***	[1.168]***
Hainan					0.09	4.65	-3.58	5.46	4.57	0.65	2.66	0.13	-2.10	1.97	-2.32	-3.14
					[2.959]	[2.523]*	[2.114]*	[2.136]**	[2.188]**	[2.297]	[2.256]	[2.228]	[2.281]	[2.136]	[2.085]	[2.084]
Chongqin												-7.08	-7.74	-5.36	-7.78	-8.39
												[0.986]***	[0.997]***	[0.934]***	[0.926]***	[0.915]***
Sichuang	-4.04	-6.58	-8.47	-3.60	-4.96	-7.60	-8.24	-7.84	-6.15	-7.78	-6.91	-6.06	-6.69	-4.14	-7.15	-8.17
	[0.968]***	[1.038]***	[1.002]***	[1.508]**	[1.089]***	[1.172]***	[0.740]***	[0.730]***	[0.740]***	[0.773]***	[0.755]***	[0.783]***	[0.805]***	[0.778]***	[0.741]***	[0.717]***
Guizhou	-5.50	-8.10	-6.68	-5.80	-5.52	-8.08	-7.57	-8.20	-8.08	-9.52	-7.51	-7.74	-6.05	-6.19	-4.84	-6.57
	[0.785]***	[0.973]***	[0.956]***	[1.366]***	[0.957]***	[1.098]***	[0.728]***	[0.678]***	[0.700]***	[0.712]***	[0.711]***	[0.726]***	[0.739]***	[0.674]***	[0.644]***	[0.643]***
Yunnan	-8.20	-7.94	-10.46	-7.59	-9.90	-10.13	-12.81	-11.18	-9.98	-9.99	-8.69	-9.17	-9.05	-5.78	-8.29	-10.99
	[1.456]***	[1.391]***	[1.326]***	[1.987]***	[1.585]***	[1.544]***	[1.089]***	[1.111]***	[1.101]***	[1.192]***	[1.167]***	[1.121]***	[1.135]***	[1.081]***	[1.093]***	[1.070]***
Shaanxi	-8.47	-10.54	-12.61	-10.04	-10.00	-11.40	-11.89	-13.54	-12.65	-13.26	-13.67	-13.56	-12.43	-12.08	-10.69	-11.04
	[0.746]***	[0.885]***	[0.876]***	[1.320]***	[0.882]***	[1.059]***	[0.670]***	[0.645]***	[0.663]***	[0.674]***	[0.675]***	[0.633]***	[0.638]***	[0.603]***	[0.571]***	[0.565]***
Ganshu	-3.57	-6.67	-8.00	-6.62	-7.09	-7.72	-5.81	-5.05	-7.15	-7.64	-7.81	-6.20	-3.93	-4.01	-3.37	-4.77
	[0.801]***	[0.892]***	[0.947]***	[1.329]***	[0.883]***	[1.101]***	[0.675]***	[0.679]***	[0.670]***	[0.706]***	[0.720]***	[0.755]***	[0.732]***	[0.627]***	[0.596]***	[0.602]***
Qinghai	-2.33	-2.22	-4.52	-1.00	-2.12	-2.17	-4.66	-3.06	-6.98	-5.51	-6.10	-6.11	-2.56	-1.76	-0.45	-1.21
	[1.335]*	[1.018]**	[0.991]***	[1.458]	[0.977]**	[1.136]*	[0.802]***	[0.788]***	[0.760]***	[0.812]***	[0.806]***	[0.815]***	[0.812]***	[0.804]**	[0.738]	[0.789]
Ningxia	-5.64	-5.42	-9.46	-5.26	-4.93	-6.53	-9.84	-8.37	-9.57	-11.25	-11.69	-10.42	-6.93	-7.10	-6.29	-6.96
	[1.091]***	[0.984]***	[0.970]***	[1.425]***	[1.064]***	[1.129]***	[0.853]***	[0.862]***	[0.837]***	[0.844]***	[0.835]***	[0.855]***	[0.864]***	[0.834]***	[0.782]***	[0.777]***
Xinjiang	-3.78	-5.21	-3.86	-1.72	-4.66	-0.94	-3.66	0.54	-4.67	-4.50	-5.37	-4.75	-1.39	-2.26	-1.80	-1.79
	[1.027]***	[1.103]***	[1.158]***	[1.501]	[1.120]***	[1.258]	[0.902]***	[0.972]	[0.846]***	[0.860]***	[0.881]***	[0.862]***	[0.871]	[0.846]***	[0.759]**	[0.760]**
Constant	192.77	186.94	202.37	185.47	185.03	184.91	198.77	205.26	220.59	220.60	217.00	203.55	193.58	182.72	167.34	163.59
	[2.236]***	[2.314]***	[2.255]***	[2.804]***	[2.387]***	[2.672]***	[2.079]***	[1.838]***	[1.847]***	[1.886]***	[1.872]***	[1.829]***	[1.651]***	[1.586]***	[1.547]***	[1.519]***
Observations	11266	12266	12810	12364	12987	13217	16111	15903	16087	16088	16121	16026	15888	15962	15847	15816

Table 5: Expenditure Elasticities of Food at Home , 1986-2001

Year	Coefficient of Ln (expenditure) β	Average budget share of food at home ω	Expenditure elasticity of food at home $\eta_{y,F} = 1 + \frac{\beta}{\omega}$
1986	-18.68	45.77	0.59
1987	-17.53	46.28	0.62
1988	-19.38	45.92	0.58
1989	-17.31	47.93	0.64
1990	-17.29	47.49	0.64
1991	-16.96	45.74	0.63
1992	-18.06	43.44	0.58
1993	-18.55	40.89	0.55
1994	-19.68	42.07	0.53
1995	-19.04	43.06	0.56
1996	-18.90	41.11	0.54
1997	-17.67	38.99	0.55
1998	-17.06	36.11	0.53
1999	-15.97	33.96	0.53
2000	-14.76	31.59	0.53
2001	-14.05	30.76	0.54

Table 6: Calculated SPI Using Engel Curvey Approach, 1986-2001

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Beijing	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Tianjin	0.85	0.99	0.85	1.02	1.01	1.02	1.03	1.03	0.97	0.90	0.90	0.86	0.90	0.91	0.96	0.91
Hebei	0.70	0.65	0.68	0.79	0.77	0.60	0.67	0.63	0.67	0.58	0.56	0.59	0.61	0.57	0.57	0.60
Shanxi	0.61	0.49	0.48	0.49	0.48	0.44	0.52	0.53	0.50	0.50	0.52	0.53	0.61	0.53	0.52	0.44
Inner Mongolia	0.73	0.68	0.63	0.71	0.67	0.68	0.56	0.61	0.59	0.60	0.53	0.56	0.60	0.58	0.63	0.59
Liaoning	0.96	0.91	0.90	1.01	1.20	1.13	1.02	0.93	0.92	0.84	0.82	0.82	0.82	0.79	0.80	0.78
Jilin	0.97	0.86	0.84	1.01	0.91	0.94	0.74	0.86	0.82	0.77	0.71	0.80	0.84	0.79	0.82	0.76
Heilongjiang	0.81	0.87	0.94	1.08	0.93	1.20	0.82	1.09	0.93	0.76	0.75	0.73	0.81	0.72	0.88	0.75
Shanghai	0.96	0.99	0.91	1.05	1.17	0.77	1.01	1.11	1.20	1.08	1.12	1.24	1.33	1.22	1.18	1.18
Jiangsu	0.89	0.81	0.76	0.85	0.95	0.80	0.77	0.78	0.86	0.81	0.83	0.78	0.86	0.87	0.80	0.73
Zhejiang	0.88	0.79	0.79	0.91	0.85	0.82	0.74	0.78	0.85	0.79	0.84	0.83	0.84	0.85	0.77	0.72
Anhui	0.82	0.72	0.79	0.80	0.83	0.76	0.75	0.71	0.79	0.71	0.75	0.74	0.70	0.81	0.78	0.71
Fujian	0.84	0.86	0.92	1.27	1.05	1.01	0.84	0.91	1.08	1.06	1.14	0.84	0.92	1.14	0.92	0.94
Jiangxi	0.70	0.63	0.65	0.82	0.74	0.65	0.58	0.60	0.66	0.66	0.65	0.65	0.69	0.64	0.60	0.52
Shandong	0.86	0.78	0.77	0.82	0.77	0.78	0.68	0.63	0.63	0.57	0.61	0.61	0.63	0.63	0.62	0.56
Henan	0.59	0.58	0.57	0.61	0.65	0.58	0.60	0.55	0.61	0.55	0.57	0.57	0.55	0.49	0.42	0.38
Hubei	0.76	0.67	0.65	0.75	0.75	0.61	0.61	0.59	0.64	0.65	0.67	0.66	0.66	0.68	0.60	0.56
Hunan	0.71	0.69	0.66	0.68	0.66	0.59	0.56	0.52	0.64	0.61	0.64	0.60	0.61	0.64	0.58	0.49
Guangdong	1.08	0.97	1.21	1.40	1.39	1.33	1.16	1.45	1.46	1.26	1.39	1.20	1.15	1.36	1.17	0.97
Guangxi	0.85	0.85	0.88	0.94	1.13	0.95	0.78	0.87	0.93	0.85	0.88	0.79	0.75	0.90	0.74	0.66
Hainan					1.01	1.32	0.82	1.34	1.26	1.03	1.15	1.01	0.88	1.13	0.85	0.80
Chongqin												0.67	0.64	0.72	0.59	0.55
Sichuang	0.81	0.69	0.65	0.81	0.75	0.64	0.63	0.66	0.73	0.66	0.69	0.71	0.68	0.77	0.62	0.56
Guizhou	0.74	0.63	0.71	0.72	0.73	0.62	0.66	0.64	0.66	0.61	0.67	0.65	0.70	0.68	0.72	0.63
Yunnan	0.64	0.64	0.58	0.64	0.56	0.55	0.49	0.55	0.60	0.59	0.63	0.60	0.59	0.70	0.57	0.46
Shaanxi	0.64	0.55	0.52	0.56	0.56	0.51	0.52	0.48	0.53	0.50	0.49	0.46	0.48	0.47	0.48	0.46
Ganshu	0.83	0.68	0.66	0.68	0.66	0.63	0.72	0.76	0.70	0.67	0.66	0.70	0.79	0.78	0.80	0.71
Qinghai	0.88	0.88	0.79	0.94	0.88	0.88	0.77	0.85	0.70	0.75	0.72	0.71	0.86	0.90	0.97	0.92
Ningxia	0.74	0.73	0.61	0.74	0.75	0.68	0.58	0.64	0.61	0.55	0.54	0.55	0.67	0.64	0.65	0.61
Xinjiang	0.82	0.74	0.82	0.91	0.76	0.95	0.82	1.03	0.79	0.79	0.75	0.76	0.92	0.87	0.89	0.88
Maximum	1.08	1.00	1.21	1.40	1.39	1.33	1.16	1.45	1.46	1.26	1.39	1.24	1.33	1.36	1.18	1.18
Minimum	0.59	0.49	0.48	0.49	0.48	0.44	0.49	0.48	0.50	0.50	0.49	0.46	0.48	0.47	0.42	0.38
Ratio of max to min	1.83	2.04	2.52	2.86	2.93	3.03	2.35	3.01	2.95	2.54	2.87	2.68	2.75	2.89	2.81	3.12
Mean	0.81	0.76	0.76	0.86	0.85	0.81	0.74	0.80	0.80	0.75	0.77	0.74	0.77	0.79	0.75	0.69
SD	0.12	0.14	0.16	0.20	0.21	0.24	0.17	0.25	0.23	0.19	0.22	0.18	0.18	0.21	0.19	0.19
CV	0.15	0.18	0.21	0.24	0.25	0.30	0.23	0.31	0.29	0.26	0.29	0.25	0.24	0.27	0.26	0.28
Year to year Corr. Coeff.		0.89	0.89	0.94	0.91	0.84	0.81	0.87	0.93	0.97	0.98	0.94	0.94	0.91	0.90	0.97
Corr. Coeff. Relative to 1986		0.89	0.89	0.82	0.85	0.80	0.86	0.82	0.82	0.83	0.79	0.85	0.82	0.82	0.86	0.83

Table 7: Calculated SPI Using Prices, 1991-1997

Province	SPI1991	SPI1992	SPI1993	SPI1994	SPI1995	SPI1996	SPI1997
Beijing	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Tianjin	1.02	1.05	1.07	1.06	1.01	1.05	0.99
Hebei	0.91	0.89	0.83	0.85	0.80	0.79	0.75
Shanxi	0.99	0.96	0.92	0.89	0.87	0.84	0.79
Inner Mongolia	0.94	0.94	0.90	0.89	0.81	0.83	0.78
Liaoning	1.09	1.07	1.03	1.10	0.97	0.95	0.89
Jilin	1.11	1.14	1.19	1.13	1.05	1.05	1.04
Heilongjiang	1.02	1.02	1.12	0.97	0.91	0.93	0.93
Shanghai	1.14	1.14	1.24	1.23	1.20	1.19	1.12
Jiangsu	1.02	1.01	1.09	1.09	1.05	1.05	0.98
Zhejiang	1.13	1.13	1.08	1.12	1.06	1.06	1.00
Anhui	0.89	0.91	0.87	0.98	0.80	0.91	0.85
Fujian	1.29	1.21	1.14	1.09	1.02	0.96	0.91
Jiangxi	0.90	0.87	0.83	0.92	0.85	0.83	0.78
Shandong	0.90	0.89	0.82	0.95	0.89	0.90	0.85
Henan	0.95	0.92	0.84	0.90	0.90	0.86	0.84
Hubei	0.96	0.95	0.88	0.87	0.84	0.84	0.79
Hunan	0.97	0.97	1.02	1.02	1.02	0.97	0.93
Guangdong	1.26	1.36	1.30	1.26	1.17	1.06	1.00
Guangxi	0.97	0.96	0.96	0.99	0.97	0.93	0.86
Hainan	1.30	1.25	1.15	1.19	1.10	1.04	0.96
Chongqing	1.05	1.11	0.98	1.03	1.01	1.07	1.00
Sichuan	0.92	0.91	0.77	0.97	0.90	0.90	0.84
Guizhou	0.86	0.83	0.79	0.87	0.80	0.80	0.73
Yunnan	0.90	0.90	0.90	0.93	0.88	0.87	0.83
Shaanxi	0.88	0.89	0.82	0.83	0.81	0.82	0.79
Gansu	0.96	0.92	0.87	0.92	0.89	0.92	0.80
Qinghai	0.86	0.84	0.76	0.80	0.75	0.75	0.71
Ningxia	0.94	0.93	0.85	0.90	0.85	0.83	0.78
Xinjiang	1.07	0.98	0.88	0.95	0.77	0.90	0.84
Maximum	1.30	1.36	1.30	1.26	1.20	1.19	1.12
Minimum	0.86	0.83	0.76	0.80	0.75	0.75	0.71
Ratio of max to min	1.51	1.64	1.71	1.58	1.60	1.59	1.58
Mean	1.01	1.00	0.96	0.99	0.93	0.93	0.88
SD	0.12	0.13	0.15	0.12	0.12	0.11	0.10
CV	0.12	0.13	0.15	0.12	0.13	0.11	0.12
Year to year Corr. Coeff.		0.96	0.91	0.91	0.93	0.92	0.97
Corr. Coeff. Relative to 1986		0.96	0.85	0.85	0.77	0.71	0.69

Note: (1) Author's own calculation using basket cost method, price data and national average consumption bundle, (2) Price of Beijing is normalized as 1.

Table 8: Calculated SPI Using Unit Values, 1986-2001

Province	SPI1986	SPI1987	SPI1988	SPI1989	SPI1990	SPI1991	SPI1992	SPI1993	SPI1994	SPI1995	SPI1996	SPI1997	SPI1998	SPI1999	SPI2000	SPI2001
Beijing	1.00	1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Tianjin	0.94	1.01	0.98	0.97	0.95	0.91	0.92	0.88	0.85	0.88	0.87	0.88	0.85	0.89	0.85	0.88
Hebei	0.88	0.95	0.99	0.97	0.99	0.93	0.93	0.90	0.83	0.84	0.82	0.81	0.78	0.76	0.72	0.68
Shanxi	0.86	0.89	0.87	0.90	0.87	0.80	0.78	0.80	0.60	0.81	0.74	0.75	0.73	0.70	0.67	0.66
Inner Mongolia	0.90	0.95	0.97	0.91	0.87	0.81	0.64	0.64	0.59	0.58	0.57	0.68	0.66	0.67	0.68	0.67
Liaoning	0.95	1.03	1.00	1.04	1.03	0.96	0.97	0.94	0.88	0.85	0.82	0.84	0.80	0.78	0.79	0.75
Jilin	0.91	0.93	0.92	0.98	0.94	0.84	0.84	0.85	0.82	0.80	0.83	0.79	0.76	0.73	0.71	0.72
Heilongjiang	0.95	0.99	0.97	0.99	0.95	0.88	0.85	0.84	0.82	0.80	0.80	0.78	0.75	0.73	0.71	0.69
Shanghai	1.00	1.17	1.15	1.16	1.12	1.05	1.22	1.30	1.26	1.23	1.25	1.29	1.16	1.26	1.20	1.14
Jiangsu	0.93	1.04	1.06	1.10	1.05	0.96	0.96	0.99	0.96	0.92	0.90	0.92	0.87	0.87	0.82	0.78
Zhejiang	0.96	1.05	1.08	1.14	1.05	1.02	1.07	1.17	1.14	1.15	1.17	1.17	1.12	1.14	1.12	1.14
Anhui	0.88	0.96	1.02	0.97	0.94	0.85	0.78	0.84	0.81	0.84	0.81	0.75	0.74	0.73	0.72	0.68
Fujian	0.95	1.09	1.04	1.25	1.12	1.00	0.84	1.07	1.06	1.02	0.99	1.00	0.98	0.98	0.98	0.95
Jiangxi	0.82	0.82	0.90	0.95	0.89	0.82	0.78	0.83	0.78	0.81	0.76	0.75	0.71	0.75	0.70	0.71
Shandong	0.89	0.94	0.98	0.97	0.95	0.88	0.85	0.84	0.83	0.83	0.80	0.84	0.82	0.80	0.76	0.76
Henan	0.81	0.91	0.93	0.93	0.91	0.84	0.82	0.79	0.75	0.77	0.74	0.74	0.71	0.71	0.68	0.66
Hubei	0.90	0.98	0.98	0.99	0.98	0.88	0.84	0.89	0.88	0.83	0.82	0.81	0.80	0.81	0.77	0.75
Hunan	0.78	0.93	0.93	0.97	0.89	0.82	0.90	0.88	0.85	0.87	0.83	0.86	0.80	0.81	0.79	0.80
Guangdong	1.15	1.25	1.39	1.52	1.43	1.31	1.50	1.57	1.52	1.49	1.53	1.52	1.49	1.34	1.49	1.48
Guangxi	0.94	1.03	1.08	1.03	1.17	0.94	0.98	1.09	1.07	1.04	0.97	0.97	0.92	0.89	0.86	0.84
Hainan			1.13		1.17	1.08	1.17	1.37	1.38	1.31	1.09	1.02	0.95	0.96	0.87	0.84
Chongqing												0.90	0.86	0.86	0.82	0.81
Sichuan	0.87	0.95	0.95	0.99	0.94	0.85	0.93	0.94	0.91	0.89	0.87	0.89	0.84	0.86	0.80	0.76
Guizhou	0.91	0.92	1.00	0.99	0.98	0.84	0.89	0.85	0.79	0.79	0.81	0.81	0.75	0.79	0.73	0.72
Yunnan	0.82	0.99	1.02	1.03	1.07	0.96	0.80	0.91	0.79	0.91	0.86	0.95	0.90	0.87	0.85	0.81
Shaanxi	0.89	0.96	0.94	0.96	0.91	0.85	0.81	0.79	0.75	0.76	0.74	0.76	0.73	0.75	0.70	0.69
Gansu	0.94	0.99	1.04	0.99	0.94	0.87	0.83	0.82	0.79	0.79	0.72	0.68	0.66	0.71	0.70	0.67
Qinghai	0.93	0.90	0.96	0.95	0.91	0.85	0.72	0.70	0.65	0.60	0.63	0.70	0.68	0.66	0.65	0.65
Ningxia	1.06	1.02	0.97	1.00	0.95	0.86	0.86	0.83	0.79	0.78	0.72	0.73	0.73	0.71	0.71	0.70
Xinjiang	0.97	1.02	0.98	1.00	0.96	0.92	0.89	0.87	0.83	0.86	0.84	0.84	0.78	0.78	0.76	0.73
Maximum	1.15	1.25	1.39	1.52	1.43	1.31	1.50	1.57	1.52	1.49	1.53	1.52	1.49	1.34	1.49	1.48
Minimum	0.78	0.82	0.87	0.90	0.87	0.80	0.64	0.64	0.59	0.58	0.57	0.68	0.66	0.66	0.65	0.65
Ratio of max to min	1.47	1.52	1.60	1.69	1.64	1.64	2.34	2.45	2.58	2.57	2.68	2.24	2.26	2.03	2.29	2.28
Mean	0.92	0.99	1.01	1.02	1.00	0.92	0.91	0.94	0.90	0.90	0.87	0.88	0.84	0.84	0.82	0.80
SD	0.08	0.09	0.10	0.12	0.12	0.11	0.17	0.20	0.21	0.19	0.19	0.18	0.17	0.16	0.18	0.18
CV	0.08	0.09	0.10	0.12	0.12	0.12	0.18	0.21	0.24	0.22	0.22	0.21	0.21	0.20	0.22	0.23
Year to year Corr. Coeff.		0.78	0.88	0.90	0.92	0.94	0.90	0.95	0.98	0.97	0.97	0.98	0.99	0.97	0.98	0.99
Corr. Coeff. Relative to 1986		0.78	0.71	0.68	0.66	0.72	0.66	0.62	0.64	0.57	0.60	0.58	0.62	0.57	0.64	0.64

Note: (1)Author's own calculation using basket cost method, unit values , wages as proxy prices for services and national average consumption bundle.

(2) Price of Beijing is normalized as 1.

Table 9: Comparison of SPIs from different methods

Engel curve	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Ratio of max to min	1.83	2.04	2.52	2.86	2.93	3.03	2.35	3.01	2.95	2.54	2.87	2.68	2.75	2.89	2.81	3.12
Coefficient Variation	0.15	0.18	0.21	0.24	0.25	0.30	0.23	0.31	0.29	0.26	0.29	0.25	0.24	0.27	0.26	0.28
Year to year Corr. Coeff.		0.89	0.89	0.94	0.91	0.84	0.81	0.87	0.93	0.97	0.98	0.94	0.94	0.91	0.90	0.97
Corr. Coeff. Relative to 1986		0.89	0.89	0.82	0.85	0.80	0.86	0.82	0.82	0.83	0.79	0.85	0.82	0.82	0.86	0.83
Basket Cost: Brandt&Holz	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Ratio of max to min	1.35	1.39	1.49	1.57	1.49	1.42	1.41	1.55	1.51	1.43	1.39	1.39	1.40	1.42	1.47	1.47
Coefficient Variation	0.06	0.07	0.09	0.11	0.10	0.09	0.09	0.11	0.10	0.09	0.09	0.08	0.08	0.09	0.10	0.10
Year to year Corr. Coeff.		0.98	0.96	0.99	0.98	0.97	0.99	0.98	0.99	0.99	0.98	0.99	0.99	0.99	0.99	0.99
Corr. Coeff. Relative to 1986		0.98	0.91	0.86	0.89	0.88	0.86	0.82	0.78	0.76	0.71	0.69	0.65	0.62	0.62	0.58
Basket Cost: Price data	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Ratio of max to min						1.51	1.64	1.71	1.58	1.60	1.59	1.58				
Coefficient Variation						0.12	0.13	0.15	0.12	0.13	0.11	0.12				
Year to year Corr. Coeff.							0.96	0.91	0.91	0.93	0.92	0.97				
Corr. Coeff. Relative to 1991							0.96	0.85	0.85	0.77	0.71	0.69				
Basket Cost: Unit value	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Ratio of max to min	1.47	1.52	1.60	1.69	1.64	1.64	2.34	2.45	2.58	2.57	2.68	2.24	2.26	2.03	2.29	2.28
Coefficient Variation	0.08	0.09	0.10	0.12	0.12	0.12	0.18	0.21	0.24	0.22	0.22	0.21	0.21	0.20	0.22	0.23
Year to year Corr. Coeff.		0.78	0.88	0.90	0.92	0.94	0.90	0.95	0.98	0.97	0.97	0.98	0.99	0.97	0.98	0.99
Corr. Coeff. Relative to 1986		0.78	0.71	0.68	0.66	0.72	0.66	0.62	0.64	0.57	0.60	0.58	0.62	0.57	0.64	0.64

Table 10: Correlation Coefficients between different SPI measures

	Engel's curve vs. Unit value	Engel's curve vs. Price data	Engel's curve vs. B&H	B&H vs. Unit value	B&H vs. Price data	Unit value vs. Price data
1986	0.71		0.36	0.60		
1987	0.63		0.31	0.72		
1988	0.69		0.53	0.80		
1989	0.74		0.54	0.88		
1990	0.76		0.57	0.81		
1991	0.66	0.71	0.65	0.82	0.76	0.74
1992	0.69	0.67	0.55	0.78	0.76	0.75
1993	0.73	0.74	0.76	0.88	0.72	0.72
1994	0.89	0.86	0.80	0.85	0.70	0.83
1995	0.79	0.75	0.74	0.85	0.67	0.80
1996	0.86	0.73	0.78	0.78	0.55	0.74
1997	0.81	0.74	0.74	0.75	0.49	0.67
1998	0.69		0.70	0.74		
1999	0.79		0.72	0.76		
2000	0.65		0.61	0.73		
2001	0.57		0.64	0.69		

Table 11: Correlation Coefficients of SPI and Income and Inter-provincial Gini Coefficients

	Corr. Coeff. (SPI and income)	Corr. Coeff. (Income and SPI adj. income)	Inequality measure (Inter-provincial Gini Coefficient)			
			Income	SPI adjusted income	Expenditure	SPI adjusted expenditure
1986	0.72	0.41	0.09	0.06	0.09	0.07
1987	0.75	0.10	0.09	0.07	0.09	0.07
1988	0.73	0.15	0.10	0.08	0.10	0.09
1989	0.69	0.14	0.10	0.10	0.11	0.11
1990	0.77	0.07	0.11	0.10	0.12	0.09
1991	0.56	0.10	0.10	0.13	0.10	0.14
1992	0.67	0.40	0.13	0.10	0.12	0.11
1993	0.67	0.30	0.15	0.13	0.15	0.14
1994	0.80	0.39	0.16	0.10	0.15	0.11
1995	0.79	0.50	0.16	0.11	0.15	0.11
1996	0.84	0.41	0.16	0.09	0.15	0.09
1997	0.81	0.57	0.17	0.10	0.15	0.11
1998	0.70	0.59	0.16	0.12	0.15	0.12
1999	0.75	0.36	0.15	0.11	0.15	0.12
2000	0.67	0.52	0.16	0.12	0.15	0.13
2001	0.65	0.44	0.16	0.13	0.15	0.13

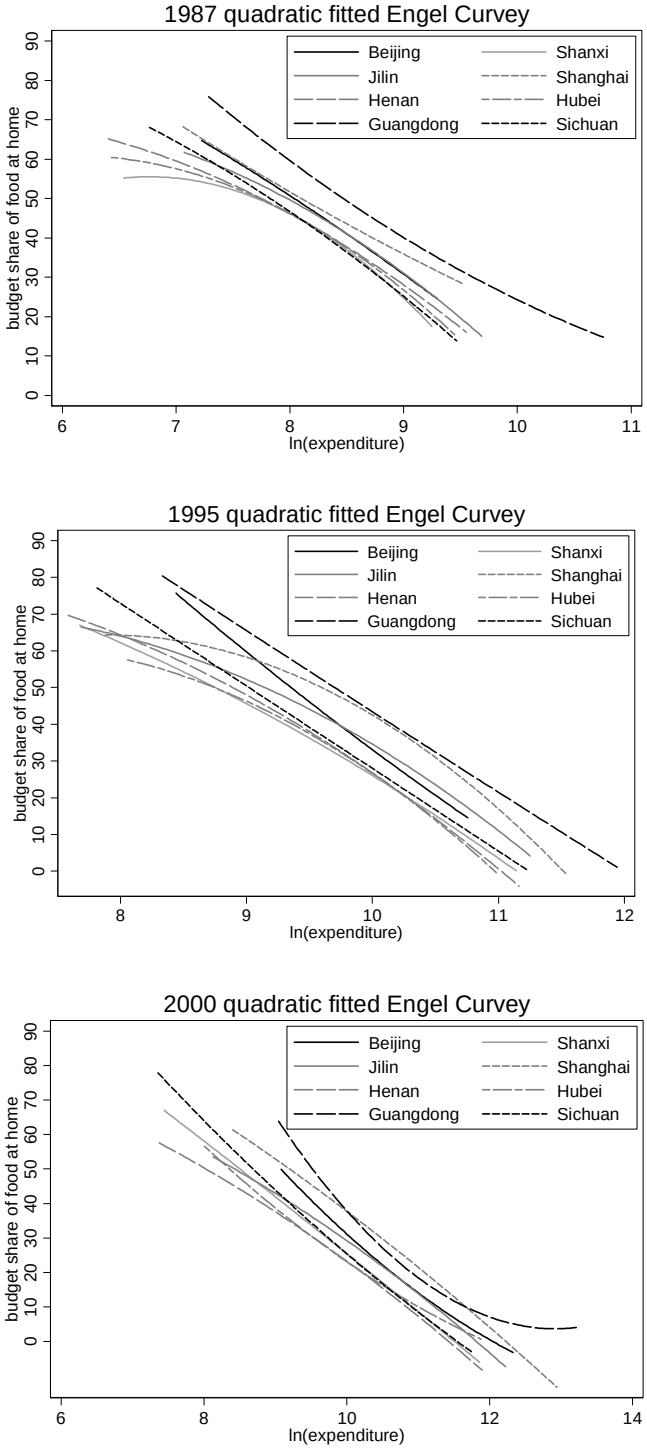
Note:(1) Author's own calculation; (2) At provincial level

Table 12: Correlation Coefficients and Gini Coefficients of Income and SPI-adjusted Income

		Inequality measure (Whole Gini Coefficient)			
	Corr. Coeff. (Income and SPI adj. income)	Income	SPI adjusted income	Expenditure	SPI adjusted expenditure
1986	0.90	0.20	0.19	0.23	0.22
1987	0.87	0.20	0.20	0.23	0.23
1988	0.85	0.22	0.22	0.26	0.26
1989	0.79	0.23	0.23	0.26	0.26
1990	0.79	0.23	0.23	0.25	0.25
1991	0.74	0.22	0.24	0.25	0.26
1992	0.84	0.24	0.24	0.26	0.26
1993	0.79	0.27	0.26	0.30	0.30
1994	0.83	0.29	0.27	0.31	0.30
1995	0.85	0.28	0.26	0.30	0.29
1996	0.83	0.28	0.25	0.30	0.28
1997	0.87	0.29	0.26	0.31	0.30
1998	0.88	0.29	0.27	0.34	0.33
1999	0.84	0.29	0.27	0.34	0.33
2000	0.87	0.31	0.30	0.36	0.35
2001	0.86	0.32	0.30	0.36	0.35

Note: (1)Author's own calculation; (2) At household level.

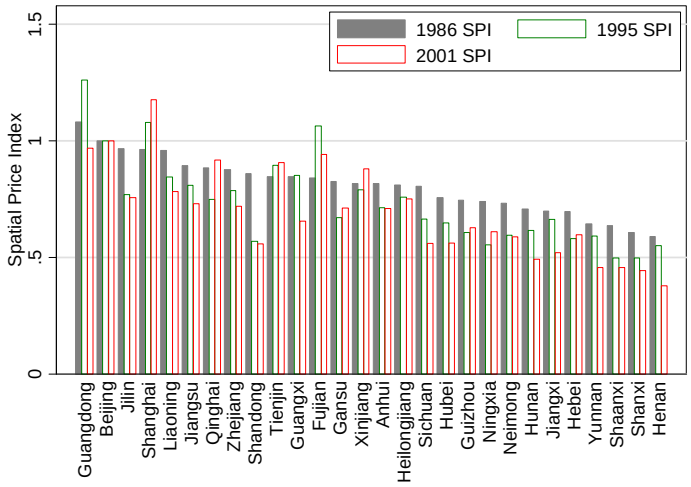
Figure 1: Food Budget Share for Selected Provinces and Years



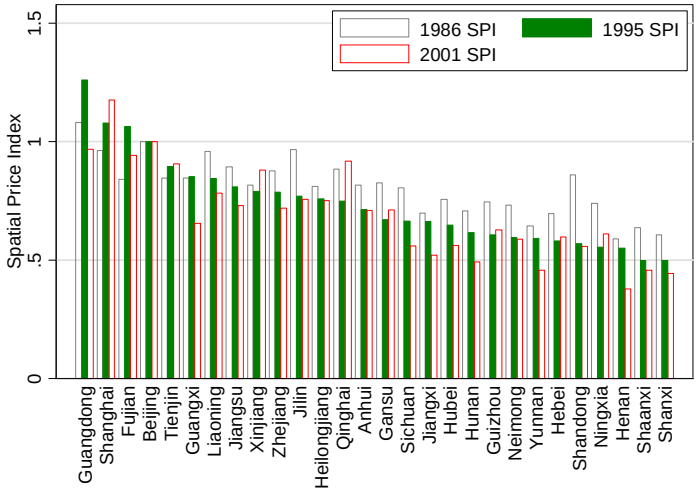
Note: (1) Author's own calculation using data from household survey

Figure 2: Comparison of SPI over time, 1986, 1995, and 2001

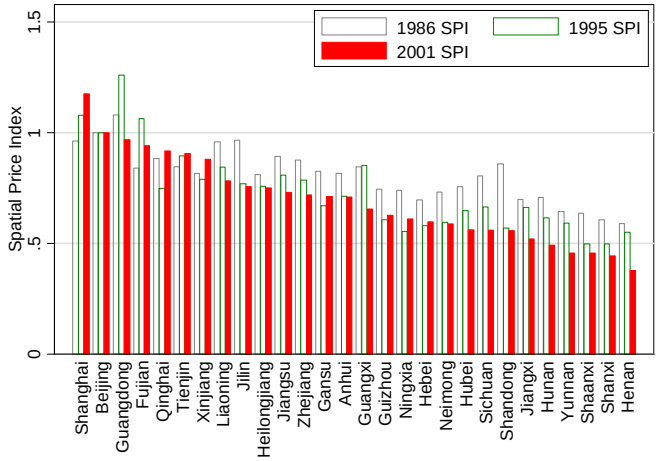
Panel A: (Sorted by 1986 SPI)



Panel B: (Sorted by 1995 SPI)

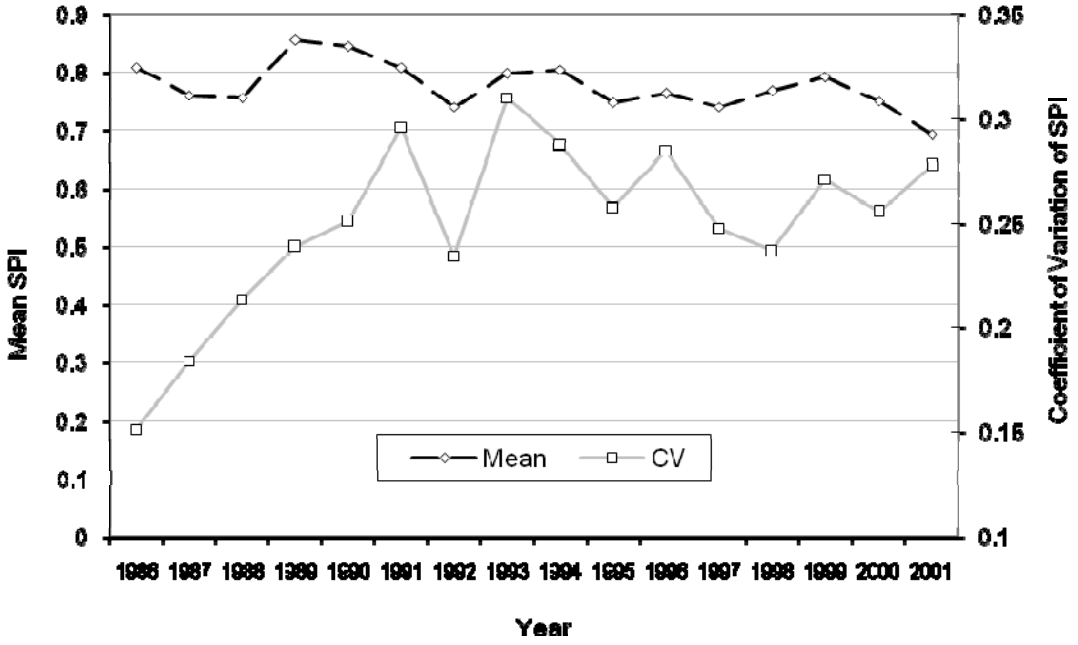


Panel C: (Sorted by 2001 SPI)



Note: (1) Author's own calculation.

Figure 3: Mean and Standard Deviation of SPI, 1986-2000



Note: (1) Author's own calculation.

Figure 4: Comparison of Coefficient of Variation of SPI over time obtained from Various Methods

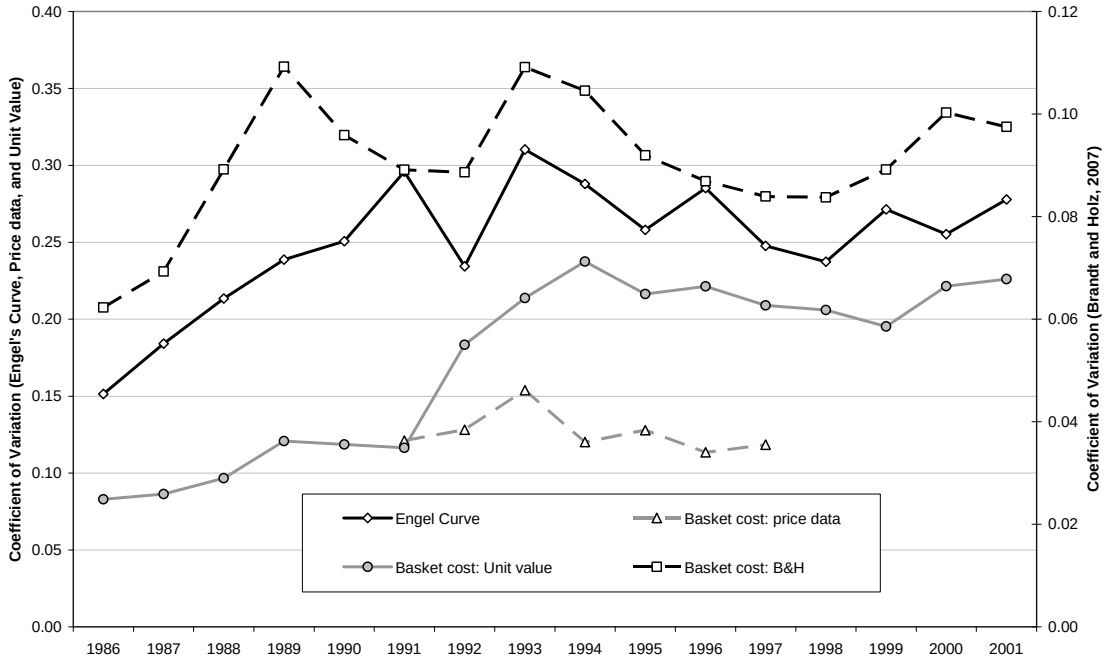
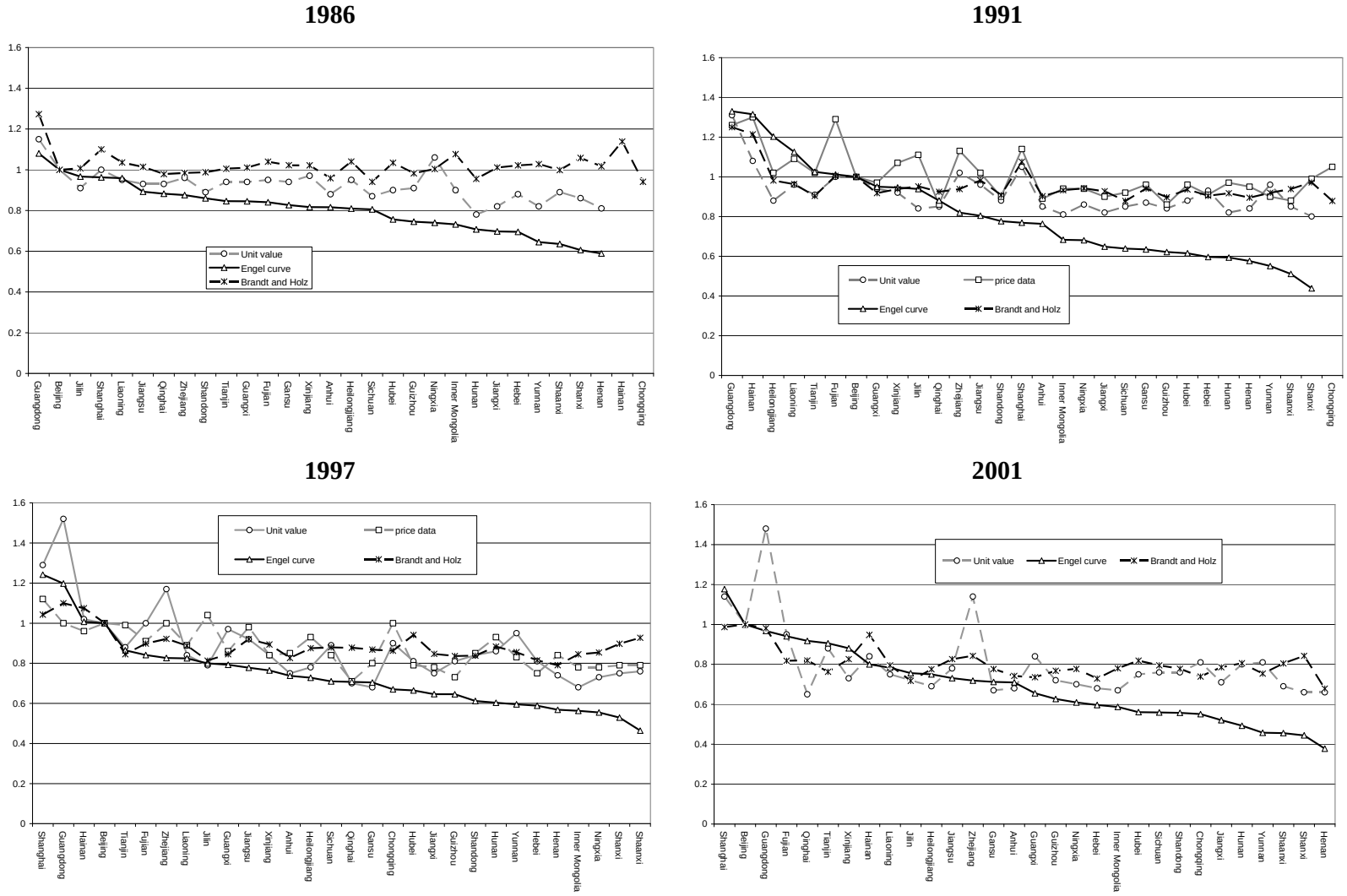
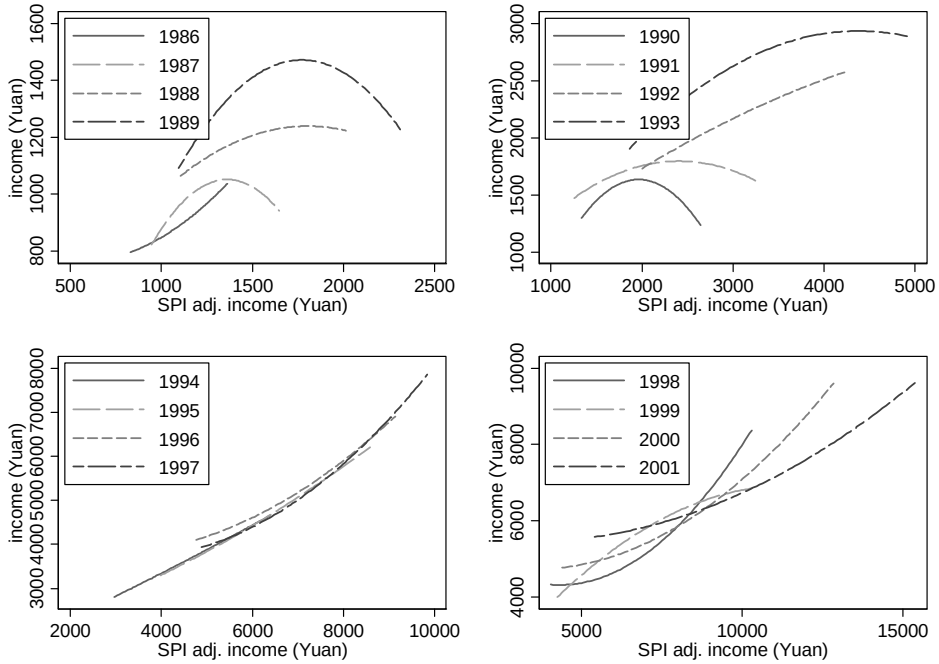


Figure 5: Comparison of SPIs obtained from different methods for various years



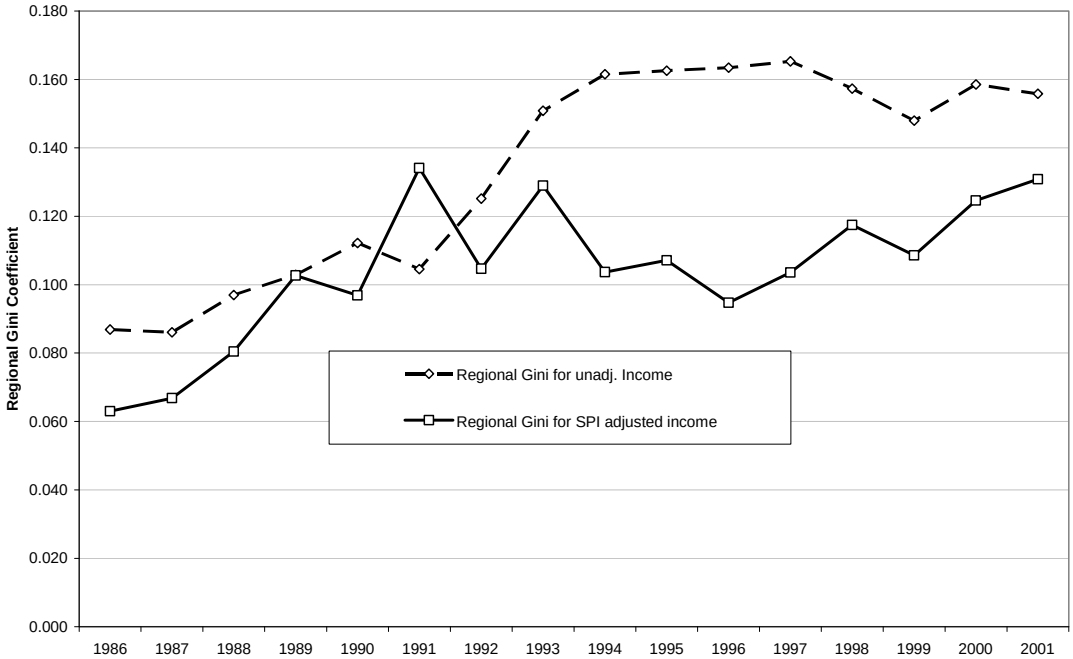
Note: (1) Author's own calculation

Figure 6: Relationship between Provincial Mean Income and SPI Adj. Mean Income



Note: (1) Author's own calculation.

Figure 7: Comparison of Gini Coefficients for Unadjusted and SPI Adjusted Average Provincial Income



Note: (1) Author's own calculation.

Figure 8: Comparison of Gini Coefficients for Unadjusted and SPI Adjusted Average household Income

Appendix A: Price Ratios of the Highest Province to the Lowest Province 1991-1997

Prices	Items	Unit	1991	1992	1993	1994	1995	1996	1997
p1	Flour	Kg	2.33	2.18	2.41	2.29	2.41	2.38	2.56
p2	Rice	Kg	4.28	2.31	2.24	1.81	2.09	2.09	2.00
p3	Stick rice	Kg	3.24	2.18	1.84	2.24	2.53	1.77	1.80
p4	Noodle	Kg	2.28	2.13	2.31	2.14	2.26	2.05	2.12
p5	Bean	Kg	4.00	3.02	3.16	2.95	3.39	3.03	2.36
p6	Tofu	Kg	1.94	1.80	1.91	2.97	4.32	4.30	4.06
p7	oil	Kg	2.37	2.33	2.52	2.21	2.98	3.33	3.19
p8	Pork	Kg	1.75	1.70	2.04	1.66	1.55	1.54	1.57
p9	Beef	Kg	1.82	1.75	1.74	1.72	1.77	2.02	1.90
p10	Lamb	Kg	3.51	3.66	4.02	5.32	3.17	2.95	2.61
p11	Chicken	Kg	2.11	2.27	2.57	3.42	3.16	3.29	2.69
p12	Duck	Kg	2.52	2.76	2.69	3.79	3.67	3.79	3.70
p13	Egg	Kg	1.71	1.67	1.65	1.88	2.10	1.98	2.53
p14	Huanghua fish	Kg	13.16	15.50	14.31	8.39	19.03	18.93	12.81
p15	Dai fish	Kg	3.34	2.75	3.40	2.02	2.12	2.21	2.21
p16	Li fish	Kg	2.50	2.65	2.76	2.14	1.82	1.74	1.90
p17	Lian fish	Kg	2.54	2.64	2.38	3.53	6.00	7.04	6.00
p18	Chao fish	Kg	2.42	3.24	3.25	6.12	7.75	7.85	7.44
p19	Salt	Kg	2.47	2.63	3.54	2.42	4.92	2.72	2.84
p20	Soy	Kg	4.43	5.28	6.94	5.28	6.36	7.01	6.90
p21	Vinegar	Kg	9.17	9.28	9.21	6.57	5.26	6.97	7.97
p22	White sugar	Kg	1.37	1.59	1.87	1.33	1.51	1.33	1.34
p23	Brown sugar	Kg	1.45	1.58	1.81	1.46	1.50	1.67	1.72
p24	Cigerrate 1	Box	3.98	4.82	4.48	5.42	5.39	5.57	4.74
p25	Cigerrate 2	Box	6.76	9.18	9.96	8.70	10.60	10.15	9.34
p26	Alcohol	Bottle	3.66	5.17	8.64	8.43	5.73	5.75	6.49
p27	Wine	Bottle	9.02	8.72	8.56	8.36	6.99	7.57	6.62
p28	Beer	Bottle	2.44	2.15	2.49	2.15	2.73	2.92	4.77
p29	Flavour tear	Kg	2.30	2.54	2.64	3.29	3.16	3.13	3.41
p30	Green tea	Kg	6.61	9.62	5.92	6.45	11.81	11.73	11.43
p31	Jujube	Kg	3.64	3.15	3.19	3.24	4.06	3.62	3.92
p32	Walnut	Kg	2.59	2.26	6.34	5.73	4.80	3.13	2.75
p33	Peanut	Kg	1.61	1.48	2.25	2.20	2.68	2.61	2.10
p34	Cake	Kg	2.56	3.13	13.20	12.61	12.49	11.11	10.84
p35	Bascuit	Kg	3.09	2.69	3.89	2.79	2.56	2.83	2.87
p36	Fresh milk	Bag	10.08	9.58	11.56	12.37	11.63	8.20	9.02
p37	Milk powder	Bag	1.74	1.88	2.41	1.88	1.87	11.58	1.80
p38	Meat can	Can	1.45	1.65	1.97	3.04	3.93	4.10	5.23
p39	Shirt	Piece	1.91	1.98	3.72	4.66	3.56	4.47	4.22
p40	Trousers	Piece	6.87	6.97	21.31	5.53	5.10	7.44	10.82
p41	Jacket	Piece	5.18	5.61	6.35	5.84	5.28	5.98	6.98
p42	Sweater	Piece	1.83	1.78	2.62	2.59	2.48	2.49	2.40
p43	Dress	Piece	8.55	7.16	8.20	6.44	4.90	7.95	7.33
p44	Skirt	Piece	6.72	5.64	6.43	5.55	5.23	5.99	5.95
p45	Children clothes	Set	2.80	3.83	5.64	5.77	5.52	6.34	7.07
p46	White cloth	Metre	1.56	1.48	3.63	3.36	4.13	3.36	3.49
p47	Color cloth	Metre	1.49	1.50	3.94	1.99	5.41	2.26	1.94
p48	Flower cloth	Metre	1.33	1.28	1.53	1.72	2.61	2.61	2.01
p49	Cambric cloth	Metre	4.86	7.45	9.13	6.76	7.84	8.17	7.80
p50	Knitting wool	Kg	1.43	1.47	1.48	1.60	1.89	1.96	2.37

Note: Author's own calculation according to the price data in Statistics of Price Survey (1998), edit by Planning Ministry and National Bureau of Statistic of China (NBS).

Appendix A (Cont.1):

Prices	Items	Unit	1991	1992	1993	1994	1995	1996	1997
p51	Knitting thread	Kg	1.38	1.37	1.42	1.98	2.36	1.71	2.11
p52	Cloth shoes	Pair	2.37	2.50	2.41	3.06	3.03	2.30	2.76
p53	Leather shoes	Pair	3.54	3.78	3.68	3.07	4.19	3.44	3.23
p54	Towel	Piece	3.02	2.85	2.64	2.97	2.90	2.51	2.43
p55	Desk	unit	3.96	4.35	7.27	4.83	3.81	4.22	4.30
p56	Mattress	unit	2.20	2.21	3.94	4.26	3.26	2.83	2.86
p57	Sewing machine	unit	1.42	1.40	2.08	1.47	2.05	1.41	1.43
p58	Washing machine	unit	3.81	3.63	3.86	3.57	3.18	3.43	4.39
p59	Eletric Fan	unit	1.90	1.78	1.96	3.21	3.17	3.44	3.40
p60	Refrigerator 1	unit	1.62	1.74	1.53	1.53	2.37	1.75	1.87
p61	Refrigerator 2	unit	2.58	2.88	2.80	2.71	2.98	1.73	1.74
p62	Rice cooker	unit	2.92	1.46	1.66	1.73	1.82	3.25	1.90
p63	Smoke extractor	unit	3.32	3.13	3.62	3.51	3.91	3.63	3.76
p64	Air conditioner	unit	4.74	4.81	4.70	4.56	5.50	4.86	6.07
p65	Heater	unit	3.67	3.65	3.74	3.62	3.44	3.50	3.85
p66	Blanket	Piece	3.50	3.74	4.13	3.90	3.65	4.43	4.63
p67	Linen	Piece	1.33	1.49	1.72	2.10	2.21	1.60	1.68
p68	Quilt cover	Set	8.11	3.34	3.52	2.36	2.70	3.56	2.94
p69	Bed cover	Set	4.50	4.23	4.72	5.32	3.48	3.66	4.19
p70	Soap	Piece	2.20	2.29	2.24	2.24	2.31	2.38	2.38
p71	Scented soap	Piece	4.26	4.26	4.34	2.83	2.84	3.19	3.16
p72	Washing powder	bag	2.78	2.07	3.25	3.36	2.89	3.00	3.13
p73	Tooth paste	Piece	5.84	5.30	4.74	3.17	19.61	3.46	17.17
p74	Tissue	Roll	5.65	4.41	4.49	5.70	5.37	3.93	4.29
p75	Battery	Piece	2.39	2.45	2.55	2.19	8.28	2.95	2.48
p76	Dish washing	Bottle	1.66	1.39	1.54	16.33	4.49	2.08	1.98
p77	Gold ornaments	G	3.21	2.53	1.43	1.43	2.10	1.41	1.39
p78	Thermometer	Piece	1.48	1.48	1.36	1.49	1.58	1.66	1.65
p79	Licorice root	Kg	3.93	5.28	4.66	3.68	3.69	2.74	3.28
p80	Pistache	Kg	3.60	2.06	2.17	2.10	3.52	1.95	2.40
p81	Motorcycle	Unit	5.32	5.58	6.91	6.99	6.58	8.61	8.67
p82	Bicycle	Unit	1.44	1.49	1.46	1.60	19.21	2.24	1.94
p83	Telephone	Unit	11.83	9.92	9.53	8.92	6.22	5.60	2.18
p84	Radio	Unit	3.35	6.87	5.75	6.35	3.63	6.26	5.93
p85	Color TV	Unit	1.70	1.80	2.95	2.84	3.09	2.63	2.57
p86	Black&white TV	Unit	1.70	13.75	1.88	1.66	2.32	1.54	1.71
p87	Recorder	Unit	1.76	2.31	3.77	3.95	4.30	4.30	2.96
p88	Camera	Unit	3.54	3.57	4.02	3.98	4.63	4.02	4.09
p89	Video player	Unit	2.54	2.44	2.79	2.69	2.70	2.45	2.35
p90	Video camera	Unit	3.44	3.70	2.36	2.14	2.63	2.28	2.69
p91	Books	Piece	2.15	1.63	1.71	1.90	1.55	2.23	1.81
p92	Film	Roll	1.21	1.25	1.20	1.29	1.78	1.29	1.28
p93	Tape	Piece	2.20	2.16	2.12	2.51	3.03	2.26	2.22
p94	Newspaper	Copy	2.29	2.29	3.02	3.17	3.44	3.50	3.08
p95	Brick	Piece	12.87	16.60	14.56	13.59	12.22	9.75	17.80
p96	Glass	Square metre	1.61	1.64	2.70	2.03	3.05	2.34	2.41
Tradable Goods			3.53	3.71	4.20	3.98	4.51	4.09	4.15

Note: Author's own calculation according to the price data in Statistics of Price Survey (1998), edit by national Planning Ministry and National Bureau of Statistic of China (NBS).

Appendix A (Cont.2):

Price	Items	Unit	1991	1992	1993	1994	1995	1996	1997
p97	Housing rent	Square metre	5.95	10.23	9.43	6.60	6.73	5.00	5.25
p98	Water	Tons	4.18	2.40	3.06	3.44	5.94	2.47	2.65
p99	Electricity	Cubic metre	3.42	2.28	3.60	4.17	2.91	2.85	2.53
p100	Coal	100 Kg	3.82	3.60	3.51	6.50	10.86	13.47	9.95
p101	Petrol gas	Kg	8.55	7.49	5.47	5.28	5.28	5.32	2.81
p102	Coal gas	Cubic metre	31.09	24.82	19.82	19.37	16.61	18.06	17.95
p103	Local phone	Once	9.08	9.08	9.08	9.19	9.05	6.59	6.23
p104	Local bus	One ticket	8.98	8.71	9.36	10.33	9.41	6.58	8.67
p105	Long distance bus	Km. person	28.07[1]	28.07	13.64	47.73	42.00	30.81	28.29
p106	Taxi	Km	12.18	8.74	5.03	5.33	3.63	3.65	3.65
p107	Hair dressing service	Once	4.84	5.20	5.71	5.73	5.37	5.21	4.86
p108	Shower	Once	5.78	8.00	8.03	8.32	10.77	13.09	13.09
p109	Movie	One ticket	3.36	4.13	4.74	4.70	7.91	5.76	6.86
p110	Tuition	Half year	19.92	16.00	15.75	16.81	15.49	8.22	5.49
p111	Child care	Month	5.54	5.57	5.42	4.89	6.75	6.45	6.18
p112	Housework	Month	8.93	13.83	17.96	11.94	9.83	11.94	14.52
p113	Shoes repair	Pair	3.43	3.42	3.54	4.41	3.78	3.57	3.20
p114	Watch repair	Piece	2.59	3.60	9.45	7.48	13.28	16.06	15.04
p115	Sewing	Set	6.60	7.84	7.17	6.58	16.78	15.56	15.22
p116	Loundry	Piece	7.97	9.31	8.52	4.97	5.21	4.83	5.71
p117	Technical repair	Once	12.89	12.62	8.01	4.81	8.28	11.71	14.58
p118	Medical registration	Once	5.75	3.78	4.69	6.08	6.52	17.78	11.87
p119	An inject	Once	3.94	4.56	3.74	3.13	3.64	4.11	5.17
p120	Bed in hospital	Bed/night	2.61	2.85	3.52	3.50	6.51	7.42	6.49
Non-tradable goods and services			8.73	8.59	7.84	8.80	9.69	9.44	9.01

Note: Author's own calculation according to the price data in Statistics of Price Survey (1998), edit by national Planning Ministry and National Bureau of Statistic of China (NBS).

[1] The original data is 117.33 here, which is replaced because it is an outlier.

Appendix B. Test of Bias in SPI Using CPI as Deflators over Time

	1991	1992		1993		1994		1995		1996		1997	
Province	ASPI	ASPI	DSPI	ASPI	DSPI	ASPI	DSPI	ASPI	DSPI	ASPI	DSPI	ASPI	DSPI
Beijing	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Tianjin	1.02	1.05	1.03	1.07	1.04	1.06	1.03	1.01	1.01	1.05	0.96	0.99	0.90
Hebei	0.91	0.89	0.90	0.83	0.86	0.85	0.82	0.80	0.78	0.79	0.72	0.75	0.64
Shanxi	0.99	0.96	0.98	0.92	0.95	0.89	0.93	0.87	0.90	0.84	0.85	0.79	0.79
Inner Mongolia	0.94	0.94	0.93	0.90	0.89	0.89	0.84	0.81	0.80	0.83	0.73	0.78	0.66
Liaoning	1.09	1.07	1.07	1.03	1.03	1.10	1.01	0.97	0.97	0.95	0.91	0.89	0.84
Jilin	1.11	1.14	1.08	1.19	1.01	1.13	0.92	1.05	0.83	1.05	0.72	1.04	0.61
Heilongjiang	1.02	1.02	1.02	1.12	0.98	0.97	0.93	0.91	0.87	0.93	0.78	0.93	0.69
Shanghai	1.14	1.14	1.14	1.24	1.15	1.23	1.16	1.20	1.17	1.19	1.17	1.12	1.13
Jiangsu	1.02	1.01	1.01	1.09	1.00	1.09	0.99	1.05	0.97	1.05	0.94	0.98	0.89
Zhejiang	1.13	1.13	1.12	1.08	1.14	1.12	1.15	1.06	1.16	1.06	1.15	1.00	1.13
Anhui	0.89	0.91	0.88	0.87	0.84	0.98	0.81	0.80	0.78	0.91	0.74	0.85	0.68
Fujian	1.29	1.21	1.27	1.14	1.22	1.09	1.18	1.02	1.13	0.96	1.04	0.91	0.93
Jiangxi	0.90	0.87	0.88	0.83	0.84	0.92	0.81	0.85	0.78	0.83	0.73	0.78	0.67
Shandong	0.90	0.89	0.89	0.82	0.85	0.95	0.81	0.89	0.77	0.90	0.72	0.85	0.67
Henan	0.95	0.92	0.93	0.84	0.85	0.90	0.79	0.90	0.73	0.86	0.66	0.84	0.59
Hubei	0.96	0.95	0.97	0.88	0.97	0.87	0.99	0.84	1.03	0.84	1.07	0.79	1.07
Hunan	0.97	0.97	1.00	1.02	1.02	1.02	1.04	1.02	1.07	0.97	1.05	0.93	1.01
Guangdong	1.26	1.36	1.24	1.30	1.26	1.26	1.23	1.17	1.16	1.06	1.06	1.00	0.93
Guangxi	0.97	0.96	0.94	0.96	0.95	0.99	0.96	0.97	0.98	0.93	0.95	0.86	0.87
Hainan	1.30	1.25	1.29	1.15	1.33	1.19	1.38	1.10	1.35	1.04	1.24	0.96	1.09
Chongqing	1.05	1.11	1.05	0.98	1.03	1.03	1.03	1.01	1.06	1.07	1.06	1.00	1.06
Sichuan	0.92	0.91	0.92	0.77	0.90	0.97	0.91	0.90	0.92	0.90	0.93	0.84	0.93
Guizhou	0.86	0.83	0.85	0.79	0.82	0.87	0.77	0.80	0.74	0.80	0.70	0.73	0.65
Yunnan	0.90	0.90	0.90	0.90	0.91	0.93	0.85	0.88	0.82	0.87	0.77	0.83	0.72
Shaanxi	0.88	0.89	0.89	0.82	0.86	0.83	0.86	0.81	0.86	0.82	0.85	0.79	0.84
Gansu	0.96	0.92	0.94	0.87	0.89	0.92	0.84	0.89	0.80	0.92	0.75	0.80	0.70
Qinghai	0.86	0.84	0.85	0.76	0.80	0.80	0.75	0.75	0.72	0.75	0.68	0.71	0.65
Ningxia	0.94	0.93	0.93	0.85	0.90	0.90	0.87	0.85	0.83	0.83	0.77	0.78	0.69
Xinjiang	1.07	0.98	1.06	0.88	1.01	0.95	0.98	0.77	0.96	0.90	0.93	0.84	0.89
Mean	1.01	1.00	1.00	0.96	0.98	0.99	0.95	0.93	0.93	0.93	0.89	0.88	0.83
Maximum	1.30	1.36	1.29	1.30	1.33	1.26	1.38	1.20	1.35	1.19	1.24	1.12	1.13
Minimum	0.86	0.83	0.85	0.76	0.80	0.80	0.75	0.75	0.72	0.75	0.66	0.71	0.59
Ratio of max. to min.	1.51	1.64	1.52	1.71	1.66	1.58	1.84	1.60	1.88	1.59	1.88	1.58	1.92
SD	0.12	0.13	0.12	0.15	0.13	0.12	0.15	0.12	0.16	0.11	0.17	0.10	0.17
CV	0.12	0.13	0.12	0.15	0.14	0.12	0.16	0.13	0.17	0.11	0.19	0.12	0.21
Correlation coefficients			0.96		0.86		0.83		0.78		0.71		0.60

Note: ASPI is calculated by basket cost method using prices for each year separately, DSPI is calculated using official provincial CPI as deflators based on ASPI in 1991.

Appendix C: Assumption on Food and Non-food Price Bias

In the estimated model, the aggregated unit values of food and non-food are used to proxy true prices of food and non food. Unit values may over/under value the true prices

$$ln\Pi_{f,j} = ln P_{f,j} + ln E_{f,j} \text{ , where } ln E_{f,j} > 0 \quad (1)$$

$$ln\Pi_{n,j} = ln P_{n,j} + ln E_{n,j} \text{, where } ln E_{n,j} > 0 \quad (2)$$

The estimated general price level is:

$$p_j = exp(\frac{\phi_j + \gamma(ln E_{f,j} - ln E_{n,j})}{-\beta}) \quad (3)$$

An important assumption is made to derive SPI, which is that the aggregated unit values of food and non food have same level of bias at each province:

$$(ln E_{f,j} - ln E_{n,j}) = 0 \quad (4)$$

Under this assumption, the estimated true price

$$p_j = exp(\frac{\phi_j}{-\beta}) \qquad \text{where } -\beta > 0 \quad (5)$$

If this assumption is violated, $ln E_{f,j} = k\, ln E_{n,j}$, where $k \neq 1$, equation (3) becomes:

$$p_j^B = exp(\frac{\phi_j + \gamma(k-1) ln E_{n,j})}{-\beta}) \quad (6)$$

If unit values of food have higher bias than non-food, $k-1>0$ and $\gamma > 0$,

$$P_j^B = exp(\frac{\phi_j + \gamma(k-1) ln E_{n,j})}{-\beta}) > P_j = exp(\frac{\phi_j}{-\beta}) \quad (7)$$

Then the true price will be under estimated by equation (5).

If unit values of food have higher bias than non-food, $k-1>0$ and $\gamma < 0$, gives

$$P_j^B = exp(\frac{\phi_j + \gamma(k-1) ln E_{n,j})}{-\beta}) < P_j = exp(\frac{\phi_j}{-\beta}) \quad (8)$$

Then the true price will be over estimated by equation (5).