

Appendix: Price Data

This appendix discusses a range of price issues:

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 - Retail price data and additional regressions/figures
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1. Alwyn Young's price data and their analysis

Agricultural procurement prices

I do not further examine the annual and monthly agricultural procurement prices Alwyn Young (AY) presents, for three reasons.¹ First, the patterns he observes don't differ much from those in the case of retail goods and industrial materials in the years 1986 through 1993, which I examine. Second, price dispersion in the case of agricultural procurement could depend on the extent to which the transportation system is able to transport highly perishable agricultural products. If that changes over time, with far-away provinces newly importing perishable agricultural products from other provinces at prices that incorporate high transportation costs, price dispersion in agricultural procurement becomes incomparable over time. Third, government price control over agricultural prices even after 1992 is likely to have been strong but not necessarily uniform over time.

To elaborate on the third point, while the official data suggest that since 1992 approximately 80-95% of all agricultural procurement occurs at market prices (Figure 1), these "market prices" are unlikely to reflect pure market prices. For example, prices manipulated (set/ controlled/ subject to maximum limits) by the neighborhood committee in charge of an urban agricultural market are regarded as "market prices." Government agents have remained in control of procurement of cotton until today, and to some extent also in control of grain procurement. What has changed over time is the administrative level at which prices are determined, the types of price controls in place, and the scope for private grain traders to enter markets. The central government appears to have surrendered most price-setting authority to provinces, which then, in many instances, passed it further down or abandoned price-setting altogether. While nearly all

¹ Alwyn Young refers to these prices in the text (p. 1112) as "prices of 130 agricultural goods purchased by commercial establishments" and in the title of the corresponding chart as "agricultural market prices." In the sources these are agricultural "procurement" prices.

grain purchases in the early 1980s occurred at state quota or above-quota prices, by the mid-1980s a combination of quota, negotiated, and market prices was in place that has endured for many products until today. In recent years the government has offered a minimum price at which it would (supposedly) buy as much as farmers want to sell.

In 2004 the Chinese Communist Party Central Committee in its first document of the year called for all-out marketization, but this was thwarted in late March by the State Development and Reform Commission, which, together with the Finance Ministry, the State Grain Bureau, the Agricultural Development Bank and other departments issued a circular establishing a nationwide minimum price for long-grained rice; as of mid-2004, minimum prices for other types of rice were under consideration, and nationwide minimum prices for wheat, corn, and other grain types were not being ruled out.² (I am not aware of what action followed, if any.)

When all grain trade occurs at centrally determined, possibly province-specific prices, variation in agricultural procurement prices is simply the result of central government decisions (and variation in agricultural procurement prices across provinces could be small). When grain trade occurs at locally set prices, variation in agricultural procurement prices is the result of local government decisions (and variation in agricultural procurement prices across provinces may but need not be larger). Even at a time when prices are supposed to be market prices, if the market price falls below the minimum price, the state-determined (central or local) minimum prices determine the degree of variation in agricultural procurement prices across provinces. Given the multitude of agricultural products, each with its own pricing rules, and given the frequent changes in these rules over time, I see little chance for a meaningful interpretation of the official agricultural procurement prices (average prices across pricing regimes and product qualities) that AY uses.

Jikun Huang and Scott Rozelle (2002) document some of the fluctuations in agricultural procurement policies over time. They also show an increasing degree of integration of agricultural markets over time. Scott Rozelle, Albert Park, Jikun Huang, and Hehui Jin (2000), while presenting anecdotal evidence of barriers to grain shipment out of Hunan province in 1988, in a detailed examination of the period 1988-95 also note the increasing degree of market integration for individual grains after 1989; grain markets, according to some measures, dis-integrated in (just) 1989.

Inflation and price dispersion

AY's analysis of price data relies on the size of the standard deviations of prices across localities (for each product in turn). Inflation impacts on the size of standard deviations. *Ceteris paribus*, the higher the rate of inflation the higher the standard deviation, and consequently the higher AY's measured price dispersion.

One example, for a one-good, two-province, two-period case, is the following. In the first year, the price of the good in province A is 6 yuan, and in province B it is 2 yuan. This implies

² See *Caijing*, no. 106 (20 April 2004), pp. 70-2. For the development of the various pricing regimes, from government-determined to minimum and market prices, see the *Price Yearbook* of each year.

that in the first year the mean price is 4 yuan, the price of the good in province A is 50% above the mean, and the price of the good in province B is 50% below the mean; the standard deviation is 2. Between the first and the second year, the economy experiences a uniform inflation rate of 100%. This implies that the second-year price of the good in province A is 12 yuan, and in province B it is 4 yuan. The mean price is 8 yuan, the price of the good in province A is 50% above the mean, and the price of the good in province B is 50% below the mean; the standard deviation now is 4. In other words, in this example the uniform 100% increase in all prices drives up price dispersion measured as standard deviation by 100%, from 2 to 4.

The higher the inflation rate (and, thus, the larger the potential for relatively large absolute price differences) the higher the incentives for price arbitrage across provinces. If there is no trade (whether due to barriers to trade, or prohibitively high transportation costs, or missing trade channels, or for whatever other reason), the standard deviation in this example doubles. If obstacles to trade are small, the standard deviation is likely to be less than double. In China between 1986 and 1989, the average annual increase in the general retail price index was 14.42% (*Statistical Yearbook 1998*, p. 301); in comparison, AY notes a 2.4% per annum increase in annual retail price *dispersion* in this period.

For the case of monthly industrial materials prices (but not for retail prices) AY reports in footnote 31 that he has “used balanced sample locale pairs to construct period-by-period estimates of the rate of inflation in each product, and found that product inflation during the period has either an insignificant or a significantly negative, effect on price dispersion. In any case, the estimated pattern of fluctuations is, once again, largely unaffected.”

A straightforward approach is to use the coefficient of variation as a measure of price dispersion. In the example presented above, the coefficient of variation does not change when inflation occurs, it is 0.5 ($2/4$) in the first period, and 0.5 ($4/8$) in the second period. The coefficient of variation is potentially problematic when logarithms are used because some prices are below 1 yuan RMB, i.e., their \ln is negative.

With solely non-negative values of the \ln of prices, the larger the coefficient of variation the larger is price dispersion, and the smaller the coefficient of variation, the smaller is price dispersion. With solely negative values of the \ln of prices, the conclusions for price dispersion are the reverse. In the case where each of the coefficients of variation is based on either uniformly positive \ln of prices or uniformly negative \ln of prices, it makes sense to simply analyze the data using the *absolute* value of the coefficient of variation.

Complications may arise if one coefficient of variation is calculated with the \ln of some prices being negative and the \ln of other prices being positive. Then a large coefficient of variation could simply reflect a balance of positive and negative values (of the \ln of prices) that cause the mean to be close to zero. As long as there is no systemic behavior of retail goods prices towards or away from the 1 yuan level (and why should there be?), the close-to-zero mean complication may not matter much in practice.

A subsequent problem is that a double-log in form of the \ln of the coefficient of variation of the \ln of prices is not possible when the coefficient of variation is negative. This means a reduced

number of observations if AY's double-transformation using logarithms is applied with the coefficient of variation as measure of price dispersion (and prices are measured in yuan RMB).

One easy solution to all these complications is to simply drop the logarithmic transformation, especially since AY provides no reason why the ln transformation should be done in the first place. Another easy solution is to simply measure prices in *fen* (i.e., the Chinese equivalent of cents), so that prices are always well above one unit of currency.

Minor problems in Alwyn Young's analysis of price data

AY uses the same product number (dummy) for a type of product independent of its characteristics; the *China Price* magazine with monthly agricultural procurement prices and monthly industrial materials prices occasionally revises these product characteristics; a revision of, for example, a size specification is likely to yield a corresponding price change (which then affects the standard deviation) of this product. For example, if a new, high-quality (expensive) product is introduced into the pool while an old low-quality (inexpensive) product is dropped from the pool, and if price dispersion for this particular new product in relative terms, measured as standard deviations relative to the mean, is the same as for the old product, then AY's measure of price dispersion goes up (which it shouldn't, in order to be a meaningful measure).³

Second, perishable agricultural goods which are grown in only a small number of provinces are likely to have larger price dispersion than non-perishable consumer goods. If the availability of these price data across provinces varies over time, this may affect overall price dispersion. The same holds for some retail goods (foods).

Third, the price data, especially the monthly price data, come with significant holes in that for many localities, price data on specific products (at a given point of time) are missing. This affects price dispersion over time if price data from far-flung provinces (with high transportation costs) are missing in, say, the earlier periods only.

Some price data (for a specific product in a specific locality at a specific point of time) appear very much out of line with the prices in other localities, as well as out of line for this locality from a time series perspective, which suggests data errors in the source. A very small number of individual price observations (price of a specific product at a specific time in a specific locality), approximately one to three, are responsible for the monthly outliers in aggregate price dispersion in the figure on monthly industrial materials prices based on the standard deviation or the coefficient of variation of prices.

Fourth, for the annual data each locality chooses one particular product within a given product category for which it obtains prices over time, i.e., the quality of retail goods differs across localities at any given point of time. Measured price dispersion is affected if a locality changes the quality specification of its product, or if different quality specifications are subject to

³ For some industrial materials prices, AY divides the original price by 10,000, or by 1,000 (or by 1), and the choice of divisor appears arbitrary. The effect of *different* products with different division practices entering or leaving the pool should be fully picked up by the product dummies.

different inflation rates.⁴ (In the case of industrial materials, quality differences may play a minor role only, if any at all.)

Fifth, the analysis gives all products equal weight. While product-specific dispersion levels are controlled for through the inclusion of product dummies in the regression (of the product- and time-specific standard deviation across provinces on product and time dummies), each observation carries equal weight in the determination of the coefficients of the time dummy variables. Ideally, each product would be weighted, perhaps by its value added nationwide, but such product-specific data are not available.

Retail price data and additional regressions/figures

In the paper, I summarize the characteristics of the four types of data AY uses. AY's stated number of products, cities, and the time period covered are maximum numbers, i.e., not at every point of time are prices on all products in all locations (and, in the case of annual data, at the same quality specification) available. For example, going back to the original sources of the data, the number of consumer goods in the first dataset in the years 1986 and 1987 is only 132 (not 305). For 100 of these, only the price in state-owned commerce is available, while for the other 32 consumer goods, prices from both society-wide and state-owned commerce are available; in later years prices are presumably society-wide prices. (AY reports that regressions in which he dropped the state-owned commerce data yielded even stronger results.) In 1992 and 1993, the number of consumer goods is only 100. There are quality differences within each product category across the 29 cities (AY's reported coverage of 30 cities is a typo unless he has other sources than those he reports), and there are a number of cities for which no data are reported.⁵

AY uses only those products for which prices on at least five locations are available. I adopt AY's rule and remove all product-years for which prices are available for less than five localities (fewer than five cities report prices for that product for that year).

AY removes all data on two products, the People's Daily and Mass Movies magazine. I do the same. In some years, the prices for each of these two products have no or little variation across localities. Presumably, AY removes these two products because he otherwise has to take the natural logarithm of a standard deviation that is zero, or near-zero. If the two products are included (and matlab somehow fudges the minimal value of the standard deviation), all significance disappears in AY's regression (findings), except for the year 1989.

⁴ If economic development leads to greater product variety over time, richer localities are likely to shift to higher-quality specifications of a particular type of product. (AY also lists this shortcoming in the subsequent section of his paper, on p. 1116.)

⁵ AY states that the collection of annual data was abandoned when the State Statistical Bureau was "overwhelmed by the number of new products appearing in the economy" (p. 1112), with each province then proceeding to calculate its local price indices in whichever manner it deemed appropriate. The Bureau of Labor Statistics in the U.S. explicitly does not publish absolute price data on specific, *nationwide uniform products* because it cannot guarantee comparability of individual products across localities. This raises questions about the quality of the Chinese price data in what one would expect to be a much less integrated market than the U.S. (Nevertheless, beginning with the year 1998, annual prices of 93 industrial consumer goods as well as of some services are again published, now in the *Price Yearbook*, for 36 cities.)

I end up with 1776 observations, in contrast to AY's 1774. Each observation is the coefficient of the corresponding time (year) dummy in a regression of the dependent variable on a complete set of product dummies and time dummies for all years except the first (1986). The coefficient represents the difference in price dispersion compared to 1986. The vertical bars reflect two standard errors.

I prefer not to transform price data or measures of variation using the natural logarithm because it is unclear to me why I should (why AY does). In Alwyn Young's own words (p. 1112), he "examine[s] the time trends in the standard deviation of the ln of regional goods prices," but then in his analysis takes the *natural logarithm of the standard deviation* of the ln. He offers no explanation why the ln is used in either of the two instances. I also prefer to control for inflation by using the coefficient of variation of prices rather than the standard deviation of prices.

Figure 2 reports the results using the whole range of measures and transformations under consideration. The first three charts (a. – c.) use as dependent variable some form of the standard deviation: the ln of the standard deviation of the ln of prices (AY's measure of price dispersion), the standard deviation of the ln of prices (dropping the second ln transformation), and the standard deviation of prices (dropping both ln transformations). As already noted in the paper, the switch to plain standard deviations leads to a *continuous* gradual increase in price dispersion (rather than first an increase, then a decrease, followed again by an increase). This is consistent with a reduction in centrally determined, nationwide uniform prices and an increase in market prices; it is also consistent with increasing incomparability of products across localities (increasing product variety as enterprises gain decision-making powers from planners). It is not consistent with a hypothesis of "trade wars that are periodically interrupted and suppressed."

The next five charts (d. – h.) use as dependent variable some form of the coefficient of variation: the coefficient of variation, the coefficient of variation of the ln of prices, the ln of the coefficient of variation of the ln of prices (with a reduced number of observations because taking the ln of a negative value of the coefficient of variation is not possible), the absolute value of the coefficient of variation of the ln of prices, and the ln of the absolute value of the coefficient of variation of the ln of prices. While the plain coefficient of variation replicates the findings using plain standard deviations, with somewhat weaker significance, all versions involving the ln lead to either no significance in any year, or decreasing price dispersion. Overall, only the standard deviation of the ln of prices replicates AY's findings for the ln of the sd of the ln of prices.

I prefer to use 1991 as base year, because 1991 is an economically stable year with low inflation, a fair share of market prices, and few differences between market and plan prices. In contrast, 1986 is a year with predominantly plan prices. Figure 3 repeats all previous variations, only now with 1991 as base year.

The numerical value of the coefficient of variation carries meaning. In 1991 the standard deviation relative to the mean (i.e., the coefficient of variation) assumes a value of 0.26. Even in the years with the highest discrepancy to the base year, the coefficient of variation is only about 0.02 lower or 0.04 higher than in 1991 (chart d.). In other words, the base year price dispersion is

quite low (at a value of 0.26), and the discrepancy in price dispersion in other years is within a band of only about 8-15% of base year price dispersion.

The price data do not appear particularly reliable. Take, for example, product 116. In locality 1 in the years 1986-89, the price sequence is 515, 96.8, 168, and 69.5yuan. In locality 2 the price goes from 628yuan to 269yuan, then 269yuan [same as in previous year], then 72yuan. This does not look particularly credible. One answer is to remove outliers.

A first definition of outliers is the following: an outlier is an individual price observation (for a particular product in a particular locality at a particular point of time) that is three or more standard deviations apart from the mean for this product at this point of time across localities. One example, in the case of retail prices, is sesame oil, which in 1986 commanded a mean price across 29 cities of 4.78 Yuan RMB per kg, with a standard deviation of 1.99; in one city the price was 11.73, which compared to all other observations is a far outlier. Perhaps this was indeed the price in that city at that time, in which case it should not have been removed, or perhaps the outlier was due to vastly different quality specifications in this city, which is also fine as long as the quality specification does not change over time. But the data could also have been wrongly reported to begin with. If the price of a particular product in one or more localities (in a given year or month) is an outlier, that product in that year or month is excluded from the analysis.

The results, reported in Figure 4, are reduced significance levels throughout. Even when plain standard deviations or plain coefficients of variation are used, significance disappears almost completely.

This procedure for removing outliers is potentially dangerous in that it sorts on the dependent variable, i.e., directly reduces price variation. However, the way the dependent variable is used here is to measure price dispersion *in comparison* to a base year. If all years are affected equally by outliers, then significance levels do not change. The fact that they change means that outliers are more prominent in some years than in others. Compared to the results when outliers are not removed, outliers appear particularly important in 1992 and 1993 (when their removal has much greater effect on price dispersion than in 1991).

A different definition of outliers focuses on the price behavior of one product in one locality *over time*. A rather conservative rule for identifying outliers is that if, for one product in one city, the price from any one year to the next increases by 100% (for example, from 1 yuan to 2 yuan) or more, or if it decreases by 40% (for example, from 1 yuan to 0.6 yuan) or more, this product-city combination is considered an outlier and removed (for all periods).⁶ For comparison, consumer price inflation in China in this period examined by AY is at most just above 20% per year. After outliers are removed, 1766 observations remain out of the originally 1776. Consequently, there is virtually no difference to not removing outliers. If a stricter rule for removing outliers is used with a 50% rise or a 30% decline as cutoff points, the number of observations reduces to 1680. The result, reported in Figure 5, is slightly higher significance for the early years (1986 through 1987 or 1988) for those measures of price dispersion where

⁶ Also, if a city reports the price of a particular product for only one of the eight years, that one price observation is eliminated.

significance was obtained in the general case (when outliers were not removed), and lower significance in the later years (no significance of 1992 ever, and reduced significance of 1993).

To avoid the complications caused by taking the coefficient of variation when the ln of some prices are negative, in yet another variation all prices are multiplied by 100 before any manipulation takes place. (No outliers are removed.) Obviously, only the outcome of the manipulations involving ln and coefficients of variation are affected (and taking absolute values of the coefficient of variation of the ln of prices makes no difference). Figure 6 in charts e. and f. shows the new findings: significantly high price dispersion, compared to 1991, in 1989 and, to a lesser extent, in 1990. This conforms to the heydays of price liberalization followed by a central clampdown. Price dispersion in other years is not significantly different from that in 1991.

Given the uncertainty about product comparability across locations, I proceed to identify a set of products that should be rather uniformly defined across localities. The data has to meet four criteria: (i) the product specifications across localities must appear similar (they are never identical except for the items removed by AY, namely the People's Daily, and Mass Movies Magazine, and I follow his procedure unquestioningly), (ii) prices must be available in both 1986 and 1993 (the first and the last year), (iii) the product must come with at least 25 price observations in each of the two years, and (iv) it is not easily perishable. This required a product-by-product inspection of product specifications in the original sources. The value of prices did *not* play a role in the selection. The selection consists of a total of 41 goods.⁷ The number of products (41) times eight years yields 328 values of price dispersion. This contrasts with AY's set of 1774 product-year values of price dispersion. (AY, with the exceptions noted above, uses all product price data available: in 1986 and 1987 132 products, and in other years up to 305 products.) Figure 7 reports the findings for the various dependent variables in the case of the consistently defined set of 41 products. There is virtually no significance, and little price dispersion pattern over time.

Monthly industrial materials price data and additional regressions/figures

AY's "industrial materials" prices are prices of means of production, i.e., prices of producer goods and of materials. The source of AY's monthly data is the Chinese magazine "China Price" (*Zhongguo wujia*), published by a research institute which since mid-1993 reports to the State Development and Reform Commission (SDRC).⁸ The SDRC is probably interested in price data

⁷ The 41 products are: standard flour, *fuqiang* flour, soybeans, sesame oil, salt, soy sauce, hard liquor, grain alcohol, beer, apples, crackers, vinegar, flower tea, green tea, peanuts, milk powder, fine washed-cotton cloth, color cloth, sports pants, bed sheet, cloth shoes with plastic sole, sweater, towel, pure knitting wool, pressure cooker, plain soap, fragrant soap, light bulb, fluorescent tubes, sewing machine, washing machine, wardrobe, color TV, black-white TV, film (for camera), bicycle, mechanical watch, camera, recording tape, *yinqiao* detoxification pills, stove coal. In the source, each product in each locality comes with further specifications that allow determination of if these products across localities are roughly the same. Virtually none of these products is identical across all localities, but these 41 products appear the best possible.

⁸ In 1991, the magazine "China Price" was published by the "Price Research Institute" of the State Price Bureau. As part of the SC Institutional Reform Scheme, between May and July 1993 the State Price Bureau was abolished as independent ministry-level institution and became a "Price Administration Division" (*jiage tiaokong si*) under the State Planning Commission, the predecessor of the SDRC (*Price Yearbook 1994*, p. 63). (The Hong Kong University of Science & Technology library catalog shows first copies of the magazine in 1994, with the institute

for those products on which it has some pricing influence, for example products for which it issues guidance if not mandatory prices (possibly locally differentiated). Price dispersion may then simply be a function of the degree to which the SDRC interferes in market pricing. There is rich evidence of the SDRC meddling in price setting as recently as 2003, with a SDRC regulation on “guiding and standardizing market price behavior.”⁹ I.e., whatever monthly price behavior is observed, it is likely to be at least in part the result of central decisions on pricing.

Data for 1/93 and 2/93, according to Alwyn Young, are hopelessly jumbled, and are therefore excluded. (AY omits some of the data for these two months, but also retains some. I decided to err on the safe side and to exclude all data for these two months.) Data for 6/96, according to Alwyn Young, are identical to data for 5/96, and are therefore excluded. The month 10/93, according to Alwyn Young, has two observations (reporting date 15th and 25th), while there are no data for 11/93; in the chart, the second set of data for 10/93 are marked as 11/93 data.

I split AY’s data of 3/90 through 5/99 into three periods: 3/90 – 4/93, 5/93 – 12/96 (due to an increase in the number of localities covered from 24 to 35), and 1/97 – 5/99 (due to a significant redefinition of product specifications).¹⁰ The regressions are run for each period separately.

Further, I use only prices of those products for which price data are reported in both the initial and the final month (24 products in the first period, 35 in the second, and 27 in the third). This means a total of 69,018 product-city price observations (covering 112 months) are used, with 15,395 observations in the first period, 31,315 in the second, and 22,308 in the third. These aggregate to 855, 1494, and 766 values of the measure of price dispersion (product-period specific values across cities). In contrast, the total dataset used by AY contains 131,996 product-city price observations (414 observations of which can be attributed to his inclusion of partial data of 1/93 and 2/93), which aggregate to 5824 values of the measure of price dispersion.

The price reporting date switched from the 5th of each month to the 15th starting in 12/92 (during the first period), and from the 15th to the 25th in 10/93 (during the second period). To take the switch in each of the first two periods into consideration in the regressions, a dummy variable

listed as part of the State Planning Commission.) In 2005 the magazine was published by the “Market and Price Research Institute” of the SDRC.

⁹ See SPC 28 Feb. 2003. (Astonishingly, the circular is issued by the State Planning Commission, which at that point had changed its name to State Development and Planning Commission, today the SDRC. The name “State Planning Commission” appears both in the *China Infobank* heading and in the circular’s title itself, as does the issuing date.) The circular lists strongly worded tasks which include “curbing abnormal price variation caused by sudden events” and “fully developing the functions of the relevant departments and sectoral associations,” but does not make the instruments to be used explicit. The wording appears chosen to be appropriate for China’s “socialist market economy,” with the old mechanisms from mandatory prices to various forms of guidance prices still in place, only perhaps less visible and more dispersed (in part allocated to sectoral associations run by the SPC/SDRC or other central government institutions).

¹⁰ While the number of cities covered in the first period was constant (24 cities) throughout the first period, the mix of cities changed over time; altogether, each of 35 cities appeared in at least one month in the first period. The number and mix of cities stayed constant in the second period (35 cities); however, while the source lists 35 cities, it may never have reported price data for any product in 3 of the 35 cities (Tianjin, Shenzhen, and Guiyang). AY’s dataset, for the second period as identified by me, does not contain data for what appear to be these three cities; this is confirmed by information in selected copies of the original monthly source (I do not have available all 112 monthly tables). Sometime in the third period, Lhasa was added as 36th city (and each of the 36 cities had some price data at least for one product at one point of time).

could be included for the second half of each period (and the time dummy for the first month in the second half of each period omitted to avoid perfect multicollinearity), and the coefficients for the months in the second half of each period to be reported in the chart would then consist of the coefficient of the monthly dummy plus the coefficient of the dummy for the second half of the period. Such a chart is little different from the one that takes no special measures to accommodate the switch in reporting date.

I follow AY's practice of dropping all products in a given month for which less than five price observations (localities reporting prices) are available.

In the regressions, and then in the figures on monthly price dispersion, each observation (monthly value) is the coefficient of the corresponding time dummy in a regression of a measure of price variation across localities for a particular product in one month on a complete set of product dummies and a complete set of time (month) dummies. Each chart reports the results of three separate regressions, one for each of the three different periods. In each regression, the individual coefficients represent the difference in price variation compared to the first month of the period (when it is set zero through the omission of the corresponding monthly dummy); i.e., price dispersion in the first month of each period (3/90, 5/93, 1/97) is the default (zero) level of variation against which all other months of the period are measured. The vertical bars reflect ± 2 standard errors.

Figure 8 reports the regression results. AY's findings largely disappear when switching to plain standard deviations, but persist, in weakened form, for plain coefficients of variation. The numerical value of the coefficient of variation carries meaning. In the first month of each of the three periods the standard deviation relative to the mean (i.e., the coefficient of variation) was 0.13, 0.14, and 0.09. Even in months of extremely high or low coefficients of variation, it was never more than 0.04 units away from the base period coefficient of variation. These two pieces of information suggest that price variation is relatively small to begin with and then fluctuates within a 25% or 45% (depending on period) band around this small value.

While product quality could vary drastically across localities in the case of retail goods, for industrial materials there should be no scope for quality differences. When a mean price of 3557.83 Yuan RMB across 12 localities includes a price of 54 Yuan RMB in one, with the range otherwise extending from 1600 Yuan RMB to 5650 Yuan RMB, the 54 Yuan RMB observation does not seem right. Similarly, a 58,000 Yuan RMB observation accompanied by all other seven observations in the 1680-5000 Yuan RMB range does not seem right. It would seem plausible to remove outliers. Using the first removal procedure (as outlined above for annual retail prices) yields 732 values of the measure of deviation in the first period (down from 855), 1147 in the second (down from 1494), and 506 in the third (down from 766). Figure 9 reports the regression results. They are little different from the case when outliers are not removed, slightly strengthening significance for some measures of price dispersion in some periods, and slightly weakening significance in others.

AY's findings are reproduced in the first chart of Figure 10, using all raw price data with the resulting 5824 observations of price dispersion; all three periods are treated as one period and none of the observations is removed (the beginning-of-period set of products need not be the

same as the end-of-period set of products, and the change in the number of localities and products covered is ignored). In plain standard deviations or coefficients of variation all significance disappears.¹¹ I.e., the double-ln transformation creates a wave-like pattern of significance that is not present in the original data. The underlying coefficient of variation, of the omitted first-month dummy variable, is 0.19, which again suggests that the divergence over time from this base level is exceedingly small.

2. Price reform measures: overview and potential for trade barriers

AY's rationale for increasing local protectionism is that (central) price liberalization in the reform period and a decentralization of central control over factor and material allocations created opportunities for local cadres to seek rents by creating barriers to inter-regional trade, or exerted pressure on local cadres to protect existing rents by creating such barriers.¹²

Price liberalization in China did not occur all at once.¹³ (i) The average agricultural procurement price reflects quota prices, negotiated prices (prior to the mid-1980s also above-quota prices) and market prices, with, in general, a decrease in the number of products with quotas and quota prices over time, as well as a decrease in quotas, but with the details largely product- and province-specific. (ii) Starting in 1984/85, many producer goods and materials, in the Chinese terminology "means of production," came with two prices (double-track price system), a plan price and a market price. In May 1984, enterprises were allowed to sell 2% of planned production and any above-plan output at prices up to 20% above the plan price; the 20% limit was abandoned in January 1985. (iii) Some retail goods (industrial consumer goods) prices were freed starting in the early 1980s, while other retail goods remained subject to rationing coupons and fixed prices until at least the late 1980s. An attempt at large-scale price liberalization for industrial products (means of production and retail goods) in 1987 led to double-digit inflation on the order of twenty percent in 1988 and 1989. Price reform was stopped. By 1990 inflation had receded, the two prices (the plan and the market price under the double-track price system) had pulled equal for most products, and price reform was continued.

AY's price argument appears to be potentially relevant in those instances where prices were not set centrally, i.e., where prices were set either by local governments or enterprises (the market), with possibly trade barriers to prevent the inflow of cheaper products and to protect local enterprises' profit margin and thus local governments' profit share or income tax revenue. But even the distinction between centrally determined prices vs. locally determined prices (by local governments or enterprises on the market) may not be a perfectly relevant measure of the potential extent to which localities have incentives to establish barriers to trade. If centrally determined prices are set at a low level, localities may still wish to erect barriers to trade in order

¹¹ The results with the coefficient of variation of the ln of prices as the dependent variable comes with very large standard errors, for reasons that are unclear (chart e. or g. in Figure 10).

¹² I have difficulty finding a succinct statement of the argument for increasing local protectionism in AY's paper. The abstract, cited in the paper, provides some indication. Various explanations are on pp. 1093-1105. Lacking a succinct statement, I am summarizing here what I understand to be AY's key rationale for increasing local protectionism.

¹³ Details on price reform reported in the following are drawn from numerous pages in various issues of the *Price Yearbook*.

to prevent their outflow. Perhaps a more relevant measure is the share of non-central output—with output under central control subject to *centrally planned* trade.

In the pre-reform period, approximately three-quarters of all output occurred in non-central enterprises (Thomas Lyons, 1986, p. 221) and, if prices of this output were also set locally, thus comes with clear opportunities for local rent seeking (accompanied by trade barriers). Similar output data are not available for the reform period except that in 1985 central state-owned enterprises in industry accounted for 16.99% of industrial gross output value and in 1995 for 15.73% of industrial value-added.¹⁴ This would suggest that the opportunities for localities to erect or maintain trade barriers increased only slightly very early on in the reform period, and then stayed approximately constant over the key period covered by AY.

Nevertheless, adopting AY's focus on prices, Figure 1 shows the share of sales in each of the three product categories (retail sales, agricultural procurement, sales of means of production) conducted at market prices, i.e., not at *centrally or locally* determined plan or guidance prices, and Figure 11 the share of *centrally* determined plan and guidance prices since 1990, when these data are available.¹⁵ These data suggest that two sub-periods of the reform period could have provided new opportunities for localities to seek rents (and establish trade barriers). One sub-period is the years 1978-85 when the share of market prices increased sharply from close to zero to approximately 30-40 percent (Figure 1), but the data are not available to show if this reflects a reduction in centrally planned/guided prices or in locally planned/guided prices; if the latter, then the opportunities for localities to erect barriers to trade remained unchanged or may even have fallen as local governments *abandoned* price setting. The second sub-period that may have provided new opportunities for localities to seek rents is the years 1990-93, when the share of centrally determined plan and guidance prices fell drastically (Figure 11), but only if this reduction covered production under local control.

A caveat on these figures on price setting (Figure 1 and Figure 11) is in order. First, by definition, market prices are all prices that are not state-determined (*guojia dingjia*) or state-guided (*guojia zhidaojia*).¹⁶ Until 1997, state-determined and state-guided prices covered only such prices at central, provincial, and municipal/ prefectural level, with everything that did not fall into these three categories by default being labeled “market” prices. (Since 1998, the terminology has been changed to central, provincial, and “below-provincial” state-determined and state-guided prices, with no explicit definition of “below-provincial.”) The official sales shares of “market” prices until at least 1997, thus, ignore prices determined at the urban district and county level, as well as one level down by neighborhood committees within urban districts (relevant at least for local farmers' markets). Second, “market” prices also include the prices of

¹⁴ For the 1985 value see *Industrial Census 1985*, pp. 32f. (value-added or net material product data are not available). For the 1995 value, see *Industrial Census 1995*, Vol. 2, p. 17, and *Statistical Yearbook 1996*, p. 42.

¹⁵ For additional comments see notes to Figure 1; in particular, the category “market prices” may contain plan/guidance prices issued by sub-municipal government units, and it also covers sales at prices whose change has to be approved by a government department. Centrally determined plan and guidance prices follow the same time trend, and therefore the sum of the two is reported in Figure 11 (the volume of sales at plan prices exceeds that at guidance prices in all three product categories in all years, usually by a factor of more than two).

¹⁶ “State-guidance prices” refers to the prices of products for which governments, price departments, or line ministries at county level or above set a base price plus an upper and lower boundary (or a fixed mark-up), or set a minimum and a maximum price. (*Price Yearbook 1990*, p. 84)

products for which prices are not officially state-determined or state-guided, but products which are still subject to price administration by central, provincial, or municipal governments. For example, “market” prices include products for which price increases need to be reported to the local or central government; the government can veto the price increases. As a result of the incorrect labeling of state-controlled prices as “market” prices and of the incomplete coverage of “state-determined” and “state-guided” prices in general, the official sales shares of “market” prices are likely to exaggerate the shares of what one would normally consider to be market prices.¹⁷

3. Institutional explanations of changes in price dispersion over time

The key alternative explanation for the observed patterns of price dispersion over time is an institutional one. This section elaborates on the corresponding (short) passages in the paper.

AY’s price data cover retail goods, with annual prices, in 1986-93, and means of production, with monthly prices, in 3/90 through 5/99. What is to be explained, in terms of the *ln of the standard deviation of the ln of prices*, is increasing price dispersion in 1986-89, decreasing price dispersion in 1989-91, increasing price dispersion in 1991-94, decreasing price dispersion in 1995-97, and increasing price dispersion in 1997-99.

In terms of the *standard deviation*, what is to be explained is a continuous, gradual increase in retail price dispersion between 1986 and 1993 (and perhaps, contrarily, a non-significant dip in price dispersion in industrial materials prices between early 1990 and late 1991); nothing of significance happens after 1993 in any prices. In terms of the *coefficient of variation*, there is nothing to be explained except perhaps a dip in price dispersion in industrial materials prices in 1992 (but not in retail prices). In the following I focus on AY’s originally claimed and verbalized patterns, even though I am not sure what to make of the *ln of the standard deviation of the ln of prices* from which AY deduced conclusions on price dispersion patterns that he then described using English language.

Pricing regimes for individual products within the categories retail goods and means of production changed over time.¹⁸ Starting in 1984/85, some means of production became subject to the dual-track price system with simultaneously a plan and a “market” price, increasing the opportunities for price differences across provinces; by 1988, two prices existed for approximately 40% of all product categories and 50-75% of sales volume. If prices of these products were previously centrally determined and set at a uniform nationwide price, the switch to market prices for some of the output opens up scope for new inter-provincial price dispersion. For example, a province with sufficient plan quota to meet all local needs enjoys the plan price; another province, with little plan quota, on the other hand, pays predominantly the market price. When market prices exceed plan prices, as was the rule through 1990, and if the marketized

¹⁷ It is unclear to what extent service sector prices are covered in retail sales or sales of means of production. In transportation (for example, the railway system), energy, and post and telecommunications, government price controls appear pervasive until today.

¹⁸ Details on price reform reported in the following are drawn from numerous pages in various issues of the *Price Yearbook*.

share increases over time, this implies an increase in price dispersion, in extent depending on the regional distribution of quotas allocated by the central plan. The price dispersion for means of production is likely to feed through into retail prices.

There are two corollaries to the plan-market transition in pricing. In China's shortage economy of the 1980s, producers of retail goods can easily sell all their output locally and may therefore have few incentives to establish nationwide distribution networks or to bother with a perhaps not particularly friendly state-run distribution network; traditionally, retail goods, i.e., consumer goods, are not part of the *central* plan, and inter-provincial trade in retail goods in the pre-reform period was presumably minimal.

Second, not all products are likely to be produced in all provinces, whether that is due to planning or to the realization of comparative advantages. For example, even in the late 1980s, China did not have a car manufacturer in every province. If prices are market-determined, provinces without local production could face near-monopoly prices imposed by an outside supplier taking advantage of high transportation/ distribution costs combined with the far distance of any alternative supplier. In other provinces, several suppliers might compete, which may result in low prices. Product prices may diverge across provinces simply due to transportation costs and market structure. An initial *increase* in price dispersion can be caused by price liberalization, with as starting point a centrally determined, nationwide uniform price. In the absence of trade barriers, profit opportunities should lead to the establishment of new enterprises in high-profit localities, but this could take time.¹⁹

The plan-market price transition in the second half of the 1980s suggests a continuous rise in price dispersion over time. The chart for retail price dispersion (the ln of the standard deviation of the ln of prices) shows that dispersion by 1989 had risen to a level significantly different from that of 1986.

Following the economy-wide, double-digit inflation rates in 1988 and 1989, procedures to control excessive market prices of both means of production and retail prices were implemented beginning in 1988/89. Products covered by the state mandatory or guidance (production) plan again became subject to state-determined prices. In October 1988 the State Council (SC) requested large and medium-sized cities to impose a reporting system for price changes in products the prices of which were originally market prices. Price departments were given the authority to prohibit or delay price increases. In 1989, the reporting system was extended across all China. The product categories and individual products within each category subject to price reporting (and thus price control) were predominantly a provincial-level matter; thus, the number of categories and products under price control differed from province to province, by central government design. For 13 product categories, price changes had to be reported by provinces to the SC. For "important" producer goods, if the center did not issue a uniform maximum price, then provincial price bureaus were to determine a local price (included in a SC list), taking into consideration local demand and supply. Some products for which the plan price had previously

¹⁹ It could also be prevented by barriers to investment in form of central government investment policies, documented in almost annually revised lists of industries in which the government prohibits or encourages investment. Changes in investment and industrial policies would then lead to changes in price dispersion over time.

been abandoned again became subject to plan prices. At times, in 1989 and 1990, 50 different central government departments were setting prices in their economic or administrative sector.

In 1991, after the period of “adjustment and consolidation” with only 4.1 and 3.8% real GDP growth in 1989 and 1990, the number of product categories on which price changes had to be reported to the SC was reduced to 5. Most provinces began to dismantle their price reporting requirements. Central government departments also shifted price control authority over many products (for some of which prices had never been freed before) to localities or enterprises themselves.

The chart for retail price dispersion shows that the high price dispersion for retail goods of 1989 fell in 1990 and 1991 (to insignificant levels compared to 1986).²⁰ The chart for industrial materials prices also shows the decline between 1990 (the starting year of this series) and 1991. This is in direct contrasts to AY’s argument that relaxation of central price controls allowed provinces to, by erecting trade barriers, manipulate prices, which then supposedly leads to an *increase* in price dispersion; the 1991 relaxation of central price controls led to a *decrease* in price dispersion.

By 1992, price liberalization became pervasive and the dual-track price system largely ceased to exist. The share of sales of means of production conducted at *centrally* determined plan or guidance prices, for example, fell from 46% in 1990 to 14% in 1993; the share of sales conducted at market prices rose from 36% to 81% (Figure 11 and Figure 1). Deng Xiaoping’s Southern Tour in January 1992 started an investment boom—not uniform across the country—causing renewed price pressure for both means of production and consumer goods. The ex-factory price index of industrial products reached 6.8% in 1992 and 24.0% in 1993 (before falling to 19.5%, 14.9%, and 2.95 in 1994–96). If imperfect markets do not respond instantaneously, or if transportation facilities are scarce, or transportation costs high, or the distribution system limited and/or inflexible—with real-world, economy-wide evidence on the inflexibility of the transportation system—provincial price dispersion will increase following differential provincial expansion. The charts on retail price dispersion and industrial materials price dispersion show the increase in price dispersion in 1992 through 1994.

Price dispersion drops off again in 1995 and 1996 when the central government takes measures to cool the economy, including limits on price increases, product specific measures like price adjustments via the state grain reserve system and price guarantees for non-staple foods, as well as the dispatch of central price inspectors..

The final increase in price dispersion in 1998/99 (chart on industrial materials price dispersion) occurs in a period of low growth and deflation. Excess supply led to intense price competition among enterprises, with enterprises, in particular state-owned enterprises (SOEs),

²⁰ The *standard deviation* of retail prices did not fall but remained flat. The reduction in AY’s *measure* of retail price dispersion between 1989 and 1991 is not statistically significant. In my institutional explanation I simply ponder how to explain AY’s *verbal claims* through institutional changes, focusing on retail price dispersion through 1993 and then on industrial materials price dispersion. Separately, the rise in AY’s measure of retail price dispersion between 1991 and 1993 contrasts with the fall in his measure of industrial materials price dispersion between early 1990 and late 1991. It seems plausible for the central government to in its policies for cooling the economy distinguish between retail goods and industrial materials.

often selling below cost. The State Development and Planning Commission issued a prohibition to sell below cost. Sectoral associations issued “self-discipline” prices and, for some products, determined average costs, and, in cooperation with the Price Bureau, a lower, minimum acceptable price level below these average costs.²¹ Not all provinces need to have been affected equally by these price wars, and local sectoral associations and local price bureaus may have established their own guidelines, which would imply rising price dispersion.²²

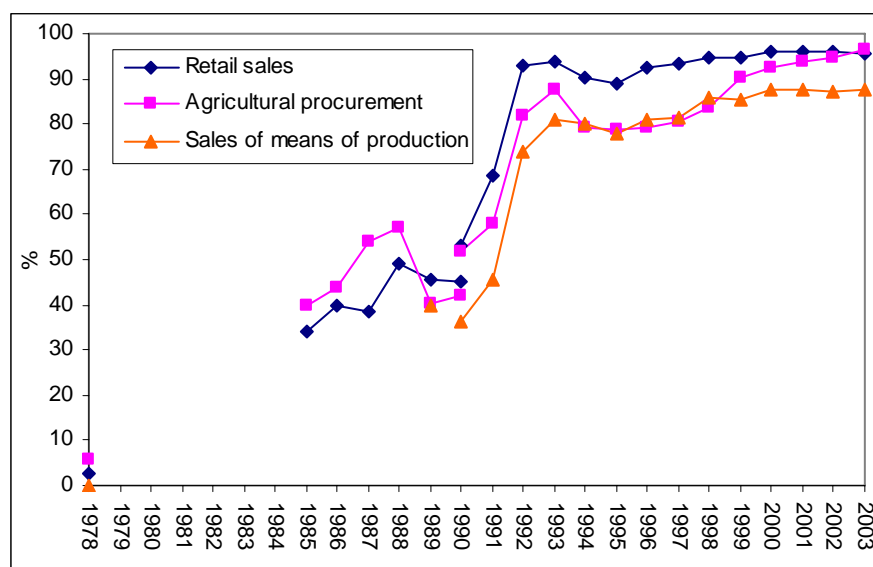
Overall, a *decrease* in price dispersion can be explained by central government decisions either directly on pricing or on cooling the economy, as well as by price arbitrage occurring gradually over time. An institutional explanation of an *increase* in price dispersion, on the other hand, beyond the initial period of price liberalization, requires recourse to some form of (possibly temporary) obstacle to price arbitrage. Obstacles there are plenty, the most obvious ones being transportation costs, transportation bottlenecks, and imperfections in the distribution system. Prices in Qinghai province for goods not manufactured in Qinghai province in the 1980s and early 1990s (say, high-tech products) must be higher than in Shanghai for the simple fact of transportation costs. Both the Qinghai and the Shanghai observations on prices get equal weight in AY’s exercise even though the latter has a three times larger population than the former. Transportation bottlenecks were pervasive at a time when inter-provincial freeways were non-existent and transportation relied on the state railway system. China in the pre-reform period did not have much of a distribution system beyond the state material supply bureau, the state commercial system, and direct supply between enterprises according to plan; the establishment of markets and non-state commercial institutions takes time, as does reform of the state-run distribution system.

²¹ The period of price competition is documented in Carsten Holz (2003), pp. 270-3. In these instances, it would appear that enterprises (or their owners) are not motivated by profit (or revenue) maximization but by selling at all cost, even if that implies large losses. The motivation could be to survive whatever industry consolidation was to follow, or perhaps to generate enough cash flow to pay wages and avoid social unrest.

²² Also see the passage in this appendix on the likely bias in the coverage of the monthly price data and its consequences, which could mean stronger than usual central interference in setting the prices covered by AY during periods of high inflation and deflation, with perhaps a time lag.

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There are two data points for 1990. Data for 1985 and 1990 are available in one table at one point of time, and it may thus be assumed that they are consistently defined over this period, and the same is true for data from 1990 through 1998 (for the two summary tables see *Price Yearbook 1991*, p. 466, vs. 1999, p. 577). For each of the three product categories in the chart, the share of market prices (reported in the chart) plus the shares of state-determined and state-guided prices add up to 100%.

More detailed data on which level of government determines or guides prices reveal a potential statistical break between 1997 and 1998, in that up through 1997 the coverage is “center, province, and municipality (prefecture),” while starting in 1998 the coverage is “center, province, and below province.” This suggests that up through 1997 prices determined or guided by governments below the municipal level are included in market prices. Alternatively, the relabeling may only be cosmetic, since the compilers of these aggregate data are unlikely to have information on state price determination and state price guidance at below the municipal level.

A further statistical break could occur in 1993, when collection of the data switched from the State Price Bureau Comprehensive Office to the SPC Price Administration Office. Provincial-level data in the same tables as the national data suggest slightly changing coverage over time; no data on Tibet (except in 1992 and 2003), and no data on Hainan, Chongqing, and Inner Mongolia are available in most (but not all) years; data on Guizhou are missing in two years, and data on Guangdong and Guangxi are missing in 1993, the year when data on a record six provinces are missing.

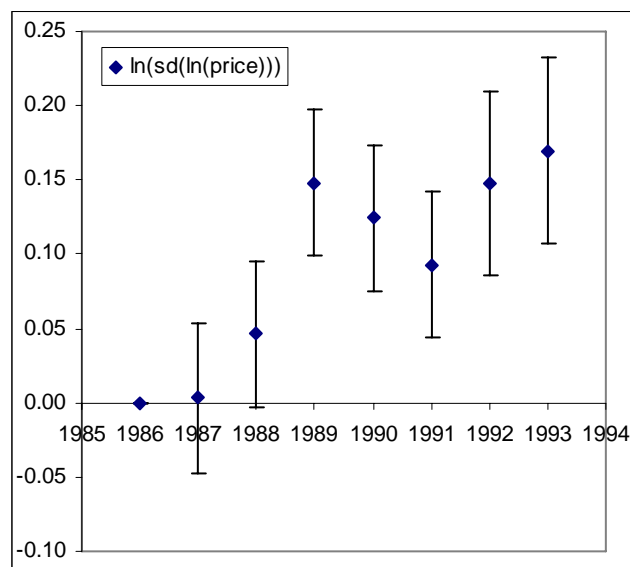
A definition of market prices is not provided with the sources. Apart from the complication that prices determined or guided by below-municipal level governments are labeled “market prices” at least through 1997, but possibly throughout the whole period, a summary text on price administration in 1989 (*Price Yearbook 1990*, p. 85) also suggests that market prices include all prices that are not formally labeled state-determined (*guojia dingjia*) or state-guided (*guojia zhidaojia*); in particular, market prices include prices that have to be reported to government price bureaus for approval.

Sources: *Price Yearbook 1989* through 2004; Bai Youzhong (1993), p. 543 for 1978 data.

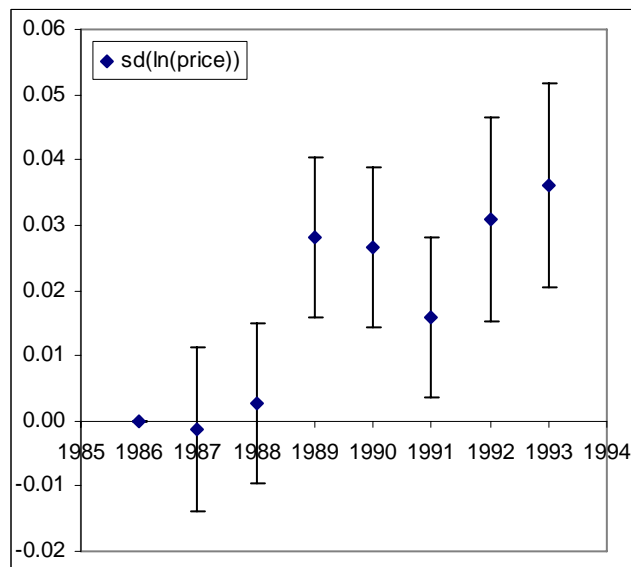
Figure 1. Share of Sales/ Procurement Value Conducted at Market Prices

Figure 2. Annual Retail Price Dispersion of Consumer Goods, Base Year 1986, 8 Charts

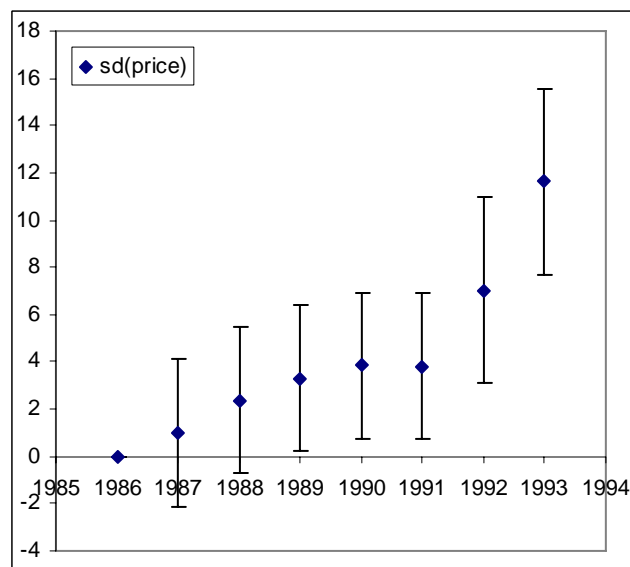
The number of observations in terms of values of the measure of price dispersion is 1776 (except when the measure of price dispersion is the ln of the coefficient of variation of the ln of prices, in which case it is 1476). For notes and sources see the corresponding figure in the paper (likewise below).



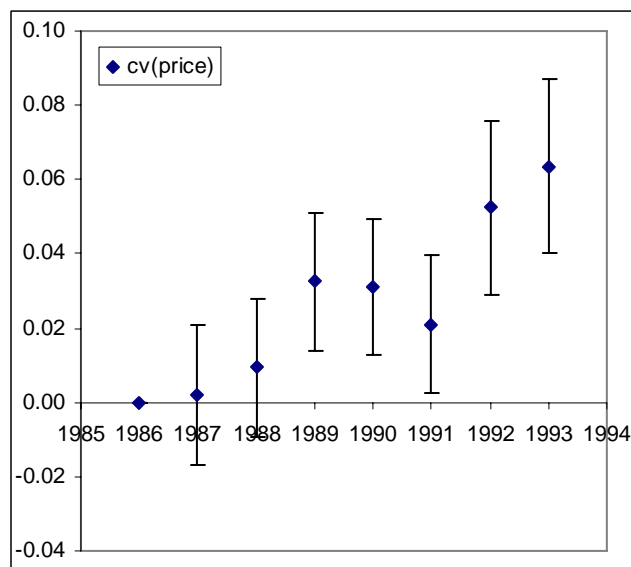
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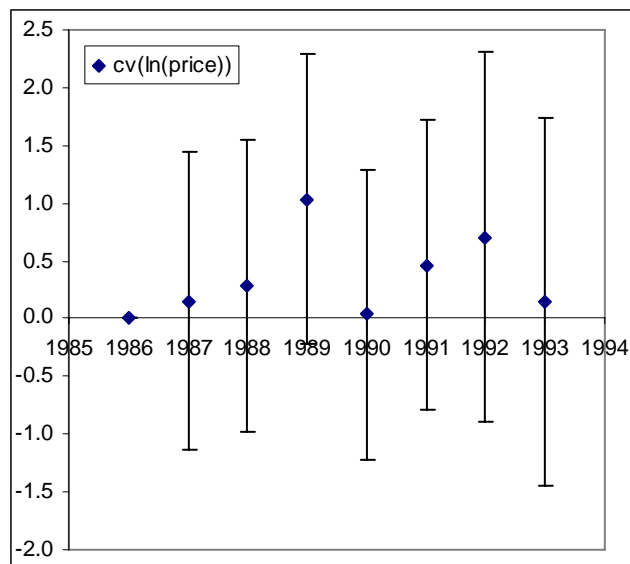
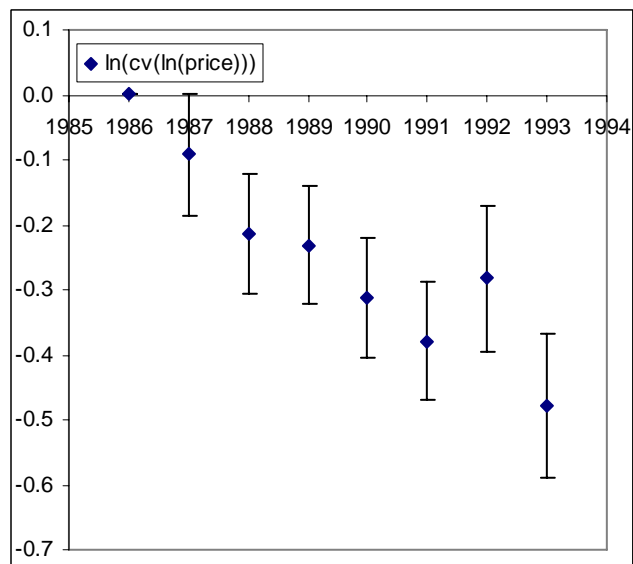
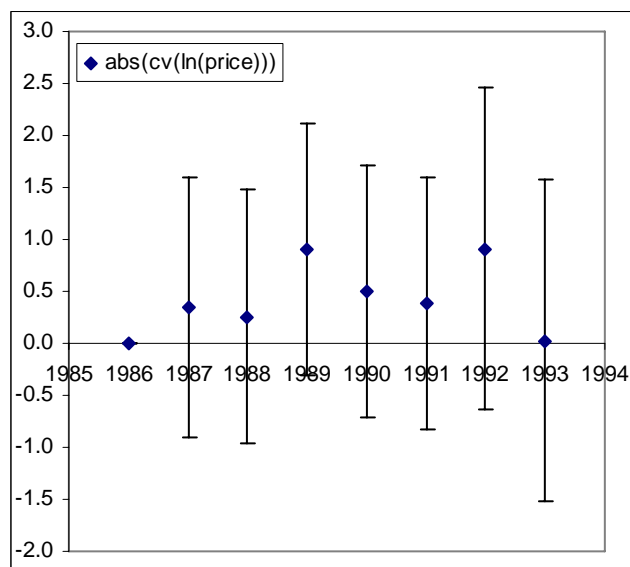


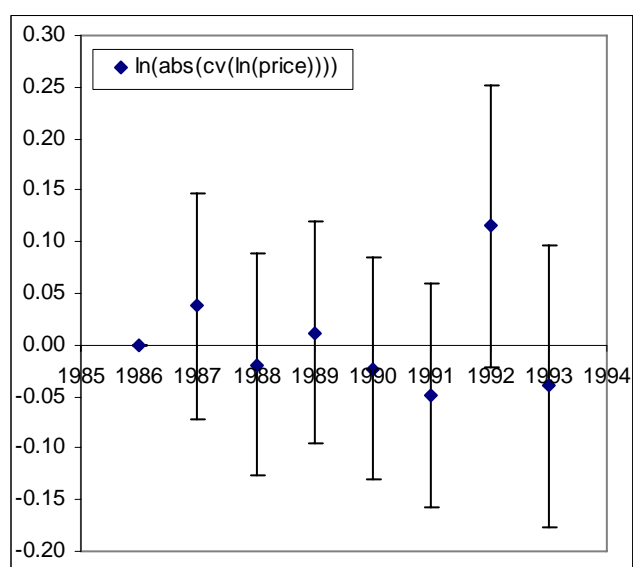
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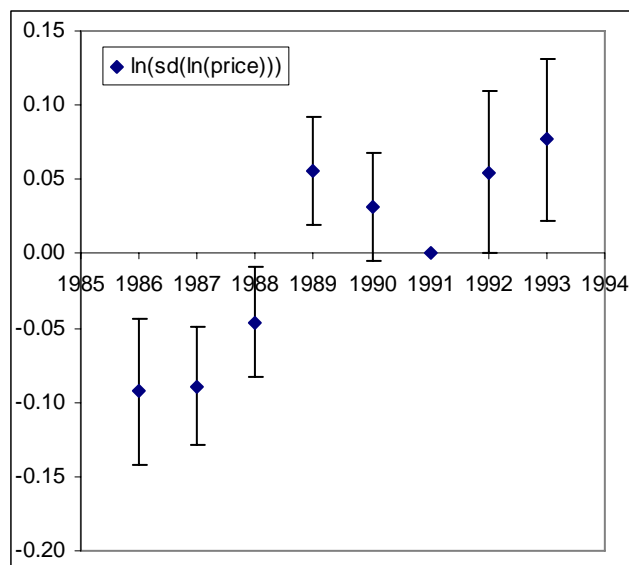
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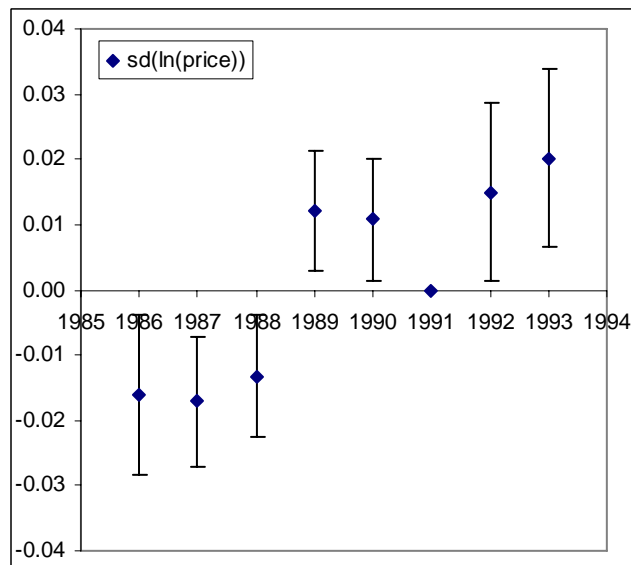
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Figure 3. Annual Retail Price Dispersion of Consumer Goods, Base Year 1991, 8 Charts

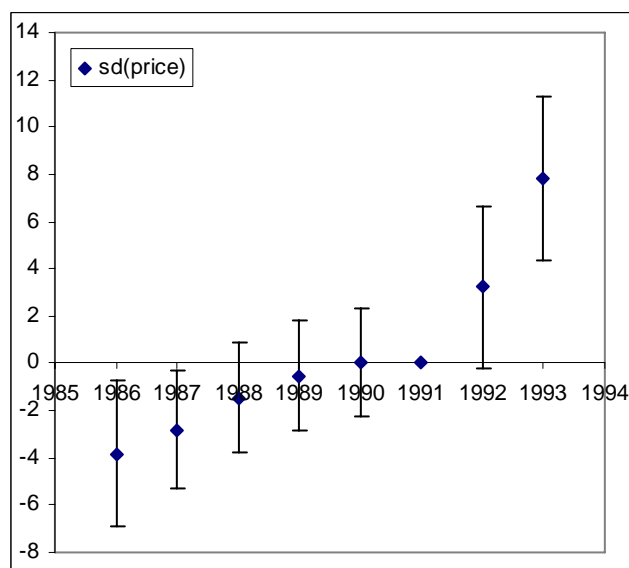
For notes see previous figure.



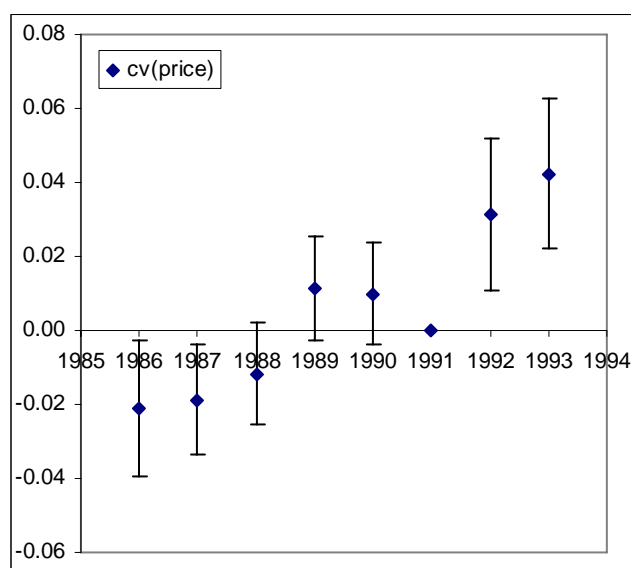
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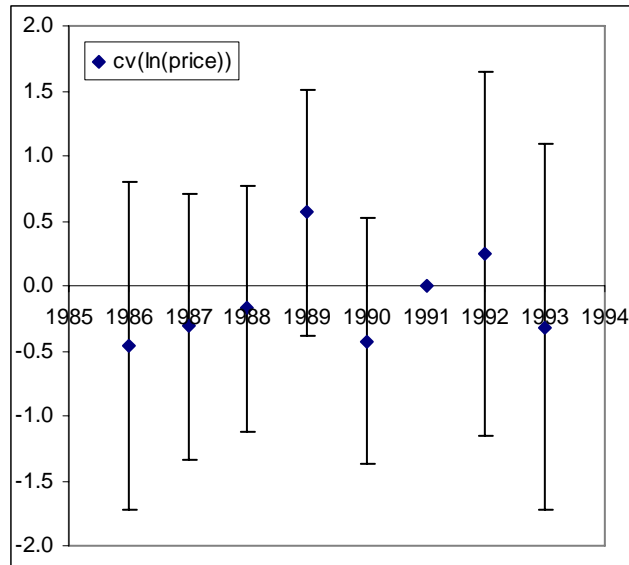
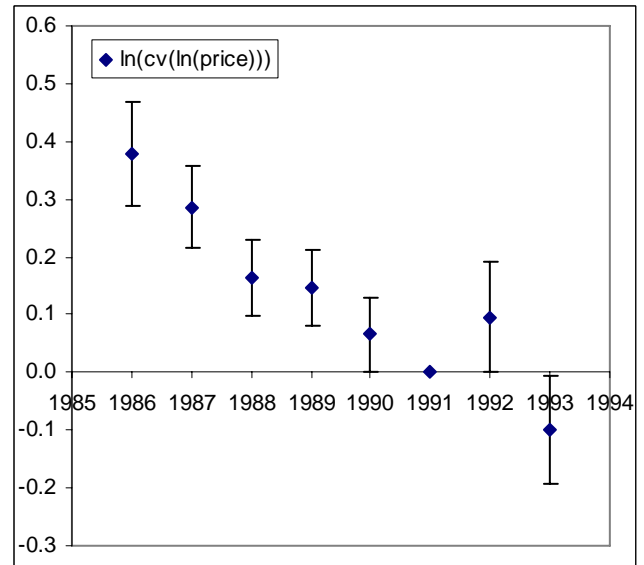
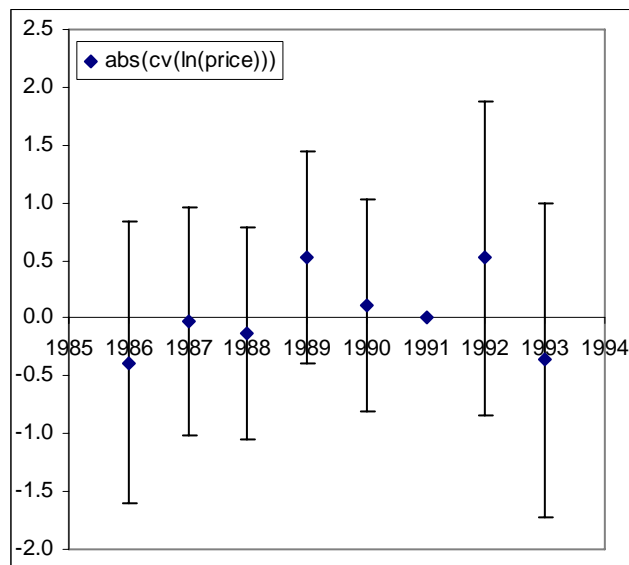


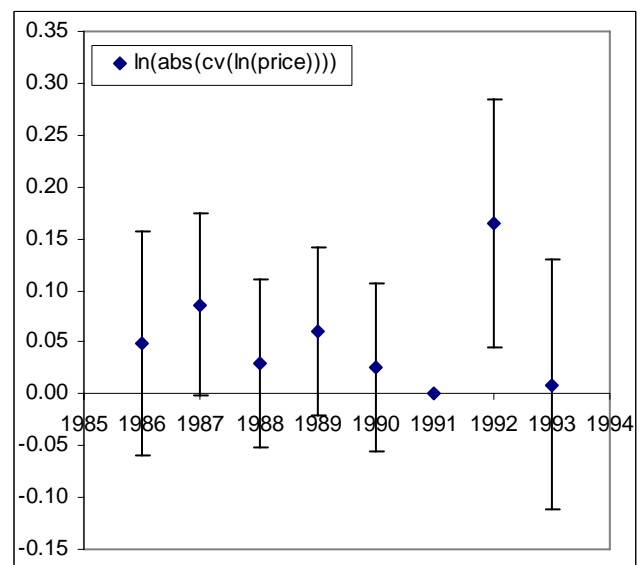
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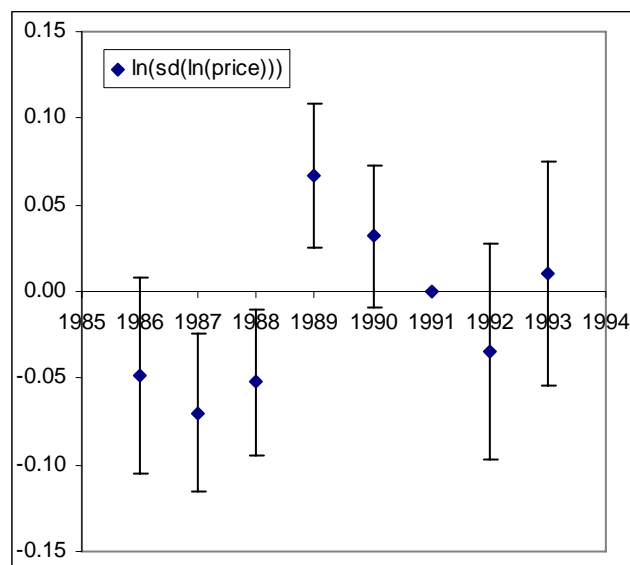
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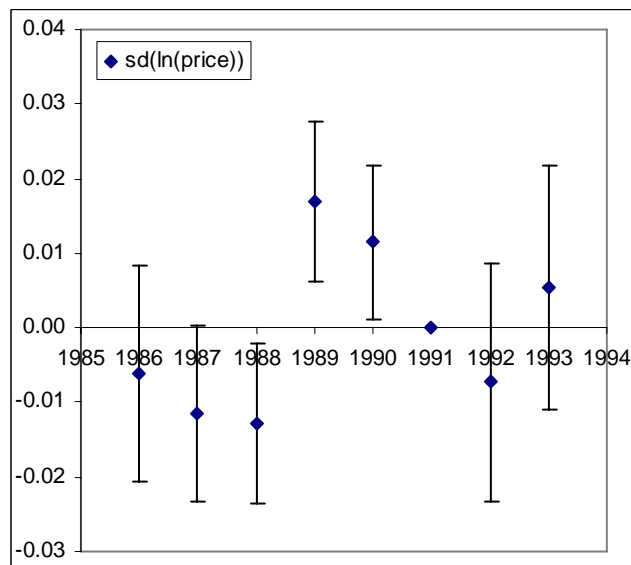
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Figure 4. Annual Retail Price Dispersion of Cons. Goods W/O Outliers Method 1, Base Year 1991, 8 Charts

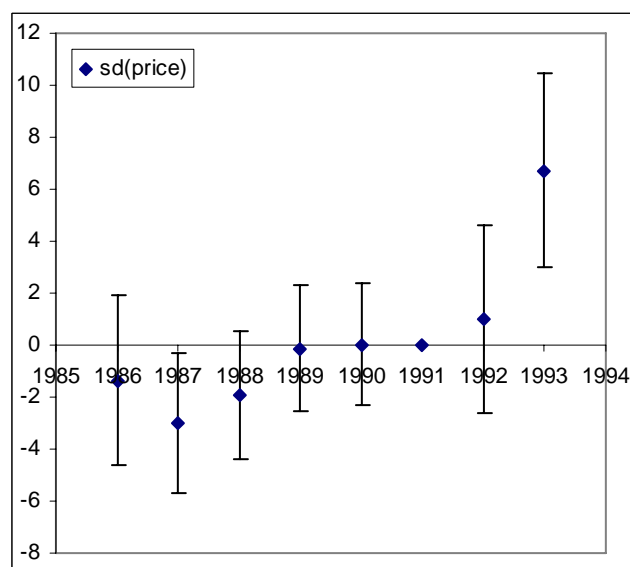
If an individual price observation for one particular product in one particular locality at one particular point of time is more than three standard deviations away from the mean of the prices of this particular product at this particular point of time across localities, then this product-time combination is removed. The resulting total number of observations in terms of values of the measure of price dispersion is 1119 (except when the measure of price dispersion is the ln of the coefficient of variation of the ln of prices, in which case it is 958).



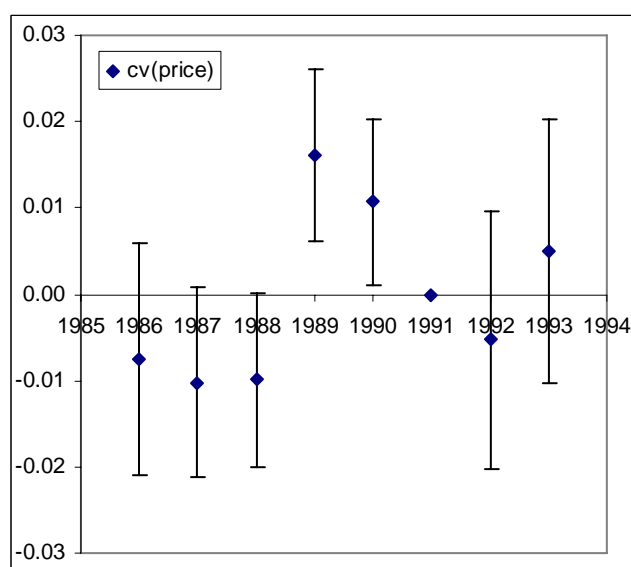
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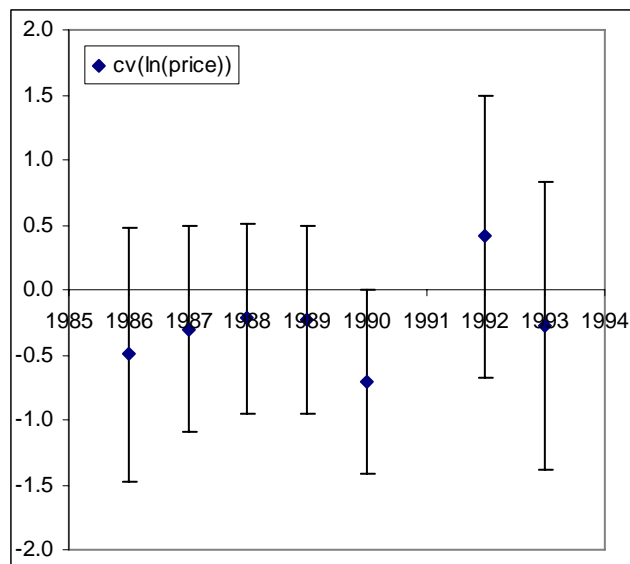
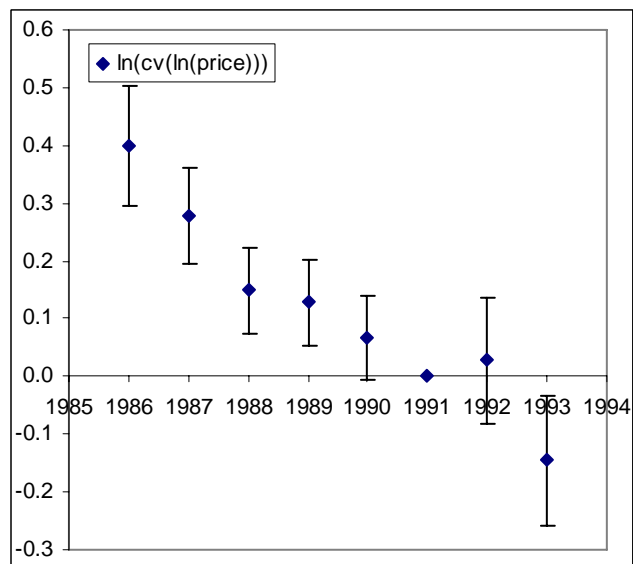
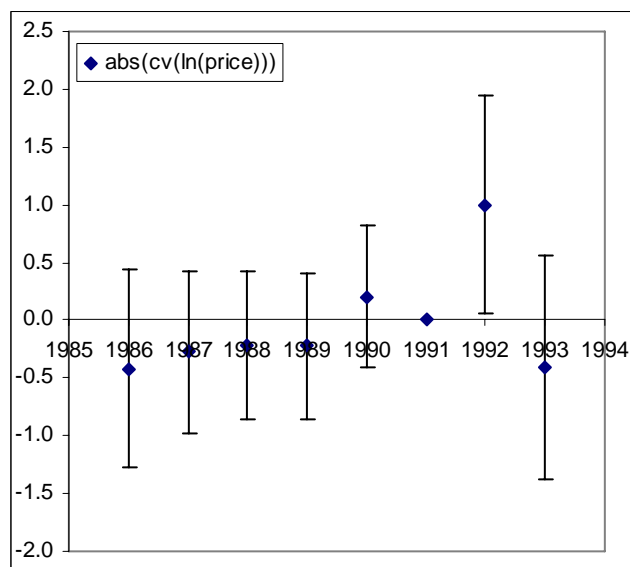


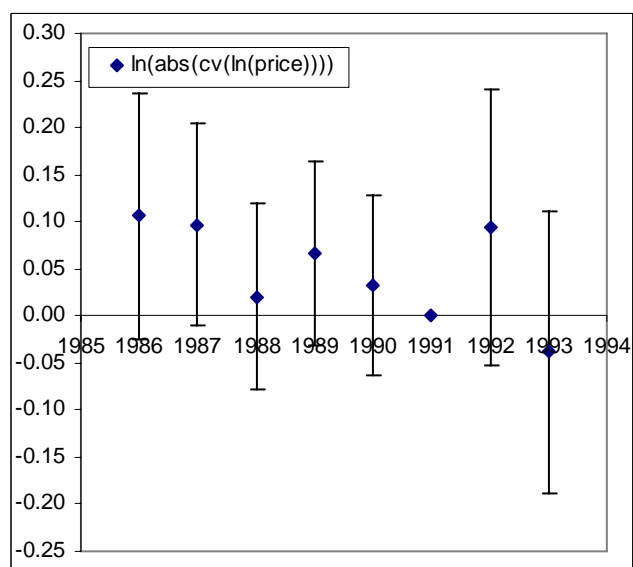
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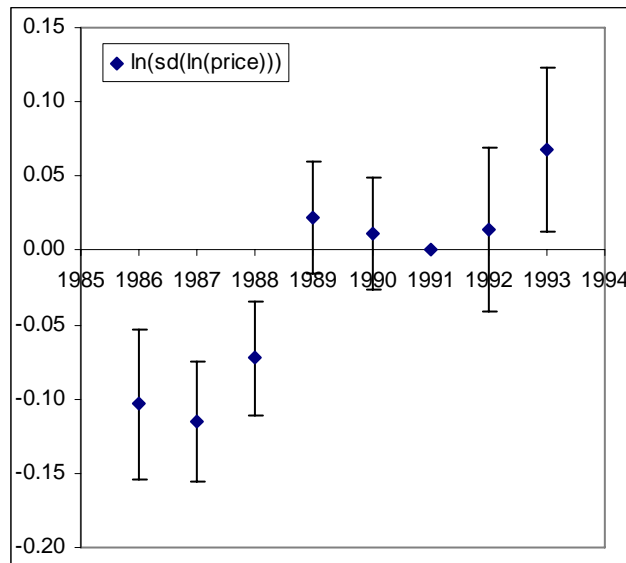
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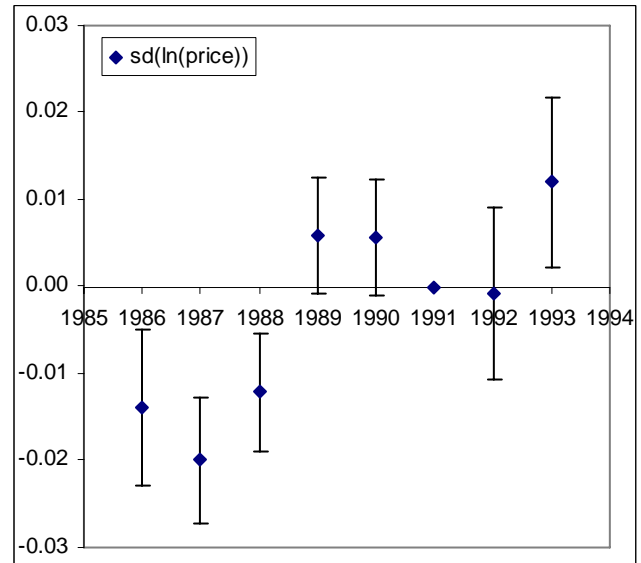
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Figure 5. Annual Retail Price Dispersion of Cons. Goods W/O Outliers Method 2, Base Year 1991, 8 Charts

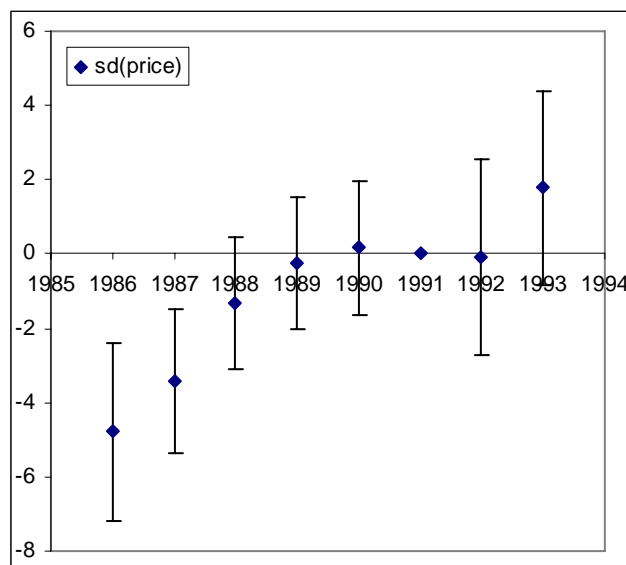
If the price of one particular product in one particular locality at one particular point of time is more than 50% higher or more than 30% lower than the price of this particular good in the same locality in the previous year, then this product-locality combination (for all years) is removed. The resulting total number of observations in terms of values of the measure of price dispersion is 1680 (except when the measure of price dispersion is the ln of the coefficient of variation of the ln of prices, in which case it is 1404).



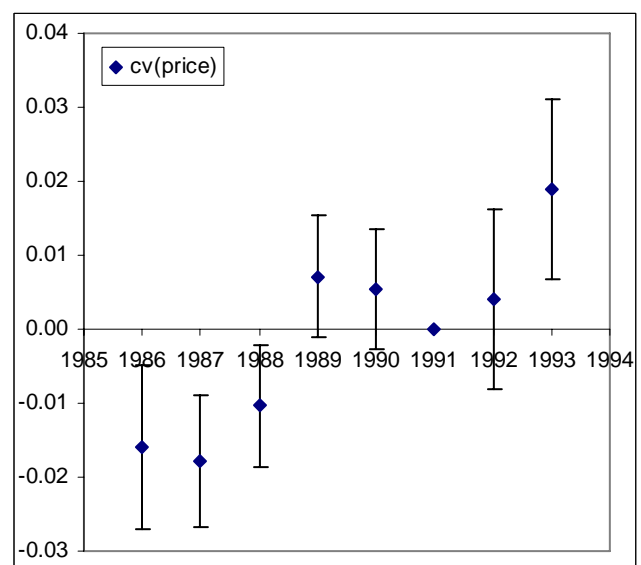
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c.



d.

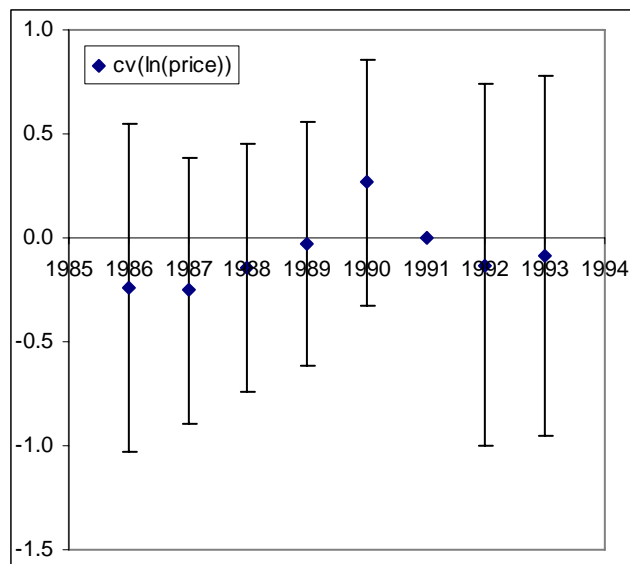
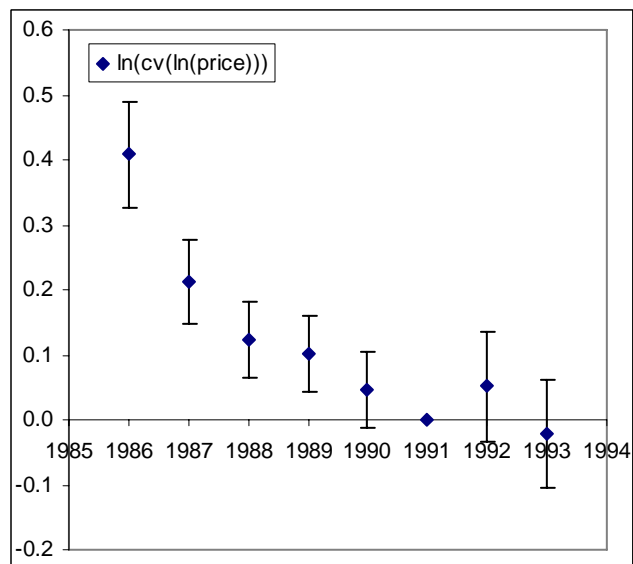
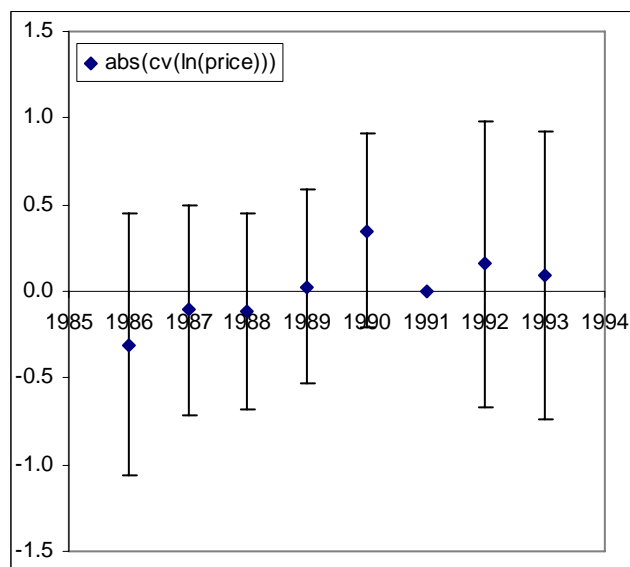


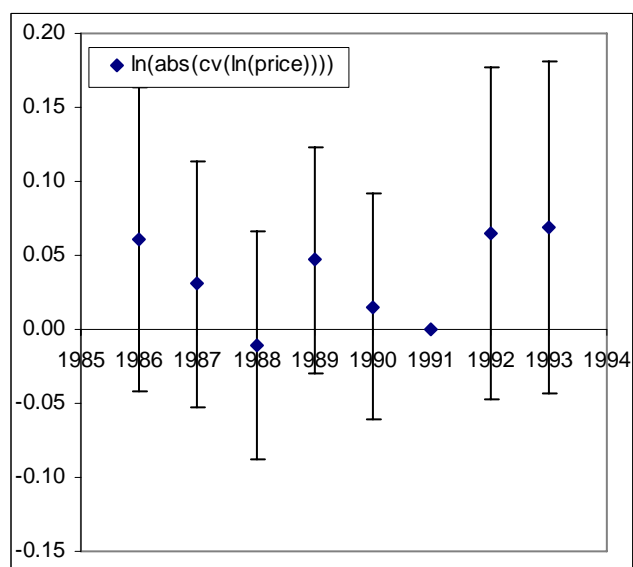
Figure 5 continued: e.



f.



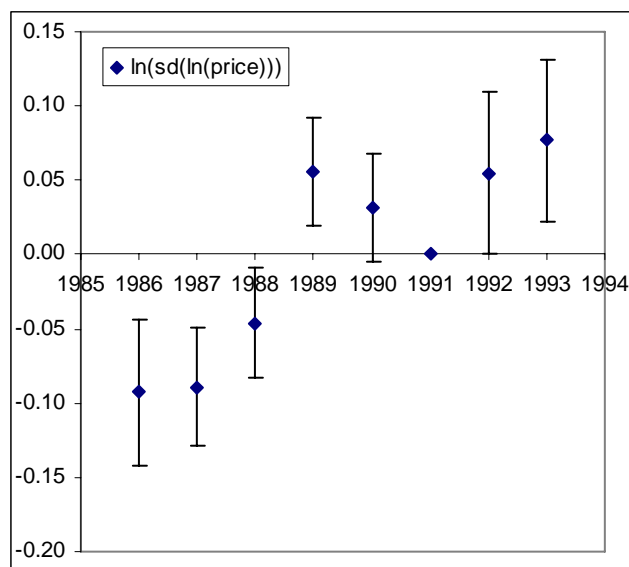
g.



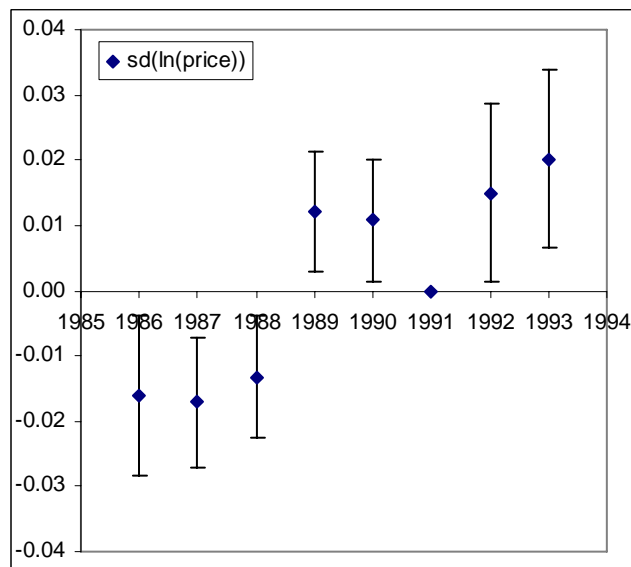
h.

Figure 6. Annual Retail Price Dispersion of Cons. Goods, Raw Prices Multiplied by 100, Base Year 1991, 8 Charts

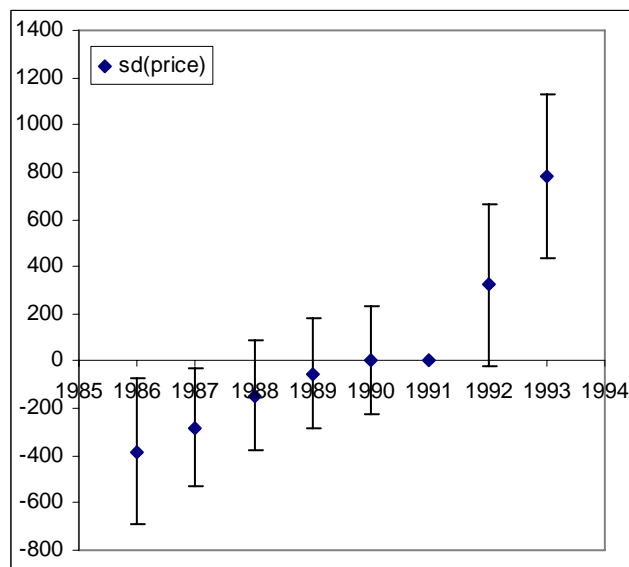
The total number of observations in terms of values of the measure of price dispersion is 1776 throughout.



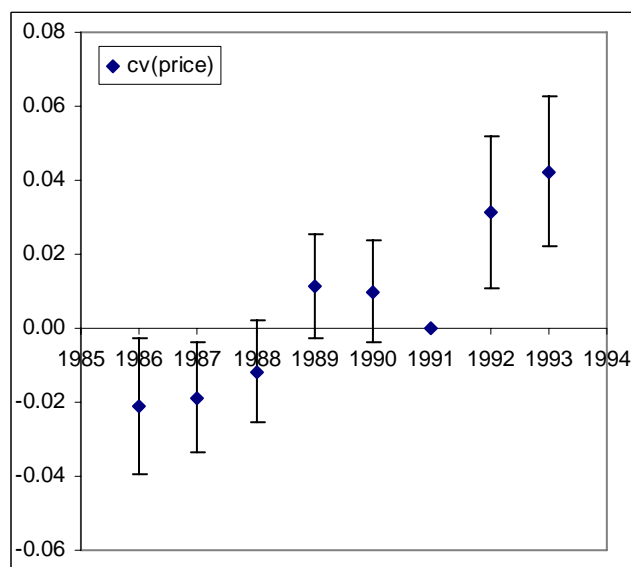
a.



b.



c.



d.

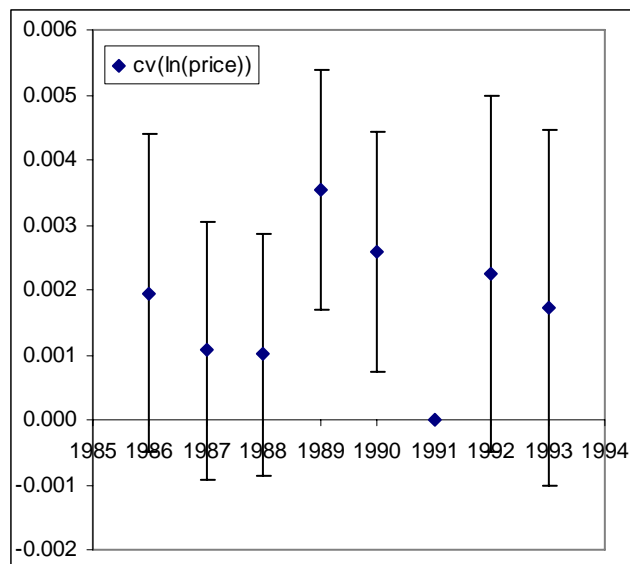
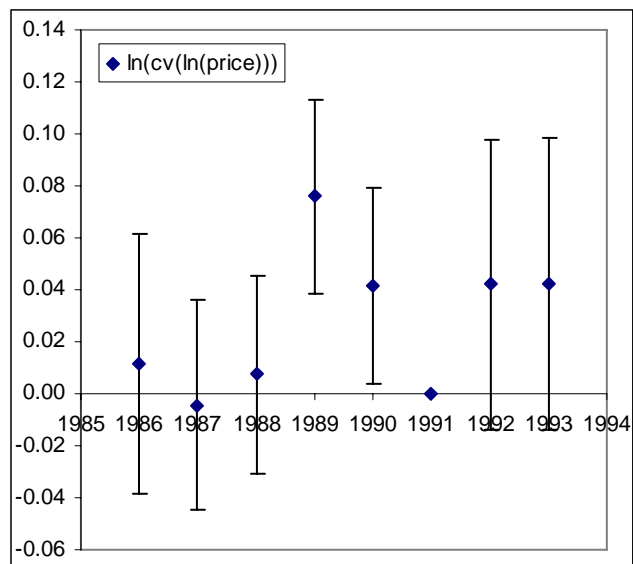
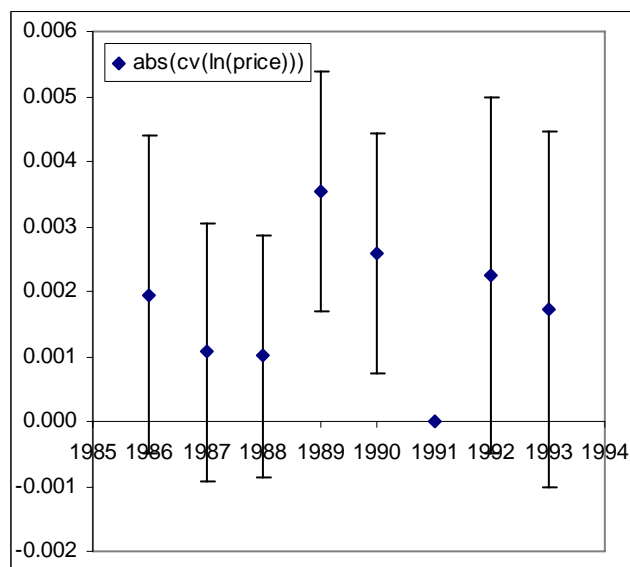


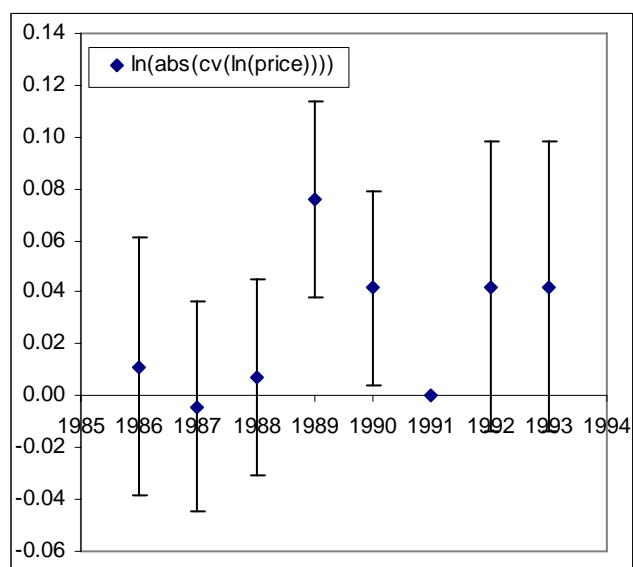
Figure 6 continued: e.



f.



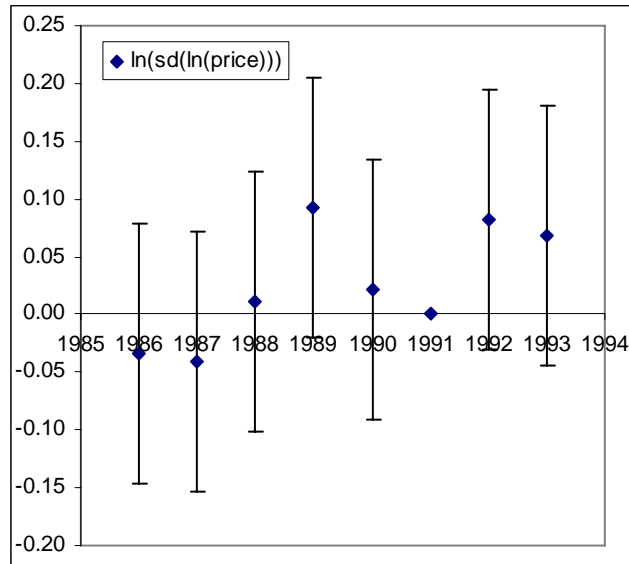
g.



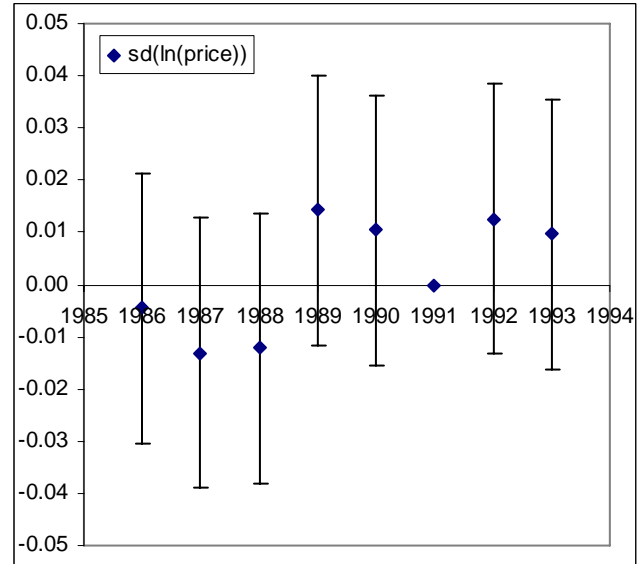
h.

Figure 7. Annual Retail Price Dispersion of 41 Core Consumer Goods , 8 Charts

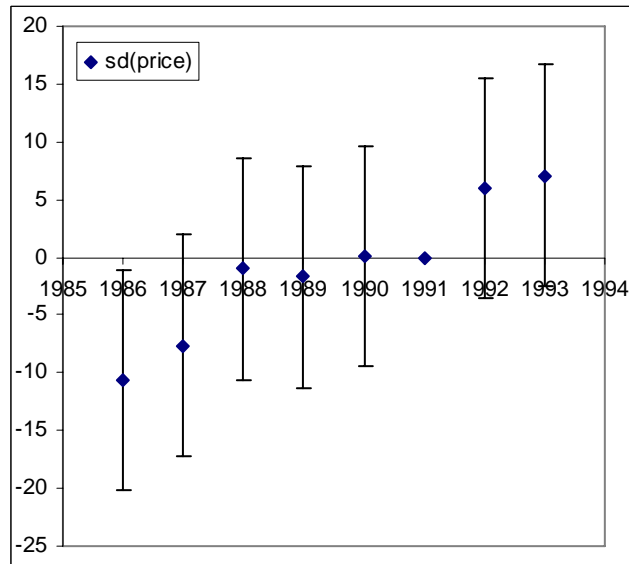
The total number of observations in terms of values of the measure of price dispersion is 328 (except when the measure of price dispersion is the ln of the coefficient of variation of the ln of prices, in which case it is 266).



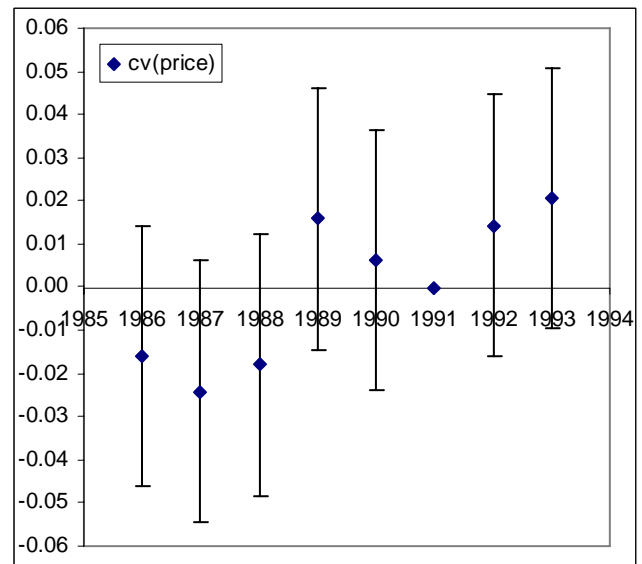
a.



b.



c.



d.

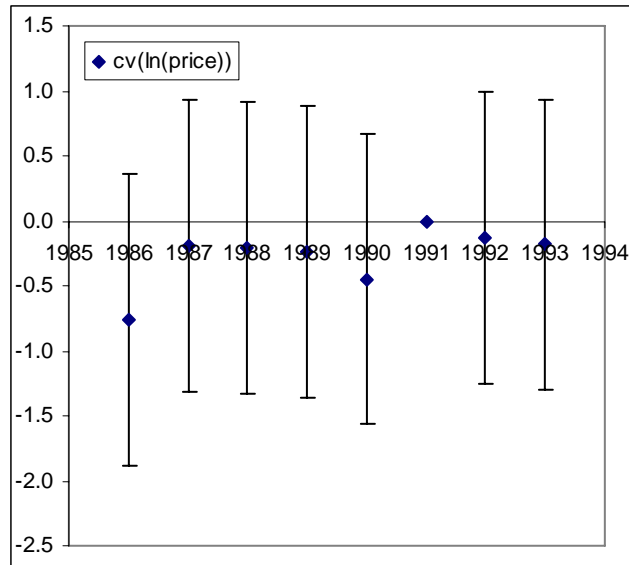
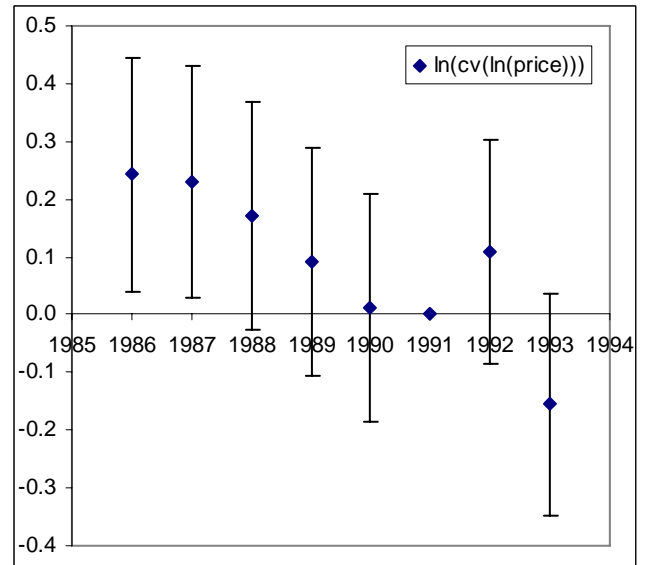
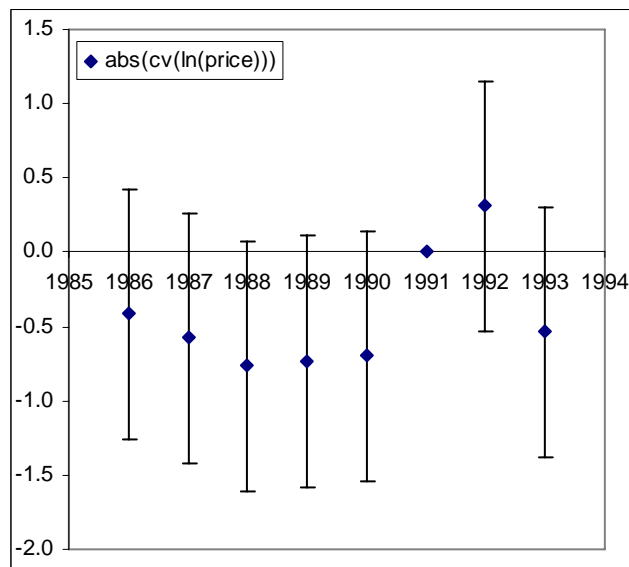


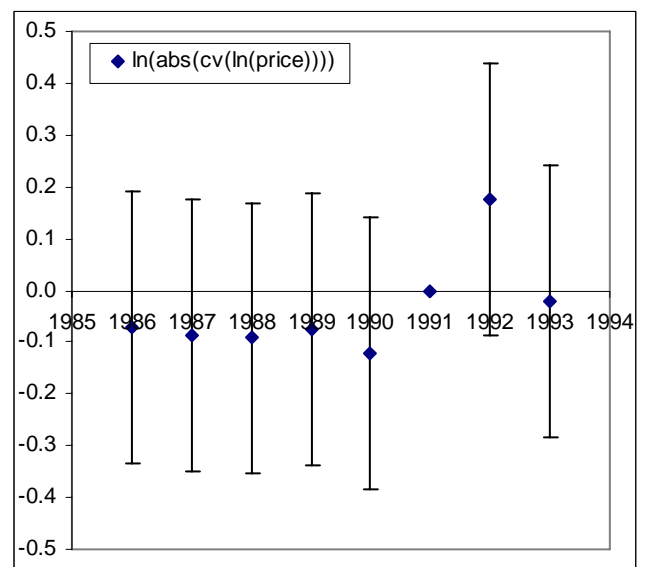
Figure 7 continued: e.



f.



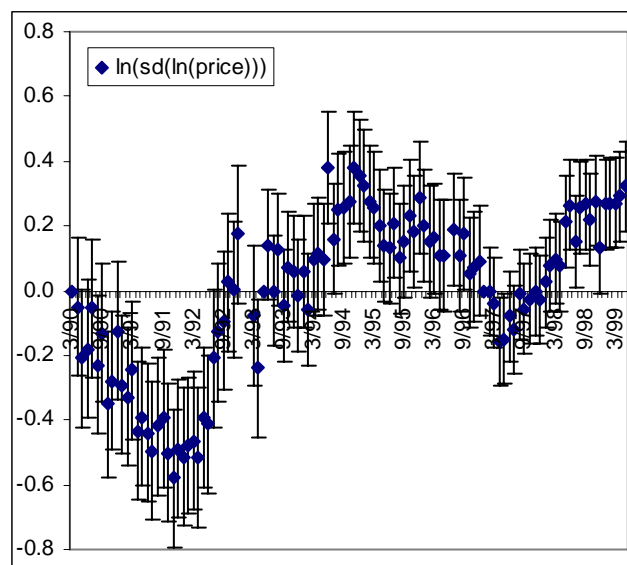
g.



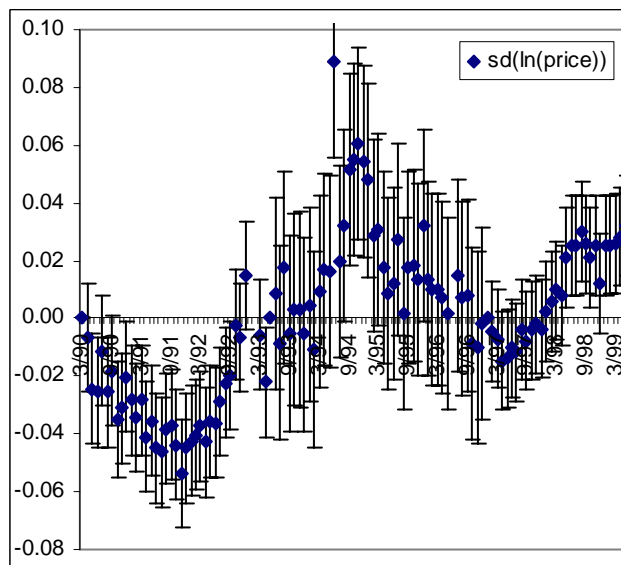
h.

Figure 8. Price Dispersion of Industrial Materials Prices, 8 Charts

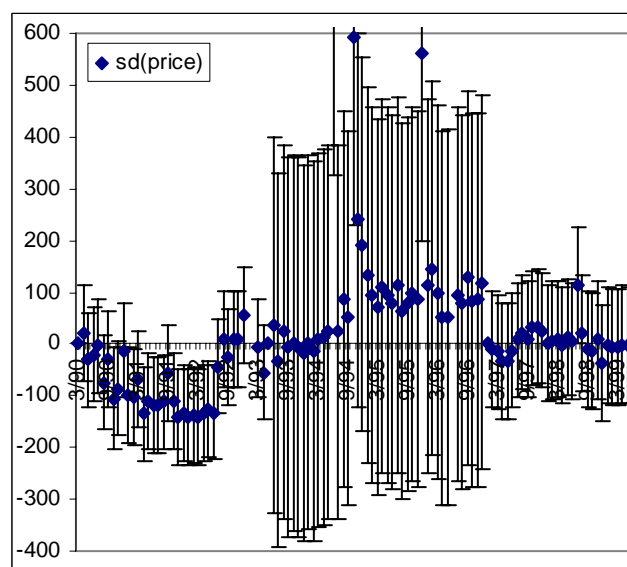
The total number of observations in terms of values of the measure of price dispersion is 855 in the first period, 1494 in the second period, and 766 in the third period. This holds for all measures of price dispersion. (Only two price observations are below 1 yuan RMB, and these do not lead to a negative coefficient of variation for the particular product across localities at the relevant period of time; and therefore there is no case when the \ln of a negative coefficient of variation would have to be taken.) For notes and sources see the corresponding figure in the paper (likewise below).



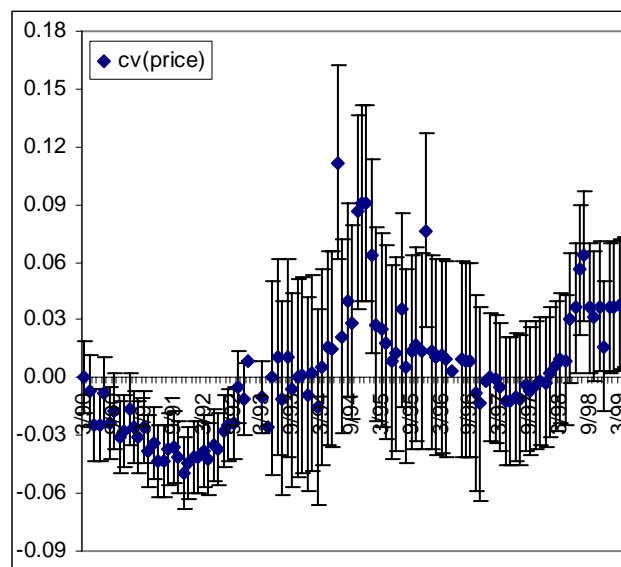
a.



b.



c.



d.

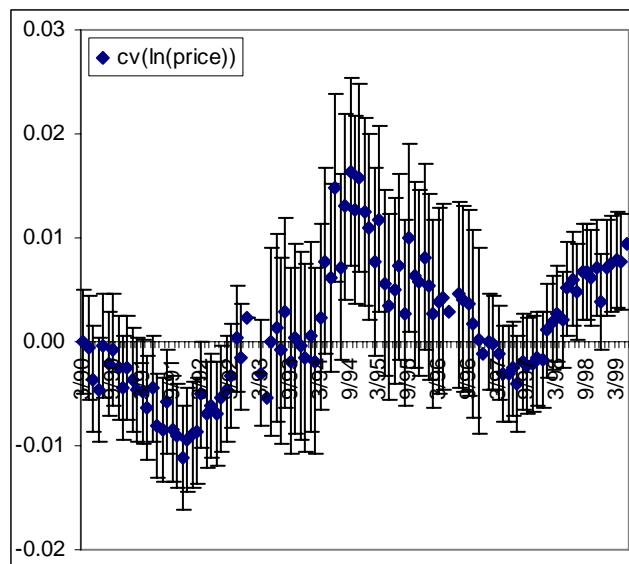
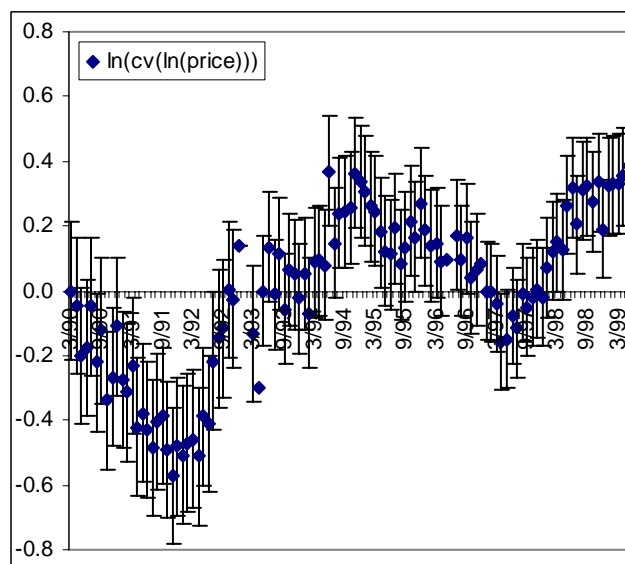
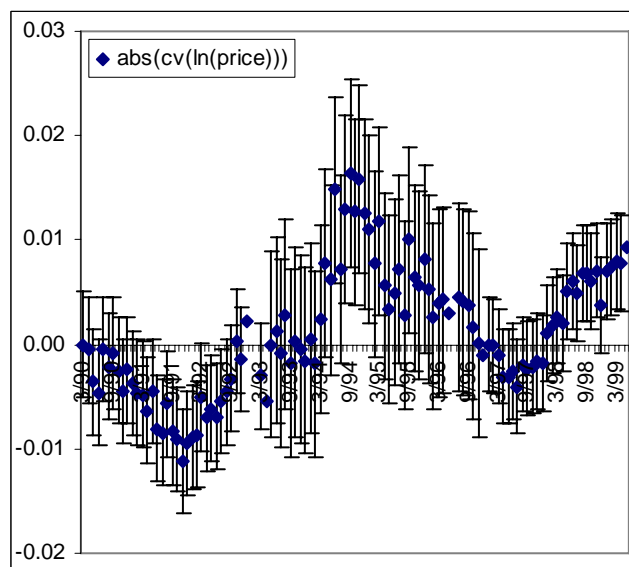


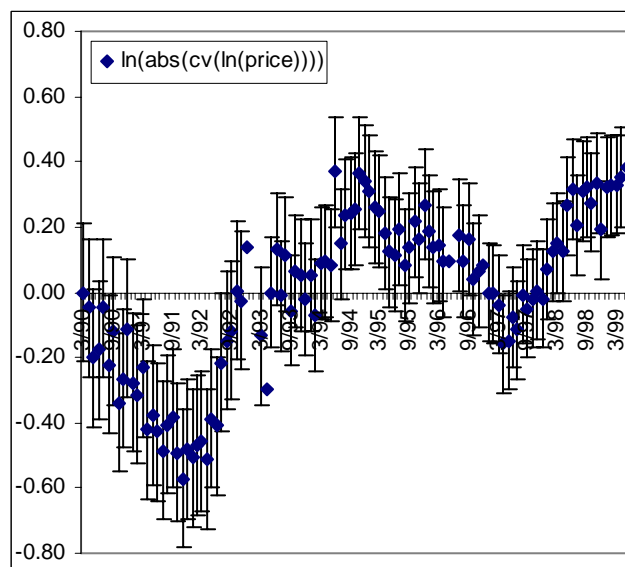
Figure 8 continued: e.



f.



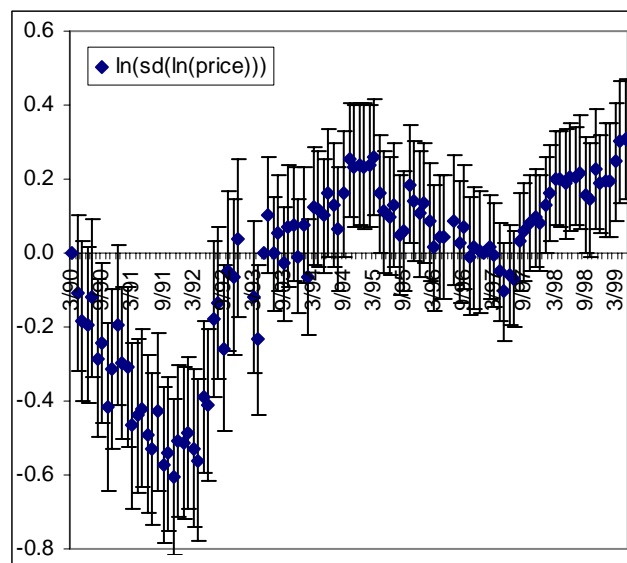
g.



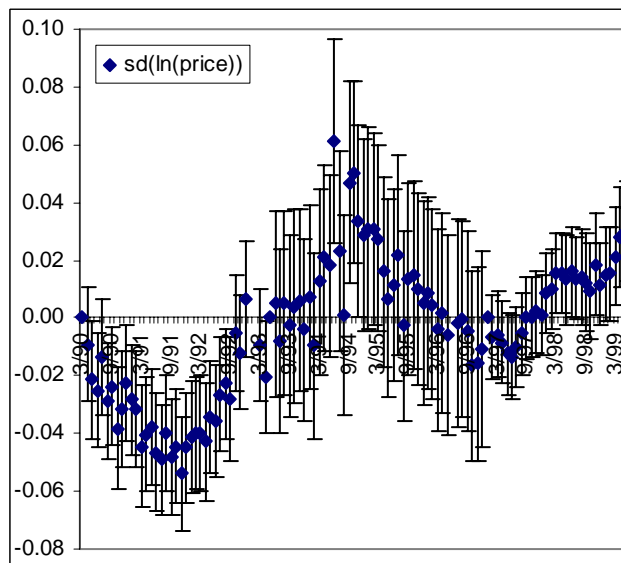
h.

Figure 9. Price Dispersion of Industrial Materials Prices W/O Outliers Method 1, 8 Charts

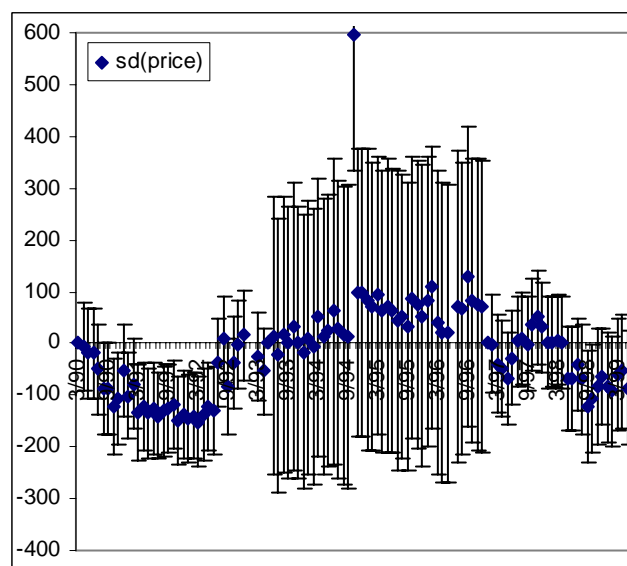
If an individual price observation for one particular product in one particular locality at one particular point of time is more than three standard deviations away from the mean of the prices of this particular product at this particular point of time across localities, then this product-time combination is removed. The total number of observations in terms of values of the measure of price dispersion is 732 (down from 855) in the first period, 1147 (down from 1494) in the second period, and 506 (down from 766) in the third period (for *all* measures of price dispersion). For notes and sources see the corresponding figure in the paper (likewise below).



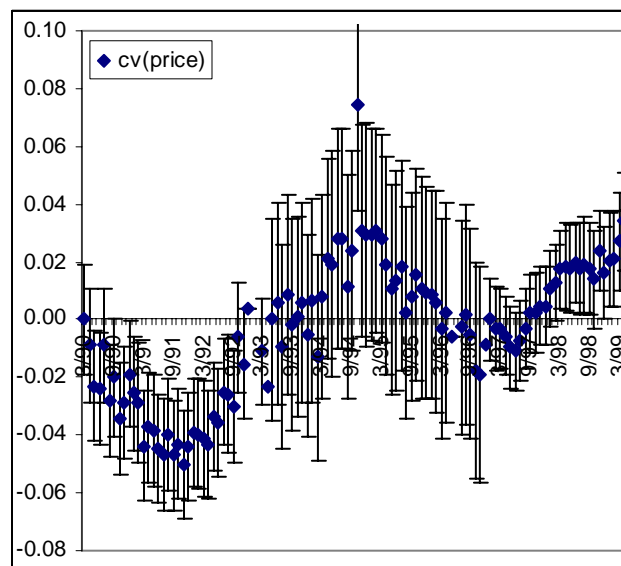
a.



b.



c.



d.

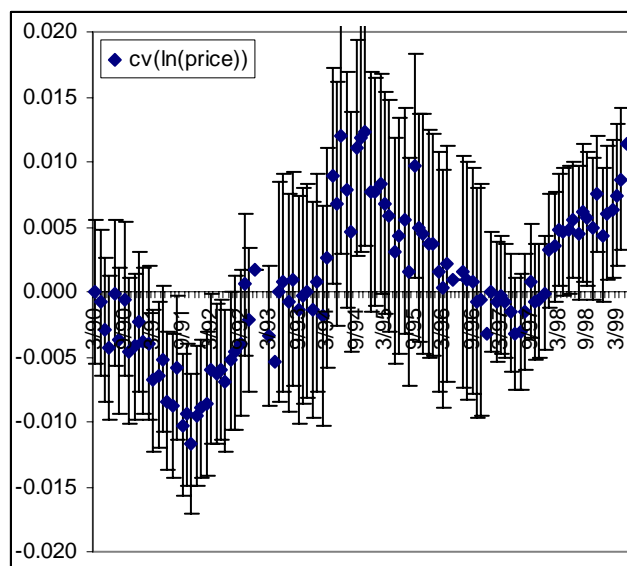
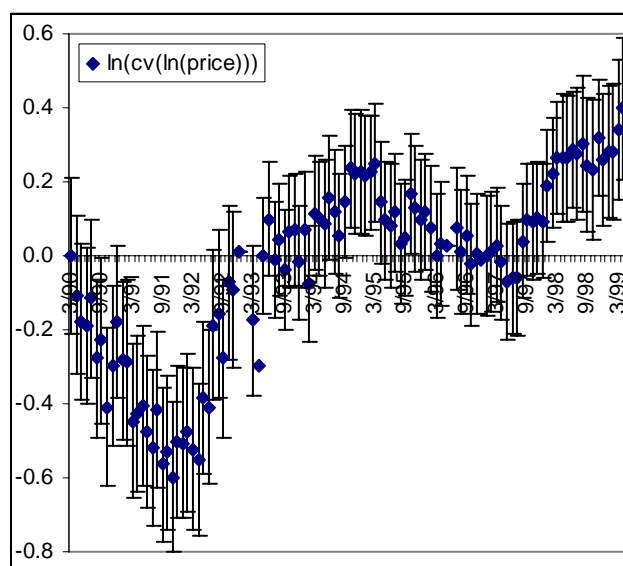
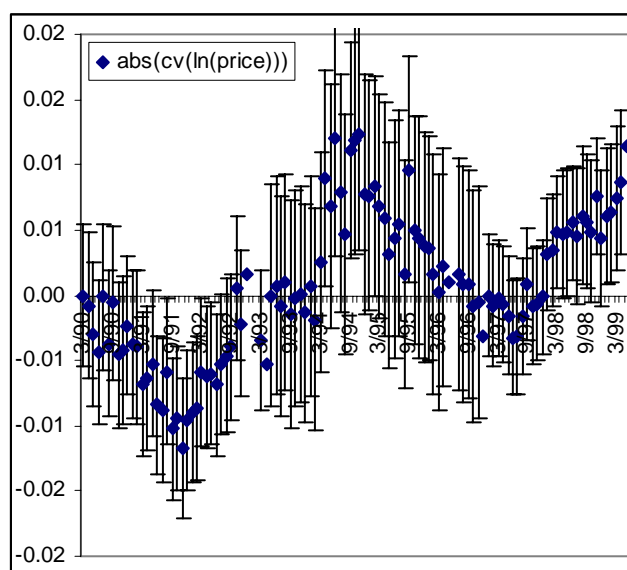


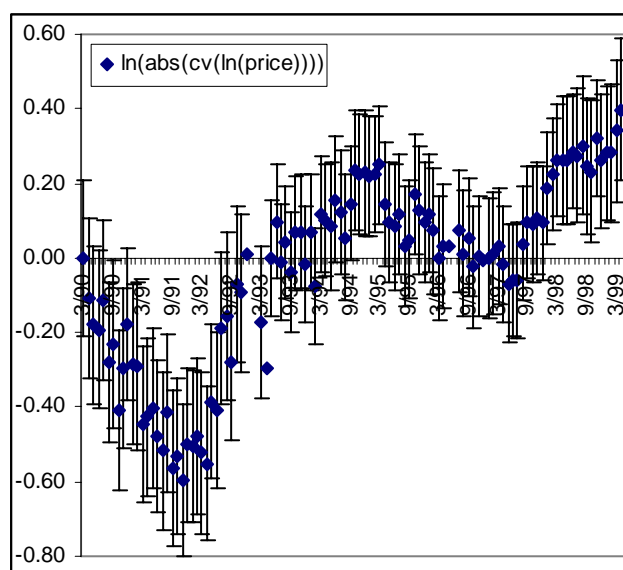
Figure 9 continued: e.



f.



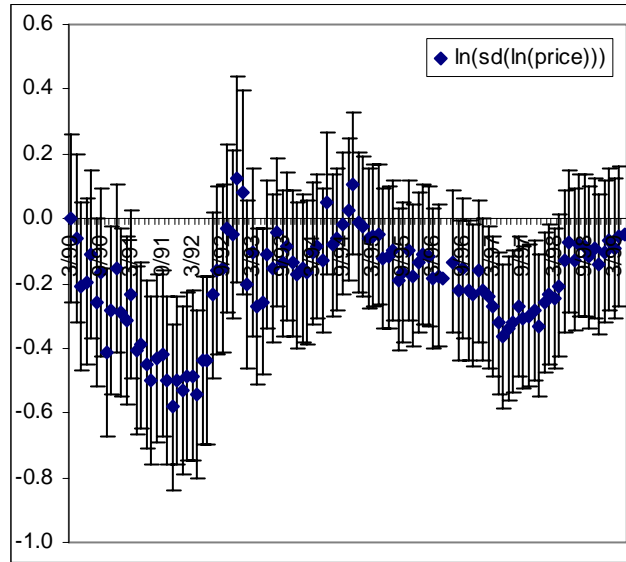
g.



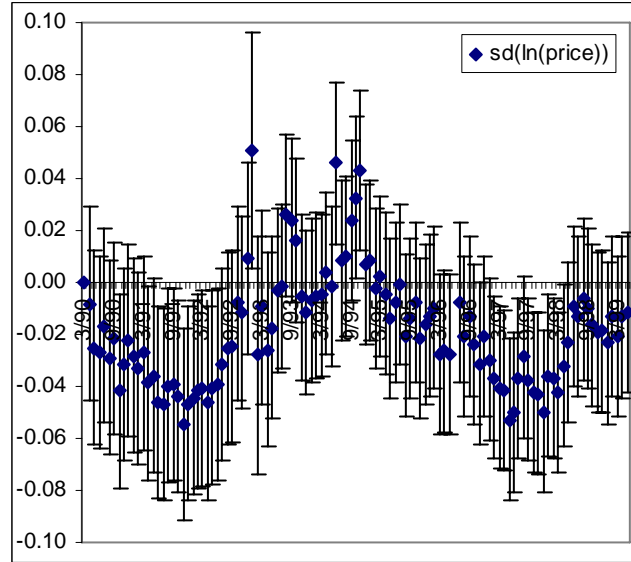
h.

Figure 10. Price Dispersion of Industrial Materials Prices, AY's original (total) data

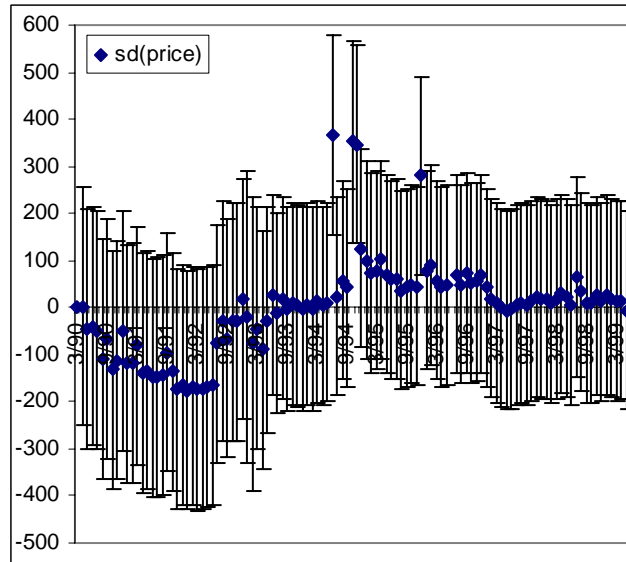
The total number of observations in terms of values of the measure of price dispersion is 5824.



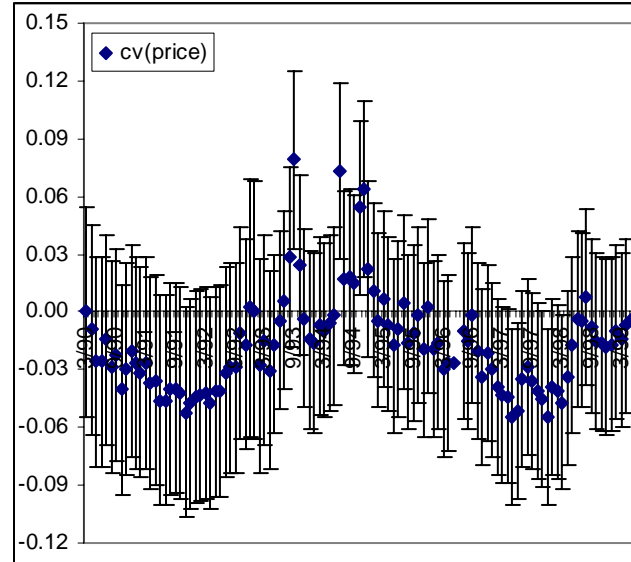
a.



b.



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d.

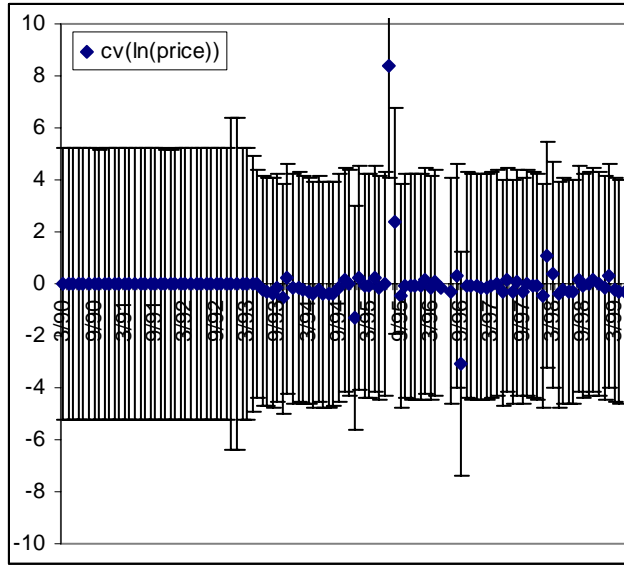
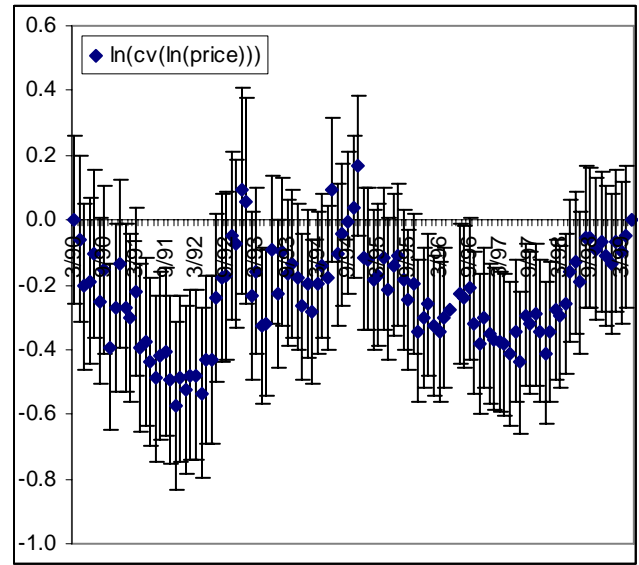
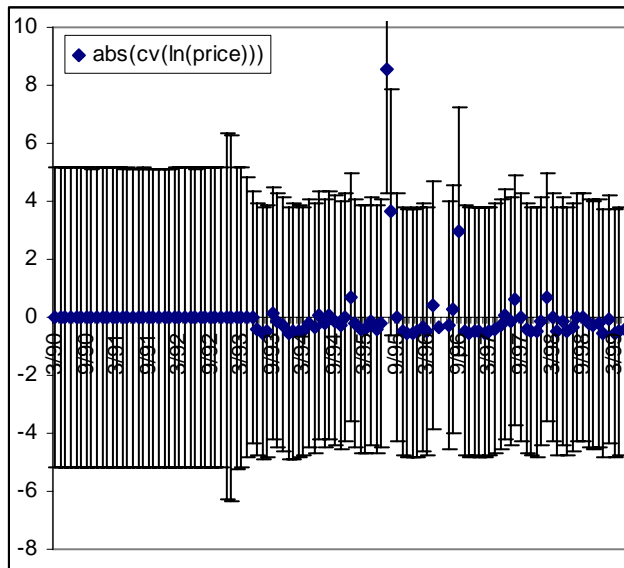


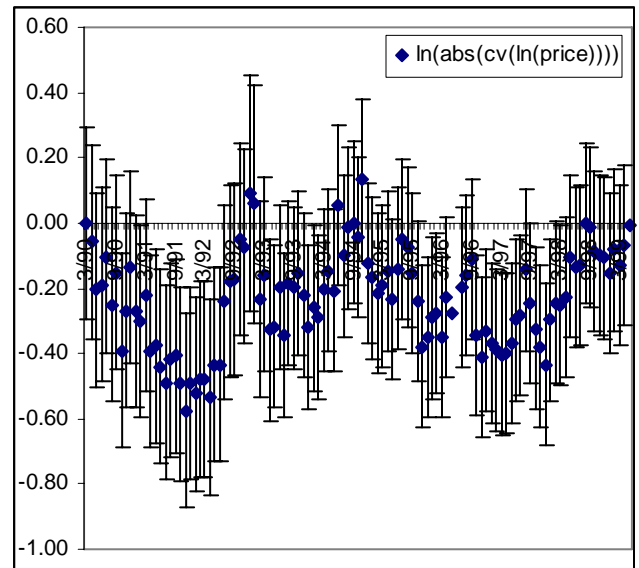
Figure 10 continued: e.



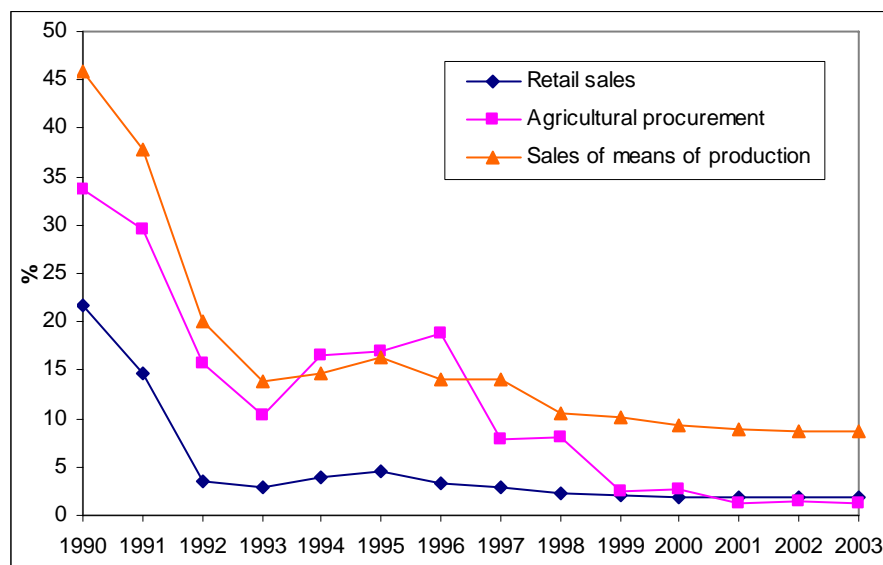
f.



g.



h.



Sources: see Figure 1.

Figure 11. Share of Sales/ Procurement Value Conducted at Centrally Determined Plan or Guidance Prices