Research Paper No. 1641

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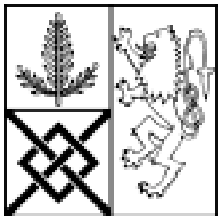
RESEARCH PAPER SERIES



GRADUATE SCHOOL OF BUSINESS

STANFORD UNIVERSITY

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THE BEHAVIOR OF PRICE DISPERSION IN A NATURAL EXPERIMENT

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The first author acknowledges financial support from Social Sciences and Humanities Research Council of Canada, grant # 410-96-0245. We thank two anonymous referees, Mark Bills, Ronald Jones and John Leach for very helpful comments, Anna Myslinska for assistance in data collection and seminar participants at Warsaw University, National Bank of Poland, CERGE-EI at Charles University, Prague and Central European University, Budapest for insightful suggestions. Leszek Skoczylas provided excellent research assistance.

Abstract

We study the behavior of prices in Poland following the big-bang market reforms in 1990, using a large, disaggregated data set. Price differences within and across regions are initially large but fall rapidly in the early stages of transition. For most goods, the rapid decline ends within a year. Dispersion is low for goods which are expensive, are bought frequently, constitute a large portion of household expenditures, and in markets characterized by intensive search for the best price. Inflation and inflation variability explain only part of the changes of price dispersion over time. The behavior of price dispersion is consistent with search for the best price and arbitrage. Overall, prices behave as economic theory predicts they would.

1. Introduction.

We study the behavior of price distributions in an economy undergoing dramatic changes. The changes create a natural experiment which allows us to address several interesting questions. How fast does the economy converge to long-run equilibrium? What economic forces lead to the convergence? What are the dynamics of convergence?

The natural experiment is Poland's big-bang transition to a market economy. In August 1989 the opposition unexpectedly won the general election. The new government was formed in September. A package of radical economic reforms was prepared during the next couple of months and introduced on January 1, 1990. The planned system was abolished and the groundwork for a market economy was established. Virtually overnight, an entirely new economic environment was created.[1]

The focus of the paper is the behavior of price dispersion during the first seven years following the big-bang reforms, using a large, disaggregated data set. Before 1990, dispersion was minimal as uniform prices were set by either the central planner or by state firms.[2] The freeing of price setting in January 1990 resulted in large differences across stores and geographical regions.

We view the period following the big-bang reforms as a natural experiment: all of a sudden economic agents are faced with a new environment in which they try to make optimal decisions. Three types of agents are involved in the natural experiment: a shopkeeper, a customer and an entrepreneur. The shopkeeper used to receive insufficient supplies, which she would sell at predetermined prices. All of a sudden she is able to set

[1] See Sachs (1993) for a description and analysis of the reforms.
[2] Differences arose only when goods were sold in unregulated private markets; the volume of these transactions was small.

prices; in addition, shortages rapidly disappear. Over a short period of time she goes from being a distributor of scarce commodities to being a profit maximizer. The customer used to search for availability of goods, as most products were in short supply. Now he is able to buy the goods he wants but prices vary across stores. This creates incentives to search for the best price. The entrepreneur used to be a shady character, who would bribe shopkeepers to buy goods which were in short supply and sell them to street vendors. Now shortages disappear but new opportunities for profit arise: prices differ across locations and regions. She establishes trading networks to buy goods at the wholesale level in cheap regions and sell them in expensive ones, arbitraging price differences.

Our analysis is based on two unique data sets. The first data set consists of prices of 55 individual products and services in individual stores in Poland during the period 1990-96. The second data set consists of monthly averages of the price levels for the same goods in each of the 49 Polish provinces (called voivodships) during the same seven years. The first data set provides evidence on price differences within regions; the second on price differences across regions. In contrast to existing studies of transition economies (for example De Masi and Koen (1996) and Koen and De Masi (1997)), our data allow us to study the behavior of prices at the level of individual seller.

The results are as follows. The rate of inflation, as well as inflation variability, are high at the beginning of transition. They fall quickly and continue to decline slowly throughout the sample period. Initial price differences across stores within regions, as well as across regions, are large; they decline rapidly after January 1990. The probability of finding a price at least 30% away from the average falls fivefold between January 1990 and November 1990; the probability of finding a price at least 20% away from the

average falls threefold. The distribution of logs of prices is almost symmetric throughout the sample. It converges very rapidly to its long-run value: by June 1990 it is very similar to the distribution in 1992-96.

We define the *first stage of transition* as the period of the initial rapid decline of price dispersion. The first stage of transition is very short: for 40% of goods the rapid decline in price differences within regions ends by July 1990; for 85% it ends by the end of 1990. It is longer, and the decline in dispersion is larger, across regions than within regions. At the end of the first stage of transition dispersion falls below, and then quickly rebounds above, the average values in 1992-96. This overshooting is more pronounced for dispersion within, than across, regions. Subsequent changes are small compared with changes during the first stage of transition. For many goods price differences within regions increase slowly over time. On the other hand, for most goods price differences across regions fall or remain stable. The long-run values of dispersion are about half of the January 1990 values.

After describing the facts we turn to existing literature for suggestions of other ways to characterize the data. We focus on three bodies of literature: search, the relationship between inflation and price dispersion, and arbitrage.

To see if search for the lowest price matters for the level of price dispersion we divide the goods on the basis of characteristics relevant to search. The results are that the more intensive is search for a good, the less dispersed are its prices. Dispersion is low for goods which are expensive, are bought frequently, constitute a large portion of household expenditures, and in markets characterized by intensive search for the best price. We

obtain similar results using data on prices of 66 goods and services in individual stores from Kiev, Ukraine, in 1999.

The dynamic behavior of price dispersion can be potentially explained by the well-known relationship between inflation and relative price variability. We find, however, that even after controlling for inflation and its variability, the pattern of fast initial decline in dispersion, followed by a relatively stable time path, is evident.

The appearance of price differences between locations creates incentives for arbitrage. We compare the ratio of dispersion within regions to dispersion across regions for different categories of goods. On average, this ratio increases. The increase is bigger for tradable goods than for nontradables; it is also bigger for durable than for perishable foodstuffs. This is consistent with active arbitrage across regions.

Overall, prices behave as economic theory predicts they would.

There are a few related papers in the literature. Berkowitz and DeJong (1999) compare price dispersion within and across two regions in Russia; Berkowitz, DeJong and Husted (1998) look at the differences between state and market prices in Russia; both papers use disaggregated data for a few groceries. In a different environment Brynjolfsson and Smith (2000) analyze the effect of search intensity on price dispersion. They compare price dispersion for books and CDs among Internet and among brick-and-mortar stores. It turns out that, despite lower search costs, price dispersion is greater among Internet retailers. This result is attributed to retailer heterogeneity with respect to trust and branding among Internet companies.

The plan of the paper is as follows. The data are described in the next section. In section 3 we describe the behavior of price dispersion within and across regions over

time. In section 4 we analyze the effects of search, inflation and arbitrage. We conclude by suggesting several explanations of the patterns in the data.

2. Description of the Data.

The data start at the beginning of the big-bang transition and cover the period of seven years from 1990 until 1996. Data from before 1990 are not comparable as the methodology was completely revamped in January 1990. The data were collected by the Polish Central Statistical Office (GUS) in order to calculate the Consumer Price Index. GUS records prices of 1500-1800 products in 307 districts, with one seller (store, street market, restaurant or service provider) per district (Bauc et al (1996) p. 55).

The analysis is based on two unique data sets. The first consists of prices of individual products and services in individual stores in Poland during 1990-1996. We have a sample of 55 goods in 47 stores (districts) each. The data comprise the complete set of price information for four out of 49 administrative provinces in Poland (called voivodships). We selected the voivodships (Katowice, Warsaw, Olsztyn, Lublin) with the largest number of stores (districts).[3] The number of stores (districts) in each voivodship is 15, 14, 10 and 8, respectively. It is important to note that the recorded prices are the actual transaction prices as sales, coupons or volume discounts are very rarely used, and were virtually unknown in the first few years of transition. The sales tax (VAT) is included in prices. The tax is the same in all regions but varies slightly across goods.

The second data set consists of monthly price averages for the same 55 goods in each of the 49 voivodships during the same period. GUS obtains the averages by

[3] The population in the four voivodships is between 3.9mln and 0.8mln, the area between 4 800sq. miles and 1 500 sq. miles. The population of districts (which are all towns) is between 930 thousand and 4 thousand. The population of Poland is 38.6mln and the area is 121 thousand square miles (GUS (1995)).

calculating the mean of all prices recorded in individual stores in the voivodship in a given month.

Depending on the good and the year, each store is sampled between 1 and 4 times a month. To make both data sets comparable, from the first set we use only the first observation for each month. [4]

In order to be included in our data, each good had to meet several criteria. We required that it did not change during the sample period. We excluded products and services with regulated prices and eliminated several goods where there were many missing observations. Finally, we wanted to have data on a variety of goods. This was difficult, as many goods had changed following the collapse of the planned economy. In the end, out of the 55 goods, 38 are groceries (20 perishable, 8 storable), 10 are manufactured products, 4 are sold in cafeterias/cafes and 3 are services. The list of the goods and various product groupings is in Table 1.

One problem with the data is that, while we know the district in which the price is sampled, we do not know the exact identity of the store. The procedure is as follows. One store is picked in each district. Price inspectors are instructed to choose the same store each time, but this is not enforced and changes of stores are not recorded. Changes in stores may be caused by unavailability of goods, transformation in the retail sector (for example changes in store type) or simply by the inspector's decision.

[4] The maximum number of observations at each date is 47; the actual number is often smaller as some data are missing (the proportion of missing observations is about 30%).

3. The Behavior of Price Distributions.

3.1. The Inflation Rate and the Variability of Relative Prices over Time.

The graph of the inflation rate and of the variability of relative prices is shown in Figure 1. CPI inflation falls rapidly from almost 80% per month in January 1990 (this number is omitted from Figure 1 for clarity) to below 5% by May 1990 and continues to decline gradually throughout the sample (it is high each January due to changes in prices of regulated goods).

We measure the variability of relative prices as the standard deviation of the inflation rates (calculated as the rate of change of the national average price of the good in question) for the 55 goods in our sample. It is shown by the dashed line in Figure 1. Its behavior is similar to that of CPI inflation: it declines rapidly from February 1990 to June 1990 and continues to fall throughout the sample period. This means that, following the big-bang transition, there were large changes in relative prices of the goods in the sample.

3.2. The Distribution of Prices.

How big is price dispersion within regions? In Figure 2 we plot the shares of prices that are at least 30%, 20% or 10% away from the (geometric) average.[5] Dispersion is substantial. The probability of finding a price at least 30% higher or at least 30% lower than the average is 16% in January 1990. It declines rapidly to about 3% in November 1990 and fluctuates around 3-4% for the rest of the sample period. The probability of finding a price at least 20% higher or at least 20% lower than the average is 29% in January 1990, declines to about 9% in October 1990 and fluctuates around 10% for the rest of the sample period.

[5] We obtain these numbers by taking logarithms of the prices and calculating differences from the arithmetic mean of the logarithms.

The distribution of logarithms of prices is almost symmetric throughout the sample. Large (above 20%) and small (below 10%) positive deviations from the mean are a bit more frequent than the corresponding negative deviations. Changes in the price distribution are shown in Figure 3, where we graph the distribution of normalized logs of prices. This normalization allows us to plot the price distribution simultaneously for all goods. The distribution converges very rapidly to its long-run value: by June 1990 it is very similar to the distribution in 1992-96. During the first six months of 1990 it becomes more peaked, with thinner tails.[6] This means that very expensive and very cheap stores disappear. It is most likely due to changes in pricing policies by shopkeepers, as bankruptcies were very rare during that period.

3.3. The Behavior of Price Dispersion Over Time.

We now turn our attention to the main focus of the paper: the behavior of price dispersion over time. The data provide two measures of intermarket price dispersion at different statistical and geographic aggregation levels. The first data set consists of prices in individual stores and covers four small geographic areas; the second set consists of voivodship averages and covers the entire country. We call the dispersion measure obtained from the first data set *price dispersion within regions*, and the one obtained from the second set *price dispersion across regions*.

We measure price dispersion with the coefficient of variation of price levels. Within regions it is calculated as follows. Denote the price of good *i* in store *j* in voivodship *v* at time *t* as P_{it}^{jv}. We first calculate the measure of price dispersion within voivodship *v*, CV_{it}^{v}:

[6] Kurtosis increases monotonically in the first six months of 1990.

$$CV_{it}^{v} \equiv \left[\frac{1}{N_{it}^{v} - 1} \sum_{j} \left(\frac{P_{it}^{jv} - \overline{P}_{it}^{v}}{\overline{P}_{it}^{v}} \right)^{2} \right]^{1/2} \qquad (1)$$

where $\overline{P}_{it}^{v}$ is the average price of good *i* across stores in voivodship *v* at time *t*, and N_{it}^{v} is the number of stores with a (non-missing) price observation for good *i* in voivodship *v* at time *t* . The measure of price dispersion within regions, CV_{it}^{W}, is the unweighted average of the four voivodship measures: $CV_{it}^{W} = \frac{1}{4} \sum_{v} CV_{it}^{v}$, v ={Katowice, Warsaw, Olsztyn, Lublin}. This approach assures that we have a sufficient number of data points for each good in each period. It is not sensitive to differences in price levels across the four voivodships, unlike a coefficient of variation calculated from all individual observations.

The measure of price dispersion across regions, CV_{it}^{A}, is constructed by calculating the coefficient of variation of price averages in the 49 voivodships:

$$CV_{it}^{A} \equiv \left[\frac{1}{48} \sum_{v=1}^{49} \left(\frac{\overline{P}_{it}^{v} - \overline{\overline{P}}_{it}}{\overline{\overline{P}}_{it}} \right)^{2} \right]^{1/2} \qquad (2)$$

where $\overline{\overline{P}}_{it} = \frac{1}{49 N_{it}^{v}} \sum_{j} \sum_{v} P_{it}^{jv}$ is the average price at time *t* over all 49 voivodships.

In Figure 4 we show the behavior of the median price dispersion within and across regions over time. Both fall very rapidly in the early months: dispersion within regions until about 7/1990; dispersion across regions until about 8/1990. The subsequent changes are small.[7]

For some goods, the behavior of price dispersion within regions is shown in Figure 5a. The typical pattern is in panel A, which shows dispersion for selected meat

[7] The picture for the average values of price dispersion is similar.

products. Dispersion is initially high but quickly falls. For goods in panel A, within 6 to 9 months, it falls from about 0.2 to about 0.05. After the initial period, the value of dispersion within regions increases and then stabilizes for most goods (with the exception of services); subsequent trends differ from good to good. In many cases (just over a half) dispersion increases over time but, for almost all goods, it remains much lower than in 1990.

While Panel A shows the typical pattern, the time path of dispersion varies across goods. Some interesting cases are shown in the remaining panels of Figure 5a. In panel B we show the behavior of price dispersion within regions for breads. Good number 19 is the standard loaf; goods number 18 and 20 are specialty breads. The dispersion of prices of the standard bread is lower than that of specialty breads. Panel C shows the behavior of cigarette prices. They were regulated until the end of 1993. When cigarette prices were freed we do not observe the initial rapid decline in dispersion. The dispersion of prices of heterogenous goods (goods bought in cafeteria/café – Panel D, and services – Panel E) does not follow the typical pattern. It is much higher than for meats and much more variable.[8] While it falls initially, it quickly returns to the levels observed in 1990. Panel F shows price dispersion of manufactured goods. For big-ticket items (goods 39-41: vacuum cleaner, kitchen mixer, bicycle) and small-ticket items (goods 43-45: razor blades, toothpaste, shaving cream), dispersion follows the usual pattern, but it is much higher for the inexpensive items.

The pattern of price dispersion across regions, shown for the same groups of goods in Figure 5b, is similar: initial rapid decline is followed by much more stable values. There are several differences. The initial decline occurs over a longer period of

[8] There are relatively few observations for services; this may be the reason for the high variability.

time, and dispersion falls more than in the case of price dispersion within regions. Moreover, increases in dispersion across regions in 1992-96 are rare.[9]

Statistics on the behavior of price dispersion for individual goods within and across regions are in tables 2a and 2b, respectively.

3.4. How Long is the First Stage of Transition?

Figures 2-5 show that the behavior of price dispersion in the initial months is distinct from the behavior in the later period. We define the *first stage of transition* as the initial period during which dispersion declines rapidly. An interesting question is: how long is the first stage? To answer it we need a criterion that would reliably select the end of the initial period. After examining the data carefully we propose a simple one. The first stage of transition is assumed to end whenever the current level of dispersion, as measured by the coefficient of variation, falls below its averages in the next three, six and twelve months. This approach avoids choosing, as the end of the initial period, a month in which dispersion is temporarily low, but it allows the choice of a month that is followed by small variations in dispersion.[10]

The histogram of the lengths of the first stage of transition is shown in Figure 6. The first stage of transition is shorter for dispersion within than across regions. The relevant statistics on dispersion within regions are in Table 2a and on dispersion across regions in Table 2b (column 7). The median length of the first stage of transition for dispersion within regions is 6 months, while for the dispersion across regions it is 9

[9] Dispersion across regions is also less volatile. It may be related to the way these two measures are computed. Dispersion across regions is calculated from voivodship averages of individual store prices. Also, some data are missing at the individual level and so dispersion within regions is sometimes calculated from a small number of observations.

[10] We also used a heuristic criterion, whereby the end of the first stage of transition was selected by examining data by hand. In most cases the same months are selected and the results are almost identical so they are not presented.

months (the corresponding numbers for the averages are 7 and 10.5 months). The initial decline is dramatic: dispersion within (across) regions falls to 46% (37%) of its value in January 1990.[11]

The initial decline of dispersion overshoots the long-run (1992-96) average. Dispersion within (across) regions falls below its average in 1992-96 for 49 (35) goods; the ratio of the end-of-transition to 1992-96 dispersion is 80% (89%). Dispersion then increases rapidly: at the first local maximum after the end of transition (which is reached after the median time of two months) dispersion is 40% (25%) higher and exceeds the long-run average for 40 (36) goods.[12]

The overall decline in price dispersion within regions is smaller than the decline in dispersion across regions. In January 1990 dispersion within regions is smaller for 28 out of 55 goods; in 1992-96 it is smaller for only 5 goods.[13] Dispersion within (across) regions in 1992-96 is 56% (39%) of its January 1990 value and 76 % (63%) of its value in 1990.

To summarize, price dispersion declines rapidly in the early stages of transition. The decline of dispersion within regions ends earlier; dispersion across regions continues to fall and eventually declines significantly more than dispersion within regions does. The initial decline overshoots the long run value; this effect is more pronounced for dispersion within regions.

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[11] All the numbers in this subsection are the median values of the appropriate ratios.

[12] It should be noted that the criterion we use only assures that dispersion increases following the end of the first stage of transition. Other aspects of the overshooting are not the result of the chosen criterion.

[13] The five exceptions are the two cafeteria products (49 and 50), two meats (1 and 5) and radiator coolant (48).

4. A Second Look at the Data.

In this section we use existing literature to provide several ways of characterizing the data. We focus on three different bodies of literature: search, the relationship between inflation, inflation variability and price dispersion, and arbitrage.

4.1 Price Dispersion and Search.

There are many papers on equilibrium price dispersion in search literature (see McMillan and Rothschild (1994) or Stiglitz (1989) for reviews). The focus of these theories is to show the existence of equilibria with non-degenerate price distributions when, for at least a subset of customers, search for the best price is costly. The models are not designed to explain empirical price distributions. Nevertheless, in several such models (see, for example Robert and Stahl (1993) and Salop and Stiglitz (1977)) for low enough search costs there is a negative correlation between search costs and the dispersion measure we use.

We now ask whether the behavior of price dispersion is correlated with search intensity. Consumer search is not a new phenomenon in Poland: consumers were very experienced searchers prior to the introduction of market reforms in 1990. It is the nature of search that changed. Under central planning search was for availability, because many goods were in short supply. One consequence of market reforms was fast elimination of shortages (see Sachs, (1993)). The combination of experienced searchers with the new phenomenon of price dispersion created conditions for intensive search for the best price.

We look at the relevance of search in two ways. First, we compare dispersion for various types of goods. We expect prices to vary more for heterogeneous goods than for homogenous goods. We expect dispersion for durable goods to be lower than for

perishable goods, as consumers can buy for later use (something they used to do a lot when goods were in short supply), making demand more elastic.[14]

Second, we compare dispersion for goods grouped by the characteristics relevant for search. We expect dispersion to be lower for products which either constitute a large portion of household expenditures or are expensive relative to other items. *CV* measures dispersion in units of the product; so a value of 10% is more important for the purchase of a bicycle than for the purchase of a shaving cream.

As summary statistics for average values of CV in Tables 2a and 2b show, the correlation between search intensity and price dispersion is negative.[15] For expensive items (goods 39 - 42), dispersion is much lower than for inexpensive items (goods 43 - 45) - see also Figure 5. Among breads, dispersion is lower for the standard loaf (good 19) than for specialty breads (goods 18 and 20). Dispersion for foodstuffs is lowest for meats, dairy products, baby formula and sugar - products important in household expenditures. Prices differ more (and dispersion does not tend to fall) for heterogeneous items where quality differs: goods bought in cafeteria/café and services. Surprisingly, price dispersion for durable foodstuffs is greater than price dispersion for perishable foodstuffs.[16]

To analyze the relationship between search intensity and price dispersion more systematically, we grouped the goods on the basis of characteristics which are relevant to search. There are four groupings. Three are the standard ones: the amount spent on a

[14] On the other hand, for a price setter, avoiding choosing an excessively high price is more important in the case of perishable foodstuffs.

[15] Summary statistics for the median values are in tables 2c and 2d. The picture is, essentially, identical, so below we discuss only the average values.

[16] Observed differences may be a consequence of the fact that perishable foodstuffs in our data are more important in household expenditures than durable foodstuffs.

single purchase, search (purchase) frequency[17] and the importance in household expenditures (conditional on the household buying the good).[18] We also add a subjective measure of search intensity, which tries to aggregate factors relevant to search - the three discussed above as well as omitted factors which do not fall neatly into one of the three categories.[19] It reflects our opinion about the effort a typical consumer of the good puts into finding the best price.

If more intensive search implies less dispersed prices, we expect dispersion to be the lowest for goods which are: the most expensive, bought most often, the most important in household expenditures and the subject of the most intensive search. We expect the goods with the highest dispersion to have the opposite characteristics.

The classification of products by the four groupings is in Table 1. We divided the goods independently into categories within each grouping and reconciled the rankings. To minimize arbitrariness, in each grouping goods are divided into three categories: high, medium and low. The groupings do measure different aspects of search, as can be seen in Table 3 which shows the correlation coefficients between them.

We compare the average and the median levels of dispersion at three exogenous moments of time (January 1990, the average in 1990, the average in 1992-96 - columns 3-5), two endogenous moments of time (the value at the end of the first stage of transition, the value at the first subsequent maximum - columns 8 and 10) as well as the values of the overall minimum and maximum (columns 1-2).

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[17] Frequency matters as it affects the value of information acquired in earlier search.

[18] A regression on shares in household expenditures would give misleading results because what matters is the share of expenditures for a household which does buy the good. For example, total expenditure on baby formula is small but it constitutes a large portion of the budget of families with babies.

[19] For example, live carp is usually bought for Christmas or Easter holidays; its weight in expenditures, the frequency of purchases and the amount spent on a single purchase are low, but search for the best price is intensive.

The results for the average values are in Tables 2a (dispersion within regions) and 2b (dispersion across regions). Despite the arbitrary nature of the rankings, they are striking. For the average dispersion within regions, out of the 84 possible pairwise orderings (4 groupings, with 3 categories in each, times 7), 71 orderings (85%) are as predicted. Of the remaining 13, nine are due to a single outlier. There are only five products classified as having the highest amount spent on a single purchase: the four big-ticket manufactured products (39-42) and one service (floor varnishing - 54). Price dispersion of floor varnishing is much larger than that of the big-ticket products and it dominates this category. When it is excluded, all orderings in the grouping are as predicted; overall 80 of orderings (95%) are as predicted. Moreover, the dispersion in the highest category in each grouping is always the smallest.[20] The results for price dispersion across regions are similar.

Of the four groupings, the one by search intensity (the subjective 'aggregate' grouping) always (i.e. 84 times out of 84) produces the predicted rankings for both average and median values and for both dispersion within and across regions.

What is surprising is that the rankings do not change: they are as predicted not only after the end of the first stage of transition but already in January 1990! If it is indeed the search activity that determines these rankings, it is striking how quickly economic forces came to work.

To investigate this further we run the following pooled regressions:

$$CV_k = \alpha_0 + \boldsymbol{\alpha}\ \boldsymbol{d}_{type} + \boldsymbol{\beta}\ \boldsymbol{d}_{time} + \varepsilon_k \qquad (3)$$

[20] When we use the median dispersion instead of the average, 68 (81%) of orderings are as predicted; with floor varnishing excluded (which matters as the category has only 4 other goods), 73 (87%) of the orderings are as predicted. In the grouping by the amount spent on a single purchase the median dispersion in the highest category is greater than the value in the middle category in January 1990 and in 1990.

where CV_k is the vector of the coefficients of variation for all goods at the various moments of time as well as at the overall minimum and maximum (columns 2-5 and 8, 10 in Tables 2a or 2b), α_0 is a constant, $\boldsymbol{d}_{type}$ denotes the search category dummies and $\boldsymbol{\alpha}$ is the vector of corresponding coefficients, $\boldsymbol{d}_{time}$ denotes the dummies corresponding to moments of time and $\boldsymbol{\beta}$ is the vector of corresponding coefficients, and ε_k is the stochastic component.

We run 2 sets of these regressions, separately for dispersion within and across regions in each set. In the first set we use only the 'aggregate' grouping by search intensity (so $\boldsymbol{d}_{type}$ contains only two dummy variables: high and medium search intensity). In the second set, we use the first three groupings (so $\boldsymbol{d}_{type}$ contains six dummy variables). The results are presented in Table 4.[21] A negative value of the coefficient means that dispersion is lower than in the omitted low category. In the first set of regressions the rankings are always as predicted, and all the differences are significant at the 5% level, for dispersion both within and across regions. In the second set, the rankings are as expected and significant in most cases; they are never reversed and significant.

We also conduct the same exercise using a similar data set on prices in Kiev, Ukraine. Ukrainian data are difficult to obtain as the base data are not held in electronic form. We have price information for 66 products and services in 1999. The goods were selected on the basis of the same criteria as those in Poland: we required that it did not change during the sample period and excluded products and services with regulated prices. In the end we obtained price information for a similar sample of goods as in the

[21] We also run a regression with all 8 dummy variables. Only the coefficients on the search intensity dummies are significant and have signs consistent with those in Table 4. This can be a result of correlation between the indicators. It is also possible that our subjective "aggregate" measure is a sufficient characterization of the relevant differences across goods.

Polish data. 40 of the goods are foodstuffs, 16 are manufactured products and 10 are services. The observations are monthly, and the number of stores differs across goods (from 6 for color passport photos to 52 for gasoline). Very few observations are missing. We divide the goods into three groupings, according to the amount spent on a single purchase, the frequency of purchases and the share in household expenditures of a household which buys the good, and compare the minimum, the maximum, and the average value of *CV* for the sample period. The list of goods, various groupings and CV values are in the Appendix, Table A1.

Overall, the results are similar. The rankings, shown in Table A2, are always as predicted. The results of regression (3), in Table A3, are as follows: dispersion in the high category is always significantly lower than in the omitted low category; in two cases out of three it is significantly lower than in the medium category. For the frequency of search grouping the dispersion in the high category is significantly higher than in the medium category.

4.2. Relative Price Variability and Inflation.

There is a vast empirical literature on the relationship between inflation and relative price variability (see Mills (1927), Parks (1978), Van Hoomissen (1988), Lach and Tsiddon (1992), Parsley (1996) and Debelle and Lamont (1997), among others). The general conclusion is that relative price variability, as well as price dispersion at the individual level, are positively related to various measures of inflation and of inflation variability. Two popular explanations of this relationship are based on menu costs and on Lucas' (1982) aggregate/local confusion approach. The menu cost approach (Barro

(1972), Sheshinski and Weiss (1977, 1983)) implies that, as the expected rate of inflation increases, the size of nominal price changes rises. If price changes within a region are not perfectly synchronized, or if stores are heterogeneous, this implies higher dispersion within regions. Price dispersion across regions would rise if local price changes are not perfectly staggered and price change patterns differ across markets.

The Lucas' (1982) aggregate/local confusion approach implies that prices may differ due to idiosyncratic composition and history of local shocks. The driving force is the inability of agents to distinguish between local and aggregate shocks. Price response to shocks is positively related to the ratio of aggregate to local shock variability; it also depends on supply and demand elasticities as well as on shock persistence (Barro (1976), Hercowitz (1981), Cukierman (1984)). If these differ across sellers and regions, aggregate shocks lead to price differences between sellers. The approach can explain both dispersion within and across regions.

Is the behavior of price dispersion in our data solely the effect of changes in inflation and in inflation variability? This is certainly possible. The graphs of CPI inflation and of a measure of inflation variability in Figure 1 show that those two series behave in a similar fashion to price dispersion (Figure 4). To test this hypothesis we estimate the following equation, separately for dispersion within and across regions:[22]

$$CV_{it} = \alpha_0 + \alpha_1 \Pi_{it} + \alpha_2 x_{\mathrm{var}\,t} + \alpha_3 t + \alpha_4 t^2 + \boldsymbol{\gamma d}_{MD} + \varepsilon_{it} \qquad (4)$$

where CV_{it} is price dispersion of good i, t denotes time, Π_{it} is the measure of inflation (CPI_t or own inflation of good i, INF_{it}) $x_{var\,t}$ is the measure of inflation variability, $\boldsymbol{d_{MD}}$ is

[22] We run OLS regressions and estimate the standard errors using non-parametric methods described in Andrews (1991), Andrews and Monahan (1992) and Newey and West (1994).

the vector of monthly dummies, α and γ are the corresponding coefficients and ε_{it} is a stochastic component.

In Table 5 we report the results only for the case of own inflation[23], i.e. the rate of change of the national average price of the good in question. The proxy for inflation variability is the standard deviation of inflation rates across the 55 goods (described in Figure 1). The regressions are run separately for the period 1/1990 - 6/1991 and 1992-96. In the first period there are 17 observations (there are 18 months but we cannot calculate the value of own inflation or the inflation variability proxy for January 1990) and so we do not include monthly dummies.

Using CPI as a measure of inflation is problematic when there are large relative price changes (which is the case in our data); CPI may not measure the underlying inflation adequately. The results are similar to these obtained for own inflation but are less often significant.

Own inflation has the expected positive effect on dispersion, both within and across regions. The effect of inflation variability is mixed; the coefficient is often of the wrong sign, especially for dispersion across regions. In the first period dispersion within and across regions falls over time at a decreasing rate. In 1992-96 the speed of change is much smaller and the pattern is more varied.

Conclusions presented above are drawn simply by looking at the estimated coefficients. Figure 7 provides further evidence that inflation and its variability do not fully explain the behavior of price dispersion. We run the regression given by (4) on the entire sample (2/90-12/96) and plot the average (across goods) of the following variable:

[23] Using CPI as a measure of inflation is problematic when there are large relative price changes (which is the case in our data); CPI may not measure the underlying inflation adequately. The results are similar but less often significant (see Konieczny and Skrzypacz, (2000)).

$$y_{it} = CV_{it} - \hat{\alpha}_0 - \hat{\alpha}_1 INF_{it} - \hat{\alpha}_2 x_{\text{var}\,t} - \hat{\boldsymbol{\gamma}}\boldsymbol{d}_{MD} \quad (5)$$

The value of y_i shows the behavior of price dispersion of good *i* after the effects of inflation, of inflation variability, seasonal effects and differences between goods have been controlled for. The familiar pattern of an initial rapid decline, followed by smaller changes later on, is evident.

Apart from these regression results, there are two additional arguments against the hypothesis that inflation and its variability fully explain the behavior of price dispersion. First, in 1992-96 the inflation rate and inflation variability both fall while price dispersion increases for many goods. Second, these variables do not explain the timing (and its variability across goods) of the end of the first stage of transition.

4.3 Price Differences across Regions and Arbitrage.

Differences between prices of homogenous goods in various locations create opportunities for arbitrage. This is a topic of interest in international trade literature. The focus of recent literature is on departures from purchasing power parity (PPP) and the speed of adjustment to PPP for regions within a currency area, in particular US cities (see, for example, Parsley and Wei (1996) and Cecchetti, Mark and Sonora (2000). As the papers use aggregated data, they concentrate on Relative PPP. The general finding is that departures from Relative PPP are temporary but last a long time (Cecchetti, Mark and Sonora (2000) review the empirical literature). Engel and Rogers (1999) find significant departures from Relative PPP. They compare the dispersion of the rates of change of the price index of a given product aggregate between cities with the dispersion of the rates of change of various aggregates within cities. One striking result is that the

departures from Relative PPP are greater for aggregates of traded goods than for aggregates of nontraded goods.

In a planned economy, arbitrage opportunities are limited as the planner dictates the geographic distribution of goods as well as sources of supply. Market reforms allow stores to choose their suppliers. Together with the elimination of shortages, this process leads to a reduction in price dispersion within and across regions. As can be seen in Tables 2a and 2b, dispersion both within and across regions declines more for tradable goods (manufactured products and durable goods) than for nontradable goods (breads, goods sold in cafeteria/café and services) - see columns 4 and 5.

As we are interested in the dispersion of price levels, our data allow us to analyze departures from the Absolute PPP. If departures from Absolute PPP are caused by trade frictions, the ratio of price dispersion within regions to dispersion across regions should be lower for traded goods than for non-traded goods. The most tradable group in our sample is goods 39-46. Each of these goods has a single producer, making arbitrage particularly easy. The non-traded products are 49-52 (goods purchased in a cafeteria or café), 53-55 (services) and 18-20 (breads). Also, durable foodstuffs are easier to trade than perishable foodstuffs. The ratios of dispersion within regions to dispersion across regions for these groups are plotted in Figure 8.[24] Their behavior is consistent with active arbitrage for traded goods and less active (or the absence of) arbitrage for non-traded goods.

[24] All ratios in Figure 8 are calculated as the average ratio, rather than the ratio of the averages.

5. Final Remarks.

We now turn to suggestions about how to explain some other patterns observed in the data. We do not attempt to test these hypotheses as our data are not sufficient for this task.

There are several possible explanations of the initial large value of dispersion and its rapid decline. Learning may explain price differences between identical stores. The big-bang reform drastically changes the economic environment. Shopkeepers face unpredictable uncertainty: inflation, costs, demand etc. are impossible to predict. Commercial relations are fluid and shopkeepers cannot rely on a stable supply. Price differences appear, giving rise to consumer search and making strategic considerations important for the first time. It is not surprising that, initially, identical price setters may make very different pricing decisions and that, over time, their policies become more similar and price differences decline as agents learn to operate in the new environment.

The remaining explanations are based on differences between stores. First, in the period immediately following the big-bang reforms, wholesale trade undergoes large changes and so costs may be substantially different across stores. Similarly, the ability to restock may also vary across stores. The lower is the probability of restocking, the higher is the option value of existing inventory and so the higher is the price. Second, search costs are initially large as customers switch from searching for availability to the new process of searching over time. Finally, arbitrage possibilities arise but, initially, arbitrage is difficult since commercial relations change: new sources of demand and supply have to

be found, transportation has to be arranged etc. All these market frictions decline over time and so dispersion falls.[25]

Our data do not allow to discriminate between these explanations. One piece of evidence we have is the behavior of cigarette prices, which were deregulated in 1994. There is no initial decline in dispersion following the deregulation; in fact, the behavior of cigarette prices at the beginning of 1994 is no different than the behavior in the later period. This is consistent with all hypotheses suggested above.

An interesting feature of the initial rapid decline of dispersion within regions is that, while there are large differences between individual goods, on the average it takes about 6 months for most groups of goods as well as for search groupings. The data are in Table 2, column 7. In general, there is no clear pattern in the time to the end of the first stage of transition for the different categories of goods. If a few outliers are eliminated (goods 5, 23, 44-46), the average time to the end of the first stage of transition varies from 5.53 months (medium category in the grouping by amount spent on single purchase) to 6.74 moths (medium category in the grouping by weight in expenditure).

The initial rapid decline takes longer for dispersion across regions than for dispersion within regions. We think the main three reasons for this are that, first, while dispersion across regions is determined solely by arbitrage, dispersion within regions is also affected by search; second, arbitrage is more difficult to set up than search for the best price; and, third, arbitrage is easier to organize over short distances.

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[25] This list, of course, does not exhaust possible explanations. For example, another possibility is that firms sell old stock at old prices and so dispersion is the artifact of staggered deliveries of new stock (Diamond (1993)). This would result in a decline in dispersion in parallel with a decline of inflation. The explanation does not, however, apply to goods which are priced in the store: meats (1-8), eggs (9), live carp (10) and breads (18-20). The behavior of price dispersion for these goods is similar to the behavior of price dispersion for the remaining foodstuffs.

The initial decline in dispersion overshoots the long run value and this effect is stronger for dispersion within regions. We suggest the following two explanations. Over time dispersion falls due to changes in the economy described above. As consumer search is sequential, consumers notice the decline in price differences with some delay. At the end of the first stage of transition consumer search is 'too intensive' and pushes dispersion below the steady-state level. When consumers notice that rewards to search have decreased, search intensity falls and dispersion increases. The effect is stronger within regions as search has a more direct effect on price behavior within, than across, regions.

It is also possible that overshooting is a statistical artifact. If our selection rule correctly picks the end of the first of transition (in the sense that the trend changes from rapid decline to a stable one) and the volatility of dispersion at the end of the first stage of transition is high, it is not surprising that the local maximum and minimum bracket the long-run average.

Unlike dispersion across regions, dispersion within regions increases for many goods in 1992-96. A possible explanation is that, over time, stores start competing by product differentiation. This may be a response to the rising income inequality following the collapse of the planned economy (Sachs, (1993)).

We find that dispersion across regions falls more than dispersion within regions, i.e. that differences in price levels across voivodships fall relative to differences in price levels within voivodships. Note that our measures of dispersion within and across regions are calculated from different data. CV^W is computed from individual prices within a region (voivodship) while CV^A is computed from average price levels in voivodships. If all voivodship averages were calculated from identical distributions, each using n

observations, the coefficient of variation for averages would be $\sqrt{n}$ times smaller than the coefficient of variation for individual prices. We do not know what the exact value of *n* is in our data: the average number of stores per voivodship is 6 (as some observations are missing, the average number of observations is about 4), and the number of observations per store each month is 1-4, depending on the good. The ratio of dispersion across regions to dispersion within regions increases in the first two years; in 1992-96 it is about 1.4 and remains fairly stable. This means that price differences across regions remain large relative to price differences within regions.

To summarize, we believe the following picture can illustrate changes in the economy which determine the behavior of prices illustrated in this paper. When the big-bang reform turns the economic environment inside out, agents learn gradually how to behave in this natural experiment. Store managers (or owners) make, for the first time, decisions on how to set prices. They initially respond by choosing widely dispersed prices. Consumers respond by searching for the best price, which is more financially (if not psychologically) rewarding than searching for availability they had to endure under central planning. Entrepreneurs respond by arbitraging price differences between regions. As time passes by, information and transportation costs decline, increasing the integration of markets. These forces move the economy rapidly towards the long-run equilibrium. The remarkable feature of this process is that prices behave as economic theory predicts they would.

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Table 1

Goods by Type and Category

	Good number	Type Of good*	Importance in expen-ditures**	Search Frequency**	Amount spent on single purchase**	Search intensity**
Back bacon "Sopocka", 1 kg	1	P	1	1	2	1
Sausage "Krakowska sucha", 1kg	2	P	1	1	2	1
Sausage "Mysliwska sucha", 1kg	3	P	1	1	2	1
Sausage "Krakowska parzona", 1kg	4	P	1	1	2	1
Sausage "Zwyczajna", 1kg	5	P	1	1	2	1
Pork wieners, 1kg	6	P	1	1	2	1
Sausage "Torunska", 1kg	7	P	1	1	2	1
Sausage "Zywiecka", 1kg	8	P	1	1	2	1
Eggs, each	9	P	1	1	2	1
Carp, live, 1kg	10	P	3	3	3	2
Herring, salted, 1kg	11	P	3	2	2	2
Sprats, smoked, 1kg	12	P	3	2	2	2
Cheese "Gouda", 1kg	13	p	2	1	3	1
Cheese "Edamski", 1kg	14	p	2	1	3	1
Butter, 82.5% fat, 250g	15	p	1	1	3	1
Margarine "Palma", 250g	16	p	1	1	3	1
Veggie butter, 250g tub	17	p	1	1	3	1
Rye bread, 1kg	18	p	1	1	3	1
Bread "Baltonowski", 1kg	19	p	1	1	3	1
Bread "Wiejski", 1kg	20	p	1	1	3	1
Powdered baby formula, 500g	21	d	1	2	2	1
Flour "Tortowa", 1kg	22	d	2	2	3	1
Flour "Krupczatka", 1kg	23	d	2	2	3	1
Flour "Poznanska", 1kg	24	d	2	2	3	1
Pearl barley "Mazurska", 1kg	25	d	3	3	3	2
Sugar, 1kg	26	d	1	2	3	1
Plum butter, 460g jar	27	d	2	2	3	2
Jam, blackcurrant, 460g jar	28	d	2	2	3	2
Apple juice, 1 liter box	29	d	2	2	3	2
Pickled cucumbers, 900g	30	d	2	2	3	2
Candy "Krowka", 1kg	31	d	2	2	3	2
Cookies "Delicje szampanskie", 1kg	32	d	2	2	3	2
Cookies "Petit Beurre" type, 100g	33	d	2	2	3	2
Pretzel sticks, 100g	34	d	2	2	3	2
Halvah, 1kg	35	d	2	2	3	3
Vinegar, 10%, 0.5l bottle	36	d	2	2	3	2
Citric acid, 10g bag	37	d	3	3	3	3
Tea "Madras", 100g	38	d	1	2	2	1

Table 1 continued.

	Good number	Type of good*	Importance in expen-ditures**	Search frequency**	Amount spent on single purchase**	Search intensity**
Citric acid, 10g bag	37	d	3	3	3	3
Tea "Madras", 100g	38	d	1	2	2	1
Vacuum cleaner, type 338,5	39	m	3	3	1	1
Kitchen mixer, type 175,5	40	m	3	3	1	1
Folding bicycle “Wigry-3"	41	m	3	3	1	1
Radio receiver "Ania"	42	m	3	3	1	1
Razor blade "Polsilver", each	43	m	3	2	3	3
Toothpaste "Pollena", 98g	44	m	2	2	3	2
Shaving cream	45	m	3	2	3	2
Sanitary pads "Donna", box of 20	46	m	2	2	2	1
Paint thinner, 0.5l	47	m	3	3	3	3
Radiator coolant “Borygo” or “Petrygo”	48	m	3	3	3	3
Mineral water in a cafeteria, 0.33l bottle	49	s	2	2	3	3
Boiled egg in a cafeteria, each	50	s	2	2	3	3
Mineral water in a café, 0.33l bottle	51	s	2	2	3	3
Pastry "W-Z" in a café, each	52	s	2	2	3	3
Car-wash, of car: "FSO 1500"	53	s	2	2	2	2
Varnishing of hardwood floor, $1m^2$	54	s	3	3	1	1
ECG test	55	s	3	3	2	3

Notes:

* p - perishable foodstuffs;
d - durable foodstuffs;
m - manufactured goods;
s - services (includes goods in cafeteria/café)

** 1 denotes goods with highest weight in expenditures, highest search frequency, largest amount spent on a single purchase and highest search intensity.

Table 2a
Price dispersion within regions

		Value of overall minimum	Value of overall maximum	Value in January 1990	Average in 1990	Average in years 1992-96	Max in 1/90? x =yes	Month transition ends	Value at end of transition	Month of first max. after end of trans.	Value of first max. after end of trans.
Column		1	2	3	4	5	6	7	8	9	10
Average for all goods		0.072	0.302	0.242	0.169	0.132		7.33	0.098	9.16	0.151
Averages for types of goods											
Perishable foodstuffs		0.049	0.209	0.185	0.101	0.086		6.30	0.067	8.15	0.102
Durable foodstuffs		0.076	0.287	0.209	0.171	0.116		8.11	0.100	9.78	0.150
Manufactured products		0.067	0.391	0.279	0.223	0.132		9.90	0.098	12.00	0.154
Services		0.135	0.479	0.438	0.280	0.302		4.57	0.181	6.43	0.289
Meats		0.043	0.180	0.169	0.097	0.071		7.63	0.064	9.38	0.092
Dairy products		0.042	0.188	0.158	0.089	0.067		6.20	0.056	8.20	0.078
Breads		0.080	0.312	0.312	0.137	0.153		3.67	0.105	5.67	0.157
Flours		0.055	0.250	0.149	0.150	0.082		12.25	0.079	14.50	0.108
Sweets		0.080	0.277	0.172	0.155	0.125		6.40	0.099	8.00	0.142
Canned fruits and vegetables		0.079	0.257	0.200	0.161	0.118		5.50	0.118	6.75	0.157
Manufactured goods - big items		0.037	0.195	0.194	0.107	0.089		6.75	0.058	8.50	0.103
Manufactured goods - small items		0.087	0.522	0.335	0.300	0.161		12.00	0.125	14.33	0.188
Cafeteria/café		0.138	0.474	0.453	0.271	0.260		5.75	0.173	7.00	0.251
Other Services		0.132	0.487	0.419	0.292	0.357		3.00	0.191	5.67	0.340
Averages for goods grouped by search considerations											
Weight in expenditure	highest	0.051	0.211	0.190	0.102	0.088		6.33	0.069	8.11	0.101
		0.090	0.319	0.245	0.192	0.147		8.36	0.117	10.00	0.166
	lowest	0.072	0.386	0.300	0.214	0.161		7.00	0.105	9.20	0.188
Search frequency	highest	0.050	0.209	0.195	0.102	0.085		6.53	0.069	8.35	0.098
		0.086	0.327	0.235	0.197	0.147		8.44	0.112	10.11	0.165
	lowest	0.071	0.383	0.331	0.203	0.167		5.82	0.108	8.09	0.199
Amount spent on single purchase	highest-incl. product 54	0.049	0.259	0.257	0.156	0.151		6.20	0.098	8.20	0.171
	highest-excl. product 54	0.037	0.195	0.194	0.107	0.089		6.75	0.058	8.50	0.103
		0.062	0.250	0.202	0.139	0.130		6.88	0.087	8.65	0.145
	lowest	0.081	0.341	0.268	0.191	0.138		7.62	0.108	9.50	0.159
Search intensity	highest	0.050	0.222	0.191	0.117	0.097		7.55	0.074	9.38	0.113
		0.083	0.313	0.227	0.196	0.135		7.56	0.112	9.50	0.163
	lowest	0.119	0.517	0.414	0.275	0.228		6.30	0.147	8.00	0.241
Individual goods											
1	Back bacon "Sopocka"	0.038	0.185	0.185	0.086	0.056	x	7	0.045	9	0.087
2	Sausage "Krakowska sucha"	0.039	0.222	0.222	0.089	0.095	x	4	0.060	7	0.084
3	Sausage "Mysliwska sucha"	0.061	0.217	0.194	0.136	0.095	o	5	0.100	7	0.217
4	Sausage "Krakowska parzona"	0.037	0.176	0.176	0.074	0.066	x	6	0.055	7	0.057
5	Sausage "Zwyczajna"	0.038	0.182	0.167	0.136	0.058	o	17	0.073	20	0.091
6	Pork wieners	0.052	0.136	0.136	0.094	0.064	o	9	0.057	10	0.060
7	Sausage "Torunska"	0.036	0.215	0.215	0.087	0.063	x	8	0.056	9	0.061
8	Sausage "Zywiecka"	0.046	0.108	0.059	0.075	0.070	o	5	0.061	6	0.075

Table 2a continued

		Value of overall minimum	Value of overall maximum	Value in January 1990	Average in 1990	Average in years 1992-96	Max in 1/90? x =yes	Month transition ends	Value at end of transition	Month of first max. after end of trans.	Value of first max. after end of trans.
Column		1	2	3	4	5	6	7	8	9	10
9	Eggs	0.054	0.236	0.236	0.098	0.088	x	8	0.061	9	0.069
10	Carp, live	0.031	0.202	0.107	0.074	0.093	o	4	0.059	7	0.116
11	Herring, salted	0.056	0.176	0.176	0.106	0.082	x	6	0.080	7	0.118
12	Sprats, smoked	0.038	0.248	0.091	0.110	0.096	o	5	0.038	7	0.136
13	Cheese "Gouda"	0.042	0.175	0.175	0.089	0.070	x	9	0.047	11	0.082
14	Cheese "Edamski"	0.046	0.139	0.117	0.093	0.069	o	7	0.064	9	0.079
15	Butter, 82.5% fat	0.040	0.163	0.163	0.081	0.059	x	4	0.055	6	0.071
16	Margarine "Palma"	0.041	0.201	0.201	0.082	0.062	x	6	0.053	8	0.076
17	Veggie butter,	0.042	0.263	0.132	0.099	0.076	o	5	0.063	7	0.081
18	Rye bread	0.104	0.313	0.313	0.167	0.212	x	2	0.137	3	0.233
19	Bread "Baltonowski"	0.056	0.223	0.223	0.106	0.102	x	5	0.079	7	0.101
20	Bread "Wiejski"	0.079	0.399	0.399	0.137	0.145	x	4	0.099	7	0.137
21	Powdered baby formula	0.052	0.179	0.113	0.113	0.074	o	10	0.068	12	0.117
22	Flour "Tortowa"	0.053	0.203	0.203	0.140	0.072	x	7	0.080	9	0.140
23	Flour "Krupczatka"	0.050	0.278	0.119	0.151	0.075	o	22	0.068	23	0.078
24	Flour "Poznanska"	0.050	0.206	0.102	0.120	0.075	o	12	0.069	15	0.087
25	Pearl barley "Mazurska"	0.067	0.312	0.170	0.190	0.104	o	8	0.098	11	0.127
26	Sugar	0.039	0.211	0.211	0.084	0.080	x	8	0.048	10	0.066
27	Plum butter	0.088	0.230	0.230	0.168	0.129	x	7	0.113	9	0.144
28	Jam, blackcurrant	0.096	0.248	0.184	0.177	0.134	o	8	0.139	9	0.134
29	Apple juice	0.057	0.225	0.116	0.114	0.101	o	5	0.061	6	0.137
30	Pickled cucumbers	0.074	0.324	0.270	0.185	0.106	o	2	0.160	3	0.212
31	Candy "Krowka"	0.073	0.246	0.207	0.159	0.117	o	10	0.083	12	0.158
32	Cookies"Delicje szampanskie"	0.067	0.204	0.204	0.107	0.112	x	4	0.074	5	0.087
33	Cookies "Petit Beurre" type	0.092	0.355	0.174	0.162	0.147	o	4	0.136	6	0.169
34	Pretzel sticks	0.097	0.230	0.150	0.153	0.131	o	4	0.127	6	0.176
35	Halvah	0.072	0.351	0.123	0.196	0.118	o	10	0.072	11	0.121
36	Vinegar	0.087	0.295	0.221	0.206	0.119	o	13	0.114	14	0.128
37	Citric acid	0.193	0.891	0.888	0.549	0.278	o	11	0.210	13	0.476
38	Tea "Madras"	0.061	0.176	0.080	0.095	0.124	o	1	0.080	2	0.141
39	Vacuum cleaner	0.035	0.225	0.225	0.109	0.080	x	10	0.035	13	0.122
40	Kitchen mixer	0.036	0.139	0.138	0.075	0.085	o	5	0.047	6	0.056
41	Folding bicycle	0.042	0.170	0.170	0.104	0.088	x	6	0.076	7	0.122
42	Radio receiver "Ania"	0.037	0.245	0.245	0.139	0.102	x	6	0.074	8	0.113
43	Razor blade "Polsilver"	0.122	0.516	0.122	0.286	0.234	o	9	0.153	11	0.194
44	Toothpaste "Pollena"	0.097	0.578	0.342	0.376	0.179	o	17	0.161	21	0.205
45	Shaving cream	0.082	0.624	0.474	0.480	0.165	o	21	0.108	24	0.183
46	Sanitary pads "Donna"	0.047	0.327	0.118	0.183	0.104	o	17	0.071	18	0.134
47	Paint thinner	0.133	0.445	0.312	0.246	0.182	o	6	0.145	8	0.197
48	Radiator coolant	0.044	0.643	0.643	0.229	0.104	x	2	0.113	4	0.213
49	Mineral water in a cafeteria	0.049	0.306	0.774	0.287	0.181	x	10	0.104	11	0.285
50	Boiled egg in a cafeteria	0.084	0.386	0.234	0.215	0.189	o	6	0.169	7	0.164
51	Mineral water in a cafe	0.203	0.759	0.445	0.300	0.364	o	5	0.204	6	0.233
52	Pastry "W-Z" in a cafe	0.215	0.443	0.358	0.283	0.307	o	2	0.217	4	0.322
53	Car-wash, of car: "FSO 1500"	0.233	0.514	0.514	0.364	0.346	x	3	0.238	5	0.374
54	Varnishing of hardwood floor	0.095	0.517	0.505	0.352	0.399	o	4	0.256	7	0.442
55	ECG test	0.069	0.429	0.239	0.161	0.326	o	2	0.080	5	0.203

Table 2b
Price dispersion across regions

		Value of overall minimum	Value of overall maximum	Value in January 1990	Average in 1990	Average in years 1992-96	Max in 1/90? x =yes	Month transition ends	Value at end of transition	Month of first max. after end of trans.	Value of first max. after end of trans.
Column		1	2	3	4	5	6	7	8	9	10
Average for all goods		0.069	0.295	0.265	0.160	0.104		10.53	0.093	13.00	0.122
Averages for types of goods											
Perishable foodstuffs		0.051	0.186	0.182	0.099	0.072		9.40	0.065	11.60	0.079
Durable foodstuffs		0.050	0.280	0.251	0.152	0.074		12.56	0.070	15.11	0.091
Manufactured products		0.054	0.374	0.310	0.192	0.088		12.60	0.089	15.30	0.116
Services		0.192	0.535	0.474	0.312	0.295		5.57	0.237	8.29	0.335
Meats		0.050	0.148	0.148	0.088	0.069		8.13	0.064	10.88	0.080
Dairy Products		0.032	0.230	0.230	0.087	0.048		10.80	0.047	12.80	0.057
Breads		0.093	0.239	0.239	0.128	0.126		7.00	0.101	9.00	0.120
Flours		0.037	0.338	0.332	0.135	0.053		17.50	0.051	20.50	0.069
Sweets		0.056	0.233	0.181	0.128	0.084		9.00	0.069	11.00	0.083
Canned fruits and vegetables		0.046	0.280	0.264	0.154	0.069		9.75	0.082	13.25	0.115
Manufactured goods - big items		0.034	0.347	0.347	0.132	0.055		8.75	0.075	12.25	0.114
Manufactured goods - small items		0.067	0.392	0.286	0.231	0.110		15.17	0.098	17.33	0.117
Cafeteria/café		0.175	0.426	0.319	0.260	0.266		6.25	0.203	9.25	0.246
Other Services		0.215	0.680	0.680	0.381	0.335		4.67	0.281	7.00	0.455
Averages for goods grouped by search considerations											
Weight in expenditure	highest	0.051	0.182	0.176	0.092	0.072		8.78	0.063	11.00	0.078
		0.075	0.312	0.266	0.172	0.111		11.27	0.102	13.91	0.127
	lowest	0.082	0.406	0.371	0.225	0.133		11.53	0.114	14.07	0.168
Search frequency	highest	0.051	0.186	0.185	0.094	0.072		8.76	0.065	11.12	0.080
		0.072	0.308	0.251	0.175	0.107		11.70	0.097	14.15	0.121
	lowest	0.091	0.434	0.425	0.228	0.145		10.36	0.123	13.09	0.191
Amount spent on single purchase	highest-incl. product 54	0.076	0.401	0.401	0.182	0.120		7.80	0.116	11.20	0.186
	highest-excl. product 54	0.034	0.347	0.347	0.132	0.055		8.75	0.075	12.25	0.114
		0.077	0.250	0.242	0.146	0.113		9.41	0.099	11.71	0.141
	lowest	0.070	0.312	0.267	0.171	0.105		11.29	0.091	13.74	0.114
Search intensity	highest	0.052	0.236	0.232	0.111	0.076		10.41	0.069	12.97	0.093
		0.057	0.285	0.242	0.177	0.087		11.19	0.094	13.31	0.117
	lowest	0.137	0.484	0.399	0.275	0.215		9.80	0.159	12.60	0.216
Individual goods											
1	Back bacon "Sopocka"	0.049	0.143	0.143	0.103	0.063	x	14	0.071	17	0.081
2	Sausage "Krakowska sucha"	0.056	0.215	0.215	0.104	0.081	x	5	0.084	8	0.096
3	Sausage "Mysliwska sucha"	0.061	0.209	0.209	0.119	0.093	x	7	0.083	9	0.106
4	Sausage "Krakowska parzona"	0.055	0.112	0.112	0.073	0.066	x	3	0.064	4	0.094
5	Sausage "Zwyczajna"	0.043	0.148	0.148	0.093	0.059	x	13	0.056	17	0.073
6	Pork wieners	0.044	0.129	0.129	0.077	0.062	x	10	0.054	14	0.062
7	Sausage "Torunska"	0.047	0.117	0.117	0.065	0.062	x	6	0.056	9	0.062
8	Sausage "Zywiecka"	0.043	0.114	0.114	0.068	0.065	x	7	0.043	9	0.065

Table 2b continued

		Value of overall minimum	Value of overall maximum	Value in January 1990	Average in 1990	Average in years 1992-96	Max in 1/90? x =yes	Month transition ends	Value at end of transition	Month of first max. after end of trans.	Value of first max. after end of trans.
Column		1	2	3	4	5	6	7	8	9	10
9	Eggs	0.036	0.104	0.099	0.070	0.059	o	9	0.052	11	0.074
10	Carp, live	0.051	0.218	0.179	0.147	0.085	o	12	0.072	13	0.091
11	Herring, salted	0.049	0.128	0.125	0.093	0.059	o	12	0.049	14	0.061
12	Sprats, smoked	0.046	0.213	0.190	0.155	0.067	o	15	0.070	16	0.066
13	Cheese "Gouda"	0.030	0.177	0.177	0.087	0.042	x	8	0.054	12	0.065
14	Cheese "Edamski"	0.030	0.182	0.182	0.089	0.043	x	15	0.052	16	0.052
15	Butter, 82.5% fat	0.037	0.164	0.164	0.069	0.051	x	4	0.053	5	0.068
16	Margarine "Palma"	0.025	0.259	0.259	0.078	0.043	x	11	0.032	14	0.048
17	Veggie butter,	0.040	0.369	0.369	0.115	0.063	x	16	0.046	17	0.049
18	Rye bread	0.112	0.206	0.206	0.149	0.148	x	7	0.130	9	0.147
19	Bread "Baltonowski"	0.075	0.216	0.216	0.112	0.096	x	7	0.076	9	0.100
20	Bread "Wiejski"	0.092	0.293	0.293	0.124	0.134	x	7	0.096	9	0.113
21	Powdered baby formula	0.028	0.153	0.125	0.082	0.038	o	10	0.043	12	0.062
22	Flour "Tortowa"	0.033	0.335	0.335	0.118	0.042	x	27	0.033	32	0.065
23	Flour "Krupczatka"	0.034	0.334	0.334	0.122	0.048	x	15	0.051	17	0.059
24	Flour "Poznanska"	0.036	0.327	0.327	0.113	0.050	x	14	0.039	18	0.055
25	Pearl barley "Mazurska"	0.044	0.358	0.334	0.186	0.071	o	14	0.082	15	0.095
26	Sugar	0.026	0.099	0.099	0.053	0.035	x	13	0.029	14	0.030
27	Plum butter	0.050	0.186	0.184	0.121	0.078	o	7	0.083	9	0.088
28	Jam, blackcurrant	0.053	0.212	0.187	0.141	0.073	o	6	0.104	12	0.168
29	Apple juice	0.039	0.423	0.423	0.190	0.061	x	8	0.101	11	0.142
30	Pickled cucumbers	0.042	0.300	0.260	0.162	0.063	o	18	0.042	21	0.061
31	Candy "Krowka"	0.050	0.154	0.118	0.091	0.066	o	11	0.059	12	0.060
32	Cookies"Delicje szampanskie"	0.058	0.192	0.192	0.098	0.087	x	6	0.070	7	0.087
33	Cookies "Petit Beurre" type	0.037	0.221	0.221	0.098	0.077	x	10	0.058	12	0.069
34	Pretzel sticks	0.076	0.172	0.114	0.121	0.100	o	7	0.096	11	0.131
35	Halvah	0.056	0.424	0.259	0.229	0.091	o	11	0.062	13	0.070
36	Vinegar	0.050	0.271	0.245	0.172	0.067	o	8	0.091	9	0.130
37	Citric acid	0.134	0.652	0.618	0.531	0.216	o	32	0.146	36	0.194
38	Tea "Madras"	0.056	0.232	0.151	0.100	0.078	o	9	0.065	11	0.071
39	Vacuum cleaner	0.027	0.389	0.389	0.153	0.046	x	16	0.073	21	0.097
40	Kitchen mixer	0.026	0.508	0.508	0.157	0.048	x	5	0.074	9	0.123
41	Folding bicycle	0.042	0.253	0.253	0.092	0.054	x	5	0.063	7	0.075
42	Radio receiver "Ania"	0.040	0.239	0.239	0.127	0.070	x	9	0.092	12	0.161
43	Razor blade "Polsilver"	0.091	0.521	0.299	0.219	0.154	o	13	0.091	16	0.121
44	Toothpaste "Pollena"	0.069	0.552	0.318	0.310	0.100	o	21	0.083	23	0.092
45	Shaving cream	0.041	0.453	0.278	0.394	0.114	o	19	0.138	21	0.174
46	Sanitary pads "Donna"	0.049	0.198	0.198	0.138	0.069	x	26	0.049	27	0.054
47	Paint thinner	0.088	0.313	0.308	0.163	0.106	o	8	0.110	9	0.118
48	Radiator coolant	0.062	0.313	0.313	0.162	0.117	x	4	0.114	8	0.141
49	Mineral water in a cafeteria	0.158	0.500	0.379	0.294	0.260	o	7	0.222	8	0.215
50	Boiled egg in a cafeteria	0.128	0.306	0.176	0.173	0.203	o	7	0.130	12	0.197
51	Mineral water in a cafe	0.199	0.399	0.319	0.258	0.312	o	6	0.201	8	0.238
52	Pastry "W-Z" in a cafe	0.215	0.499	0.400	0.317	0.288	o	5	0.259	9	0.335
53	Car-wash, of car: "FSO 1500"	0.161	0.508	0.508	0.353	0.221	x	5	0.311	7	0.359
54	Varnishing of hardwood floor	0.243	0.616	0.616	0.382	0.383	x	4	0.277	7	0.474
55	ECG test	0.239	0.916	0.916	0.407	0.401	x	5	0.256	7	0.531

Table 2c
Price dispersion within regions (Medians)

Table 5		Value of overall minimum	Value of overall maximum	Value in January 1990	Average in 1990	Average in years 1992-96	Month transition ends	Value at end of transition	Month of first max. after end of trans.	Value of first max. after end of trans.
Column		1	2	3	4	5	7	8	9	10
Median for all goods		0.056	0.236	0.201	0.137	0.102	6.00	0.079	8.00	0.128
Median for types of goods										
Perishable foodstuffs		0.042	0.202	0.176	0.093	0.073	5.50	0.060	7.00	0.083
Durable foodstuffs		0.070	0.238	0.179	0.156	0.114	8.00	0.082	9.50	0.135
Manufactured products		0.045	0.386	0.235	0.206	0.104	7.50	0.092	9.50	0.158
Services		0.095	0.443	0.445	0.287	0.326	4.00	0.204	6.00	0.285
Meats		0.039	0.183	0.180	0.088	0.065	6.50	0.059	8.00	0.080
Dairy products		0.042	0.175	0.163	0.089	0.069	6.00	0.055	8.00	0.079
Breads		0.079	0.313	0.313	0.137	0.145	4.00	0.099	7.00	0.137
Flours		0.052	0.242	0.145	0.146	0.075	10.00	0.075	13.00	0.107
Sweets		0.073	0.246	0.174	0.159	0.118	4.00	0.083	6.00	0.158
Canned fruits and vegetables		0.081	0.239	0.207	0.172	0.117	6.00	0.126	7.50	0.140
Manufactured goods - big items		0.036	0.197	0.197	0.107	0.087	6.00	0.061	7.50	0.117
Manufactured goods - small items		0.090	0.547	0.327	0.266	0.172	13.00	0.129	14.50	0.196
Cafeteria/café		0.144	0.414	0.401	0.285	0.248	5.50	0.186	6.50	0.259
Other Services		0.095	0.514	0.505	0.352	0.346	3.00	0.238	5.00	0.374
Medians for goods grouped by search considerations										
Weight in expenditure	highest	0.044	0.206	0.189	0.094	0.075	5.50	0.061	7.00	0.082
		0.073	0.286	0.203	0.172	0.118	7.00	0.108	9.00	0.142
	lowest	0.056	0.312	0.225	0.161	0.104	6.00	0.080	7.00	0.136
Search frequency	highest	0.042	0.201	0.011	0.093	0.070	6.00	0.061	7.00	0.081
		0.073	0.278	0.203	0.168	0.119	7.00	0.104	9.00	0.141
	lowest	0.044	0.383	0.239	0.161	0.104	6.00	0.080	7.00	0.127
Amount spent on single purchase	highest-incl. product 54	0.037	0.225	0.225	0.109	0.088	6.00	0.074	7.00	0.122
	highest-excl. product 54	0.036	0.197	0.197	0.107	0.087	6.00	0.061	7.50	0.117
		0.052	0.215	0.176	0.106	0.088	6.00	0.068	7.00	0.117
	lowest	0.072	0.286	0.205	0.164	0.117	6.50	0.101	8.50	0.139
Search intensity	highest	0.046	0.206	0.176	0.099	0.076	6.00	0.064	8.00	0.087
		0.078	0.248	0.194	0.165	0.118	5.50	0.111	7.00	0.140
	lowest	0.103	0.444	0.335	0.264	0.211	6.00	0.149	7.50	0.208

Table 2d
Price dispersion across regions (Medians)

Table 5		Value of overall minimum	Value of overall maximum	Value in January 1990	Average in 1990	Average in years 1992-96	Month transition ends	Value at end of transition	Month of first max. after end of trans.	Value of first max. after end of trans.
Column		1	2	3	4	5	7	8	9	10
Median for all goods		0.049	0.239	0.221	0.122	0.070	9.00	0.072	12.00	0.091
Medians for types of goods										
Perishable foodstuffs		0.047	0.179	0.178	0.093	0.063	8.50	0.056	11.50	0.071
Durable foodstuffs		0.047	0.252	0.233	0.121	0.069	10.50	0.063	12.00	0.070
Manufactured products		0.045	0.351	0.304	0.160	0.085	11.00	0.087	14.00	0.120
Services		0.199	0.500	0.400	0.317	0.288	5.00	0.256	8.00	0.335
Meats		0.048	0.136	0.136	0.085	0.064	7.00	0.060	9.00	0.077
Dairy Products		0.030	0.182	0.182	0.087	0.043	11.00	0.052	14.00	0.052
Breads		0.092	0.216	0.216	0.124	0.134	7.00	0.096	9.00	0.113
Flours		0.035	0.334	0.334	0.120	0.049	14.50	0.045	17.50	0.062
Sweets		0.056	0.192	0.192	0.098	0.087	10.00	0.062	12.00	0.070
Canned fruits and vegetables		0.046	0.256	0.224	0.152	0.068	7.50	0.092	11.50	0.115
Manufactured goods - big items		0.033	0.321	0.321	0.140	0.051	7.00	0.073	10.50	0.110
Manufactured goods - small items		0.066	0.383	0.304	0.191	0.110	16.00	0.101	18.50	0.120
Cafeteria/café		0.178	0.449	0.349	0.276	0.274	6.50	0.212	8.50	0.226
Other Services		0.239	0.616	0.616	0.382	0.383	5.00	0.277	7.00	0.474
Medians for goods grouped by search considerations										
Weight in expenditure	highest	0.046	0.158	0.150	0.088	0.063	8.00	0.056	10.00	0.072
		0.050	0.303	0.252	0.140	0.075	8.00	0.076	12.00	0.087
	lowest	0.049	0.358	0.308	0.162	0.085	12.00	0.091	13.00	0.121
Search frequency	highest	0.044	0.177	0.010	0.089	0.063	7.00	0.056	9.00	0.073
		0.050	0.300	0.245	0.141	0.077	10.00	0.070	12.00	0.087
	lowest	0.051	0.434	0.334	0.162	0.085	8.00	0.092	9.00	0.123
Amount spent on single purchase	highest-incl. product 54	0.040	0.389	0.389	0.153	0.054	5.00	0.074	9.00	0.123
	highest-excl. product 54	0.033	0.321	0.321	0.140	0.051	7.00	0.073	10.50	0.110
		0.049	0.153	0.148	0.100	0.066	9.00	0.064	11.00	0.073
	lowest	0.051	0.303	0.260	0.144	0.081	9.00	0.082	12.00	0.094
Search intensity	highest	0.042	0.209	0.206	0.103	0.062	9.00	0.056	12.00	0.071
		0.050	0.219	0.207	0.151	0.075	10.50	0.082	12.00	0.092
	lowest	0.131	0.462	0.316	0.244	0.210	7.00	0.138	9.00	0.196

Table 3

Correlations Between Search Indicators.

	Weight in expenditure	Search frequency	Amount spent on single purchase	Search intensity
Weight in expenditure	1	0.86	-0.12	0.52
Search frequency	0.86	1	-0.19	0.47
Amount spent on single purchase	-0.12	-0.19	1	0.43
Search intensity	0.52	0.47	0.43	1

Table 4

Results of regressions (3)

	Search Intensity	
	High	Medium
Dispersion within regions	-0.154 *+	-0.102 *
Dispersion across regions	-0.145 *+	-0.118 *

	Amount Spent on Single Purchase		Frequency of Search		Share in Expenditure	
	High	Medium	High	Medium	High	Medium
Dispersion within regions	-0.088 *+	-0.024 *	-0.087 *+	-0.050 *	-0.040 ‡	-0.013
Dispersion across regions	-0.038 *+	0.017	-0.117 *	-0.099 *	-0.044 *+	0.016

Notes:

* denotes significantly negative coefficient (at 5% significance level against one-sided alternative)

+ denotes High coefficient significantly lower than Medium coefficient (at 5% sig. level, one-sided alternative)

Table 5
Results of regressions (4)

		Dispersion within regions		Dispersion across regions		Dispersion within regions		Dispersion across regions	
Period		2/90-6/91	92-96	2/90-6/91	92-96	2/90-6/91	92-96	2/90-6/91	92-96
CPI	mean coeff.	-0.010	-0.018	-0.003	0.024				
	+ve signif. *	3	10	11	13				
	-ve signif. *	6	13	3	11				
Own	mean coeff.					0.071	0.196	0.065	0.093
inflation	+ve signif. *					13	30	19	27
	-ve signif. *					7	5	5	8
Inflation	mean coeff.	0.202	0.033	0.264	0.026	0.135	-0.004	0.122	0.012
variability	+ve signif. *	11	16	16	21	12	10	14	13
	-ve signif. *	2	12	4	14	3	11	8	11
time	mean coeff.	-0.939	0.003	-1.189	-0.063	-0.878	0.020	-1.281	-0.059
	median coeff.	-0.612	0.008	-0.978	-0.039	-0.720	0.011	-0.854	-0.057
	max. coeff.	9.400	1.378	4.450	0.730	9.827	1.656	4.251	0.733
	min coeff.	-15.290	-2.610	-8.052	-0.771	-13.140	-2.597	-10.370	-0.765
	+ve signif. *	4	19	2	12	2	17	3	13
	-ve signif. *	19	12	30	18	14	13	28	21
time ^{2}	mean coeff.	0.034	0.000	0.043	0.001	0.032	0.000	0.045	0.001
	median coeff.	0.026	0.000	0.035	0.000	0.028	0.000	0.038	0.001
	max. coeff.	0.527	0.021	0.260	0.008	0.452	0.021	0.333	0.009
	min coeff.	-0.355	-0.013	-0.154	-0.006	-0.371	-0.015	-0.155	-0.007
	+ve signif. *	18	12	28	20	16	14	27	22
	-ve signif. *	4	18	1	11	3	17	4	12
Ave slope	mean coeff	-0.250	0.008	-0.336	0.004	-0.232	0.015	-0.375	0.006
	+ve signif. *	9	22	7	20	8	22	6	24
	-ve signif. *	17	12	23	20	15	10	23	19
R^2	average	0.64	0.43	0.78	0.53	0.66	0.50	0.80	0.58
	median	0.68	0.43	0.83	0.56	0.72	0.51	0.87	0.60
	maximum	0.91	0.84	0.99	0.86	0.95	0.91	0.99	0.86
	minimum	0.07	0.12	0.23	0.12	0.06	0.10	0.26	0.22

Notes:
1. * denotes significance at the 5% level.
2. Average slope is the average first derivative with respect to time in the fitted equation.

Figure 1

CPI inflation and inflation variability

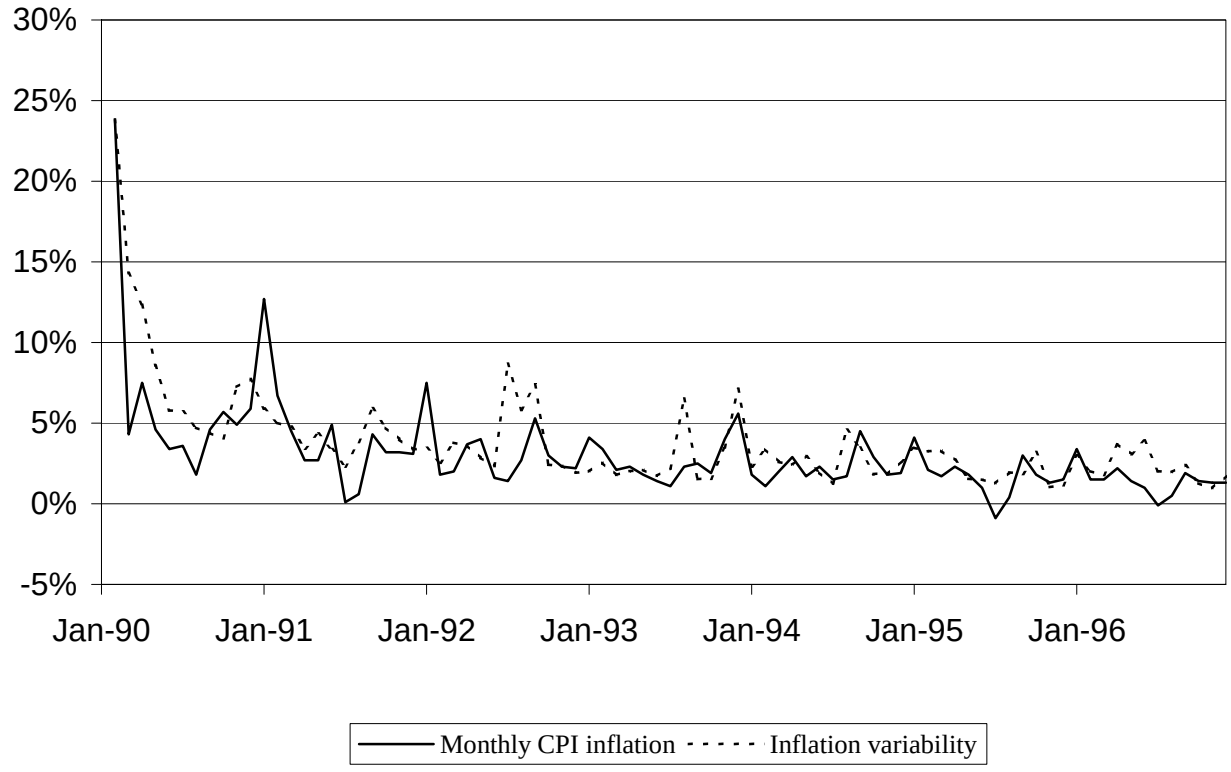
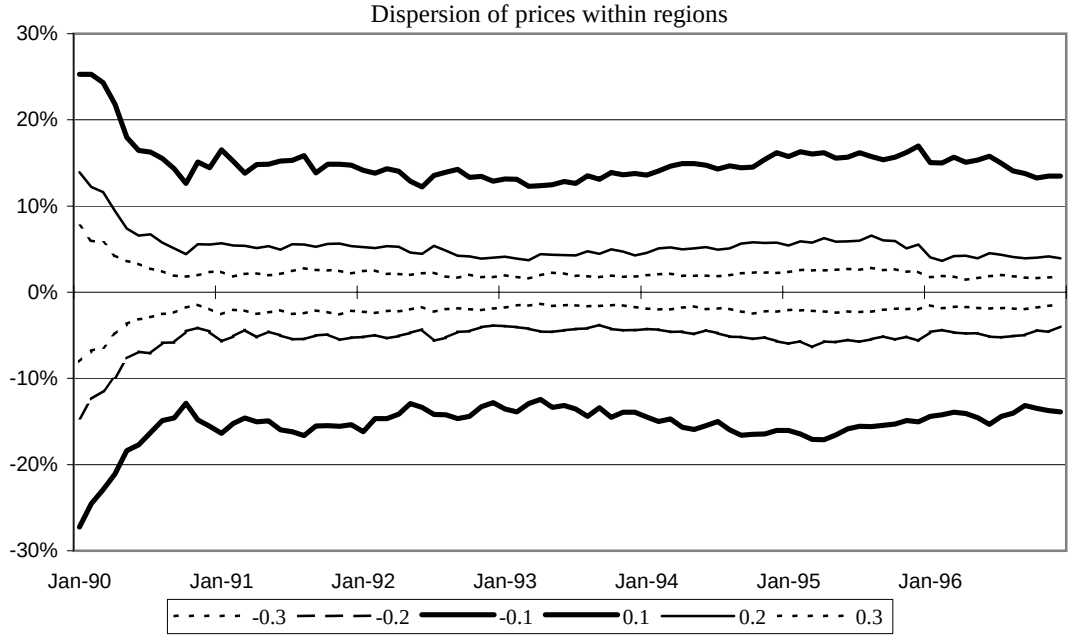


Figure 2

Dispersion of prices within regions



Note: each line shows the percentage of observations which are at least the given relative amount away from the average price. Data for below-average prices are shown as negative for clarity.

Figure 3

Price distributions within regions

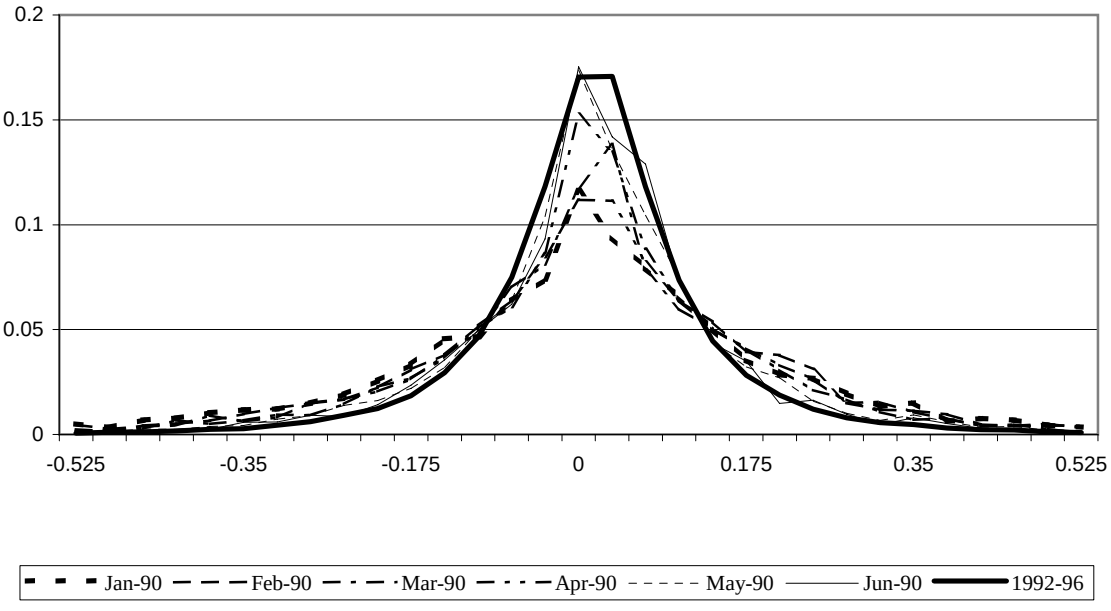


Figure 4

Median price dispersion

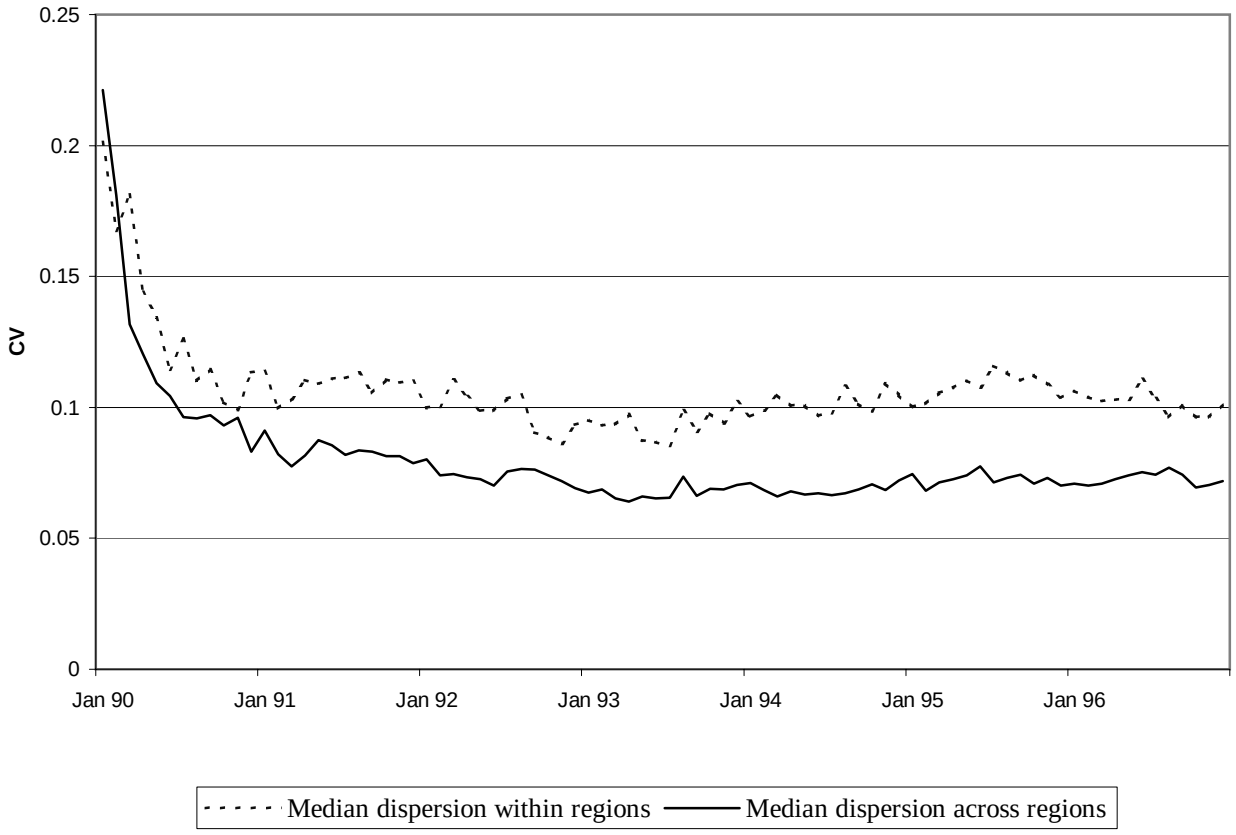
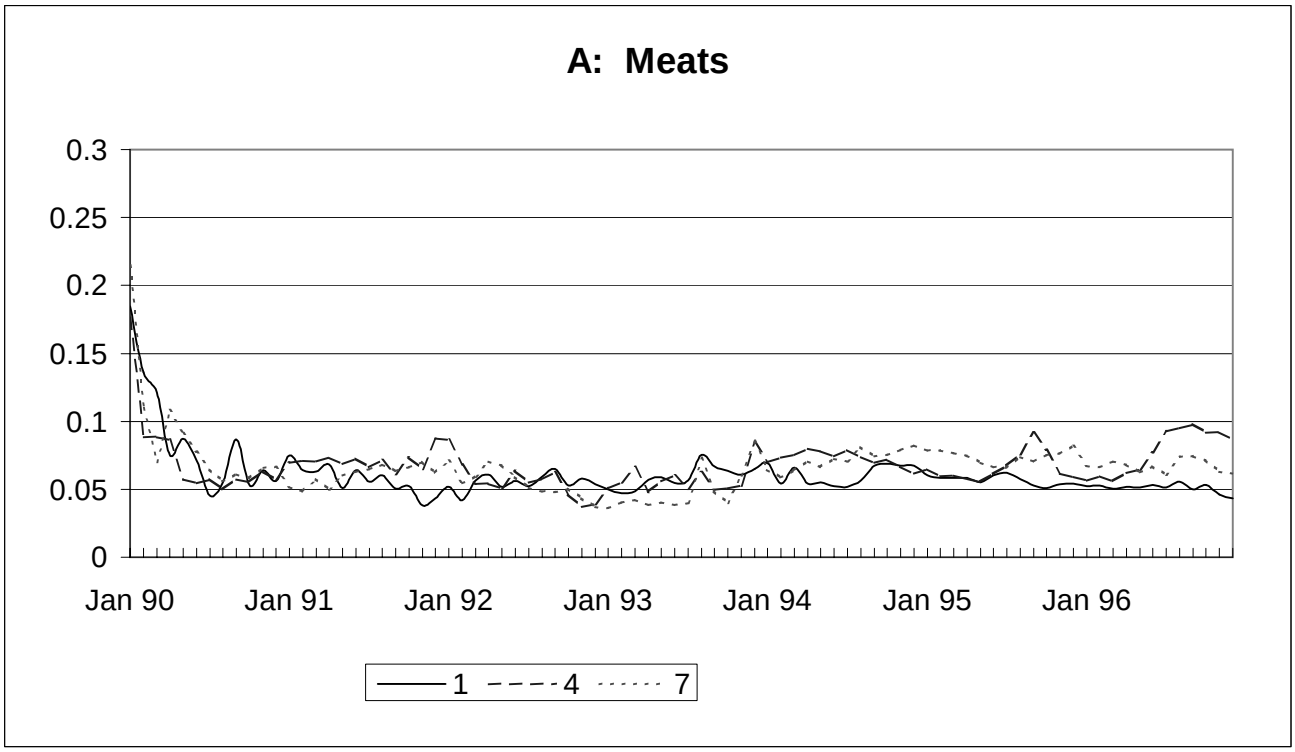
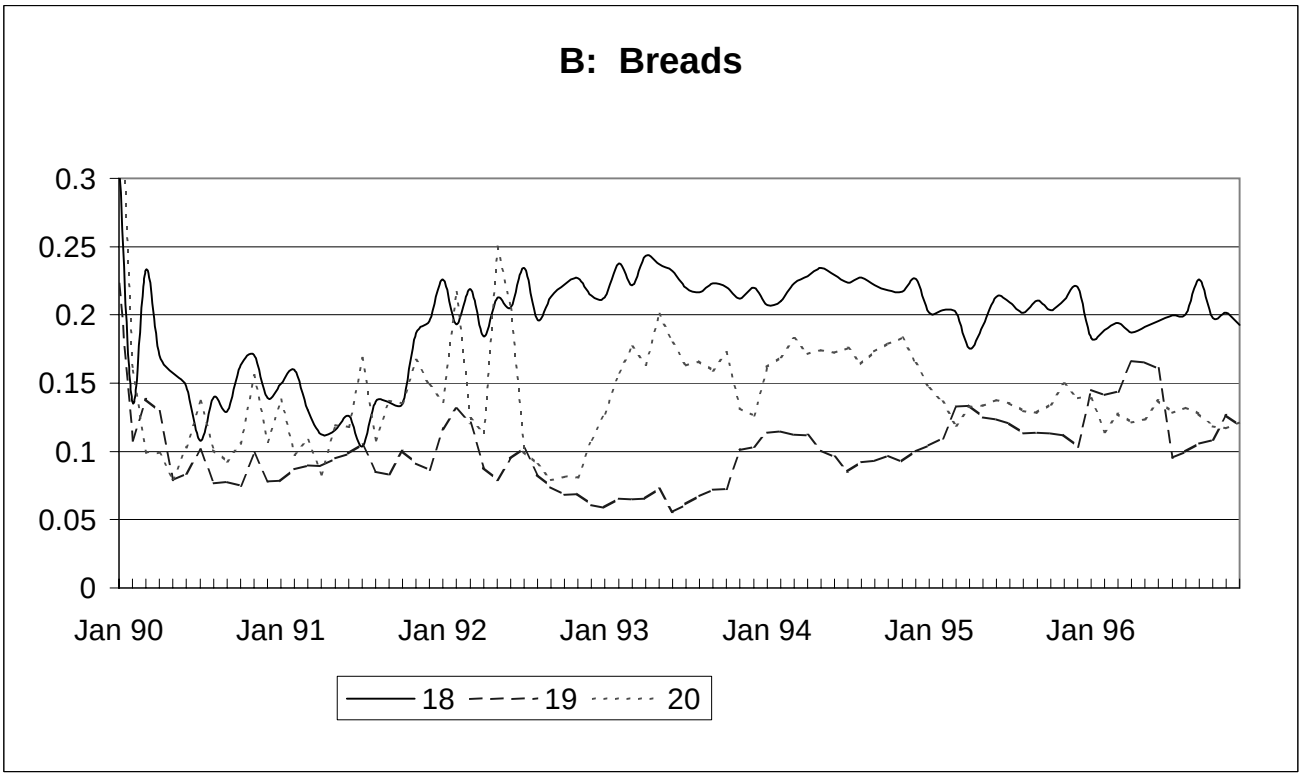
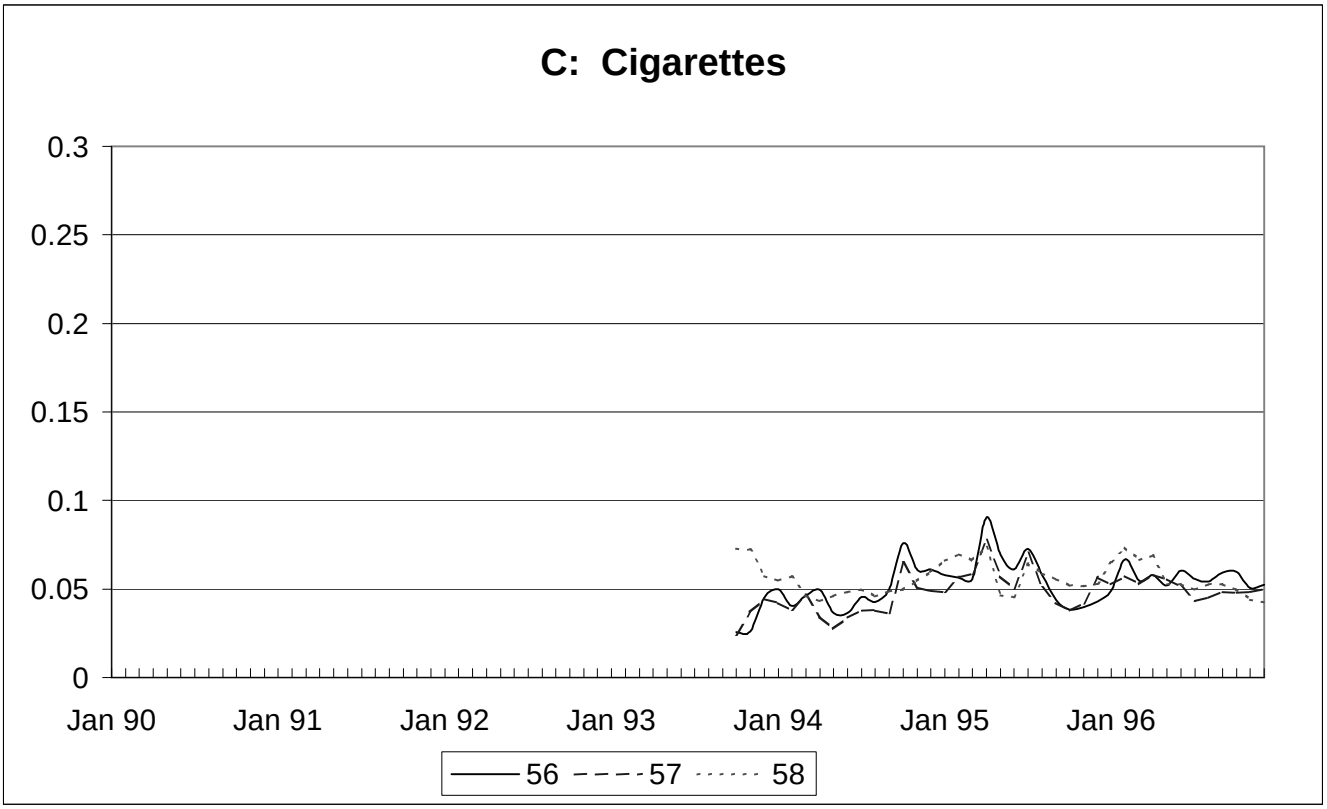
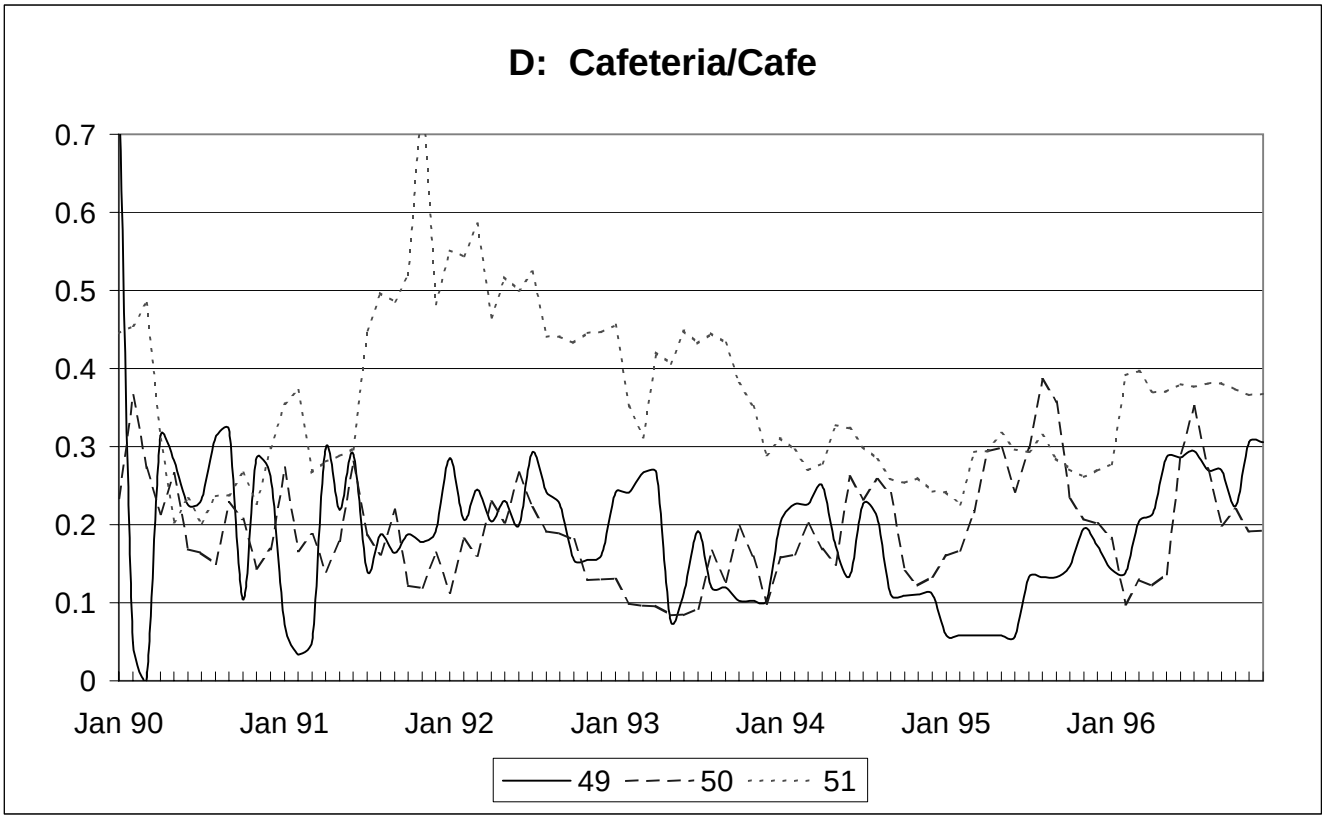


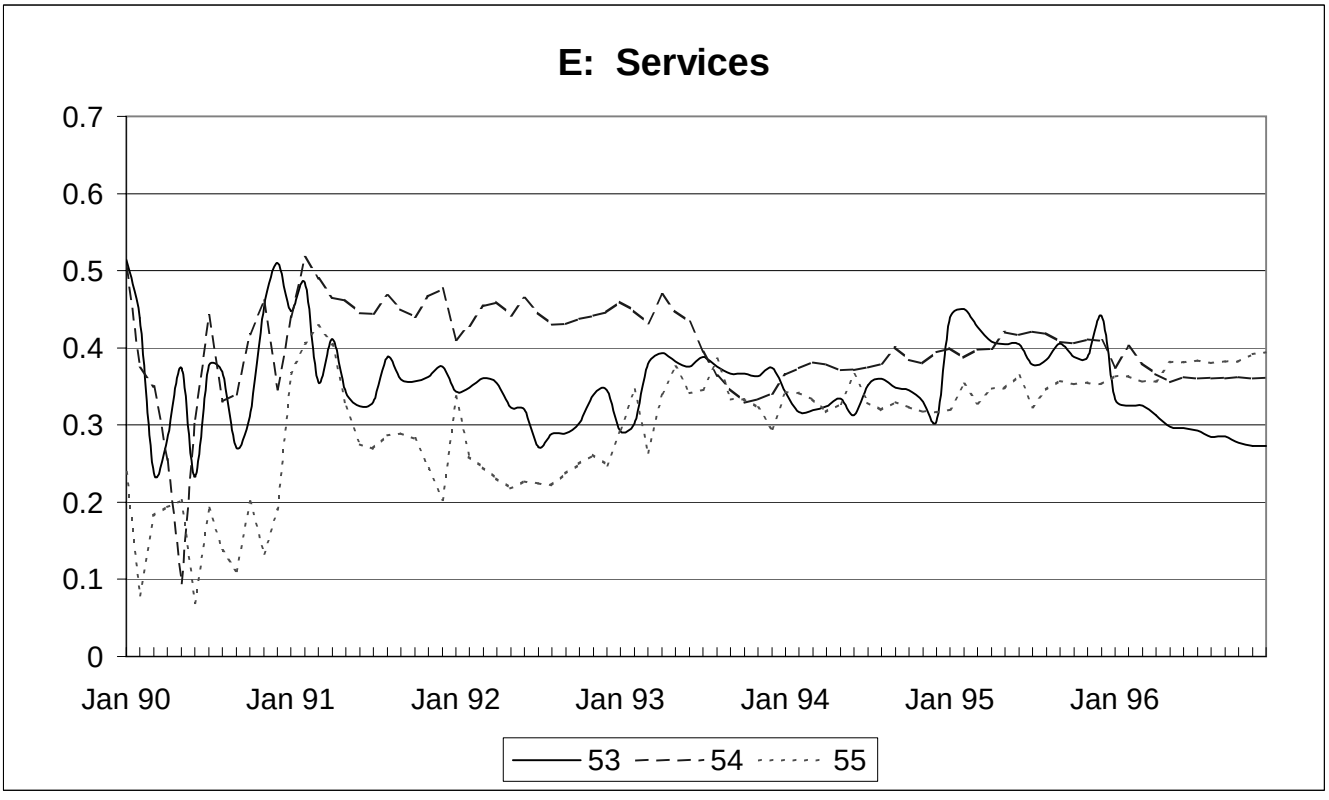
Figure 5a
Price dispersion within regions, selected goods






C: Cigarettes
0.3
0.25
0.2
0.15
0.1
0.05
0
Jan 90
Jan 91
Jan 92
Jan 93
Jan 94
Jan 95
Jan 96
56
57
58


D: Cafeteria/Cafe
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Jan 90
Jan 91
Jan 92
Jan 93
Jan 94
Jan 95
Jan 96
49
50
51


E: Services
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Jan 90
Jan 91
Jan 92
Jan 93
Jan 94
Jan 95
Jan 96
53
54
55

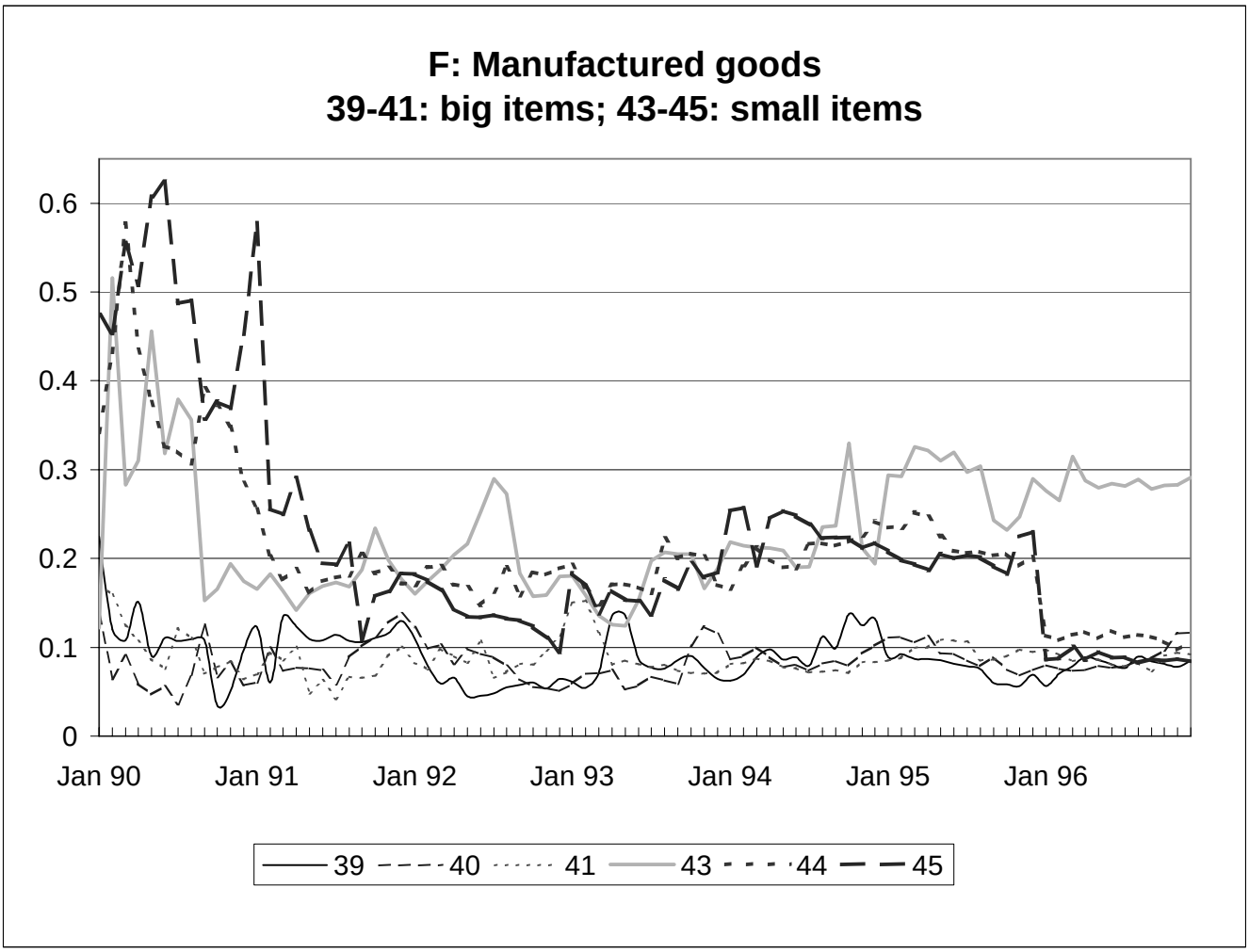
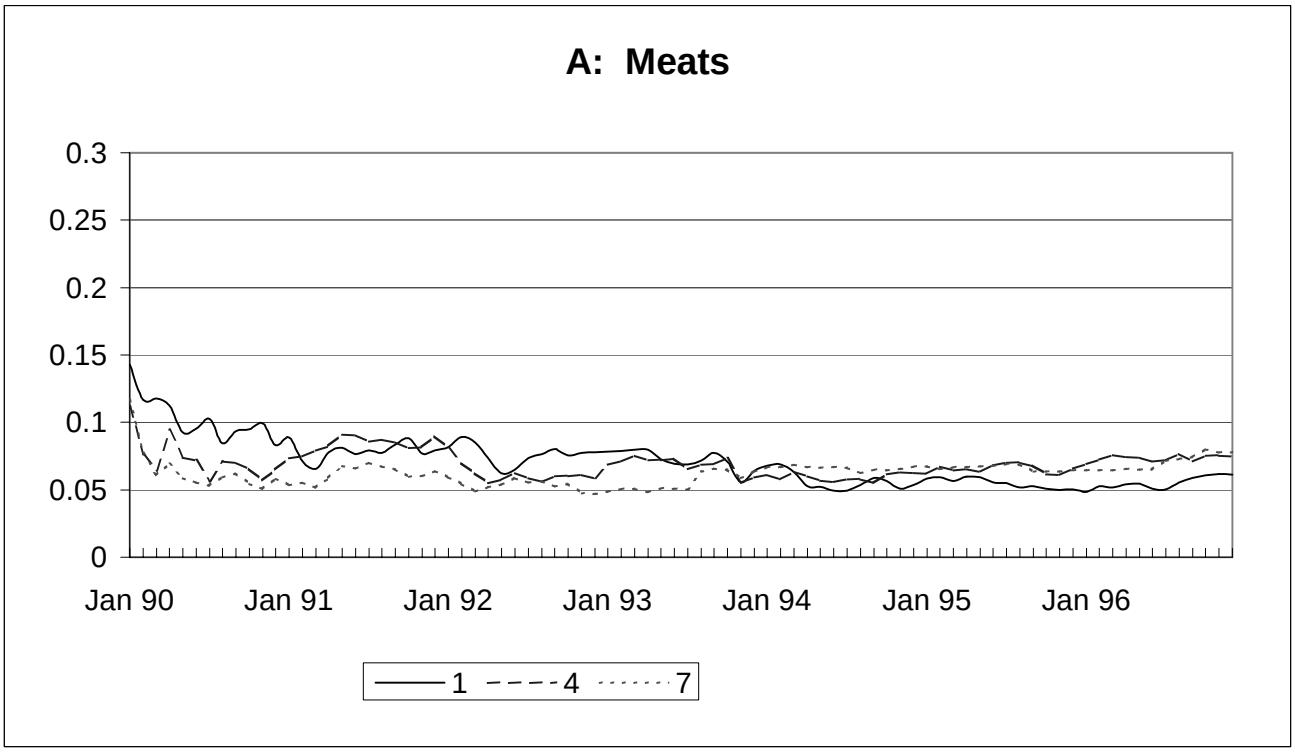
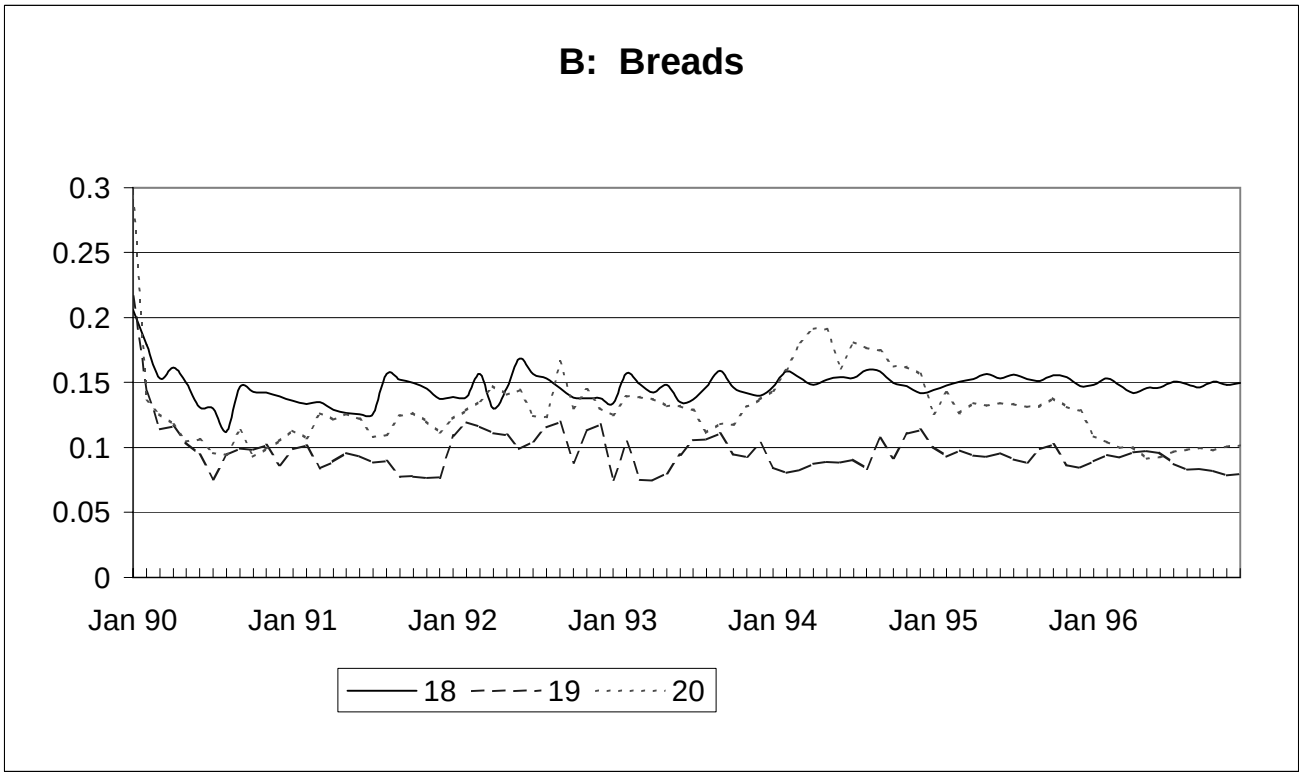
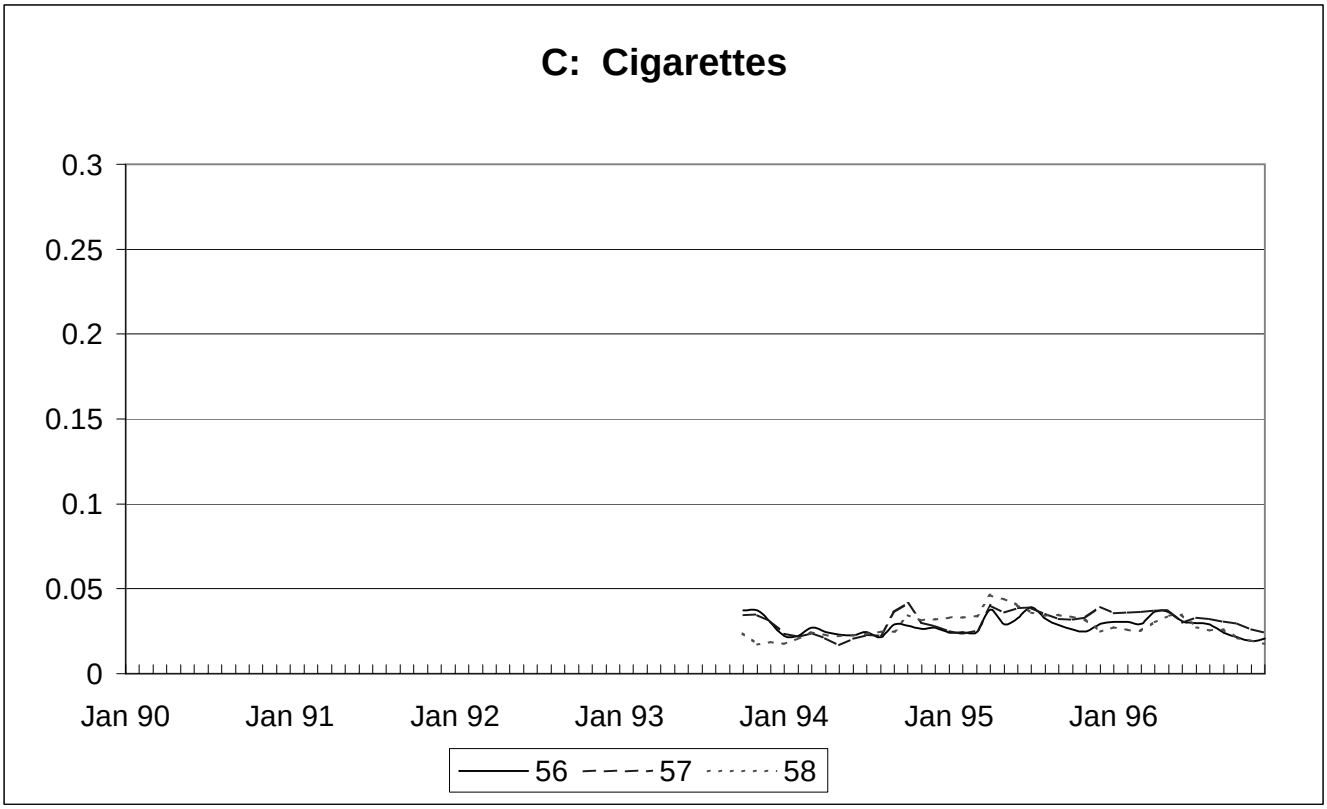
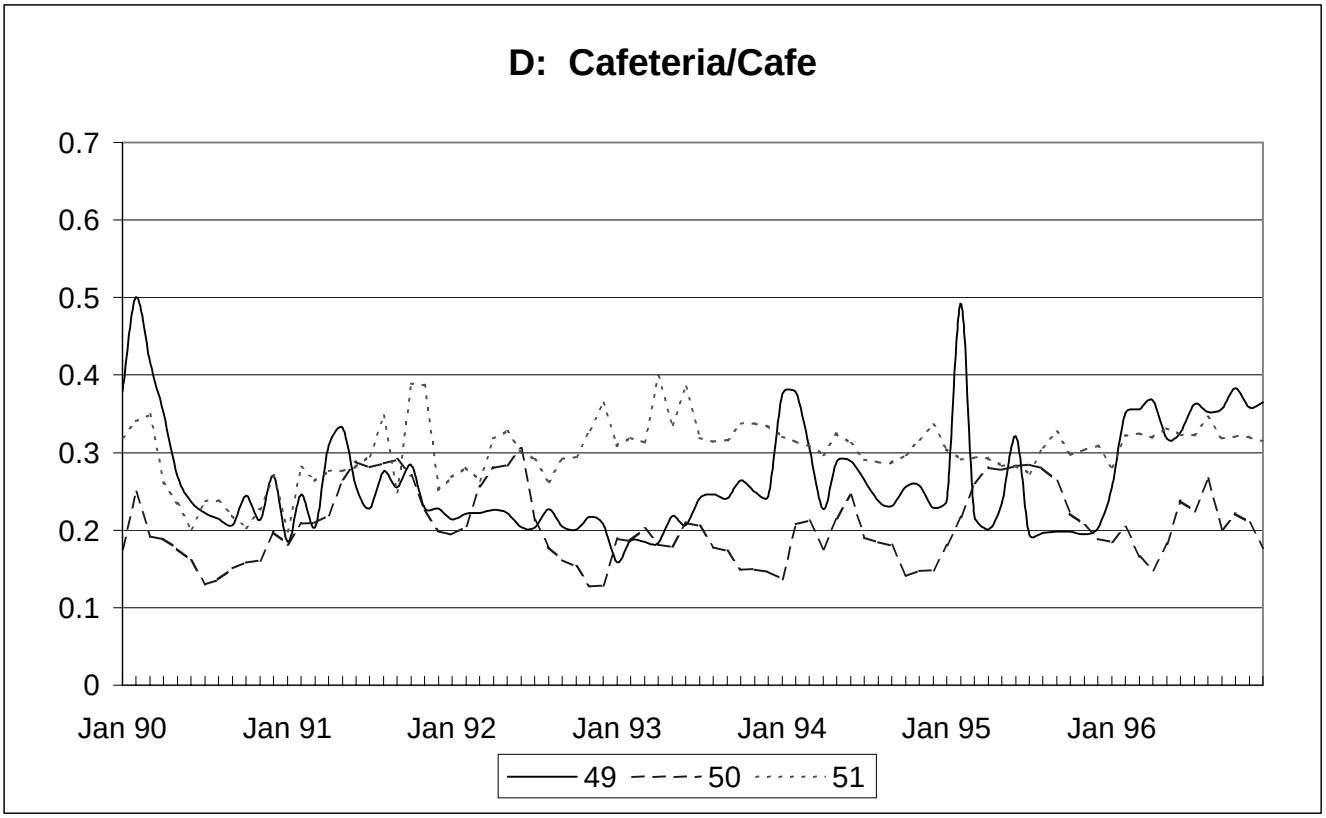

F: Manufactured goods
39-41: big items; 43-45: small items
0.6
0.5
0.4
0.3
0.2
0.1
0
Jan 90
Jan 91
Jan 92
Jan 93
Jan 94
Jan 95
Jan 96
39
40
41
43
44
45

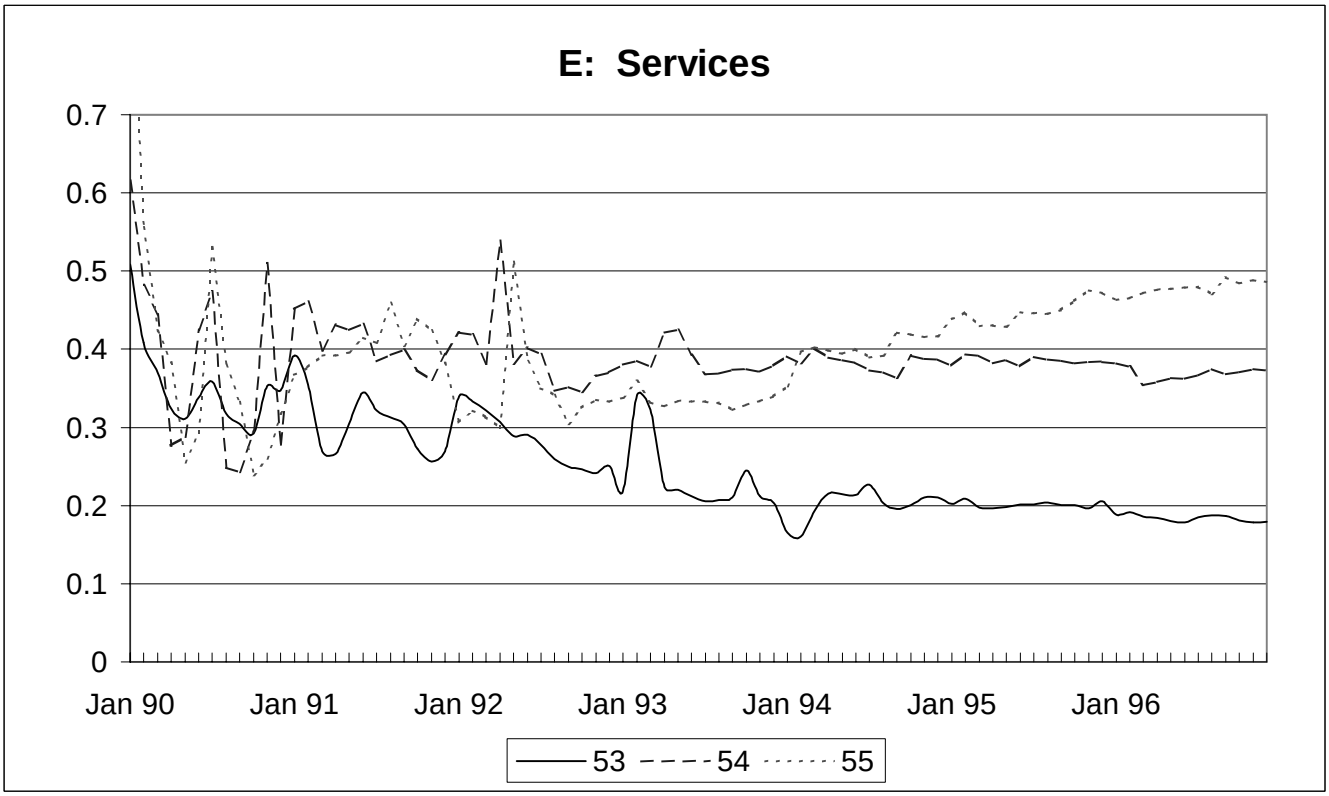
Figure 5b
Price dispersion across regions, selected goods






C: Cigarettes
0.3
0.25
0.2
0.15
0.1
0.05
0
Jan 90
Jan 91
Jan 92
Jan 93
Jan 94
Jan 95
Jan 96
56
57
58


D: Cafeteria/Cafe
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Jan 90
Jan 91
Jan 92
Jan 93
Jan 94
Jan 95
Jan 96
49
50
51


E: Services
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Jan 90
Jan 91
Jan 92
Jan 93
Jan 94
Jan 95
Jan 96
53
54
55

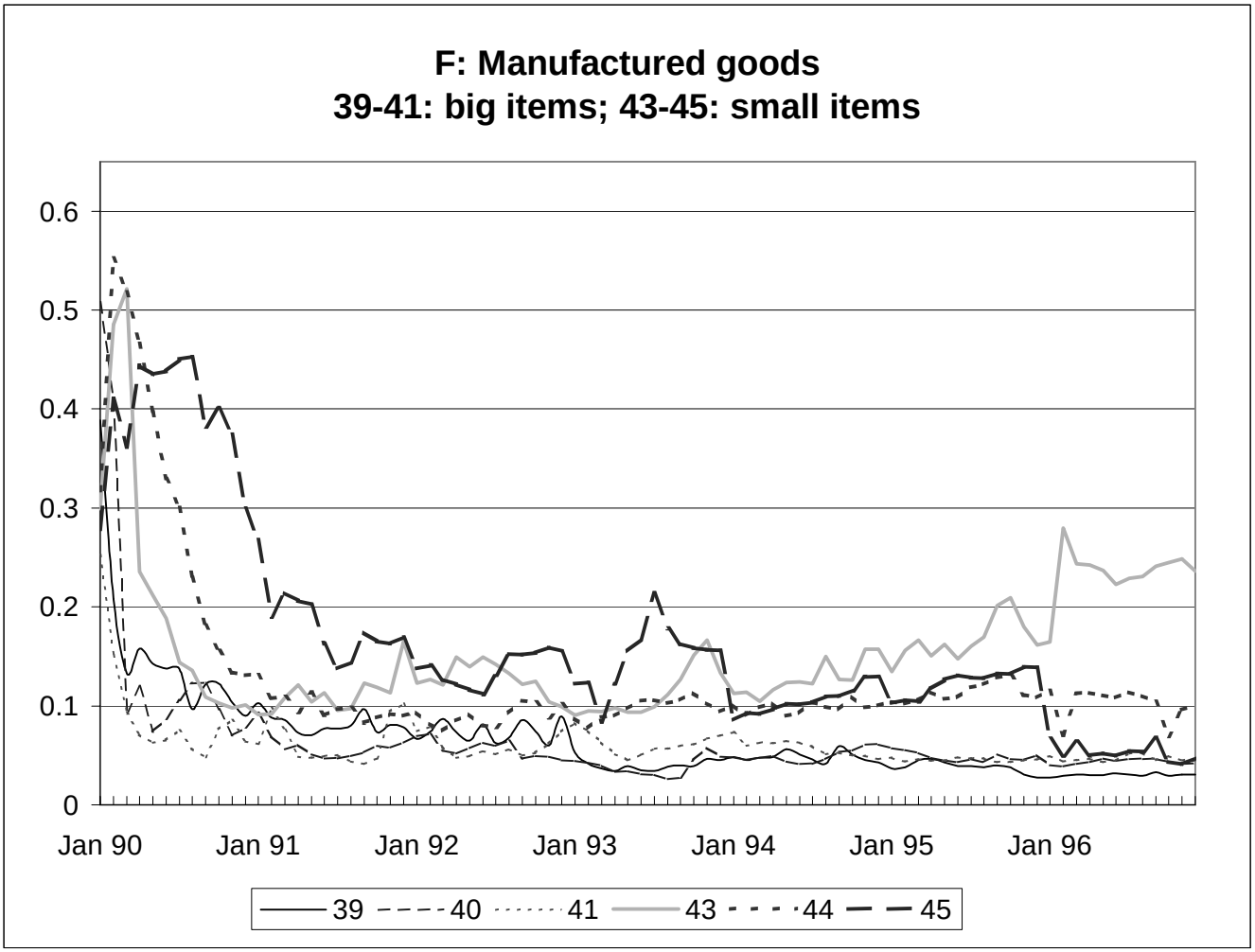

F: Manufactured goods
39-41: big items; 43-45: small items
0.6
0.5
0.4
0.3
0.2
0.1
0
Jan 90
Jan 91
Jan 92
Jan 93
Jan 94
Jan 95
Jan 96
39
40
41
43
44
45

Figure 6

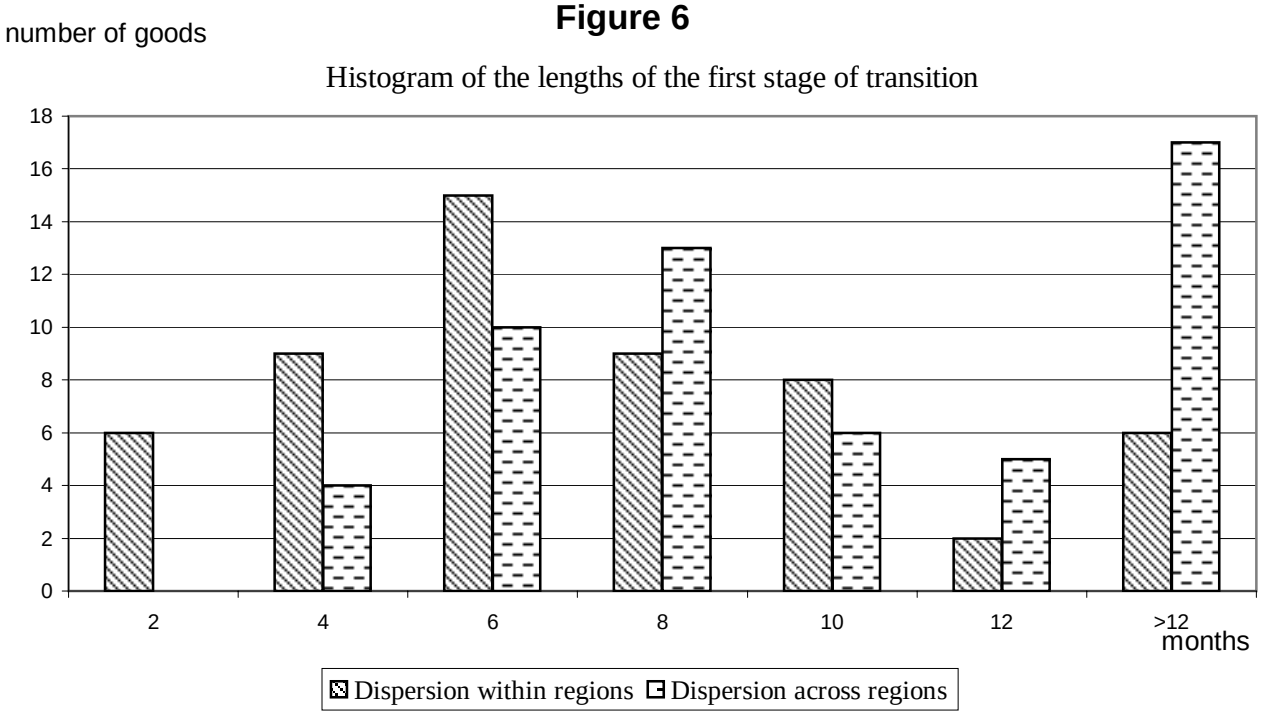

number of goods
Histogram of the lengths of the first stage of transition
18
16
14
12
10
8
6
4
2
0
2
4
6
8
10
12
>12
months
Dispersion within regions
Dispersion across regions

Figure 7

Average price dispersion controlled for inflation, inflation variability, seasonal effects and differences in levels across goods.

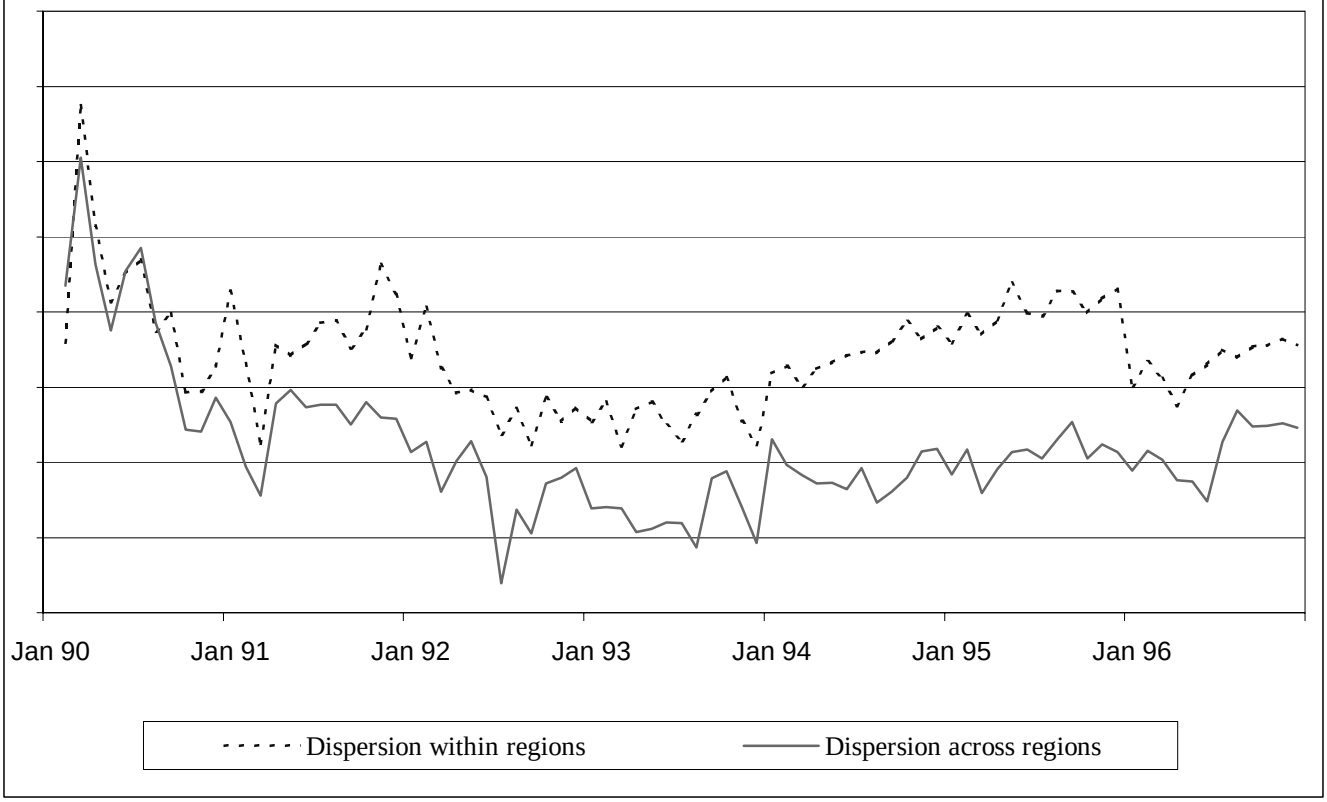


Figure 8a

Behavior of the ratio of CV within to CV across regions

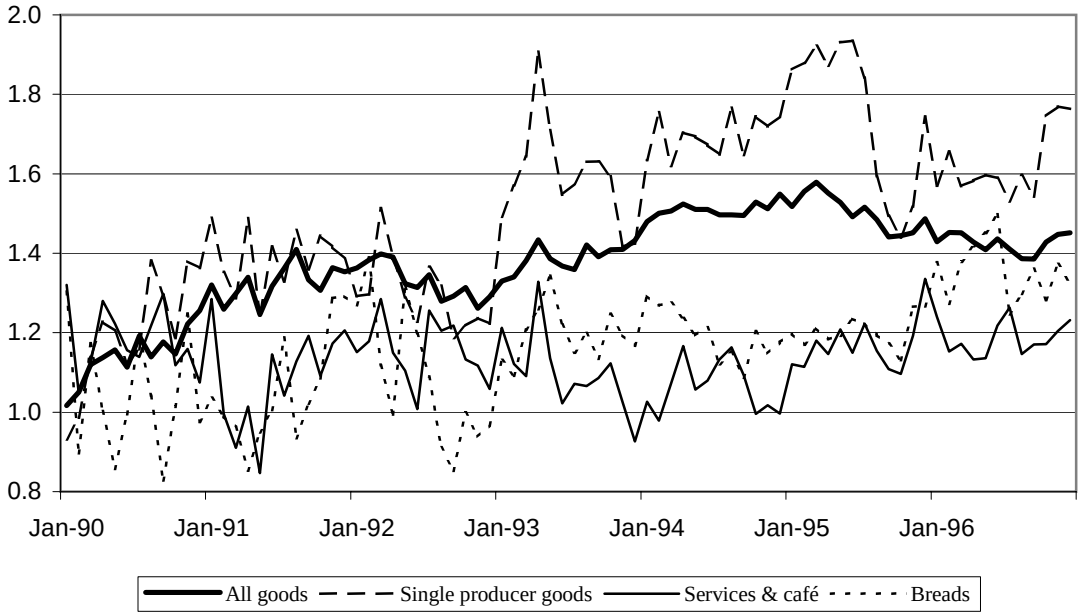
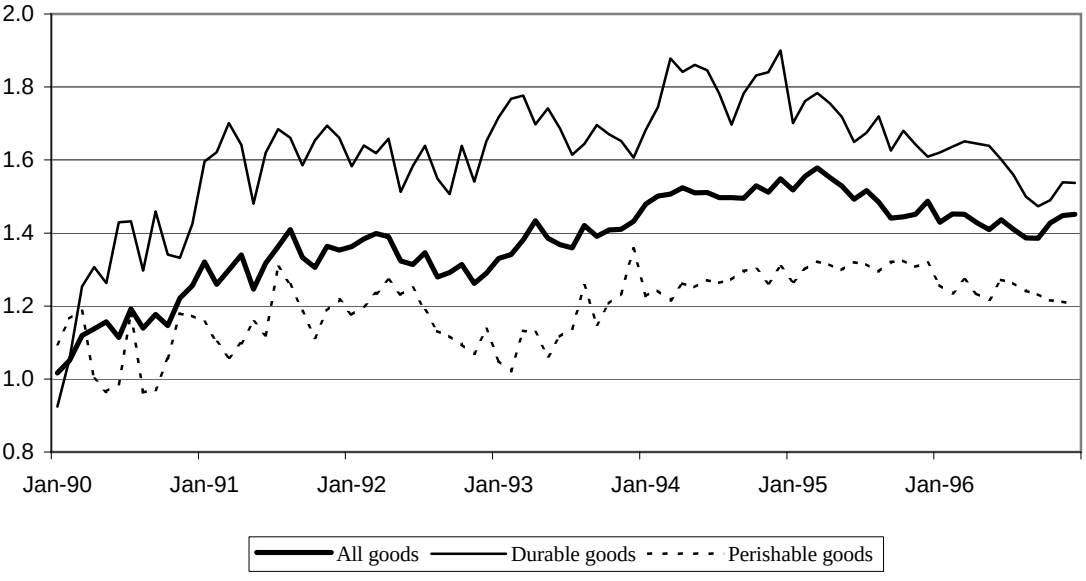


Figure 8b

Behavior of the ratio of CV within to CV across regions



Appendix

Table A1

Goods by Type and Category.

	#	Importance in expen-diture	Search frequency	Amount spent on single purchase	Average CV	Minimum CV	Maximum CV
beef	1	1	1	2	0.196	0.182	0.228
boneless beef	2	1	1	2	0.134	0.111	0.147
pork	3	1	1	2	0.135	0.107	0.179
boneless pork	4	1	1	2	0.174	0.142	0.205
chicken	5	1	1	2	0.062	0.051	0.075
bacon	6	1	1	2	0.146	0.096	0.206
cooked sausage "Malocnaja"	7	1	1	2	0.116	0.098	0.130
cooked sausage "Szachtiorskaja"	8	1	1	2	0.091	0.079	0.115
smoked sausage "Krakovskaja"	9	1	1	2	0.138	0.112	0.167
ham	10	1	1	2	0.159	0.140	0.169
fish, fresh (carp)	11	3	3	2	0.113	0.078	0.176
fish, frozen (mintay)	12	3	3	2	0.058	0.044	0.076
red caviar	13	3	3	2	0.189	0.154	0.221
herring	14	2	2	3	0.067	0.056	0.075
sprats, per tin	15	3	2	3	0.127	0.051	0.155
butter (unsalted)	16	2	2	3	0.122	0.081	0.196
sunflower oil, packaged	17	2	2	3	0.100	0.045	0.129
sunflower oil, bulk	18	2	2	3	0.102	0.053	0.211
hard cheese "Bukovinskij"	19	2	2	3	0.142	0.072	0.231
condensed milk	20	2	2	2	0.071	0.047	0.100
bottled milk	21	1	1	3	0.123	0.093	0.253
milk, bulk	22	1	1	3	0.023	0.000	0.069
tomato sauce "Krasnodarskij"	23	3	2	3	0.096	0.080	0.108
eggs	24	1	1	2	0.087	0.053	0.181
sugar	25	1	2	3	0.036	0.000	0.095
Kiev cake	26	3	2	2	0.059	0.038	0.075
honey	27	3	2	2	0.125	0.080	0.158
tea "dilmah"	28	1	2	2	0.159	0.099	0.182
coffee beans	29	2	2	3	0.210	0.163	0.227
salt	30	3	2	2	0.177	0.150	0.259
flour "Kijev Mlyn"	31	2	2	2	0.102	0.074	0.138
rice	32	2	2	2	0.074	0.050	0.095
pearl barley	33	2	2	2	0.093	0.051	0.227
dry pasta	34	2	2	2	0.114	0.083	0.149
vodka	35	1	1	2	0.103	0.087	0.127
cognac "Diesna"	36	1	1	2	0.064	0.051	0.098
champagne "Sovietskoje"	37	2	2	2	0.055	0.049	0.064
gasoline, 92 octane	38	1	1	2	0.106	0.046	0.234
vacuum cleaner	39	3	3	1	0.115	0.105	0.165
washing machine "Mrija"	40	3	3	1	0.108	0.068	0.168
camera	41	3	3	1	0.092	0.071	0.102
fridge "Nord"	42	3	3	1	0.178	0.152	0.190
tape recorder, stereo	43	3	3	1	0.111	0.053	0.181
color TV "Elektron"	44	3	3	1	0.082	0.050	0.107
newspaper "Fakty"	45	3	1	3	0.083	0.000	0.211
pen	46	3	2	2	0.544	0.510	0.624
notebook	47	3	2	3	0.164	0.125	0.181

Table A1 continued

	#	Importance in expen-diture	Search frequency	Amount spent on single purchase	Average CV	Minimum CV	Maximum CV
matches	48	3	2	3	0.112	0.098	0.125
washing powder "Lotos M"	49	2	2	2	0.124	0.115	0.137
washing soap, 72%	50	2	2	3	0.097	0.061	0.116
juice in a café	51	2	2	3	0.329	0.288	0.359
coffee	52	2	2	3	0.540	0.488	0.608
baking soda	53	3	3	3	0.291	0.245	0.385
yeast	54	3	2	3	0.107	0.093	0.131
vinegar	55	3	2	2	0.193	0.168	0.238
cigarettes "prima luks"	56	1	1	3	0.050	0.033	0.066
mineral water	57	2	1	3	0.186	0.167	0.215
key cutting	58	3	3	3	0.528	0.505	0.583
parking fee 1	59	2	1	3	0.356	0.337	0.421
parking fee 2	60	2	1	3	0.492	0.412	0.592
laying tile, per sq. m	61	3	3	1	0.192	0.118	0.561
passport pictures, color	62	3	3	3	0.251	0.230	0.292
passport pictures, black and white	63	3	3	3	0.206	0.206	0.206
cinema ticket	64	2	2	3	0.759	0.734	0.811
ultrasound	65	3	3	2	0.835	0.631	0.886
tooth filling	66	3	3	2	0.703	0.624	0.808

Table A2

Averages for goods grouped by search considerations

		Average CV	Minimum CV	Maximum CV
Weight in expenditure	Highest	0.111	0.083	0.154
		0.207	0.171	0.255
	Lowest	0.216	0.175	0.273
Search frequency	Highest	0.144	0.114	0.195
		0.172	0.138	0.214
	Lowest	0.253	0.208	0.319
Amount spent on single purchase	Highest	0.126	0.088	0.211
		0.172	0.138	0.215
	Lowest	0.211	0.175	0.261

Table A3

	Amount Spent on One Purchase		Frequency of Search		Share in Expenditure	
	High	Medium	High	Medium	High	Medium
Coefficients	-0.218 * +	-0.011	-0.121 * -	-0.196 *	-0.105 * +	0.040
t values	-4.559	-0.448	-2.220	-4.786	-2.174	1.185

Notes:

* denotes coefficients significantly different from zero.
+ denotes coefficient on High significantly smaller than the corresponding coefficient on Medium.
- denotes coefficient on High significantly larger than the corresponding coefficient on Medium.

All tests at 5% confidence level against one-sided alternative