

Ysusi, Carla

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Targeting: A Microdata Approach**

**Carla Ysusi**  
Banco de México

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# Consumer Price Behavior in Mexico Under Inflation Targeting: A Microdata Approach\*

Carla Ysusi<sup>†</sup>  
Banco de México

## Abstract

In this paper we do a statistical analysis of the Mexican Consumer Price Index microdata set to characterize the rigidities of the price setting process in the different sectors of the Mexican economy. The microdata set goes from July 2002 to December 2009. Broadly, results show that there exists a considerable heterogeneity in the price setting behavior across different sectors and over time. Evidence was found that when big shocks affect inflation, there is a strong co-movement of the fraction of the firms that change prices with the level of inflation.

**Keywords:** Consumer Price Index, price setting process, frequencies and magnitudes of price changes.

**JEL Classification:** C19; E31.

## Resumen

En este documento se realiza un análisis estadístico del Índice Nacional de Precios al Consumidor usando microdatos para caracterizar las rigideces en el proceso de determinación de precios en los diferentes sectores de la economía mexicana. La base de microdatos va de julio 2002 a diciembre 2009. Los resultados muestran que existe una heterogeneidad considerable en el comportamiento de las empresas al fijar precios y a través del tiempo. Se encontró evidencia de que ante fuertes choques que afectan la inflación, el porcentaje de empresas que cambian precios y el nivel de inflación presentan movimientos en paralelo.

**Palabras Clave:** Índice Nacional de Precios al Consumidor, proceso de formación de precios, frecuencias y magnitudes de los cambios de precios.

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<sup>†</sup> Dirección General de Investigación Económica. Email: cysusi@banxico.org.mx.

# 1. Introduction

In this paper we do a statistical analysis of the Mexican Consumer Price Index (*Índice Nacional de Precios al Consumidor* (INPC)) microdata set to study the price setting process in the different sectors of the Mexican economy and characterize its rigidities. The microdata set goes from July 2002 to December 2009, comprising part of the period during which the Mexican Central Bank has been working under an inflation targeting regime and inflation has been historically low in Mexico. A better knowledge of the way prices are set is important for understanding the short-term effects of the monetary policy. An adequate response to shocks will depend on the understanding of the price dynamics, the rigidity levels, and the differences between sectors. Studying nominal rigidities, where prices do not change instantly after a shock but remain rather constant for a period, is essential for understanding the implications of monetary policy on the short run. In this respect, it is important to understand to what extent price rigidities are present in the INPC.

The identification of the rigidities that dominate the price setting process could also be the starting point for a microeconomic analysis that studies the incentives that are causing these rigidities in different sectors. The results presented here may point out rigid sectors and the need for further research to understand the source of such price rigidities.

Furthermore, the result may be helpful to validate existent macroeconomic models based on assumptions about the price rigidities. There are studies documenting that price setters follow time dependent strategies where the frequencies of price changes are exogenous (Taylor (1980); Calvo (1983)), state dependent strategies where such frequencies are endogenous (Dotsey, King and Wolman (1999); Caplin and Spulber (1987)), or a combination of both suggesting the co-existence of firms which use different pricing strategies (Dotsey et al. (1999)). In time dependent models monetary shocks typically have longer lasting effects on real output than in the state dependent ones, so it is important to empirically distinguish between them.

In some countries important studies have been done addressing the previous issues, see for example, Bils and Klenow (2004), Klenow and Kryvtsov (2008), and Nakamura and Steinsson (2008) for USA. In the Inflation Persistence Network, Aucremanne and Dhyne (2004) did a study for Belgium; Hoffmann and Kurz-Kim (2005) for Germany; Álvarez and Hernando (2004) for Spain; Baudry et al. (2004) for France; Veronese et al. (2005) for Italy; Jonker et al. (2004) for the Netherlands; Baumgartner et al. (2005) for Austria; Dias et al. (2004) for Portugal; Lünnemann and Mathä (2005b) and Vilmunen and Laakkonen (2005) for Finland; and Dhyne et

al. (2005) sum up results for the European Central Bank joint research. A review of different literature studying price microdata was done in Mackowiak and Smets (2008) and Klenow and Malin (2010).

For Latin America the empirical evidence has until recently been particularly scarce. To fill this gap, a joint project with other Latin American Central Banks has been organized, from which this paper forms part. Nevertheless, notice that for Mexico there were already two studies about the price setting process: Castañon et al. (2008) and Gagnon (2009). The first paper is based on firms survey data and the second one on prices microdata (although as explained later, the microdata set stops in 2002). The results of these two papers will be compared to our results at the end of this paper.

In this document, we will try to quantify the degree of nominal rigidity of consumer prices in the Mexican economy at the sector level. This was previously done by Gagnon (2009) with data from 1994 to 2002 (extending it to 2004 but without linking the series). Nevertheless, most of his sample covers the high inflation era and the disinflation period. The 3% annual inflation target was set by the Mexican Central Bank in 2003,<sup>1</sup> so Gagnon (2009) sample incorporates only few months of this regime. Here we will focus on studying a low inflation period under inflation targeting, our sample starts in 2002 and finishes in 2009.

Broadly, results show that in Mexico there exists a considerable heterogeneity in the price setting behavior across different sectors (fruits and vegetables change prices on average more than once a month but housing prices take more than 12 months on average to change) and over time. Evidence was found that when big shocks affect inflation, there is a strong co-movement of the fraction of the firms that change prices with inflation, i.e. the frequency of price changes moves strongly with inflation under these circumstances.

In this paper, we shall first describe the Mexican Consumer Price Index and the microdata set to be used (Section 2). Some definitions will be given in Section 3, followed by the main results about frequencies, implied durations, and magnitudes in Section 4. Also in Section 4 a comparison between our results and previous studies for Mexico will be given. Finally conclusions and possible further work are presented in Section 5. In the Appendix, the same statistics for a few products are shown using an alternative dataset (the collected prices and not the monthly averaged prices).

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<sup>1</sup>In 2003 the 3% annual inflation target was fully established by the Mexican Central Bank, although announced since 2002 (see Banco de México (2002)). Nevertheless, some features of this regime were introduced since 1999 leading to a disinflation period. See Ramos-Francia and Torres (2005) for an extensive discussion on implemented measures.

## 2. Mexican Consumer Price Index

The Mexican Consumer Price Index, *Índice Nacional de Precios al Consumidor (INPC)*, is an economic indicator that measures the variations of a representative basket of goods and services in Mexico throughout time. For its construction, there is a continuous collection of the prices of specific items that form 315 homogeneous product categories of goods and services. Each month around 235 thousand prices of these specific items are recorded to calculate the price variations of the categories (see Banco de México (2010)). Each category has a different weight in the INPC. The categories and their weights are determined based on the Encuesta Nacional de Ingreso y Gasto de los Hogares (ENIGH), survey done by the Mexican Statistical Institute, INEGI. This national survey takes into account households' income and how they spend it. The last update of the INPC basket was done on the second fortnight of June 2002. The geographic representation of the index is ensured by including 46 cities of the country from all the different states. For more information about the construction of the INPC see Banco de México (2002).

Headline inflation is computed using the price variations of the 315 product categories. Given that not all product prices have the same pattern of behavior, it is convenient to classify categories into groups for the analysis. In this document we will do our analysis at group level. Merchandise can be divided in two groups, food and rest of merchandise; services in three groups, housing, education, and rest of services; agricultural products in two groups, fruits and vegetables and farm-related goods (that include cattle products and eggs); and lastly administered goods (that include gasoline, electricity, and gas) and regulated goods and services (that include, for example, public transport, parking fees, driving licence fee, etc.). The products included in each group that were used in this paper are shown in Tables 6 to 14.

### 2.1. The microdata

In this paper we will study the nine groups of the INPC described above. The studied period goes from July 2002 to December 2009. The first observation of our database corresponds to the first observation of the latest basket.

Our dataset consists of quotes that correspond to the monthly average of the collected prices of a given item, which are published each month in the *Diario Oficial de la Federación*. Each quote corresponds to a specific city, outlet, and good and can be identified by a code. In total we have more than 100 thousand price trajectories<sup>2</sup>

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<sup>2</sup>Banco de México collects the prices of around 85 thousand different goods and services at a

consisting of more than six million quotes and forming the 315 product categories (see Table 1).

Our database has some features that need to be specified before presenting the results. Our results will depend greatly on them, therefore they need to be analyzed carefully.

The main one is that the individual prices are not published; the *Diario Oficial de la Federación* only publishes the monthly average of these prices. For some items (the most volatile ones, like agricultural goods), up to four prices are collected per month, but only their average is available.<sup>3</sup> Our quantitative results may be biased due to this averaging, nevertheless the qualitative conclusions will stand.<sup>4</sup>

Sales cannot be identified in our dataset. Discounts are taken into account when recording prices (except for conditional discounts), but they are not flagged in the *Diario Oficial de la Federación*. As documented in Bils and Klenow (2004), Nakamura and Steinsson (2008), and Mackowiak and Smets (2008), an important number of price changes are temporary discounts. Nevertheless it has been argued that sales and substitutions may have a macroeconomic content and that both may be much related to inflation. Therefore our dataset will include sales and product substitutions.

Another fact to take into account is that not all quotes correspond to individual items, some quotes are an average of a small sample of similar goods (for example: three different brands of trousers form a sample of one of the trouser quotes). All products composed of a small sample of items are excluded from our database (this feature is mainly observed in clothing products<sup>5</sup>). Own housing, hotels, car insurance, gold and silver (in the jewelry category), phone services, education, electricity, and highway tolls quotes are calculated through subsystems which are calculated with observed prices. This kind of products will also be dropped from the dataset, except those that have regulated prices (as regulated products will be studied separately). Additionally, some item prices are sampled at each source around every six months, e.g. housing rent. These trajectories are also eliminated.

Finally, as in all databases, there can exist outliers, i.e. prices that seem highly

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time; we have around 100 thousand trajectories due to substitutions.

<sup>3</sup>Gagnon (2009) uses a filter to smooth these averages. Nevertheless, different filters can be used and each will give different results; therefore we decided to work with raw data.

<sup>4</sup>In the Appendix results for a few products are given using all the collected prices and not the published averages.

<sup>5</sup>Clothing products are not composed of small sample of items nowadays but of prices of individual items. However, given that at the beginning of our sample they were, we are excluding them.

improbable. Given that we are taking the prices from the *Diario Oficial de la Federación*, this can be of importance given that typos cannot be ruled out. We exclude the biggest price increases and decreases keeping 99.9% of our database.

The second column of Table 1 shows the characteristics of the database once the previous facts have been taken into account. Here 38 product categories will be excluded, leaving us with 277 product categories, 75,496 trajectories and more than 5 million quotes. These represent 79.94% of the INPC.

## 2.2. Unregulated and regulated products

The prices of some of the sampled products are regulated. These products form the administered and regulated goods and services groups. Given that the frequencies and magnitudes of the changes of these prices are not determined by the market, they can present very different dynamics from the other products and can bias our results. Therefore we will study separately the groups of regulated products and the ones of unregulated products.

Table 2 shows this division and gives the number of categories and weights of each of the groups. Once the weights of the excluded categories are accounted, the regulated products account for around 21% of the INPC.

## 3. Some definitions

In line with other countries' research on the topic, we will follow Klenow and Kryvstov (2008) notation and decomposition. The monthly price changes will be decomposed into two components, the fraction of items that present a price change on that month (extensive margin adjustments) and the weighted average of the size of the change (intensive margin adjustments). So if  $p_{it}$  is the log-price of the  $i$ -th item at time  $t$ , the indicator function of a price change is

$$I_{it} = \begin{cases} 0 & \text{if } p_{it} = p_{it-1} \\ 1 & \text{if } p_{it} \neq p_{it-1} \end{cases}.$$

So if the weight corresponding to a product divided by the number of items of that product category that registered a price change is  $\omega_i$  then the frequency or the weighted fraction of products that present a price change at time  $t$  is

$$fr_t = \sum_i \omega_i I_{it}$$



and the average magnitude of the price changes at time  $t$  is

$$dp_t = \frac{\sum_i \omega_i I_{it} (p_{it} - p_{it-1})}{\sum_i \omega_i I_{it}}.$$

Therefore inflation (measured as the difference of log-prices) at time  $t$  can be expressed as

$$\pi_t = fr_t * dp_t.$$

An equivalent decomposition can be done by separating positive price changes from negative price changes. So the indicator functions for price increases and price decreases at time  $t$  are respectively

$$I_{it}(+) = \begin{cases} 1 & \text{if } p_{it} > p_{it-1} \\ 0 & \text{if } p_{it} = p_{it-1} \end{cases} \quad I_{it}(-) = \begin{cases} 1 & \text{if } p_{it} < p_{it-1} \\ 0 & \text{if } p_{it} = p_{it-1} \end{cases},$$

the frequencies of price increases and price decreases at time  $t$  are

$$fr_t(+) = \sum_i \omega_i I_{it}(+) \quad fr_t(-) = \sum_i \omega_i I_{it}(-)$$

and finally the average magnitude of price increases and price decreases at time  $t$  are

$$dp_t(+) = \frac{\sum_i \omega_i I_{it}(+) (p_{it} - p_{it-1})}{\sum_i \omega_i I_{it}(+)} \quad dp_t(-) = \frac{\sum_i \omega_i I_{it}(-) (p_{it} - p_{it-1})}{\sum_i \omega_i I_{it}(-)}.$$

Now inflation can be expressed in function of the frequencies and magnitudes of price increases and the frequencies and magnitudes of price decreases

$$\pi_t = fr_t(+) * dp_t(+) + fr_t(-) * dp_t(-).$$

The average duration of a price spell can also be computed. A simple way of estimating it is by calculating the implied average duration from the frequencies of each item, i.e.

$$\bar{d}_j = \frac{-1}{\ln(1 - fr_j)}.$$

## 4. Main results from microdata

In this section we will present the decomposition of our data in frequencies, implied duration, and magnitudes for each group<sup>6</sup> (in Table 6 to 14 these statistics are shown for all products). Weighted statistics and raw ones will be presented as they give us different information. If we want to study headline inflation or one of its subindexes, it is convenient to look at the weighted ones. Instead, if we need to detect categories or sectors with atypical rigidities, as a starting point for a microeconomic analysis, it is convenient to look at the raw ones.

### 4.1. Frequencies and Implied Duration

#### 4.1.1. Group level

On average, in Mexico, during the sample period, 35% of prices are changing each month. The average frequency of price increases per month is 24% while the one of price decrease is only 11%. Nevertheless there is a big difference between regulated products and unregulated ones. On average, 32% of unregulated product prices are changing each month, from which 20% are increases and the remaining 12% are decreases. In contrast, the average frequency of price changes of regulated products is 47%, from which the majority are increases (40%) and decreases are rare (7%). Although, in general, there is an asymmetry between the upward and downward changes, price decreases are not that infrequent (more than a third of the changes are decreases). This goes in line with previous literature, for example, for the Euro area see Altissimo et al. (2006) and for the United States see Peltzman (2000). Peltzman (2000) concludes that "output prices tend to respond faster to input increases than to decreases" and that this "asymmetric response to cost shocks is substantial and durable". Ball and Mankiw (1994) give a menu-cost model as a possible explanation for these asymmetries.

There is also a considerable heterogeneity in the frequency of price changes across sectors. In Table 3, the average frequency of price changes, increases, and decreases are given for the nine groups of the INPC. Notice how the prices for the groups of fruits and vegetables, farm-related goods, and administered goods change the most (85%, 64% and 90% respectively). Fruits and vegetables and farm-related goods prices increase and decrease almost with the same frequency, probably due to sea-

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<sup>6</sup>The results in this section may be statistically biased as we use the published averaged monthly prices. In the Appendix the results for a few products are given using the collected prices, and it can be inferred that our main conclusions stand.

sonal characteristics. Quite the opposite, administered goods prices are continuously increasing and rarely decreasing. On the other hand, unregulated services (the groups of housing, education, and rest of services) and regulated goods and services show few price adjustments and, in all of these groups, upward adjustment of their prices are much more common than downward ones.<sup>7</sup> Education almost does not present downward changes. The groups of food and other merchandise show less extreme behaviors having average frequencies of 37% and 32% respectively. This important heterogeneity across sector has previously been documented for other countries, for the Euro area see Altissimo et al. (2006) and for U.S. see Carvalho (2006). The last one studies how this sectoral heterogeneity affects the dynamics of monetary economies.

There is also no dominant spell length. Different implied durations predominate for different groups (Table 5). On average there is a price change every 5 months. However there is a price increase on average every 8 months but a price decrease every 30 months. Notice how the groups of administered goods, fruit and vegetables, and farm-related products change prices on average at least once a month. On the other hand, the prices of the services are stickier. The housing group changes prices on average once a year or less, education less than every six months and rest of services less than every 3 quarters. In all the groups, as expected, it takes much longer to have a price decrease than a price increase. Regulated goods and services seem to change prices once a year on average; however this is just an average, notice that these prices can be constant for very long periods and then change more frequently in others.

#### 4.1.2. Product level

At product level (see Tables 6 to 14), the average frequency of price changes of unregulated goods ranges from 3.98% (newspapers) to 97% (tomato). This heterogeneity is clearly illustrated in Figure 1 where average frequencies for each product are shown in progressive order. The x-axis shows the accumulated percent of products plotted to that point. The median for unregulated products is 37% while the mean was 32%. In contrast, for regulated products the median is 7% while the mean was 27% indicating a highly skewed distribution (many products with few price changes and not many products with a big number of them).

All previous results are reinforced with Figure 2. The box plots show the distri-

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<sup>7</sup>The results from the group of housing need to be analyzed carefully given that the trajectories of their main components, housing rent and own housing, were taken out of the database

bution properties of the frequencies of price changes, of price increases, and of price decreases of the items for each of the groups. The differences in location, symmetry, and dispersion between the groups are perfectly captured. Notice that the distribution of the administered goods is skewed to the left, concentrating most of the frequencies around 90% and having mainly upward movements. Meanwhile fruits and vegetables and farm-related goods have more symmetric distributions. Also the distributions of the frequencies of price increases and decreases are very similar for these agricultural groups, meaning that it is almost as likely to have a downward than an upward movement. Education is an extreme case, it has the lowest median, the smallest dispersion, and almost all the distribution is explained by the price increases. Housing and rest of services distributions are strongly skewed to the right given that most of their items do not change prices frequently.

### **4.1.3. Time series**

When studying the time series of frequencies, it seems that the frequency of price changes moves importantly with the annual headline inflation (Figure 3). As inflation trends upward the proportion of products with price increases also broadens, and when inflation shows a downward trend the proportion of price increases diminishes. An inverse relation is exhibited with the price decreases, although less strong compared to the price increases. Now, looking carefully at two important episodes, the increase of international commodity prices from mid-2006 to 2008 and the economic recession of 2009, the previous result is evident. From mid-2006 until end of 2008, the share of products increasing their prices boomed and the share of decreasing prices seemed to have stayed stable causing an important increase in headline inflation. When looking at 2009, it is clear how the number of price increases lowered considerably and the number of price decreases raised since the beginning of the year causing the important fall of headline inflation.

Nevertheless, as pointed out previously, not all sector have the same price behaviors. Looking at Figures 4 to 7 the differences between the groups are clear. The different groups present very different behaviors. Firstly there is an important difference between the unregulated and the regulated groups. For unregulated goods and services (Figure 4), the frequencies of price increases exhibit an upward trend since 2006. This trend changes direction only at the beginning of 2009. The frequency of price decreases is more stable, however it exhibits a slight upward slope since the end of 2008. This change of trend for the frequencies of both price increases and decreases since the beginning of 2009 match the fall of annual headline inflation. Importantly,

notice that the frequencies of unregulated goods move strongly with annual headline inflation; the correlation between this inflation series and unregulated goods price increases frequency is .51 and between it and the price decreases frequency is -.28. So as pointed out before, when inflation is rising the number of firms increasing prices augments and the number of firms reducing prices drops.

From all the groups (Figures 6 and 7), fruits and vegetables and farm-related products seem to have the fewer rigidities; upward and downward movements of prices are common. It is easily seen in the farm-related group, that when headline inflation is increasing the difference between the share of its product with price increases and those with price decreases is positive and large. In episodes when this inflation has a downward trend, this difference is very small or even negative. In contrast, services groups (housing, education, and rest of services) show strong seasonality and strong rigidities. The frequencies of the group of rest of services show a continuous upward trend and, even during the recent episode of recession, its prices seem to be the ones reacting the less from all the groups of unregulated products. The groups of food and rest of merchandise also show an upward trend mainly after 2006 on their price changes frequencies, nevertheless after the first quarter of 2009 there is a change of trend. This is due mainly to an important fall on the frequencies of rising prices. The frequency of negative price changes raised but in a smaller proportion.

For regulated products (Figure 5), frequencies of price changes do not follow a clear pattern given that they are dependent of public policies. The average frequencies of price changes of administered goods (Figures 6 and 7) are mainly constant at very high levels except for periods where the government freezes or reduces prices, like the recent period starting at the beginning of 2009. Regulated goods and services have a relatively constant level of price frequencies (after accounting for seasonality) except for the past last years where the average frequencies of price increases seem to have risen significantly.

## **4.2. Magnitudes**

### **4.2.1. Group level**

In Mexico, as with frequencies of price changes, there is a big heterogeneity between sectors in the average size of their price increases and decreases (see Table 4). From all unregulated product categories, the services have the larger price movements (although infrequent) while agricultural goods have the smaller ones (although very

frequent). Regulated products show big disparities as well, administered goods have many tiny changes while regulated goods and services have more unfrequent bigger ones.

The previous result can be easily seen in a histogram. Figure 8 shows the distribution of the sizes of price changes (for all products, unregulated products, and regulated ones). The distribution of unregulated products show fat tails; there are many small price changes, but there are some large price changes. Although there are more price increases, the number of price decreases is also important. Regulated products show a completely different story; most price changes are very small and mainly positive (this mainly due to administered goods). Compare how around 47% of unregulated price changes are smaller than 5% in absolute value, while more than 86% of regulated price changes are in that range. Also notice that more than 13% of unregulated price changes, but only 4% of the regulated ones, are above 20% in absolute value.

#### **4.2.2. Time series**

The size of price increases and decreases, differently from frequencies, do not seem to move importantly with annual headline inflation (Figure 9). Even during episodes when inflation increases or falls significantly, the size of price increases and decreases seem to be stable. There is a subtle increase in the size of price decreases during 2009, but the adjustment is not as important as the adjustments in frequencies shown in Figure 3. The story is not very different for unregulated and regulated products, which do not seem to co-move strongly with inflation (Figures 10 and 11). Although when looking at each group separately (Figures 12 and 13), the magnitudes of the price changes from the groups of food, rest of merchandise, and farm-related products vary slightly according to inflation.

### **4.3. Time or State Dependent**

The results given in this paper have been showing that there is evidence of both state and time dependence. In some sectors adjustments in the frequencies of price changes move strongly with annual headline inflation pointing out the need to study the extensive margin and a possible state dependent scenario. Nevertheless in other sectors seasonality is strong giving evidence of time dependence. To complement the research scatter-plots are given in Figures 14 to 21.

Figures 14 and 15 show the scatter-plots of average frequencies against the month

of the year for each of the groups and Figures 16 and 17 the scatter-plots of average magnitudes against the month of the year. Some seasonality can be identified in many of the groups. Housing and education are the most obvious cases when looking at frequencies. Nevertheless, other groups like food, farm-related goods, and regulated goods and services, also show some seasonal effects. When looking at average magnitudes, education is again the one with the strongest dependence. Fruits and vegetables and farm-related goods show some cycles in its pattern of average magnitudes although less strong than for average frequencies.

The scatter plots of average frequencies against annual headline inflation are shown in Figures 19 and 20 and for average magnitudes against this inflation series in Figures 21 and 22. These plots reinforce the results of the previous section. Average frequencies seem to move strongly with inflation. This is particularly evident for food, rest of merchandise, and rest of services. As words of caution, notice that a simple scatter-plot is not a robust way of detecting relationships and dynamics. In some cases the relationships shown may be not significant, there may be a lag on the responses of certain groups, or extreme values may be causing unwanted effects. As further research, a good model may need to be developed to confirm or reject the results given here.

Summing up, in Mexico heterogeneity of the pricing dynamics between sectors is crucial. Some groups, like housing (excluding rents and own housing) and education, seem to be time dependent. All the other unregulated groups seem more to be state dependent.

#### **4.4. Comparison with Previous Research**

Finally we should compare our results to previous papers done for Mexico, specifically Castañon et al. (2008) and Gagnon (2009). Castañon et al. (2008) study the price setting process through a survey of firms of the manufacturing industry. Gagnon (2009) uses a similar database as ours, microdata collected from the Diario Oficial, although the sample stops in 2004.

Comparing average monthly frequencies, Gagnon (2009) reports that 22.1% of unregulated prices changed each month on average in 1994, 39.2% in 1995 and 27.3% in 2001. We have that on average for our complete sample (2002-2009) the average monthly frequency for unregulated goods is 32%. This figure seems a bit high compared to Gagnon's one; this is due to the fact that Gagnon filters the data to get a lower bound while we do not use any filter as explained previously (so ours may be seen as a higher bound for the frequencies (see appendix)). Despite this difference,

both papers register that on average 42% of the price changes are decreases and the remaining 48% are increases.

Castañon et al. (2008) report that firms maintain prices unchanged for around 6 months. Gagnon, after restricting his basket for it to be comparable to the one of Bils and Klenow (2004), gives a mean duration of 6.6 months for the period June 2000 to June 2002 and 7 months for the period January 2003 to December 2004. For our complete sample, the mean duration for unregulated goods is 5.1 months.<sup>8</sup>

Nonetheless the three papers give the same conclusion, there is a big heterogeneity in the price setting process between sector. There is evidence of both time and state dependent strategies.

## 5. Conclusions

In this paper we studied the dynamics of price changes of the product categories included in the INPC using microdata published in the *Diario Oficial de la Federación* from July 2002 to December 2009. This period is characterized by a regime of inflation targeting and by historically low and stable levels of inflation, although some temporary shocks were present. Main findings can be synthesized as follows:

- A main feature of the price setting behavior in Mexico is the heterogeneity between sectors. As expected, there are big differences between unregulated and regulated sectors, but important differences also exist between the unregulated ones.
- When studying price changes frequencies, services seem to be stickier than the average, and agricultural goods change prices constantly.
- Price increases are more common than price decreases. The agricultural sector seems to have the more symmetrical distribution on this respect and services the more skewed one.
- The average size of the price changes also differ between sectors. There are many small price changes, but big changes are not uncommon.
- Average frequencies are correlated with annual headline inflation while average magnitudes do not seem to move that strongly with it. When big shocks affect inflation, the fraction of firms adjusting their prices seem to vary considerably.

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<sup>8</sup>Both Gagnon's figures and our figures may be biased given the datasets, the exact frequency and durations can only be obtained using the collected prices and not the averaged ones.



When focusing on the time series, at the beginning of our sample, average frequencies and magnitudes were rather stable. Nevertheless, when inflation is importantly affected by shocks, mainly frequencies of price changes respond. Although on average the price setting in Mexico seem to be state dependent (mainly under big shocks), each sector seem to have a different strategy when setting prices and there is also evidence of time dependent behaviors.

This paper gives an initial insight of the price setting process in Mexico. Nevertheless it only gives descriptive statistics, and it should be taken as a starting point for a better model or a microeconomic analysis of specific sectors that can provide deeper conclusions.

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## Appendix

The results given in this paper are based on the monthly averages of the collected prices of items that form the *Índice Nacional de Precios al Consumidor* which are published each month in the *Diario Oficial de la Federación*. As explained carefully in Gagnon (2009), the fact of working with monthly averages instead of the collected prices may bias the results. For example, if the price change for a weekly sampled item does not happen at the beginning of the month, but instead, let us say, in the last week, the averaged price of that month will differ from the last observed price. This fact can cause that one given price change may be reflected in the averages as two smaller consecutive ones, therefore frequencies may be overestimated and magnitudes underestimated when using averages.

In this appendix, the average frequencies and average magnitudes of price changes will be estimated for a few products using the collected prices and not the monthly averages. This will allow us to have an idea of how biased are the results if averages are used.

Monthly average frequencies and average magnitudes for price changes, price increases, and price decreases are shown in Table 15 for few of the product categories of the *Índice Nacional de Precios al Consumidor* using the collected prices and not the monthly averages. Comparing these figures with the corresponding ones in Tables 6 to 14, it can be seen that by using monthly averaged prices the average frequencies tend to be overestimated and the average magnitudes underestimated. Nevertheless, all the statistics are biased and in the same direction for all items. So even if the quantitative results are not exact, the qualitative results of the paper stand.

The conclusions given in this document can be drawn independently of the inherent problems of using averaged prices. However, it will be of interest as future work to use all collected prices, and not the monthly averages, to do the estimations given that additional characteristics of the price setting process can be studied (for example synchronization, survival analysis and hazard functions, the use of psychological and round prices).

	All Products	Excluding 38 Categories
<b>Total</b>		
Categories	315	277
Weight	100%	79.94%
Trajectories	102,615	75,496
Quotes	6,510,431	5,192,170
Mean Monthly Quotes	73,151	58,339
Minimum Monthly Quotes	57,568 (Ago.2002)	-
Maximum Monthly Quotes	85,837 (Oct.2007)	-
<b>Unregulated Products</b>		
Categories	295	257
Weight	82.83%	62.78%
Trajectories	97,592	70,473
Quotes	6,118,069	4,855,792
<b>Regulated Products</b>		
Categories	20	20
Weight	17.16%	17.16%
Trajectories	5,024	5,024
Quotes	391,854	336,378

Table 1: Categories, trajectories, and quotes of the whole database.

	All Products	Excluding 38 Products
Unregulated Products		
Categories	295	257
Weight	82.83%	78.53%
Food		
Categories	67	67
Weight	14.67%	18.35%
Rest of Merchandise		
Categories	124	90
Weight	22.35%	21.68%
Housing		
Categories	6	4
Weight	17.86%	4.22%
Education		
Categories	8	8
Weight	5.2%	6.50%
Rest of Services		
Categories	35	35
Weight	14.68%	17.69%
Fruit and Vegetables		
Categories	34	34
Weight	3.27%	4.09%
Farm-Related		
Categories	21	21
Weight	4.8%	6.00%
Regulated Products		
Categories	20	20
Weight	17.16%	21.47%
Administered		
Categories	4	4
Weight	7.77%	9.72%
Regulated		
Categories	16	16
Weight	9.39%	11.75%

Table 2: Categories and weights of regulated and unregulated groups.

FREQUENCIES					
	Unweighted	Weighted		Unweighted	Weighted
All Products					
Price changes	0.39	0.35			
Price increases	0.23	0.24			
Price decreases	0.16	0.11			
Unregulated Products			Regulated Products		
Price changes	0.40	0.32	Price changes	0.27	0.47
Price increases	0.23	0.20	Price increases	0.22	0.40
Price decreases	0.17	0.12	Price decreases	0.05	0.07
Food			Administered		
Price changes	0.43	0.37	Price changes	0.90	0.90
Price increases	0.26	0.23	Price increases	0.81	0.81
Price decreases	0.17	0.14	Price decreases	0.09	0.09
Rest of Merchandise			Regulated		
Price changes	0.29	0.32	Price changes	0.11	0.12
Price increases	0.17	0.19	Price increases	0.07	0.06
Price decreases	0.12	0.13	Price decreases	0.04	0.06
Housing					
Price changes	0.10	0.10			
Price increases	0.08	0.08			
Price decreases	0.02	0.02			
Education					
Price changes	0.14	0.15			
Price increases	0.13	0.14			
Price decreases	0.01	0.01			
Rest of Services					
Price changes	0.12	0.15			
Price increases	0.09	0.11			
Price decreases	0.03	0.04			
Fruit and Vegetables					
Price changes	0.86	0.85			
Price increases	0.45	0.44			
Price decreases	0.41	0.41			
Farm-Related					
Price changes	0.61	0.64			
Price increases	0.34	0.37			
Price decreases	0.27	0.27			

Table 3: Weighted and unweighted average frequencies of price changes.



MAGNITUDES					
	Unweighted	Weighted		Unweighted	Weighted
All Products					
Price changes	0.016	0.022			
Price increases	0.094	0.075			
Price decreases	0.133	0.132			
Unregulated Products			Regulated Products		
Price changes	0.015	0.022	Price changes	0.024	0.022
Price increases	0.096	0.085	Price increases	0.063	0.041
Price decreases	0.133	0.143	Price decreases	0.129	0.089
Food			Administered		
Price changes	0.013	0.015	Price changes	0.006	0.006
Price increases	0.065	0.062	Price increases	0.014	0.015
Price decreases	0.069	0.067	Price decreases	0.059	0.064
Rest of Merchandise			Regulated		
Price changes	0.011	0.010	Price changes	0.029	0.035
Price increases	0.101	0.085	Price increases	0.075	0.063
Price decreases	0.135	0.110	Price decreases	0.147	0.110
Housing					
Price changes	0.028	0.028			
Price increases	0.099	0.105			
Price decreases	0.337	0.395			
Education					
Price changes	0.028	0.031			
Price increases	0.099	0.061			
Price decreases	0.337	0.228			
Rest of Services					
Price changes	0.042	0.047			
Price increases	0.115	0.103			
Price decreases	0.233	0.196			
Fruit and Vegetables					
Price changes	0.006	0.005			
Price increases	0.147	0.153			
Price decreases	0.149	0.155			
Farm-Related					
Price changes	0.007	0.008			
Price increases	0.067	0.061			
Price decreases	0.071	0.063			

Table 4: Weighted and unweighted average magnitudes of price changes.

DURATIONS					
	Unweighted	Weighted		Unweighted	Weighted
All Products					
Price changes	4.6	5.5			
Price increases	7.3	8.7			
Price decreases	20.3	30.7			
Unregulated Products			Regulated Products		
Price changes	4.0	5.1	Price changes	12.4	7.2
Price increases	6.2	7.0	Price increases	21.8	15.1
Price decreases	18.0	28.6	Price decreases	50.1	38.2
Food			Administered		
Price changes	2.0	2.6	Price changes	0.4	0.4
Price increases	3.6	4.3	Price increases	0.6	0.6
Price decreases	7.1	10.2	Price decreases	23.4	20.8
Rest of Merchandise			Regulated		
Price changes	3.9	3.5	Price changes	15.4	12.7
Price increases	6.5	5.8	Price increases	27.1	27.0
Price decreases	12.7	11.6	Price decreases	56.7	52.5
Housing					
Price changes	12.3	12.5			
Price increases	14.8	15.0			
Price decreases	65.5	67.8			
Education					
Price changes	7.0	6.3			
Price increases	8.0	7.0			
Price decreases	69.2	70.1			
Rest of Services					
Price changes	12.2	9.7			
Price increases	15.8	12.1			
Price decreases	62.6	58.8			
Fruit and Vegetables					
Price changes	0.5	0.5			
Price increases	1.7	1.8			
Price decreases	2.0	2.0			
Farm-Related					
Price changes	1.1	1.0			
Price increases	2.4	2.2			
Price decreases	3.4	3.3			

Table 5: Weighted and unweighted average durations of price changes.

FOOD	fr	fr(+)	dp	dp(+)	dp(-)	impl. dur.	impl. dur.(+)
Corn tortilla	0.19	0.14	0.040	0.086	0.084	4.61	6.53
Corn dough and flour	0.35	0.22	0.018	0.065	0.060	2.36	4.06
Corn (maize)	0.39	0.24	0.028	0.090	0.074	2	3.57
Sweet rolls, coffeecakes	0.39	0.23	0.016	0.054	0.041	2.03	3.76
White bread	0.37	0.21	0.011	0.058	0.053	2.15	4.14
Tin loaf (sliced bread)	0.45	0.3	0.017	0.046	0.040	1.69	2.82
Pastries and cakes	0.33	0.21	0.019	0.062	0.062	2.52	4.14
Soup pasta	0.55	0.31	0.009	0.069	0.067	1.26	2.74
Popular cookies (crackers)	0.54	0.32	0.012	0.070	0.070	1.29	2.61
Whole-wheat tortillas	0.35	0.24	0.021	0.062	0.064	2.31	3.7
Other cookies	0.48	0.28	0.013	0.072	0.072	1.54	3
Wheat flour	0.49	0.29	0.012	0.068	0.068	1.48	2.9
Cereal flakes	0.53	0.29	0.007	0.068	0.068	1.33	2.89
Rice	0.59	0.34	0.016	0.076	0.065	1.12	2.41
Ham	0.58	0.34	0.007	0.056	0.063	1.14	2.4
Sausages	0.58	0.34	0.010	0.061	0.063	1.16	2.39
Chorizo sausage	0.44	0.27	0.011	0.055	0.059	1.71	3.14
Other cold cuts	0.46	0.29	0.010	0.058	0.070	1.63	2.96
Dried beef	0.32	0.2	0.012	0.067	0.079	2.59	4.46
Bacon	0.47	0.28	0.011	0.059	0.059	1.56	3.05
Canned tuna and sardine	0.57	0.34	0.014	0.060	0.053	1.17	2.39
Other fish and seafood in brine	0.34	0.21	0.014	0.113	0.139	2.38	4.26
Pasteurized and whole milk	0.29	0.21	0.019	0.045	0.049	2.93	4.24
Powdered milk	0.47	0.29	0.009	0.045	0.051	1.57	2.89
Evaporated and sweetened milk	0.47	0.3	0.010	0.041	0.046	1.57	2.75
Fresh cheese	0.51	0.3	0.009	0.057	0.065	1.42	2.76
Yoghurt	0.57	0.3	0.000	0.062	0.067	1.18	2.85
Oaxaca or Asadero cheese	0.54	0.32	0.009	0.052	0.055	1.28	2.56
Cream	0.47	0.26	0.004	0.059	0.063	1.56	3.29
Manchego Chihuahua cheese	0.54	0.33	0.010	0.055	0.059	1.29	2.51
Other types of cheeses	0.49	0.3	0.014	0.072	0.072	1.47	2.83
Ice cream	0.38	0.21	0.000	0.070	0.091	2.11	4.18
American yellow cheese	0.5	0.29	0.007	0.062	0.070	1.46	2.91
Butter	0.41	0.26	0.021	0.072	0.068	1.89	3.31
Vegetable oils and fats	0.58	0.34	0.014	0.064	0.057	1.16	2.39
Other dried vegetables	0.4	0.24	0.019	0.081	0.077	1.96	3.56
Canned juices	0.57	0.31	0.004	0.069	0.076	1.19	2.67
Processed peppers	0.48	0.29	0.016	0.075	0.071	1.51	2.95
Canned vegetables	0.45	0.27	0.013	0.067	0.068	1.65	3.15
Tomato puree and canned soups	0.46	0.27	0.008	0.069	0.078	1.62	3.19
Other canned fruits	0.48	0.28	0.009	0.060	0.059	1.54	3.09
Babies food (fruits and vegetables)	0.44	0.27	0.009	0.052	0.057	1.73	3.25
Sugar	0.52	0.31	0.024	0.076	0.051	1.35	2.69
Instant coffee	0.48	0.29	0.008	0.047	0.052	1.54	2.93
Toasted coffee beans	0.34	0.22	0.017	0.067	0.071	2.4	4.1
Bottled sodas	0.32	0.18	0.001	0.063	0.079	2.55	4.99
Bottled water	0.35	0.19	0.002	0.082	0.092	2.3	4.7
Mayonnaise and mustard	0.48	0.28	0.010	0.063	0.065	1.52	3.01
Salt and chicken seasoning	0.4	0.24	0.011	0.069	0.076	1.95	3.63
Other condiments	0.37	0.22	0.003	0.066	0.086	2.14	4.04
Chips and similar items	0.46	0.28	0.014	0.069	0.069	1.61	3.06
Soda powder	0.43	0.23	0.007	0.082	0.079	1.79	3.84

FOOD (cont.)	fr	fr(+)	dp	dp(+)	dp(-)	impl. dur.	impl. dur.(+)
Chocolate	0.53	0.31	0.009	0.057	0.059	1.33	2.71
Sweets, caramel and honey	0.4	0.24	0.012	0.074	0.084	1.94	3.58
Powder gelatin	0.56	0.33	0.013	0.072	0.069	1.22	2.52
Other cooked food	0.25	0.17	0.024	0.084	0.108	3.53	5.41
Fried (pork) beef	0.14	0.11	0.029	0.066	0.082	6.39	8.66
Roasted chicken	0.33	0.23	0.017	0.048	0.057	2.54	3.85
Barbecued goat meat or birria	0.15	0.12	0.030	0.062	0.078	6.14	8.13
Pizzas	0.23	0.16	0.014	0.072	0.108	3.84	5.91
Beer	0.36	0.21	0.007	0.054	0.060	2.23	4.22
Tequila	0.44	0.21	-0.005	0.060	0.066	1.74	4.22
Other spirits	0.39	0.22	0.004	0.062	0.069	2.05	4.13
Rum	0.4	0.24	0.006	0.052	0.058	1.93	3.73
Brandy	0.43	0.23	0.006	0.061	0.056	1.78	3.86
Wine	0.31	0.18	0.023	0.099	0.085	2.7	4.98
Cigarettes	0.2	0.18	0.047	0.060	0.069	4.59	5.15

Table 6: Food categories' statistics.

OTHER MERCHANDISE	fr	fr(+)	dp	dp(+)	dp(-)	impl. dur.	impl. dur.(+)
Hats	0.1	0.07	0.017	0.124	0.230	9.19	13.45
Other expenses for footwear	0.12	0.08	0.002	0.093	0.199	7.91	11.78
Bags, baggage and belts	0.15	0.09	0.008	0.174	0.242	6.35	10.93
Kitchen furniture	0.3	0.17	0.003	0.099	0.132	2.81	5.21
Dining tables	0.32	0.18	0.009	0.099	0.117	2.62	4.92
Stoves	0.35	0.2	0.006	0.080	0.095	2.3	4.43
Boilers	0.26	0.17	0.018	0.071	0.080	3.25	5.3
Living room furniture	0.34	0.2	0.007	0.090	0.105	2.39	4.57
Dining room furniture	0.31	0.17	-0.002	0.102	0.134	2.7	5.25
Mattresses	0.34	0.21	0.006	0.096	0.132	2.39	4.3
Other home furniture	0.28	0.16	0.005	0.123	0.158	3.04	5.65
Bedroom furniture	0.34	0.19	0.003	0.089	0.115	2.44	4.63
Fridges	0.34	0.2	0.004	0.069	0.085	2.37	4.53
Washer machine	0.35	0.19	0.005	0.082	0.089	2.32	4.65
Other electric appliances	0.29	0.16	-0.003	0.102	0.142	2.96	5.62
Air conditioning	0.23	0.12	0.005	0.117	0.126	3.92	7.74
Fans	0.25	0.15	0.021	0.130	0.144	3.52	6.21
Irons	0.3	0.18	0.010	0.112	0.138	2.78	5.06
Blender	0.32	0.19	0.010	0.094	0.117	2.57	4.64
TV sets	0.29	0.14	0.011	0.135	0.110	2.96	6.53
Computers	0.21	0.09	-0.010	0.141	0.129	4.2	10.17
Sound system	0.28	0.14	-0.008	0.124	0.136	3.03	6.73
Video players	0.26	0.11	-0.034	0.134	0.154	3.3	8.69
Radios and recorders	0.24	0.13	-0.002	0.134	0.163	3.64	7.15
Bulbs	0.25	0.15	0.018	0.114	0.123	3.45	6.17
Matches	0.11	0.08	0.056	0.143	0.133	8.46	12.58
Batteries	0.3	0.17	0.012	0.107	0.120	2.85	5.27
Candles	0.26	0.18	0.020	0.099	0.148	3.34	5.15
Brooms	0.28	0.17	0.003	0.098	0.135	3.04	5.51

OTHER MERCHANDISE (cont.)	fr	fr(+)	dp	dp(+)	dp(-)	impl. dur.	impl. dur.(+)
China and glassware	0.28	0.16	-0.002	0.113	0.170	3.1	5.61
Cooking battery	0.26	0.15	0.006	0.136	0.179	3.29	5.99
Plastic cookware	0.25	0.15	0.012	0.132	0.175	3.42	5.99
Other cookware appliances	0.24	0.14	-0.008	0.124	0.187	3.67	6.76
Bedspreads	0.2	0.12	0.007	0.139	0.183	4.56	8.11
Linen	0.21	0.14	0.023	0.116	0.153	4.27	6.82
Bed sheets	0.2	0.12	0.005	0.121	0.173	4.43	7.68
Blankets	0.15	0.09	-0.005	0.154	0.249	6.23	10.66
Towels	0.21	0.13	0.001	0.112	0.166	4.17	7.32
Curtains	0.16	0.1	0.008	0.122	0.190	5.9	9.6
Detergents	0.52	0.3	0.010	0.059	0.057	1.35	2.77
Fabric softener and cleaners	0.53	0.28	-0.001	0.066	0.076	1.33	3.05
Bleach	0.5	0.27	0.000	0.068	0.079	1.46	3.19
Soap for clothes	0.44	0.27	0.015	0.071	0.072	1.72	3.19
Air freshener	0.37	0.22	0.014	0.093	0.098	2.2	4.12
Pesticides	0.42	0.23	0.002	0.102	0.117	1.84	3.88
Antibiotics	0.41	0.27	0.024	0.078	0.084	1.91	3.15
Painkillers	0.4	0.27	0.020	0.075	0.089	1.94	3.23
Cardiovascular medicine	0.36	0.26	0.027	0.067	0.081	2.25	3.33
Nutritional supplements	0.37	0.25	0.018	0.082	0.103	2.13	3.55
Contraceptives and hormones	0.39	0.28	0.030	0.073	0.073	1.99	3.05
Gastrointestinal medicine	0.39	0.26	0.019	0.074	0.094	2.03	3.31
Expectorants and decongestants	0.39	0.25	0.020	0.078	0.087	2.02	3.42
Other medicine	0.35	0.24	0.022	0.072	0.084	2.29	3.62
Dermatological medicine	0.33	0.21	0.011	0.085	0.116	2.53	4.34
Antiviral medicine	0.37	0.24	0.011	0.082	0.115	2.15	3.72
Healing supplies	0.27	0.16	0.005	0.105	0.146	3.17	5.62
Lenses and other appliances	0.11	0.07	0.015	0.105	0.203	9.01	12.93
Dental prothesis	0.06	0.06	0.054	0.111	0.317	15.12	17.59
Hair products	0.48	0.26	0.001	0.083	0.094	1.51	3.29
Lotion and perfumes	0.26	0.16	-0.006	0.116	0.183	3.29	5.92
Face soap	0.41	0.24	0.010	0.070	0.075	1.88	3.62
Toothpaste	0.37	0.21	0.004	0.072	0.086	2.13	4.18
Deodorant	0.44	0.24	0.004	0.072	0.079	1.72	3.59
Skin creams	0.43	0.24	0.011	0.103	0.106	1.8	3.66
Razors and shaving machines	0.31	0.18	0.008	0.100	0.119	2.73	5.1
Make-up	0.28	0.16	-0.004	0.107	0.160	3.02	5.56
Other toiletry	0.26	0.15	0.006	0.116	0.147	3.26	5.98
Other make-up supplies	0.29	0.17	0.004	0.108	0.145	2.97	5.41
Toilet paper	0.47	0.27	0.008	0.088	0.100	1.57	3.16
Diapers	0.47	0.28	0.017	0.085	0.080	1.56	3.06
Sanitary towels	0.45	0.24	0.005	0.087	0.092	1.69	3.62
Napkins	0.46	0.27	0.009	0.073	0.077	1.6	3.24
Tissues	0.38	0.22	0.007	0.081	0.095	2.11	4.04
Automobile	0.31	0.21	0.008	0.035	0.043	2.67	4.34
Bicycle	0.23	0.14	0.010	0.111	0.143	3.85	6.73
Tires	0.31	0.21	0.011	0.066	0.102	2.71	4.32
Other spare parts	0.19	0.13	0.012	0.083	0.142	4.68	7.06
Accumulators	0.23	0.18	0.028	0.060	0.077	3.83	5.13
Text books	0.12	0.1	0.037	0.081	0.129	7.66	9.84
Other books	0.12	0.08	0.032	0.125	0.179	7.72	11.38

OTHER MERCHANDISE (cont.)	fr	fr(+)	dp	dp(+)	dp(-)	impl. dur.	impl. dur.(+)
Notebooks and files	0.22	0.14	0.014	0.111	0.152	4.03	6.65
Pens, pencils and others	0.19	0.12	0.023	0.118	0.145	4.88	7.95
Newspapers	0.04	0.03	0.054	0.156	0.446	24.59	29.72
Magazines	0.06	0.05	0.059	0.096	0.181	15.86	18.41
Toys	0.22	0.13	0.004	0.150	0.194	4.05	7.42
CD's and cassettes	0.17	0.09	-0.005	0.114	0.144	5.4	10.5
Pets food	0.39	0.23	0.014	0.077	0.082	2.05	3.73
Photographic material and equipment	0.2	0.11	0.000	0.103	0.134	4.4	8.21
Musical instruments and others	0.15	0.1	0.006	0.102	0.171	6.3	10
Sporting appliances	0.17	0.11	0.003	0.126	0.212	5.27	8.6

Table 7: Other merchandise categories' statistics.

HOUSING	fr	fr(+)	dp	dp(+)	dp(-)	impl. dur.	impl. dur.(+)
Housing maintenance materials	0.21	0.15	0.014	0.066	0.102	4.14	6.21
Housing maintenance services	0.08	0.06	0.020	0.082	0.253	12.39	15.31
Domestic service	0.06	0.05	0.028	0.129	0.606	15.37	17.85
Other housing services	0.06	0.05	0.050	0.118	0.383	17.26	20.01

Table 8: Housing categories' statistics.

EDUCATION	fr	fr(+)	dp	dp(+)	dp(-)	impl. dur.	impl. dur.(+)
College	0.15	0.13	0.020	0.052	0.269	6.27	7.02
Elementary school	0.17	0.16	0.037	0.052	0.151	5.24	5.71
High school	0.15	0.13	0.025	0.060	0.263	6.17	6.99
Junior high school	0.16	0.15	0.040	0.058	0.214	5.57	6.02
Kindergarten	0.16	0.14	0.044	0.063	0.162	5.83	6.43
Technical career	0.1	0.08	0.053	0.109	0.247	9.67	11.61
Further education	0.08	0.07	0.042	0.135	0.340	11.27	14.17
Play school and nursery	0.16	0.15	0.036	0.057	0.170	5.71	6.35

Table 9: Education categories' statistics.

OTHER SERVICES							
	fr	fr(+)	dp	dp(+)	dp(-)	impl. dur.	impl. dur.(+)
Drycleaners service	0.1	0.08	0.022	0.075	0.196	9.56	12.01
Laundry service	0.07	0.06	0.052	0.132	0.283	13.9	17.3
Medical consultation	0.05	0.05	0.067	0.125	0.298	18.33	21.39
General hospitalization	0.08	0.07	0.046	0.082	0.148	11.9	14.21
Surgical procedure	0.07	0.06	0.067	0.116	0.189	13.84	16.56
Dental care	0.06	0.05	0.058	0.125	0.297	15.34	18.31
Cabinet medical studies	0.08	0.07	0.041	0.097	0.188	11.48	14.45
Labor hospitalization	0.08	0.07	0.061	0.100	0.152	11.97	14.25
Clinical analysis	0.08	0.06	0.046	0.106	0.174	12.14	15.61
Medical consultation during pregnancy	0.05	0.05	0.086	0.125	0.200	18.39	20.97
Medical services during labor	0.05	0.05	0.072	0.120	0.272	18.04	20.6
Clinical analysis during pregnancy	0.09	0.07	0.029	0.096	0.198	11.07	14.48
Haircut	0.07	0.06	0.049	0.127	0.287	13.58	16.9
Beauty parlor	0.08	0.07	0.057	0.150	0.314	11.65	14.68
Air transportation	0.75	0.44	0.001	0.080	0.115	0.73	1.71
Car repair	0.09	0.07	0.033	0.104	0.300	10.54	12.87
Car washing and waxing	0.08	0.06	0.013	0.102	0.291	12.29	16.03
Car maintenance	0.14	0.1	0.024	0.103	0.165	6.82	9.9
Travel service packages	0.62	0.34	-0.004	0.093	0.120	1.04	2.45
Movie theaters	0.1	0.08	0.036	0.071	0.147	9.51	11.41
Night clubs	0.06	0.05	0.024	0.116	0.259	14.97	20.02
Cable or satellite TV services	0.08	0.06	0.017	0.097	0.253	12.09	15.83
Other entertainment	0.06	0.04	0.072	0.184	0.262	17.42	23.41
Sporting club	0.08	0.06	0.062	0.113	0.222	12.63	14.99
Sports shows	0.06	0.04	0.058	0.185	0.312	17.25	23.2
Internet services	0.04	0.02	-0.028	0.187	0.229	23.65	49.52
Movie rentals	0.08	0.06	0.029	0.125	0.268	12.35	16.5
Diners/Snack bars	0.13	0.12	0.072	0.105	0.153	7.04	8.13
Restaurants	0.14	0.12	0.040	0.071	0.156	6.78	7.95
Canteen, bars	0.08	0.06	0.030	0.101	0.263	12.58	15.76
Coffee shops	0.11	0.09	0.072	0.129	0.237	8.39	10.03
Professional services	0.06	0.05	0.043	0.179	0.491	14.91	18.89
Funeral services	0.09	0.08	0.034	0.085	0.238	10.6	12.67

Table 10: Other services categories' statistics.

FRUITS AND VEGETABLES	fr	fr(+)	dp	dp(+)	dp(-)	impl. dur.	impl. dur.(+)
Apple	0.88	0.46	0.004	0.092	0.092	0.47	1.62
Bananas	0.83	0.42	0.003	0.111	0.108	0.57	1.83
Orange	0.9	0.46	-0.002	0.148	0.160	0.43	1.61
Avocado	0.93	0.48	-0.001	0.127	0.135	0.37	1.54
Mango	0.55	0.29	0.015	0.201	0.206	1.26	2.87
Papaya	0.89	0.45	0.004	0.109	0.107	0.46	1.65
Lime	0.94	0.52	0.011	0.200	0.227	0.36	1.36
Other fruits	0.79	0.42	0.008	0.131	0.132	0.65	1.84
Grape	0.92	0.51	0.017	0.155	0.155	0.4	1.41
Melon	0.94	0.48	0.008	0.161	0.152	0.35	1.53
Watermelon	0.88	0.45	0.004	0.158	0.157	0.46	1.66
Pear	0.87	0.47	0.007	0.092	0.094	0.49	1.56
Peach	0.87	0.47	0.012	0.146	0.144	0.49	1.57
Grapefruit	0.89	0.46	0.001	0.117	0.125	0.46	1.61
Pineapple	0.92	0.47	0.007	0.133	0.124	0.4	1.58
Guava	0.87	0.44	0.002	0.109	0.109	0.49	1.71
Tomato	0.97	0.5	0.001	0.248	0.256	0.28	1.45
Potato	0.88	0.47	0.010	0.122	0.114	0.46	1.6
Onion	0.93	0.48	0.007	0.192	0.195	0.38	1.51
Other vegetables	0.78	0.41	0.005	0.127	0.130	0.66	1.91
Green tomato	0.94	0.46	-0.001	0.199	0.193	0.35	1.62
Zucchini	0.95	0.48	0.005	0.201	0.198	0.34	1.51
Serrano pepper	0.93	0.45	0.000	0.181	0.171	0.38	1.67
Carrots	0.88	0.45	0.005	0.130	0.124	0.47	1.68
Other fresh peppers	0.9	0.46	0.002	0.160	0.161	0.44	1.64
Poblano pepper	0.95	0.49	0.008	0.175	0.168	0.32	1.47
Lettuce and cabbage	0.87	0.45	0.006	0.149	0.147	0.5	1.69
Peas	0.72	0.38	0.008	0.132	0.134	0.78	2.06
Nopales (cactus)	0.72	0.4	0.008	0.127	0.136	0.78	1.98
Chayote or pear squash	0.92	0.46	-0.001	0.189	0.188	0.4	1.63
Cucumber	0.93	0.48	0.002	0.179	0.187	0.37	1.52
Green beans	0.88	0.47	0.005	0.149	0.159	0.47	1.58
Beans	0.57	0.32	0.010	0.078	0.077	1.2	2.59
Dried peppers	0.48	0.28	0.011	0.084	0.087	1.53	3.08

Table 11: Fruit and vegetables categories' statistics.



FARM-RELATED	fr	fr(+)	dp	dp(+)	dp(-)	impl. dur.	impl. dur.(+)
Chicken parts	0.71	0.4	0.007	0.064	0.066	0.81	1.95
Fresh whole chicken	0.71	0.4	0.006	0.061	0.064	0.8	1.95
Pork flesh	0.64	0.35	0.005	0.059	0.061	0.97	2.29
Chops and lard	0.54	0.31	0.012	0.069	0.066	1.28	2.68
Beef tenderloin	0.49	0.28	0.007	0.049	0.049	1.5	3.04
Leg of pork	0.68	0.37	0.005	0.062	0.065	0.88	2.14
Beef steak	0.59	0.35	0.009	0.051	0.054	1.12	2.3
Ground beef or mince	0.59	0.35	0.008	0.056	0.060	1.11	2.35
Beef cutlet and ribs	0.6	0.35	0.008	0.059	0.067	1.11	2.28
Short loin	0.54	0.32	0.009	0.056	0.061	1.3	2.57
Special selection of beef	0.5	0.3	0.008	0.054	0.062	1.46	2.81
Beef liver	0.48	0.26	0.009	0.100	0.103	1.54	3.29
Entrails	0.58	0.32	0.011	0.095	0.094	1.15	2.56
Other cuts of meat	0.46	0.28	0.006	0.068	0.092	1.63	3.05
Other fish	0.66	0.36	0.005	0.077	0.082	0.93	2.25
Prawn	0.73	0.37	-0.001	0.059	0.063	0.77	2.17
Crappie or kelp bass	0.7	0.37	0.003	0.075	0.078	0.84	2.18
Other seafood	0.59	0.33	0.006	0.078	0.081	1.11	2.53
Sea bass and mere	0.58	0.32	0.006	0.075	0.077	1.17	2.63
Snapper	0.66	0.35	0.004	0.076	0.080	0.94	2.31
Egg	0.72	0.42	0.014	0.072	0.067	0.78	1.85

Table 12: Farm-related categories' statistics.

ADMINISTERED	fr	fr(+)	dp	dp(+)	dp(-)	impl. dur.	impl. dur.(+)
Electricity bill	0.97	0.77	0.007	0.032	0.091	0.27	0.68
Domestic gas	0.82	0.73	0.007	0.013	0.037	0.59	0.77
Low-octane gasoline	0.89	0.86	0.004	0.006	0.063	0.45	0.5
High-octane gasoline	0.9	0.88	0.005	0.006	0.043	0.43	0.48

Table 13: Administered goods categories' statistics.

REGULATED	fr	fr(+)	dp	dp(+)	dp(-)	impl. dur.	impl. dur.(+)
Water rights	0.15	0.15	0.031	0.039	0.146	5.97	6.28
Housing taxes	0.06	0.06	0.054	0.069	0.218	16.2	17.14
Local telephone service	0.26	0.07	-0.005	0.020	0.015	3.35	13.61
Long distance national phone service	0.07	0	-0.009	0.000	0.009	14.33	89
Long distance international phone service	0.04	0	-0.009	0.104	0.009	22	89
Telephone line	0.08	0.04	-0.040	0.205	0.320	12.51	23.87
Collective/public transportation	0.06	0.05	0.095	0.103	0.110	17.02	17.69
Urban bus	0.06	0.06	0.077	0.091	0.220	16.21	16.98
Taxi	0.05	0.04	0.050	0.100	0.310	21.14	24.19
Subway or electric train	0.02	0.01	0.061	0.066	0.051	64.71	67.54
Interstate bus	0.2	0.15	0.018	0.052	0.108	4.59	6
Lubricating oils	0.21	0.15	0.025	0.076	0.101	4.17	6.05
Car taxes	0.31	0.12	-0.004	0.004	0.009	2.73	7.53
Highway tolls	0.11	0.1	0.024	0.032	0.078	8.88	9.63
Parking	0.05	0.04	0.053	0.135	0.391	20.16	23.99
License and other documents fees	0.08	0.06	0.043	0.097	0.251	12.55	14.96

Table 14: Regulated goods and services categories' statistics.

APPENDIX TABLE	fr	fr(+)	fr(-)	dp	dp(+)	dp(-)	impl. dur.	impl. dur.(+)
<b>FOOD</b>								
Bottled sodas	0.26	0.14	0.12	0.001	0.100	0.113	3.41	6.78
Cigarettes	0.13	0.11	0.02	0.068	0.099	0.145	7.09	8.22
<b>OTHER MERCHANDISE</b>								
Matches	0.10	0.07	0.03	0.166	0.346	0.209	9.99	15.06
Pesticides	0.31	0.17	0.14	0.003	0.147	0.167	2.66	5.39
<b>HOUSING</b>								
Housing maintenance services	0.07	0.05	0.02	-0.014	0.171	0.56	15.20	20.49
Domestic service	0.05	0.04	0.01	-0.042	0.214	0.912	18.21	23.73
<b>EDUCATION</b>								
Elementary school	0.17	0.14	0.03	0.040	0.064	0.085	5.26	6.35
High school	0.15	0.12	0.03	0.033	0.079	0.167	6.27	7.88
<b>OTHER SERVICES</b>								
Laundry service	0.10	0.07	0.03	0.061	0.191	0.312	14.99	20.39
Movie theaters	0.05	0.04	0.01	0.062	0.190	0.358	17.41	22.92
	0.07	0.06	0.01	0.049	0.110	0.204	12.92	16.14
<b>FRUITS AND VEGETABLES</b>								
Mango	0.44	0.24	0.20	0.021	0.281	0.283	1.73	4.42
Tomato	0.87	0.44	0.43	0.001	0.338	0.345	0.48	1.71
<b>FARM-RELATED</b>								
Beef liver	0.31	0.17	0.14	0.014	0.171	0.180	2.65	5.25
Other cuts of meat	0.31	0.18	0.13	0.007	0.112	0.143	2.69	4.95
<b>ADMINISTERED</b>								
Electricity bill	0.86	0.70	0.16	0.007	0.039	0.127	0.51	0.84
Low-octane gasoline	0.75	0.72	0.03	0.005	0.008	0.081	0.72	0.79
<b>REGULATED</b>								
Car lubricating oils	0.18	0.12	0.06	0.030	0.099	0.109	4.94	7.68
Parking	0.05	0.04	0.01	0.030	0.297	0.750	19.97	26.96

Table 15: Statistics for certain products using all collected prices instead of the monthly averaged prices.

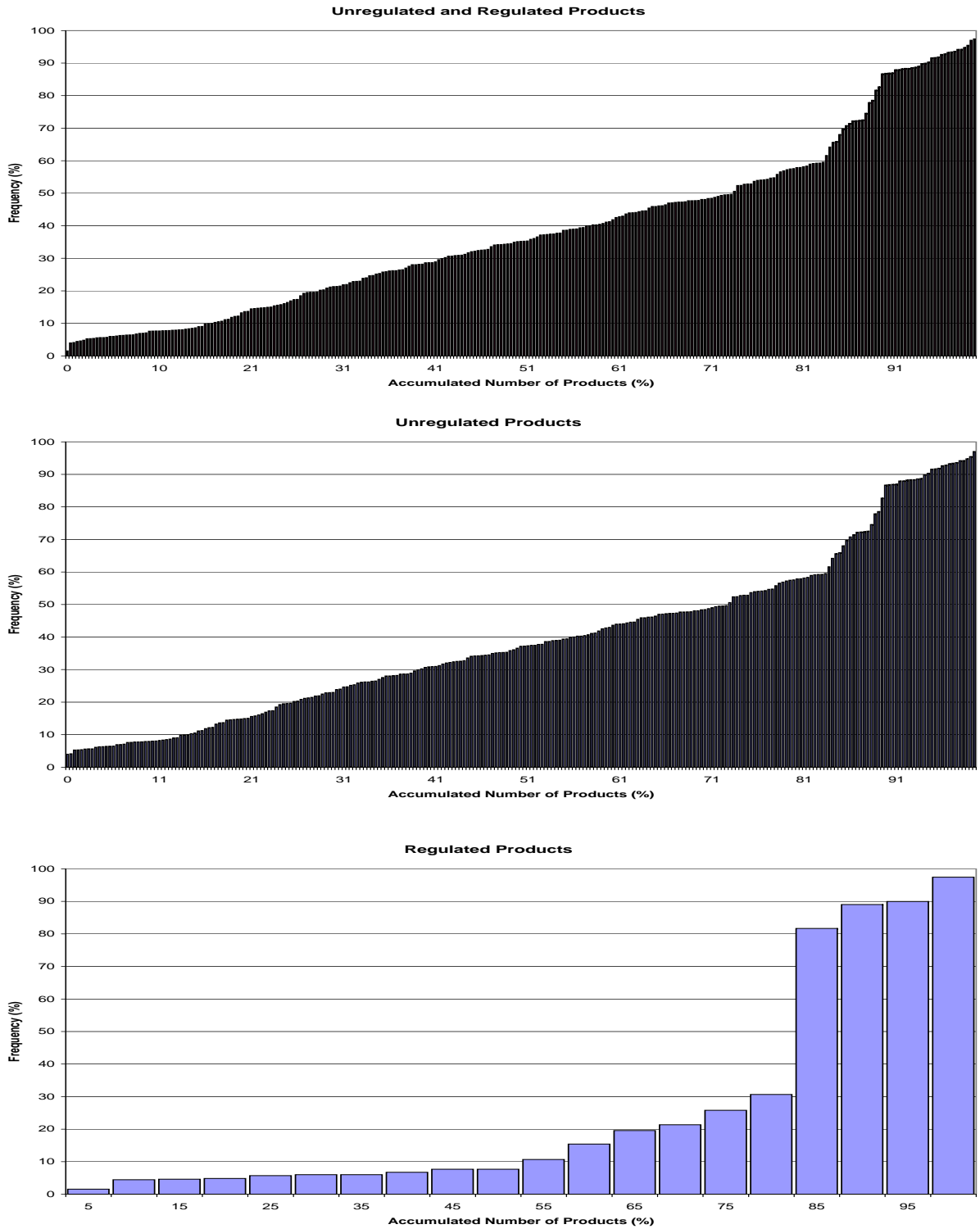


Figure 1: Frequency of price changes by product.

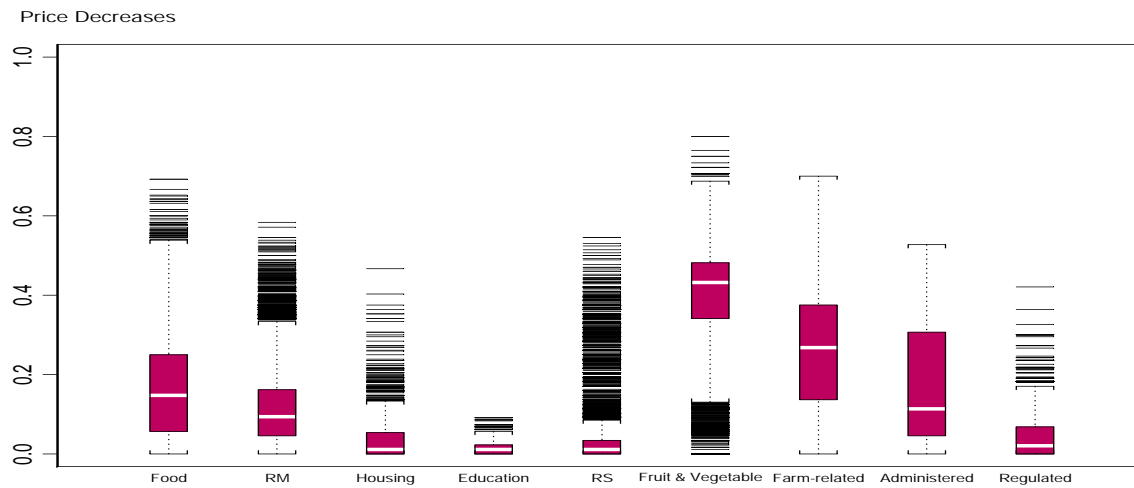
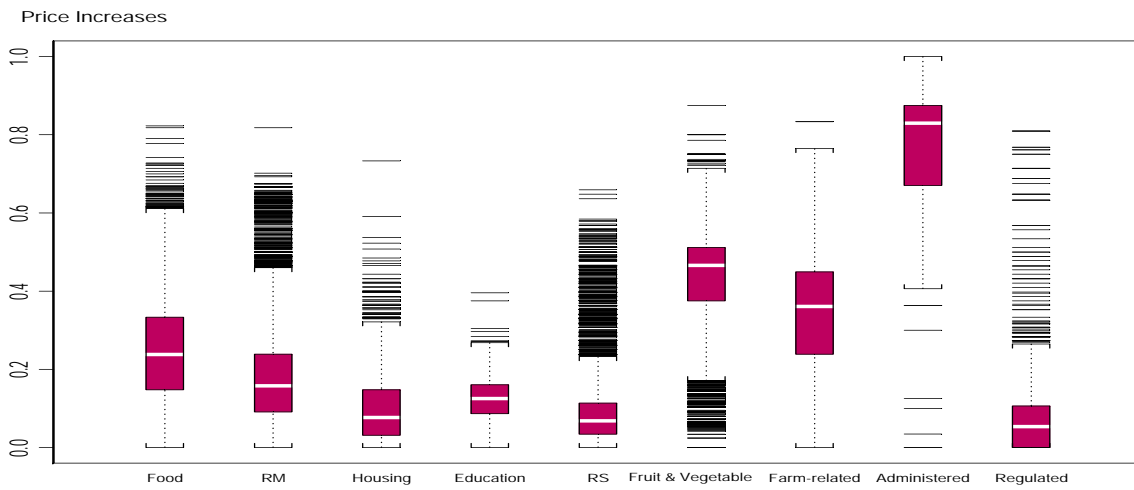
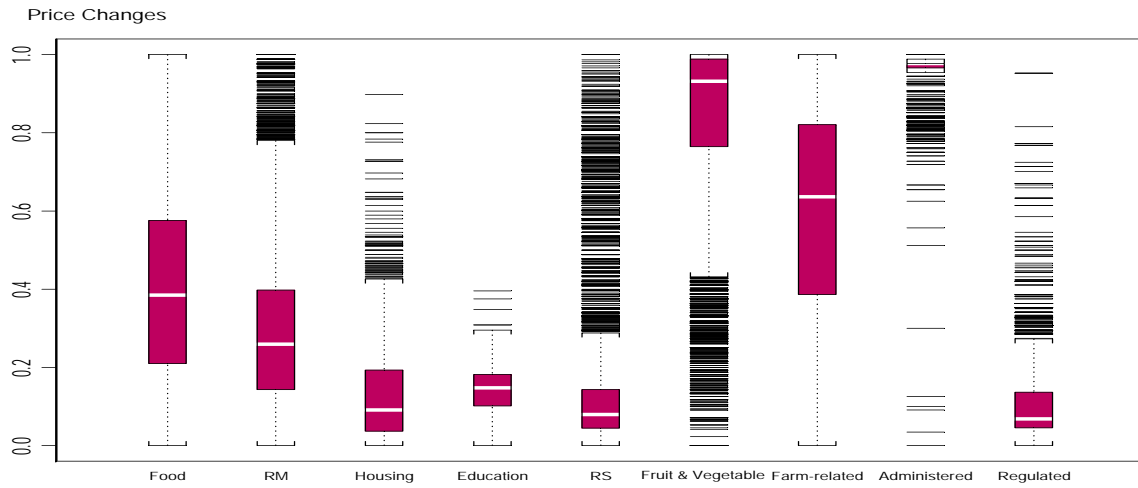


Figure 2: Box-plot of the frequencies of price changes for each group.

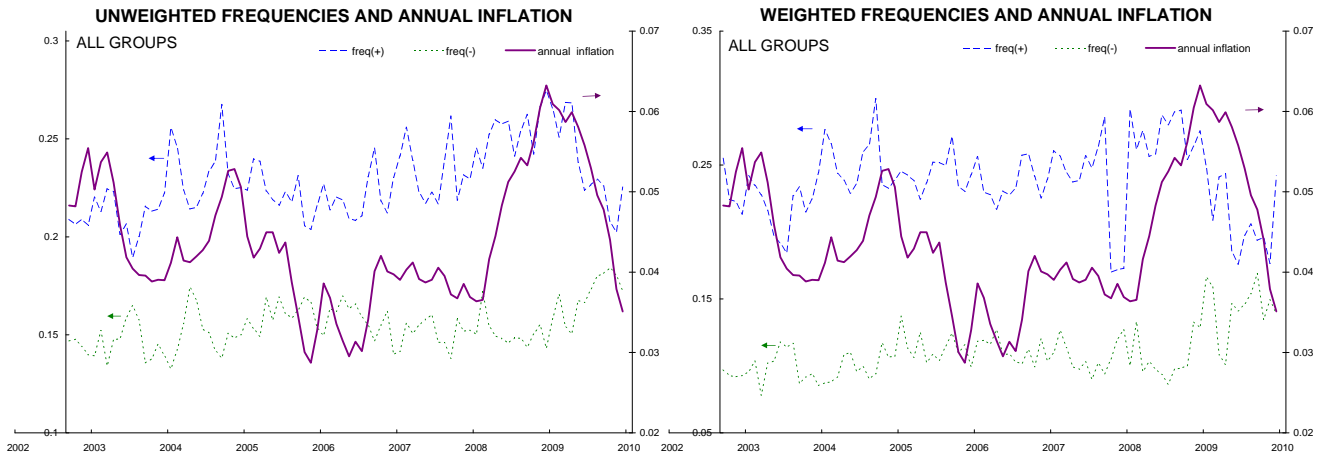


Fig. 3: Time series of annual headline inflation and the price changes frequencies of all products.

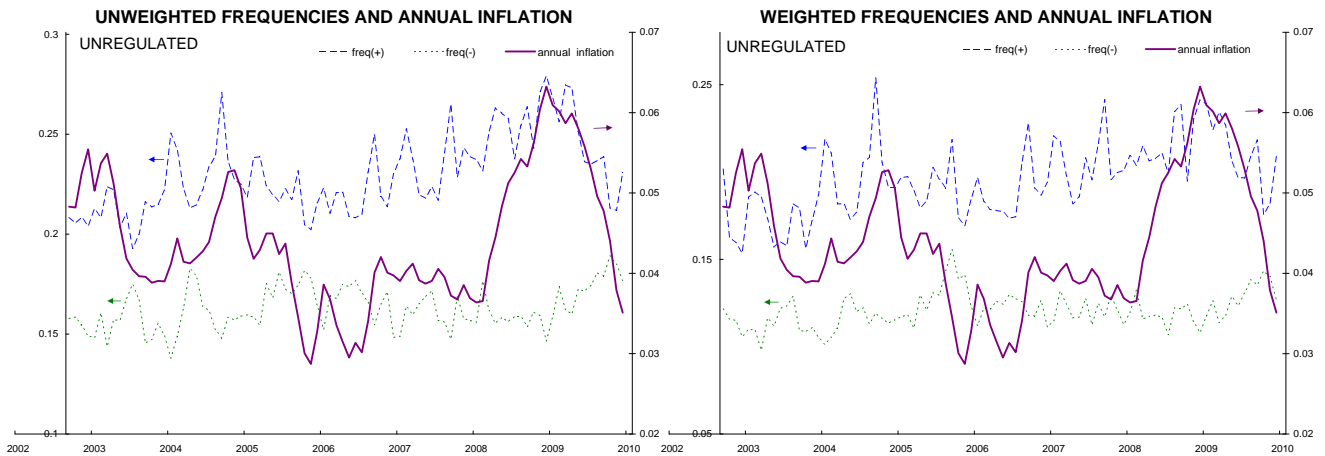


Fig. 4: Time series of annual headline inflation and the price changes frequencies of unreg. products.

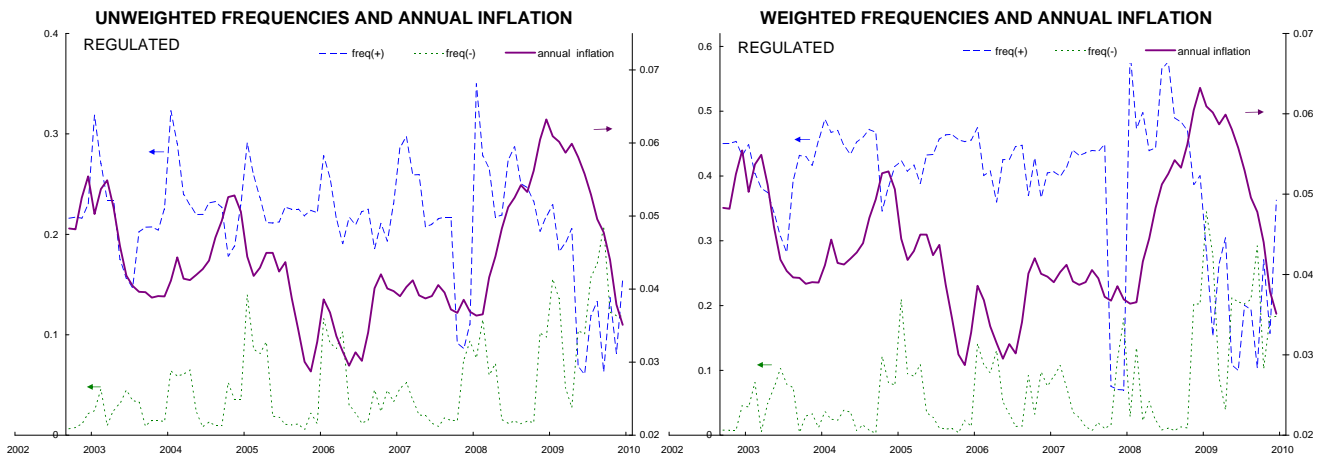


Fig. 5: Time series of annual headline inflation and the price changes frequencies of reg. products.

### UNWEIGHTED FREQUENCIES

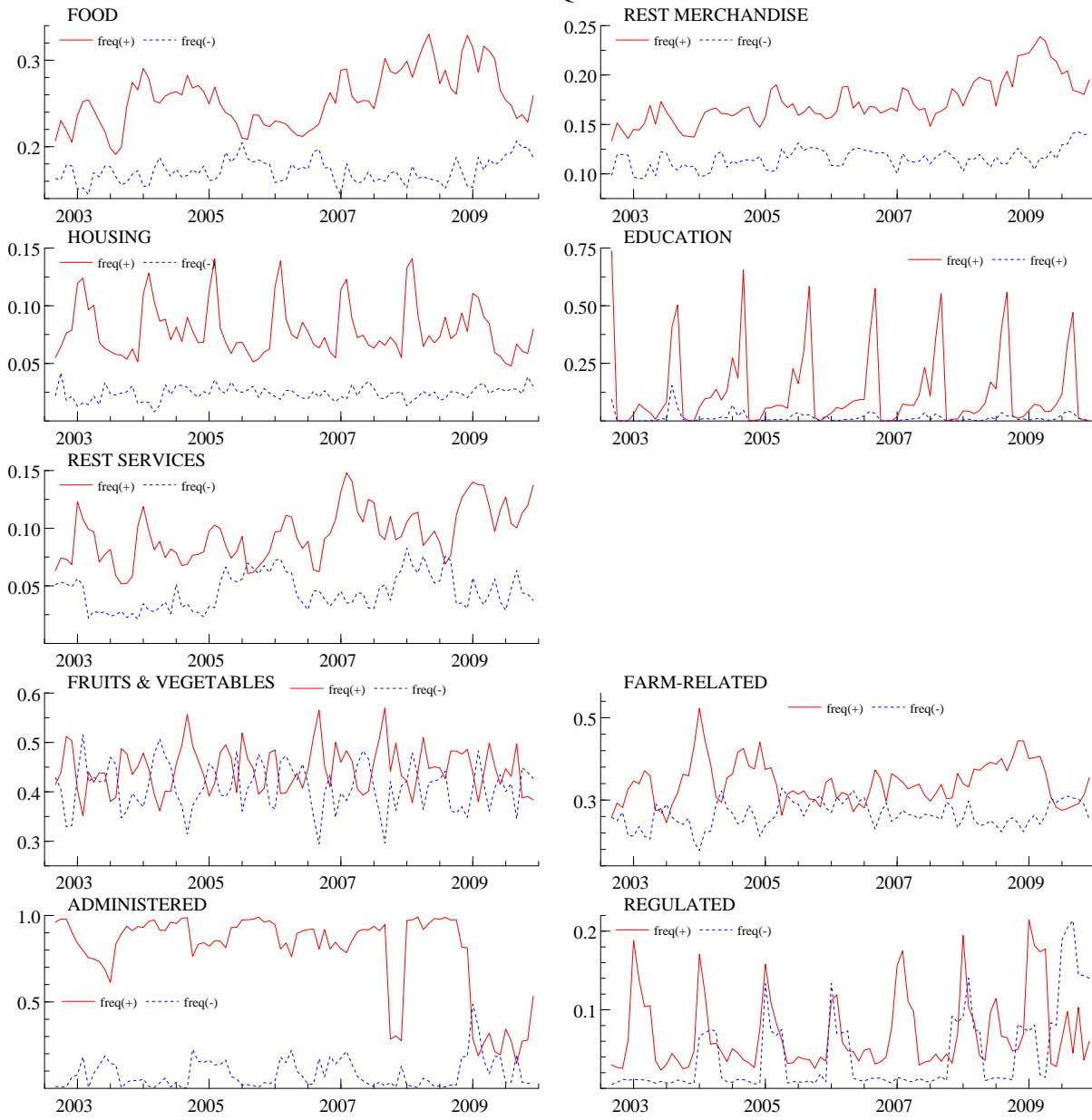


Figure 6: Time series of the unweighted frequencies of price increases and decreases.

### WEIGHTED FREQUENCIES

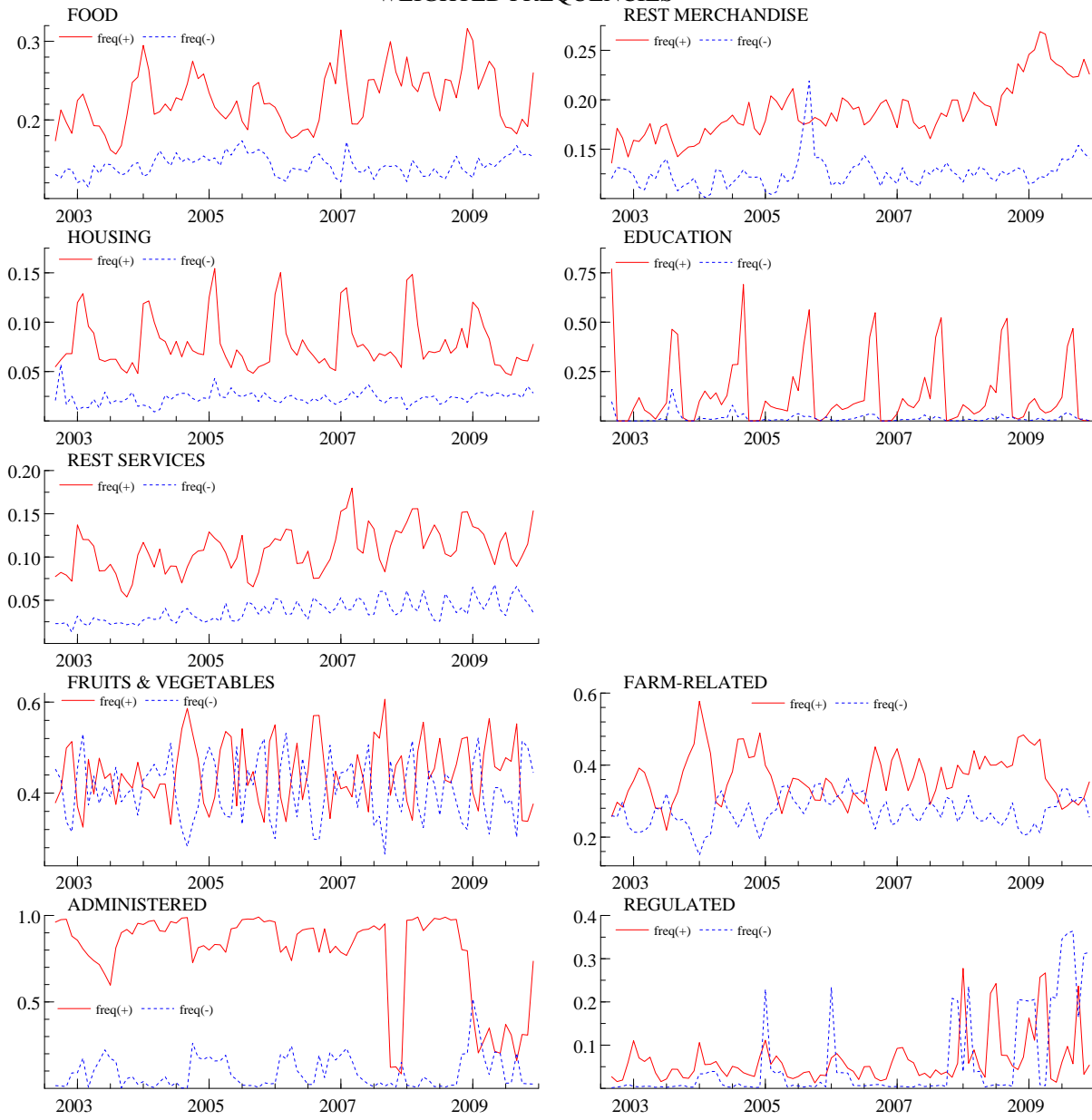


Figure 7: Time series of the weighted frequencies of price increases and decreases.

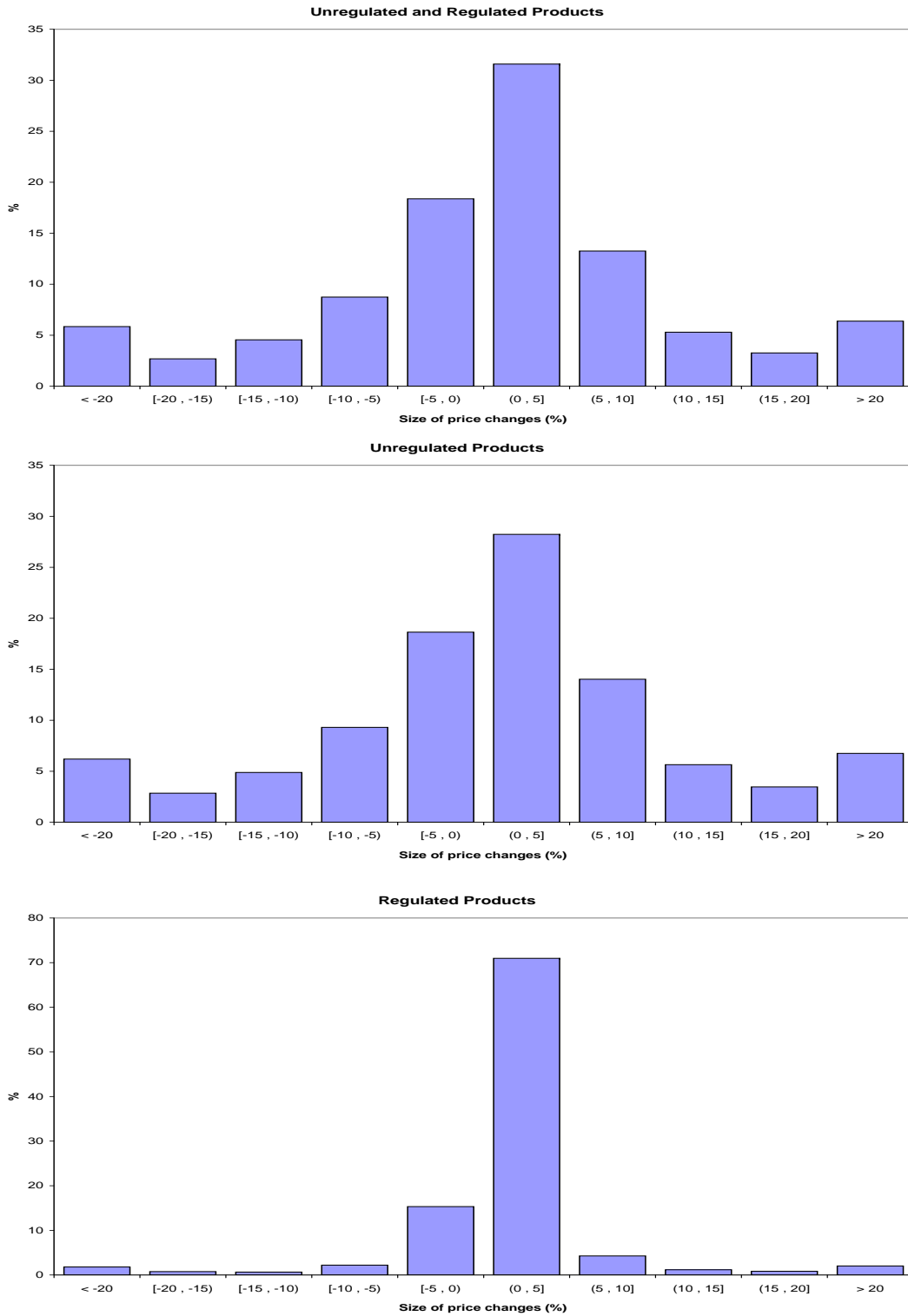


Figure 8: Distribution of the size of price changes.



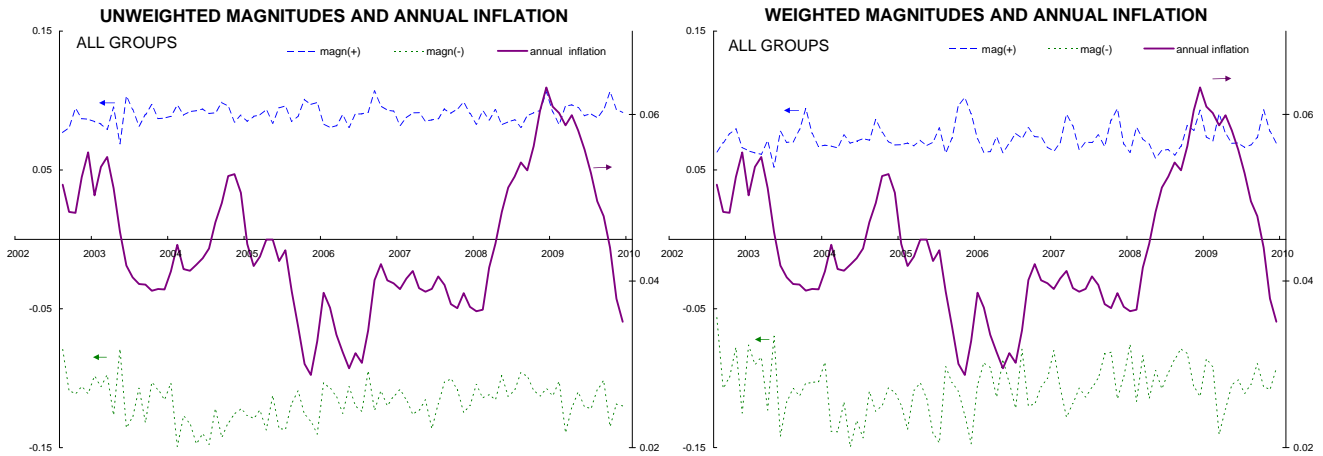


Fig. 9: Time series of annual headline inflation and the size of price changes of all products.

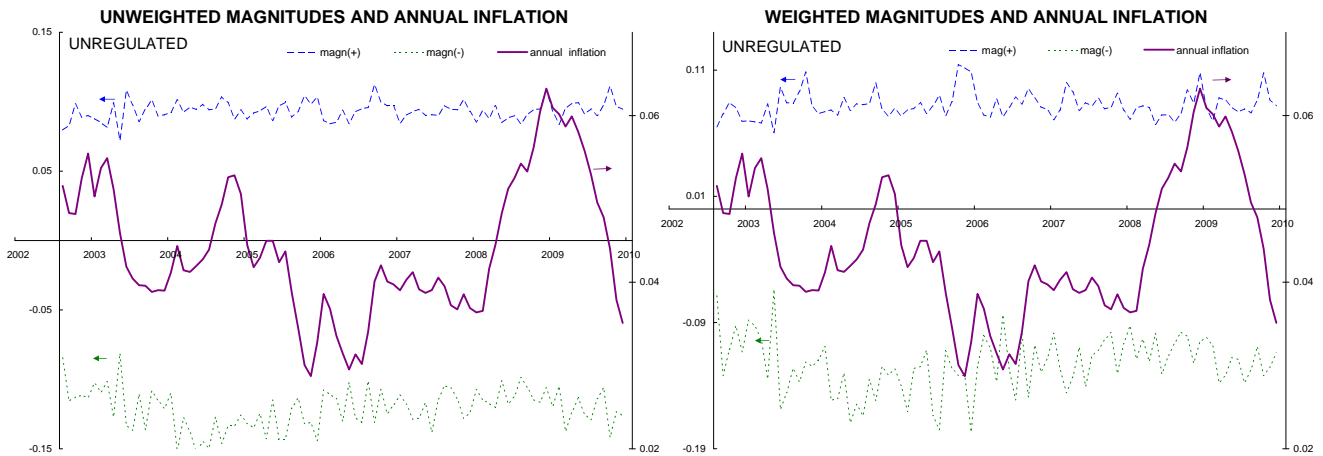


Fig. 10: Time series of annual headline inflation and the size of price changes of unreg. products.

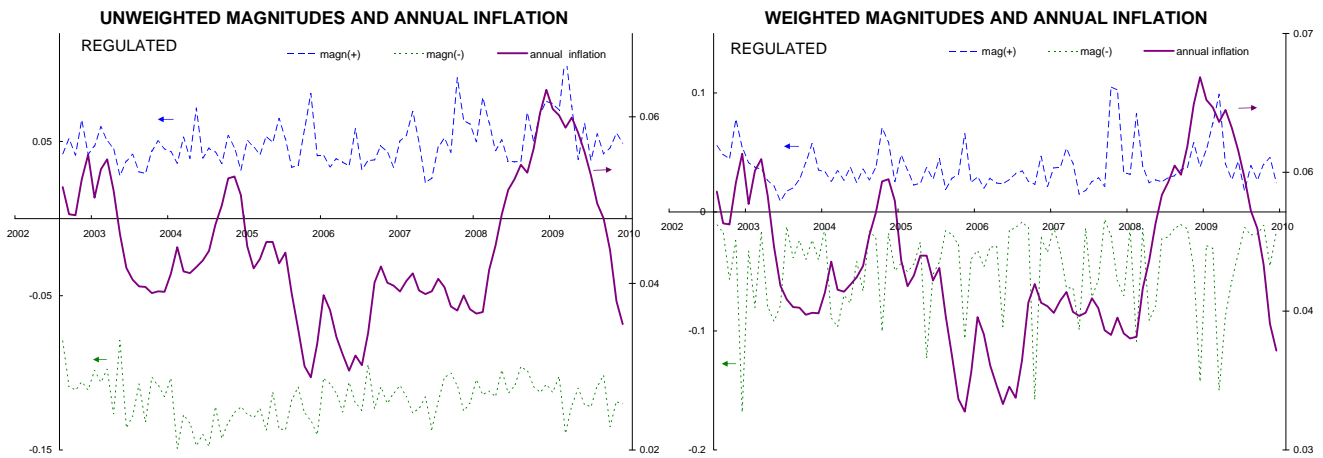


Fig. 11: Time series of annual headline inflation and the size of price changes of reg. products.

### UNWEIGHTED MAGNITUDES

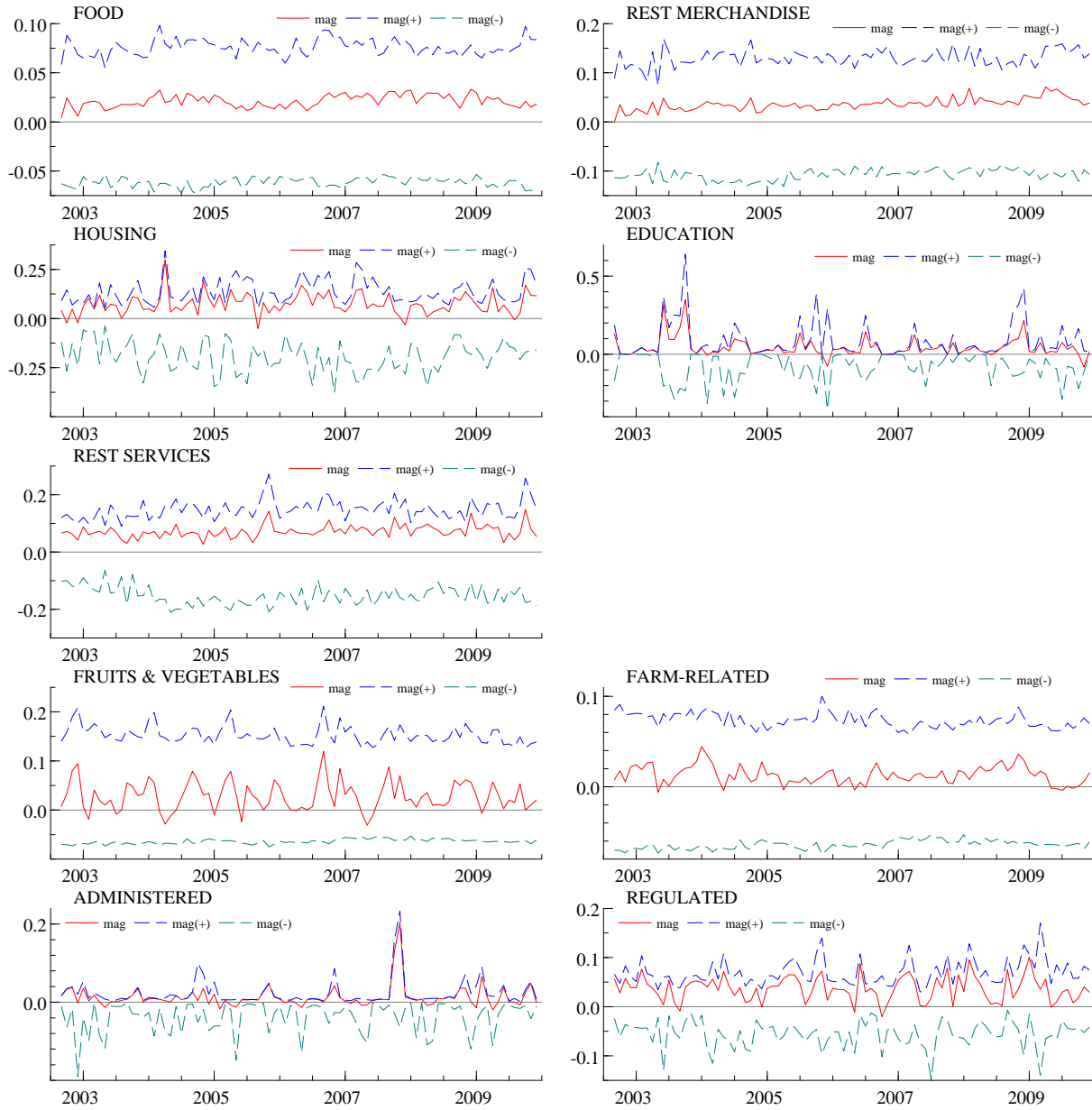


Figure 12: Time series of the unweighted magnitudes of price changes.

### WEIGHTED MAGNITUDES

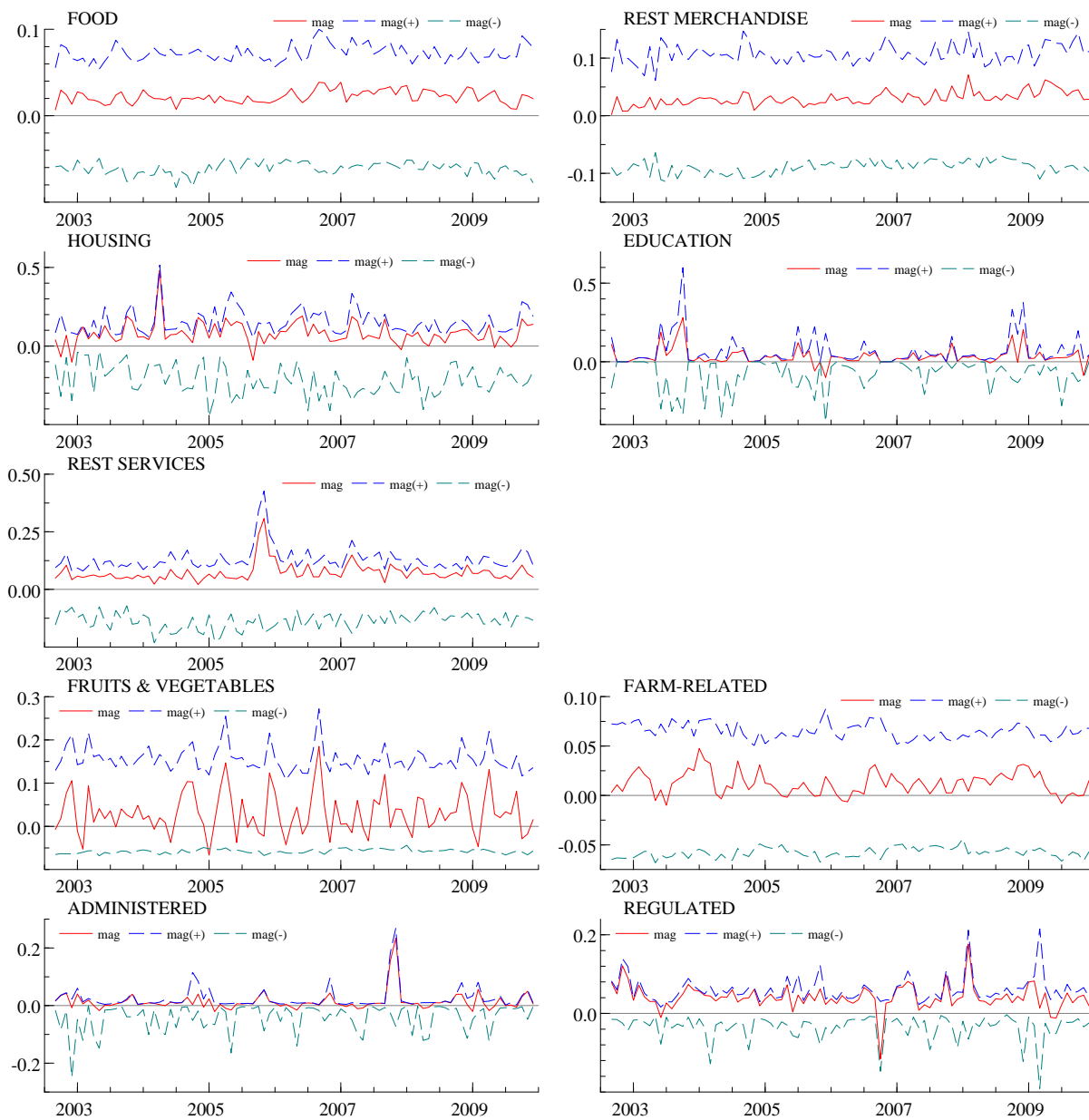


Figure 13: Time series of the weighted magnitudes of price changes.

## FREQUENCIES VS MONTH

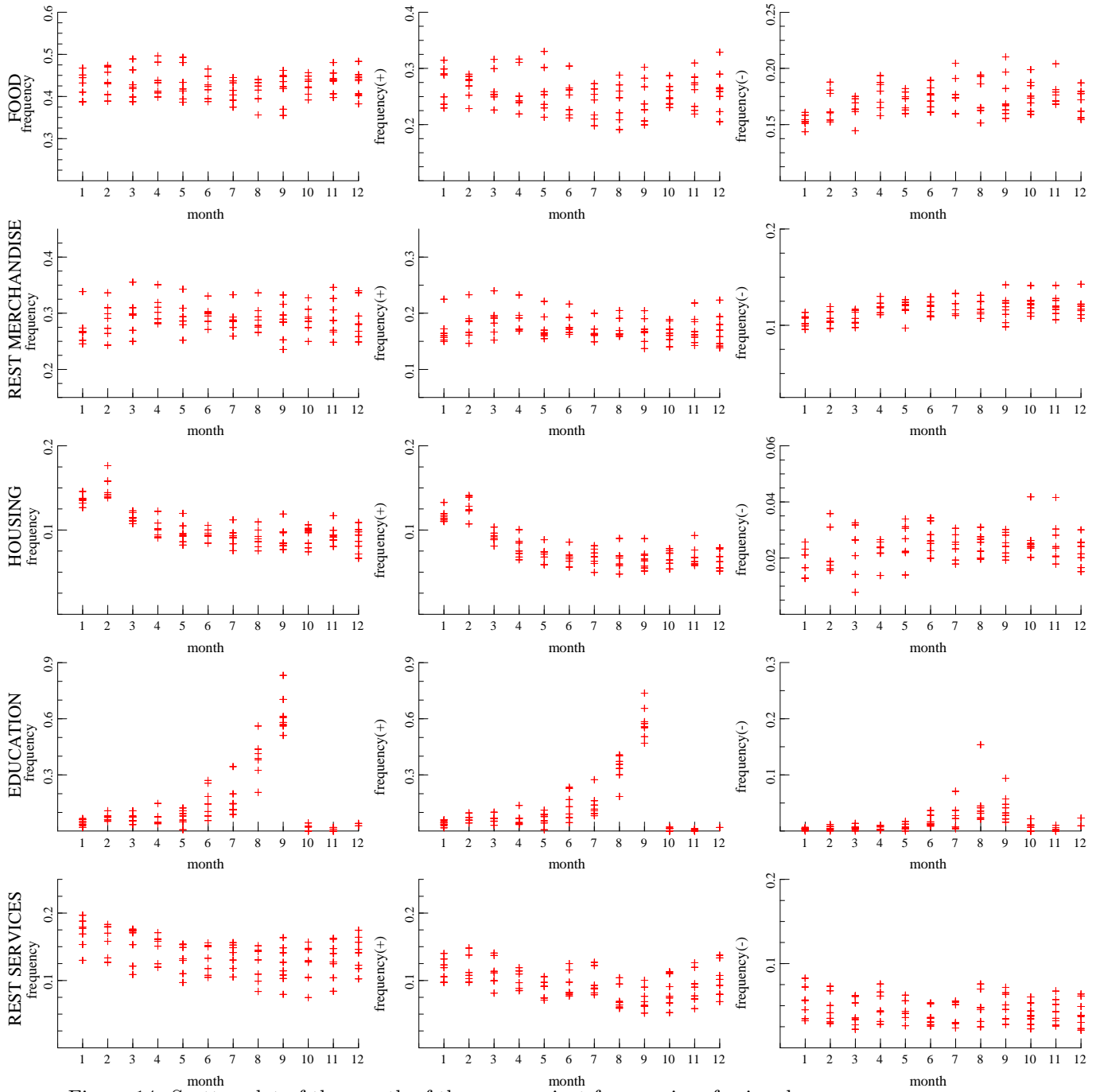


Figure 14: Scatter plot of the month of the year against frequencies of price changes.

# FREQUENCIES VS MONTH

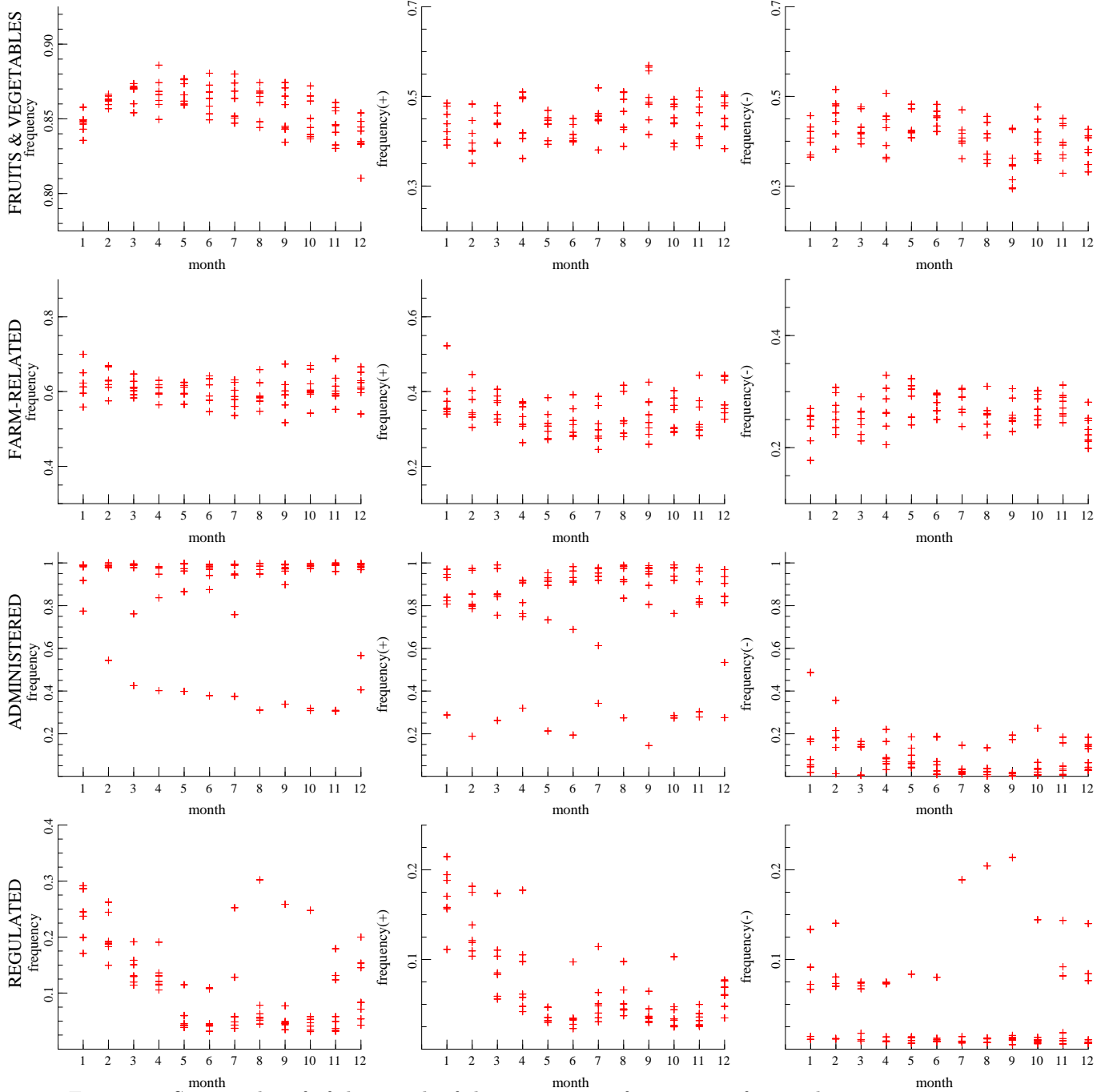


Figure 15: Scatter plot of of the month of the year against frequencies of price changes.

# MAGNITUDES VS MONTH

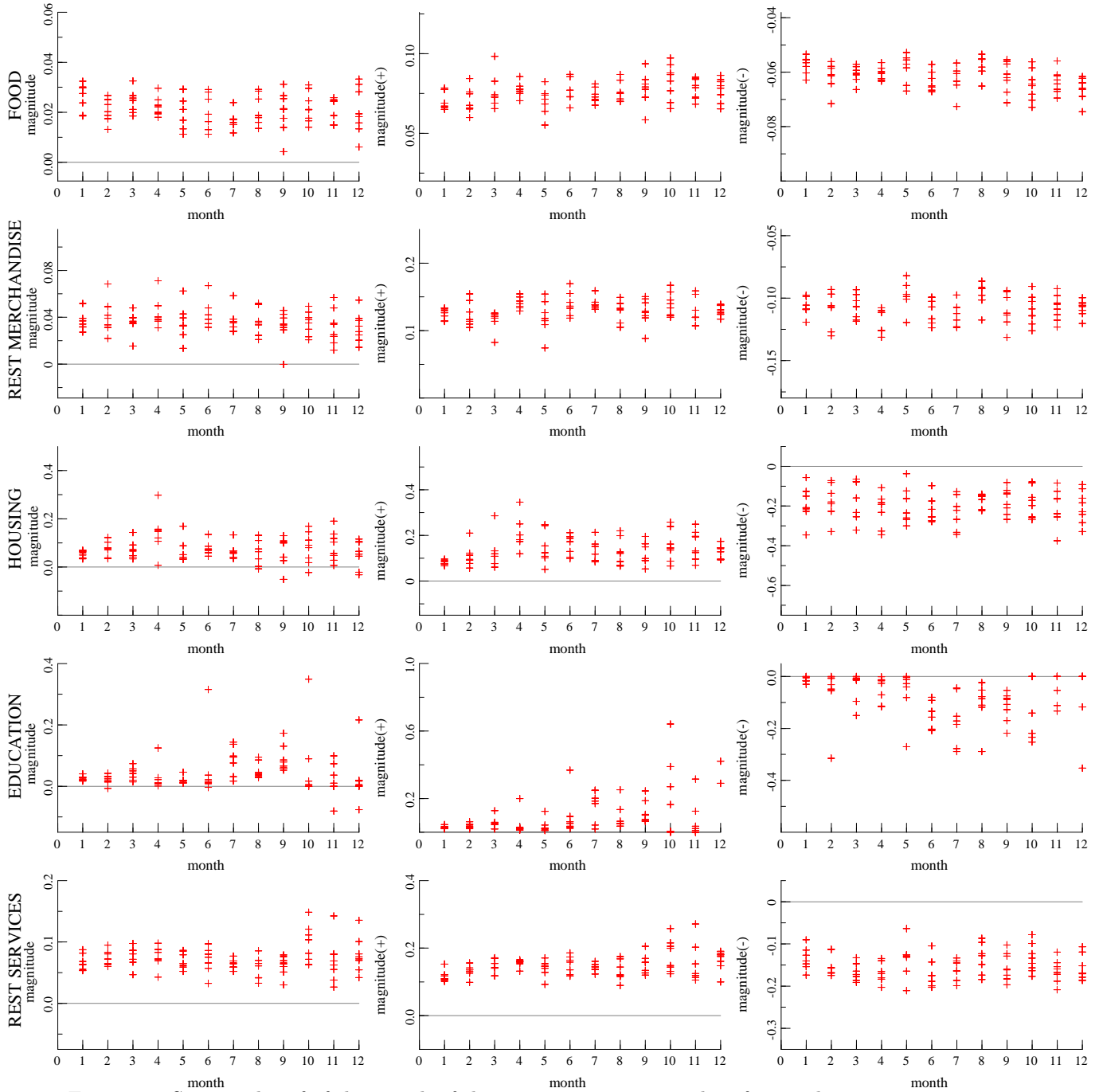


Figure 16: Scatter plot of of the month of the year against magnitudes of price changes.

# MAGNITUDES VS MONTH

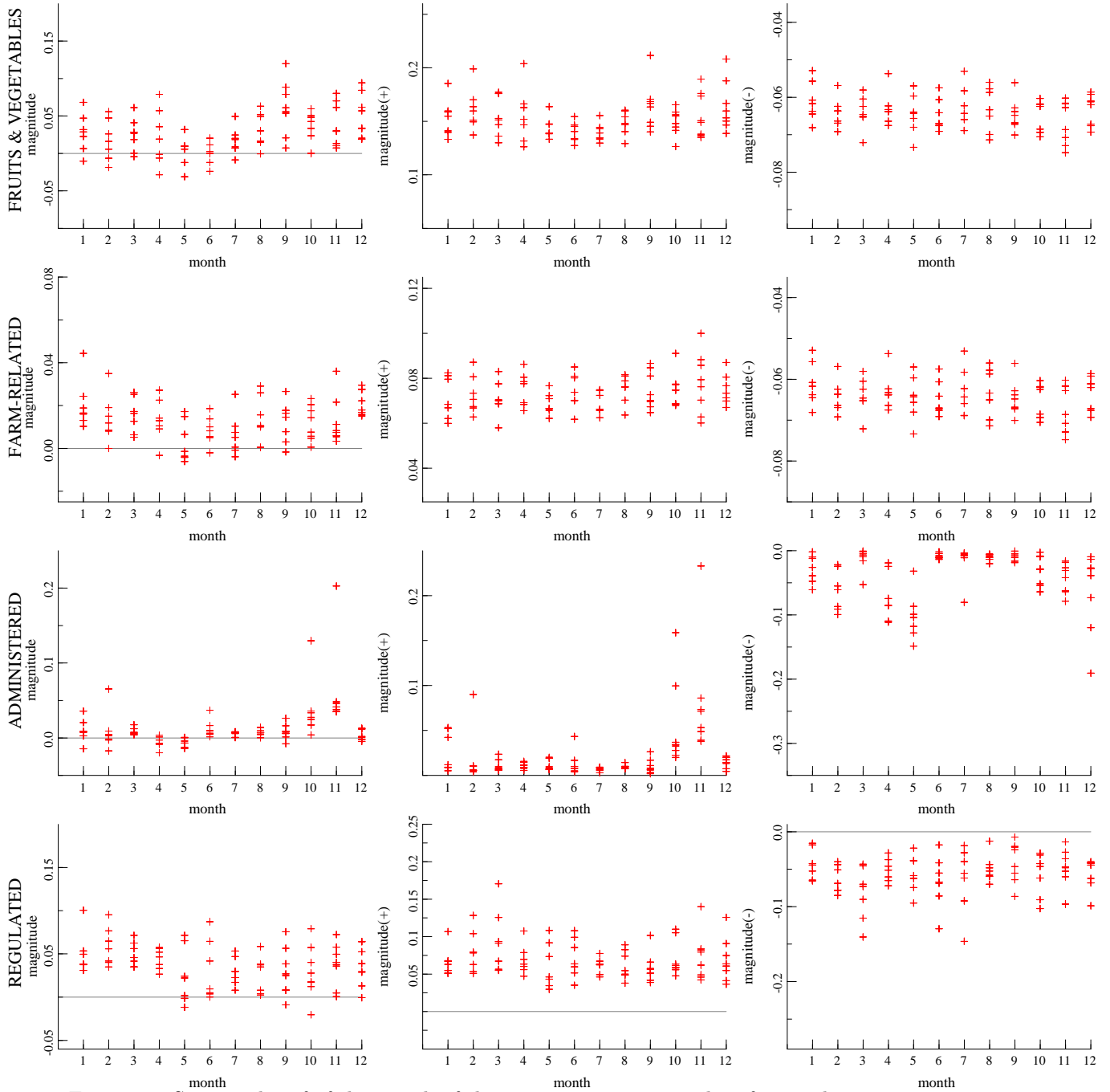


Figure 17: Scatter plot of of the month of the year against magnitudes of price changes.

# FREQUENCIES VS ANNUAL INFLATION

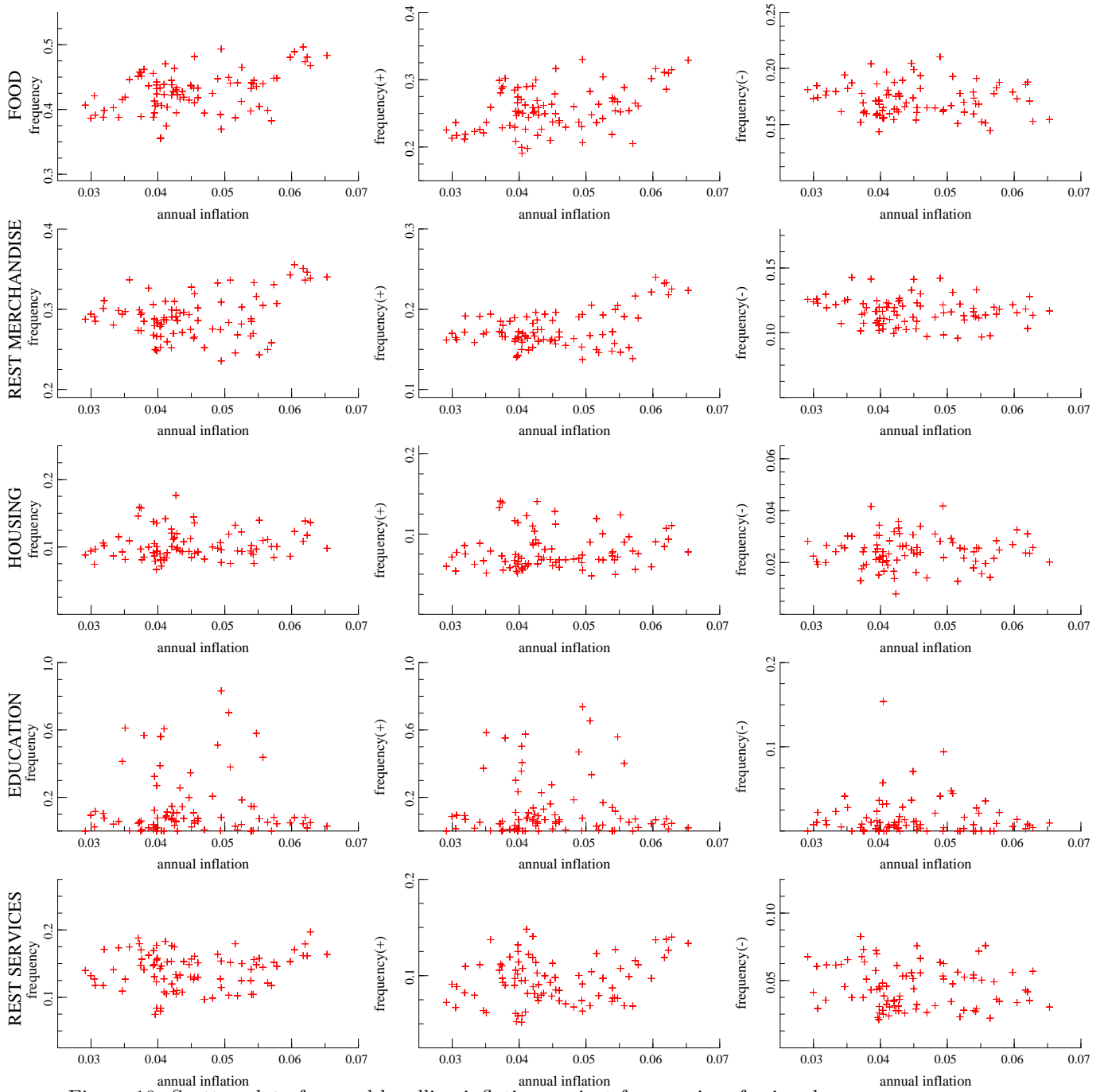


Figure 18: Scatter plot of annual headline inflation against frequencies of price changes.



## FREQUENCIES VS ANNUAL INFLATION

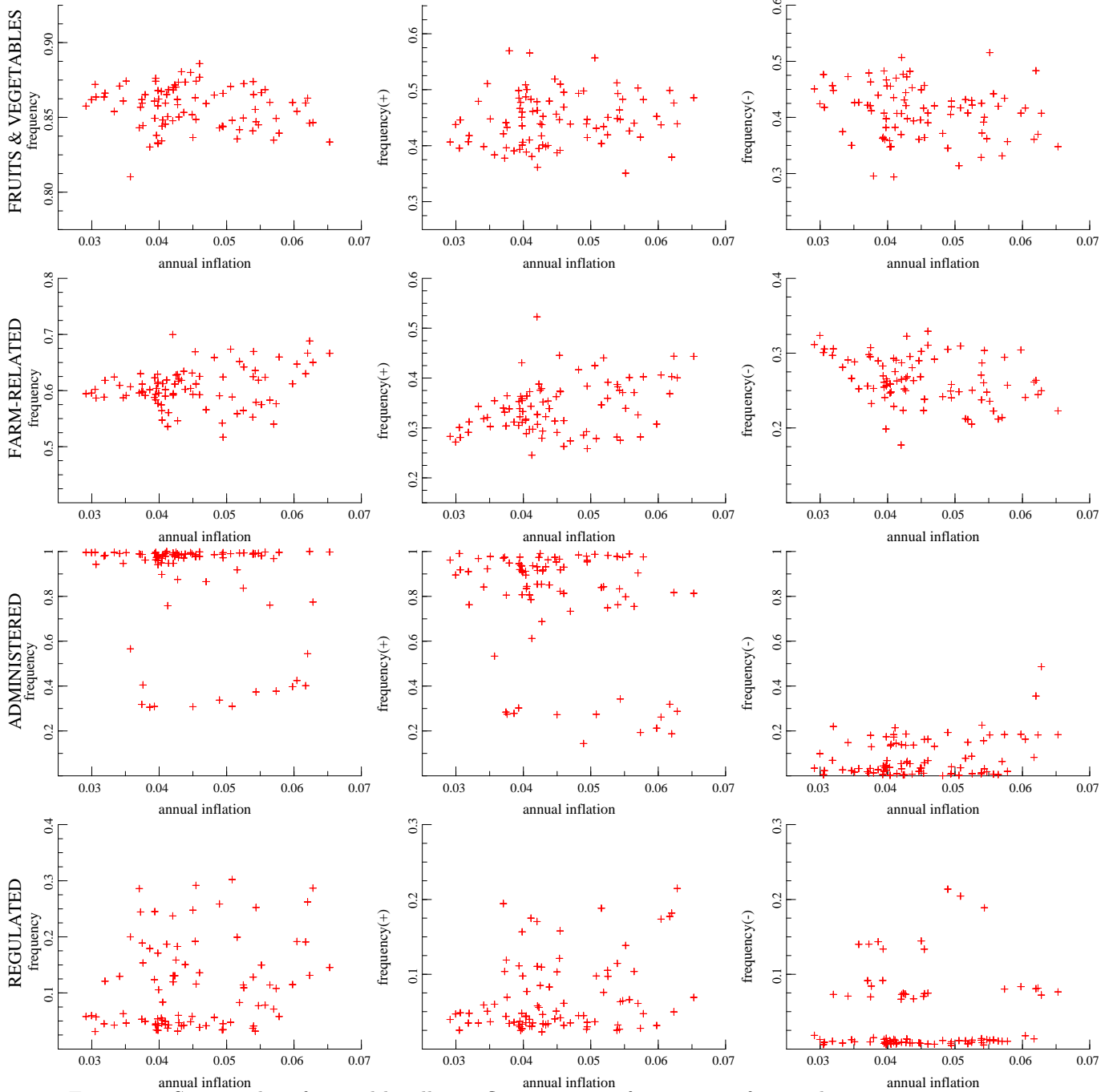


Figure 19: Scatter plot of annual headline inflation against frequencies of price changes.

# MAGNITUDES VS ANNUAL INFLATION

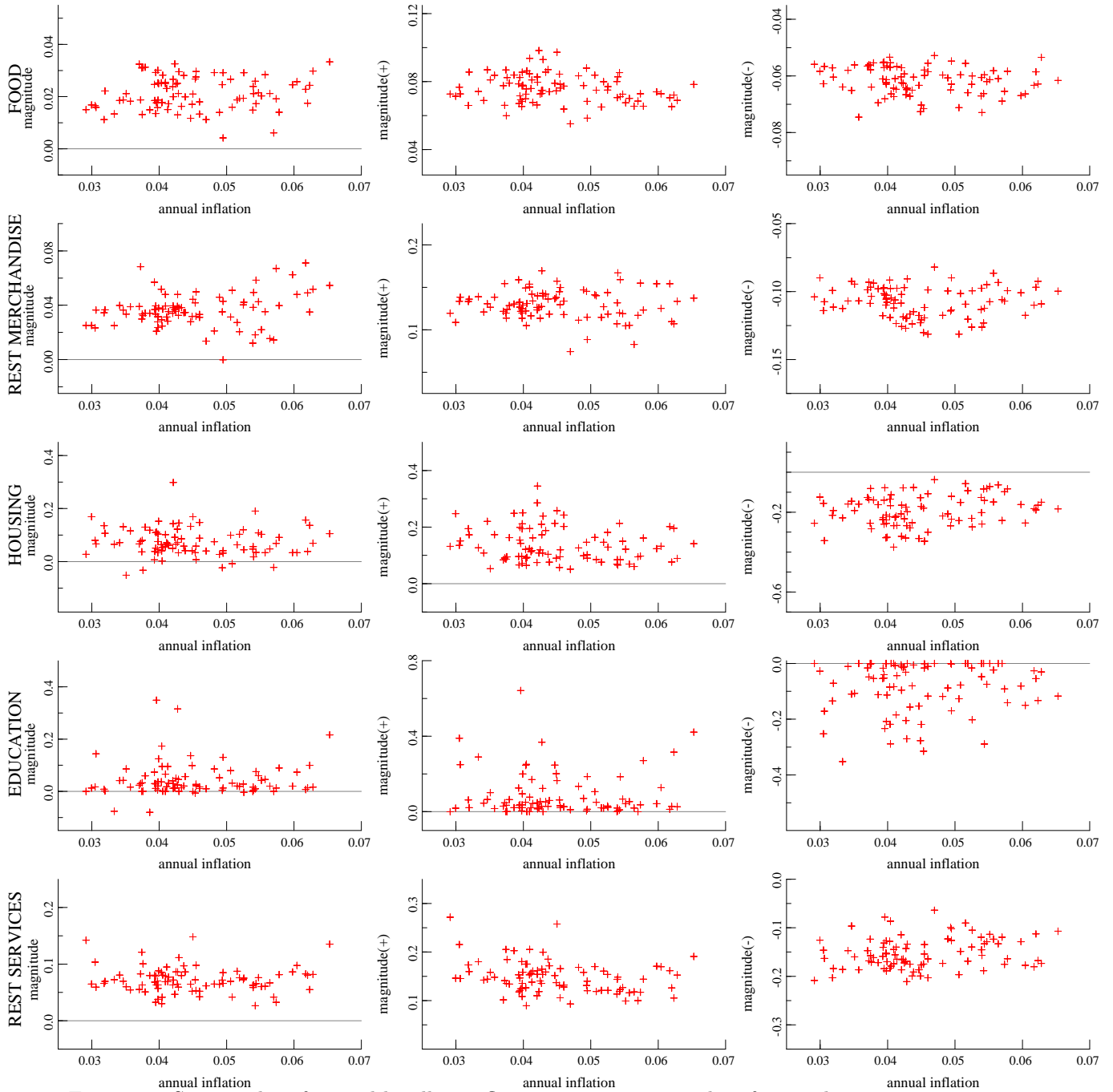


Figure 20: Scatter plot of annual headline inflation against magnitudes of price changes.

## MAGNITUDES VS ANNUAL INFLATION

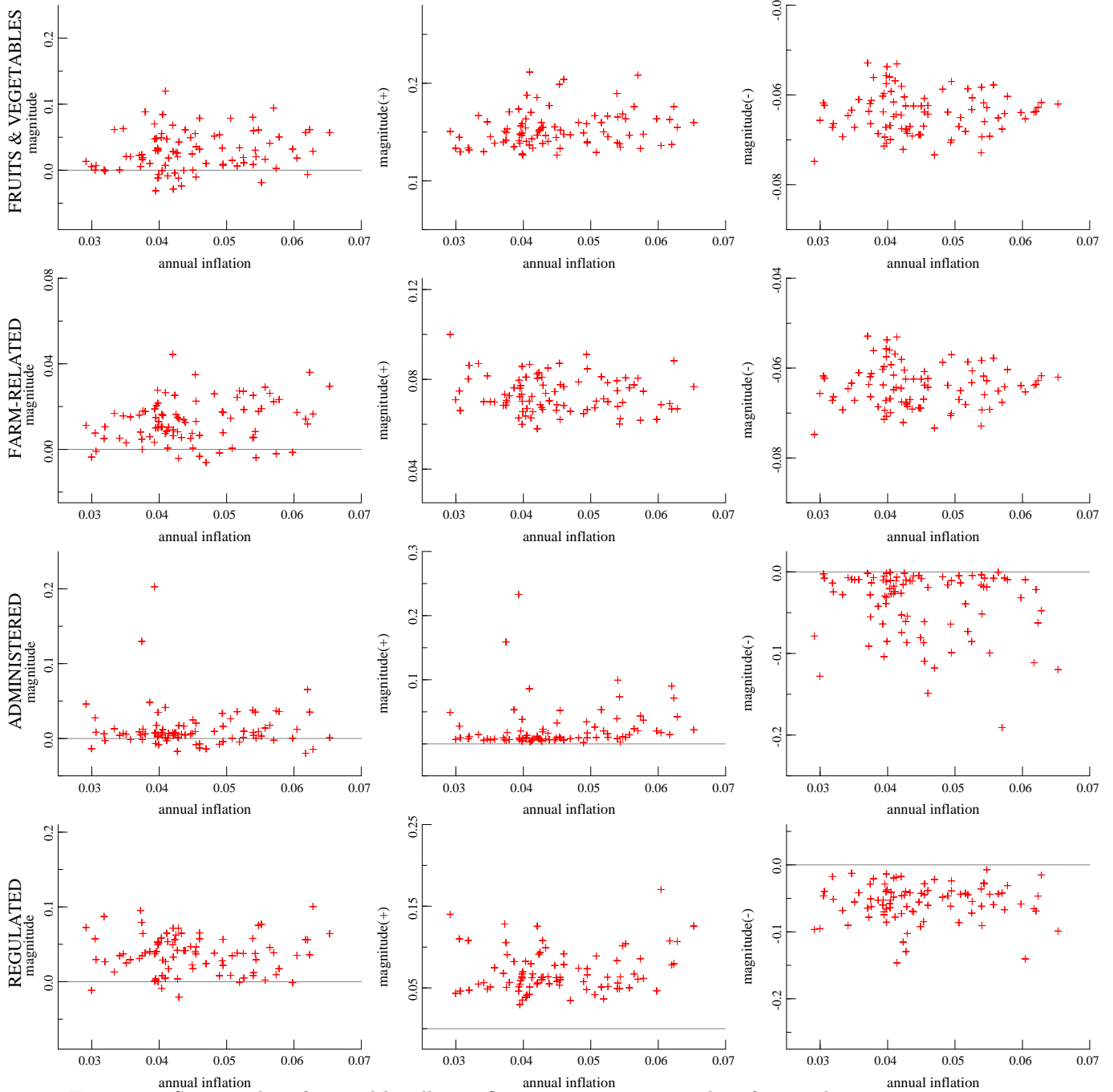


Figure 21: Scatter plot of annual headline inflation against magnitudes of price changes.