Artigos

Asymmetric Price Transmission between the Wholesale and Retail Segments: an Empirical Study for Local Vegetable Markets*

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Resumo: O artigo investiga a prevalência de transmissão assimétrica de preços entre os segmentos de atacado e varejo para seis produtos vegetais selecionados na cidade do Rio de Janeiro-Brasil tomando como referência dados semanais ao longo do período 2007-8. A evidência econométrica exploratória em geral não favorece um processo assimétrico de transmissão de preços. Todavia, evidência parcial de ajuste assimétrico de preços é encontrada no caso de um produto quando os mercados são considerados separadamente.

Palavras-chave: atacado; varejo; transmissão assimétrica de preços

JEL: D40; Q11; Q13

1. Introduction

The transmission of prices along a supply chain is a recurring theme in the media. In fact, possible asymmetric price adjustments between the wholesale and retail sectors are occasionally mentioned in such a way that increases on the wholesale price would tend to be more readily ratified at the retail level than price reductions in that segment, so that prices would rise as "rockets" but fall as "feathers" [see e,g. Bacon (1991) and Tappata (2009)].

The transmission pattern of prices is partially due to the possibility of holding inventory, transportation costs or the exercise of market power by middlemen [Ray et al. (2006) provide a summary of the theoretical arguments].

At the empirical level the literature sought to test the existence of asymmetric price transmission from wholesale to retail. One observes different studies focusing on the fuel sector as exemplified by Bacon (1991), Duffy-Deno (1996), Godby et al. (2000), Eckert (2002), Chen et al (2005) and Resende and Alves (2012). The overall evidence, often based on time-series methods, tends to support the existence of asymmetric price

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adjustment. Despite the emphasis on fuel markets, Peltzman (2000) has obtained evidence for a large number of consumer and producer goods in the U.S. and in more than 2/3 of the considered markets, asymmetric price transmission tended to prevail.

The recent steady increases in food prices motivate the undertaking of similar studies in that context, especially for the case of developing countries. Representative studies on asymmetric price transmission in agricultural goods are given by Ward (1982), Minten and Kyle (2000) and Miller and Hayenga (2001). The Brazilian literature on asymmetric price transmission is relatively scarce and representative works are provided by Azevedo and Politi (2008) and Aguiar and Figueiredo (2011) and investigated price transmission in São Paulo with approaches that are connected with the present paper. In particular, the former authors considered price transmission in the ultra high temperature (UHT) and pasteurized milk segments and encountered less competition in the second case. The latter authors, on the other hand, considered price transmission in the context of rice, beans, poultry, beef, pork, soybean oil, cheese and eggs, and identified significant asymmetric patterns that were largely associated with high market concentration. One can, nevertheless, observe that many of the considered products are less perishable and potentially more prone to the exercise of market power and thus the consideration of other perishable goods can be instructive. A distinct strand of the empirical literature focuses on the integration of different markets so as to assess the prevalence of the law of one price. Applications that investigate international price transmission include Margarido et al. (2007) and Cunha et al. (2010) that respectively address the international market for soybeans and coffee (arabicca variety).

The present paper aims at investigating possible asymmetric transmission patterns between the wholesale and retail segments in the context of local markets for fresh vegetables in Brazil by taking advantage of a unique data set.

The paper is organized as follows. The second section discusses the theoretical arguments that can lead to asymmetric patterns in price transmission between wholesale and retail and discusses the previous empirical evidence. The third section discusses the construction of data and presents the empirical model to be estimated. The fourth section presents the empirical results. The fifth section brings some final comments.

2. Price Transmission in the Production Chain

The phenomenon of asymmetric adjustment in prices occurs when these prices rise quickly in response to increased costs, but do not decline at the same speed if the costs have been reduced. These costs in most cases reflect the prices of the main raw material or primary cost components. Therefore, the comparison usually involves the prices charged by sellers of the product at the wholesale and retail segments. Meyer and Von Cramon-Taubadel (2004) highlight three criteria for classifying price transmission. First, one would consider the magnitude or the speed of price transmission. The magnitude of changes in wholesale prices can be a key aspect in determining adjustment costs for retailers. Second, the direction of the asymmetry is relevant. If retail prices responses to increases in wholesale prices occur at a greater magnitude and/or speed as compared to adjustments following wholesale price reductions, one observes a positive asymmetry, otherwise one refers to a negative asymmetry. Third, asymmetry can impact price transmission in vertical or spatial terms. In fact, the present application focuses on the vertical price transmission in a given productive chain.

Most of the literature on price transmission is empirical. There is little work involved in developing a theoretical model to explain the asymmetry in the transmission of prices. The explanation of the asymmetry in those articles is related to the existence of monopoly power of firms (Benabou and Gertner (1993), Borenstein and Shepard (1996)), or inflation with adjustment costs in prices (Ball and Mankiw (1994). But none of these works completely exhaust the subject and provide a satisfactory theoretical framework.

Ray et al. (2006) try to fill this gap by combining aspects of literature about the behavior of distribution channels with adjustment costs in prices. These authors suggest that the adjustment costs faced by the retail segment can result in asymmetric behavior of wholesale prices. If there are costs of adjustment in retail, prices will not vary due to small fluctuations in wholesale prices. This causes the demand curve perceived by the wholesalers as having a perfectly inelastic region, where their prices can vary without any reduction in quantity demanded. Thus, small price increases are profitable for the wholesalers and small reductions in their prices are detrimental in terms of profitability, since it does not represent an increase in quantities sold, since retail prices will not change.

For large changes in wholesale prices, those authors consider that retail prices respond promptly. There would be, therefore, different behaviors regarding the asymmetry in accordance to the magnitude of changes in wholesale prices. It should be noted, however, the nature of the simplified model that considers a single firm in wholesale and retail and assumes a sequential model along the lines of a Stackelberg setup. In the case of marketing of foods with a reasonable number of small retailers, the context would be somewhat different.

Minten and Kyle (2000) consider an application for urban grain markets in Zaire and emphasized the traditional explanations of asymmetric behavior in prices that relate to the concentration in the retail industry and to government intervention. The empirical model is based on Gardner (1975) and Heien (1980). It is shown that the wholesalers are faced with a kinked demand, implying different elasticities for increases and decreases in prices. As a result, retail prices respond differently to increases and reductions in wholesale prices.

Another explanation is given by Kinnucan and Forker (1987), that contends that the elasticity of wholesale-retail transmission is different according to the factor causing the change in the wholesale price, whether caused by increased retail demand or increase in costs. If it was caused by the latter factor, the transmission to retail prices should be less significant than it would be in the former case. However, the existence of inventories, can sometimes neutralize the impact of changes in demand for the product wholesale dealers on wholesale prices.

Regardless of other reasons evoked to explain the asymmetric transmission of wholesale to retail, one is certainly the strongest: a possible market power of retailers, certainly could favor asymmetric price transmission.

In contrast, Tappata (2009) and Lewis (2011) highlighted the role of the consumer-search protocols on asymmetric price transmission. The former study considers a non-sequential model of consumer-search where there are informed and uninformed consumers along the lines of Varian (1980) and Burdett and Judd (1983). Conditional on consumers' search intensity, firms´ profit maximization is characterized by setting prices that are less dispersed under high than under low production costs. Under rational expectations, consumers antecipate such tendency and the number of consumers engaged in search is lower when costs are expected to be high. Ultimately, firms would face different demand elasticities folowing reductions or increases in costs, what would lead to asymmetric transmission of input cost shocks. Indeed, if those are not independent over time, one would observe distinct consumers´expectations depending on the level of cost in the previous period.

Lewis (2011), on the other hand, assumes adaptive expectations in terms of a reference-price search model, where consumers' expectations of prices are based on prices observed during previous purchases as given by the average price level from the previous period. A salient implication is that that consumers search less when prices are falling, thus resulting in higher profit margins and a slower price response after cost changes. The author further investigates the empirical adequacy in the context of gasoline markets and obtains favourable supporting evidence, It is worth noting, thar the models that were just mentioned, emphasize search aspects related to the informational structure faced by consumers and do not explicitly focus on non-competitive practices by the firms, Nevertheless, the author´s aim was mostly to provide an explanation to asymmetric price transmission in markets with the characteristics of the gasoline market but it is important to observe that the storage potential is limited in the case of fresh vegetables and also the search methods could differ as compared to fuel markets.

Having summarized the basic conceptual aspects that explain asymmetric price transmission, one needs to outline the empirical strategy for assessing such asymmetric effects in the present study. The basic rationale of the approach considered in this paper takes as reference the work of Houck (1977). The approach considers a variable Y that depends on an exogenous variable segmented for situations of abrupt increase or decrease. In the context of this paper, we consider variables segmented for wholesale price changes. The expression (1) could easily be extended to include other exogenous variables that can be segmented or not:

$$\Delta Y_i = \alpha_0 + \alpha_1 \Delta X_i^* + \alpha_2 \Delta X_i^{**} \qquad (1)$$

where for i = 1, 2, ..., t one has $\Delta Y_i = Y_i - Y_{i-1}$; $\Delta X_i^* = X_i - X_{i-1}$ if $X_i > X_{i-1}$ and 0 otherwise; $\Delta X_i^{**} = X_i - X_{i-1}$ if $X_i \leq X_{i-1}$ and 0 otherwise. Note that the segmented variables would be equivalent to consider the variation in wholesale prices in successive periods by multiplication with a dummy variable set to a strict price increase or non-decrease.

One can relate expression (1) with the initial position of the dependent variable Y_0 (Y would relate to the retail price of this application and segmented variables X are related to wholesale prices) using the following identity:

$$Y_t = Y_0 + \sum_{i=1}^{t} Y_i \qquad (2)$$

Combining (1) and (2) it follows that[1]:

$$Y_t - Y_0 = \alpha_0 t + \alpha_1 (\sum_{i-1}^{t} \Delta X_i^*) + \alpha_2 (\sum_{i=1}^{t} \Delta X_i^{**}) \qquad (3)$$

Thus, it is clear that the variation of the retail price on the initial position may be related to a segmented trend variables and segmented variables capturing accumulated changes in prices. It should be mentioned that the inclusion of other exogenous variables in equation (1) would have motivated a more comprehensive empirical specification such as considered in this article. As previously emphasized, other exogenous variables (segmented or not) could be included in terms of accumulated changes. The hypothesis of symmetric adjustment would require $\alpha_1 = \alpha_2$ that would be tested against the alternative hypothesis $\alpha_1 \neq \alpha_2$.

Finally, we point out that a second generation of empirical work considers the potential problem of spurious regressions in the case of non-stationary variables. In fact, the comprehensive literature survey by Meyer and Von Cramon-Taubadel (2004) highlights the emergence of error correction models in the investigation of asymmetric price adjustments. As will be clear in the results´ section, this problem does not emerge in this application, which would be unlikely since the model does not use variables in levels.

1 Expression (3) could be extended in terms of a specification with lags [see Ward (1982)].

3. Empirical Application

3.1 - Econometric Issues

In the previous section there was a clear prevalence of models for time series data in the study of asymmetric price transmission and often, the availability of long series allows a focus on long-term patterns. Examples include analysis of cointegration in the context of threshold autoregressive models (threshold autoregressive models) and cyclical properties investigated in the frequency domain. In this paper, the sample period is relatively short and so we seek to undertake an analysis similar to that developed by Minten and Kyle (2000) and consider the empirical strategy suggested by Houck (1977) to test for asymmetries. The empirical equation for a given product as motivated by the expression (4) is given by:

$$RP_t - RP_0 = \alpha_0 + \alpha_1 t + \alpha_2 (\sum_{i=1}^{t} \Delta WP_i^{*}) + \alpha_3 (\sum_{i=1}^{t} \Delta WP_i^{**}) + \alpha_4 (\sum_{i=1}^{t} \Delta DIES_i) + \varepsilon_t \quad (4)$$

where ε_t denotes a stochastic error and the variables are defined as follows:

- $RP_t - RP_0$: diference of retail price relative to the value in the initial period;
- t: time trend;
- $\sum_{i=1}^{t} \Delta WP_i^{*}$:cumulative wholesale price variations in the case of price increases in two consecutive periods;
- $\sum_{i=1}^{t} \Delta WP_i^{**}$:cumulative wholesale price variations in the case of price reductions or constancy in two consecutive periods;
- $\sum_{i=1}^{t} \Delta DIES_i$: cumulative price variation on the diesel price.

Minten and Kyle (2000) suggest the possibility of estimating a system using seemingly unrelated regressions [SUR-seemingly unrelated regressions]. In fact, the possibility of contemporaneous correlations among the errors associated with different agricultural products seems to be relevant as they may be subject to common shocks, in which case a system would be more efficient estimator[2]. In this application, we consider such an estimator for six agricultural products in three different representative local markets (in 3 different regions in the city of Rio de Janeiro, Brazil). One can consider specifications with lags as suggested by Ward (1982), However, the relatively short sample period limits the pursual of dynamic

2 The seemingly unrelated regression-SUR estimator is a generalized least squares methof that considers the system of equations and provide an efficient estimator by considering possible correlations between error terms in different equations. See e.g. Greene (2003) for details.

specifications in the present application. Moreover, the evidence memtioned by Minten and Kyle (2000) points to a range of 2.7 to 6.2 days between buying at wholesale and selling in retail markets for fresh vegetables, but we have no more specific information in the present case. The empirical model considers a constant, and the null hypothesis of symmetric transmission from wholesale prices to retail requires $\alpha_2 = \alpha_3$ to be tested against the alternative hypothesis of asymmetric transmission that requires $\alpha_2 \neq \alpha_3$.

3.2- Data

The study considers two basic data sources relating to the prices of vegetables, fruits and vegetables sold in the city of Rio de Janeiro, Brazil. The wholesale data was obtained from the main wholesale central [DITEC-CEASA] with daily frequency since 2005. For retailers, however, the base was available for street markets (feiras livres) in 8 different localities on a weekly basis but only for the years 2007 and 2008 as provided by the Coordination of, Licensing and Inspection (City of Rio de Janeiro). Therefore, it was necessary to restrict the study to 2007 and 2008 and the data generated weekly averages were constructed. It is worth mentioning that the data include wholesale varieties for each product unlikethe retail data. In this sense, it was decided to select products with complete series and for which the type of variety was clearly explained what necessarily restricted the number of products available for the analysis and one was only able to study six products that either have an ordinary quality or a premium standard (extra). [the selected products were extra zucchini, common cassava, extra yams, extra scarlet eggplant, extra cucumbers and extra butter beans]. At the level of wholesale the products are sold in boxes that despite supposedly being the same over time include some small variation in weight, so it was considered the average weight of the box to generate the price per kilogram. For the retail segment, the price per kilogram is already collected. On the other hand, I consider a specific retail market in each region [Tijuca (northern) Leblon (southern), Barra da Tijuca (west)]. That said, the sample consists of 70 weekly observations, with the first week that begins on 29/01/2007 and with the one started last week on 26/05/2008[3]. Thus, it should be noted the novelty of using these databases that were subject to selection procedures and compliance data. It should be noted that more recently, IBRE FGV-enabled, for academic purposes, access to unpublished retail prices used in constructing the CPI, but such access islimited to a few similar items and access to wholesale prices or even variations in the level of product is not readily possible.

3 Therefore, after accumulated changes and the final specification with a lagged dependent variable, the number of observations drop to 69 and 68 .

Additionally, we consider the average price of diesel in the state of Rio de Janeiro as a proxy for the transportation cost of retailers. Data were obtained from weekly surveys conducted by the National Petroleum Agency-ANP for a sample of fuel stations. Table 1 presents descriptive statistics for the database.

Table 1 Summary statistics

Product		Mean	Standard dev.	Minimum	Maximum
Zucchini (extra)	Wholesale	1.01	0.34	0.53	1.86
	Retail-Tijuca	2.81	0.48	2.00	3.90
	Retail-Leblon	2.94	0.65	2.00	4.60
	Retail-Barra	2.86	0.44	1.80	4.00
Cassava (common)	Wholesale	0.78	5.89E-02	0.66	0.91
	Retail-Tijuca	1.97	0.22	1.00	2.50
	Retail-Leblon	2.16	0.39	1.00	3.00
	Retail-Barra	1.95	0.22	1.00	2.20
Yam (extra)	Wholesale	1.11	0.23	0.82	1.77
	Retail-Tijuca	3.04	0.45	2.00	3.90
	Retail-Leblon	2.90	0.37	2.00	4.00
	Retail-Barra	2.96	0.41	2.00	3.60
Scarlet eggplant (extra)	Wholesale	1.22	0.34	0.69	2.24
	Retail-Tijuca	2.74	0.75	1.60	3.90
	Retail-Leblon	2.81	0.51	2.00	4.00
	Retail-Barra	2.53	0.74	1.00	4.60
Cucumber (extra)	Wholesale	0.72	0.17	0.43	1.20
	Retail-Tijuca	2.26	0.35	2.00	3.50
	Retail-Leblon	2.14	0.26	1.90	2.80
	Retail-Barra	1.94	0.28	1.40	2.60
Green beans (extra)	Wholesale	2.02	0.71	0.82	3.82
	Retail-Tijuca	4.40	1.19	2.80	7.90
	Retail-Leblon	4.38	1,02	2.50	6.80
	Retail-Barra	4.38	1.00	3.00	6.90
Diesel		1.83	4.61E-02	1.81	2.01

Table prepared by the author based on data from DITEC-CEASA

It can be seen that the sample shows a wide heterogeneity among the different retail markets and considered as would be expected in a market of small retailers in wholesale margins for retailers tend to be high. Indeed, considering a marketing margin analogous to the Lerner index defined as (pretail-pwholesale)/pretail displays an interesting pattern. Despite of occasional fluctuations, the descriptive statistics reported in Table 2 indicate that on average behavior is similar and show somewhat different products and markets. Note that margins close to 60% seem to be typical.

Table 2 - Trade margins

Product	Market-Northern Zone (Tijuca)				Market – Southern Zone (Leblon)				Market – West Zone (Barra da Tijuca)			
	Mean	Std, dev.	Min.	Max.	Mean	Std, dev.	Min.	Max.	Mean	Std, dev.	Min.	Max.
Zucchini	0.64	9.96E-02	0.40	0.78	0.65	0.11	0.38	0.82	0.65	9.98E-02	0.41	0.82
Cassava	0.59	9.09E-02	0.09	0.71	0.63	8.82E-02	0.28	0.76	0.59	9.78E-02	0.15	0.67
Yam	0.63	9.48E-02	0.24	0.76	0.61	9.64E-02	0.31	0.77	0.62	8.68E-02	0.40	0.76
Scarlet eggplant	0.55	0.11	0.28	0.72	0.56	9.30E-02	0.35	0.73	0.49	0.18	-0.22	0.73
Cucumber	0.68	7.40E-02	0.44	0.82	0.66	6.79E-02	0.49	0.78	0.63	7.25E-02	0.46	0.78
Green beans	0.54	0.11	0.10	0.78	0.53	0.15	-0.01	0.82	0.53	0.14	0.17	0.80

Table prepared by the author based on data from DITEC-CEASA

Finally, we point out that it was not possible to obtain complete series and unambiguous definition for more perishable products like other green vegetables. In any case, beyond the relatively low degree of perishability of some selected products, one should not expect a significant storage capacity by small traders. In vegetable retail markets in general, it is common to observe a significant price reduction just before the end of the operation of the market. This shows that the storage does not seem to be a practice even with less perishable products. It would have been interesting to carry out analysis for green vegetables in order to rule out the possibility of storage. Unfortunately, there were no consistent data for that category.

Appendix 1 presents graphs comparing the evolution of retail and wholesale prices for the six products considered in this study where the different local markets are subject to common wholesale prices. A cursory inspection generally indicates similar shapes and small discrepancies that could indicate asymmetric price transmission. In that sense, it appears that if asymmetric transmission prevails it does not appear to be dramatic, but of course, a careful analysis will depend on the econometric estimation to be discussed in the next section.

4. Empirical Results

The previously mentioned system [corresponding to the expression (4)] was estimated by the method of seemingly unrelated regressions - SUR using the software Stata SE 12.0. The results for the markets of the north (Tijuca). south (Leblon) and west (Barra da Tijuca) regions of the city of Rio de Janeiro. A first approximation relied on time series estimations for each of those local markets. However, as one is dealing with data for time series, it is important to examine the stationarity of the series involved in order to avoid spurious regression problems. Thus, unit root tests [augmented Dickey-Fuller ADF] were carried out and the evidence indicated that the vast majority of the series is already stationary (I (0)) whereas the diesel price series is integrated of order 1 (I(1)). In this sense,– one can proceed safely with the model specified for variables in terms of changes[4].

4. The associated results can be provided upon request.

However, the evidence based on Durbin-Watson tests indicated the presence of serial correlation and suggested the possible relevance of persistence effects. In that sense, the final empirical model was specified with a lagged dependent variable. Thus, the estimation was carried out with a parsimonious lag structure by considering models with one lag. The corresponding evidence for each of the three local markets is presented in appendix 2 (in tables 4, 5 and 6). In order to gain confidence on the chosen specification it is important to test for the presence of serial correlation in the residuals. For that purpose, a multivariate version of the Q statistics by Ljung-Box with a maximum allowed lag of 6 weeks is considered [see Hosking (1980) for details]. In all three markets, one cannot reject the null hypothesis of absence of serial correlation. Some salient results emerge takes as reference the 5% significance level:

a) The time trend variable only reveals significant coefficients in only 2 out of 18 cases and in both cases for a particular product (yam), indicating that general trends not captured by other explanatory variables as a rule do not seem important. However. it is necessary to highlight the short sample period of the study and does not make the result surprising;

b)The cumulative increase in diesel prices has positive impact on retail price changes in the case of 9 out of 18 cases (spanning over 5 different products) and gas a significant unexpected effect in 1 case. Thus, that cost component appears to play an important role as separated from abrupt changes in wholesale prices;

c)Persistence effects appear to prevail in retail price setting as the lagged dependent variable coefficients are statistically significant and positive in 16 out of 18 cases;

d) The coefficients of determination (R^2) in the different equations have mostly reasonable magnitudes. As for the individual significance of coefficients, 35 out of 108 are significant but the segmented variables that aimed at capturing abrupt changes in wholesale prices have significant impact on retail price changes only for one product (zucchini at the Leblon matket);

e)Even though the aforementioned patterns prevail at the different local markets, non-negligible heterogeneity appears as relevant

Additionally, it can be relevant to consider the relationship between the different local markets as can be subject to common shocks. In fact, it is worth noting that CEASA is by far the main wholesale provider and also the interdependence between different products is potentially important. In order to incorporate this last aspect, the evidence presented in table 3 is based on a stacked sample where the three local markets are considered and two local dummy variables are used (DTIJ and DLEB that respectively refer to the local markets in Tijuca and Leblon).

Some salient results can be summarized as follows and takes as reference the 5% significance level:

i) Now the time trend variable reveals significant coefficients in 3 out of 6 cases;

ii) The cumulative increase in diesel prices has positive impact on retail price changes in the case of 5 products;

iv) Persistence effects appear to prevail as 5 out of 6 products had positive and significant coefficients associated with the retail price changes for 1 lag. In the case of 2 lags the effect emerges only in the case of 1 product;

v) The coefficients of determination (R^2) in the different equations have mostly good magnitudes. In terms of the individual significance of coefficients, 24 out of 48 are significant but the segmented variables that aimed at capturing abrupt changes in wholesale prices have no significant impact on retail price changes and therefore the weak evidence of asymmetric price transmission that was previously observed for 1 product does not emerge in the context of this pooled sample that considered the possibility of interrelated shocks across markets;

iv) The heterogeneity of price dynamics in the different local markets appears to be indicated by the summary statistics that were previously presented. The dummy variables aimed at controlling for such heterogeneities and in fact 9 out of the 12 coefficients related to DTIJ and DLEB are statistically significant.

Table 3 - Econometric Results [sample comprising the Northern Zone – Tijuca, Southern Zone – Leblon and West Zone – Barra da Tijuca]

Dependent variable: $DRP=RP_t - RP_0$ (no. of observations: 67)

Regressors	Zucchini	Cassava	Yam	Scarlet eggplant	Cucumber	Green beans
Time trend	- 0.016 (0.000)	-0.001 (0.368)	-0.001 (0.314)	-0.010 (0.000)	-0.001 (0.102)	-0.008 (0.009)
DTIJ	-0.304 (0.000)	0.012 (0.763)	-0.333 (0.000)	0.320 (0.000)	0.138 (0.001)	-0.060 (0.609)
DLEB	0.431 (0.000)	0.127 (0.004)	-0.389 (0.000)	-0.301 (0.000)	-0.242 (0.000)	-0.403 (0.002)
DRP(-1)	0.027 (0.847)	0.419 (0.000)	0.350 (0.000)	0.525 (0.000)	0.470 (0.000)	0.573 (0.000)
DRP(-2)	0.009 (0.951)	0.002 (0.974)	0.125 (0.053)	-0.176 (0.017)	-0.002 (0.974)	0.014 (0.836)
$\sum_{i=1}^{t} \Delta WP_i^{*}$	-0.218 (0.357)	-0.017 (0.976)	0.166 (0.490)	0.098 (0.630)	0.127 (0.430)	0.143 (0.429)
$\sum_{i=1}^{t} \Delta WP_i^{**}$	0.338 (0.117)	-0.510 (0.381)	-0.388 (0.179)	-0.011 (0.966)	0.142 (0.459)	-0.050 (0.798)
$\sum_{i=1}^{t} \Delta DIES_i$	5.257 (0.000)	-0.464 (0.419)	1.851 (0.006)	5.333 (0.000)	1.919 (0.000)	5.450 (0.001)
R^2	0.554	0.301	0.742	0.652	0.702	0.680

Multivariate Ljung-Box statistic (for a maximum of 6 lags):
Tijuca: Q = 224.397 (0.333); Leblon: Q = 239.104 (0.134); Barrra da Tijuca: Q = 238.300 (0.142)

Note: p-values are reported in parentheses

The evidence in principle, does not suggest clear cut asymmetric transmission patterns, though it would be desirable to use longer series and more variability to arrive at more conclusive results some interesting results emerge. To obtain more clear conclusions we should consider the asymmetry tests involving the examination of joint significance of coefficients in Table 4.

Table 4 - Wald Tests for Symmetry in Price Transmission

Product	test Statistic $\chi^2_{(1)]}$	p-value
Zucchini	2.310	0.129
Cassava	0.240	0.622
Yam	1.770	0.183
Scarlet eggplant	0.008	0.778
Cucumber	0.003	0.954
Green beans	0.390	0.532

Note: p-values are reported in parentheses

The evidence does not favor asymmetric price transmission with the exception of zucchini and is therefore less strong if compared with the predominance of asymmetric price adjustments found by Minten and Kyle (2000) for the market in Kinshasa. Zaire, despite their focus on grains. One possibility is that increased competition in the Brazilian case occurs because the range of alternatives is wider such as the competitive given pressure exerted by supermarkets.

5. Concluding Remarks

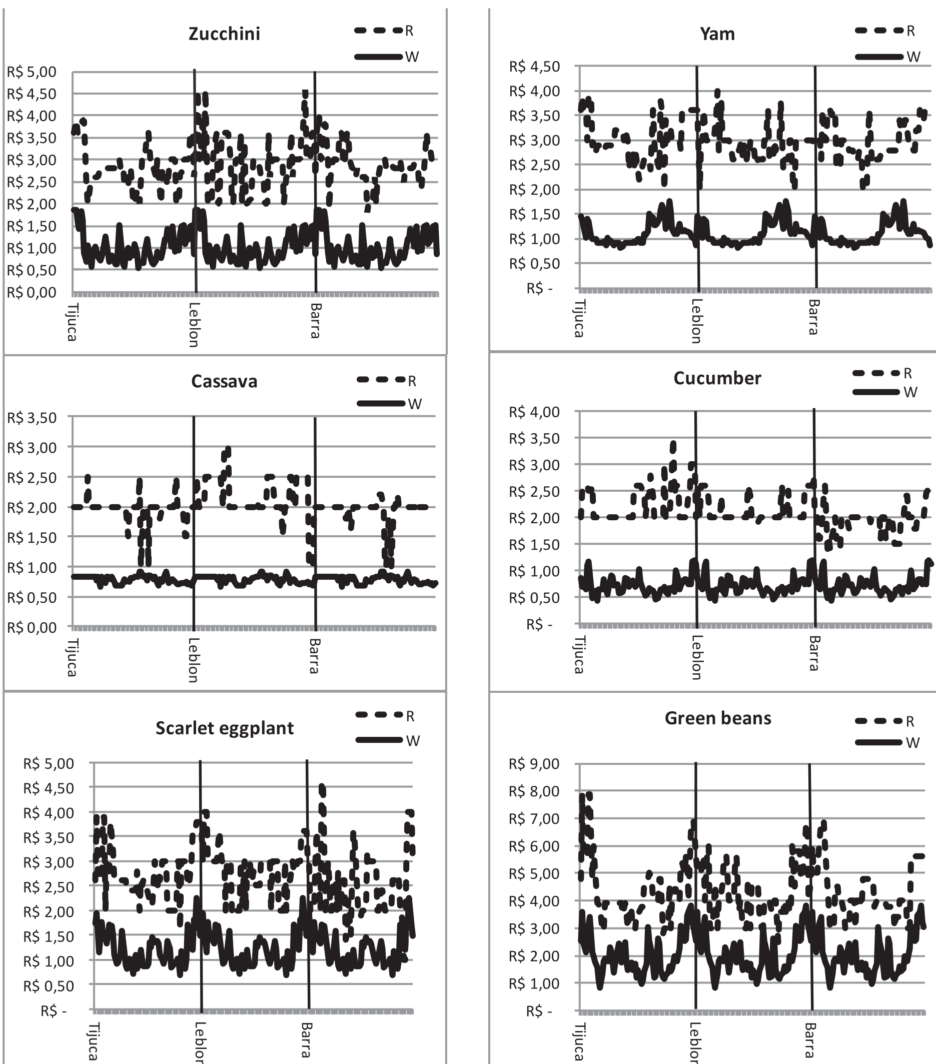
The article sought to investigate the transmission of prices from wholesale to retail for a set of selected vegetables in the city of Rio de Janeiro. This database. that had not been previously used and allowed a first empirical approach to that issue.

The study was exploratory but produced some suggestive results that warrant further investigation. In fact, statistically significant effects were detected only in one case when the markets were considered separately but not for the pooled sample. Moreover, different markets seem to have somewhat distinct price dynamics.

Different directions for future research seem relevant. Previous empirical studies that tested asymmetric adjustment of prices from wholesale to retail usually focused on the wholesale/retail transmission for gasoline. It would be interesting to more closely study the transmission in the context of a product in which the difficulty of storage and perishability of the product will does not prevail. On the other hand, cyclical properties of prices could be usefully investigated with models of time series in the frequency domain.

APPENDIX 1

Retail (R) and wholesale (W) prices for selected vegetables



APPENDIX 2

Table 5 - Econometric Results [Northern Zone – Tijuca]
Dependent variable: $DRP=RP_t - RP_0$ (no. of observations: 68)

Regressors/ statistics	Zucchini	Cassava	Yam	Scarlet eggplant	Cucumber	Green beans
Constant	- 0.413 (0.001)	0.052 (0.402)	-0.371 (0.001)	-0.192 (0.193)	0.083 (0.381)	-0.138 (0.542)
Time trend	-0.003 (0.353)	-0.003 (0.083)	-0.372 (0.001)	-0.005 (0.159)	0.001 (0.788)	0.004 (0.509)
DRP(-1)	0.475 (0.000)	-0.100 (0.354)	0.455 (0.000)	0.333 (0.002)	0.479 (0.000)	0.637 (0.000)
$\sum_{i=1}^{t} \Delta WP_i^{*}$	0.356 (0.125)	-0.876 (0.240)	0.086 (0.817)	-0.206 (0.514)	0.107 (0.800)	0.252 (0.377)
$\sum_{i=1}^{t} \Delta WP_i^{**}$	-0.032 (0.889)	-1.002 (0.198)	-0.754 (0.093)	0.146 (0.733)	0.210 (0.545)	0.318 (0.330)
$\sum_{i=1}^{t} \Delta DIES_i$	1.546 (0.209)	0.866 (0.242)	2.275 (0.084)	5.395 (0.002)	0.975 (0.358)	5.822 (0.030)
R^2	0.417	0.062	0.321	0.367	0.297	0.572
Wald tests for symmetry	1.024 (0.303)	0.010 (0.918)	1.682 (0.195)	0.360 (0.549)	0.026 (0.871)	0.016 (0.900)

Multivariate Ljung-Box statistic (for a maximum of 6 lags): Q = 233.448 (0.198)

Note: p-values are reported in parentheses

Table 6 - Econometric Results [Southern Zone – Leblon]

Dependent variable: $DRP=RP_t - RP_0$ (no. of observations: 68)

Regressors/statistics	Zucchini	Cassava	Yam	Scarlet eggplant	Cucumber	Green beans
Constant	- 0.309 (0.098)	0.098 (0.245)	0.345 (0.001)	- 0.524 (0.001)	-0.210 (0.006)	- 0.793 (0.005)
Time trend	0.001 (0.857)	0.001 (0.624)	- 0.006 (0.014)	-0.006 (0.065)	-0.002 (0.134)	-0.007 (0.308)
DRP(-1)	0.164 (0.116)	0.430 (0.000)	0.235 (0.015)	0.280 (0.009)	0.458 (0.000)	0.371 (0.001)
$\sum_{i=1}^{t} \Delta WP_i^{*}$	0.946 (0.039)	0.512 (0.611)	0.444 (0.225)	0.204 (0.494)	0.067 (0.808)	0.132 (0.719)
$\sum_{i=1}^{t} \Delta WP_i^{**}$	-0.698 (0.104)	-0.219 (0.835)	0.410 (0.347)	-0.636 (0.124)	0.119 (0.604)	-0.468 (0.217)
$\sum_{i=1}^{t} \Delta DIES_i$	1.521 (0.452)	-2.973 (0.005)	2.011 (0.066)	4.054 (0.008)	2.248 (0.003)	6.902 (0.030)
R^2	0.116	0.452	0.137	0.369	0.462	0.322
Wald tests for symmetry	4.924 (0.026)	0.192 (0.661)	0.003 (0.957)	1.844 (0.174)	0.015 (0.902)	0.920 (0.338)

Multivariate Ljung-Box statistic (for a maximum of 6 lags): Q = 236.701 (0.159)

Note: p-values are reported in parentheses

Table 7 - Econometric Results [West Zone – Barra da Tijuca]
Dependent variable: DRP=RP_t –RP_0 (no. of observations: 68)

Regressors/statistics	Zucchini	Cassava	Yam	Scarlet eggplant	Cucumber	Green beans
Constant	-0.322 (0.004)	-0.015 (0.791)	0.021 (0.809)	-0.106 (0.596)	-0.089 (0.220)	- 0.265 (0.135)
Time trend	-0.001 (0.806)	-0.001 (0.657)	-0.001 (0.685)	-0.008 (0.122)	-1.16E 05 (0.995)	-0.001 (0.806)
DRP(-1)	0.618 (0.000)	0.384 (0.000)	0.480 (0.000)	0.454 (0.000)	0.460 (0.000)	0.843 (0.000)
$\sum_{i=1}^{t} \Delta WP_i^{*}$	0.424 (0.091)	0.380 (0.596)	-0.341 (0.366)	0.712 (0.122)	-0.120 (0.711)	0.462 (0.062)
$\sum_{i=1}^{t} \Delta WP_i^{**}$	0.092 (0.694)	0.509 (0.500)	-0.339 (0.460)	0.378 (0.536)	0.132 (0.618)	-0.198 (0.445)
$\sum_{i=1}^{t} \Delta DIES_i$	0.552 (0.617)	0.500 (0.460)	2.449 (0.033)	4.832 (0.043)	2.157 (0.005)	1.311 (0.520)
R^2	0.414	0.202	0.445	0.354	0.422	0.684
Wald tests for symmetry	0.677 (0.410)	0.012 (0.914)	8.60E-06 (0.998)	0.132 (0.716)	0.270 (0.604)	2.458 (0.117)

Multivariate Ljung -Box statistic (for a maximum of 6 lags): Q = 242.194 (0.107)

Note: p-values are reported in parentheses

Asymmetric Price Transmission between the Wholesale and Retail Segments: an Empirical Study for Local Vegetable Markets

Abstract: The paper investigates the prevalence of asymmetric price transmission between the wholesale and retail segments for six selected vegetable products in the city of Rio de Janeiro-Brazil taking as reference weekly data along the 2007-8 period. The exploratory econometric evidence mostly does not favor an asymmetric price transmission process. Nevertheless, partial evidence on asymmetric price adjustment is encountered in the case of one product when markets are considered separately.

Key-words: wholesale; retail; asymmetric price transmission

JEL: D40; Q11; Q13

References

- AGUIAR. D.R.D.. FIGUEIREDO. A.M. (2011). Poder de Mercado no Varejo Alimentar: uma Análise usando os Preços do Estado de São Paulo. *Revista de Economia e Sociologia Rural*. 49 (4). 967-990
- AZEVEDO. P.F.. POLITI. R.N. (2008). Concorrência e Estratégias de Precificação no Sistema Agroindustrial do Leite. *Revista de Economia e Sociologia Rural*. 46 (3). 767-802
- BACON. R. Rockets and Feathers: the Asymmetric Speed of Adjustment of U.K. Retail Gasoline Prices to Cost Changes. *Energy Economics.* 13 (3). pp. 211-18 . 1991
- BALL. L.. MANKIW. G. A Sticky-Price Manifesto. *Carnegie-Rochester Conference Series on Public Policy*. 41. pp. 127-151. 1994
- BENABOU. R., GERTNER. R. Search with Learning from Prices. Does Increased Inflationary Uncertainty Lead to Higher Mark-Ups?. *Review of Economics Studies*. 60 (1). pp. 69-93. 1993
- BORENSTEIN. S., SHEPHARD. A. Dynamic Pricing in Retail Gasoline Markets. *RAND Journal of Economics*. 27. pp. 429-451. 1996
- BURDETT, K., JUDD, K.L. Equilibrium Price Dispersion. *Econometrica,* 51 (4) , pp. 955–970, 1983

- CUNHA, D.A., VALE, S.M.L.R., BRAGA, M.J., CAMPOS, A.C. Integração e Transmissão de Preços no Mercado de Café Arábica. *Revista de Economia e Sociologia Rural*. 48 (4). pp. 515-542, 2010
- DUFFY-DENO. K. Retail Price Asymmetries in Local Gasoline Markets. *Energy Economics*.18 (1-2). pp. 81-92. 1996
- ECKERT. A. Retail Price Cycles and Response Asymmetry. *Canadian Journal of Economics*. 35 (1). pp. 52-77. 2002
- GARDNER. B. The Farm-Retail Price Spread in a Competitive Food Industry. *American Journal of Agricultural Economics*. 57 (3). pp. 399-409. 1975
- GODBY. R.. LINTNER. A.N.. STENGOS. T.. WANDSCHNEIDER. N.. Testing for Asymmetric Price in the Canadian Retail Gasoline Market. *Energy Economics*. 22 (3). pp. 349-368. 2000
- GREENE, W.H. (2003), *Econometric Analysis*, Upper Saddle River: Prentice Hall.
- HOSKING, J. R. M. 1980. The Multivariate Portmanteau Statistic. *Journal of the American Statistical Association*. 75 (371). pp. 602–608.
- HOUCK. J.P. An Approach to Specifying and Estimating Non-Reversible Functions. *American Journal of Agricultural Economics.* 59 (3). pp. 570-572. 1977
- KINNUCAN. H.W.. FORKER. O.D. Asymmetry in Farm-Retail Price Transmission for Major Dairy Products. *American Journal of Agricultural Economics*. 69 (2). pp. 285-292. 1987
- LEWIS, M.S. Asymmetric Price Adjustment and Consumer Search: An Examination of the Retail Gasoline Market, *Journal of Economics and Management Strategy*, 20 (2), pp. 409-449, 2011
- MARGARIDO, M.A., TUROLLA, F.A., BUENO, C.R.F. The World Market for Soybeans: Price Transmission into Brazil and Effects from the Timing of Crop and Trade. *Nova Economia*. 17 (2). pp. 241-270, 2007
- MEYER. J.. VON CRAMON-TAUBADEL. S. Asymmetric Price Transmission: a Survey. *Journal of Agricultural Economics*. 55 (3). pp. 581-611. 2004
- MILLER. D.J.. HAYENGA. M.L. Price Cycles and Asymmetric Price Transmission in the U.S. Pork Market. *American Journal of Agricultural Economics*. 83 (3). pp. 551-562. 2001
- MINTEN. B.. KYLE. S. Retail Margins. Price Transmission and Price Asymmetry in Urban Food Markets: the Case of Kinshasa (Zaire). *Journal of African Economies*. 9 (1). pp. 1-23. 2000

- PELTZMAN, S. Prices Rise Faster Than They Fall. *Journal of Political Economy,* 108 (3), pp. 466–502, 2000
- RAY. S.. CHEN. H.. BERGEN. M.E.. LEVY. D. Asymmetric Wholesale Pricing: Theory and Evidence. *Marketing Research*. 25. pp. 131-154. 2006
- TAPPATA, M., Rockets and Feathers: Understanding Asymmetric Pricing, *RAND Journal of Economics,* 40, pp. 673-687, 2009
- VARIAN, H.R. A Model of Sales, *American Economic Review*, 70 (4), pp. 651–659, 1980.
- WARD. R.W. Asymmetry in Retail. Wholesale and Shipping Point Pricing for Fresh Vegetables. *American Journal of Agricultural Economics*. 62 (2). pp. 205-212. 1982

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