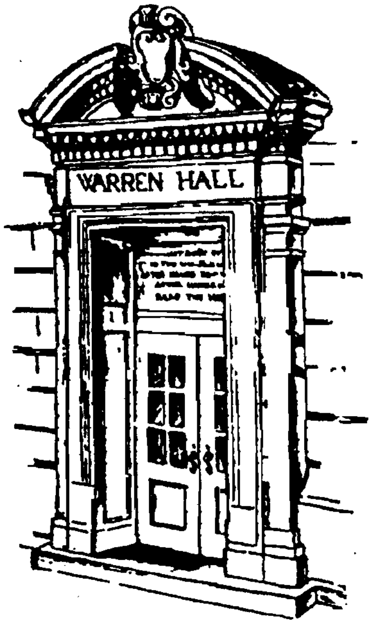

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Department of Agricultural, Resource, and Managerial Economics
Cornell University, Ithaca, New York 14853-7801 USA

Asymmetry In Wholesale - Retail Food Price Transmission

In An African Metropolitan Area:

The Case Of Kinshasa (Zaire)

Bart Minten
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ABSTRACT

This study presents a new explanation of asymmetric price behavior in food markets based on the presence of transactions costs, and provides evidence from a developing country. Price liberalization can in many cases be insufficient for efficient operation of African food markets. This is mainly due to the existence of significant transactions costs, caused by deficient infrastructure and information systems. A model based on search costs and kinked demand curves is used to explain asymmetric price behavior in retail markets in Kinshasa (Zaire).

I. INTRODUCTION

Since the beginning of the 1980s, structural adjustment and price liberalization programs in agricultural and food markets have been implemented in most African countries. Among other objectives, price liberalization was designed to encourage competition among traders and abandonment of the frequent practice of imposing official government prices for agricultural products. It was hoped that liberalization would permit efficient operation of markets with consequent improvements in resource allocation and welfare. However, agricultural markets still suffer from deficiencies and private traders are often perceived as unscrupulous speculators although they may have ample justification for their margins.

One of the explanations is the existence of transaction costs. It has recently been argued that transaction costs are more important in developing countries than in developed countries (Klitgaard, 1991; Thorbecke, 1992; de Janvry et al., 1992; Staatz et al., 1993)[1]. This is especially the case in the marketing sector. Because of poor information, this sector is often much larger than necessary and entrepreneurial talent is tied up in transacting rather than producing. In most Sub-Saharan countries, there is a pervasive lack of infrastructure, both physical and institutional, and the legal system is typically weak and often counterproductive. This creates an environment where information is not a free good and customers and traders face

[1] *Arguments are: large and significant cultural differences; greater quality variation in developing countries and fewer available screening signals of the true quality of an item; the greater incidence of poverty and the more unequal distribution of wealth what implies that the use of collaterals as a substitute for information is restricted; high uncertainty about future production, a function of unpredictable weather, and government and donor policies; and finally, unreliable contract enforcement mechanisms.*

significant opportunity costs when collecting information on prices, costs and other market conditions.

The focus of this paper is on asymmetric price behavior, i.e. the different transmission of price increases compared to decreases, in the retail markets of Kinshasa (Zaire). The contribution is two-fold.

First, it offers an alternative explanation for asymmetry through a model based on transactions costs. Previous explanations are based on industry concentration and government intervention (Hall et al., 1981). In the first case, food retailers are said to have sufficient market power to pass cost increases through to consumers rapidly while not passing price decreases on to consumers, thereby retaining a larger margin as excess profits. Another explanation for asymmetric behavior is given by Kinnucan and Forker (1987). Wholesale - retail price transmission elasticities differ depending on whether observed changes in the marketing margin are caused by retail level demand shifts for food or wholesale level supply shifts for the agricultural product. If strictly cost-push elements are the cause, wholesale-retail price transmission is shown to be smaller in numerical value than if strictly demand pull forces are at work.

Second, it measures asymmetric responses in retail price transmission of a developing country market. Previous analyses are confined to strongly regulated American agricultural markets (Hall et al., 1981; Ward, 1982; Bailey, Brorsen, 1982; Kinnucan, Forker, 1987; Hahn, 1990; Pick et al., 1990; Hansmire, Willett, 1993). These results indicate that retail prices in dairy markets appear to behave asymmetrically but it seems not to be a widespread phenomenon in other markets. Hahn's results suggest that asymmetry is especially important in retail price adjustments.

However, none of these explanations seem satisfactory in African retail markets. First, it is difficult to maintain that high industry concentration describes food retailing. Many people are involved in food retailing and entry and exit barriers seem to be very small. Second, government intervention in the pricing of agricultural commodities after structural adjustment is limited but although prices are liberalized, the legal framework is often not very well adapted. Third, the existence of inventories is normally expected to neutralize the effect of demand shifts, because stocks and not prices would be affected (Kinnucan, Forker, 1987). The structure of the paper is as follows. First, a model based on search costs is developed. Then, data sources and estimation procedures are explained. In a fourth section, the empirical results from Zaire are presented. The paper finishes with conclusions and policy implications.

II. THEORETICAL CONSIDERATIONS

A model specification much used in marketing margin studies is the mark-up model (Gardner, 1975; Heien, 1980). This model permits margins to consist of either absolute or percentage markups or a percentage thereof. The model can be written as:

$$R = f(W,Z)$$

where R is the retail price, W is the wholesale price and Z is a vector representing marketing inputs. The foundation of the markup pricing model rests on the hypothesis that prices of agricultural products and other inputs at lower levels of the marketing system cause prices at higher market levels. The use of the mark-up model to describe price transmission is dependent on three assumptions: a Leontief production function, constant returns to scale, and competitive markets (Heien, 1980). The use of the Leontief production technology implies that agricultural and marketing service inputs are used in fixed proportions. Constant returns to scale is equivalent to assuming constant marginal costs which implies that the volume moving through the system is not a relevant variable in the price transmission model.

The mark-up model is extended to include imperfect information and search costs in a competitive market. The present model considers a problem of limited price information concerning a homogeneous product[2]. It is supposed that identical consumers know the distribution of prices charged in the market but do not know which retailer charges which price. This information may be obtained at a "search cost" which differs among consumers and is characterized by a density function F(s).

The retailer's problem is to maximize profits, i.e.

$$Max_R \;\; N(R)Rq(R) - N(R)(W+Z)q(R) = N(R)Mq(R) - N(R)Zq(R)$$

where N(R) is the number of customers patronizing the retailer, R is the price charged by the retailer, q(R) is the quantity bought by the customer, W is the wholesale price, M is the marketing margin, Z is a vector of other marketing inputs. The first order condition for this maximization problem is:

[2] *It can be re-interpreted as a model of quality search if the quality of the commodity differs for a given price.*

$$-\frac{\partial N}{\partial R}\frac{R}{N} - \frac{\partial q}{\partial R}\frac{R}{q} = \frac{R}{R - (W + Z)} = \frac{R}{M - Z}$$

If ϵ is the elasticity of demand facing the retailer or

$$\epsilon = -\frac{dlnN}{dlnR} - \eta(R)$$

where $\eta(R) = -\partial q/\partial R.R/q$ is the elasticity of the individual demand curve, then this condition can be rewritten as a profit maximizing retailer equating marginal revenue to marginal costs or

$$R = \frac{W + Z}{1 - \frac{1}{\epsilon}}$$

A kinked demand model implies different elasticities for price increases (ϵ^+) and price decreases (ϵ^-). Hence, retail prices will respond differently to wholesale price increases (W^+) and to price decreases (W^-).

$$R^+ = \frac{W^+ + Z}{1 - \frac{1}{\epsilon^+}}; \quad R^- = \frac{W^- + Z}{1 - \frac{1}{\epsilon^-}}$$

If for example $\epsilon^+ > \epsilon^-$, then the same change in wholesale prices at the optimum causes a different change in retail prices, i.e. $|\Delta R^+| > |\Delta R^-|$.

A kinked demand model arises in competitive markets with search costs and imperfect information (Braverman, 1980; Stiglitz, 1987; Sibly, 1992; McMillan, Morgan, 1988). This theory has a strong appeal for developing countries where sellers on the food market are seemingly undifferentiated and publicity for a particular seller is non existent. If a retailer raises its price, customers with low search costs may proceed to search for a lower-priced store. If a retailer lowers its price, it may sell more to its current customers, and more individuals who are searching products will decide to purchase there. But even if it became publicly known that some retailer had lowered its price, it might not become known which retailer had done so. The lack of information systems, measures of quality, grades and weight in food retailing markets in developing countries imply significant search costs for the customer.

Three special cases of search costs are taken into consideration (s_t is the cost of the t^{th} search): a. linear: $s_t = \bar{s}$ (and $s_1 = 0$); b. convex: $s_t \geq s_{t-1}$ ($s_1 > 0$); c. concave: $s_t \leq s_{t-1}$ ($s_1 > 0$). Many of the costs of search are fixed: after going to a food retail market, the marginal costs of going to an additional retailer may be relatively small. But there are also increasing costs associated with search: time and money become increasingly scarce. On the other hand, agricultural products are also sold outside the official markets by street vendors. In this case, fixed search costs are less and variable search costs are more important.

Along the lines of the search model developed by Stiglitz (1987), assume that there are L customers and N retailers, all charging a price $R=R^*$. The share of customers for each retailer is L/N. If a retailer wants to raise its price, its low-search-cost customers will leave. The retailer that raises its price sells only to customers. Those individuals with search costs

$$M = \frac{L}{N}[1 - F(\hat{s}(R))]$$

s < s̄ will search for another retailer and F(ŝ(R)) gives the fraction of individuals who search at each value of R. Differentiating this, the elasticity of demand is:

$$\epsilon^{+}(R^{*}) = \eta(R^{*}) + f(0)q(R^{*})R^{*}$$

Stiglitz (1987) shows that in the case of search without replacement and

a) linear search costs:

$$\epsilon^{-}(R^{*}) = \eta(R^{*}) + \frac{2(N-1)}{N}f(0)R^{*}q(R^{*})$$

b) convex search costs:

$$\epsilon^{-}(R^{*}) = \eta(R^{*}) + \frac{f(0)R^{*}q(R^{*})}{N-1}$$

c) concave search costs:

$$\epsilon^{-}(R^{*}) = \eta(R^{*}) + (N-1)f(0)R^{*}q(R^{*})$$

The introduction of search costs generates different elasticities for a price increase than a price decrease and causes a kink in the demand curve. Hence, this model serves as an explanation for asymmetric price behavior.

Several authors criticize the assumptions of the mark-up model. Wohlgenant and Haidacher (1989) research the fixed proportions of agricultural and marketing service inputs for major foods in the U.S. and show that farm-level derived demand elasticities are more than 40 percent larger than those obtained by assuming fixed proportions. In a developing country context and for a wholesale-retail margin it can be argued that substitution between wholesale products and marketing inputs is minor because of the relatively small amounts of marketing service inputs required in retail marketing and the limited technology employed. Wohlgenant and Mullen (1987) argue that with both supply and demand shifts, no mark-up pricing relationship can depict accurately the relationship between retail and wholesale price. In the Zairean framework, it is expected that there will be shifts in the supply curve and changes in the wholesale price of the different commodities because of seasonal variation in production and changing road conditions while shifts in the demand curve and changes in the retail price occur because of variations in purchasing power and consumer preferences. Given the short period of analysis, we will assume that the latter shifts are less important and hence, that the mark-up model is valid[3,4,5].

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[3] *Analysis of variability of retail prices, wholesale prices and marketing margins may provide some evidence on price responsiveness at different levels. In the case of instantaneous and symmetric transmission of price changes from one level to another, one would expect retail and wholesale prices to have similar variability. Variable retail prices with stable wholesale prices would seem to indicate that wholesale prices do not respond to retail price changes (Pick et al., 1990). Table 1 shows that retail prices are more variable than wholesale prices.*

[4] *It is difficult to assess demand shifts because of lack of data during that time period. An indication is that the real wages index in the public administration evolved from 22.4 in 1987 and 1988 to 24.9 in 1989 (1975=100) and that the Gross Domestic Product grew from 1096.3 in 1987 to 1120.8 million Zaires in 1988 (expressed in 1970 Zaires). Neither of these indicators show a large change.*

[5] *Results of causality tests would allow a decision on how to estimate the price transmission system: it can be estimated in a single equation if there is unidirectional causality while in the case of bidirectional causality, a simultaneous system is appropriate. However, causality tests are not appropriate if price interactions are asymmetric because causality tests are based on linear models and asymmetric price transmission is a nonlinear process (Hahn, 1990).*

III. DATA AND METHODOLOGY

A. Data

Food prices on nine retail markets and five wholesale markets in Kinshasa were gathered by the division of markets, prices and rural credit and the K.U.Leuven-A.G.C.D. project in the Ministry of Agriculture after the implementation of the price liberalization program. Four of the surveyed markets have a wholesale and retail market. Continuous weekly prices are available from the first week of 1987 through the fourth week of 1989. The weekly price series are not deflated because the purpose of this analysis is to examine the asymmetric behavior of nominal prices and not relative prices.

B. Estimation Procedures

The Houck procedure (1977) to test for asymmetric behavior is used. In a mark-up model, the retail price is caused by the wholesale price and the estimated equation is[6]:

$$R_t - R_0 = \sum_{i=0}^{n} \alpha_i (W_t - W_{t-i}) D_{up} + \sum_{i=0}^{n} \beta_i (W_t - W_{t-i}) D_{do} + \gamma_i S_i + \delta T + \sum_{i=0}^{n} \eta (G_t - G_0) + \epsilon_t$$

where R is the retail price, W is the wholesale price, $D_{up} = 1$ if $W_t > W_{t-1}$ and 0 otherwise, $D_{do} = 1$ if $W_t \leq W_{t-1}$ and 0 otherwise, G is the price of gasoline, T is a trend variable, $S_{1,2,3}$ are seasonal dummies for first, second and third quarter, n is the number of lags, and t is the

[6] *Because most weekly variables are integrated of order one (I(1)) but are not co-integrated over levels, a specification without error correction term is appropriate.*

time period. The gasoline price, seasonal dummies and trend variable are used as proxies for changes in marketing costs.

According to this equation, the sign of $(W_t - W_{t-i}) D_{up}$, the period to period increase, should always be positive and the sign of $(W_t - W_{t-i}) D_{do}$, the period to period decrease, should always be negative. The coefficients α_i and β_i should be positive (negative) when a positive (negative) net relationship exists between R_t and W_t. The sum of the coefficients should equal one if absolute price changes are completely transmitted.

Seemingly Unrelated Regression (SUR) techniques are used for estimation in this analysis. The use of SUR implies that the error terms are contemporaneously correlated. It can be hypothesized that random events such as weather, fuel shortage, strikes, etc. affect all products alike. Suppose there are N equations $Y_i = X_i \beta_i + \epsilon_i$ where the subscript i refers to the *i*th equation. These equations can be written in matrix notation as $Y^* = X^* \beta^* + \epsilon^*$. Specifying the general equations in this way enables a test of the null hypothesis that the pricing structure in the Zairian food distribution sector is symmetrical:

$$H_0\colon \sum_{i=0}^{n} \alpha_{ij} = \sum_{i=0}^{n} \beta_{ij} \quad for \quad j = 1,\ldots,m$$

versus the alternative:

$$H_1\colon \sum_{i=0}^{n} \alpha_{ij} \neq \sum_{i=0}^{n} \beta_{ij} \quad for \quad j = 1,\ldots,m$$

where m is the number of products. A way to develop a test statistic for testing H_0 against H_1 is to use an extended version of the single equation F-test. Assuming the errors are normally distributed, an expression for λ_f can be derived (Judge, 1988):

$$\lambda_f = \frac{g/J}{(y - X\hat{\beta})'(\Sigma^{-1} \otimes I)(y - X\hat{\beta})/(MT - K)} \sim F_{(J,\, MT-K)}$$

where the system of equations is:

$$y = X\beta + \epsilon$$

and T is the number of observations, M is the number of equations, K is the number of regressors, J is the number of restrictions, $\Sigma \otimes I$ is the covariance matrix, and

$$g = (R\hat{\beta} - r)'(R[X'(\Sigma^{-1} \otimes I)X]^{-1}R')^{-1}(R\hat{\beta} - r)$$

It can be shown that the denominator converges in probability to one and hence can be omitted, leaving

$$\hat{\lambda}_f = \frac{\hat{g}}{J}$$

as a new operational statistic that has an approximate $F_{(J,MT-K)}$ distribution (Judge, 1988).

IV. EMPIRICAL RESULTS

Table 1 shows the price level and the number of weekly periods of increasing and decreasing prices for major agricultural products at the retail and wholesale level for the period 1987 - 1989. The retail margin ranges from seventeen percent of the final retail price for maize in grains to fifty-four percent for peanuts in grain (compared to peanuts in shell). The margin is largest for transformed products and smallest for the more standardized products. In general, almost the same number of periods of increasing and decreasing prices are found but the average price increase is significantly larger than the average price decrease, causing an upward trend in prices and reflecting an inflationary environment.

Table 2 (in levels) and 3 (in differences) show the results for the asymmetry test using a seemingly unrelated regression model. Initially four lags were used in the regression. Most products show significant effects only for the contemporaneous and one period lagged price. Because of the high multicollinearity of contemporaneous and lagged prices and because of the fast turn-over by retailers[7], it was decided to incorporate only one lag in the regression. To check the overall acceptability of the residual autocorrelation, the Ljung-Box Q-statistic is used. If significant auto-correlation was found, additional lags were incorporated based on a correlogram of the residuals. In that way, the Ljung-Box Q-statistic becomes insignificant for all products.

All products show a significant influence (at the 10 percent level) of the increasing wholesale price on the retail price while only three retail prices out of nine are affected by price decreases at the wholesale level. The price increase is transmitted in the same week for all products. Six products, of which three are significant, have a negative sign for the lagged transmission, i.e. some retail prices are overshooting wholesale price increases. Almost the same results hold for the difference specification. Eight retail prices are influenced by increasing wholesale prices while only three products are significantly affected by decreasing wholesale prices.

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[7] *Goossens et al. (1994) and Minten (1995) show that it takes the retailer on average 2.7 to 6.2 days, depending on the product, to sell the products they bought on the wholesale market.*

Table 1: Mean and Standard Deviation of Price Levels, Number of Periods of Increasing and Decreasing Prices and Mean Nominal Price Increase and Decrease for Major Agricultural Products at the Retail and Wholesale Level in Kinshasa in the Period 1987 - 1989 (Weekly Prices)

Product	Price Level		Increasing Prices		Decreasing Prices	
	Mean	St. Deviat.	Number	Mean	Number	Mean
Retail:						
White Beans	192.9	104.7	68	12.0	39	8.9
Colored Beans	157.5	94.4	54	15.3	53	7.4
Cassava Bandundu[8]	57.1	28.1	43	6.4	54	2.3
Cassava Bas-Zaire	58.9	28.0	55	4.1	42	2.6
Peanuts in shell	99.5	52.7	62	5.7	45	3.5
Maize in grains	41.7	20.5	58	2.8	49	1.4
Cassava flour	68.3	31.7	48	4.5	59	1.3
Peanuts in grains	165.0	91.8	61	8.3	46	4.4
Maize flour	93.8	45.6	62	6.8	45	4.5
Wholesale:						
White Beans	136.2	70.1	59	14.4	48	11.9
Colored Beans	120.4	61.4	58	12.1	49	7.4
Cassava Bandundu	35.3	12.5	62	2.6	45	1.7
Cassava Bas-Zaire	44.2	16.3	56	3.7	51	2.5
Peanuts in shell	76.7	76.7	61	5.8	46	5.5
Maize in grains	34.5	34.5	61	2.5	46	1.6

[8] *Cassava chips from Bandundu are considered to have a different quality than those from Bas-Zaire because of the higher expected losses (the chips are more damaged from the longer trip in Bandundu than in Bas-Zaire) and discoloration, different processing methods.*

Table 2: Results of the Regression of Weekly Retail Food Prices on Wholesale Prices and Other Variables during 1987 - 1989 in Kinshasa (Seemingly Unrelated Regression; the Values in Brackets are t-Ratios)

Independent variables	Dependent variable: $R_t - R_0$				
	Maize grains	Maize flour	White Beans	Colored Beans	Cassava BDD
Intercept	2.30 (1.21)	-7.21 (-1.56)	12.12 (1.77)	4.79 (0.45)	1.42 (0.39)
W^{up}_t	0.95 (7.19)	0.81 (2.57)	0.63 (8.14)	0.68 (4.51)	1.07 (4.09)
W^{up}_{t-1}	-0.34 (-2.11)	0.51 (1.44)	-0.26 (-2.16)	-0.11 (-0.76)	0.69 (1.75)
W^{do}_t	-0.44 (-1.72)	0.75 (1.23)	0.20 (1.11)	0.54 (2.21)	0.98 (2.26)
W^{do}_{t-1}	0.82 (3.25)	0.42 (0.69)	0.01 (0.10)	0.07 (0.24)	-0.13 (-0.32)
S_1	-2.30 (-2.13)	-0.33 (-0.13)	-4.94 (-1.01)	3.24 (0.54)	-0.18 (-0.10)
S_2	-5.00 (-3.72)	-4.66 (-1.47)	3.80 (0.70)	1.24 (0.23)	-1.16 (-0.52)
S_3	-3.27 (-3.46)	-7.42 (-2.91)	-14.46 (-3.37)	-17.84 (-3.25)	-2.84 (-1.36)
Gas_t	0.05 (1.08)	0.39 (3.52)	-0.53 (-1.79)	-1.42 (-4.62)	0.02 (0.13)
$Trend_t$	-0.14 (-2.32)	-0.02 (-0.13)	-0.35 (-0.91)	0.33 (0.92)	-0.86 (-3.97)
R_{t-1}	0.39 (4.52)	0.41 (4.35)	0.72 (10.90)	0.72 (7.40)	0.42 (4.93)
R^2	0.98	0.98	0.98	0.97	0.97
Ljung-Box Q-stat.	6.16	3.83	2.21	2.94	5.61
(Prob.)	(0.40)	(0.70)	(0.89)	(0.82)	(0.47)
ARCH F-stat.	1.50	0.44	1.13	0.65	1.08
(Prob.)	(0.19)	(0.85)	(0.34)	(0.68)	(0.38)

BDD = Bandundu; BZ = Bas-Zaire

S_1, S_2, S_3 are seasonal dummies for months 1 to 3, 4 to 6, 7 to 9 respectively.

Transformed retail products are compared to the raw material wholesale product.

Table 2: (continued)

Independent variables	Dependent variable: $R_t - R_0$			
	Peanuts in shell	Peanuts in grains	Cassava Flour	Cassava BZ
Intercept	4.96 (1.46)	11.25 (2.58)	-8.70 (-3.49)	8.10 (2.33)
W^{up}_t	0.31 (2.23)	0.64 (3.98)	0.35 (1.94)	0.95 (5.82)
W^{up}_{t-1}	0.08 (0.61)	-0.17 (-1.05)	-0.10 (-0.42)	-0.41 (-2.34)
W^{do}_t	0.07 (0.43)	0.29 (1.43)	0.31 (1.07)	0.43 (1.59)
W^{do}_{t-1}	0.07 (0.45)	-0.16 (-0.81)	-0.08 (-0.28)	-0.13 (-0.50)
S_1	-3.71 (-1.40)	-4.28 (-1.45)	2.37 (1.84)	-5.71 (-3.01)
S_2	-5.79 (-2.19)	-3.51 (-1.25)	-0.24 (-0.17)	-5.56 (-3.00)
S_3	-0.16 (-0.07)	-0.79 (0.31)	-4.74 (-3.26)	-2.75 (-1.55)
Gas_t	0.14 (1.13)	-0.04 (-0.29)	0.19 (2.28)	-0.17 (-1.98)
Trend	-0.36 (-2.46)	-0.56 (-2.88)	0.34 (2.51)	-0.39 (-2.55)
R_{t-1}	0.59 (6.89)	1.11 (11.20)	0.50 (6.50)	0.70 (6.97)
R_{t-2}		-0.35 (-3.84)		0.14 (1.20)
R_{t-3}				-0.16 (-1.35)
R_{t-4}				-0.02 (-0.14)
R_{t-5}				0.17 (1.71)
R^2	0.98	0.99	0.98	0.98
Ljung-Box Q-stat	2.17	9.99	5.55	8.56
(Prob.)	(0.90)	(0.15)	(0.47)	(0.20)
ARCH F-stat.	1.49	4.84	0.14	5.28
(Prob.)	(0.19)	(0.00)	(0.99)	(0.00)

BDD = Bandundu; BZ = Bas-Zaire
S_1, S_2, S_3 are seasonal dummies for months 1 to 3, 4 to 6, 7 to 9 respectively.
Transformed retail products are compared to the raw material wholesale product.

Table 3: Results of the Regression of First Differences of Weekly Retail Food Prices on First Differences in Wholesale Prices during 1987 - 1989 in Kinshasa (Seemingly Unrelated Regression; the Values in Brackets are t-Ratios)

Independent variables	Dependent variable: R_t - R_{t-1}				
	Maize grains	Maize flour	White Beans	Colored Beans	Cassava BDD
Intercept	-0.79 (0.49)	-5.10 (-0.99)	3.66 (0.58)	-2.01 (-0.18)	3.75 (0.88)
W^{up}_t - W^{up}_{t-1}	0.89 (6.44)	0.53 (1.51)	0.54 (6.69)	0.41 (3.47)	0.97 (2.93)
W^{up}_{t-1} - W^{up}_{t-2}	0.13 (1.18)	0.61 (2.15)	0.04 (0.81)	0.22 (2.19)	0.46 (2.04)
W^{do}_t - W^{do}_{t-1}	-0.19 (-0.69)	1.33 (1.93)	0.10 (0.52)	0.58 (2.18)	0.24 (0.51)
W^{do}_{t-1}- W^{do}_{t-2}	0.25 (1.40)	0.97 (2.10)	-0.00 (-0.04)	0.21 (1.18)	0.17 (0.64)
S_1	-2.90 (-2.60)	-0.72 (-0.25)	-6.81 (-1.33)	0.52 (0.09)	-2.55 (-1.24)
S_2	-0.21 (-0.17)	4.71 (1.52)	0.02 (0.00)	3.44 (0.60)	-2.27 (-0.91)
S_3	0.14 (0.16)	0.97 (0.43)	-8.89 (-2.00)	-8.69 (-1.63)	-1.66 (-0.71)
Gas_t - Gas_{t-1}	0.16 (2.71)	0.44 (3.06)	-0.54 (-1.53)	-1.63 (-4.52)	0.08 (0.49)
$Trend_t$	-0.03 (-0.49)	0.03 (-0.20)	-0.21 (-0.48)	-0.17 (-0.45)	-0.36 (-1.58)
R_{t-1} - R_{t-2}	-0.42 (-4.40)				-0.25 (-2.81)
R_{t-2} - R_{t-3}					-0.30 (-3.25)
R_{t-4} - R_{t-5}					-0.27 (-2.83)
R_{t-5} - R_{t-6}	-0.41 (-3.75)				
R^2	0.32	0.36	0.47	0.38	0.35
Ljung-Box Q-stat.	3.09	9.40	4.78	5.41	5.33
(Prob.)	(0.80)	(0.15)	(0.57)	(0.49)	(0.50)
ARCH F-test	4.65	0.42	1.75	0.60	1.85
(Prob.)	(0.00)	(0.85)	(0.12)	(0.72)	(0.10)

BDD = Bandundu; BZ = Bas-Zaire
S_1, S_2, S_3 are seasonal dummies for months 1 to 3, 4 to 6, 7 to 9 respectively.
Transformed retail products are compared to the raw material wholesale product.

Table 3: (continued)

Independent variables	Dependent variable: $R_t - R_{t-1}$			
	Peanuts in shell	Peanuts in grain	Cassava BZ	Cassava Flour
Intercept	0.44 (0.13)	-0.35 (-0.09)	5.43 (1.53)	2.06 (0.68)
$W^{up}_t - W^{up}_{t-1}$	0.11 (0.75)	0.46 (2.93)	0.78 (5.20)	0.55 (2.37)
$W^{up}_{t-1} - W^{up}_{t-2}$	0.03 (0.41)	0.00 (0.00)	0.26 (2.27)	-0.14 (-0.86)
$W^{do}_t - W^{do}_{t-1}$	0.07 (0.36)	0.25 (1.17)	0.46 (1.71)	0.14 (0.40)
$W^{do}_{t-1} - W^{do}_{t-2}$	0.04 (0.36)	-0.02 (-0.14)	0.11 (0.85)	-0.13 (-0.67)
S_1	-2.04 (-0.71)	-4.50 (-1.47)	-3.91 (-2.06)	-0.64 (-0.45)
S_2	-1.06 (-0.39)	-0.39 (-0.13)	-3.47 (-2.00)	-1.98 (-1.13)
S_3	1.08 (0.43)	0.29 (0.11)	-0.94 (0.56)	-1.75 (-1.04)
$Gas_t - Gas_{t-1}$	0.05 (0.34)	-0.18 (-1.21)	-0.10 (-1.25)	-0.20 (-1.78)
$Trend_t$	0.02 (0.16)	-0.01 (-0.06)	-0.30 (-1.95)	0.04 (0.26)
$R_{t-1} - R_{t-2}$		0.28 (2.96)	-0.17 (-1.81)	
$R_{t-4} - R_{t-5}$			-0.27 (-2.27)	
R^2	0.06	0.31	0.31	0.40
Ljung-Box Q-stat.	8.22	10.72	4.80	8.59
(prob.)	(0.22)	(0.10)	(0.57)	(0.20)
ARCH Test	1.27	3.18	8.37	0.79
(prob.)	(0.27)	(0.01)	(0.00)	(0.58)

BDD = Bandundu; BZ = Bas-Zaire

S_1, S_2, S_3 are seasonal dummies for months 1 to 3, 4 to 6, 7 to 9 respectively.

Transformed retail products are compared to the raw material wholesale product.

Price transmission elasticities are calculated at the mean for the wholesale-retail price spread using the level specification (Table 4). The elasticity of price transmission measures price responsiveness between market levels. It is defined as the responsiveness of retail prices (R) to a one percent change in the wholesale price (W) as seen by:

$$\eta = \frac{\partial R}{\partial W}\frac{W}{R}$$

To calculate the change in retail price for a change in wholesale prices, the contemporaneous and one period lagged coefficients are taken into account. An F-test is conducted on the hypothesis that there is symmetric behavior for the nine equations in the SUR model simultaneously. The results indicate a rejection of the hypothesis of symmetric behavior (F: 5.4440; Prob > F^*: 0.0001). F-values are calculated for the specified hypothesis for the nine products separately (Table 4). In eight out of nine cases, the price transmission elasticity for price increases is larger than the elasticity for price decreases and in six out of nine cases, significant asymmetric behavior is found[9]. Of the nine products, only beans and cassava flour are described by symmetric behavior. Peanuts and cassava from Bandundu are the most significantly asymmetric products. Goossens (1994) argues that the quality of beans is relatively uniform compared to other products. Peanuts at the wholesale level are sold in shell making it difficult to evaluate quality and quantity as an unknown percentage of shells is empty and grains can be moldy or damaged by insects. The quality of cassava from Bandundu is more uncertain than cassava from Bas-Zaire because of the unknown impact of greater

[9] *Using the difference equation, six out of nine show significant asymmetric behavior (reversed asymmetric behavior is found for maize flour).*

transport damage. Hence, a possible explanation for asymmetric behavior might be that some products are more homogenous than other products such that search costs are less and that elasticities of price increases are equal to elasticities of price decreases.

Table 4: Elasticities of Retail - Wholesale Price Transmission for Major Agricultural Products under Rising and Falling Prices and Results for the Test of Symmetric Behavior (Kinshasa, Weekly, 1987 - 1989)

	Elasticity		F-test		
	Increasing	Decreasing	F-value	Prob > F	Conclusion
White Beans	0.261	0.148	2.50	0.11	Symmetric
Colored Beans	0.436	0.467	0.10	0.75	Symmetric
Cassava Bandundu	1.088	0.525	16.81	0.00	Asymmetric
Cassava Bas-Zaire	0.405	0.225	4.92	0.03	Asymmetric
Cassava flour	0.129	0.119	0.00	0.96	Symmetric
Peanuts in shell	0.300	0.108	10.38	0.00	Asymmetric
Peanuts in grains	0.219	0.060	11.76	0.00	Asymmetric
Maize in grains	0.506	0.315	5.64	0.02	Asymmetric
Maize flour	0.486	0.431	5.30	0.02	Asymmetric

For most products, the price of gasoline does not significantly affect the retail margin except for white and colored beans, where the coefficient has a counter-intuitive sign and for transformed products (cassava flour and maize flour). Milling of maize grains and cassava chips are mainly done by means of mechanical mills, which require fuel. The elasticity of the retail price of the transformed product with respect to the gasoline price (evaluated at the mean) is 0.13 and 0.19 for cassava flour and maize flour respectively.

V. CONCLUSIONS

The price transmission between wholesale level and retail level is analyzed in Kinshasa (Zaire) to test for asymmetric behavior. The hypothesis of symmetric behavior for all products simultaneously as measured by an F-test is rejected. All retail prices are significantly affected by wholesale price increases while only half of them are affected by wholesale price decreases. Six out of nine products show significant asymmetric behavior. This asymmetry can be explained by search costs incurred by the customer. It is shown that the existence of search costs can generate kinked demand curves in competitive markets which implies a different price elasticity for price increases and price decreases. Products characterized by lower search costs because of more homogeneity and standardization behave symmetrically while other products with higher search costs behave asymmetrically.

Policy implications imply efforts to reduce search costs. A first implication concerns the setting of grades and standards. This can be an important function of collectives and cooperatives and could take a number of forms such as brand names, guarantees and bonding of participants. Second, public gathering and dissemination of information and legally established mandatory reporting systems are likely to improve market performance. Studies that examine the effects of increasing consumer information on food prices provide evidence that credible comparative price information reduces price dispersion and average retail prices in a metropolitan area (Marion, 1986). Promising experiences with agricultural market information systems in Africa are under way in Mali and Cameroon. As this analysis only focuses on the Kinshasa market in Zaire, the extension of this study is obvious. It would be useful if studies could be done on more products, other urban markets, other countries, and for longer time periods.

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