Title:

Cost Pass Through in the Case of Sequential Oligopoly: An Empirical Study of the Fluid Milk Market[♣]

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Subject Code: Agricultural Marketing

Abstract: We estimate the cost pass through rates (CPTR) in the Boston fluid milk market while taking into account strategic conduct (Vertical Nash, Vertical Stackleberg) between retailers and processors. By using structural demand and supply specification we estimate and test for the pass through rates at different stages of fluid milk marketing channels. Processors have higher pass through rates than retailers.

[♣] Paper selected for presentation at the American Economic Association Annual Meeting. NAshville, Tenessee – 1999.

Introduction:

Research in agricultural economics on Cost Pass Through Rates (CPTR) has concentrated almost exclusively on homogeneous products and competitive market channels (e.g. Gardner 1975, Heien 1980, Kinnucan and Forker 1987, Frigon 1999). Recently Mccorriston et al. (1998) relax the competitive assumption but continue to maintain the homogeneous product assumption. Moreover, rather than estimate or test their model, they assumed its validity and used parameter estimates from other sources to estimate cost pass through elasticities for agricultural product industries. Ashenfelter et al. (1998) working on the Staples-Office Depot merger case have estimated firm specific cost shocks using a reduced form estimation procedure. In this paper we use a structural model to analyze the CPTR for individual firms in a differentiated product oligopoly. We estimate the CPTR for firm specific as well as industry wide cost shocks.

This paper uses Information Resources Inc. (IRI) - Infoscan database to estimate the firm level CPTR for fluid milk products for each of the top four supermarket chains in Boston (Stop & Shop, Shaw's, Star Market and DeMoulas). Our data set is monthly from March 1996 to July 1998. This period includes the dramatic increase in farm level fluid milk price due to the advent of the Northeast Dairy Compact (NEDC). For this reason we are particularly interested in how each chain changes it's fluid milk price when farm level fluid milk price, an industry wide cost shift variable, changes.

Cost Pass-Through Models for Differentiated Product Oligopoly:

Ashenfelter et al. (1998) show that in a simple partial equilibrium model there can be two types of cost shocks – industry wide and firm specific. Given an oligopolistic market structure, a firm specific shock will not only influence that firm's own price level, other firms also may react to that price change and change their prices. Therefore in a structural model as opposed to reduced form model one can estimate three types of cost pass-throughs: Cost pass-through for each firm within a channel due to industry wide cost shocks, own cost pass-through due to own firm specific shocks and cross pass-through rates of other firms as a result of a shocked firm's price change. All literature on price transmission in agricultural economics has only considered the industry wide cost shocks and Ashenfelter et.al. (1998) consider only the first two of the three. For this paper, we estimated three vertical models: supermarkets with downstream integration, a vertical Nash model where each supermarket chooses an exclusive supplier, and a similar vertical Stackleberg model. Results were similar, so mainly due to space constraints we present only the vertical Nash model.

Vertical Nash Channel Model:

In a Vertical Nash equilibrium, as defined by Choi (1991), each processor chooses its price conditional on both the retailer's markup on its own product, and all retail prices. Each retailer determines its markup conditional on the respective wholesale price and retail prices of competing retailers[1]. For the simplicity of exposition we derive a two retailers two processors model. In the empirical section of this paper we extend the model to four retailers and four processors.

We assume a Bertrand pricing game. Let the demand functions of the retailers be the following:

$$q_1 = a_0 - a_1 p_1 + a_2 p_2$$
$$q_2 = b_0 + b_1 p_1 - b_2 p_2 \qquad [1(a)\text{-}(b)]$$

Let the retailer's cost function be the following:

$$TC_1 = w_1 * q_1$$
$$TC_2 = w_2 * q_2 \qquad [2(a)\text{-}(b)]$$

where: w_1 and w_2 are the wholesale prices received by the processors.

So, the retailers profit functions can be written as :

[1] The estimated model assumes an vertical dyads in equilibrium, i.e. each retailer deals with only one processor. For all the models estimated the model presented here fits the best with the data. Our future research will explore other innovative relationships between processors and retailers.

$$\Pi_1^R = (p_1 - w_1)q_1$$
$$\Pi_2^R = (p_2 - w_2)q_2 \qquad [3(a)-(b)]$$

Linear mark-up is assumed by the processor at the retail level; so, retail price can be written as:

$$p_1 = w_1 + r_1$$
$$p_2 = w_2 + r_2 \qquad [4(a)-(b)]$$

where: r_1 and r_2 are the linear mark-up at the retail level.

We simplify the processor level marginal cost function in the following manner:

$$wmc_1 = m + m_1$$
$$wmc_2 = m + m_2 \qquad [5(a)-(b)]$$

where: m is the industry specific marginal cost component and m_1 and m_2 are the processor specific cost components.

So, the processors profit functions can be written as:

$$\Pi_1^P = (w_1 - m - m_1)q_1$$
$$\Pi_2^P = (w_2 - m - m_2)q_2 \qquad [6(a)-(b)]$$

After deriving all the profit maximizing first order conditions both at the processing and retail level we obtain the following CPTR equations using algebra of comparative static.

In the case of two retailers and two processors, at the processor level we will have six pass-through measures:

For the industry wide shock we have two CPTRs:

$$\left.\frac{dw_1}{dm}\right|_{dm_1=dm_2=0} = \frac{6a_1b_2 - 2a_2b_1 - a_2b_2}{9a_1b_2 - 4a_2b_1}$$
$$\left.\frac{dw_2}{dm}\right|_{dm_1=dm_2=0} = \frac{6a_1b_2 - 2a_2b_1 - a_1b_1}{9a_1b_2 - 4a_2b_1} \qquad [7(a)-(b)]$$

For the processor specific shocks we will have four CPTRs:

$$\left.\frac{dw_1}{dm_1}\right|_{dm=dm_2=0} = \frac{6a_1b_2 - 2a_2b_1}{9a_1b_2 - 4a_2b_1}$$
$$\left.\frac{dw_2}{dm_1}\right|_{dm=dm_2=0} = \frac{-a_1b_1}{9a_1b_2 - 4a_2b_1} \qquad [8(a)-(b)]$$

$$\left.\frac{dw_1}{dm_2}\right|_{dm=dm_2=0} = \frac{-a_2b_2}{9a_1b_2 - 4a_2b_1}$$
$$\left.\frac{dw_2}{dm_2}\right|_{dm=dm_1=0} = \frac{6a_1b_2 - 2a_2b_1}{9a_1b_2 - 4a_2b_1} \qquad [8(c)-(d)]$$

Note however that $\frac{dw_1}{dm_1} = \frac{dw_2}{dm_2}$ in this two-person game, however this is unique to the two firm game. In a game with more than two players both at the retail and processor level this equality disappears. Also note that since we have assumed constant marginal cost all pass-through rates are functions only of demand parameters.

Similarly, we can estimate four CPTRs for retailers when wholesale prices changes:

$$\left.\frac{dp_1}{dw_1}\right|_{dw_2=0} = \frac{2a_1b_2}{4a_1b_2 - a_2b_1}$$

$$\left.\frac{dp_2}{dw_1}\right|_{dw_2=0} = \frac{-a_1b_1}{4a_1b_2 - a_2b_1}$$

$$\left.\frac{dp_1}{dw_2}\right|_{dw_1=0} = \frac{-a_2b_2}{4a_1b_2 - a_2b_1} \qquad [9(a)\text{-}(d)]$$

$$\left.\frac{dp_2}{dw_2}\right|_{dw_1=0} = \frac{2a_1b_2}{4a_1b_2 - a_2b_1}$$

For the purpose of consistency the following relationship should hold:

- In the case of industry wide shocks:

$$\left.\frac{dp_1}{dm}\right|_{dm_1=dm_2=0} = \left(\left.\frac{dp_1}{dw_1}\right|_{dw_{2=0}} * \left.\frac{dw_1}{dm}\right|_{dm_1=dm_2=0}\right) + \left(\left.\frac{dp_1}{dw_2}\right|_{dw_1=0} * \left.\frac{dw_2}{dm}\right|_{dm_1=dm_2=0}\right)$$

$$\left.\frac{dp_2}{dm}\right|_{dm_1=dm_2=0} = \left(\left.\frac{dp_2}{dw_1}\right|_{dw_{2=0}} * \left.\frac{dw_1}{dm}\right|_{dm_1=dm_2=0}\right) + \left(\left.\frac{dp_2}{dw_2}\right|_{dw_1=0} * \left.\frac{dw_2}{dm}\right|_{dm_1=dm_2=0}\right) \qquad 10[a\text{-}b]$$

- Similarly, for channel specific shocks:

$$\left.\frac{dp_1}{dm_1}\right|_{dm=dm_2=0} = \left(\left.\frac{dp_1}{dw_1}\right|_{dw_{2=0}} * \left.\frac{dw_1}{dm_1}\right|_{dm=dm_2=0}\right) + \left(\left.\frac{dp_1}{dw_2}\right|_{dw_1=0} * \left.\frac{dw_2}{dm_1}\right|_{dm=dm_2=0}\right)$$

$$\left.\frac{dp_2}{dm_1}\right|_{dm=dm_2=0} = \left(\left.\frac{dp_2}{dw_1}\right|_{dw_{2=0}} * \left.\frac{dw_1}{dm_1}\right|_{dm=dm_2=0}\right) + \left(\left.\frac{dp_2}{dw_2}\right|_{dw_1=0} * \left.\frac{dw_2}{dm_1}\right|_{dm=dm_2=0}\right) \qquad 11[a\text{-}b]$$

$$\left.\frac{dp_1}{dm_2}\right|_{dm=dm_1=0} = \left(\left.\frac{dp_1}{dw_1}\right|_{dw_{2=0}} * \left.\frac{dw_1}{dm_2}\right|_{dm=dm_1=0} \right) + \left(\left.\frac{dp_1}{dw_2}\right|_{dw_1=0} * \left.\frac{dw_2}{dm_2}\right|_{dm=dm_1=0} \right)$$

$$\left.\frac{dp_2}{dm_2}\right|_{dm=dm_1=0} = \left(\left.\frac{dp_2}{dw_1}\right|_{dw_{2=0}} * \left.\frac{dw_1}{dm_2}\right|_{dm=dm_1=0} \right) + \left(\left.\frac{dp_2}{dw_2}\right|_{dw_1=0} * \left.\frac{dw_2}{dm_2}\right|_{dm=dm_1=0} \right) \quad 12[a\text{-}b]$$

The above six equations also implies that we need to estimate the two stage CPTRs then the overall CPTR can be estimated from these consistency equations.

Variable Definitions and Model Specification:

We use IRI scanner data of monthly averages for fluid milk prices, price reduction activities and package sizes from the four retail chains in the Boston market. The fluid milk category consists of the total fluid milk disappearance of skim/low fat and whole milk within a retail chain. The farm level fluid milk price will be taken as exogenous. Since the Federal Milk Marketing Order sets the farm level (class-I) prices for the entire US, based on manufacturing milk prices (Basic Formula Pricing), the assumption that the farm level fluid prices for Boston are exogenous is not unrealistic. Demand for fluid milk in Boston does not appreciably affect the national supply-demand system for manufacturing milk upon which the Boston market farm level fluid price is based.

To identify the demand side we specify weighted average percentage price reduction on fluid milk for each retailer in each demand equation. To identify the supply side we specify volume per unit for each retail chain. Volume per unit (e.g. quarts or gallons), captures cost components related to package size; so, we use it as a supply side variable.

Empirical Estimation Procedure:

To estimate our models, we use the fluid milk demand equations for retailers and the appropriate first order conditions. We specify linear demand function for the convenience of estimation and tractability. We use the following set of demand equations:

$$
\begin{aligned}
q_{SS} &= i_1 + a_1 p_{SS} + a_2 p_{Sh} + a_3 p_{SM} + a_4 p_D + \vartheta_{SS} WRR_{SS} \\
q_{Sh} &= i_2 + b_1 p_{SS} + b_2 p_{Sh} + b_3 p_{SM} + b_4 p_D + \vartheta_{Sh} WRR_{Sh} \\
q_{SM} &= i_3 + c_1 p_{SS} + c_2 p_{Sh} + c_3 p_{SM} + c_4 p_D + \vartheta_{SM} WRR_{SM} \\
q_D &= i_4 + d_1 p_{SS} + d_2 p_{Sh} + d_3 p_{SM} + d_4 p_D + \vartheta_D WRR_D
\end{aligned}
\qquad [13(a)\text{-}(d)]
$$

where, q and p are quantity and price variables; and the subscript *SS* – Stop & Shop, *Sh* – Shaw's, *SM* – Star Market and *D* – DeMoulas. Weighted Average Price Reduction (WRR_i) of any price reduction is used as demand side promotional instruments. We close the model with the following linear marginal/average cost function:

$$mc_i = m + m_i + \eta_i VPU_i \qquad [14]$$

where, m is the price of raw milk, $m_i\,(i = SS, Sh, SM, D)$ are the firm specific unobserved (to the econometrician) cost component and VPU_i (volume per unit) captures the cost component related to packaging. The unobserved cost component will be estimated within the system.

For our vertical Nash model, we have two profit functions that needs to be maximized. At the retail level we have the following profit function:

$$\pi_i^R = (p_i - w_i)*q_i \qquad [15]$$

and at the processor level:

$$\pi_i^P = (w_i - mc_i)*q_i \qquad [16]$$

By manipulating the first order conditions derived from the two profit functions we obtain the following estimable first order conditions:

$$
\begin{aligned}
p_{SS} &= m + m_{SS} + \mathrm{h}_{SS} VPU_{SS} - \left(\frac{2}{a_1} \right) q_{SS} \\
p_{Sh} &= m + m_{Sh} + \mathrm{h}_{Sh} VPU_{Sh} - \left(\frac{2}{b_2} \right) q_{Sh} \\
p_{SM} &= m + m_{SM} + \mathrm{h}_{SM} VPU_{SM} - \left(\frac{2}{c_3} \right) q_{SM} \\
p_{D} &= m + m_{SS} + \mathrm{h}_{D} VPU_{D} - \left(\frac{2}{d_4} \right) q_{D}
\end{aligned}
\qquad [17]
$$

We use these four equations and the four demand equation to estimate the vertical Nash game with non-linear 3SLS regression using econometric software package SHAZAM (ver. 8).

Estimation Results:

Graph-I shows the fluid milk price for the four retailers and the announced co-op milk (farm level fluid) price for Boston within our period of study. We certainly do see variation in these prices over time. The impact of Northeast Dairy Compact (NEDC) is clearly visible in June 1997 when it increased the farm level milk price to $1.46/Gallon, Thereafter the fluid milk price is pegged at that level. Note also that there is substantial variation among retail prices from the four supermarket chains. Graph-II, shows the first differences for these price series. There does seem to be some asymmetric price transmission. As co-op price dipped in Feb'97, the retailers did not follow the price decrease, but as the NEDC raised the co-op fluid price, the retailers followed. In this short paper, we are mainly interested in overall pass-through rate rather than pass-through rates of when raw milk prices increase or decrease. However we do have a plan to extend the model and separately estimate the rate of pass-through for raw milk price increases and decreases.

Table-I presents the descriptive statistics of the variables used in the analysis. Table-II, presents the regression results. We have negative and significant own price demand coefficients for all chains. The cross price coefficients of the market share leader, Stop & Shop are significant in the demand equations for Star Market and DeMoulas implying switching of consumers from these two retailers when stop & Shop changes price but the other cross results in table – II indicate that the opposite is not true. Shaw's is the only retailer whose pricing decisions affect Stop & Shop's demand. On the other hand Shaw's demand is sensitive to the pricing decisions of only DeMoulas. Star Market is the only retailer whose demand is sensitive all the other retailers pricing. Demand at DeMoulas on the other hand is quite sensitive to the price changes at Stop & Shop and Shaws. The regression result do show that smaller players in Boston market (Star Market: 15.8% and DeMoulas: 12% market share in 1998) are quite sensitive to the bigger players (Stop & Shop: 27% and Shaw's: 16.6% market share in 1998) pricing decisions.

In table - III (a)-(b), IV and V (a)-(b) we present the estimated pass-through rates and their significance level. We get on the average a total channel pass through rate (Table III (b)) of slightly less than 0.9 for all the retailers for changes in the raw milk price and the processor level pass through rates (Table III (a)) are slightly less than one but higher than the total CPTR implying retailers absorb some of the pass throughs of the processors. And in all the cases of total CPTR due to raw milk price shocks, we can not reject the null hypothesis that CPTR's are equal to 0.9. In the case of processor to retail CPTR: for Stop & Shop and Shaw's we cannot reject the null hypothesis that the CPTR is one but for the other two retailers we can reject this hypothesis despite the fact that Stop & Shop's CPTR is slightly lower than Star Market's CPTR. This can only be due to higher variation of Stop & Shops CPTR. Table-IV contains estimated CPTRs from wholesale to retail price. The effect of the shock at own wholesale price is significantly different from zero for all the retailers (on the average slightly greater than 50%). This result corresponds with the case of monopoly with linear demand and constant marginal cost function where CPTR is always 50%. Also, all the cross shocks at the wholesale level are significant except in the case of Star Market. Turning now to firm specific pass-through rates (Table V-a and b), the effect of unobservable cost shocks on own prices are always greater than those on other's prices (cross shocks) and significantly different from zero. The observed positive pattern of cross shocks in table IV and V (a-b) mean that other firms follow a firms' price rise with price increases. Due to space limitations we mainly analyze the overall effect of unobservable shocks as presented in Table V-b. In the case of processor specific unobservable cost shocks for Shaw's, Stop & Shop and DeMoulas all the own and cross shocks are significant and positive. Star Market is the only exception as its own CPTR is significant but the cross CPTRs are not. From the regression results we know that the demand of Star Market is sensitive to others prices but not the other way round. SO, it is rational for the other players in the market not to respond to Star Markets' price change as their consumers are insensitive to the pricing change at Star Market.

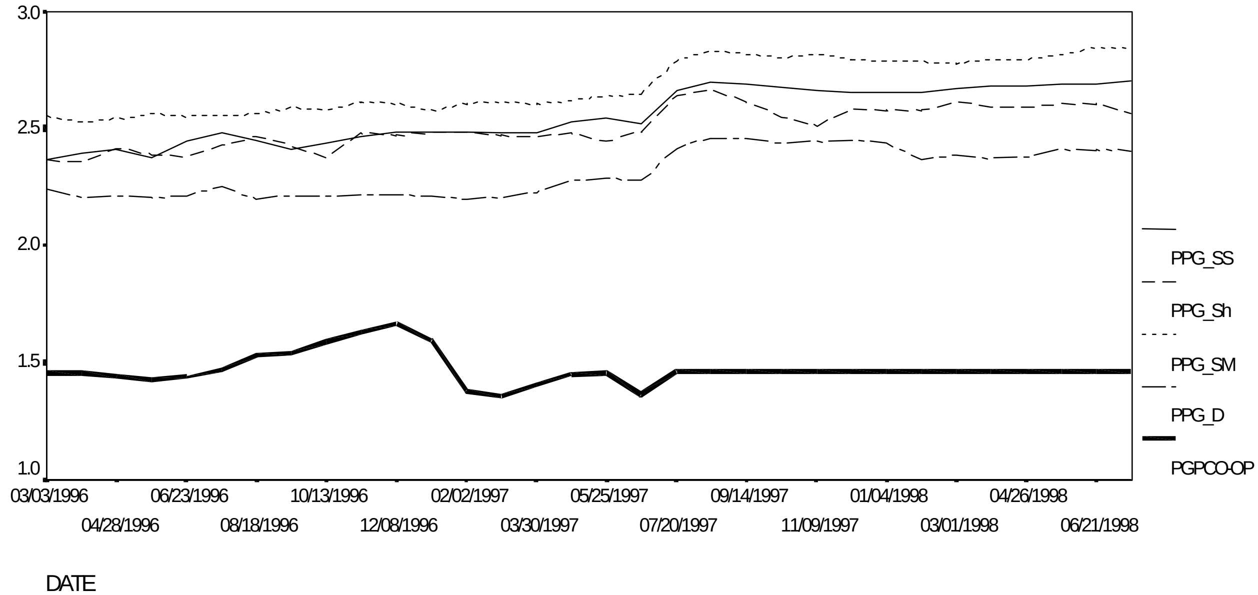
Due to the two stage nature of the structural framework, estimated CPTRs in table III-(a) and V can be used to generate total CPTRs of table III-b following equations 10 (a-b). Similarly total effect of firm specific shocks (Table V-b) can be generated using estimated CPTRs in Table IV and V-a following equations 11 and 12 (a-b).

Conclusions:

In this paper, using a simplified model we demonstrate how to measure and test pass-through rates using a structural model for an explicit strategic game. Our estimate of the total pass-through rates in the case of raw milk price increase for four supermarkets average 90 percent and the CPTRs are not significantly different from 0.90. CPTRs are higher than 0.9 at the processor level and lower at the retail level. We also find that the pass-through rates due to changes in firm specific unobservable cost vary widely. All own and cross cost shocks are positive and mostly significantly different from zero. This latter point implies followship pricing behavior between firms that is conducive to overall market price elevation. It is also consistent with widely practiced marketing strategy of lowest price guarantee. Also, sensitivity of smaller retailers (Star Market and DeMoulas) to bigger retailers (Stop & Shop and Shaw's) in terms of cross price coefficients can be construed as strength of the bigger retailers in effecting smaller retailers. Presence of significant assymetric cross price coefficients and CPTRs imply complex underlying retail market structure involving demographics, locations and other chain specific variables and future models should explicitly incorporate these underlying structures. Our empirical results from other games (not presented in this paper) indicates that the total pass-through rate does not vary much for different strategic specifications. Here in this paper we present the estimated vertical Nash game because this model best fits with the data.

To the best of our knowledge this is the first paper that has attempted to estimate the rate of price transmission in a structural model for a differentiated product market, in this case four supermarket chains selling fluid milk. There are certain advantages of using the structural approach rather than a reduced form approach. Different strategic behavior must be explicitly specified within a structural model. So, this approach allows one to evaluate the impact of specific types of strategic behavior. On the other hand, a specific structural model may not be the correct one. Future research should develop rigorous specification tests to discriminate between alternative games.

Graph – I: Retail and Co-op Price per gallon:



Graph – II: Retail and Co-op Price per Gallon (First Differenced):

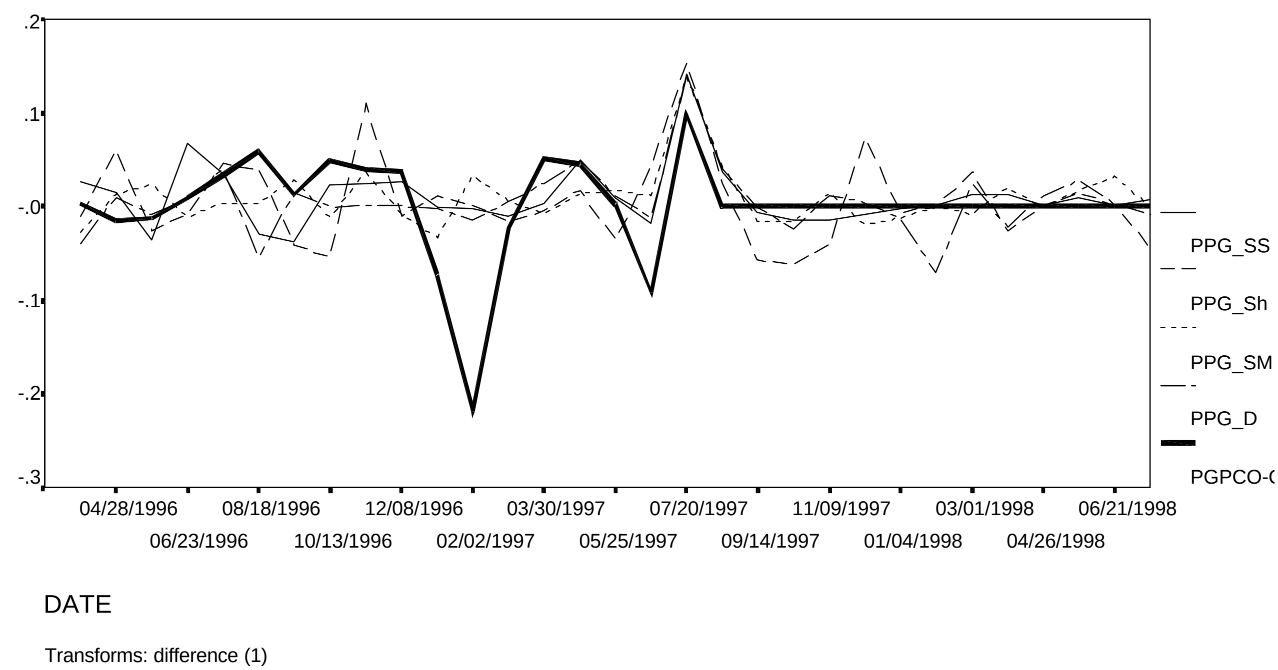


Table – I: (Descriptive Statistics of the Variables):

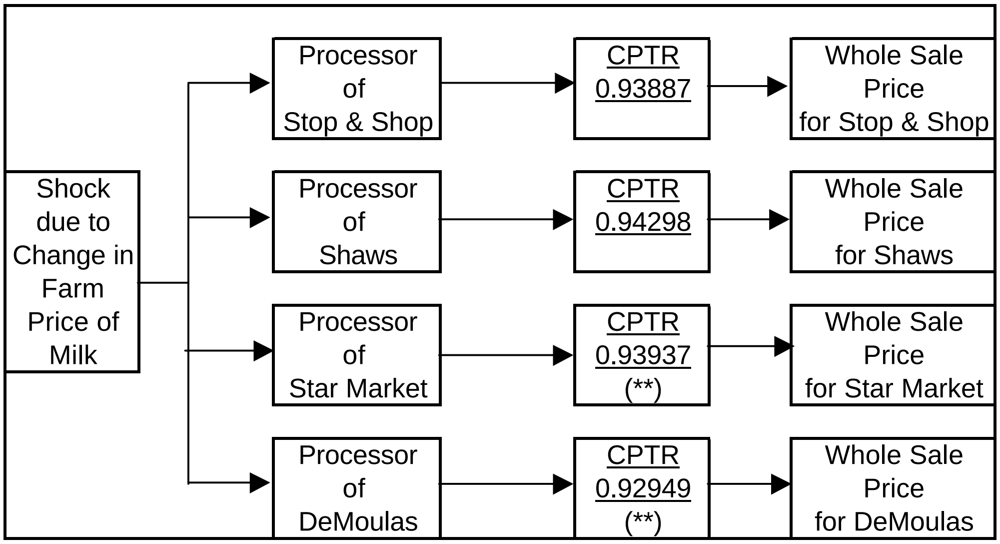
	Mean	Std. Deviation	Minimum	Maximum
Variable: Price per Gallon				
Stop & Shop	2.553	0.1175	2.3672	2.701
Shaw's	2.5047	0.0888	2.355	2.6677
Star Market	2.6835	0.11584	2.526	2.8469
Demoulas	2.31	0.100187	2.1985	2.45757
Co-op Announced Class-I Fluid Milk Price for the Boston Market				
PGPCO-OP	1.4711	0.068921	1.3539	1.667
Variable: Quantity Sold ('000 gallon)				
Stop & Shop	1214.4	69.653	1085.8	1381.2
Shaw's	988.71	42.760	906.67	1063.6
Star Market	623.69	29.781	573.23	681.68
Demoulas	867.42	37.959	793.45	945.77
Variable: Weighted Average % Price Reduction (Any Price Reduction)				
Stop & Shop	11.93	4.07	7.14	20.18
Shaw's	14.19	3.29	7.20	22.15
Star Market	9.37	3.06	5.80	17.55
Demoulas	12.18	4.96	7.06	29.00
Variable: Volume per unit (Gallon per unit sold)				
Stop & Shop	0.68755	0.0069817	0.67411	0.69872
Shaw's	0.71743	0.0067679	0.70369	0.72651
Star Market	0.65251	0.0071587	0.64025	0.66802
Demoulas	0.73722	0.0061670	0.72546	0.74767

Table II: Regression Result of Vertical Nash Channel Game

Variable Name	Estimate	Standard Error	Asymptotic t-statistic
Demand Parameters for Stop & Shop			
Intercept I1	3821.2	1836.1	2.0812
Own Price A1	-8.3838	2.3441	-3.5766
Shaw's Price A2	4.1382	1.6630	2.4885
Star Market Price A3	-0.41235	2.9368	-0.14041
Demoulas Price A4	4.1239	2.9424	1.4015
Wghtd Avg % Price Redctn. A5	1.7278	11.412	0.15140
Demand Parameters for Shaw's			
Intercept I2	2979.4	1586.6	1.8779
Stop & Shop Price B1	3.1348	2.6264	1.1936
Own Price B2	-11.273	1.7100	-6.5922
Star Market Price B3	1.3147	2.3685	0.55506
Demoulas Price B4	6.3302	2.2869	2.7680
Wghtd Avg % Price Redctn. B5	6.4964	4.4948	1.4453
Demand Parameters for Star Market			
Intercept I3	5478.1	1083.7	5.0550
Stop & Shop Price C1	4.0715	1.3168	3.0920
Shaw's Price C2	3.6041	0.84640	4.2582
Own Price C3	-12.552	1.4153	-8.8684
Demoulas Price C4	4.0772	1.5381	2.6508
Wghtd Avg % Price Redctn. C5	-1.2668	4.3940	-0.28831
Demand Parameters for Demoulas			
Intercept I4	1126.8	1244.3	0.90557
Stop & Shop Price D1	4.8495	2.2235	2.1810
Shaw's Price D2	3.4372	1.3452	2.5551
Star Market Price D3	1.3307	2.2506	0.59126
Own Price D4	-10.744	1.9095	-5.6263
Wghtd Avg % Price Redctn. D5	-0.99436	3.8297	-0.25964
Cost Parameters			
Stop & Shop			
Intercept CI1	1455.0	296.76	4.9029
Vol. Per Unit M1	-962.58	454.35	-2.1186
Shaw's			
Intercept CI2	1360.8	245.51	5.5425
Vol. Per Unit M2	-700.08	298.32	-2.3468
Star Market			
Intercept CI3	1152.6	224.04	5.1446
Vol. Per Unit M3	-60.184	177.87	-0.33836
Demoulas			
Intercept CI4	1200.4	248.76	4.8256
Vol. Per Unit M4	-709.78	320.09	-2.2174

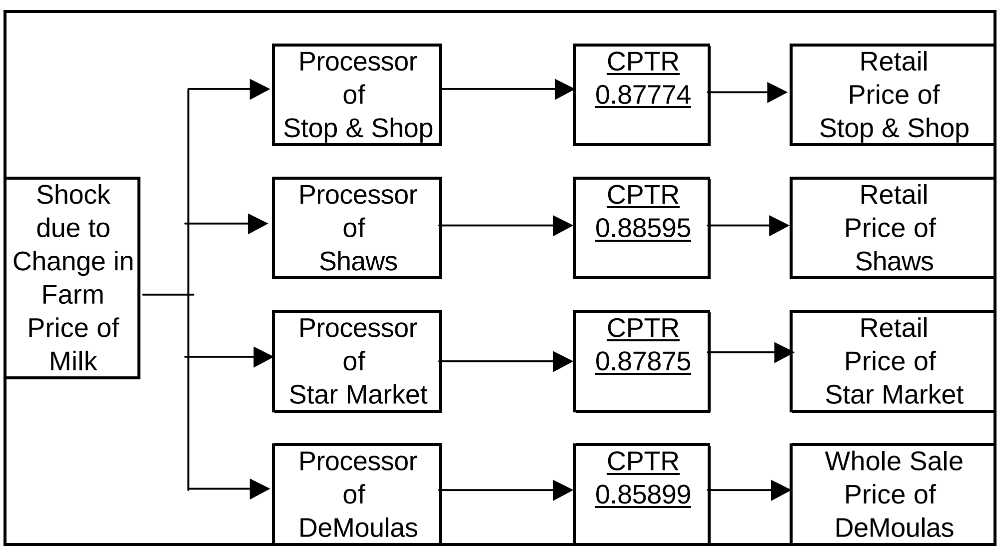
*** Value of the Minimized Objective Function = 64.07059**

Table III-a: Effect of Industry Wide Cost Shock (Milk Price) on Whole Sale Price



Test statistic - Wald chi-square Test
Significance Level: (*) 10%; (**) 5%; (***) 1%.
*** Null Hypothesis: CPTR = 1.**

Table III-b: Total Effect of Industry Wide Cost Shock (Milk Price) on Retail Price



Test statistic - Wald chi-square Test
Significance Level: (*) 10%; (**) 5%; (***) 1%.
*** Null Hypothesis: CPTR = 0.90.**

Table IV: Effect of Whole Sale Price Shock on Retail Price

Stop & Shop

Shock	Channel	CPTR	Effect on
Shock on the Whole Sale Price of Stop & Shop	Stop & Shop	0.56776 (***)	Retail Price of Stop & Shop
		0.13115 (**)	Retail Price of Shaws
		0.1365 (***)	Retail Price of Star Market
		0.15757 (***)	Retail Price of DeMoulas

Shaws

Shock	Channel	CPTR	Effect on
Shock on the Whole Sale Price of Shaws	Shaws	0.17147 (***)	Retail Price of Stop & Shop
		0.57033 (***)	Retail Price of Shaws
		0.13212 (***)	Retail Price of Star Market
		0.13811 (***)	Retail Price of DeMoulas

Star Market

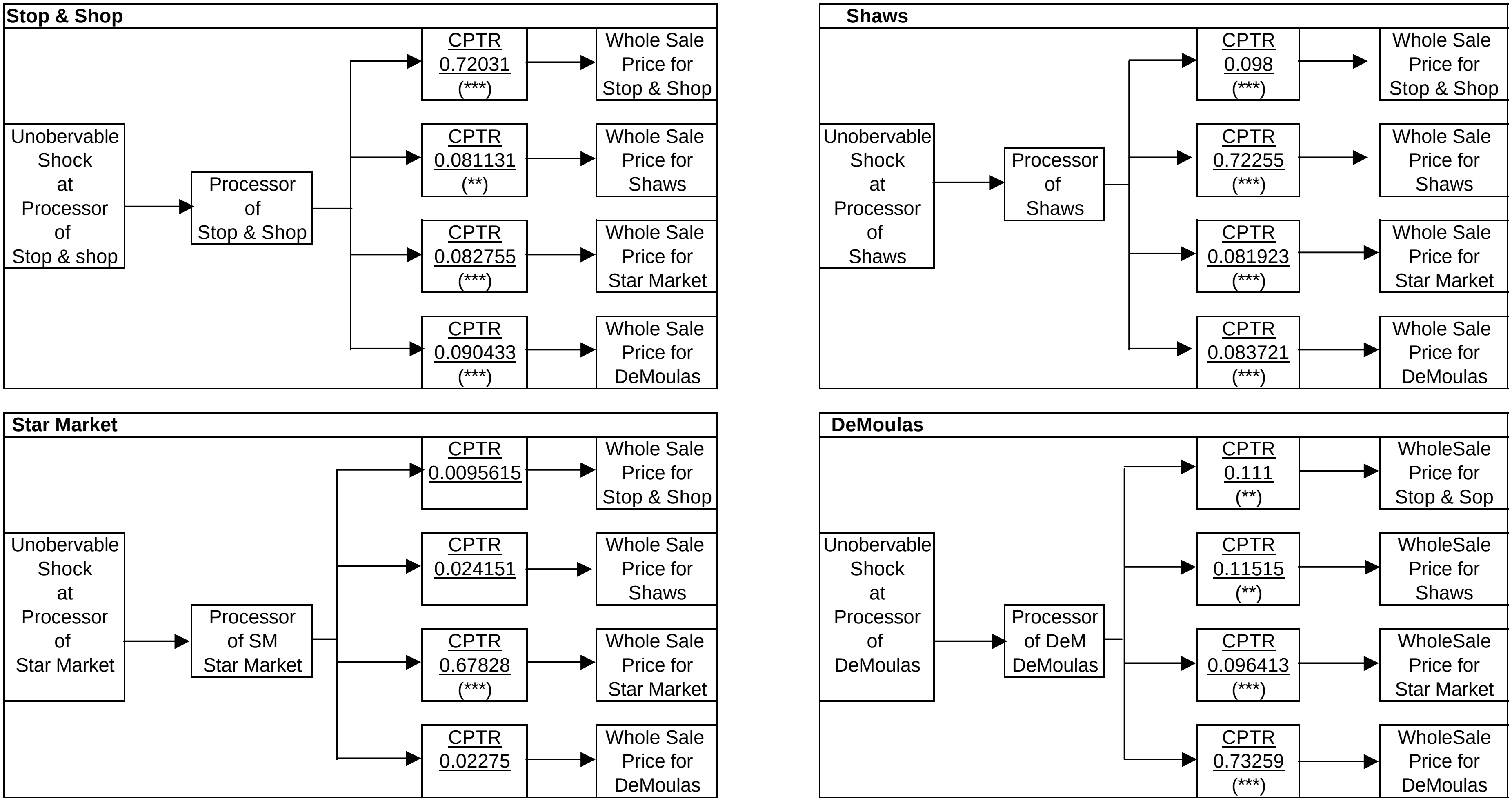
Shock	Channel	CPTR	Effect on
Shock on the Whole Sale Price of Star Market	Star Market	0.0077438	Retail Price of Stop & Shop
		0.042372	Retail Price of Shaws
		0.51389 (***)	Retail Price of Star Market
		0.040351	Retail Price of DeMoulas

DeMoulas

Shock	Channel	CPTR	Effect on
Shock on the Whole Sale Price of DeMoulas	DeMoulas	0.18904 (*)	Retail Price of Stop & Shop
		0.19927 (***)	Retail Price of Shaws
		0.15413 (***)	Retail Price of Star Market
		0.58409 (***)	Retail Price of DeMoulas

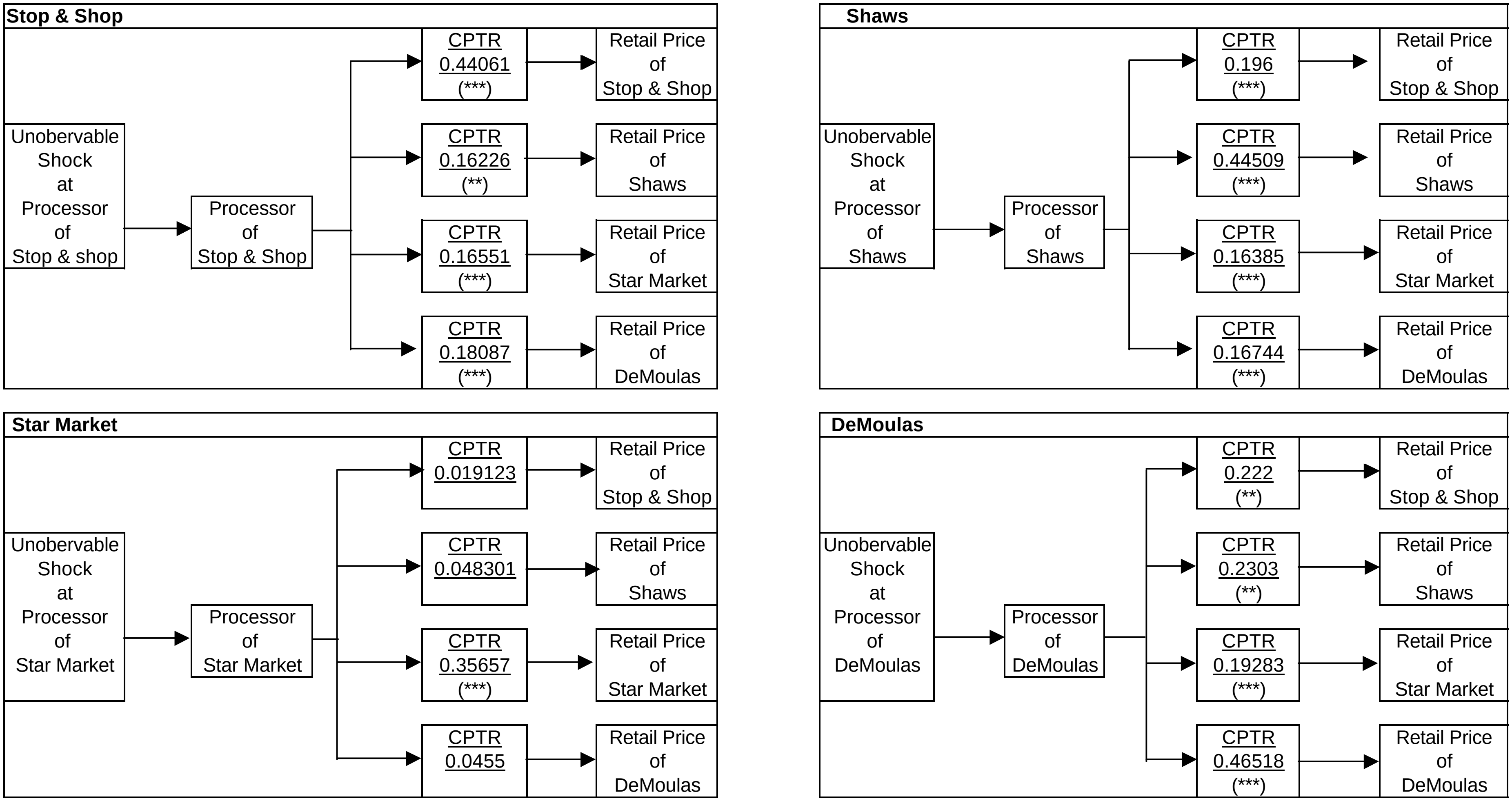
Test statistic - Wald chi-square Test; Significance Level: (*) 10%; (**) 5%; (***) 1%.
*** Null Hypothesis: CPTR = 0.**

Table V-a: Effect of Processor Specific Unobservable Cost Shock on WholeSale Price



Test statistic - Wald chi-square Test; Significance Level: (*) 10%; (**) 5%; (***) 1%.
*** Null Hypothesis: CPTR = 0.**

Table V-b: Total Effect of Processor Specific Unobservable Cost Shock on Retail Price



Test statistic - Wald chi-square Test; Significance Level: (*) 10%; (**) 5%; (***) 1%.
*** Null Hypothesis: CPTR = 0.**

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