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In the Northeastern Fluid Milk Market

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Abstract

A hybrid approach to estimate the asymmetric price transmission between the farm gate and the retail market is proposed. The model is estimated for the fluid milk market of the Northeast U.S., that of the metropolitan area of New York City as well as that of Upstate New York. Spatially disaggregated data allows the impact of regional dairy regulation on the farm-retail price spread to be assessed, as well as the behavior of the middlemen regarding price transmission on markets with different levels of retail concentration to be estimated. Results suggest that intermediaries transmit variations in milk farm price in an asymmetric way in the short-run; that governmental intervention might force middlemen to act competitively in terms of price transmission; and that a high degree of concentration at the retail level is not synonymous with inefficient price transmission.

1. Introduction

Throughout the 1920's and 1930's, the U.S. government passed several acts designed to counteract the perceived market power of dairy processors, and consequently, increase the share of economic surplus captured by producers (Doyon and Novakovic, 1997). The level of market power exerted by middlemen in the U.S. dairy industry is still a subject of controversy in the literature today. The evolution of marketing margins raises concerns among farmers regarding the efficiency of price transmission in the sector.

The concept of price transmission is closely related to market efficiency (Emerick, 1994) and its analysis aims at answering the following questions: by how much is a change in farm price reflected in retail price? How much time does it take for the adjustment to take place? Is there a difference in the way that the retail price adjusts to an increase or a decrease in farm price? (Ibid.). These questions are of primary importance to both consumers and dairy farmers. In fact, if an increase in milk farm price is more fully transmitted to consumers than a decrease, then the competitive market regulation mechanisms are not effective. That, in turn, may have implications in terms of society's welfare.

The objective of this study is to develop a marketing margin model to investigate potential asymmetry in farm price transmission. Spatially disaggregated data are used in order to assess the price transmission process in regions with different market structures. To reach this objective, Section 1 presents a concise literature review as well as the theoretical framework of the study. Section 2 presents the empirical model as well as the appropriate tests. Section 3 is a succinct description of the data used. Finally, Section 4 describes the empirical results.

2. Literature and Theoretical Framework

2.1 Literature review on price transmission

Numerous studies have analyzed asymmetric price transmission because it is perceived as a symptom of market imperfection. Asymmetry in farm-retail price transmission may result from a high degree of concentration beyond the farm gate (Kinnucan and Forker, 1987), from government interventions (Ibid.) or from imperfect information among economic agents (Stiglitz, 1989).

The hypothesis that a high degree of concentration in the food industry may be the cause of asymmetric price transmission is based on the Mason-Bain paradigm (structure-conduct-performance model). This paradigm maintains that a positive relationship exists between price, profit, price-cost margin and the degree of concentration of an industry[1]. On the other hand, modern market theorists like Stiglitz (1979, 1989) have argued that if an industry shows a low degree of concentration, the cost of collecting and processing information will be high for consumers. Therefore, firms could enjoy a certain degree of market power, which could lead to asymmetric price adjustment. The observations of Weaver et al. (1989) for the food industry tend to support the modern market theorist's view.

With respect to government intervention, Kinnucan and Forker (1987) indicated that the price support policy in the U.S. dairy industry might affect the behavior of middlemen and lead to asymmetric price transmission. Under such a regulation, intermediaries may see a farm price decrease as being only a temporary phenomenon, so that changing the retail price of milk is not necessary to remain competitive.

Kinnucan and Forker (1987) combined the markup model proposed by Heien (1980) and the approach proposed by Houck (1977) to specify and estimate nonreversible functions. This procedure is used to assess the asymmetric response in the retail price to variations in the farm price in the U.S. dairy industry. This approach has been subsequently used in the citrus industry (Pick et al., 1990), in the beef, lamb and pork industry (Griffith and Pigott, 1993), in the dairy industry (Emerick, 1994), and in the peanut industry (Zhang et al., 1995). However, Kinnucan and Forker's methodology has some limitations, such as the assumption of constant return to scale and that of a competitive market beyond the farm gate.

The competitive market hypothesis is of particular importance because long-run asymmetry in price transmission may reflect the market power of the middlemen (processor and/or retailers). In addition, the assumption that the farm-retail price spread is independent of the quantity of the agricultural commodity marketed is limiting. A decrease in the quantity marketed may not result in a corresponding reduction in the use of marketing inputs, which could likely have an impact on the industry's marketing margin.

Moreover, Kinnucan and Forker, as well as Emerick (1994), used nationally aggregated data which did not allow them to identify which factor is likely to be predominant in explaining asymmetric price response. In fact, nationally aggregated data cannot

[1] See Schmalensee et al. (1989), chap.16, for a complete discussion and an extensive literature review of these issues.

reflect a region-specific feature such as the degree of concentration of retailers.

Hansen et al. (1994) mentioned two types of asymmetric price transmission: short-run and long-run. Short-run asymmetry occurs when the immediate effect on retail price is not the same whether farm price is increasing or decreasing, but the long-run impact is similar. Long-run or irreversible asymmetry occurs when an increase in the farm price in the short-run has a different impact than a decrease in the long-run, i.e. after the full adjustment period. The major distinction between these two types of asymmetric price transmission relates to their respective effect on marketing margins. Long-run price transmission asymmetry implies that intermediaries increase their margins in an irreversible way while short-run asymmetry reflects a temporary effect on marketing margins. The Kinnucan and Forker approach does not allow the explicit evaluation of short or long-run asymmetry on the farm-retail price spread.

The marketing cost model that was first proposed theoretically by Tomek and Robinson (1990) offers an interesting alternative to the markup model. Wohlgenant and Mullen (1987) have interpreted this structural model as a reduced empirical form. The marketing cost model has been widely used in several industries to explain the farm-retail price spread (Wohlgenant and Mullen, 1987 (beef); Thompson and Lyon, 1989 (orange); Farminow and Laubsher, 1991 (corn); Lyon and Thompson, 1993 (milk)). Although the performance of this model did vary significantly among studies, Lyon and Thompson (1993) found it robust for the U.S. fluid milk market. They indicate that the marketing cost model performs especially well with monthly spatially-disaggregated data. Furthermore, and unlike the markup model, the marketing cost model does not assume constant return to scale. It relies, however, on the assumption of a competitive market. Thus, marketing firms are assumed to purchase milk up to the point where the marginal marketing cost is equal to the farm-retail price spread[2]. The marketing cost model, in a competitive market situation, can be expressed as follows:

$$M = f\,(Q, MC) \qquad (1)$$

[2] The use of that model for the U.S. fluid milk industry is especially relevant. The governmental regulation in that industry makes the Class I price of milk known at least one month before a sale is actually concluded. At that price, the processors can buy as much milk as they wish. Thus, we can subtract the farm price at both sides of the profit maximizing equation in a competitive market (retail price = marginal cost) and obtain the following identity: farm-retail price spread = marginal marketing cost.

where M is the farm-retail price spread, Q is the quantity of the agricultural commodity marketed and MC is a marketing cost index.

Studies that have analyzed the asymmetric price transmission in the U.S. dairy industry have shown that increases in the farm price are transmitted more fully to the retail price than are decreases (Kinnucan and Forker, 1987; Novakovic, 1991; Emerick, 1994; Hansen et al., 1994). Based on this result, Hansen et al. (1994) argue that asymmetric price transmission is one of the main factors that have driven the expansion of the farm-retail price spread since the late eighties in the U.S. fluid milk market. Therefore, the short-run and long-run asymmetry concepts can be further defined as follows:

Short-run price transmission asymmetry: situation where middlemen take advantage of the farm price fluctuations to generate *temporary*, above-normal profit.

Long-run or irreversible price transmission asymmetry: situation where middlemen take advantage of the farm price fluctuations to generate *permanent*, above-normal profit.

2.2. The Theoretical Model

The concept of above-normal profit refers to the ability of marketing firms to maintain progression in the farm-retail price spread above that of the marginal marketing cost. To account for these potential deviations from the competitive market equilibrium, a further variable is added to the marketing cost model. This variable reflects farm price fluctuations, which could be the source of competitive market deviations through short- or long-run asymmetries. Therefore, the marketing cost model in a situation of imperfect competition becomes:

$$M = f\,(Q, MC, \partial) \qquad (2)$$

where ∂ accounts for competitive market deviations due to farm price instability. The other variables were defined previously. The economic relationship depicted by equation (2) is the basis of this study. The next section is devoted to the determination of the empirical form of that relationship.

3. The Empirical Model and Appropriate Tests

3.1. The Empirical Model

To develop an empirical form of the model presented in the previous section, assume a competitive market situation in period 0. Thus the relationship depicted by equation (1) is valid in period 0. Furthermore, suppose that farm price fluctuations begin in period 1. The empirical form of equation (2) can be expressed as a linear marketing cost model in a competitive market situation (equation 1), with the ∂ variable added. Therefore, equation (2) takes the form:

$$M = a_o + a_1 MC + a_2 Q + \partial + \varepsilon \qquad (3)$$

where ε is the error term and ∂ reflects competitive market deviations, which is equal to zero in the initial period. The other variables have been defined previously.

The methodology originally proposed by Houck (1977) to estimate irreversible functions is used to develop the ∂ term in equation (3). Note that rather than combining the markup model to Houck's procedure to test for asymmetry in price transmission, this approach combines the marketing cost model and Houck's methodology. This approach also allows the competitive market assumption as well as that of constant return to scale to be relaxed. The potential deviations from the competitive market situation (∂) are given by farm price variations. Following Houck's methodology, ∂ is given by:

$$\partial = a_3 t + a_4 INCFP + a_5 DECFP \qquad (4)$$

where *t* is a trend variable and the variables *INCFP* and *DECFP* represent the cumulative increase and decrease in farm price respectively. Following Houck, these variables are defined as the absolute value of the summation of month-to-month increases or decreases in farm prices, with the starting point being the first month of the analysis. These variables are defined mathematically as follows:

$$INCFP_k = \sum_{i=1}^{k} (FP_i - FP_{i-1}) \text{ for } FP_i > FP_{i-1}$$

$$DECFP_k = \left| \sum_{i=1}^{k} (FP_i - FP_{i-1}) \right| \text{ for } FP_i < FP_{i-1}$$

Note that parameters a_4 and a_5 in equation (4) indicate the effect on the marketing margin of an increase or a decrease in farm prices respectively. According to previous studies in the U.S. dairy industry (Kinnucan and Forker, 1987 ; Emerick, 1994), the impact of rising or falling farm prices may be distributed over time. To test for this, let M_1 and M_2 be the number of periods needed for full adjustment of marketing margins to an increase or a decrease in farm prices respectively (number of lags). Incorporating this number of lags into equation (4), empirical form for ∂ is given by:

$$\partial = a_3 t + \sum_{i=0}^{M1} a_{4,i} INCFP_{t-i} + \sum_{i=0}^{M2} a_{5,i} DECFP_{t-i} \qquad (5)$$

Substituting ∂ by equation (5) in equation (3), equation (6) can access the middlemen behavior regarding transmission to retail prices of farm price variations:

$$M = a_0 + a_1 Q + a_2 MC + a_3 t + \sum_{i=0}^{M1} a_{4,i} INCFP_{t-i} + \sum_{i=0}^{M2} a_{5,i} DECFP_{t-i} + \varepsilon \qquad (6)$$

This equation specifies the farm-retail price spread as a function of two main components: the marginal marketing cost reflected by variables *Q* and *MC*, and the middlemen behavior in the farm-retail price transmission process estimated by the parameters of *INCFP* and *DECFP*.

Note that *MC* can also be expressed in such a way so as to reflect rising and falling phases in marketing costs, as well as a lagged response in adjustment using the same methodology as above. Using this empirical formulation, the question of whether middlemen are transmitting increases and decreases in their marketing cost to the farm-retail price spread in a symmetric fashion can be tested. Thus, *MC* can be expressed as:

$$a_2 MC = \sum_{i=0}^{N1} a_{2A,i} INCMC_{t-i} + \sum_{i=0}^{N2} a_{2B,i} DECMC_{t-i} \qquad (7)$$

where N_1 and N_2 are, respectively, the number of lags for marketing cost increases and marketing cost decreases.

Substituting equation (7) in equation (6) and adding dummy variables to account for possible seasonal adjustment, the complete estimating equation is expressed by equation (8):

$$M = a_0 + a_3 t + a_1 Q + \sum_{i=0}^{N1} a_{2A,i} INCMC_{t-i} + \sum_{i=0}^{N2} a_{2B,i} DECMC_{t-i} + \sum_{i=0}^{M1} a_{4,i} INCFP_{t-i} + \sum_{i=0}^{M2} a_{5,i} DECFP_{t-i} + D1 + ... + D11 + \varepsilon \qquad (8)$$

where D1, D2... D11 are monthly binary variables.

3.2. Testing for Asymmetric Marketing Cost Transmission

To test for symmetric marketing cost transmission by middlemen, the cumulative value of increases in marketing cost should be equivalent to the cumulative value of decreases in marketing cost. Therefore, the following test is performed [3] :

(H1) $$\sum_{i=0}^{N1} a_{2A,i} + \sum_{i=0}^{N2} a_{2B,i} = 0 .$$

3.3. Testing for Farm Price Transmission

Complete price transmission requires that the cumulative values of the parameters associated with variables *INCFP* and *DECFP* are not statistically different from zero. Therefore, the tests are given by expressions H2 and H3.

(H2) $$\sum_{i=0}^{M1} a_{4,i} = 0$$ *for farm price increase,*

(H3) $$\sum_{i=0}^{M2} a_{5,i} = 0$$ *for farm price decrease*

If hypothesis H2 is rejected, this indicates that farm increases are not fully transmitted to the retail level. Similarly, the rejection of H3 indicates that farm price decreases are not fully transmitted to the retail level. Note that the alternative hypotheses to H2 and H3 can be either positive or negative.

3.4. Testing for Asymmetric Farm Price Transmission

The purpose of this test is to formally assess the competitive conduct of middlemen regarding price transmission. Tests discussed in section 2.2. are necessary but not sufficient to identify asymmetry in farm price transmission. To address the issue of asymmetric price transmission, the parameters associated with an increase in farm price must be compared to those associated with a decrease in farm price. Hence, this category of test verifies whether the marketing margin reacts differently to an increase or a decrease in the farm price.

As mentioned previously, the extreme case of asymmetric price transmission is long-run asymmetry. In order to test for that phenomenon, which reflects permanent, above normal profits for middlemen, the following test is performed:

(H4) $$\sum_{i=0}^{l} a_{4,i} + \sum_{i=0}^{l} a_{5,i} = 0$$

where $l = max[M_1;M_2]$.

Note that if the number of lags is different between the rising phase and the falling phases in farm price (i.e. $M_1 \neq M_2$), then the last M_t-M_v (where $M_t>M_v$) parameters of the variable having the shorter lag length are simply assumed to be zero with no variance.

To assess short-run asymmetry in price transmission, at least one of the following equalities in H5 must be rejected:

(H5) $$\sum_{i=0}^{j} a_{4,i} + \sum_{i=0}^{j} a_{5,i} = 0$$

where $j = 0,1,..., max[M_1;M_2]-1$.

Note that it is possible to have short-run asymmetry and no long-run asymmetry in price transmission, and vice versa. If none of the equalities in H4 and H5 are rejected, one should still test for price leveling. Price leveling is not only characterized by symmetry in price transmission, but also by the fact that all individual parameters associated with increases in farm prices are equal to those associated with decreases in farm prices, for a specific period. Consequently, price leveling implies an identical lag length for farm price increases and farm price decreases. The appropriate test for price leveling is provided by expression H6.

(H6) $$|a_{4,i}| = |a_{5,i}| \quad \forall\ i$$

If none of the equalities in H1, H2, H3, H4, H5 and H6 are rejected, then a perfectly competitive conduct from middlemen on markets beyond the farm gate can be assumed.

4. Data

4.1. Regions

Fluid milk does not undergo major transformation between the farm and the retail outlet. Consequently, a close relationship between the fluid milk farm price and the retail price is expected. The model given by equation (8) is estimated for the Northeast U.S., Upstate

[3] Note that the parameters of *DECMC* ($a_{2B,i}$) should exhibit a negative sign because this variable is an absolute value.

New York and New York City[4]. By examining these three specific regions, it was possible to test the middlemen's behavior with respect to price transmission and asymmetry in price transmission in a region with a low retail market concentration (NYC) and in another with a relatively high retail market concentration (Upstate New York)[5]. Furthermore, the particular features of the New York City market (low degree of concentration, high population density, multiple activities) might create an important information problem among consumers, which would favor asymmetric price transmission as mentioned previously (Stiglitz, 1989).

4.2. Data Description

The models are estimated using monthly data for the 1980-1997 period, and all economic variables are expressed in real terms using the consumer price index for the Northeast U.S. as deflator (1982-84=100). This imposes homogeneity of degree zero on the economic relationships. A brief description of the variables is presented below.

M : Marketing margin, i.e. the difference between the retail price and the farm price of fluid milk.

Farm prices for Upstate New York and NYC are simply the Class I price of the New York-New Jersey Federal Milk Marketing Order (FMMO) based on one half gallon of milk with 3.5% butterfat (source : *New York State Departement of Agriculture and Markets* [NYSDAM]). Farm prices for Northeast U.S. is the Class I price average (weighted by quantity) of the four FMMO's that regulate this area, i.e. New York-New Jersey, New England, Middle Atlantic and Eastern Ohio-Western Pennsylvania FMMO's (source : NYSDAM).

Retail prices in Upstate New York and NYC are prices of one half-gallon of whole milk (source: NYSDAM). For Northeast U.S., prices are from the Bureau of Labor Statistics (BLS).

TREND: Trend variable ; this variable takes the value 1,2,3,…,215 (215 monthly observations).

Q: Quantity of milk used by processors for the fluid market. For Upstate New York and NYC, this variable reflects Class I milk in the New York-New Jersey FMMO. For Northeast U.S., this variable is total quantity of milk used in Class I in the 4 FMMOs mentioned previously (source: NYSDAM). The L1 suffix indicates that the variable has been lagged by one month.

MC : A marketing cost index; its construction is based on the estimated share of total marketing costs of the main intermediaries in the industry, i.e. processors, retailers, and haulers. Labor, energy and packaging are the marketing costs that were taking into account (source : BLS). The INC and DEC prefixes reflect the fact that this variable has been split in rising and falling marketing cost phases, following Houck's methodology (1977).

INCFP : Cumulative farm price increase as defined previously ($/cwt). The Li suffix indicates that this variable has been lagged by i months.

DECFP : Cumulative farm price decrease as defined previously ($/cwt). The Li suffix indicates that this variable has been lagged by i months. Similarly, the suffixes 1991 added at the end of the variable denote a slope shifter to evaluate if the marginal effect of that variable has changed since the imposition of the price gouging law in NYC (1991).

D1…D11: Monthly binary variables. Di takes the value 1 in month i, and 0 otherwise.

DD: Binary variable to reflect the deregulation of the NYC milk market as of February 1987.

5. Empirical Results

5.1. Lag Length

Based on previous literature, the maximum lag length was first fit to five months for both farm price increases (*INCFP*) and farm price decreases (*DECFP*). Then, if the last lagged variable was not statistically significant at the 10% level, it was excluded from the regression. This iterative procedure stopped when the last lag was found to be statistically different from zero. In order to avoid multicolinearity, one could plea for an Almon polynomial lag scheme. However, any imposition of parameter weights would have been purely arbitrary because no lag structure was deemed, a priori, to be obvious.

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[4] The "New York City" term designates the 11 counties of the New York City metropolitan region. Upstate New York includes the rest of the counties in the State. According to the Bureau of Labor Statistics definition, the Northeastern region includes the following States: Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New York, New Jersey and Pennsylvania.

[5] See Franklin and Cotterill (1993).

For the Northeast U.S. and Upstate New York, the iterative estimation results suggest that farm price increases should be lagged by one month while for NYC, no lags are significant. However, when the three regions conflicted in terms of lag lengths, the maximum lag length was kept in all equations. This procedure allows homogenizing result analysis among the regions. Therefore a one-month lag length was specified for farm price increases (*INCFP*) in all three equations. For farm price decreases, iterations for Northeast U.S. and for NYC suggested a 4-month lag. Even though a one-month lag would have been sufficient for Upstate New York, all three equations were estimated with a four-month lag.

The lag lengths are different than those found in previous studies. Kinnucan and Forker (1987) found that a 3 month lag was necessary for both farm price increases and decreases to adequately model the fluid milk market. Kinnucan and Forker reached this result by adding an additional lag until a non-significant parameter was found. Thus, the discrepancy can first be explained by the different methodology used by Kinnucan and Forker to determine the lag length. Also, their use of national data as compared to regional data in this study may have caused this dissimilarity. Emerick (1994) specified a 2-month lag for both farm price increases and decreases. Her decision was, however, subjective and based on her a priori knowledge of the U.S. fluid milk market.

With respect to the marketing cost variables (*INCMC* and *DECMC*), no lagged variables were found statistically significant. Note that these lagged variables were included into the regressions only when the number of lags for the farm price variables was identified. The final estimated equation, therefore, includes only the current values of *INCMC* and *DECMC*.

5.2. Regression results

Table 1 presents the econometric results for the three geographical areas. Autocorrelation was endemic in each of the three areas. Therefore, the equations were estimated by the maximum likelihood method with a first order correction for autocorrelation. Because of the controversy surrounding the use of the R^2 when OLS is not used, correlation coefficients (CC) between the dependent variable and the estimated values of the regressions are reported [6]. The CC range from 0.973 to 0.987, depending upon the region. This suggests that the models have good explanatory power.

The results presented in Table 1 conformed to expectations. The trend variable is negative in all three equations but is not statistically different from zero at the 5% level. This suggests that technological change and productivity gains have not significantly reduced the farm-retail price spread during the period. No significant seasonal variations in the marketing margin were apparent since a test to verify if the monthly binary variables were jointly equal to zero could not be rejected at the 5% level in either of the regions.

Two major regulatory changes have affected the New York City (NYC) fluid milk market and they are taken into account in the analysis. First, the deregulation of the distribution of milk in NYC permitted Farmland Dairies (a major New Jersey milk dealer) to penetrate this market in January 1987. Before 1987, the NYC milk market was protected from outside competition by a system of licenses that granted the right to distribute milk to a limited number of milk dealers. To account for this regulatory change, a dummy variable is included in the regression as of February 1987 (DD_{1987}).

Results indicate that Farmland Dairies' entry into the market has significantly reduced marketing margins as shown by the highly significant dummy variable (DD_{1987}). This suggests that the New York City milk market deregulation has led to a lower farm-retail price spread. This result is not surprising since the larger New York City milk dealers were convicted of price fixing after an investigation in the early eighties.

The second major change to New York State dairy policy is the introduction in June 1991 of the "200% law". The price gouging law, as it was referred to, imposed a maximum marketing margin of 200% of the farm price to all intermediaries in the fluid milk market. This law was enacted by the New York State legislature following the perceived lack of response in retail prices of milk to decreases in farm prices. On the other hand, farm price increases were perceived to be efficiently transmitted to retail prices. Note that retailers in NYC were the main targets of this law. Thus, slope shifters ($DECFPLi_{1991}$) were included in the NYC equation to test if the price gouging law changed the behavior of middlemen regarding transmission of farm price decreases.

Results indicate that the price gouging law has changed the way that New York City's middlemen transmit farm price decreases since most parameters of the variable $DECFP_{1991}$ and its lags are statistically significant. This result has implications on farm price transmission asymmetry before and after 1991, as will be discussed below.

A similar methodology was used in the Northeast U.S. equation to assess the impact of the reduced role of the price support program in setting farm prices since

[6] See Judge et al. (1980), p.255.

1989. However, the inclusion of slope shifters for the variables *INCFP* and *DECFP* and their lags as of 1989 in the Northeast U.S. equation has not produced any significant results. Moreover, a statistical test aimed at verifying if these slope shifters were simultaneously equal to zero could not be rejected. According to this result, it seems that the forsaking of the price support policy since 1989 in the U.S. dairy industry has not changed middlemen behavior regarding price transmission. Consequently, governmental intervention as a cause of asymmetry, as formulated by Kinnucan and Forker (1987), could not be confirmed by our results. Therefore, slope shifters for 1989 are omitted from the presentation.

Assuming that processors may not be able to transmit instantaneously to their selling prices the economies of scale that may result from a greater quantity of milk used in Class I, the quantity variable was lagged by one month (*QL1*). This variable is statistically significant only in NYC. The rationale behind the negative sign for this variable is that fluid milk processors ruled by a Federal or State Milk Marketing Order can order as much milk as they wish. However, only milk that is finally directed to the fluid milk consumption market is calculated as being part of Class I. The remaining milk is calculated (even though processed by fluid milk plants) as being part of either Class II or Class III and receives a lower price. Thus, the larger the quantity used in Class I, the more profitable it is for fluid milk processors. The non-significant result for the Northeast U.S. and Upstate New York may reflect that this variable is a poor proxy for the actual milk consumption in these regions.

5.3. Marketing Cost Transmission

Results on marketing cost increases and decreases (*INCMC* and *DECMC*) are similar across the three regions. As mentioned previously, no lagged variables were kept on the final estimated equations since they were not statistically significant. This result suggests that variations in marketing costs are transmitted to the farm-retail price spread within a month. It should, however, be noted that in all regions, marketing cost increases are significant while marketing cost decreases are not. This tends to suggest asymmetric marketing cost transmission but the formal test of this hypothesis was not accepted (Table 2). Consequently, no statistical evidence of non-competitive conduct by middlemen with respect to this cost variable can be established.

5.4. Farm Price Transmission

Results on farm price transmission are presented in Table 3. In all regions, there is no statistical evidence supporting the hypothesis that farm price increases are not fully transmitted to retail price since the hypothesis of full price transmission is not rejected (H2). With respect to the transmission of farm price decreases, statistical evidence that they are not fully transmitted to retail price is only found in NYC (H3), and only before the price gouging law was enacted. Similarly, results indicate that long-run asymmetry in price transmission did occur only in NYC before the price gouging law (H4). The long-run asymmetry in the price adjustment process in NYC before 1991 suggests that an under-allocation of milk in Class I occurred because of the permanent above-competitive-level selling-price of milk. Moreover, under-allocation of milk in Class I could have resulted in sustainable lost of income for farmers because of the higher price for this category. Consumers may also have suffered from the non-competitive conduct of middlemen through higher prices, and consequently, under-consumption of milk. Therefore, assuming low cost to the government, these results suggest that the price gouging law has increased the society's welfare by pushing the production and consumption of fluid milk toward the competitive level.

Table 3 also reports the test results on short-run asymmetry (H5) in the farm-retail price transmission. After 3 months, short-run asymmetry exists in NYC and in the Northeast U.S. Asymmetric price response seems to be milder in Upstate New York, since it lasts only for 2 months.

Results for Upstate New York contrast fundamentally with those of NYC before the imposition of the price gouging law. In fact, middlemen in Upstate New York seem to act quite competitively regarding price transmission without being forced to do so by any binding law and even though they are much more concentrated than their counterparts in NYC. This tends to support the hypothesis that the problem of consumer information is the predominant cause of asymmetric price transmission, rather than a high degree of concentration in the industry above the farm gate. This result is further strengthened by the fact that, in line with the SCP model, the retailer's four firm concentration ratio was included as an exogenous variable to the Upstate New York and NYC equations. This variable did not, however, generate any significant results. This result is similar to that of Binkley & Connor (1996) for dairy products. Moreover, the parameters of the CR-4 variable had a negative sign and its inclusion in the equations altered the significance level of the trend term. Thus, it seems that the impact of the CR-4 concentration ratio, which has not decreased since 1980 in the two geographical areas, is captured by the trend variable (gain in productivity, technological progress). This hypothesis is strengthened by the high correlation between the two variables. Consequently we decided not to include the CR-4 variable in the estimated equation.

Note that there is no evidence of short-run asymmetry (within 1 month) in the Northeast U.S. and in Upstate New York. This indicates that the marketing margin expands in the same proportion after a farm price increase or decrease. However, in NYC, price transmission asymmetry begins instantaneously.

Our general results regarding price transmission asymmetry are different than those of Kinnucan and Forker (1987) and of Emerick (1994). While the present study finds evidence of short-run asymmetry in the fluid milk market, these studies found evidence of long-run asymmetry. The difference could be attributed, partly, to methodological differences in the modeling approaches, the data used, and the period covered by the analysis. Unlike Kinnucan and Forker and Emerick, who assumed a competitive environment, the methodology proposed in this study formally defines long-run asymmetry as being a permanent deviation from a competitive market situation. Also, the use of spatially disaggregated data that reflects different regional market structures as well as the time period under study may have contributed to the different results.

6. Conclusion

This paper proposes a model that is a hybrid of those usually used in the literature on asymmetric price transmission. The model was estimated for three regions: the Northeast U.S., Upstate New York and New York City. Results indicate that long-run asymmetry was present in the NYC market before the application of the price gouging law in June 1991 but disappeared thereafter. This last element, combined with the fact that only a short-run asymmetry seems to have remained since 1991, suggest that the New York State legislature has successfully inhibited permanent above-normal profit earned by middlemen. Results for the Northeast U.S. and Upstate New York show that middlemen have transmitted the farm price fluctuations in an asymmetric way in the short-run. These observations provide support for the modern market theorist's view on the role of market concentration.

It is important to note that the use of the Class I price as the farm price for fluid milk does not take into account over-order payment, which may be the source of the short-run asymmetry observed in the three geographical areas. In fact, if one observes that the over-order payment increases when the farm price of milk goes down and that it remains constant when the farm price goes up, then the over-order payment granted by processors might be the source of short-run asymmetry. Because of this possibility, it cannot be rigorously concluded that the short run asymmetry phenomenon is necessarily the result of non-competitive conduct from middlemen.

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Data Source

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Table 1 : Estimated parameter values of the fluid milk margin equations in New York City, Upstate New York and Northeast U.S.

Variables	New York City	Upstate NY	Northeast U.S.
INTERCEPT	0.685570 ** (16.170)	0.513628** (15.101)	0.541171** (12.824)
TREND	-0.001461 (-1.203)	-0.001817 (-1.734)	-0.001500 (-1.293)
QL1	-0.000169* (-2.543)	0.000049388 (0.646)	-0.000009693 (-0.410)
INCMC	0.005042* (2.402)	0.005145* (2.031)	0.005403* (2.260)
DECMC	-0.002448 (-1.369)	-0.000131 (-0.059)	-0.002670 (-1.335)
INCFP	-0.0004192 (-0.716)	-0.010671 (-1.657)	-0.019190** (-3.190)
INCFPL1	0.008452 (1.448)	0.012038 (1.903)	0.017026** (2.804)
DECFP	0.027616** (8.841)	0.018452** (5.318)	0.021736** (6.667)
DECFPL1	-0.008813* (-2.582)	-0.009041* (-2.306)	-0.002222 (-0.626)
DECFPL2	-0.002277 (-0.655)	-0.000008990 (-0.002)	-0.003889 (-1.072)
DECFPL3	-0.000220 (-0.064)	-0.002656 (-0.663)	0.006174 (1.720)
DECFPL4	-0.004126 (-1.295)	-0.004711 (-1.280)	-0.011722** (-3.520)
DD_{1987}	-0.082162** (-9.188)	-------	--------
$DECFP_{1991}$	-0.000085015 (-0.151)	-------	--------
$DECFPL1_{1991}$	-0.001260* (-2.234)	-------	--------
$DECFPL2_{1991}$	-0.001112 (-1.952)	-------	--------
$DECFPL3_{1991}$	-0.001736** (-3.040)	-------	--------
$DECFPL4_{1991}$	-0.001348* (-2.342)	-------	--------
CC	0.98672	0.97298	0.97309

The values in parentheses are the standard error of the coefficients. The estimated coefficients of the monthly dummy variables are not reported in order to make the presentation easier.

* Significant at the 5% level ; ** Significant at the 1% level.

Table 2 : Marketing cost transmission test results (F-test)

Null hypothesis		New York City	Upstate New York	Northeast U.S.
(H1)	*Symmetry in marketing cost transmission*	0.6342 (not rejected)	1.6094 (not rejected)	0.5546 (not rejected)

Table 3 : Price transmission test results (F-test)

Null hypothesis		**NYC** (Before the price gouging law)	**NYC** (After the price gouging law)	**Upstate New York**	**Northeast U.S.**
(H2)	*Farm price increase fully transmitted*	0.6666	0.6666	0.1167	0.1705
(H3)	*Farm price decrease fully transmitted*	5.0317*	1.4091	0.1456	3.0928
(H4)	*No asymmetry after month 4*	4.8876*	2.1933	1.4135	1.0486
(H5)	*No asymmetry after month 3*	7.6576**	4.9174*	2.4714	6.5617*
(H5)	*No asymmetry after month 2*	8.1896**	6.3919*	4.5097*	3.2460
(H5)	*No asymmetry after month 1*	11.4629**	10.1217**	4.6692*	6.1604*
(H5)	*No asymmetry after month 0*	11.1584**	11.0009**	1.0521	0.1233

* Null hypothesis rejected at the 5% level
** Null hypothesis rejected at the 1% level.

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