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ABSTRACT

This article examines the impact of Wal-Mart Supercenters' entry on incumbents' pricing behavior and demand. Using a structural model and milk data from the Dallas/Fort Worth supermarket chains, empirical results show that an expansion of Supercenters caused incumbents to price milk significantly more competitively, dropping on average 22.5% between 1996 and 2002, in spite of declines in their milk demand. Furthermore, consumer gains exceeded incumbent losses, lending further support to the notion that Wal-Mart is good for competition and consumers.

Keywords: *Wal-Mart, competition, conduct, entry, supermarkets, food retailing*

JEL classifications: *L10, L19, L66, L59*

I. INTRODUCTION

As the largest retailer in the world, Wal-Mart has shown itself to be an economic force in the discount industry (e.g. Hausman and Leibtag; Basker and Noel, 2007; Khanna and Tice, 2000). Its influence on the economy has made it a recent target of policy-makers via "Anti-Big Box" legislation and living-wage laws. Wal-Mart is now applying its cost-saving innovations to the food-retailing sector via its Supercenters, large stores averaging 100,000 square feet and offering grocery items as well as discount merchandise. This entry into food retailing poses a new obstacle to law-makers, since now it is not just applying its "Always Low Prices, Always" strategy to discount merchandise, but also to essential items, such as milk and other groceries, thereby making groceries more accessible to lower income households so that they may "Save Money. Live Better."

Since the first WMS opened in 1988, Wal-Mart has redefined the food-retailing industry by extending its logistic system and low-cost strategy to food retailing.[1] Since then, Wal-Mart

has opened, on average, 100 Supercenters per year (Wal-Mart Annual Reports). The increased convenience lures consumers away from traditional supermarkets (Singh, Hansen, and Blattberg, 2006) while the lower prices induce them to spend at least 42% more than at traditional supermarkets (IRI Consumer Network Panel Data).

Understandably, incumbent supermarket chains experience the need to respond aggressively (Khanna and Tice, 2000). The preponderant evidence is that entry of WMS's causes incumbents' prices to decline. Previous work has either used price aggregates (Hausman, 2007) or ad-hoc price regressions to relate incumbents' prices to Wal-Mart's entry (Basker, 2005, 2007; Capps and Griffin, 1998; Currie and Jain, 2002).

In her analysis of the impact of Wal-Mart's entry, Basker (2005) points out that although Wal-Mart's entry into a given market can lower prices by increasing the competitive pressure on incumbents-- as predicted by standard imperfect competition models-- very little empirical work has been done to quantify these effects. Furthermore, given the lack of structural models to analyze the impact of Wal-Mart on competitors' behavior, the disciplining effect of Wal-Mart's entry is imputed rather than formally demonstrated in terms of effects of changes in demand and pricing behavior. No previous study has taken a rigorous look at the effect of WMS entry on the pricing strategies of incumbent food-retailing firms.

The Dallas/Forth Worth milk market provides an interesting case study for structurally analyzing the impact of the expansion of WMS's on incumbents' (supermarkets) pricing behavior. First, focusing on this case study allows one to look more closely at the reaction of incumbents to Wal-Mart's expansion in terms of demand, cost and pricing impacts. Second, the Dallas/Forth Worth area is characterized by few, large incumbents and therefore one with potential for non-competitive conduct by incumbents before Wal-Mart's entry, allowing

disciplining effects to more easily be observed. Also, the top two incumbents in this market are also the contemporary top two food-retailers in the nation (Albertson's and Kroger), making the general conclusions transferable to other geographic markets. Third, fluid milk is relatively a homogeneous product which is a component of nearly all shopping baskets; shifts in demand and pricing behavior due to Wal-Mart's entry are likely to be reflected in the milk demand as consumers are lured away from supermarkets. Last, empirically quantifying the incumbents' strategic price response in the Dallas/Fort Worth milk market will develop a basis for future research on the conduct-disciplining effect of entry of WMS's.

Wal-Mart Food Economics

The economic impact of Wal-Mart, now the number one retailer in the world, has generated its own literature investigating its impact on consumers, workers, existing businesses and communities, particularly in the last few years. Here, the focus is on the impact of WMS's entry on the prices of and demand facing the incumbents.

Wal-Mart charges significantly lower prices for food than traditional supermarkets. The extant literature shows that price discounts offered by Wal-Mart range from 0% to 39% below supermarket prices. Basker and Noel (2007) find food prices at WMS's to be about 10% lower than those at competing grocery stores. Hausman and Leibtag (2007) find a 30% premium at traditional supermarkets over superstores, mass merchandisers, and club stores for an array of products. An April 2002 UBS Warburg survey of 100 grocery and non-grocery items in 4-5 grocery stores in three markets with both WMS's and traditional grocery stores found that Wal-Mart's prices were 17-39% lower than competitors' prices (Currie and Jain, 2002). However,

Cotterill, Rabinowitz, and Tian (2002) found that, in New England, WMS's do not always offer a lower milk price than selected supermarkets.

Price is not the only competitor attribute that is affected by WMS entry. Singh et al. (2006) finds that a WMS was luring away large-basket buyers leading to fewer stores visits and 17% decline in sales at a Northeastern supermarket chain. However, they find no consistent pattern for supermarket price changes. An explanation is offered by Barnes et. al. (1996) who found that stores in the Northeast often fared better than their counterparts in the south as Wal-Mart entered food-retailing locally since the north has traditionally been more competition (lower profits) than in the south. This suggests that Wal-Mart's entry had a greater impact in non-competitive retailing environments. Likewise, Artz and Stone's (2006) find that WMS's have a greater impact on local food stores in metropolitan areas than in rural ones, causing on average 8% loss in sales at metropolitan food stores and approximately 4% loss in sales at rural ones.

Incumbent retailers are found to be reactive to Wal-Mart's entry, increasing their investments (resulting in an increased number of stores), with more profitable stores being more likely to respond aggressively to Wal-Mart's entry (Khanna and Tice, 2000). Unlike the evidence on the negative impact on sales and indisputably lower prices, the evidence on the extent of price response by supermarkets is mixed, often being modest to non-existent in favor of non-price responses.

Basker (2005), using data on 10 products at Wal-Mart Discount Stores (and not Supercenters), finds that the price effect of Wal-Mart's entry differ by product and city size. For some products, including toothpaste, shampoo, aspirin, and laundry detergent, Wal-Mart entry reduces average retail prices by an economically large and statistically significant 7–13%.

Basker and Noel (2007), using data on 24 grocery items and 6 non-food items in 175 markets, find that the competitive effect of WMS entry on the prices charged by other supermarkets and grocers is a modest 1-1.2%, and that the largest supermarket chains (Kroger, Albertson's, Safeway) reduce their prices by even less.

Hausman and Leibtag (2006) examine the impact of Wal-Mart on traditional supermarket and mass merchandiser sales and conclude that not only do Wal-Mart-like stores significantly lower prices, but also that prices change because households change their purchasing behavior, seeking convenience. Volpe and Lavoie (2006), focusing on the competitive price effect of six Wal-Mart Supercenters on national brand and private label supermarket prices in New England, find that Supercenters decrease prices by 6-7% for the national brands and 3-7% for private label products.

Regarding the case of the Dallas/Fort Worth metroplex, WMS's have been growing in this market since 1995, but did not seem to pose a real threat to retailers until March 1999, when the pace of opening accelerated rapidly. The considerable expansion of Wal-Mart in 1999 may have triggered the milk price war pointed out by Cotterill and Brundage (2001). Furthermore, Capps and Griffin (1998) conducted a study of the urban/rural fringe of the Dallas/Fort Worth metroplex and found Wal-Mart to decrease David's Supermarket sales by 21%. They predict that mass merchandisers like Wal-Mart will be responsible for 14% sales reduction at traditional grocery chains in this area.

Kim (2005) applies a dynamic oligopoly model to the Dallas/Fort Worth milk market to explain the alleged milk price war via demand and cost shocks. He finds that the players in the Dallas/FortWorth fluid milk market collude when demand is high and defect when costs are high. However, by excluding the main component of demand shocks in the fluid milk market of

Dallas/Fort Worth (i.e., WMS expansion) and by assuming that private label milk has different cost shocks than manufacturer brand milk, the validity of his conclusions about conduct in this market is questionable.

This article provides a framework to gain insight into the factors galvanizing price reductions in stores that compete directly with Wal-Mart in groceries by determining a link between the expansion of WMS's and competitive food pricing conduct.

II. THE MODEL

Appelbaum's (1982) oligopoly model was used as a basis to construct a conceptual model of pricing behavior resulting from the entry of a large low-cost firm, such as Wal-Mart. Consider a market where N firms sell a homogeneous good. Total incumbent output is given by $Q = \sum_{i=1}^{N} q_i$, where q_i is the quantity supplied by incumbent i. The market demand function for milk faced by the incumbents is assumed to be of semi-logarithmic form given by

$$\ln Q = \delta_0 + \eta(\frac{p_r}{d}) + \delta_1 WMS + \sum_{i=2}^{k} \delta_i Z_i \,, \tag{1}$$

where p_r is the retail price, Z is a vector of demand shift variables, d is a deflator and *Wal-Mart* reflects the volume of milk sold by Supercenters. Note that *Wal-Mart*'s entry is not assumed to change the semi-elasticity of demand with respect to price, although the effect on the price elasticity per se depends on the impact of *Wal-Mart* on milk as a negative demand shifter. The total cost function is assumed to be of Gorman Polar form to facilitate aggregation over firms. The firm's marginal retail cost for milk is thus given by

$$mc_i = \beta_0 + \beta_1 p_w + \sum_{k=2}^{m} \beta_k R_k, \tag{2}$$

where p_m is the wholesale price of milk and R_k represents a vector of prices for non-milk inputs.

Consider the entry of WMS's (*WMS*) in the retail milk market of Dallas/Fort Worth. Now, in maximizing their profits from milk, each retailer sets price where the perceived marginal revenue equals marginal cost so that

$$(3) \qquad p_r = -\frac{s_i}{\eta}(1 + \varphi_{0i} + \varphi_{1i} WMS) + \frac{\partial C_i(q_i, W)}{\partial q_i},$$

where the conjectural variation among incumbents is assumed to be a linear function of WMS's entry, η is the semi-elasticity of demand, $C_i(q_i,W)$ is total retailing cost, and s_i is the firm's market share, and $\varphi_i = \varphi_0 + \varphi_1 WM S$ is incumbent's conjectural variation defined as $\varphi_i = \frac{d\sum_{j \neq i}^{n} q_j}{dq_i}$, thus denoting a measure of coordination among the incumbents. The parameter φ_0 denotes, of course, the conjectural variation in the absence of WMS's.

Using (2), multiplying both sides by s_i and summing across the incumbents, following Lopez, Azzam, Lirón-España (2002), yields the aggregate incumbent supply relation given by

$$(4) \qquad p_r = -\frac{H(1 + \Phi_0 + \Phi_1 * WMS)}{\eta} + \left(\beta_1 p_f + \sum_{j=2}^{m} \beta_j R_j \right).$$

The β's, Φ's, and η are parameters and H is the Herfindahl-Hirschman index of concentration among the incumbents ($H = \sum s_i^2$).

Following Equation (4), the impact of WMS's on retail milk prices is given by

$$(5) \qquad \frac{\partial p_r}{\partial WMS} = -\frac{H\Phi_1}{\eta},$$

since η is assumed not to vary with WMS's entry. However, the higher the sensitivity of incumbents' conduct to WMS's entry, the higher the pre-existing level of market concentration

or the more price-insensitive the incumbents' demand is, the higher the marginal impact of Wal-Mart on incumbents' pricing. WMS's entry is not just expected to reduce milk prices but also to discipline the conduct of the incumbents in the market through Φ_1.

For this case, the Lerner index of oligopoly power is given by

$L = -\frac{H(1+\Phi_0+\Phi_1 WMS)}{\varepsilon}$, where ε is the price elasticity of demand (= ηp_r). The impact of Wal-Mart's entry on pricing conduct is given by

$$\frac{\partial L}{\partial WMS} = \frac{1}{\varepsilon}\left[H\Phi_1 + L\left(H\Phi_1 + \eta\delta_1\right)\right], \tag{6}$$

which is the impact WMS's has on the incumbents' pricing conduct in milk weighted by the Herfindahl index of concentration and by the overall power in the market as well as the reduction in residual demand due to WMS expansion scaled by the price responses of the consumers-- the semi-elasticity, but not price, is assumed to be unaffected by WMS's.

III. DATA AND ESTIMATION

Equations (1) and (4) denoting the demand for milk facing the incumbent supermarket chains and their pricing behavior are estimated with data from the Dallas/Fort Worth milk market area. The five chains in the sample are Albertson's, Kroger, Minyard, Tom Thumb, and Winn Dixie. The core data come from the Information Resources Incorporated-Infoscan (IRI) database provided by the Food Marketing and Policy Center at the University of Connecticut. It includes 58 four-week-ending observations covering the period from March 1996 to July 2000. Quantity of milk sold is aggregated at the chain level and the retail price ($/gallon) was computed by dividing aggregate dollar sales by the total quantity of milk sold.

Demand shifters include per capita consumer income, average age of the population, percentage of the population that is Hispanic, and household size, all collected from Market Scope. The milk price and income in the demand equation were deflated by the consumer price index with base year 1982-84. The measurement of the entry of Wal-Mart, which affects both demand and pricing behavior, requires special attention.

The number of WMS's in Dallas/Fort Worth was chosen as the relevant measurement of entry, [2] and was obtained from Market Scope on a yearly basis and extrapolated using the entry strategy that Sam Walton (1992) describes in his autobiography: by focusing opening dates around Memorial and Labor Day while not having too many stores open on the same day. To correct for potential endogeneity of entry (Neumark, Zhang and Ciccarella, 2005), trend variables were used to instrumentalize for the number of Supercenters. [3] The trend regression that best fit the expansion of Dallas/Forth Worth Supercenters is a spline function given by

$$WMS_t = \underset{(20.54)}{5.201} + \underset{(14.88)}{0.150}\, trend1_t + \underset{(32.64)}{0.750}\, trend2_t ,$$

Where the t-ratios are in parenthesis, WMS_t is the number of WMS's at time period *t, trend1* is a trend variable that equals *t* starting at 1 for period 1 and taking a value of 38 for that period onward. The variable *trend2* takes a value of 0 for periods 38 or less and starts at period 39 thus describing Supercenter expansion only for the second period. The R^2 of this regression was 98%, thus substantially explaining the number of Supercenters in Dallas/Forth Worth.

For the marginal cost embedded in the pricing equation, the empirical measure for the price of milk is the Federal Milk Market Order announced Class I fluid milk price. Under fixed markup contracts, this variable is a good instrument for the wholesale price of milk paid by retailers to milk processors (Chidmi, Lopez, and Cotterill, 2005). Other input prices are the retail wages, measured by the average retail earnings rate in Dallas/Fort Worth in dollars/hour minus

the benefits included in those wages (obtained from the U.S. Bureau of Labor Statistics, 2007) and an energy index for the Dallas/Fort Worth area obtained from the Bureau of Labor Statistics.

The Herfindahl Index was also instrumentalized due to its potential endogeneity. Predicted values of regressing the Herfindahl indexes on exogeneous variables were used. The explanatory variables in that regression were: three incumbents' merger dummies (all these mergers happened with companies outside the Dallas/Forth Worth area), the commercial electricity price for Texas collected from the Bureau of Labor Statistics, the retail industry employee earnings collected from the Bureau of Labor Statistics, and a time trend. The R^2 of this regression was approximately 85%.

Once all the variables to estimate the parameters of equations (1) and (4) were operational, they were estimated using the Generalized Method of Moments technique. Note that the system is recursive, non-linear in parameters, and has a cross-equation restriction *(*η). The results are presented below.

IV. EMPIRICAL RESULTS

The estimated parameters are reported in Table 1. In general, the model results are consistent with a priori expectations in terms of signs of the coefficients and estimated price elasticities and marginal costs relative to previous studies.[4] In addition, all but two of the estimated coefficients are significantly different from zero at the one percent level. Furthermore, the results of the J-test for over-identifying restrictions in the model and a Hausman test for endogeneity of the instruments used for the number of Supercenters support the validity of the estimated model for further inference.[5]

[INSERT TABLE 1 HERE]

The results for the demand for milk indicate that as the number of WMS's increased, the demand for milk facing the incumbent supermarkets significantly declined. On average, an additional WMS caused a 1.87% decrease in the gallons of milk sold at supermarkets regardless of price effects, nine times smaller than Singh et. al.'s (2006) finding of 17% reduction in volume sales for the entire grocery category. Although by construction, the number of Supercenters does not affect the estimated semi-elasticity coefficient, it does affect the price *elasticity* of incumbents' demand. The empirical results indicate that the each additional Supercenter in the Dallas/Fort Worth area increases the incumbents' price elasticity of demand for milk by approximately 0.0052 in absolute value, making their demand more price elastic.

By increasing the price sensitivity of supermarket consumers, Wal-Mart's entry contributes to disciplining pricing conduct of incumbents. However, one of the most compelling results depicting the disciplining effect of Wal-Mart's entry is the negative impact of the estimated number of WMS's on conjectural variation elasticity, which is estimated at -0.0725 and highly significant. This implies that each additional WMS in Dallas/Fort Worth decreases the collusive behavior exhibited by the incumbents.

The test of the impact of WMS's on oligopoly pricing involves both the own-price elasticity of demand and the conjectural variations elasticity. The estimated marginal impact on the Lerner index was -0.00838 and it is significant at the 1 percent level. This result indicates the Lerner index of oligopoly power of the incumbents in Dallas/Fort Worth decreases by 0.00838 for each additional WMS.

[INSERT FIGURE 1 HERE]

Figure 1 presents the estimated incumbent's Lerner index for milk over the sample period. Linking this to WMS entry events provides some interesting insights into the pricing reaction of the incumbents and the Dallas/Fort Worth milk price war. The Lerner index hits a high point of 0.4168 in August 1997, when Wal-Mart only has eight Supercenters. The Lerner index decreases until Wal-Mart hits 12 Supercenters; then shoots up to nearly meet its previous high. However, this behavior is only sustained for three months before decreasing to its minimum of 0.13601 at the end of the sample period. In short, Wal-Mart's Supercenter expansion induced the Dallas/Fort Worth retail milk market to become more competitively priced.

To gain further insight into the implications of the empirical results, two counterfactual experiments were conducted on prices and compared to the status quo prices: 1) prices under perfectly competitive behavior by incumbents ($[1+\Phi_0+\Phi_1 WMS]H = 0$) and 2) oligopoly prices in the absence of WMS's ($\Phi_1 = 0$). The results are presented in Figure 2. This counterfactual analysis illustrates how WMS's induce more competitive levels of pricing behavior as well as the stark contrast of incumbent power with WMS's presence versus without it.

[INSERT FIGURE 2 HERE]

If WMS's had not entered the Dallas/Fort Worth market, milk prices would have remained in a high range between approximately $3 and $3.50 a gallon. The corresponding price reduction due to WMS's presence averages 22.5%, ranging from 7.9% at the beginning of the sample to 67.7% at the end of the sample when dividing the price difference by the baseline

price. This result is well within the range of WMS-induced price reductions estimated by Currie and Jain (2002) for a broad range of products. Moreover, the trend of the baseline price is away from the incumbent oligopoly situation in which WMS's are absent and toward the perfectly competitive scenario. In the last period of the study, July 2000, the baseline price and the perfectly competitive price are only 28¢ apart, which, statistically speaking, is insignificantly different from zero.

A consequence of lower milk prices is that the total quantity of milk sold from the incumbents increases in spite of a negative shift in demand increases due to WMS's expansion. In 1996, consumers were buying about 1 million more gallons of milk at the five largest supermarkets in Dallas/Fort Worth due WMS's pro-competitive effect on milk prices. By 2000, this number increased to 1.3 million gallons, not including those gallons sold at Wal-Mart.

Incumbents' producer surplus and supermarket consumers' surplus are computed by comparing the baseline scenario versus the scenario in which WMS would be absent from the market. The results in constant March 1996 dollars are presented in Figure 3.[6] In March 1996, when Wal-Mart only had a few Supercenters in Dallas/Fort Worth, the estimated incumbents' quasi-rent loss was $300,654 (about $60,000 average per supermarket chain) in fluid milk alone in that four-weekly period, a moderate but significant amount. However, by July 2000, when Wal-Mart had expanded to 21 Supercenters, the estimated incumbents' quasi-rent loss reaches nearly $4 million or about $800,000 per retailer four-weekly in fluid milk alone. This is not only a significant loss to incumbent supermarket chains, but one should keep in mind that it represents losses in a single four-week period. On average, incumbents lost $1.18 million each four-week period over the 58 observations or about $68 million in March 1996 dollars.

[INSERT FIGURE 3 HERE]

The consumers considered in this analysis are only those customers of the incumbent supermarket chains and not of WMS's and other grocery retail outlets. In spite of decreased demand facing incumbents due to WMS's ability to lure price-sensitive consumers away, consumers gain due to the ensuing drop in the price of milk the pro-competitive effect of WMS's. Consumers shopping at incumbents' supermarkets in Dallas/Fort Worth gained, on average, $3.4 million in March 1996 dollars. The gain in consumer surplus increases along with the number of WMS's. While, in 1996, consumers gained $1.24 million in a four-week period, by July 2000, this number had increased to $7.7 million. Since these gains far exceed the losses to incumbents' supermarkets, the analysis indicates a net allocative efficiency consequence of WMS's presence.

In short, this study documents that upon WMS entry, oligopolistic incumbents' lose and consumers gain and that consumers' gains exceed the losses to supermarkets in Dallas/Fort Worth. Under the Kaldor-Hicks compensation principle, therefore, they could have compensated the supermarkets for their losses and still have a considerable surplus. This result indicates some strong benevolent impacts of WMS in spite of its negative effects on existing businesses.

V. CONCLUDING REMARKS

Wal-Mart Supercenters are a strong economic force in the retailing sector and have been a recent target of policy-makers. They have been associated with lower prices offered by its direct and indirect competitors (Hausman, forthcoming; Graff, 1996), particularly in food retailing (Currie and Jain, 2002; Basker, 2007. Volpe and Lavoie, 2007, Hausman, forthcoming).

The causal relationship shown to exist between Wal-Mart Supercenters and lower retail food prices clearly raises the question of how they are able to shape the competitive strategies of the other players in the market. In the case of the Dallas/Fort Worth milk market incumbent supermarkets were exhibiting stable, non-competitive pricing behavior prior to Wal-Mart Supercenter expansion, which, after rapid expansion, ignites a price war in milk, and a permanent drop in prices after Wal-Mart Supercenter expansion.

A structural oligopoly model of incumbent supermarket demand and pricing behavior was estimated allowing for potential conduct, pricing, and demand impacts of Wal-Mart's expansion. Scanner data for 1996-2000 were obtained in 58 four-week periods and the model was estimated using the Generalized Method of Moments technique. .

The empirical results indicate that Wal-Mart Supercenter's expansion disciplines the fairly collusive conduct of incumbent supermarkets in the Dallas/Fort Worth milk market, causing those incumbents to adopt behaviors not statistically different from a perfectly competitive behavior. Therefore, the average milk price reduction of 22.5% is due to Wal-Mart Supercenters' ability to cause incumbent firms to alter their strategic behaviors. Moreover, the rapid expansion of Wal-Mart Supercenters causes sales at incumbent supermarkets to drop 1.87%, indicating that, despite lower prices at incumbent supermarkets, Wal-Mart Supercenters was still able to lure consumers away from the traditional retailers.

As a consequence of their pro-competitive effect, Wal-Mart Supercenters improved the allocative efficiency of the Dallas/Fort Worth milk market by inducing consumer surplus gains that exceed incumbent supermarket losses.

In light of the welfare results, the option of limiting Wal-Mart Supercenter expansion or prohibiting its entire presence or future entry in a market via "Anti-Big Box" legislation or

living-wage laws would not necessarily lead to net welfare gains. In fact, as evidenced here, such legislation could lead to substantial net welfare losses favoring incumbents at the expense of consumers. Further, this study shows that Wal-Mart can discipline tacit collusion, the only legal form of collusive behavior.

While this paper cannot wholly and conclusively answer the popular question "Is Wal-Mart Good for America?", it does affirm that Wal-Mart Supercenters are good for competition, since these giant food retail outlets are able to mitigate non-competitive behavior in a collusive market. Without question, additional research will help in understanding the impacts Wal-Mart has on incumbent supermarket behavior and consumers' shopping experience. Wal-Mart has been a catalyst for change in the retail industry; understanding the way in which it impacts the food sector through its Supercenters is just the first step in discovering the magnitude of its entire impact on society.

ENDNOTES

[1] These 185,000 square foot stores sell over 100,000 different products-- ranging from general merchandise to groceries, all under one roof-- it is the epitome of one-stop shopping, which is a much desired feature in today's fast-paced society. On the other hand, Discount Stores, which preceded Supercenters, do not sell food. Wal-Mart's trend is to open Supercenters and transform existing Discount Stores. In addition, the company has recently introduced smaller scale urban stores.

[2] Two other measures of Wal-Mart's entry were considered. An obvious choice is the quantity of milk sold by Wal-Mart. However, data on Wal-Mart milk quantity and pricing were unavailable. Another candidate variable is WMS's grocery market share. While market share may also be argued to be an accurate representation of actual Wal-Mart's presence overall, during the time period considered, the market share of WMSs remained virtually constant. This is probably due to the pricing behavior of the incumbents-- they may have been successful in retaining their market share for a while. In addition, the actual market share may not fully account for the full threat of entry. Therefore, the number of stores is the best indication of the presence and increasing threat of WMS to incumbents.

3. Neumark, Zhang, and Ciccarella (2005) use the distance from Benton Country, Arkansas (Wal-Mart's headquarters and origin) as the instrument for entry in a national study. Since all the Supercenters in this study were practically at the same distance from Benton county, time became the instrument of choice. Endogeneity may arise because Wal-Mart entry decisions are often linked to potential profitability of markets which are in part dictated by incumbents' conduct.

4. The own-price semi-elasticity of demand is estimated to be -0.1945 and is significant at the one percent level and it is equivalent to an own-price elasticity of demand to be approximately -0.32 at average values, which is in the range of previous estimates at the supermarket level for other cities (Cotterill and Putsis, 2000; Gould, 1996). The estimated marginal cost of retail milk, which is embedded in the pricing equation, is estimated at $1.73 at average values and this estimate significant at the one percent level. The range is $1.71 to $1.98 per gallon, which is also consistent with previous estimates for comparable periods for other cities *** {how does the estimated marginal cost of milk compares to other estimates by previous authors?, not necessarily Dallas/Fort Worth}***.

5. Two tests were used to assess the model validity. First, the J-test was used to test over-identifying (the cross-equation) restriction. The p-value of the J-test was 0.1022, failing to reject the null hypothesis that the over-identifying restrictions hold. Second, the Hausman test was conducted to verify if the number of Supercenters was indeed endogenous, as earlier assumed. We failed to reject endogeneity in the demand equation but not in the pricing equation at the 1 percent level. However, endogeneity with the demand equation implies endogeneity in the system and the number of Supercenters was instrumentalized with the trends variables described before. The Hausman test rejects endogeneity of the instrumentalized number of Supercenters at the 1 percent level.

6. One should be reminded that, due to lack of milk sales data for Dallas/Fort Worth Supercenters, only the quasi-rents accruing to the incumbents are included, leaving out any Supercenters' milk quasi-rents, thus possibly over-estimating total suppliers' losses if one included any quasi-rents gains to Wal-Mart. Likewise, since Wal-Mart lures away more consumers as it expands, the consumer gains are likely underestimated as it only includes those shopping for milk at supermarkets. Furthermore, Wal-Mart is likely to attract the most price sensitive consumers which are likely to have larger consumer surplus gains from lower prices.

REFERENCES

Appelbaum, E. "The estimation of the degree of oligopoly power." *Journal of Econometrics*, 19, 1982, 287-299.

Artz, G. and K. Stone. "Analyzing the Impact of WMS's on Local Food Store Sales." *American Journal of Agricultural Economics*, 88, 2006, 1296-1303.

Basker, E. and Noel. "The Evolving Food Chain: Competitive Effects of Wal-Mart's Entry into the Supermarket Industry." Working paper, University of Missouri, 2007.

Basker, E. "Selling a Cheaper Mousetrap: Wal-Mart's Effect on Retail Prices." *Journal of Urban Economics*, 58, 2005, 203-229.

Barnes, Connell, Hermenegildo, and Mattson. "Regional Differences in the Economic Impact of Wal-Mart." *Business Horizons*, July-August, 1996.

Capps Jr., O. and J.M. Griffin. "Effect of a Mass Merchandiser on Traditional Food Retailers." *Journal of Food Distribution Research*, 29, 1998, 1-7.

Chidmi, B. "Supermarket Price Competition in Dallas Fort Worth Fluid Milk Market." *Selected Paper*, American Agricultural Economics Association Annual Meeting, Portland, OR, July 29-August 1, 2007.

Chidmi, B., R. Lopez, and R. Cotterill. "Retail Oligopoly Power, Dairy Compact, and Boston Milk Prices." *Agribusiness*, 21, 2005, 477-491.

Cotterill, R., and M. Brundage. "Competition, or the Lack Thereof in Local Fluid Milk Markets: San Francisco, Seattle, Chicago, Miami and Dallas-Fort Worth." *Food Marketing and Policy Center*, Issue Paper No. 21, 2001. Available online at http://www.fmpc.uconn.edu.

Cotterill, R., and W. Putsis. "Market Share and Price Setting Behavior for Private Labels and National Brands." *Review of Industrial Organization*, 17, 2000, 17-39.

Currie, N., and A. Jain. "Supermarket Pricing Survey," *UBS Warburg Global* Equity Research, 2002.

Dahlman, G. "The Blurring Food Retail Channels." U.S. Bancorp Piper, 2002.

Economagic. (2006). Economic time series page. Retrieved November 18, 2006, from http//www.economagic.com.

Gould, B. "Factors Affecting U.S. Demand for Reduced-Fat Fluid Milk." *Journal of Agricultural and Resource Economics*, 21(1), 1996, 68-81.

Graff, T. O. "Unequal Competition among Chains of Supercenters: Kmart, Target, and Wal-Mart," *Professional Geographer*, 58(1), 2006, 54–64.

Hausman, J. and Leibtag, E. "Consumer Benefits from Increased Competition in Shopping Outlets: Measuring the Effects of Wal-Mart." *The Institute for Fiscal Studies*, Department of Economics working paper, 2006.

_____. "Consumer Benefits from Increased Competition in Shopping Outlets: Measuring the Effect of Wal-Mart," *Journal of Applied Econometrics*, forthcoming.

Information Resources Incorporated-Infoscan (IRI). *Food Marketing and Policy Center.* University of Connecticut.

Kim, D. "Measuring Market Power in a Dynamic Oligopoly Model: An Empirical Analysis." Working paper, International University of Japan, 2006.

Kinsey, J., and B. Senauer. "Consumer Trends and Changing Food Retailing Formats." *American Journal of Agricultural Economics*, 78, 1996, 1187-1191.

Khanna and Tice. "Strategic Responses of Incumbents to New Entry: The Effect

of Ownership Structure, Capital Structure, and Focus." *Review of Financial Studies*, 13, 2001, 749-779.
Lopez, R., A. Azzam, and C. Lirón-España. "Market Power and/or Efficiency: A Structural Approach." *Review of Industrial Organization*, 20, 2002, 115-126.
Market Scope. 1995-2001. Progessive Grocer Annual Editions.
Neumark, D., J. Zhang, and S. Ciccarella. "The Effects of Wal-Mart on Local Labor Markets." Working paper, National Bureau of Economic Research, 2005.
Singh, V. P., K. T. Hansen, and R. C. Blattberg. "Market Entry and Consumer Behavior: An Investigation of a WMS," *Marketing Science*, 25(5), 2006, 457–476.
U.S. Bureau of Labor Statistics. "State and area employment, hours, and earnings." Washington, D.C., 2001, http://data.bls.gov/labjava/outside.jsp?survey=sa.
Trade Dimensions. *Information Resources, Inc. (IRI) Infoscan*. Data on milk markets. Wilton, CT: Custom CD, 1996-2000.
U.S. Department of Energy. Energy Information Administration website, 2006. Retrieved November 6, 2006, from http://www.eia.doe.gov.
U.S. General Accounting Office. "Dairy industry: Information on milk prices and changing market structure." U.S. General Accounting Office, Resources, Community, and Economic Development Division, Washington, D.C, 2001.
Volpe, R., and N. Lavoie. "The Effect of WMS's on Grocery Prices in New England." Working paper, University of Massachusetts, 2006.
Wal-Mart Stores, Inc. "Wal-Mart Annual Report." http://walmartstores.com/Files/2006AR.pdf (accessed July 2, 2007).
Walton, S., and J. Huey. *Sam Walton: Made in America*. New York: Doubleday, 1992.

TABLE 1
Parameter estimates for milk retail pricing and demand equations

Variable	Parameter	Estimate		St. Error	T-Ratio
Demand Equation					
Retail price	η	-0.1945	**	0.0022	8.6906
Estimated number of WMS's	δ_1	-0.0187	**	0.0012	14.794
Per capita income	δ_2	0.0024	**	0.0006	3.4836
Average age of population	δ_3	-0.0548		0.0336	1.6319
Percentage Hispanic	δ_4	0.0252	**	0.0077	3.2375
Household size	δ_5	1.3072	**	0.2386	5.4767
Constant	δ_0	13.100	**	1.2070	10.853
Pricing Equation					
Raw milk price	β_1	0.9495	**	0.1024	9.2666
Retail wage rate (earnings – benefits)	β_2	0.1717	**	0.0305	5.6199
Energy index	β_3	-0.0289	**	0.0094	3.0765
Constant	β_0	0.5712		0.4797	1.1906
Conduct parameter constant	Φ_0	1.2266	**	0.4651	2.6370
Estimated number of WMS's	Φ_1	-0.0725	**	0.0099	7.2695
Semi-elasticity of demand	η	-0.1945	**	0.0223	8.6906
Related Measures					
Elasticity of demand	$\eta\,\overline{p}$	-0.3212	**	0.0369	8.6906
Marginal cost	$\Sigma\beta_i\overline{w}_i$	1.7314	**	0.2211	7.8283
Lerner Index	$[\overline{H}\,(1+\Phi_0+\Phi_1\overline{WMS})]/[\eta\,\overline{p}\,]$	0.5281	**	0.1350	3.8649
Conj. Var. Elasticity	$\overline{H}\,[1+\Phi_0+\Phi_1\overline{WMS}\,]$	0.1696	**	0.0466	3.6394
Over-identifying restrictions (J-test)	χ^2_{25}	34.269	*	p-value:	0.1022
Total impacts (derivatives w.r.t. *WMS*)					
Elasticity of demand		-0.0052	**	0.0010	5.1843
Lerner index		-0.0083	**	0.0009	9.2222

Notes: ** and * indicate significance at the 1% and 10% levels; T-ratios are in absolute value

FIGURE 1
Incumbents' Lerner Index for milk and number of Wal-Mart Supercenters

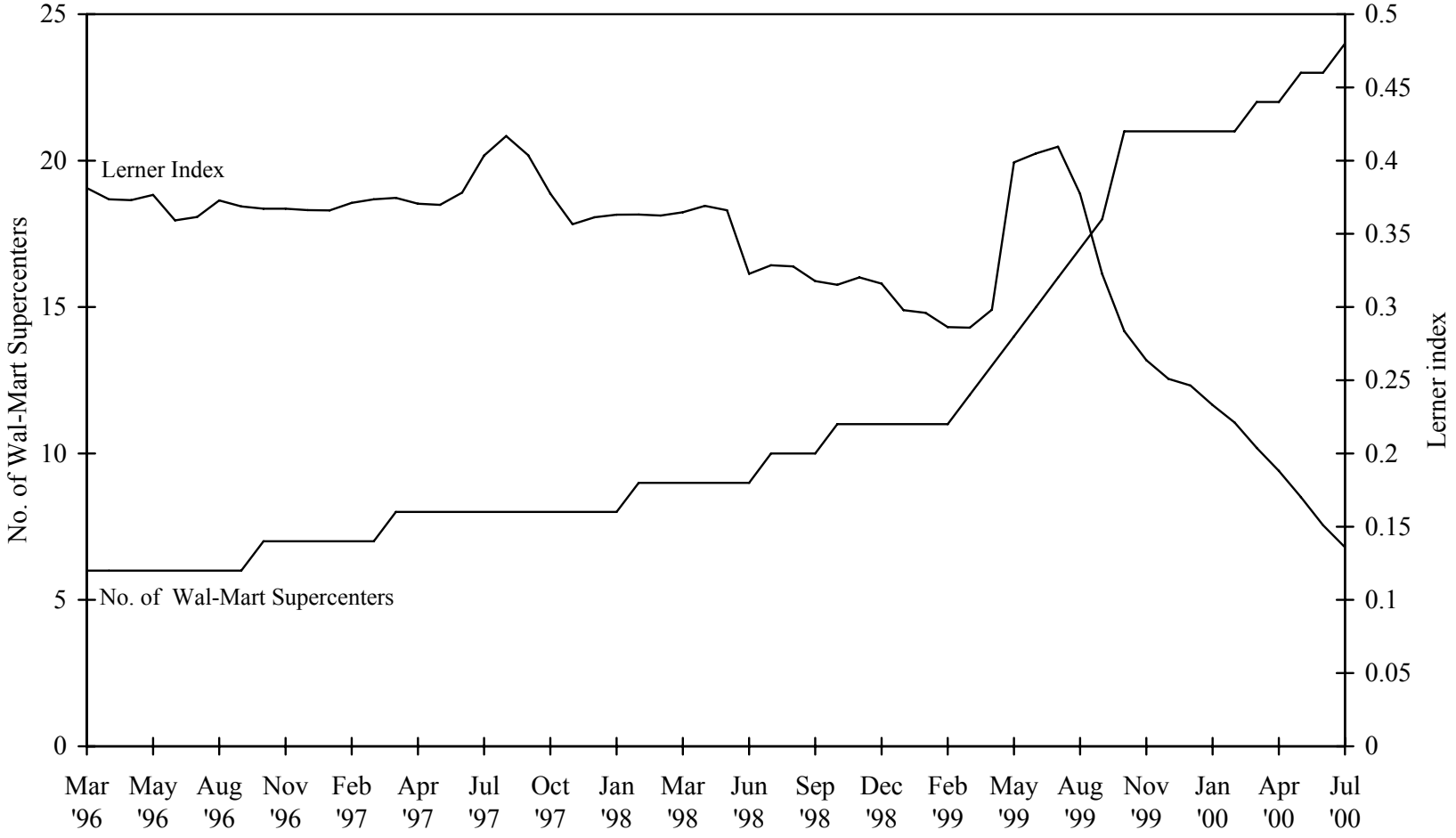


FIGURE 2
Incumbent supermarket milk prices under alternative conduct regimes

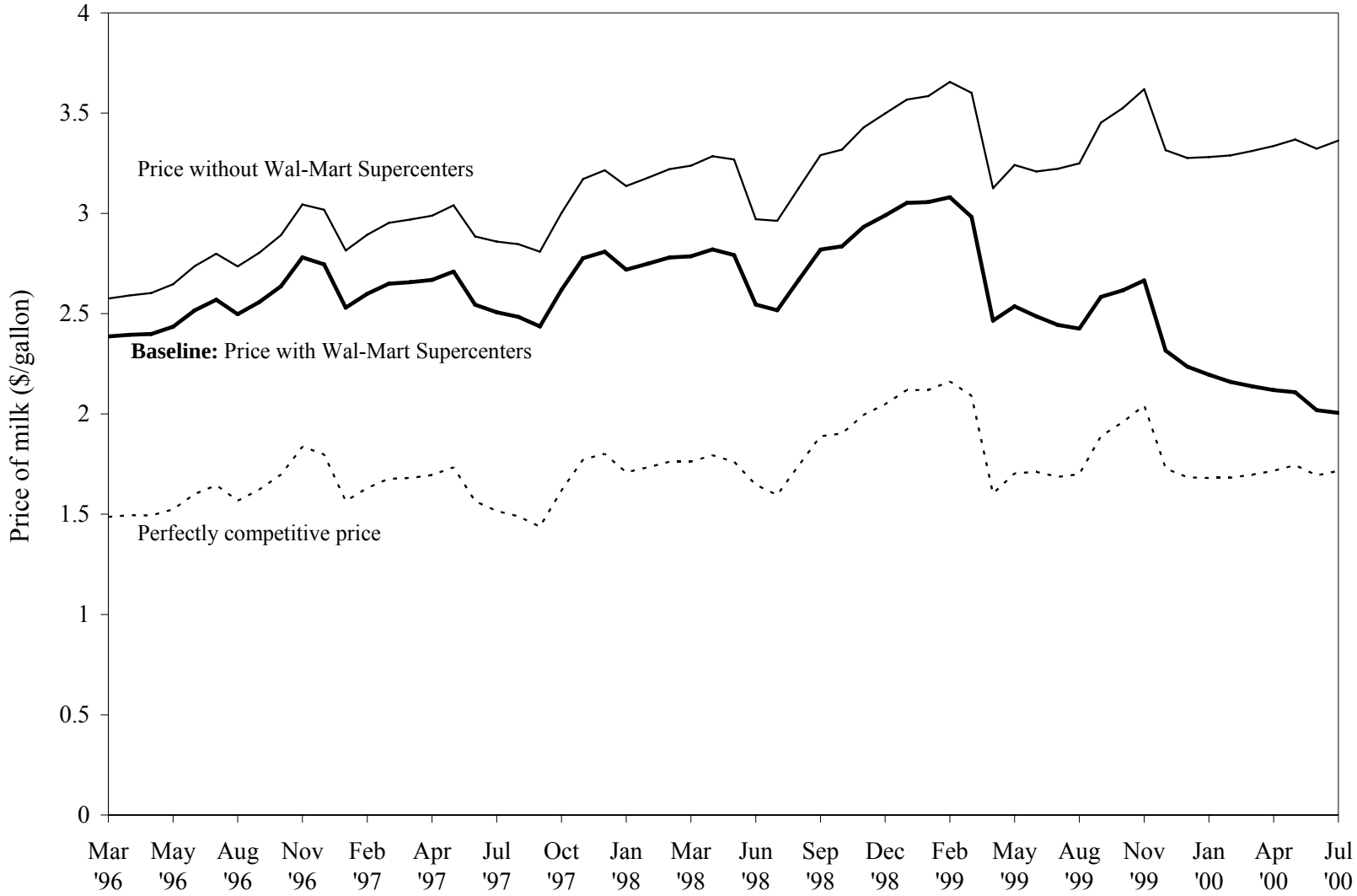
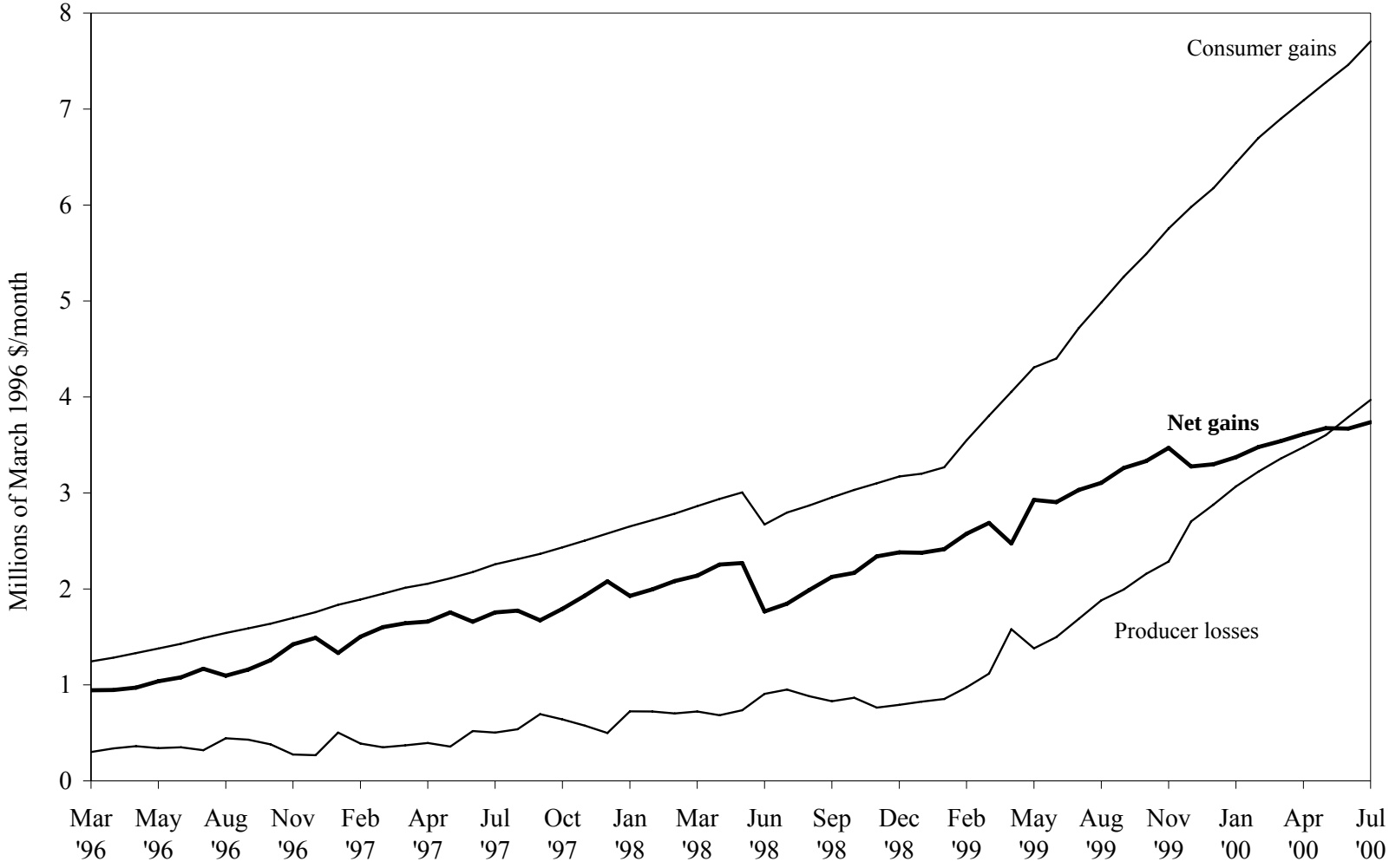


FIGURE 3
Milk market welfare effects due to the presence of Wal-Mart Supercenters



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