Do Shifting Milk-Production Patterns Weaken the Dairy Supply Chain? The Case for the Southeastern U.S.

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Milk production across much of the southeastern United States has been declining for more than two decades. Since the early 1990s the region has witnessed average annual declines in milk production of about five percent and a 40-percent decline in the number of dairy farms. This decline, coupled with an increasing population in the region, and hence an increasing demand for milk, has resulted in ever-increasing shipments of milk into the Southeast, primarily from the Southwest and to a lesser extent from the Midwest. As production in these areas has expanded to fill the void left by farm losses in the Southeast, it has also tended to become more geographically concentrated. A high concentration of milk production in relatively distant geographic areas and a need to ship milk long distances to processing plants in the Southeast raises several food-security and supply-chain issues. Any outbreak of a highly contagious animal disease in a concentrated production area has the potential to cause a significant portion of the Southeast's supply to be quarantined without warning and without recourse to other readily available reserves for an indefinite amount of time. Disruption in the transportation infrastructure due to natural disasters or terrorist attacks could also interrupt the delivery of milk from distant supply areas to Southeastern processing plants.

This research report uses available milk production, shipping, price and consumption data to project the likely impact of such hypothetical scenarios on short-term supply availability; retail prices; and consumption in the milk-deficit, population-dense areas of the southeast. It also estimates the economic impact of these scenarios on the Southeast economy and in particular on the long-term viability of milk-processing plants dependent upon shipments from outside the region. Finally, the estimated impacts of these scenarios are compared with the projected costs of increasing and maintaining a regional Southeastern production base.

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The Production–Consumption Gap

Those states selected to compose the Southeast fluid-milk market for this analysis are Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee. Particular attention will be given to Georgia due to the level of detailed data available, and results will be generalized to the broader Southeast region. Milk production across the Southeastern states, as defined here, has declined by an annual average of three percent for the past decade, from 7.5 billion pounds in 1997 to only 5.7 billion pounds in 2006. At the same time, the population in these states grew at an average annual rate of two percent, from 50.2 million in 1997 to 58.5 million in 2006 (USDA-NASS 1997–2006). U.S. per-capita consumption of fluid-milk products during the same time period declined slightly, from 191.2 pounds per year in 1997 to about 180 pounds in 2006 (USDA-ERS 2006). Taken together, these statistics imply that the milk-production shortfall in the Southeast—that is, the difference in Southeast production and estimated fluid consumption—increased from 2.1 billion pounds in 1997 to 4.8 billion pounds in 2006 (Figure 1). This decline in Southeast production may be attributed to a number of factors, including relatively higher productions costs compared to other areas of the country, increased employment opportunities in other industries that make it increasingly difficult to keep successive generations on the farm, and increasing land values in rapidly urbanizing areas that serve to make farm land more valuable in alternative uses. At the same time that Southeast milk production has declined, production in other areas of the country, primarily in the Southwest and to a lesser extent in parts of the Midwest, has increased to fill the gap. For example, milk production in Texas grew from 5.8 billion pounds in 1997 to 7.2 billion pounds in 2006, and production in Indiana grew from 2.2 bil-

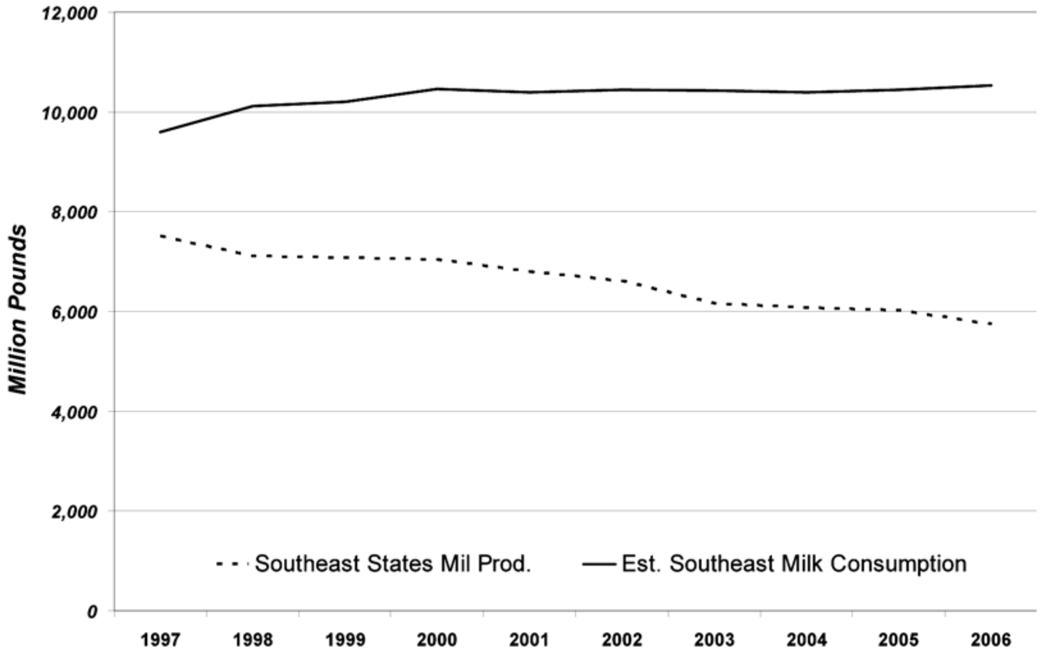

Figure 1.

lion pounds in 1997 to 3.3 billion pounds in 2006, for average annual increases of 2.6 percent and 4.7 percent, respectively (Figure 2) (NASS 2006).

While production decreases in one part of the country coupled with simultaneous production increases in another are at best only circumstantial evidence of changing milk production and shipping patterns, closer examination of those patterns for Georgia—a state for which detailed data is available—reveals that both Texas and Indiana have, at various times, supplied substantial quantities of milk to Georgia processing plants (Figure 3) (Gates 2007).

An important characteristic of milk-production growth in those areas exhibiting increasing production, such as Texas and Indiana in this example, is the tendency toward highly concentrated pockets of production in a few geographic areas within those states.

A number of potential threats to the milk production and distribution system may be hypothesized, including terrorist attacks at the farm level such as introduction of Foot and Mouth Disease (FMD) in areas of high animal concentration, contamination of animal feed and water supplies, direct contamination of milk shipments, destruction of major transportation infrastructure such as interstate highways and bridges, as well as myriad presently unidentified possibilities. Any of these hypothetical situations could have the effect of shutting down milk production or shipments from one or more of the Southeast's outside supply areas for an indefinite amount of time.

Theoretically, this situation can be modeled in terms of a supply and demand framework as shown for Georgia in Figure 4, where S_{GA} represents short-run (fixed) milk production in the state. The short run may be assumed to be as long as a year or more due to the extended period associated with biological lags in bringing additional cows into production in response to price increases. S_I represents the supply of milk available from outside the southeast, and is somewhat more elastic, even in the short run, due to the ability of fluid-milk processors to bid supply away from other uses such as cheese, butter, or milk powder production. D_{GA} represents Georgia demand for fluid milk. It is assumed that local production can be procured at a lower cost than

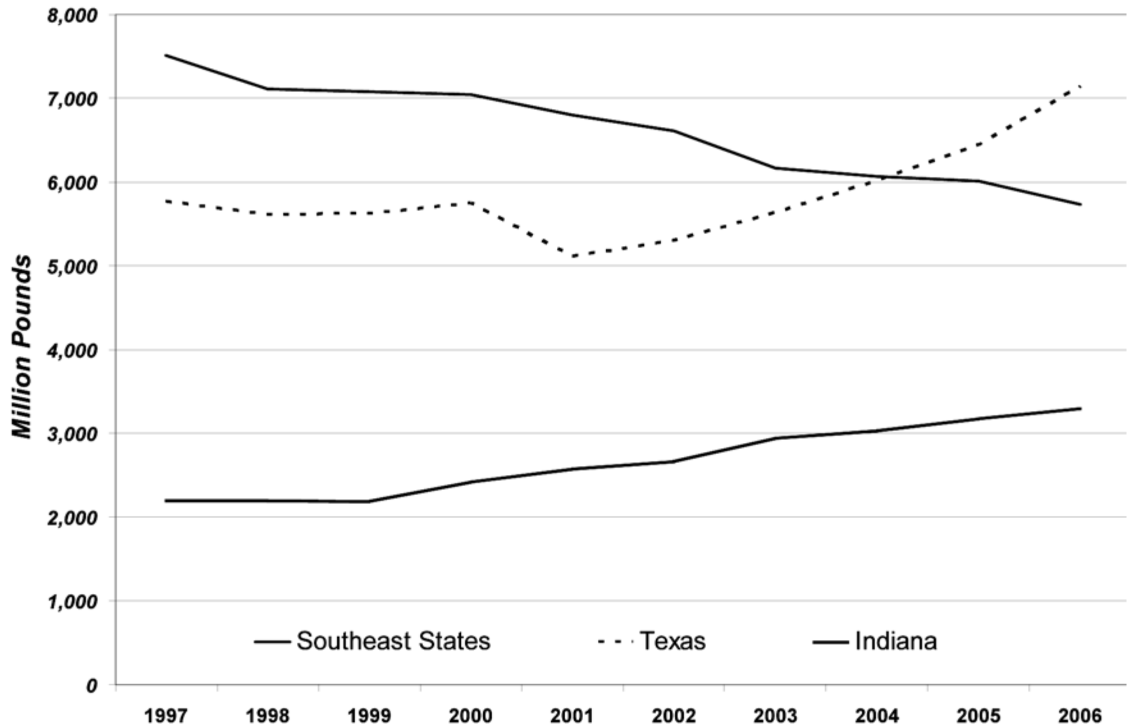

Figure 2.

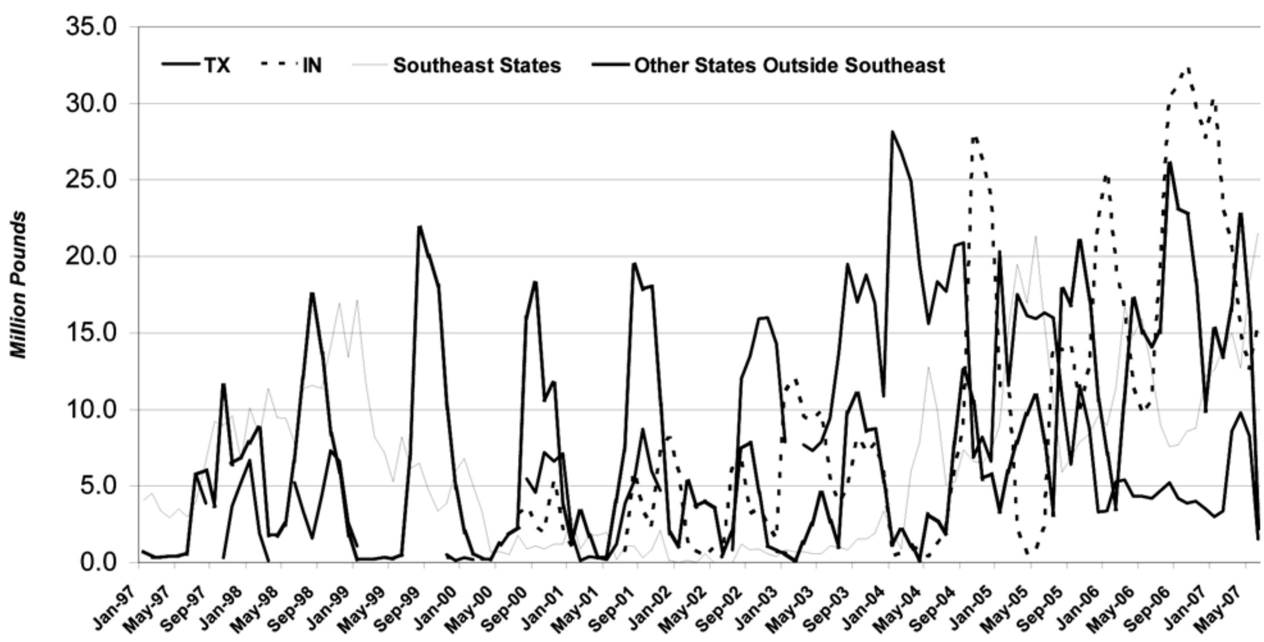

Figure 3.

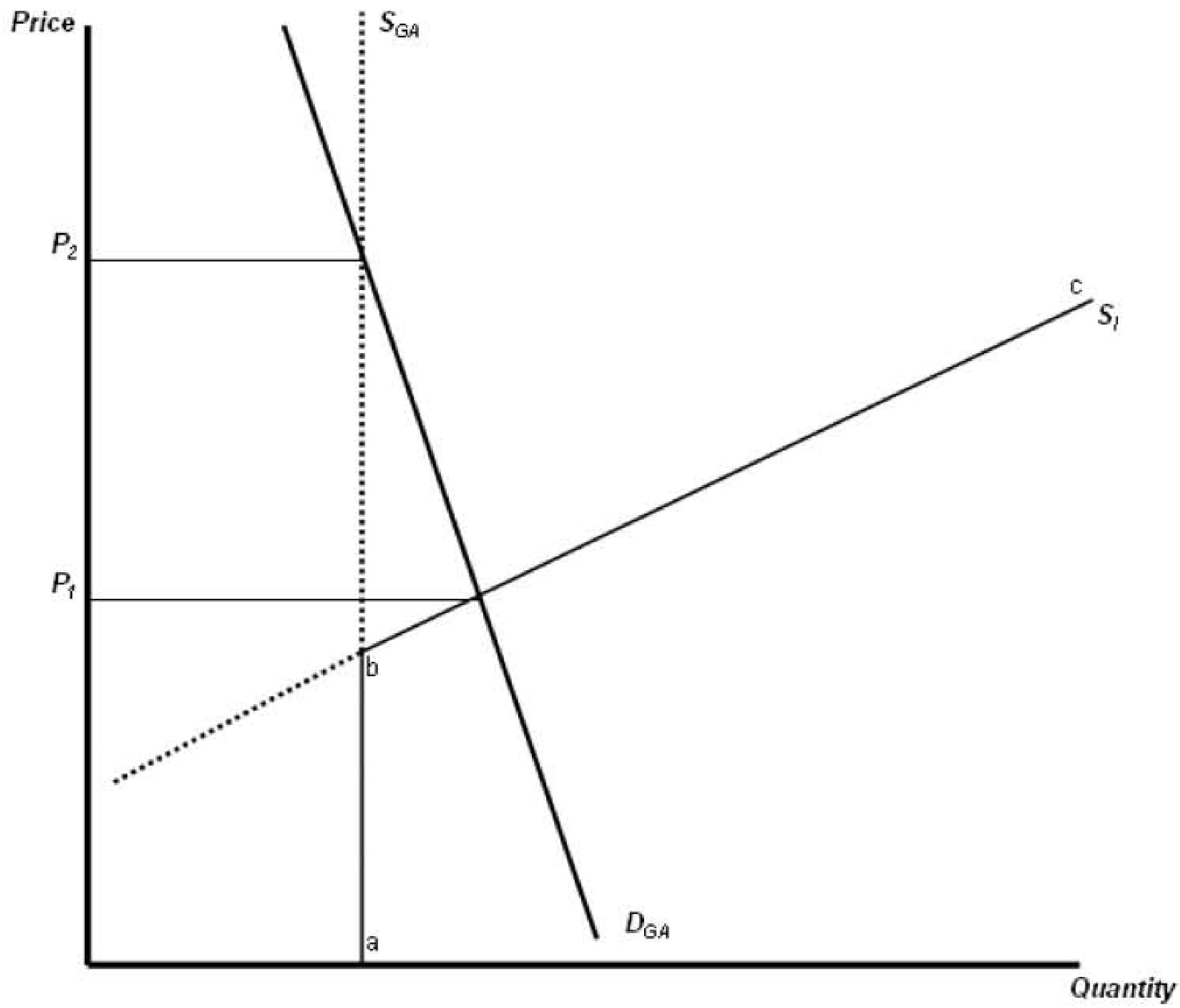

Figure 4.

production from outside the Southeast and therefore is used first, with production from outside the region making up the difference. This results in a "kinked" supply curve a,b,c. If the outside supply, b,c, is removed due to some interruption in the supply chain, prices would be expected to rise from P_1 to P_2. Taking the state of Georgia as an example, since the quantity of milk produced in the Georgia and the total quantity demanded by the state are observable, as is the average retail price of milk in the Atlanta, the impact of removing some or all of outside supply can be estimated. Combining this data with generally accepted estimates of the price elasticity of demand for fluid milk, typically in a highly inelastic range of −0.14 to −0.17 (Balagtas and Kim 2007), results in anticipated prices of between $20 and $25 per gallon in the absence of outside supplies from Texas and Indiana, the two primary states supplying the Southeast.

If only that portion of Georgia's supply coming from Texas were lost and could not be replaced from other sources in the short run, prices would be expected to rise to about $4.35 per gallon and if only the portion of supply associated with Indiana were lost, prices would be expected to rise to about $15.89 per gallon. These scenarios assume that prices would be allowed to rise to free-market levels based on prevailing supply-and-demand conditions. In reality, price gouging laws in Georgia (Georgia Governor's Office of Consumer Affairs 2007)—and presumably in most, if not all, other states—prevent retailers from raising prices on basic food products during a declared state of emergency. Since most situations which would involve wide-scale interruptions in milk production or transportation would very likely qualify as an emergency, prices would in all likelihood be capped at pre-emergency levels. This would present milk plants in Georgia and across the Southeast with a situation in which supplies were severely restricted and prices were capped. The likely consequences of such a situation would be that all plants currently operating in the state would no longer be able to continue to do so if supplies were limited to Southeast production for a prolonged period. The question of how long such a situation might prevail depends upon such factors as how severe an outbreak of FMD might be, how quickly it was detected, how many cows had to be destroyed, and how large an area was quarantined. Scenarios involving short-term loss of major transportation infrastructure would likely result in much shorter delays and smaller impacts to the dairy sector.

The results in Table 1 show the estimated impact on Georgia's economy of a long-term (one year or more) loss of milk imports from Texas and Indiana, the state's two major outside supply areas.

Economic impacts can be estimated with input-output models (IMPLAN 2004) that separate the economy into various industrial sectors such as agriculture, construction, manufacturing, trade, and services. The input-output model then calculates how a change in one industry changes output, income, and employment in other industries. It is assumed that a long-term loss of nearly half the state's milk-processing volume in the absence of the ability to raise prices to consumers would result in consequences ranging from existing plants operating at reduced capacities to the complete shut-down of some plants. These changes, or impacts, are expressed in terms of direct and indirect effects. Impacts are interpreted as the contribution of the enterprise to the total economy. Direct effects represent the initial impact on the economy of either construction or operations of an enterprise. The direct impact on Georgia's economy of the long-term loss of milk imported from Texas and Indiana would be more than $800 million in lost output, $74.5 million lost labor income, and the loss of more than 1,400 jobs. Indirect effects are changes in other industries caused by direct effects of an enterprise, and include changes in household spending due to changes in economic activity generated by direct effects. The indirect impact of long-term loss of milk imports would be $341.5 million in lost output, $108 million in lost labor income, and loss of an additional 2,305 jobs. Thus the total economic impact—the sum of direct and indirect effects—would be more than $1.1 billion in lost output, $182.5 million in lost labor income, and a total of 3.707 lost jobs. In addition, more than $16 million in state taxes and $12 million in local taxes would be lost. Output impacts are a measure of economic activity that results from enterprise expenditures in a specific industrial sector. Output is equivalent to sales, and offers insights into how initial economic activity

Table 1. Economic Impacts of Decreased Fluid-Milk Processing, Total TX and IN Imports to Georgia.

	Direct impact	Indirect impact	Total impact
Output ($)	827,702,400	341,509,541	1,169,211,941
Labor Income ($)	74,465,272	108,053,051	182,518,323
Employment	1,402	2,305	3,707
State Taxes ($)			16,252,415
Local Taxes ($)			12,093,544

in one sector leads to sales in other sectors. Personal-income impacts measure purchasing power that is created due to the output impacts. This impact provides the best measure of how standards of living are affected for residents in the impact area. An enterprise involves a specified number of employees that is determined by the technology of the enterprise; employment multipliers indicate the effect on employment resulting from the enterprise initiating economic activity. IMPLAN indirect employment includes both full-time and part-time jobs without any distinction. Jobs calculated within an IMPLAN industrial sector are not limited to whole numbers; fractional amounts represent additional hours worked without an additional employee.

Is Local Supply a Solution?

One option for mitigating the risk associated with concentrating milk supplies in areas of the country far from the Southeast is to expand local production through some type of production-incentive plan. Successful implementation of such a plan would require recognition of the risks involved in supplying a major portion of the Southeast's demand from distant areas where production is often highly concentrated and possibly at greater risk of disruption, a long-term commitment to paying milk producers a price sufficient to promote sustained production growth, and most importantly, a determination as to whether the long-term benefits of cultivating and maintaining local production outweigh the risks of losses from interruption of the supply chain.

It is beneficial to understand how changes in farm-level milk prices impact production. In addition to the price of milk, numerous other factors may influence production, including feed prices, land values, replacement heifer prices, and government programs to name a few. Extensive research has been conducted in the area of farm-level milk production responses to changes in milk prices at a national level, yielding a wide range of estimated price elasticities. Price elasticity is a measure of the expected percentage change in the quantity of a commodity produced given a one-percent change in its price. A review of current peer-reviewed academic research reveals estimates ranging from 0.07 to 0.59 (Cox, Chavas, and Jesse 1994; FAPRI 1998; OMB 1998; Suzuki and Kaiser 1997). Little, if any, work has been published in the area of estimating supply response functions for the Southeast and even less specifically related to individual states.

Simulating incremental price increases based on long-run prices offers a projection of how much milk production in the Southeast may be expected to increase in response to price incentives. A range of milk-supply increases is derived based on the long-run elasticity estimate cited above. The low estimate (0.07) represents a short-term or partial response with very limited potential for increasing short-run production in the Southeast. The high estimate (0.59) is attributed to Suzuki and Kaiser and represents a long-term or full effect. Dairy farmers have limited options to respond to price increases in the short run. Milk-cow numbers cannot be adjusted easily except by less rigorous culling. Options to boost milk production per cow are similarly limited in a well-managed herd. In the longer term, some additional heifers can be raised and the rate of dairy farm exits may slow, thereby slowing or reversing the long-term trend in cow numbers.

Between 2000 and 2006, the average mailbox milk price—the price actually received by farmers for their milk—as published by USDA was $14.72 per hundredweight for the Southeast Federal Milk Marketing Order (AMS 2006). The results of simulating incremental price increases based on a long-run supply elasticity of 0.59 are shown in Figure 5. These results suggest that in Georgia the difference in local production and imports could be made up through expanded state production at a long-run average price of about $17 per hundred pounds of milk. It is assumed that results would be similar for neighboring Southern states facing similar production costs and conditions.

Conclusion

Many states in the Southeastern U.S. have experienced declining milk production and an increasing reliance on imports from other areas of the country for more than a decade. As milk production expands in alternative supply areas in the Southwest and Midwest to fill the gap between supply and demand, it also tends to become increasingly concentrated in a few geographic areas. Concurrent with these declines in production is growth in population in the Southeast and hence an increasing demand for milk products.

A number of threats to the milk production and

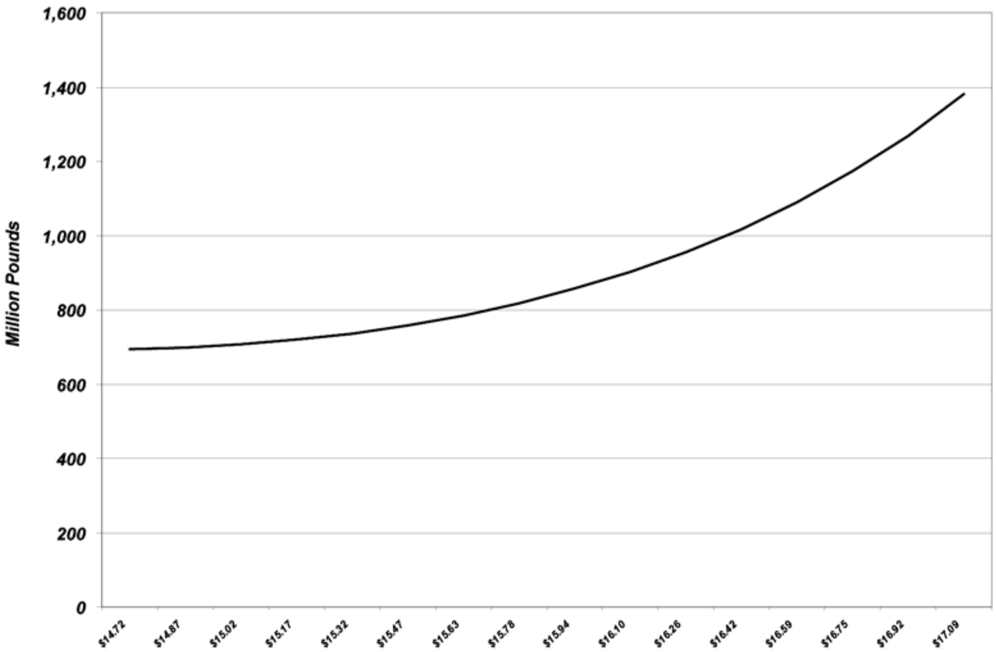

Figure 5.

distribution system may be hypothesized which could disrupt or eliminate shipments into the Southeast for an indefinite period. Disruption of milk shipments has the potential to increase milk prices substantially in the absence of government intervention to control prices during emergency situations. Price controls present their own potential set of problems; namely that if milk processors cannot raise prices or readily procure additional supplies, they face the possibility of operating at significantly reduced levels of efficiency or shutting down. The estimated annual impact of eliminating milk imports into Georgia is more than $1.3 billion. The possibility of offsetting the need for high levels of imports by expanding local production through production incentive plans exists. The benefits of implementing such a plan should be carefully weighed against its costs. It is estimated that a long-term increase in the price paid to producers in the range of 15 percent would make a significant contribution to expanding milk production in Georgia. This methodology provides a framework for further analysis of the risks and potential risk-mitigation strategies available to the southeast dairy industry.

References

Agricultural Marketing Service (AMS). 2006. "Milk Marketing Order Statistics, Retail Milk Prices." Washington D.C.: U.S. Department of Agriculture.

Balagtas, J. V. and S. Kim. 2007. "Measuring The Effects of Generic Dairy Advertising In a Multi-Market Equilibrium." *American Journal of Agricultural Economics* 89(4):932–946.

Cox, T., J. P. Chavas, and E. Jesse. 1994. "Regional Impacts of Reducing Dairy Price Supports and Removing Milk Marketing Orders in the U.S. Dairy Sector." Staff Paper No. 377. Department of Agricultural and Applied Economics, University of Wisconsin-Madison.

Food and Agricultural Policy Research Institute (FAPRI). 1998. "U.S. Dairy Model Documentation Supply and Demand Components." FAPRI-UMC #17-98. Unpublished manuscript.

Gates, P. 2007. "Georgia Dairy Facts – 2006." Atlanta: Dairy Division, Georgia Department of Agriculture.

Georgia Governor's Office of Consumer Affairs.

2007. *O.C.G.A.* Sections 10-1-393.4 and 10-1-438.

Minnesota IMPLAN Group, Inc. 2004. *IMPLAN Professional Version, Version 2.0 User's Guide, 3rd Edition*. Stillwater, MN.

Office of Management and Budget. 1998. "The Economic Effects of the Northeast Interstate Dairy Compact." A Study Required by Section 732 of the FY 1998 Agriculture Appropriations Act (PL 105-86). Washington, D.C.

Suzuki, N. and H. M. Kaiser. 1997. "Imperfect Competition Models and Commodity Promotion Evaluation: The Case of U.S. Generic Milk Advertising." *Journal Agricultural and Applied Economics* 29(2):315–325.

U.S. Department of Agriculture, Economic Research Service (ERS). 2007. "Dairy Products, Per Capita Consumption, United States."

U.S. Department of Agriculture, National Agricultural Statistics Service (NASS). 1997–2006. "Milk Production, Disposition & Income Summary."