Dairy products - artificial

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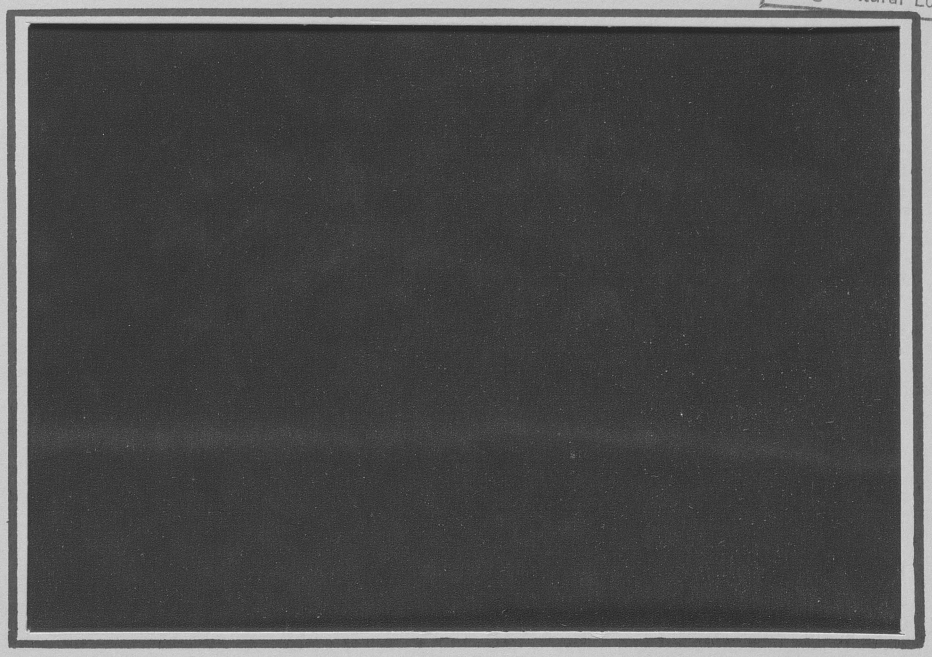

DEPARTMENT OF AGRICULTURAL ECONOMICS

Purdue University

Lafayette, Indiana

THE IMPACT OF IMPORTS OF MANUFACTURED MILK PRODUCTS ON THE U.S. DAIRY INDUSTRY

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Novakovic, Andrew M. and Robert L. Thompson.--The Impact of Imports of Manufactured Milk Products on the U.S. Dairy Industry

The time paths of adjustment of consumption, production, and price of specific dairy products and raw milk are estimated under three alternative levels of manufactured product imports. Much larger than historically "normal" import levels are required to bring about a substantial impact upon the dairy industry in the longer run.

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THE IMPACT OF IMPORTS OF MANUFACTURED MILK PRODUCTS ON THE U.S. DAIRY INDUSTRY

Andrew M. Novakovic and Robert L. Thompson

Events in 1972-1975 have generated considerable debate on U.S. dairy policy. As dairy prices rose substantially above support levels in 1972, the government repeatedly increased import quotas on American cheese, butter, and nonfat dry milk for brief periods during 1973 to mid-1974. Although the exact effect of these increased imports is not known, the reduction of dairy product prices in early 1974 can be partially attributed to the high level of imports. Furthermore, in the Tokyo Round of multilateral trade negotiations under the General Agreement on Tariffs and Trade, the U.S. is seeking reductions in barriers to its agricultural exports in the face of stiff opposition from the European Community (EC). Several studies indicate that, while an increase in most agricultural exports could be expected, imports of dairy products could increase. (U.S. Congress, Johnson (1973, 1975), Vermeer, et.al.). Hence it has been suggested that the U.S. should open its dairy market to the EC in exchange for greater access to the EC for American feed grains (U.S. Congress, Comptroller General).

Studies of the potential impact of freer trade on the dairy industry have been conflicting (Johnson 1973, Buxton and Frick, USDA 1975). Previous studies of dairy trade policy appear to have relied heavily upon professional familiarity with world and local dairy conditions, backed up by existing models. In part, the research reported here adds to the existing literature by estimating the time paths of adjustment within specific dairy product sectors to changes in the levels of individual manufactured product imports via one unified model.

The Model

An annual simultaneous equations model of the U.S. dairy industry is used to analyze the domestic impacts of increased dairy imports. Figure 1 depicts the interactions among all endogenous variables in the model plus exports and imports, which are assumed to be exogenous under the current quota policy. The model describes the dairy industry at three market levels: farm, wholesale, and retail. Raw milk is produced at the farm level; supply and use of major manufactured dairy product groups are explained at the wholesale and retail levels. Five major product groups are considered: fluid milk products, American cheese, butter, nonfat dry milk, and frozen desserts. All other dairy products are treated as a sixth "other products" category.

The price determination mechanism is based upon the Federal Milk Marketing Order system. The quantity mechanism is described in two parts: the retail-wholesale components and the farm component. In general, the retail-wholesale component consists of equations to determine consumption, retail price, production, year-end commercial stocks, year-end government stocks, and wholesale price. The farm component consists of equations explaining year-end heifer calf, heifer, and cow numbers, year-end heifer and cow eliminations, production per cow, and farm level prices.[1/] The parameters of the simultaneous equations model were estimated via two-stage least squares using annual data for 1955-1974. The model specification, data, and estimates are in Novakovic.

The Impact of Import Levels

Using the Gauss-Seidel technique, the authors first solve the model for a base period, year 1, using the observed values of all predetermined variables.[2/] Next, import levels for American cheese, butter, and nonfat

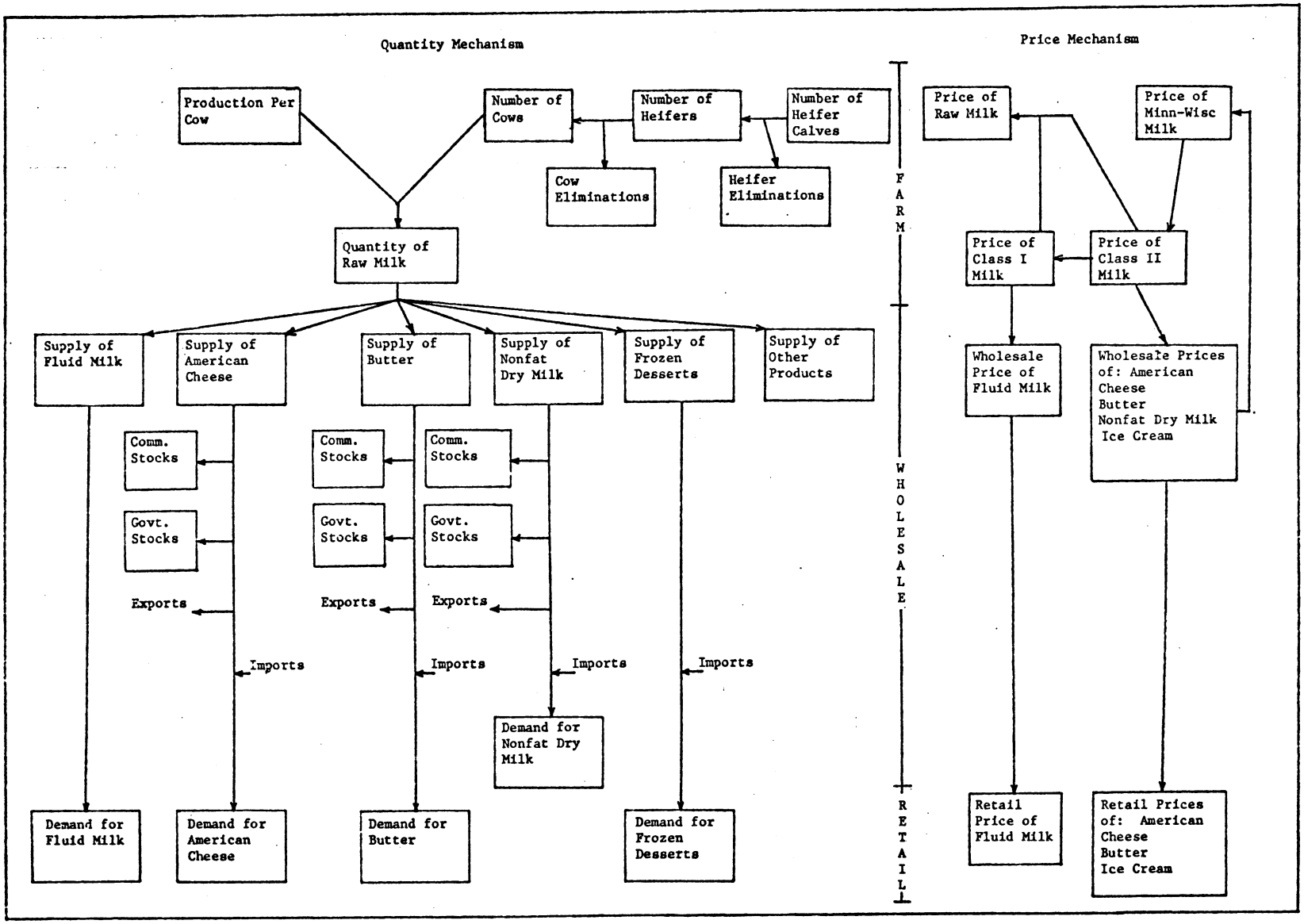

Figure 1. Schematic Representation of the Relationship Among Endogenous Variables in the Model.

dry milk were varied from those in the base year, and the model was solved recursively for 10 years (years 2 through 11) to estimate the time paths of adjustment to the specified changes in import levels. Lagged endogenous variables equaled the appropriate values from the previous year. Imports were held constant at the levels established in year 2. All other exogenous variables were maintained at their base period levels. The base year chosen was 1974, the last year for which data were available.

Three different scenarios are evaluated. Scenario 1 investigates a return of import levels from their 1974 highs to the levels observed in the earlier 1970's (about 1 1/2 percent of consumption). Specifically, Scenario 1, the "normal" case, sets imports at 20 million pounds for American cheese and two million pounds each for butter and nonfat dry milk. An analysis of the impact of import levels twice that of the "normal" case is provided in Scenario 2. This is approximately the level which a USDA study (1975) suggests might result initially from free trade in dairy products. Scenario 3, a "high" import quota case, examines the impact of continuing American cheese, butter, and nonfat dry milk imports at approximately the 1973-1974 levels -- 100, 50, and 100 million pounds, respectively.

The simulated impacts are summarized in Table 1. Selected results are graphed to illustrate the basic trends and patterns of adjustment.

Figure 2 shows the adjustment in the price of raw milk. Following an initial increase, the price of raw milk in Scenarios 1 and 2 converges to a level approximately equal to the base period level after three years. Continuation of relatively high import levels in Scenario 3 results in a price that is 14 cents/cwt. lower than the base price by year 11. Milk production, shown in Figure 3, initially increases but

Table 1. Effects of Three Alternative Dairy Import Levels on Selected Endogenous Variables.

Variable	Observed Values 1974	Projected Values, Scenario 1, by Year				Percentage Change Year 1 to Year 11	Percentage Change From Scenario 1, Selected Years			
							Scenario 2		Scenario 3	
		1	2	3	11		2	11	2	11
Fluid Milk Consumption	47603	49327	49041	49247	49315	- .02	.16	.12	.70	.52
Fluid Milk Production	51753	53477	53191	53397	53465	- .02	.15	.11	.65	.48
Wholesale Fluid Milk Price	8.64	9.06	9.24	9.11	9.07	.11	- .54	- .44	-2.38	-1.87
Retail Fluid Milk Price	78.4	75.1	76.3	75.4	75.1	0.0	- .39	- .27	-1.97	-1.46
American Cheese Production	1832	1747	1785	1751	1737	- .57	-1.01	- .75	-4.03	-2.82
American Cheese Consumption	1767	1682	1646	1672	1681	- .06	.55	.42	2.55	1.84
Wholesale American Cheese Price	79.9	82.8	85.6	83.6	82.9	.12	- .82	- .60	-3.74	-2.90
Retail American Cheese Price	72.9	70.5	71.5	70.8	70.6	.14	- .42	- .28	-1.68	-1.27
Butter Production	962	944	969	967	968	2.54	- .20	- .31	-4.85	-5.06
Butter Consumption	902	900	899	900	900	0.0	0.0	- .11	0.0	- .11
Wholesale Butter Price	65.7	67.7	68.2	67.9	67.9	.30	.15	.15	1.47	1.18
Retail Butter Price	94.6	93.0	93.2	93.1	93.1	.11	.11	.11	.64	.43
Nonfat Dry Milk Production	1020	866	647	811	841	-2.89	2.16	1.55	-3.86	-3.09
Nonfat Dry Milk Consumption	802	744	680	726	742	- .27	3.09	2.02	14.11	9.70
Wholesale Nonfat Dry Milk Price	58.6	62.0	65.7	63.1	62.1	.16	-1.83	-1.29	-8.37	-6.44
Raw Milk Production	115553	119827	122265	121709	116612	-2.68	- .26	-2.34	-1.13	-10.30
Production Per Cow	8947	9171	9177	9173	9172	.01	- .02	- .01	- .08	- .04
Raw Milk Price	8.32	8.10	8.38	8.17	8.13	.37	- .95	- .49	-4.06	-2.09
Cow Numbers	12916	13065	13323	13268	12714	-2.69	- .24	-2.33	-1.05	-10.26
Heifer Numbers	3625	3587	3359	3402	3360	-6.33	- .03	- .24	- .18	-1.01
Heifer Calf Numbers	3969	3832	3877	3843	3837	.13	- .31	- .18	-1.44	- .78

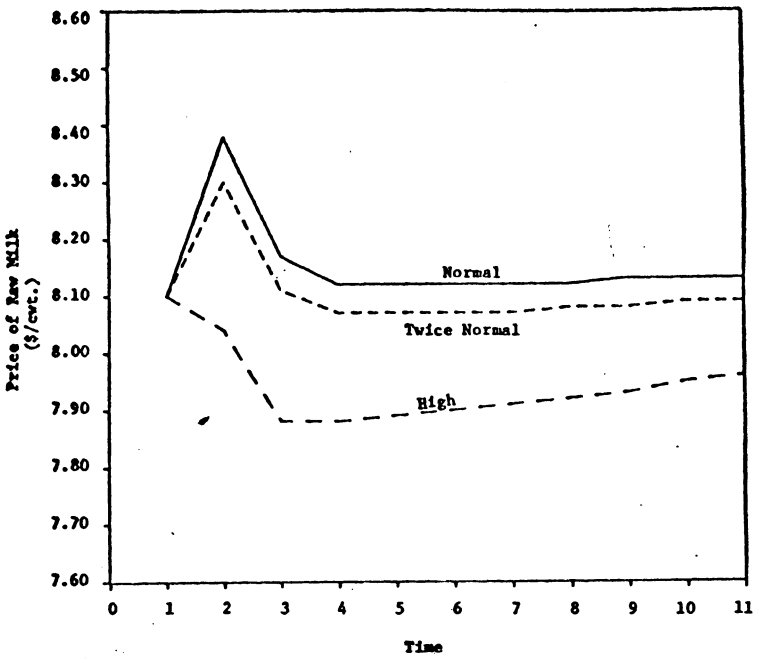

Figure 2. The Effect of Import Levels on the Price of Raw Milk

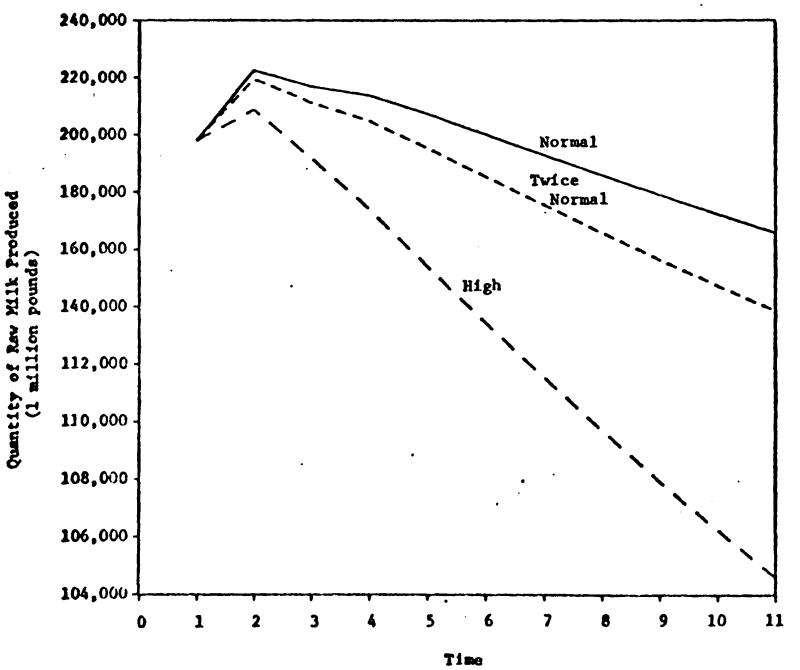

Figure 3. The Effect of Import Levels on the Quantity of Raw Milk Produced

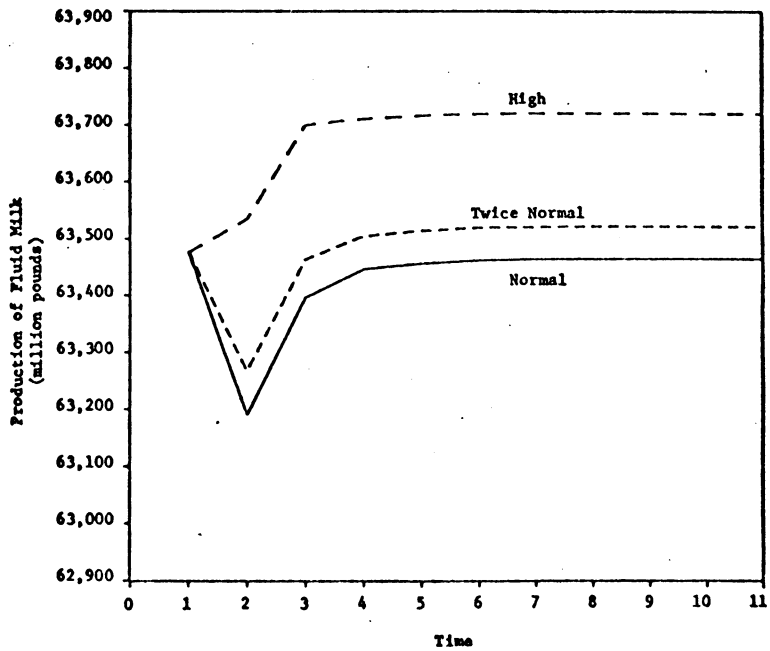

Figure 4. The Effect of Import Levels on the Production of Fluid Milk

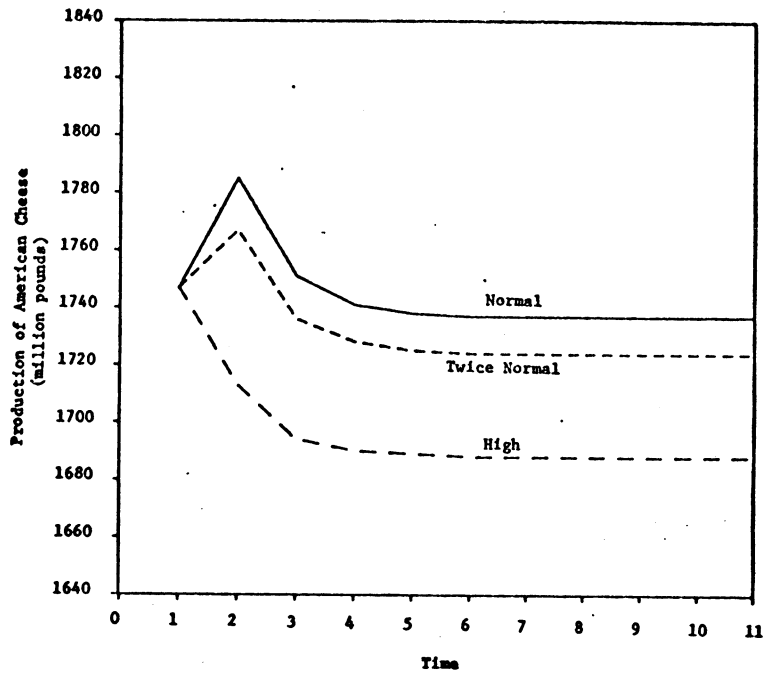

Figure 5. The Effect of Import Levels on the Production of American Cheese

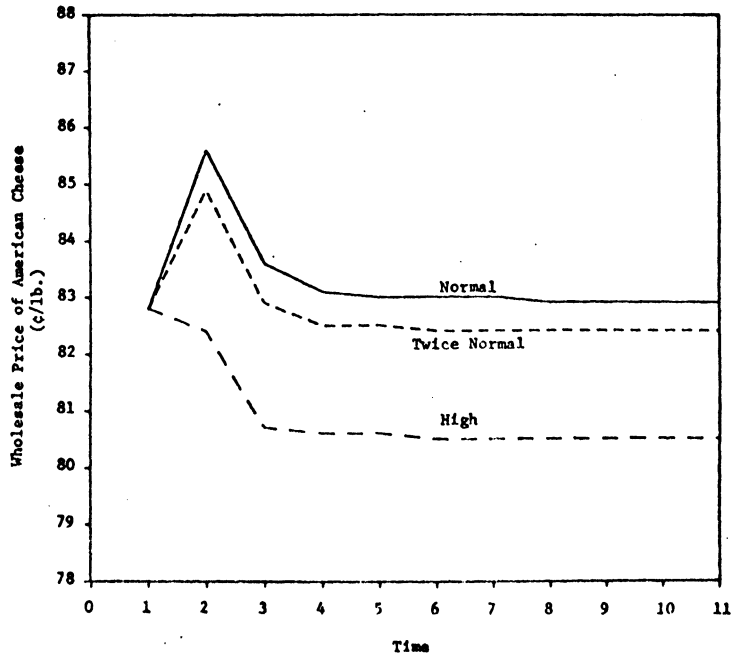

Figure 6. The Effect of Import Levels on the Wholesale Price of American Cheese

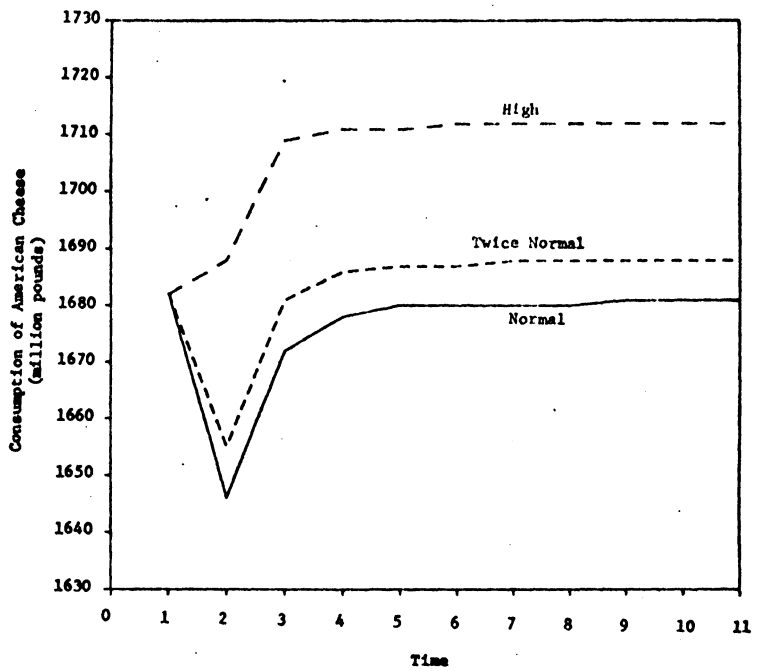

Figure 7. The Impact of Import Levels on the Consumption of American Cheese

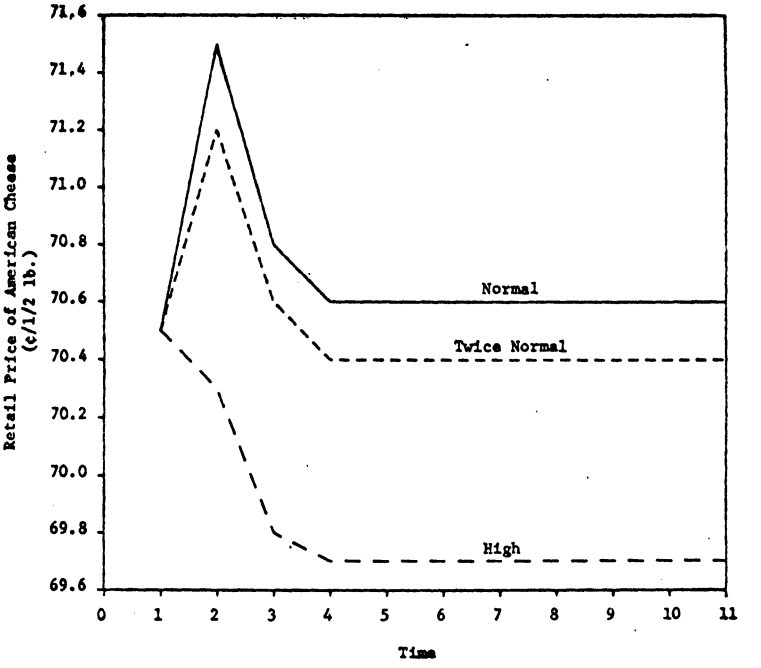

Figure 8. The Impact of Import Levels on the Retail Price of American Cheese

then decreases in the following years. By the eleventh year, production is down 2.7 percent under Scenario 1 and 13.5 percent under Scenario 3, when compared with the base year. (Dairy cow herd adjustments follow a similar pattern).

Figure 4, which shows the changes in the quantity of fluid milk produced, illustrates the pattern of the production response in both the fluid and frozen dairy products sector. Production is higher in all periods under Scenario 3 than under Scenario 1. Changes in Class I and II prices seem to be responsible for these results. As these prices decrease, production of fluid milk and frozen desserts is stimulated. This implies that raw milk is diverted to the production of nonimported products as manufactured product imports increase.

Production adjustments in the cheese and butter sectors are represented by the results for American cheese shown in Figure 5. In both cases, higher imports led to lower production. However, nonfat dry milk production responded somewhat differently. In Scenarios 1 and 2 import levels were set much below the high 1974 level. At these low levels, production under Scenario 2 is stimulated in the same way as fluid and frozen dairy product production. In Scenario 3, import levels are so high that the own price effect dominated the effect of cheap input prices and thus led to a lower level of nonfat dry milk production. Wholesale price responses are illustrated by the price of American cheese in Figure 6. At the retail level, increased imports are generally associated with increased consumption and decreased prices. The impacts of changes in import levels on the consumption and retail prices of American cheese are illustrated in Figures 7 and 8, respectively, and represent the impacts at the retail level.

Implications

Rather large changes in import levels are required to bring about substantial impacts on the dairy industry. As Table 1 illustrates, the difference in the magnitudes of almost all endogenous variables under "normal" and "twice normal" import levels is less than one percent. Only when imports are a much larger proportion of consumption, as in Scenario 3, does a significant impact upon the dairy sector appear. For example, in Scenario 3, the price of raw milk is 17 cents, or two percent, lower than that in Scenario 1 by the eleventh year. Even at the widest divergence between raw milk prices in Scenarios 1 and 3 (in year 2), the difference is only four percent or 34 cents.

Although comparisons of these results with those of other studies are difficult because of the different techniques and models used, these results suggest a more modest impact than that derived in other studies. In the USDA study (1975) a decline in the raw milk price of 18 cents per hundredweight for each additional billion pounds of aggregate dairy imports, measured in terms of milk equivalents, was estimated. Using this value, the level of imports under Scenario 3 should result in a raw milk price that is about 30 cents lower than that in Scenario 1. This is about the same as our computed short run response in years 2 and 3, but it is much greater than the computed difference after ten years. Using "open U.S. market" import levels from the USDA study, Salathe, Dobson, and Peterson estimated that an increase in aggregate imports of one billion pounds would be accompanied by a 14 cent decrease in the price of raw milk in Wisconsin.[3/]

When comparing these results, several factors should be kept in mind. The USDA and Salathe, et.al. studies were based on imports much higher than those under current programs. The "open U.S. market" policy assumed aggregate

imports representing 25 percent of manufactured milk product consumption; this compares with an average import of about one to two percent during the last 20 years. Such high levels were not examined in this study because it was felt that extrapolating so far beyond the range of the data upon which the econometric model was based would severely strain the credibility of the results.

The aggregate impacts of changes in imports are likely to vary over the milk producing regions of the U.S. Quite different impacts of increased butter and cheese imports would be felt by dairy farmers in Wisconsin, New York, Iowa, and California. In regions characterized by different alternative uses for their resources the fixity of both capital assets and labor in dairy farming is likely to effect the farmers' response and their ability to respond. Asset fixity may also affect the rate of adjustment of the dairy processing sector.

Perhaps a question more basic than that of the regional impacts is just how high dairy imports would be under a freer dairy trade policy. An answer to this question would require structural estimates of export supply functions for butter, cheese, and nonfat dry milk for each of the important dairy exporting countries. To the authors' knowledge no rigorous modeling efforts exist in the literature which estimate these critical relations, and there is little agreement on the likely orders of magnitudes of price-quantity relationships. To this end the authors suggest the need for modeling efforts for the dairy sectors of at least the European Community and Oceania.

Footnotes

Andrew M. Novakovic is a Graduate Research Assistant and Robert L. Thompson is an Assistant Professor, both in the Department of Agricultural Economics at Purdue University. The authors acknowledge helpful comments and criticisms received in the course of this study from F.M. Babb, R.F. Fallert, R.G. Lattimore, B.A. McCarl, G.L. Nelson, G.E. Schuh, and J.K. Whittaker. The authors bear responsibility for any remaining errors or deficiencies in the final product.

1/ This takes as a point of departure the fact that the cattle herd is a capital stock (Jarvis, Yver, Lattimore, and Freebairn and Rausser). Farmers are expected to retain more animals for use in future production when there is an increase in the expected price of milk, ceteris paribus. Different retention behavior is hypothesized for each age cohort since the change in the capital value of an animal will be greater for those animals further from expected slaughter.

2/ A more detailed discussion of the Gauss-Seidel technique and its uses can be found in Heien, Matthews and Womack.

3/ Since Wisconsin produces a relatively much larger proportion of manufactured milk than the U.S. as a whole, it is plausible that the impact of dairy imports would be more harsh in Wisconsin than in much of the rest of the country. In that case Salathe et.al.'s results would imply that the aggregate impact on the U.S. market would be less than that predicted by the USDA (1975).

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Biographical Information

Andrew M. Novakovic, a native of Wisconsin, is a Graduate Research Asssitant in the Department of Agricultural Economics at Purdue University. He completed the requirements for the Master of Science degree at Purdue in August 1976 and is now studying for the Ph.D. He received his Bachelor of Science degree from the University of Wisconsin at River Falls in May 1974 and has been a graduate student at Purdue since then. This paper reports a part of the results of Novakovic's M.S. Thesis.

Robert L. Thompson is an Assistant Professor in the Department of Agricultural Economics at Purdue University. His principal area of responsibility is in international trade research. He also teaches a graduate course in international trade and an undergraduate course in world agricultural development. A native of New York State, Thompson received his B.S. from Cornell University in June 1967. His graduate work was done at Purdue University, where he received the M.S. degree in January 1969 and the Ph.D. degree in May 1974. His international experience includes study in Denmark, work with the agricultural extension service in Laos, and teaching agricultural production economics in Brazil. Thompson served as Novakovic's major professor in carrying out the research reported here.