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［論　文］

The Development of Japanese Livestock & Livestock Product Models and Impact Analysis

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Introduction

Japanese markets for livestock and livestock products, both dairy and meat, have undergone substantial changes in recent years. For example, in milk and dairy product markets, the milk price has been going down and the quantity of dairy products imported has been increasing since 1987. Domestic meat prices, especially those of dairy beef, have been trending downward since the mid 1980s and imports of meat products have been on the rise during that same period. Furthermore, the Uruguay Round of GATT is causing trade policy changes which are expected to exacerbate these trends. Understanding the factors underlying these trends and subsequently incorporating those same factors through econometric analysis is useful in order to anticipate what the next few years might hold in store for Japanese agriculture.

The objectives of this paper are two-fold: (1) We will present an econometric model which includes milk, dairy products, cattle, beef, hogs, pork, and poultry; and (2) We will examine the effects of different scenarios on Japanese livestock and livestock product markets, particularly those of Hokkaido. The first of these objectives, the econometric model, will serve as the analytic tool which will be applied to satisfy the second objective. This model adds together the separate work of the authors, Suzuki [23] and Thompson [25], creating a more complete system than either dairy or meats model alone. The combination allows more endogenous variables, so the system takes fewer important variables as given. In other words, either model alone is less complete, because each must omit one of the outputs of dairy cow farms - either milk or calves - from the variables solved. Suzuki's model alone has exogenous calf price; Thompson's model alone has exogenous milk price. By linking the two models together, dairy and beef markets are solved, so both major output prices of dairy cow farms are included.

There have already been several econometric models of Japanese dairy markets. (N.) Suzuki [24], Otsuka [17], Matsubara [12, 13],

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Yuize [28, 29], Ito [7], and OECD AGLINK [10] are all examples. However, (N.) Suzuki, Otsuka, and Matsubara models do not consider dairy products individually. Their models do not account for supplies and demands and prices of the different dairy products which are important to the total dairy markets and to Japanese policy making. The existing dairy product models are those of Yuize and OECD AGLINK. Of these, the former was developed in 1976 and at the least requires re-estimation and likely even restructuring to better account for joint butter/skim milk powder production, which Yuize treated separately, and new policies. The OECD model does accommodate joint production of butter and skim milk powder. However, the butter supply is determined by butter demand without simultaneity. This method omits all supply-side considerations of butter/powder production and ignores policy involvement in that market.

There have also been several preceding studies regarding the Japanese meat markets, such as Ohga and Inaba [16], Monma [14], Matsubara [12, 13], Yuize [28, 29], Wahl et. al. [5, 26, 27], Furuya [4], Kanada [9], and Hotta et. al. [6]. Of these, however, only Yuize and Wahl created models which extended beyond the beef sector. Again, Yuize's work is old. Wahl's study, though not as old, still precedes trade agreements and a decade of market changes. As such, simplifications upon which he relied, such as perfect substitution across dairy and imported beefs, are now suspect. Market structure must therefore be reconsidered, as must the estimation. There have also been many Japanese meat demand estimations, many of which are compiled and updated by Dyck [2], as well as those of Mues et. al. [15], Lin et. al. [11], and Reynolds et. al. [19].

Structure of the Model System

The structural econometric models used in this paper are comprised of over a hundred equations representing technological and biological constraints, market-clearing identities, and economics-based behavior. Key decision-making points in the supply and demand of each commodity were identified, considered in light of economic theory, and estimated. The dairy model was estimated by 2SLS from 1974 to 1995. The livestock and meat equations were estimated by means of OLS over varying time periods due to data limitations, with the longest matching the 1974-1995 range of the dairy model and the shorter set of equations estimated 1980-1995.

Most of the data for these models come from official Japanese sources. All the inventory numbers are from Livestock Statistics by MAFF. For the milk and milk products model, dairy product supplies are from Milk and Milk Products Statistics by MAFF, imported dairy products are from Japan Exports and Imports by Ministry of Finance, and expenditure data are from Family Income and Expenditure Survey of MCA. The livestock and meat model data for quantities are from Food Balance Sheet of MAFF, and prices are from Wholesale Meat Marketing Statistics or Meat Statistics in Japan by MAFF. Input price data are found in Prices and Wages in Rural Areas by MAFF and the costs shares are from Livestock Costs of Production also by MAFF.

Some series are derived from official data or cannot be found in the official data books. For example, the fluid milk price is calculated from the average farm milk price, the standard and guaranteed milk prices, and the quantities of milk allocated to fluid and manufacturing uses. This method follows that established by N. Suzuki [24]. In the poultry model, a distinction is made between broiler production and other poultry production - from laying hen slaughter or other species. The broiler production is computed as the share of broiler-type birds relative to total bird shipments multiplied with the total production number. Although artificial, this helps identify the portion of poultry production which responds to broiler prices. The number of calves born which are embryo transplants are small exogenous data used in the beef model. These data come from MAFF indirectly through Kanada [9]. Stocks of domestic beef are also exogenous to the model. In years where official data is not available, these are separated into wagyu and dairy components by using the wagyu and dairy beef production shares of total production. For poultry, pork, and beef supply models' behavioral equations, input price indices are sometimes used. The weights of these indices are based on averages of the corresponding cost categories in Livestock Costs of Production. Although dominated by feed prices, this allows the inclusion of multiple inputs in estimation. World prices for meat and dairy products are from United States Department of Agriculture (USDA).

All of these models are reported in more detail elsewhere, including structure, coefficients, and statistics of fit.** However, for present purposes, a summary of structure and estimates is presented here.

Figure 1 shows the two models and how they interact. The dairy model, on the left, is based on Suzuki and Saito [21, 22]. The supply and allocation of milk is separated into two parts, Hokkaido and Tofuken. The total dairy cows are separated into Hokkaido dairy cows and Tofuken dairy cows. Milk per cow in each region is estimated and milk production is dairy cows time milk per cow. The milk allocation problem in Tofuken divides the milk into Tofuken fluid use and manufacturing use, while the milk allocation problem in Hokkaido separates milk into Hokkaido fluid use, Tofuken fluid use, and manufacturing use. The Tofuken fluid milk market is modeled as a duopoly, following the methods developed by Suzuki [23] and Subotnik [20]. The manufacturing milk and dairy product markets are for all Japan, not for each region. Since 1987, the manufacturing milk quota, or in-quota milk, determines how much milk is available for butter and skim milk powder production. The remaining milk, the over-quota milk, is available for cheese production.

Demand for fluid milk in Hokkaido and Tofuken are estimated separately. These are matched with the milk allocated to fluid use to solve for fluid milk prices. Nation-wide demands for butter, skim milk powder, and cheese are also estimated. In butter and skim milk powder markets, the imports are determined by policy, so these are exogenous to the model. An exception is skim milk powder imports for feed use, which are endogenous. Cheese imports are more difficult because there are different types of cheese and the policy is complex. Imports are separated into natural cheese for processing at no tariff (within domestic content ratio), natural cheese for processing with tariff (over domestic con tent ratio), natural cheese for consumption, and processed cheese for consumption. Each of these types of cheese imports responds to different economic incentives, so each one is a different equation in the dairy model.

** For the dairy model, see Suzuki [23]. For the meat models, see Thompson [25].

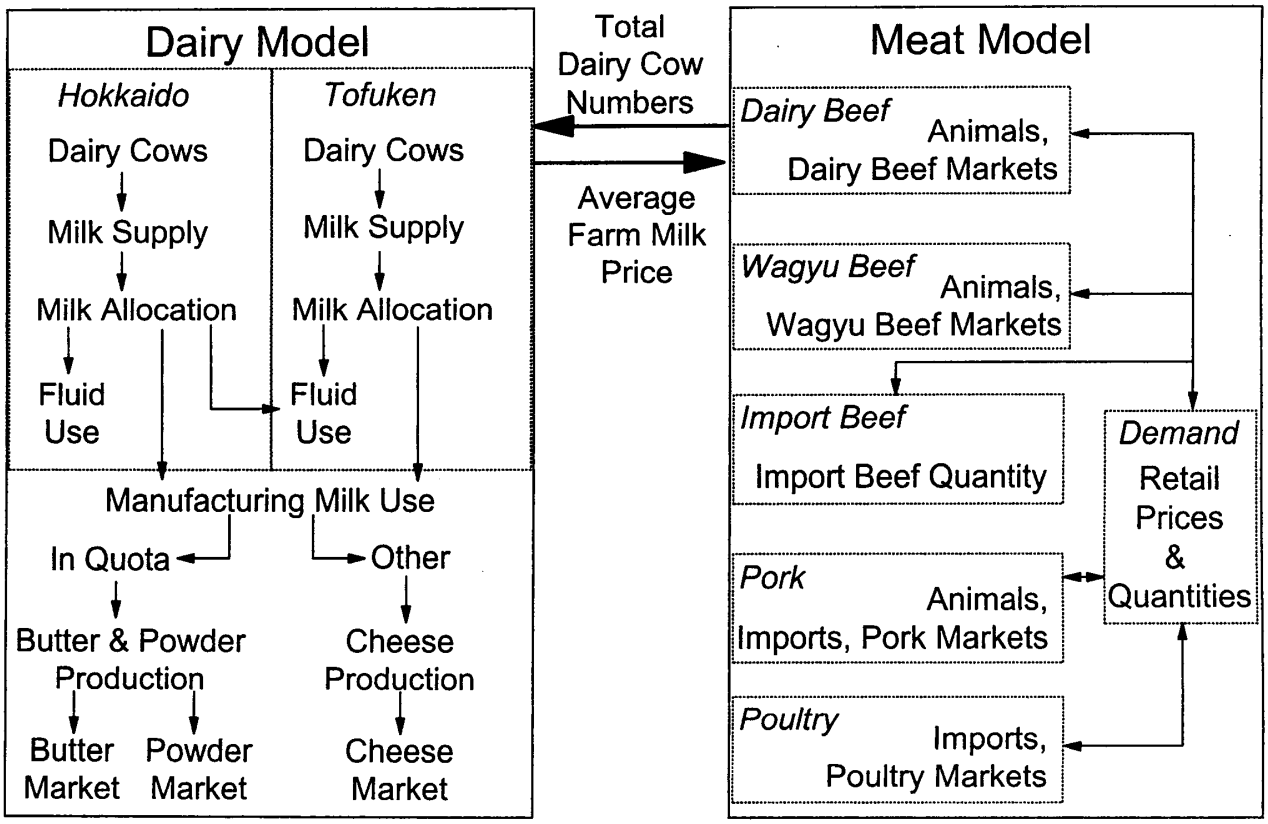

Figure 1: The System of Models

The dairy product prices of each of these products is endogenous and solved simultaneously in the model. However, because of policy, the product prices do not influence the average farm milk price. The average farm milk price depends on policy and on fluid milk markets.

The right side of Figure 1 shows the meat model. The meat model covers beef, pork, and poultry. The first component is for dairy beef. The dairy beef model solves for the male and female dairy animal numbers, male and female dairy animal slaughter, and dairy beef production. The female dairy animals depend on the average farm price of milk and the dairy beef price, because these are the output prices for the dairy farmer. From the dairy cow numbers come the calf numbers. The calf numbers will determine future slaughter. Average animal weights at slaughter are estimated as functions of trends and prices. To get dairy beef production, multiply slaughter number times the weight at slaughter, then sum across male, female, and calves.

Likewise in the wagyu and pork sectors, animal numbers, slaughter numbers, slaughter weight, and production are solved. Also, in the pork sector, pork imports are estimated as a function of the domestic wholesale price, the Standard Import Price, and the world price adjusted by the tariff. The poultry sector only solves for production and imports, with imports a function of the domestic wholesale price and the world price with tariff. The import beef quantity is also solved in the model by comparing the import beef price with the domestic beef prices, wagyu and dairy.

Beef, pork, and poultry are in the consumer demand part of the model. The system is estimated as a Linear Expenditure System (LES), as described by Deaton and Muellbauer [1], Johnson et. al. [8], and Powell [18]. Each consumer decides how much to spend on each of these three meats, based on prices, income, and exogenous fish prices. This is where interaction across the different meats can occur.

The connection between the two models is through the dairy cow numbers and the milk prices. These are the only variables both models share; there are no other links possible between these dairy and meat models. Because of the structure, the milk price comes from the supply and demand conditions of the dairy model and the dairy cow numbers are from the livestock inventories of the meat model.

The dairy model solves for the average farm milk price, but total dairy cow numbers are exogenous. The dairy beef model solves for the total dairy cow numbers, but takes the average farm milk price as exogenous. To link the models, the dairy model uses the dairy beef model's total dairy cow numbers and the dairy beef model uses the dairy model's average farm milk price. When using either model alone, one of these markets is ignored. Suzuki's dairy model does not include the dairy beef market, even though the dairy beef price and dairy cattle numbers affect milk production. Thompson's meat model does not include the milk market, so milk prices are exogenous even though they are very important in determining dairy female slaughter and dairy cow numbers. While either of these models can be operated alone, the two can be combined to create a much more useful model which covers meat and dairy markets in a simultaneous solution.

By linking the models, for example, when there is a change in the fluid milk market in Hokkaido or Tofuken, the average farm price of milk changes, so the dairy beef model will change the dairy cow numbers, and then the milk supply will change. Alternatively, if there is a change in the beef import price, then the dairy beef price will fall which will lower dairy cow numbers. Although this change will be small due to the small revenues from selling calves relative to the revenue from milk production, this effect is still present. If dairy cow numbers fall, the dairy model will have less milk production, so the average farm milk price will increase. In other words, since milk and beef are both produced by dairy farmers, dairy cow numbers react to both prices. With both of these models linked together, milk prices, beef prices, and dairy cow numbers are all simultaneous.

Results of Estimation and Final Tests

Estimated parameters are just as critical as the model structure. The supply side parameters are indeed important, yet must be considered with appropriate perspective as the total supply of any of these commodities is dependent on multiple equations. In the case of the dairy model commodities or either of the domestic beef supplies, the structure causes considerable interaction across equations when supply is determined. Rather than show potentially deceiving supply-side elasticities, we have chosen to instead show the reader the degree of supply response through the impact analysis reported at the end of this paper. We hope the results will satisfy curiosity regarding the performance of each commodity's supply. More information is available in Suzuki [23] and Thompson [25].

The demand elasticities are much more transparent as they tend to be less complex.

This is certainly true in the case of the dairy model commodities, which are all independent of each other in their demands. These elasticities are shown in **Table 1**. The meat demands are more difficult as the retail demand for the three types, beef, pork, and poultry, each depend upon the prices of the other two. Additional indirect price effects also change retail meat demands because total meat expenditures is estimated as a function of a Stone's Price Index of the retail meat prices, income, and fish prices. Even more difficulty is presented if we include the wholesale beef market which also contains substitution across the three types of beef tracked in the models. For simplification and ease of comparison with other studies, only the retail demand elasticities of the LES and the total meat expenditure equation have been reported in **Table 1**.

The elasticities reported above can be compared to those of other researchers, though sometimes this can be difficult due to model structure. In the case of fluid milk demands, for example, the study here estimates Hokkaido and Tofuken markets separately, unlike the previous work mentioned earlier. The dairy product own-price elasticities are acceptable. The relative income elasticities of the milk and dairy product demands seem reasonable, with fluid milk and cheese elastic while butter and skim milk powder are inelastic.

The retail demands for the three meats from this study's LES all have reasonable elasticities. Again, comparability is limited as each of the preceding studies specified demand differently, with different structures, causing differences in the interpretation of the results. Still, most of the elasticities seem in line with studies of the past, but it should be noted that the beef own-price and expenditure terms are on the high side of the range established by past studies. Conversely, the expenditure

Table 1: Elasticities of Demand for Dairy and Meat Products

Single Equation Results	Own-Price		Cross-Price	income
Fluid Milk Consumption, Hokkaido	-1.52			1.37
Fluid Milk Consumption, Tofuken	-0.57			1.02
Skim Milk Powder Consumption	-1.19			0.92
Butter Consumption	-0.65			0.85
Cheese Consumption	-0.67			1.39
Total Meat Expenditures	-0.94		0.10(Fish)	0.89
LES Retail Demand Results	Beef Price	Pork Price	Chicken Price	Expenditure
Beef Consumption				
Marshallian	-2.58	0.35	-0.03	2.31
Hicksian	-1.73	1.30	0.43	
Pork Consumption				
Marshallian	1.06	-1.32	-0.00	0.26
Hicksian	1.16	-1.21	0.05	
Poultry Consumption				
Marshallian	0.72	0.03	-0.93	0.18
Hicksian	0.79	0.10	-0.90	

terms of pork and chicken are both lower than those reported in previous research. The expenditure effects are not wholly surprising given recent meat markets in which beef expenditure growth has remained strong while pork and chicken expenditures have stagnated. These considerations are absent in previous works whose estimation periods end before 1990. Such a downward shift in income elasticities of pork and chicken is supported by other recent estimations, Mues et. al. [15] and Reynolds et. al. [19], as well as in this study.

The LES retail demands were chosen as they offered the best combination of theoretic appeal and practicality. Earlier single-equation estimates were retired due to their inability to accommodate the theoretic requirements implied by the consumer's utility maximization problem. Alternative demand systems were also attempted, for example various specifications of the LES and an Almost Ideal Demand System (AIDS), but results were not deemed practical due to counter-intuitive cross-price effects. It should be noted that in moving from single-equation demands to the LES, all own-price elasticities and the beef income elasticity were increased (in absolute value), cross-price elasticities against pork and chicken prices remained low or even lower.

Given the model structure and elasticities, the obvious question is model performance. Performance measures were created for the entire system from 1980-1995, so the full sample period was not necessarily used for each model. It should be noted that some linkage equations which estimate domestic prices from world prices were omitted from the system in simulation as the estimation periods did not match that of the full system. This is especially true of the linkage equation for the CIF beef price which was estimated over only the last several years in hopes of capturing only the characteristics which will continue into the future rather than the characteristics present in the days when LIPC quotas dominated imports. These few equations are designed for forecasting under conditions such that using them in the full system for the 1980-1995 simulation would be misleading.

The Root Mean Square (RMS) errors and Theil statistics are reported in **Table 2.** Some of the cheese variable names have been abbreviated for space. One of these is natural cheese imported with a tariff for consumption or processing use, labeled "Ch. Imp. for Cons. Or Proc. (tariff>0)" on **Table 2.** This category includes all processed cheese imports and natural cheese imports over the domestic content ratio required by policy. Another abbreviation is used for natural cheese imports for processing at no tariff, labeled "Cheese Imp. for Proc. (tariff=0)" on **Table 2.** Natural cheese imports within the domestic content ratio set by policy which face no tariff. Cheese imports must be separated because Japanese policy lets some cheese enter without tariff while imposing tariffs on other imports.

As can be seen, performance varies considerably, but the average is 11%. In fact, if the highest is omitted, the average RMS percent error falls almost to 6%. Several variables which are often small have very poor RMS errors, such as imports and some of the smaller categories of milk use, but in these cases the RMS errors have little meaning. One example is "Processed Cheese Imports" which has very large error statistics, but it is a very small amount relative to the total cheese market. The extreme example is the "Hokkaido Change in Dairy Cows", an identity which is often

Table 2 : Performance Measures of the Full System

Simulated 1980-1995,with world prices exogenous

Variable	RMS% Error	Theil Statistic	Variable	RMS% Error	Theil Statistic
Hokkaido Milking Cows	3.6	0.019	Wagyu Steer Beef Production	5.2	0.025
Tofuken Milking Cows	2.7	0.013	Wagyu Calf Beef Production	0.0	0.000
Hokkaido Milking Cows,Average	3.3	0.017	Total Wagyu Beef Production	6.8	0.034
Tofuken Milking Cows,Average	2.6	0.013	Wagyu Male Calf Price	25.0	0.110
Hokkaido Milk per Cow	2.0	0.010	Wagyu Female Calf Price	20.7	0.097
Tofuken Milk per Cow	1.3	0.007	Wagyu Calf Input Cost Index	0.0	0.000
Hokkaido Milk production	3.7	0.019	Feedlot Input Cost Index	0.0	0.000
Tofuken Milk production	2.2	0.011	Dairy Females	2.5	0.012
Hokkaido Milk Supply	3.8	0.020	Dairy Cows	2.4	0.012
Tofuken Milk Supply	2.2	0.011	Dairy Calf Deliveries	2.3	0.011
Hokkaido Milk for Hokkaido Fluid	11.0	0.054	Dairy Female Slaughter	4.7	0.023
Hokkaido Milk for Tofuken Fluid	26.7	0.111	Dairy Steer Slaughter	3.9	0.019
Hokkaido Over-Quota Manufg Milk	21.9	0.074	Average Dairy Steer Weight	1.3	0.006
Guaranteed Milk Supply for Cheese		0.068	Average Dairy Female Weight	2.0	0.010
Hokkaido Fluid Milk Price	11.0	0.050	Dairy Calf Beef Production	0.0	0.000
Hokkaido Farm Milk Price	1.9	0.009	Dairy Steer Beef Production	4.1	0.020
Hokkaido Fluid Milk Demand	11.0	0.054	Dairy Female Beef Production	4.5	0.023
Tofuken Milk for Tofuken Fluid	2.0	0.011	Dairy Beef Production	3.6	0.018
Tofuken Over-Quota Manufg Milk	73.5	0.236	Dairy Female Calf Price	13.2	0.048
Tofuken Fluid Milk Price	3.2	0.017	Dairy Input Price Index	1.0	0.005
Tofuken Farm Milk Price	2.5	0.013	Wagyu Beef Wholesale Price	6.3	0.031
Tofuken Fluid Milk Demand	1.7	0.009	Dairy Beef Wholesale Price	5.3	0.025
Milk Over Both Quotas	25.3	0.109	Wagyu Beef Demand	6.8	0.034
Skim Milk Powder Production	3.1	0.016	Dairy Beef Demand	3.6	0.018
Skim Milk Powder Price	3.3	0.016	Import Beef Demand	7.8	0.043
Skim Milk Powder Demand	2.6	0.013	Beef Imports	7.9	0.043
Skim Milk Powder Imports for Feed	19.7	0.088	Wagyu Beef Demand Per Person	6.8	0.034
Butter Production	4.9	0.026	Dairy Beef Demand Per Person	3.6	0.018
Butter Price	7.1	0.034	Import Beef Demand Per Person	7.8	0.043
Butter Demand	4.8	0.025	Sow Herd	1.5	0.008
Butter Price,Milk Equivalent	7.1	0.035	Total Pig Inventory	1.2	0.006
Skim Milk Powder Price,Milk Equiv.	3.3	0.016	Total Pig Slaughter	2.4	0.012
Cheese Price,Milk Equivalent	2.6	0.013	Pork Production	2.1	0.010
Natural Cheese Prod.for Cons.	11.6	0.055	Pork Demand	1.2	0.006
Natural Cheese Prod.for Proc.	7.3	0.036	Pork Imports	7.9	0.027
Total Cheese Production	7.0	0.035	Piglet Input Price Index	0.0	0.000
Price of Cheese	2.6	0.013	Pork Demand Per Person	1.2	0.006
Cheese Demand	3.4	0.015	Retail Pork Price	0.9	0.005
Ch.Imp.for Cons.or Proc.(tariff>0)	8.5	0.038	Pork Wholesale Price	4.0	0.018
Cheese Imp.for Proc.(tariff=0)	7.3	0.034	Broiler Production	1.4	0.007
Processed Cheese Imports	90.9	0.117	Total Poultry Production	1.3	0.007
Total Cheese Imports	5.1	0.023	Poultry Demand	2.0	0.010
Milk Available for Cheese Makers	10.4	0.009	Poultry Demand Per Person	2.0	0.010
Dairy Cows,in Milk	2.4	0.012	Poultry Imports	16.4	0.054
Average Farm Milk Price	2.0	0.010	Broiler Input Price Index	0.0	0.000
Total Change in Dairy Cows		0.376	Poultry Retail Price	2.2	0.011
Hokkaido Change in Dairy Cows	515.5	0.421	Poultry Wholesale Price	4.6	0.024
Wagyu Females	2.7	0.014	Beef Expenditure per Person	3.8	0.019
Wagyu Males	2.4	0.012	Pork Expenditure per Person	1.2	0.006
Wagyu Calf Deliveries	2.4	0.012	Poultry Beef Expenditure per Person	2.6	0.012
Wagyu Female Slaughter	10.8	0.056	Total Beef Demand per Person	4.0	0.022
Wagyu Steer Slaughter	5.5	0.027	Retail Beef Price	1.8	0.009
Average Wagyu Female Weight	1.2	0.006	Meat Expenditure per Person	0.9	0.005
Average Wagyu Steer Weight	0.9	0.005	Retail Meat Price index	1.0	0.005
Wagyu Female Beef Production	10.6	0.054	Wholesale Beef Price index	3.1	0.015

very close to zero. The data for this variable frequently gets extremely close to zero, making the RMS error very high even if the absolute error is almost zero. Two variables' RMS percent errors are not reported, namely "Guaranteed Milk Supply for Cheese" and

"Total Change in Dairy Cows", because each has a zero in the sample period; since they are both constructed by identities which do equal zero in some years, it is impossible to calculate the RMS percent errors for these variables. The only variables which are not small and have large errors are the calf prices and some categories of Hokkaido milk allocation. Even these are not unacceptable, though they do indicate areas of potential future revisions. There is evidence that the link between calf and wholesale prices has been changing over time. This is mostly captured by including a trend, but the error is still noticeably large. The milk allocation problem is sensitive and one small category is solved as a residual. Hence, even a small error in a larger category is apt to cause a large error in the smaller residual use. All of the wholesale and retail prices and all of the larger quantity variables show good RMS percent errors and Theil statistics.

The system performance when tested in combination, rather than with all models isolated, has an average RMS percent error of 11%. Omitting the variables listed above which vary close to zero, the average falls to 5%.

Impact Analysis with the Livestock and Livestock Product Models

The system with all the models linked together was then used for making a baseline and for impact analysis. There are many external factors affecting the system, such as tariff rates, income, and world prices. It is useful to know how these exogenous variables affect the livestock and livestock product markets. For example, what happens if Japan's income grows faster or slower. We can use the models in impact analysis for this information.

Impact analysis is a two-step process, as shown in **Figure 2**. First, the models must be solved to make a baseline. In the top left corner of **Figure 2**, there is a box which shows types of exogenous variables. Some assumptions are made for these variables, the assumptions are put into the livestock and livestock product model, and then the solution will be the baseline. So the baseline is a solution based on reasonable or normal assumptions for the exogenous data.

The second step in doing impact analysis is to make a scenario. In the bottom left of Figure 2, change one assumption and then put the new exogenous variables into the model. The new solution will be the scenario. By comparing the scenario and the baseline, we can see the effect of changing one exogenous variable. For example, to examine the effect of income, a scenario with different income growth assumption can be made. This scenario will give a different model solution. The difference between the scenario solution and the baseline solution shows how important income is to the dairy and meat sectors in Japan.

A baseline was created in which the models were run over assumed exogenous data. In order to produce a best guess of what will occur in the next few years, the models were first solved for 1996 data, even where preliminary, before developing projections through 2000. This process was performed in late 1997, so almost no Fiscal Year 1997 data was available at the time. The baseline solution depends upon the following assumptions:

* Average weather,
* World meat prices as reported in the FAPRI baseline of January 1997 [3], which shows rising world beef prices

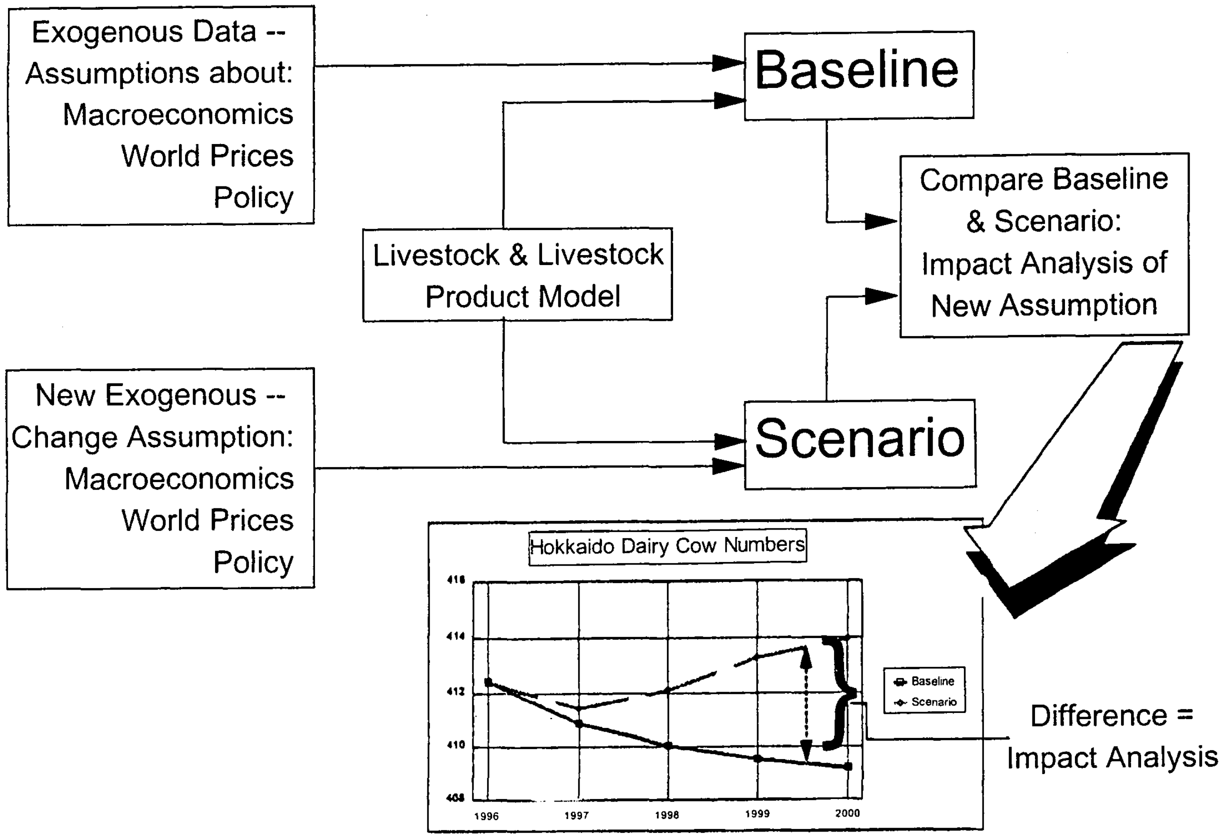

Figure 2: Baseline and Impact Analysis

and world pork and chicken prices that vary from year to year without distinct trend. World dairy prices are fixed at 1996 levels,

* Continuation of stated Japanese agriculture policies regarding both internal markets and imports (including changes required by the Uruguay Round),
* A return to more normal circumstances for beef and pork markets, with renewed consumer confidence in beef and slow entry of alternate foreign sources of pork to replace Taiwan, and
* Per person nominal income growth of 2.5%, WPI and CPI inflation rates of between 0.5% to 1.5%, slow appreciation of the yen, and population flat in Hokkaido and slowly growing in Tofuken.

With these assumptions imposed, the baseline solution was created to offer a basis of comparison for several exogenous shocks to the livestock and livestock product sector. The baseline simply provides an acceptable path against which we can compare different possible scenarios.

The first two columns in **Table 3** are the baseline values of each of the variables listed. Note that space limitations are such that only a few variables are shown and only the 1997 and 2000 baseline values are reported. The percent change from 1997 to 2000 are included to help summarize the baseline. These indicate continuing declines in Hokkaido and Tofuken dairy cows and increasing milk production in each of these regions due to more rapid growth in milk per cow. In Tofuken, the net effect on production is only a slight rise. Despite a larger quantity of milk production, Hokkaido fluid milk use is little changed as more milk is diverted from that market to the stronger Tofuken fluid market or used for manufacturing dairy products. The continuing upward trend of shipments from Hokkaido to Tofuken causes an upward pressure on Hokkaido fluid milk prices and a downward pressure on Tofuken fluid milk prices, but the Hokkaido milk prices remain lower than those in Tofuken.

The payment quota and most policy prices are held constant by assumption, so butter and skim milk powder markets do not change greatly. There is some increase in aggregate demand, as reflected in the rising prices, which could be offset by higher imports than the fixed level assumed here. The cheese market sees more changes, with growth in prices and imports reflecting strong demand in coming years.

With lower dairy cow numbers, dairy beef production is also anticipated to decline, forcing corresponding reductions in per capita consumption. Dairy beef wholesale prices do rise, but this is also a result of strong cross-price effects between dairy beef and import beef. Dairy beef users face decreasing supplies and more expensive substitutes (due to the assumption of slowly rising import beef prices), so dairy beef prices are bid higher.

Total female wagyu numbers increase in the coming years as some re-investment occurs after the recent liquidation. Rising females causes rising production, but the biologic delay is long and little of that increase is realized in the next few years. The impact on per capita wagyu beef consumption is small. This growth is certainly insufficient to keep pace with demand strength spurred by both assumed income growth and the weak cross-price effects from dairy and import beef.

Imports of beef and pork both pose extreme difficulty due to the anomalies present at the beginning of the baseline. Recall the assumption that demands return to more normal levels, absent health fears of late, and that pork import sources satisfactory to Japanese buyers are assumed to become available as markets adjust to the recent events in Taiwan. As a result, beef imports increase even in the face of higher world prices. However, resumption of pork imports at the 1996 level is not foreseen in the very near future. One reason is that, although suppliers are assumed to be available, it is not likely to be immediate nor at the same price as those of nearby Taiwan. Another important reason is domestic supplies, which are anticipated to halt their trend of decline briefly in response to recent high prices. High 1997 wholesale pork prices encourage investment in breeding herds, raising production. As this domestic supply comes on line so too does the new import suppliers, causing strong downward pressure on prices. Lower prices will quickly discourage the importers and, more slowly, domestic production.

The poultry market is strongly affected by world poultry prices. The assumption is of flat world poultry prices, a stronger yen, and decreasing tariff on poultry imports as required by the Uruguay Round. The poultry import price falls, so poultry imports rise. The income growth for Japan is assumed to be good, so the demand stays strong and keeps domestic poultry prices from falling.

Three different scenarios for impact analysis are shown here. In each scenario, one exogenous variable is changed, so the model can show the effect clearly. On **Table 3**, results of each scenario for the listed variables are stated in terms of the percent change from the baseline value. The table shows results of (1) a 10% decrease in CIF beef prices, (2) a 10% decrease in feed prices, and (3) a 2% increase in income. Many of the exogenous variables are very important to these models, but these shocks have been chosen as being especially important. By looking at these shocks, the model shows how these key variables can affect the Japanese livestock and dairy markets.

Table 3: Selected Baseline Results & Scenario Effects

Variable	Baseline Results Absolute Levels 1997	2000	Growth 1997 to 2000	#1: -10% to CIF Beef Prices 1997	2000	#2: -10% to Feed Prices 1997	2000	#3: +2% to Income 1997	2000
	Value		*Percent*	*Percent Change from Baseline Solution to Scenario Solution*					
Hokkaido Milking Cows(Thou.Head)	411	409	-0.4	-0.0	-0.1	0.1	1.2	0.1	0.9
Tofuken Milking Cows(Thou.Head)	602	557	-7.4	-0.0	-0.1	0.2	1.8	0.2	1.6
Hokkaido Milk Production(Thou.Tons)	3,644	3,853	5.7	-0.0	-0.1	0.9	4.4	0.1	0.8
Tofuken Milk Production(Thou.Tons)	5,207	5,251	0.8	-0.0	-0.1	0.4	2.6	0.1	1.2
Hokkaido Farm Milk Price(Yen／Kg)	70	69	-0.8	0.0	0.0	-0.4	-1.9	0.6	0.6
Tofuken Farm Milk Price(Yen／Kg)	87	85	-2.4	0.0	0.1	-0.5	-3.0	3.8	4.1
Hokkaido Milk for Hokkaido Fluid(Th.Tons)	444	433	-2.6	-0.0	-0.1	1.9	8.3	1.6	3.0
Hokkaido Milk for Tofuken Fluid(Th.Tons)	548	690	26.0	-0.0	-0.1	2.3	10.3	-8.4	-6.8
Hokkaido Over-Quota Manufg Milk(Th.Tons)	833	912	9.4	-0.0	-0.1	1.6	6.8	5.0	7.2
Total Tofuken Milk Supply(Thou.Tons)	5,150	5,195	0.9	-0.0	-0.1	0.4	2.7	0.1	1.2
Tofuken Milk for Tofuken Fluid(Thou.Tons)	4,309	4,390	1.9	0.0	0.0	-0.1	-0.3	2.1	2.0
Tofuken Over-Quota Manufg Milk(Th.Tons)	197	162	-18.0	-0.2	-2.7	11.7	95.0	-43.3	-17.0
Hokkaido Fluid Milk Price(Yen／Kg)	77	82	5.4	0.0	0.1	-1.7	-7.4	1.5	0.4
Tofuken Fluid Milk Price(Yen／Kg)	90	87	-3.0	0.0	0.0	-0.4	-2.7	3.7	4.5
Butter Supply(Thou.Tons)	91	93	2.2	0.0	0.0	0.0	0.0	0.5	0.5
Skim Milk Powder Supply(Thou.Tons)	209	214	2.4	0.0	0.0	0.0	0.0	0.4	0.4
Total Cheese Supply(Thou.Tons)	32	33	3.4	-0.0	-0.0	0.1	0.4	3.8	3.9
Total Cheese Imports(Thou.Tons)	173	195	12.3	-0.0	-0.0	0.0	0.1	1.2	1.1
Butter Price(Yen／Kg)	984	1,065	8.2	0.0	0.0	0.0	0.0	1.7	1.7
Skim Milk Powder Price(Yen／Kg)	526	560	6.4	0.0	0.0	0.0	0.0	1.2	1.2
Price of Cheese(Yen／Kg)	1,361	1,376	1.1	0.0	0.0	-0.0	-0.2	1.8	1.9
Dairy Beef Production(Thou.Tons)	305	299	-2.3	-0.5	-0.8	0.1	1.5	-0.2	0.7
Dairy Female Calf Price(Thou.Yen／Hd)	95.9	96.7	0.8	-3.0	-3.4	3.3	6.4	2.4	3.3
Dairy Beef Cons.Per Person(Kg)	1.69	1.64	-2.8	-0.5	-0.8	0.1	1.5	-0.2	0.7
Dairy Beef Wholesale Price(Yen／Kg)	851	900	5.7	-4.8	-5.1	-0.1	-2.5	1.4	-0.1
Total Wagyu Females(Thou.Head)	1,113	1,168	4.9	-0.0	-0.1	-0.1	1.5	0.0	0.2
Wagyu Beef Production(Thou.Tons)	239	244	2.1	-0.0	-0.1	0.3	0.5	0.0	0.1
Wagyu Male Calf Price(Thou.Yen／Hd)	464	459	-1.1	-0.7	-0.6	2.7	3.6	1.1	0.4
Wagyu Female Calf Price(Thou.Yen／Hd)	381	371	-2.6	-0.7	-0.4	2.2	2.4	1.0	0.2
Wagyu Beef Cons.Per Person(Kg)	1.32	1.34	1.5	-0.0	-0.1	0.3	0.5	0.0	0.1
Wagyu Beef Wholesale Price(Yen／Kg)	2,169	2,233	2.9	-0.4	-0.4	-0.3	-0.6	0.6	0.4
Import Beef Cons.Per Person(Kg)	5.01	5.26	5.0	2.7	3.0	-0.0	-0.2	0.7	0.6
Beef Imports(Thou.Tons)	899	955	6.2	2.7	3.0	-0.0	-0.2	0.7	0.6
Pork Production(Thou.Tons)	1,280	1,277	-0.3	-0.0	-0.1	0.8	4.3	0.0	0.1
Pork Cons.Per Person(Kg)	11.67	12.05	3.3	-0.2	-0.2	0.1	0.7	0.2	0.2
Pork Imports(Thou.Tons)	754	912	21.0	-0.4	-0.2	-0.9	-4.4	0.4	0.2
Pork Wholesale Price(Yen／Kg)	516	483	-6.5	-0.2	-0.2	-0.6	-3.4	0.2	0.1
Total Poultry Production(Thou.Tons)	1,228	1,208	-1.6	-0.0	-0.1	0.6	3.1	0.0	0.1
Poultry Cons.Per Person(Kg)	11.31	11.56	2.2	-0.2	-0.3	0.1	0.3	0.2	0.2
Poultry Imports(Thou.Tons)	628	703	12.1	-0.6	-0.6	-1.0	-4.6	0.6	0.5
Chicken Wholesale Price(Yen／Kg)	209	214	2.3	-0.2	-0.2	-0.4	-1.7	0.2	0.2

The beef price is chosen as beef imports are very important to the domestic beef supply, because more beef is imported than produced. World pork and poultry prices are also important, as shown in Thompson [25], but are of less importance to Japan's dairy market. The feed price is the largest input for all these industries and are correlated across types. In the event of crop problems in the world, prices would rise, pulling up feed prices for Japanese livestock producers. Ignoring world meat and dairy prices, then, this scenario shows what would happen to Japanese meat and dairy markets. The third scenario examines the effect of Japanese economic growth on Japanese meat markets. This scenario changes the income assumption to see how demand is changed and how production and imports react as prices rise. A 2% increase in income is chosen, but the effects would be of opposite direction and similar magnitude in the event of a 2% decrease. Whether to consider a return to better growth or a recession, we leave to the reader.

Other variables might have been chosen, such as the exchange rate, the world pork and poultry prices, or the manufacturing milk quota. Any of these variables would have strong effects as well on certain parts of the model. In fact, many other impact analysis tests on such variables are performed in Suzuki [23] or Thompson [25].

Scenario #1: CIF beef prices fall by 10%.

The world beef prices are exogenous to these Japanese models, so a question which could be asked is: "What if world beef prices decrease by 10%?" This question is important because Japan imports more beef than it produces; domestic beef prices depend on world beef prices. Since liberalization, the world beef prices influence the dairy beef price, in particular, as shown by the decreasing import and dairy beef prices in the early 1990s and the recent strength. Hence, world beef price changes affect domestic beef markets directly and dairy, pork, and poultry markets indirectly.

In the system, the researcher can change the world beef price variable by 10% and solve the complete system again. Results are given in **Table 3** by showing the percent changes in the same selected variables of the baseline. In other words, **Table 3** shows the percent change caused by the 10% decrease in import beef prices, as compared to the baseline.

The most obvious place to begin is the imports of beef. The falling world beef prices cause an immediate increase in beef imports of 2.7% above the baseline. Cross-price effects lower competing meat demands which in turn drives other meat prices down. This is most apparent in the dairy beef prices which fall by 4.8%, about half as much as the CIF beef prices.

Lower dairy beef prices bring about lower dairy calf prices. This effect is not great since dairy calf prices were found to depend more on farm milk prices than upon dairy beef prices. Still, a small decrease in dairy calf prices is realized, causing a decrease in dairy cow numbers of a similarly small magnitude. The changes in the dairy industry are very, very small. The only exception is on Tofuken other manufacturing milk use. This use of milk is a small residual, as Tofuken fluid use is the dominant category. Even a small change in Tofuken milk production will have some quantity effects on these two categories, implying larger percent changes on the small, residual

Tofuken other manufacturing use. Again due to the size of Tofuken's over-quota manufacturing milk - it is dwarfed by Hokkaido's larger amount -, the cheese market is little affected.

By 2000, the fourth year of the impact analysis, the domestic beef production has started to change because of lower domestic beef prices. In 2000, dairy beef production is almost 1% lower than the baseline, but wagyu beef production is little different because of the low substitution. Beef imports are 3% higher than the baseline level.

Scenario #2: Feed prices fall by 10%.

This scenario examines a change in Japanese feed prices of -10% which is phased in at -5% in 1997 and then the full -10% from 1998 on. Note that there is no change assumed in world meat or dairy product prices. Feed prices are important to all these industries because it is the most important input, according to Livestock Costs of Production of 1995. Purchased feed costs account for 25% and 30% of total wagyu calf and milk production costs, respectively. For dairy cattle fattening and piglets, the shares of purchased feed costs are higher still at 46% and 62%. Broiler purchased feed costs in 1991 are 66% of total costs. Changing all of these feed prices by 10% at the same time is acceptable because the correlation between them is very strong - the correlation coefficients are over 0.99 for the sample period.

Decreasing feed prices will have many effects on the complete system, most obviously on the incentives domestic producers face. Domestic supplies of all commodities are expected to rise, driving down prices and discouraging imports. Remember that all percent changes are relative to the baseline.

This is in fact what occurs. Certainly pork and poultry follow this path. The beef markets are somewhat more complex due to biological lags. The first year's impact on wagyu beef supply is ambiguous, and even by the end it may seem small. However, this short table does not allow sufficient space to show the industry's response. Wagyu beef production in the first three years increases only slightly and in one year even declines. This may seem counter-intuitive, but it is actually a result of producers' behavioral decision to invest. More wagyu cow numbers causes less female wagyu slaughter in the short-run, lowering wagyu beef production and driving wagyu prices slightly higher. This is only partially offset by heavier slaughter weights allowed by the lower feed prices. In short, wagyu beef production cycles are seen in the industry's response to the feed price shock. The years shown in **Table 3** do not clearly demonstrate either the stages of wagyu response nor the end results, which include production and consumption about 1-1.5% higher, wholesale prices about 1-1.5% lower, and calf prices 1-3% higher. This narrowing of the margin between wholesale and calf prices is the expected result as the largest cost of feedlots has decreased, causing operators to bid higher the prices of calves.

The dairy industry is also affected by lags in response. Again, the first several years witness little change in dairy beef production due to lower female slaughter. The final effects on dairy cow numbers are almost achieved by the year 2000 numbers shown on **Table 3**, as the final numbers show about 1.3% more Tofuken dairy cow numbers and 2.2% more Hokkaido dairy cow numbers. Dairy beef prices at the wholesale level are still sliding in the final year shown and are only about halfway to their final percent decrease of about 6%. The effects on female dairy calf prices are most positive in the first few years, when feed prices are weak and before supply has had time to respond.

The impact on the imports of beef are insignificant in the first few years of this scenario since the domestic beef supplies do not change immediately. It is only after the effects of producers' behavioral decisions finally reach the markets, driving the domestic beef prices lower, that beef imports start to fall.

The results in the year 2000 illustrate how the dairy industry is affected by policy. The dairy cow numbers and milk production in both regions rise, with 4.4% more milk production in Hokkaido and 2.6% more milk production in Tofuken. Not shown, the milk per cow in both regions is also rising due to the appearance of feed prices, as the deflator of milk prices, in those equations. Higher production results in higher milk use in all categories shown, except for Tofuken fluid use in Tofuken. This deviation partially offsets the increase in Hokkaido fluid milk shipped to Tofuken. The Tofuken fluid market is a duopoly with each supplier's reaction function including its competitor's supply. Hence, when greater milk availability increases milk shipments from Hokkaido, the Tofuken cooperatives see reason to decrease their own supplies to the Tofuken fluid market. This effect is almost countered by greater availability of milk in Tofuken, but not quite, leaving a slight decrease in Tofuken fluid use in Tofuken. Of course, the increasing milk supplies cause prices to fall in all fluid markets, pulling down average farm milk prices as well.

One allocation category not shown in the table is within-quota manufacturing milk use. This quota is set at the 1997 values for the baseline and does not change in the scenario, so there are no changes to show. Dairy policy dictates that only this milk is to be used for making designated dairy products such as butter and skim milk powder. Also set by policy is the Standard Purchase Price, the milk input price of designated dairy product makers. Demand for these dairy products is not affected by feed prices, so there is no movement in dairy product supply or demand for designated products. Hence, butter and skim milk powder markets do not show any change in **Table 3**. Policy restrictions do not allow the changes occurring in milk production to be passed on to these markets.

Since 1987, cheese has not been a designated product. Over-quota manufacturing milk is used to make cheese and other non-designated products, so the changes seen in other manufacturing milk, Hokkaido or Tofuken, in **Table 3** will impact cheese production. The effects are small, however, implying a shift in allocation of over-quota manufacturing milk between modeled and non-modeled commodities. When cheese production rises slightly, even smaller changes in prices and imports result. It must be remembered that total cheese imports is an aggregate which includes a category for tariff-free natural cheese imports for further processing. This quantity is determined by the domestic content ratio times the quantity of domestic natural cheese used for further processing. As the domestic supply rises, some of which is to be used for further processing, this category of imports will rise. Hence, although the small price drop does cause a corresponding small drop in certain categories of imports, these are even less than the slight increase in tariff-free natural cheese imports for further processing.

The complexities of the dairy policies were recreated with some difficulty in the dairy model used in this study. The system reflects the policy rigidities much as it incorporates the biologic constraints which the livestock industries face.

Scenario #3: Income growth 2% higher than the Baseline

Income growth in the baseline was assumed at 2.5% per year. If income growth is raised to 4.5% per year, the demands of all the commodities should increase, driving prices higher and raising the quantity supplied in each market. Again, this simplistic a priori belief will be confounded somewhat by biological lags and policy. This scenario is very important because the income level determines the demand for each product through the income elasticity. Recall from Table 1 that beef, cheese, and fluid milk all have income elasticities greater than one. Changing the assumption about income growth will change the demands all the dairy and meat products, but will affect these goods the most. In other words, Japan's macroeconomy greatly influences these product markets.

The immediate demand increases in the dairy markets cannot be met by immediate increases in domestic supplies. The demand for fluid milk responds strongly to income, as shown in the elasticities earlier. In the first year of the scenario, since there are no new supplies to meet the higher demand, the allocation of milk changes to reassign the milk supply to the use with the higher marginal revenue, which is fluid use. In aggregate, there is a shift from manufacturing use to fluid use to meet the additional demand.

As more dairy cows are brought into production, by 2000 the supply of milk has risen enough to allow for higher aggregate fluid and manufacturing milk allocation. The initial milk re-allocation in Hokkaido eases by 2000. Regional differences are still apparent, as Tofuken other manufacturing milk use remains well below baseline levels and prices in the two regions have moved apart relative to the convergence seen in the baseline, because Tofuken farm milk prices depend more on fluid milk prices.

Some immediate supply response occurs in dairy products, even in the designated product markets which draw their input milk from the fixed quota. This implies a shift in allocation of that quota milk across designated uses which favors butter/skim milk powder production in response to the higher prices. This is a small effect of half a percent, but points out the absence of other designated product markets whose inclusion could potentially alter this result. Even with higher production, the prices of these designated products do rise, however, giving justification to higher imports should prices exceed the band set by policy. However, policy is held constant so it is assumed that butter imports and skim milk powder imports do not change. The supply of cheese responds as well, again implying a shift in allocation of milk, though this time the pool of milk in question is the other manufacturing milk. Prices of cheese rise, encouraging imports.

The income elasticity of the meat expenditure equation and expenditure elasticities of the LES retail demands are tested in this scenario. A priori expectations from the elasticities given before are that the beef markets will be most impacted. This holds with first year effects on domestic beef wholesale prices stronger than those on pork or chicken and the imports of beef changing more than the other two types of meat imports, especially those of pork which are more restricted by policy. Supply response of wagyu and dairy beef in the first few years, again, shows the biological constraints as investment causes lower slaughter, decreasing supplies available in the first few years. By 2000, the domestic production of wagyu and dairy beef have begun to increase, softening the initial price effects. In fact, dairy beef production has increased sufficiently to drive prices lower than in the baseline. This is caused by the fact that the beef component of producers' revenue is outweighed by the dairy component. Hence, even though the contribution of the beef component becomes slightly negative, the average farm price of milk has risen by more than enough to compensate, sustaining the increase in cow numbers. This can be seen in the dairy calf price which still remains strong even after supply has begun to respond to the higher demand, because the milk prices are strong.

After four years of higher than baseline income growth, domestic supplies of all these livestock products are higher and still increasing compared to the baseline levels. Note that dairy beef, pork, and poultry production are still decreasing, though at a slower pace. Imports are also higher than the baseline, but decreasing slightly as domestic supplies compete for the higher demand.

Summary and Conclusion

This paper has presented an econometric model which recreates the livestock, meat and dairy, markets of Japan in a manner consistent with economic theory, biological considerations, and existing policy. This model builds on the work of preceding researchers who also modeled some of these same industries in isolation or, occasionally, in a partially linked system. Improvements were attempted to update both structure and parameters in light of new policies and new market conditions. Elasticities of demand show that the parameters are in line with others' estimates and the model performance measures, RMS and Theil statistics, are shown. There is room for improvement. The calf demand equations should be better if F1 numbers are incorporated. Separate prices of imported cheese for different uses could benefit the cheese import equations. In addition, other commodity markets could be added, such as condensed milk, cream, feed inputs, eggs, or fish.

Once the system was constructed, several assumptions were made about macroeconomic variables, policies, and world prices. The models were lined up to historic data and preliminary 1996 data and then run out to produce a baseline. Key results of the baseline are as follows, comparing 2000 to 1997 numbers:

* Decrease in dairy cow numbers of -0.4% in Hokkaido and -7.4% in Tofuken
* Hokkaido milk production 5.7% higher ; Tofuken milk production up 0.8%
* Flat or lower farm milk prices; -0.8% in Hokkaido and -2.4% in Tofuken
* Fluid milk prices converging across Hokkaido (+5.4%) and Tofuken (-3.0%)
* Strong growth in imports of cheese (12%), pork (21%), and poultry (12%)

* Per capita meat demand rising with assumed income growth; wagyu beef (+2%), import beef (+5%), pork (+3%), and poultry (+2%) all rise, but dairy beef supply decreases with cow numbers, so dairy beef per capita falls (-3%)
* Lower production of dairy beef (-2%) and poultry (-2%), pork production almost flat (-0.3%) and wagyu beef production higher (+2%) due to high recent prices

This baseline was the basis of comparison used in three subsequent scenarios. Each of these scenarios shows how policy and biologic constraints affect the responses both in Hokkaido and Tofuken milk markets as well as in all-Japan's meat and dairy product markets. The first shock was to the CIF import beef price. This scenario shows that a 10% decrease in the CIF price causes a 3% increase in beef imports. The dairy beef wholesale price falls by about 5% and the wagyu beef, pork, and poultry wholesale prices fall only a little. The milk market does not change very much because milk prices are more important than beef prices to most milk producers.

If the feed prices fall by 10%, the Hokkaido fluid milk price falls by 7.4% and the Tofuken milk price falls by 2.7%. However, the Hokkaido farm milk price falls about 2% and the Tofuken farm milk price falls 3%. This is because the quantity of milk shipped from Hokkaido to Tofuken increases by 10%. Dairy cow numbers increase by 1.8% in Tofuken and 1.2% in Hokkaido. Japan's total meat consumption does not change so much, but production increases by as much as 4.3% for pork and 3.1% for poultry at the expense of imports which fall by 4.4% for pork and 4.6% for poultry.

The impact analysis of income shows that it is also very important to these markets. The 2% increase in income raises all three meat demands, especially beef demand. Per person consumption of dairy beef and import beef both go up by more than half a percent. Wagyu beef per person climbs a little, but most of the effect is on wagyu prices, with the wagyu wholesale price rising 0.4% Beef imports rise by 0.6%, pork imports by 0.2%, and poultry imports by 0.5%. Farm prices of milk rise by 4.1% in Tofuken and 0.6% in Hokkaido, so dairy cow numbers go up by 1.6% in Tofuken and 0.9% in Hokkaido. The additional dairy cows create more slaughter animals, pushing dairy beef production up 0.7%. This is more than the increase in demand for dairy meat when import prices are fixed, so the dairy beef prices fall back below the baseline level. This is a result of the links between the dairy model and meat model of this study. The markets for both milk and dairy beef are simultaneous, so we can see that the increased demand for milk causes more of the by-product, dairy beef, causing dairy beef prices lower.

This study shows us a baseline through 2000. By examining the results, the reader can see what might happen in the next few years, which quantities and prices are under pressure to rise or to fall. The impact analysis can help the reader consider how important CIF import beef prices, input prices, and income are. This type of analysis can help people understand how current events affect livestock and livestock product markets in Hokkaido and Tofuken.

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