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A MARKET ANALYSIS OF CHEESE, BUTTER, NONFAT DRY MILK,
AND BUTTER OIL IN JAMAICA

FOR USAID/JAMAICA

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EXECUTIVE SUMMARY

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PURPOSE OF THE ANALYSIS

USAID/Jamaica commissioned an evaluation of the Jamaican dairy industry in order to determine the capacity of the consumer market to absorb an increase in cheese, butter, nonfat dry milk, and butter oil. The objectives include: (a) survey the country wholesale (and Government) distribution system and estimate the market size for cheese, butter, nonfat dry milk, and butter oil, (b) survey the processed product variety (including exports/imports), (c) identify brands and market shares, (d) using available statistics, review commercial imports of the commodities in question to determine the extent to which the PL-480 commodity affects commercial imports, (e) examine product pricing controls and guidelines, (f) identify and discuss conditions which impede market development, (g) review commercial import statistics to determine the accuracy of the current Usual Marketing Requirement (UMR) calculations, and (h) determine the extent to which the local processing capacity can absorb additional dairy commodities beyond those levels currently being imported.

METHODOLOGY

Information was gathered on the Jamaican dairy industry by interviewing USAID/Jamaica personnel, Jamaica Agricultural Development Foundation (JADF) personnel, Jamaica Department of Agriculture (JDA) personnel, Dairy Industries (DI) personnel (manufacturer of cheese and butter), wholesalers of dairy products, and the Jamaica Statistical Institute (JSI). The projections of market sales through 1990 were made using multiple regression analysis.

FINDINGS

It was found that the markets for cheese, butter, nonfat dry milk, and butter oil will increase by 96.5, 58.0, 75.5, and 51.7 percent through 1990 over the 1986 level. Although sales will grow in the future, these projections must be accepted as projections and that the actual observed quantity will likely differ from the projections. The adjusted R^2 for the models ranged from .1847 to .3443 which means that only 18.47 and 34.43 percent of the variability in the quantities demanded is explained by the independent variables. This is not unusual for models based on bi-monthly and quarterly data; however, it makes the confidence interval quite large around the sales projections. Furthermore, the variables used to project sales are projections themselves. A difference in actual behavior and projected behavior of these variables will cause the projected quantity demanded to be different from the actual quantity demanded. With that said, sales of all dairy commodities will grow in the future.

Dairy Industries mostly imports cheddar cheese along with a very small quantity of edam, gouda, and eggmont. Cheddar cheese is an inexpensive cheese that is plentiful on the world market. Cheese is sold in processed and unprocessed form. DI processes the cheddar into five pound tins and multi-vac plastic packages in quarter, one-half, and one pound sizes. Wholesalers buy cheese from DI and sell the cheese under the wholesalers brand name.

Butter is imported in bulk form mainly from the United States (JADF) and New Zealand. Jamaicans have eaten New Zealand butter for many years and have acquired a taste for it. U.S. butter is seen as inferior to New Zealand and sells at a discount to New Zealand butter. DI packages butter into one-half and one pound packages and sells to wholesalers who merchandise butter under brand names.

NFDM and butter oil is imported by the Jamaica Commodity Trading Company (JCTC). JCTC sells to buyers who convert the products into other products or sell NFDM across the counter to consumers.

PL-480 cheese and butter are imported by JADF and sold to DI. NFDM and butter oil are not imported into Jamaica as a PL-480 commodity. From 1984 through 1986, PL-480 imports of cheese and butter ranged from 31.3 to 41.9 percent of total imports for cheese and from 52.1 to 72.4 percent of total imports for butter.

Cheese and butter are not controlled by the pricing commission. Cheese and butter prices rarely move upward unless the processor (DI) increases its price. Then everyone in the

vertical system makes changes at that time. The press is very interested in the prices of dairy products and wants to know why prices are increased. This results in price increases infrequently but they generally are substantial given the knowledge that another increase will be in the distant future. In the meantime, the price of cheese and butter has decreased relative to those products whose prices have increased. This likely results in more consumption of cheese and butter relative to other products. When the price of cheese and butter does finally increase, the consumer must make adjustments within a short period of time rather than gradually over time. This likely results in some unrest among the populace. However, given the public pressure to hold prices, I am not certain of an alternative approach.

The price of NFDM and butter oil for all uses is controlled by the Government. When the price moves, it moves in large jumps. For example, the price of NFDM going into over the counter sales did not change between January of 1981 and February of 1984 (Table C5). Then in March, the price increased from \$28.88 per 50 pound bag to \$59.95, a 108% increase. The price escalated the next April of 1985 by 47.2% to \$88.27 per 50 pound bag. Then in January, 1987, the price fell to \$32. Changes similar in magnitude have occurred for NFDM used in condensed milk and ice cream.

The price of butter oil going into condensed milk sales did not change between January of 1981 and February of 1984. Then in March, the price increased from \$726.20 per 200 kg drum to \$1775, a 144% increase. The price increased the next April of 1985 by 17.7% to \$2088.68 per 200 kg drum and has remained there since. Changes similar in magnitude have occurred for butter oil used in fluid milk and ice cream.

Conditions that impede market development of cheese and butter include: (a) JADF product is imported at the world market price. It does not include any charge for transportation and does not incur any gain or loss from the exchange rate. All other imported cheeses and butter incur these expenses. Therefore, not having JADF product will likely increase the average price charge by DI which will likely decrease the sales of cheese and butter, (b) not having JADF product causes stockouts of cheese and butter and causes people to substitute other foods. When cheese and butter return to the shelf, consumers may not purchase cheese and butter, (c) the informal 50%-50% requirement whereby JADF product cannot have more than 50% of the market. This likely increases the average price charged for cheese and butter and likely decreases sales, (d) JADF cheese has a higher moisture content than cheese from other countries and will degrade quicker under warm conditions, (e) DI does not possess a slicing machine and this precludes the restaurant and hotel trade for cheese and butter, (f) the

seasonality of product demand whereby cheese is viewed as a holiday treat and is consumed at a lower rate at other times of the year, (g) JADF butter has a lower melting point than butter from other countries and will degrade quicker under warm conditions.

The factors that impede the market development of NFDM and butter oil include: (a) the price compared to other products, (b) the level of per capita income, (c) the prices of products that use NFDM and butter oil compared to substitute products, and (d) the taste compared to substitute products.

The Usual Marketing Requirement (UMR) is a five year moving average of the imports of cheese that is used to forecast the future sales of cheese and butter. The accuracy of the UMR to forecast sales is analyzed. Moving averages on a one, two, three, four, and five year moving average basis are calculated. The average error of forecast for each moving average length is calculated. This analysis demonstrates that using the previous year as an indicator of current demand has a smaller forecast error than any other length of moving average. A five year moving average changes slowly and will not indicate the current size of the market. In a growth market which is currently the case in cheese, a five year moving average will lag behind the actual growth. In a down market, a five year moving average will show the market to be larger than it actually is. The five year moving average is not sensitive enough to current market conditions for JADF.

In 1987, DI could process 9000 tons of processed cheese while running 16 hours per day and 250 work days per year. DI is expecting to process between 4000 and 4500 tons this year. If a third shift were added, 11,000-12,000 tons of cheese could be processed.

If the market were to change and DI were to make processed and unprocessed cheese, then DI could process 6000 tons of cheese and 2000 tons of unprocessed cheese on a 16 hour day and 250 days per year. In 1987, DI will make 4000-4500 tons of processed cheese and 300-400 tons of unprocessed cheese. Thus processing capacity is not a constraint.

In 1987, DI could process 4000 metric tons of butter while running 16 hours per day and 250 work days per year. DI is expecting to process between 1600 and 2000 metric tons this year. If a third shift were added, 6000 metric tons of butter could be processed.

CONCLUSIONS

A. The market demand for cheese, butter, nonfat dry milk, and butter oil will grow through 1990.

B. Low prices and an aggressive advertising campaign should be continued for cheese and butter.

C. The amount of cheese and butter sent to JADF should be based on current market conditions. The UMR should, at the very least, be based on last years sales and not a five year average. At the most, a forecasting model should be developed that takes into consideration current market conditions.

D. The flow of cheese and butter into Jamaica should reflect the month to month demand of the market. Stockouts in stores is not conducive to market growth.

E. Local processing capacity can absorb additional cheese and butter beyond levels currently being imported. Nonfat dry milk and butter oil have less capacity left for growth.

RECOMMENDATIONS

A. The Development Coordinating Committee (DCC) of the United States Government should insure JADF adequate cheese and butter to supply a growing market. The product should be delivered to JADF on a timely basis which coincides with current market conditions.

B. DI. wholesalers, and retailers should continue to sell at low prices and to advertise aggressively.

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CHEESE

OBJECTIVE (a.) Survey country wholesale (and Government) distribution system and estimate market size for cheese. This analysis will be conducted on a historical basis from which future demand may be projected.

In order to determine the demand for cheese, the market level must be chosen from which the demand is estimated. When cheese reaches the market place, it is in a variety of packages and forms (e.g. processed, unprocessed, spreads, five pound tins, multi-vac packages). Estimating the demand for each of these is beyond the scope of this study. What is more important is the quantity of product that needs to be imported in order to be able to produce the variety of product at retail. The Jamaica Agricultural Development Foundation (JADF) imports product in bulk form (cheddar) and sells it to Dairy Industries (DI) who transforms the product into a marketable form. DI also imports other product from other countries of which New Zealand is the major importer. Therefore, estimating the demand for cheese at the ex-factory level will be the focal point of this study.

Virtually no cheese is made in Jamaica (A small project may start up) and what is made is on a very small scale. Therefore, it is assumed that all cheese is imported and converted to a marketable product. DI receives most of the cheese with the balance going to the restaurant and hotel trade. DI does not possess the equipment required to slice the cheese for this market.

Most of the cheese brought in by DI is cheddar which is a low cost cheese made in large volumes. It is felt that the more expensive cheeses would not sell well because of the high cost.

The cheese market reached a peak in 1974 when 7202.57 metric tons were imported (Table A1). Cheese imports started to decline after that and reached the bottom in 1980 when 1074.513 metric tons were imported. This decline took place in the 1970's because of a foreign exchange problem. The Jamaican government slowed the conversion of Jamaican dollars to foreign currency which traders found to be undesirable. Therefore, the

importation of cheese slowed until 1981 and started to pickup again and rose to 3937.936 metric tons in 1986 (Table A1).

Therefore, the market conditions in the late 1970's were different than those that are currently observed in Jamaica. Also the data could only be obtained for 1984-1987. Thus, the estimation of demand will include only the years 1984-1987 and is based on sales data obtained from DI.

The variables to be included in the model are:

- a. Quantity of all cheese sold by DI (CHEESEQ)
(Dependent variable)
- b. Weighted price of all cheese sold by DI ex-factory
(PC)
- c. National disposable income (NDI)
- d. Seasonality (S)
- e. Consumer price index (CPI) for meat, poultry, and fish (CPIMPF).

Price is an important factor in the model because a large proportion of the Jamaican population is in the lower income groups. Consumers respond to price very quickly. The price used is a weighted average price charged by DI at their loading dock. This will reflect the prices of different uses that the basic cheese (cheddar) is used in. The prices charged by distributors, wholesalers, and retailers drive off of the price charged by DI. Therefore, the movement of the loading dock price of DI is highly correlated with prices charged at the other levels of the marketing chain.

DI is very aggressive in their marketing program. They advertise on TV, in the press, hold workshops to educated people on how nutritious cheese is and how to cook with it, and radio. DI does generic advertising and the wholesalers do brand advertising. The advertising has been important for the re-introduction of cheese back into the market place. However, advertising information was not available over a long enough time period to be of use in the model. Therefore, advertising expenditures are not included in the model.

It is estimated that 70% of the cheese market is in the low and middle income portion of the population. In 1983-84, the Jamaican people spent an average of 43.8% (Food Consumption Survey 1983-84, Ministry of Agriculture, Hope) of their income on food. Therefore, national disposable income is included in the model.

Easter and Christmas are periods of high consumption in Jamaica. The 1983-84 food expenditure survey showed that 38.8% of the dairy and dairy products were purchased during the second quarter of the year and 52.8% in the fourth quarter of the year (Food Consumption Survey 1983-84, Ministry of Agriculture, Hope).

Therefore, seasonality is included in the model.

Meat poultry, and fish can be viewed as substitutes for cheese. Therefore, the CPI for these products is included in the model.

A bimonthly model is used because of the lack of annual observations. The data starts in Jan-Feb of 1984 through May-Jun of 1987. A projection for the year is made by projecting for an average two months and then taking that figure times six. Projections of the variables in the model are made in order to make projections for the next three years. The data is deflated (Table A2) by the consumer price index (all products for Jamaica: CPIALL) in order to determine the movement of the price of cheese relative to the other products in the economy. A log linear functional form is estimated.

It was found that the Dairy Industries projected market for cheese in Jamaica in 1990 will be double the projection for 1986 (Table A1). Although cheese sales will grow in the future, these projections must be accepted as projections and that the actual observed quantity will likely differ from the projections (i.e., compare the actual and the projection for 1986 in Table A1). The adjusted R^2 for the model is .3138 which means that only 31.38 percent of the variability in the quantity of cheese demanded is explained by the independent variables. This is not unusual for models based on bi-monthly data. Furthermore, the variables used to project cheese sales are projections themselves. A difference in actual behavior and projected behavior of these variables will cause the projected quantity demanded of cheese to be different from the actual quantity demanded. With that said, cheese sales will grow in the future.

OBJECTIVE (b). Survey processed product variety (including exports/imports).

JADF cheese is imported in bulk form and is cheddar. The other cheeses imported by DI are edam, gouda, and eggmont. This represented about two or three tons in 1986. Other cheeses are imported by the hotels and restaurants and those stores catering to the upper class. However, given the importance of price to the Jamaican populace, the market for the more exotic cheeses is very limited.

The product variety sold to the consumer is processed cheese and unprocessed cheese. The cheese is processed so that it will not spoil as readily without refrigeration. The processed cheese is sold in five pound tins and in multi-vac plastic packages in quarter, one-half, and one pound packages. Cheese spreads are also sold. There is also a white processed cheese and velveta. DI is considering the sale of a flavored cheese. DI does not have a slicing machine which precludes such

customers as restaurants and hotels.

OBJECTIVE (c). Identify brands and market shares (Table A3).

There are six wholesalers and each has their own brand. They do brand advertising. DI packages the product in brand identified packages. The market shares are presented in Table A3. The U.S. brands are Dairy Inn, Eve, Mappco, Golden Choice, Meal Mate, and Muss n. The New Zealand brands are Tastee, Cheddar, Sungold, Chesdare, and Crest.

OBJECTIVE (d). Using available statistics, review commercial imports of the commodities in question to determine the extent to which PL-480 commodity affects commercial imports.

The import statistics are available on an annual basis (Table A1). JADF imports are also available. Over the three years of the existence of JADF, the PL-480 imports have ranged from 31.3% of total imports to 41.9%. This is below the informal 50-50% guidelines followed since the inception of JADF. JADF's product is purchased at a lower cost to DI than other cheese which allows DI to offer cheese at a lower per unit cost. Given the importance of price in Jamaica, more cheese is likely consumed because of PL-480.

OBJECTIVE (e). Examine product pricing controls and guidelines.

Cheese is not controlled by the pricing commission. Cheese prices rarely move upward unless the processor (DI) increases its price. Then everyone in the vertical system makes changes at that time. The press is very interested in the prices of dairy products and wants to know why prices are increased. This results in price increases infrequently but they generally are substantial given the knowledge that another increase will be in the distant future. In the meantime, the price of cheese has decreased relative to those products whose prices have increased. This likely results in more consumption of cheese relative to other products. When the price of cheese does finally increase, the consumer must make adjustments within a short period of time rather than gradually over time. This likely results in some unrest among the populace. However, given the public pressure to hold prices, I am not certain of an alternative approach.

OBJECTIVE (f). Identify and discuss conditions which impede market development.

- a. JADF product is imported at the world market price. It does not include any charge for transportation and does not incur any gain or loss from the exchange rate. All other imported cheeses incur these expenses. Therefore, not having JADF product will likely increase the average price charge by DI.
- b. Not having JADF product causes stockouts of cheese and causes people to substitute other foods for cheese.
- c. The 50%-50% requirement whereby JADF product cannot have more than 50% of the market. This likely increases the average price charged for cheese.
- d. Stockouts at Easter and Christmas.
- e. Unprocessed cheddar needs refrigeration.
- f. JADF cheese has a higher moisture content than cheese from other countries and will degrade quicker under warm conditions.
- g. DI does not possess a slicing machine or a shredder and this precludes the restaurant and hotel trade.
- h. If the price of cheddar increases over the next few years because of countries changing to specialty cheese, the higher price will decrease demand.
- i. Seasonality of product demand whereby cheese is viewed as a holiday treat and is consumed at a lower rate at other times of the year.

OBJECTIVE (g). Review commercial import statistics to determine the accuracy of current Usual Marketing Requirement (UMR) calculations.

This is a five year moving average of the imports of cheese. The import figures are used to determine the average. Moving averages on a one, two, three, four, and five year moving average basis have been calculated (Table A4). The average error and coefficient of variation for each moving average length is calculated. This analysis demonstrates that using the previous year as an indicator of current demand has a smaller forecast error than any other length of moving average. A five year moving average changes slowly and will not indicate the current size of the market. In a growth market which is currently the case in cheese, a five year moving average will lag behind the actual growth. In a down market, a five year moving average will show the market to be larger than it actually is. The five year moving average is not sensitive enough to current market conditions for JADF.

OBJECTIVE (h). Determine the extent to which local processing capacity can absorb dairy commodity beyond those levels currently being imported.

In 1987, DI could process 9000 tons of processed cheese while running 16 hours per day and 250 work days per year. DI is

expecting to process between 4000 and 4500 tons this year. If a third shift were added, 11,000-12,000 tons of cheese could be processed.

If the market were to change and DI were to make processed and unprocessed cheese, then DI could process 6000 tons of cheese and 2000 tons of unprocessed cheese on a 16 hour day and 250 days per year. In 1987, DI will make 4000-4500 tons of processed cheese and 300-400 tons of unprocessed cheese. Thus processing capacity is not a constraint.

BUTTER

OBJECTIVE (a). Survey country wholesale (and Government) distribution system and estimate market size for butter. This analysis will be conducted on a historical basis from which future demand may be projected.

In order to estimate the demand for butter, the market level must be chosen from which the demand is estimated. Unlike cheese, butter is sold as an input into further manufacturing and to the consumer to be consumed as butter. However, one equation will be used to forecast the future demand for butter. It will be estimated as a derived demand that is factored by DI as the product sets on the dock at DI.

In the 1974, butter imports reached a level of 8861.238 metric tons (Table B1). It was mostly imported from New Zealand. The trend was downward after 1974 and a low was reached in 1982 when 520.948 metric tons were imported. The trend since has been upward with imports of 1662.689 metric tons in 1986. The previous year was very low (389.561 metric tons); but this appears to be an aberration and not an indication of things to come. JADF imported 52.1% of the butter imported in 1985 and 72.4% in 1986.

The timeliness of obtaining foreign currency for Jamaican dollars was slow and seen as undesirable by importers in the late 1970's. Therefore, imports of butter slowed considerably. Butter became hard to get by consumers and they started using margarine. As a consequence, consumers developed a taste for margarine. Butter is also recognized as high cholesterol and may pose a health problem to some if not consumed in moderation.

In 1984, JADF started importing PL-480 butter into Jamaica and selling it to DI. American butter is seen as inferior to New Zealand butter because of taste and low melting point. American butter does taste different and comes to a market that has only known New Zealand butter. A low melting point (American butter) can cause problems on the way home when the temperatures are high, the car or other mode of transport is not air-conditioned, and the time of travel is long. Because of the low melting point, the American butter can become rancid more quickly than the New Zealand butter if not properly refrigerated. Thus, New Zealand butter is sold at a premium price to American butter.

When PL-480 butter started to be imported into Jamaica, DI and the wholesalers were confronted with a consumer taste and

preference problem. Two things happened. First, the price for American butter was set lower than New Zealand butter. Second, DI started a generic advertising campaign on behalf of American butter and the wholesalers started brand advertising for American butter.

In 1983, the importation of butter started to increase and has been growing every since except for 1985. Therefore, the market conditions in the 1970's are different than those that are currently observed in Jamaica. Also, data could only be obtained for the years 1984-87. Thus, the estimation of demand will include only the years 1984-1987 and is based on sales data from DI.

WHOLESALE DEMAND FOR BUTTER

Butter can be used in the manufacture of ice cream, malted drinks, and chocolate in place of butter oil. It is estimated that 65% of the imported butter goes to manufacturers and the remaining goes to the consumer market.

The variables to be included in the model are:

- a. Quantity of butter sold by DI (BUTTERQ) (Dependent variable)
- b. Weighted average price of butter sold to manufacturers and consumers by DI (PB)
- c. National disposable income (NDI)
- d. Consumer price index for meat, poultry, and fish (CPIMPF).
- e. Price of butter oil (BUTOILP)

Price is an important factor in the model. Manufacturers are assumed to respond to price very quickly because of the assumed response of consumers to the price changes of retail products. The price used is a weighted average price charged by DI at their loading dock. This will reflect the prices of butter from different countries and different sized containers. The prices charged by distributors, wholesalers, and retailers drive off of the price charged by DI. Therefore, the movement of the loading dock price of DI is highly correlated with prices charged at the other levels of the marketing chain.

DI is very aggressive in their marketing program. They advertise on TV, in the press, hold workshops to educate people on how to use butter to cook with, and radio. DI does generic advertising and the wholesalers do brand advertising. The advertising has been important for the re-introduction of butter back into the market place. However, insufficient data was available. Therefore, advertising expenditures are not in the model.

In 1983-84, The Jamaican people spent an average of 43.8% (Food Consumption Survey, *ibid*) of their income on food. Therefore, national disposable income is included in the model.

Meat poultry, and fish can be viewed as substitutes for butter. Therefore, the CPI for these products is included in the model.

Butter is used in the manufacture of ice cream. Butter oil serves as a substitute input into the manufacturing process. The price of butter oil will be included in the model.

A bi-monthly model is used because of the lack of annual observations. A forecast for the year is made by forecasting for an average two months and then taking that figure times six. Projections of the variables in the model are made in order to make projections for the next three years. The data (Table B2) is deflated by the consumer price index in order to determine the movement of the price of butter relative to the other products in the economy. A log linear functional form is estimated.

It was found that the Dairy Industries projected market for butter in Jamaica in 1990 will be 58.0 percent higher than that projected for 1986 (Table B1). Although butter sales will grow in the future, these projections must be accepted as projections and that the actual observed quantity will differ from the projections (i.e., compare the actual and the projection for 1986 in Table B1). The adjusted R² for the model is .3443 which means that only 34.43 percent of the variability in the quantity of butter demanded is explained by the independent variables. This is not unusual for models based on bi-monthly data. Furthermore, the variables used to project cheese sales are projections themselves. A difference in actual behavior and projected behavior of these variables will cause the projected quantity demanded of butter to be different from the actual quantity demanded. With that said, butter sales will grow in the future.

OBJECTIVE (b). Survey processed product variety (including exports/imports).

JADF butter is imported in bulk form and is a salted butter. The other major importer of butter is New Zealand. It is an unsalted butter and is viewed by Jamaicans as superior to American butter. The New Zealand butter has a higher melting point and does not become rancid as quickly as American butter. Small quantities of butter from other countries is imported and each have a characteristic taste.

The product variety sold to the consumer is from different countries and is sold in one-half and one pound paper labels. DI does not have a slicing machine which precludes such customers as

restaurants and hotels.

OBJECTIVE (c). Identify brands and market shares.

The wholesalers do brand advertising. DI packages the product in brand identified packages. The market shares are shown in Table B3. The U.S. brands include Dairy Inn, Golden Cream, and Delite. The New Zealand brands are Inchody, Mountain Maid, and Eve.

OBJECTIVE (d). Using available statistics, review commercial imports of the commodities in question to determine the extent to which PL-480 commodity affects commercial imports.

The import statistics are available on an annual basis (Table B1). JADF imports are also available. Over the three years of the existence of JADF, the PL-480 imports have ranged from 52.1% of total imports to 72.4%. JADF product is purchased at a lower cost to DI than other butter which allows DI to offer butter at a lower per unit cost. Given the importance of price in Jamaica, more butter is likely consumed because of PL-480.

OBJECTIVE (e). Examine product pricing controls and guidelines.

Butter was not controlled by the pricing commission. Butter prices rarely move upward unless the processor (DI) increases its price. Then everyone in the vertical system makes changes at that time. The press is very interested in the prices of dairy products and wants to know why prices were increased. This results in price increases infrequently but they generally are substantial given the knowledge that another increase will be in the distant future. In the meantime, the price of butter has decreased relative to those products whose prices have increased. This likely results in more consumption of butter relative to other products. When the price of butter does finally increase, the consumer must make adjustments within a short period of time rather than gradually over time. This likely results in some unrest among the populace. However, given the public pressure to hold prices, I am not certain of an alternative approach.

OBJECTIVE (f). Identify and discuss conditions which impede market development.

- a. JADF product is imported at the world market price. It does not include any charge for transportation and does not incur any gain or loss from the exchange rate. All other imported butters incur these expenses. Therefore,

- not having JADF product will increase the average price charge by DI.
- b. No JADF product causes stockouts of butter and causes people to substitute other foods for butter.
 - c. The 50%-50% requirement whereby JADF product cannot have more than 50% of the market.
 - d. JADF butter has a lower melting point than butter from other countries and will degrade quicker under warm conditions. It also cannot be transported as far without refrigeration.
 - e. DI does not possess a slicing machine and this precludes the restaurant and hotel trade.

OBJECTIVE (g). Review commercial import statistics to determine the accuracy of current Usual Marketing Requirement calculations.

This is a five year moving average of the imports of butter. Import figures are used to determine the average. Moving averages on a one, two, three, four, and five year moving average basis are calculated (Table B4). The average error and coefficient of variation for each moving average length is calculated. This analysis demonstrates that using the previous year as an indicator of current demand has a smaller forecast error than any other length of moving average. A five year moving average changes slowly and will not indicate the current size of the market. In a growth market which is currently the case in butter, a five year moving average will lag behind the actual growth. In a down market, a five year moving average will show the market to be larger than it actually is. The five year moving average is not sensitive enough to current market conditions for JADF.

OBJECTIVE (h). Determine the extent to which local processing capacity can absorb dairy commodity beyond those levels currently being imported.

In 1987, DI could process 4000 metric tons of butter while running 16 hours per day and 250 work days per year. DI is expecting to process between 1600 and 2000 metric tons this year. If a third shift were added, 6000 metric tons of butter could be processed.

NON-FAT DRY MILK (NFDM)

OBJECTIVE (a). Survey country wholesale (and Government) distribution system and estimate market size for non-fat dry milk (NFDM). This analysis will be conducted on a historical basis from which future demand may be projected.

In order to estimate the demand for NFDM, the market level must be chosen from which the demand is estimated. Unlike cheese, NFDM is sold as an input into further manufacturing and to the consumer to be consumed as NFDM. Therefore, one equation will be used to project the future demand for NFDM with it being estimated as a derived demand that is faced by the Jamaica Commodity Trading Company (JCTC).

The period of analysis will be from 1982-1986. This period is used because the data was not disaggregated by firm until 1982. The data is from JCTC and was compiled by Mr. David Johnston, Ministry of Agriculture, Hope, Jamaica. Also, the import figures prior to 1982 contained NFDM from the EEC which is a gift to Jamaica. It is used solely for the school lunch program. The EEC gift is not included in the data used to estimate the model.

All NFDM is imported. It is used to make fluid milk, condensed milk, evaporated milk, chocolates, ice cream, sour cream, malted milk, flavored powdered milk, yogurt, liquid breakfast, pastries, bread, and cookies.

MANUFACTURING LEVEL DEMAND FOR NFDM

NFDM can be used in the manufacture a variety of milk products. In 1986, 85% of the NON-EEC imported NFDM went to manufacturers and the remaining went to the consumer market.

The variables to be included in the model are:

- a. Quantity of NFDM (NFDMQ)(dependent variable)
- b. Weighted price of NFDM char ed by JCTC for NFDM used for manufacturing and consumer purposes (NFDMPP)
- c. National disposable income (NDI)
- d. CPI for meat, poultry, and fish (CPIMPF)
- e. Butter oil price (BUTOILP)
- f. Government price change (GP)

Price is an important factor in the model. Manufacturers

are assumed to respond to price very quickly because of the assumed response of consumers to the price changes of retail products. The price used is a weighted average price charged by the JCTC. This will reflect the prices of NFDM for different uses. The prices charged by distributors, wholesalers, and retailers drive off of the price charged by the JCTC. Therefore, the movement of the JCTC price is highly correlated with prices charged at the other levels of the marketing chain.

In 1983-84, The Jamaican people spent an average of 43.8% (Food Consumption Survey, *ibid*) of their income on food. Therefore, national disposable income is included in the model.

Meat poultry, and fish can be viewed as substitutes for NFDM. Therefore, the CPI for these products is included in the model.

Butter oil is used in the manufacture of ice cream, evaporated milk, condensed milk etc. Butter oil serves as a complement input into the manufacturing process. The price of butter oil is included in the model.

The Jamaican government is the only importer of NFDM and sets the price charged buyers. The price does not change for months at a time. A variable is included to account for this effect.

A quarterly model is used because of the lack of annual observations. A projection for the year was made by projecting for an average quarter and then taking that figure times four. Projections of the variables in the model are made in order to make projections for the next three years. The data (Tables C1 and C2) is deflated by the consumer price index in order to determine the movement of the price of NFDM relative to the other products in the economy. A linear functional form is estimated.

It was found that the projected market for NFDM in Jamaica in 1990 will be 75.5 percent higher than that projected for 1986 (Table C4). Although NFDM sales will grow in the future, these projections must be accepted as projections and that the actual observed quantity will differ from the projections (i.e., compare the actual and the projection for 1986 in Table C4). The adjusted R^2 for the model is .2826 which means that only 28.26 percent of the variability in the quantity of NFDM demanded is explained by the independent variables. This is not unusual for models based on quarterly data. Furthermore, the variables used to project NFDM sales are projections themselves. A difference in actual behavior and projected behavior of these variables will cause the projected quantity demanded of NFDM to be different from the actual quantity demanded. With that said, NFDM sales will grow in the future.

OBJECTIVE (b). Survey processed product variety (including exports/imports).

Medium heat and high heat NFDM are imported. Nestles uses high heat and everyone else uses the other.

OBJECTIVE (c). Identify brands and market shares.

The uses of NFDM are broken into four areas with the percentage of total usage in 1986 indicated in parenthesis. They are (a) condensed and evaporated milk (60.8%), (b) liquid milk (17.5%), (c) sold over the counter to consumers (15.2%), and (d) used to make ice cream, used in cooking, etc (4.3%) (Table C3). The remaining 2.1% goes into various other uses. The market shares by firm for each category are indicated in the Table.

OBJECTIVE (d). Using available statistics, review commercial imports of the commodities in question to determine the extent to which PL-480 commodity affects commercial imports.

No PL-480 comes into the country; however, the EEC has been giving the Ministry of Education free NFDM and butter oil to produce milk for school children. The ministry has four plants and is building a fifth that produces milk for school children. These imports are included in the total import figures (Table C4) but are not included in the data used to estimate the model (commercial imports -Table C4).

OBJECTIVE (e). Examine product pricing controls and guidelines.

The price of NFDM for all uses is controlled by the Government. When the price moves, it moves in large jumps. For example, the price of NFDM going into over the counter sales did not change between January of 1981 and February of 1984 (Table C5). Then in March, the price increased from \$28.88 per 50 pound bag to \$59.95, a 108% increase. The price escalated the next April of 1985 by 47.2% to \$88.27 per 50 pound bag. Then in January, 1987, the price fell to \$32. Changes similar in magnitude have occurred for NFDM used in condensed milk and ice cream.

The weighted average price for all uses of NFDM shows similar changes and is always less than the price paid by The Jamaica Commodity Trading Company (Table C5).

OBJECTIVE (f). Identify and discuss conditions which impede market development.

- a. The price of NFDM.
- b. Taste.
- c. Disposable income.

OBJECTIVE (g). Review commercial import statistics to determine the accuracy of current Usual Marketing Requirement calculations.

Not applicable.

OBJECTIVE (h). Determine the extent to which local processing capacity can absorb dairy commodity beyond those levels currently being imported.

In 1986, Jamaica Milk Products purchased 60.9% of the NFDM, fluid milk processors purchased 17.5 %, and over the counter sales took 15.2% (Table C3). The other 6.4% went to ice cream and other products. The weighted capacity utilization of the first three users is 75.9% (Calculated using the capacity utilization figures in Table C6 and the percentages in this paragraph).

BUTTER OIL

OBJECTIVE (a). Survey country wholesale (and Government) distribution system and estimate market size for butter oil. This analysis will be conducted on a historical basis from which future demand may be projected.

In order to estimate the demand for butter oil, the market level must be chosen from which the demand is estimated. Unlike cheese, butter oil is sold as an input into further manufacturing. Therefore, one equation will be used to project the future demand for butter oil with it being estimated as a derived demand that is faced by the Government.

The period of analysis will be from 1983-1986. This period is used because the data was not disaggregated by firm until 1982. The data is from JCTC and was compiled by Mr. David Johnston, Ministry of Agriculture, Hope, Jamaica. Also; the import figures prior to 1983 contained NFDM from the EEC which is a gift to Jamaica. It is used solely for the school lunch program. The EEC gift is not included in the data used to estimate the model.

All butter oil is imported. It is used to make fluid milk, condensed milk, evaporated milk, chocolates, ice cream, sour cream, malted milk, flavored powdered milk, yogurt, liquid breakfast, pastries, bread, and cookies. The variables to be included in the model are:

- a. Quantity of butter oil (BUTOILQ)(dependent variable)
- b. Weighted price of butter oil charged by JCTC for butter oil used for manufacturing and consumer purposes (BUTOILP)
- c. National disposable income (NDI)
- d. NFDM price (NFDMP)

Price is an important factor in the model. Manufacturers are assumed to respond to price very quickly because of the assumed response of consumers to the price changes of retail products. The price used is a weighted average price charged by the JCTC. This will reflect the prices of butter oil for different uses. The prices charged by distributors, wholesalers, and retailers drive off of the price charged by the JCTC. Therefore, The movement of the JCTC price is highly correlated with prices charged at the other levels of the marketing chain.

In 1983-84, The Jamaican people spent an average of 43.8% (Food Consumption Survey, *ibid*) of their income on food.

Therefore, national disposable income is included in the model.

NFDM is used in the manufacture of ice cream, evaporated milk, condensed milk etc. NFDM serves as a complement input into the manufacturing process. The price of NFDM is included in the model.

A quarterly model is used because of the lack of annual observations. A projection for the year is made by projecting for an average quarter and then taking that figure times four. Projections of the variables in the model are made in order to make projections for the next three years. The data (Tables D1 and D2) is deflated by the consumer price index in order to determine the movement of the price of butteroil relative to the other products in the economy. A log-linear functional form is estimated.

It was found that the projected market for butteroil in Jamaica in 1990 will be 51.7 percent higher than that projected for 1986 (Table D4). Although butteroil sales will grow in the future, these projections must be accepted as projections and that the actual observed quantity will differ from the projections (i.e., compare the actual and the projection for 1986 in Table D4). The adjusted R^2 for the model is .1847 which means that only 18.47 percent of the variability in the quantity of butteroil demanded is explained by the independent variables. This is not unusual for models based on quarterly data. Furthermore, the variables used to project butteroil sales are projections themselves. A difference in actual behavior and projected behavior of these variables will cause the projected quantity demanded of butteroil to be different from the actual quantity demanded. With that said, butteroil sales will grow in the future.

OBJECTIVE (b). Survey processed product variety (including exports/imports).

None.

OBJECTIVE (c). Identify brands and market shares.

The uses of butter oil are broken into three areas with the percentage of total usage in 1986 indicated in parenthesis. They are (a) condensed and evaporated milk (74.0%), (b) liquid milk (15.4%), (c) used to make ice cream, used in cooking, etc (10.1%). The remaining 0.5% goes into various other uses. The market shares by firm for each category are indicated in Table D3.

OBJECTIVE (d). Using available statistics, review commercial imports of the commodities in question to determine the extent to which PL-480 commodity affects commercial imports.

No PL-480 comes into the country; however, the EEC has been giving the Ministry of Education free butter oil and NFDM to produce milk for school children. The ministry has four plants and is building a fifth that produces the milk for the children. These imports are not included in the import figures (Table D4).

OBJECTIVE (e). Examine product pricing controls and guidelines.

The price of butter oil for all uses is controlled by the Government. When the price moves, it moves in large jumps. For example, the price of butter oil going into condensed milk sales did not change between January of 1981 and February of 1984 (Table D2). Then in March, the price increased from \$726.20 per 200 kg drum to \$1775, a 144% increase. The price increased the next April of 1985 by 17.7% to \$2088.68 per 200 kg drum and has remained there since. Changes similar in magnitude have occurred for butter oil used in fluid milk and ice cream.

The weighted average price for all uses of butter oil shows similar changes (Table D1).

OBJECTIVE (f). Identify and discuss conditions which impede market development.

- a. The price of butter oil.
- b. The price of products that use butter oil in the manufacturing process.

OBJECTIVE (g). Review commercial import statistics to determine the accuracy of current Usual Marketing Requirement calculations.

Not applicable.

OBJECTIVE (h). Determine the extent to which local processing capacity can absorb dairy commodity beyond those levels currently being imported.

Same as NFDM.

APPENDIX A

Table A1. Imports of Cheese^a

Year	Cheese Imports ^b	PL-480 Imports ^c	PL-480 %	DI Exfactory Sales
-----Metric Tons-----				
1973	4475.233			
1974	7202.570			
1975	5602.152			
1976	5303.964			
1977	2248.811			
1978	1878.875			
1979	1940.567			
1980	1074.513			
1981	1686.087			
1982	2777.833			
1983	1853.217			
1984	2107.468	659.015	31.3%	1663.710
1985	2566.171	1074.111	41.9%	2261.846
1986	3937.936	1350.91	34.3%	3566.284
1986 ^d				3770.44
1987 ^b				4369.18
1988 ^d				5263.07
1989 ^d				6278.15
1990 ^d				7409.89

a. Calendar year.

b. Includes cheese imports (JADF) under PL-480. Source: External Trade Yearbook, Jamaica, various issues.

c. Source: Sent to JADF from the Statistical Institute of Jamaica on a monthly basis.

d. Projected sales based on DI data from 1984-1987 (Table A2). Equation estimated is equation (5) in Appendix B.

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Table A2. Variables used to estimate the sales quantity for cheese.

OBS ^a	CHEESEQ ^b	PC ^c	NDI ^d	Se	CPIALL ^f	CPIMPF ^g
1	264.47	9724.48	7231.25	0	433.700	422.550
2	359.42	10059.27	7481.33	1	449.050	448.750
3	182.51	10204.65	7731.41	0	485.050	463.500
4	216.98	11814.75	7981.50	0	520.600	533.300
5	356.44	12046.02	8282.33	0	533.900	559.250
6	283.90	12407.25	8583.17	1	543.150	572.450
7	545.30	12407.25	8884.00	0	556.100	581.700
8	621.48	12407.25	9184.83	1	582.950	597.750
9	207.04	12407.25	9485.67	0	615.500	639.100
10	220.39	12407.25	9786.50	0	643.450	661.050
11	346.63	12407.25	10116.37	0	660.600	677.300
12	321.01	12847.77	10446.23	1	668.100	694.800
13	736.02	13946.86	10776.10	0	689.950	709.700
14	743.77	13940.26	11105.97	1	695.250	725.800
15	371.69	13940.26	11435.83	0	705.200	706.300
16	706.04	13944.66	11765.70	0	720.850	700.700
17	228.72	13894.00	12017.00	0	737.650	707.000
18	780.03	13933.65	12268.29	1	740.150	713.850
19	917.87	13944.66	12519.58	0	738.350	725.550
20	1293.78	13940.26	12770.88	1	749.911	750.041
21	418.48	13953.47	13022.17	0	761.472	774.531

a. Bi-monthly data starting with Jan-Feb 1984.

b. Metric tons of cheese. Calculated from monthly data provided by Dairy Industries.

c. J\$ per metric ton of assorted cheese (weighted average price). Calculated from monthly data provided by Dairy Industries.

d. National disposable income in millions of J\$. Calculated from National Income and Product, Jamaica, various issues. Linear interpolation between annual observations.

e. Variable used to capture the seasonal nature of cheese demand.

f. Consumer price index for all consumer products. Calculated from monthly data. The Statistical Institute of Jamaica.

g. Consumer price index for meat, poultry, and fish. Calculated from monthly data. The Statistical Institute of Jamaica.

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Table A3. Cheese brands and market shares for 1986^a.

<u>Brand</u>	<u>Share</u>
A (U.S)	20.84
B "	13.22
C "	4.53
D "	1.43
E "	3.90
F "	<u>0.00</u>
G (New Zealand)	31.09
H "	14.07
I "	4.80
J "	2.26
K "	3.86

a. Information obtained from Dairy Industries.

Table A4. Usual Marketing Requirements (UMR) for Cheese

	Cheese Imports ^a	UMR5 ^b (MT)	UMR4 ^c (MT)	UMR3 ^d (MT)	UMR2 ^e (MT)	UMR1 ^f (MT)
1978	1878.875	4966.546	5089.371	4384.976	3776.388	2248.811
1979	1940.567	4447.274	3758.451	3143.883	2063.843	1878.875
1980	1074.513	3394.874	2843.054	2022.751	1909.721	1940.567
1981	1686.087	2483.346	1785.692	1631.318	1507.54	1074.513
1982	2777.833	1765.771	1645.011	1567.056	1380.300	1686.087
1983	1853.217	1871.575	1869.750	1846.144	2231.960	2777.833
1984	2107.468	1866.443	1847.913	2105.712	2315.525	1853.217
1985	2566.171	1899.824	216.151	2246.173	1980.343	2107.468
1986	3937.936	2198.155	2326.172	2175.619	2336.820	2566.171
1987		2648.525	2616.198	2870.525	3252.054	3937.936
Average Error		1377.286	1153.025	890.483	800.647	667.815
Coefficient of Variation		78.4%	91.71%	98.61%	84.05%	63.85%
Standard Deviation of Error		1079.809	1057.402	878.082	672.912	426.402

- a. Cheese Imports are in Metric Tons.
- b. Five year moving average
- c. Four year moving average
- d. Three year moving average
- e. Two year moving average.
- f. One year moving average.

Table B1. Imports of Butter^a

Year	Butter Imports ^b	PL-480 Imports ^c	PL-480 %	DI exfactory Sales
-----Metric Tons-----				
1973	8137.422			
1974	8861.238			
1975	5125.157			
1976	7260.510			
1977	2254.574			
1978	1189.622			
1979	835.754			
1980	720.911			
1981	827.711			
1982	520.948			
1983	559.532			
1984	1054.585	667.593	63.3%	411.818
1985	389.561	203.147	52.1%	521.650
1986	1662.689	1203.292	72.4%	1487.062
1986 ^d				1404.780
1987 ^d				1498.700
1988 ^d				1717.920
1989 ^d				1959.200
1990 ^d				2219.790

a. Calendar year.

b. Includes butter imports (JADF) under PL-480. Source: External Trade Yearbook, Jamaica, various issues.

c. Source: Sent to JADF from the Statistical Institute of Jamaica on a monthly basis.

d. Projected sales based on DI data from 1984-1987 (Table B2). Equation estimated is equation (6) in Appendix B.

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Table B2. Variables used to estimate the sales quantity for butter.

OBS ^a	BUTTERQ ^b	PB ^c	NDI ^d	CPIALL ^e	CPIMPF ^f	BUTOILP ^g
1	11.822	11072.47	7231.25	433.700	422.550	863.97
2	1.653	11497.57	7981.50	520.600	533.300	1800.00
3	309.105	11473.34	8282.33	533.900	559.250	1800.00
4	89.238	11490.96	8583.17	543.150	572.450	1800.00
5	13.995	11475.55	8884.00	556.100	581.700	1800.00
6	104.950	10819.17	9184.83	582.950	597.750	1800.00
7	71.538	9861.04	9485.67	615.500	639.100	2088.68
8	44.514	10548.25	9786.50	643.450	661.050	2088.68
9	98.197	10486.58	10116.37	660.600	677.300	2088.68
10	188.457	9026.25	10446.23	668.100	694.800	2088.68
11	179.770	8640.80	10776.10	689.950	709.700	2088.68
12	183.134	9072.51	11105.97	695.250	725.800	2088.68
13	243.570	9325.81	11435.83	705.200	706.300	2088.68
14	334.076	10248.70	11765.70	720.850	700.700	2088.68
15	271.710	10830.18	12017.00	737.650	707.000	2088.68
16	274.802	11515.19	12268.29	740.150	713.850	2088.68
17	70.746	12605.48	12519.58	738.350	725.550	2088.68
18	138.126	11834.57	12770.88	749.911	750.041	2088.68
19	201.242	11581.27	13022.17	761.472	774.531	2088.68

a. Bi-monthly data starting with Jan-Feb 1984. Mar-Apr and May-Jun of 1984 are not available.

b. Metric tons of butter. Calculated from monthly data provided by Dairy Industries.

c. J\$ per metric ton of butter (weighted average price). Calculated from monthly data provided by Dairy Industries.

d. National disposable income in millions of J\$. Calculated from National Income and Product, Jamaica, various issues. Linear interpolation between annual observations.

e. Consumer price index for all consumer products. Calculated from monthly data. The Statistical Institute of Jamaica.

f. Consumer price index for meat, poultry, and fish. Calculated from monthly data. The Statistical Institute of Jamaica.

g. J\$ per 200 kg drum of butter oil.

Table B3. Butter brands and market shares for 1986^a.

<u>Brand</u>	<u>Share</u>	
A (U.S)	51.09	
B "	19.10	75.59
C "	5.40	
D (New Zealand)	<u>22.06</u>	
E	0.93	24.00
F	1.42	

a. Information obtained from Dairy Industries.

Table B4. Usual Marketing Requirements (UMR) for Butter

Year	Butter Imports ^f	UMR5 ^a	UMR4 ^b	UMR3 ^c	UMR2 ^d	UMR1 ^e
-----Metric Tons-----						
1978	1189.622	6327.780	5875.370	4880.080	4757.542	2254.57
1979	835.754	4938.220	3957.466	3568.24	1722.098	1189.622
1980	720.911	3333.123	2885.115	1426.65	1012.688	835.754
1981	827.711	2452.274	1250.215	915.429	778.333	720.911
1982	520.948	1165.714	893.500	794.792	774.311	827.711
1983	559.532	818.989	726.331	689.857	674.330	520.948
1984	1054.585	692.971	657.276	636.064	540.240	559.532
1985	389.561	736.737	740.694	711.688	807.059	1054.585
1986	1662.689	670.467	631.157	667.893	722.073	389.561
Average Error		1786.960	1412.610	1039.560	781.782	491.001
Coefficient of Variation		100.25%	112.26%	123.69%	139.42%	88.72%
Standard Deviation of Error		1791.42	1585.73	1285.79	1089.93	435.60

- a. Five year moving average
- b. Four year moving average
- c. Three year moving average
- d. Two year moving average
- e. One year moving average
- f. Metric tons.

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Table C1. Variables used to estimate the sales of NFDM

QTR	YEAR	NFDMQ ^a	NFDMP ^b	NDI ^c	D1 ^d	D2 ^e	CPIMPF ^f	BUTOILP ^g	CPIALL ^h
1	1982	1071.24	1836.57	4990.30	1	0	338.6	760.95	338.3
2	1982	1848.26	1693.40	5122.10	1	0	340.0	784.87	343.9
3	1982	2294.52	1635.69	5253.90	1	0	344.0	787.63	351.1
4	1982	2452.08	1685.03	5560.70	1	0	356.7	775.40	356.1
1	1983	2569.12	1722.91	5867.50	1	0	363.0	760.95	362.8
2	1983	2082.00	1726.88	6174.20	1	0	368.0	784.87	374.7
3	1983	2010.22	1718.95	6481.00	1	0	381.3	787.63	397.8
4	1983	2400.28	1764.76	6856.10	1	0	391.6	775.40	411.5
1	1984	2789.19	1698.68	7231.30	1	0	430.2	793.38	437.4
2	1984	2463.99	3665.65	7606.40	0	0	459.7	1785.18	474.5
3	1984	2175.86	3340.98	7981.50	0	0	539.6	1784.37	524.1
4	1984	1903.80	3644.06	8432.80	0	0	570.4	1785.39	541.1
1	1985	1859.70	3611.02	8884.00	0	0	584.9	1794.21	564.9
2	1985	3240.77	4226.44	9335.30	0	1	627.5	2088.68	608.4
3	1985	1944.14	4282.83	9786.50	0	1	664.3	2088.68	650.3
4	1985	1602.76	4271.82	10281.30	0	1	691.1	2088.68	667.9
1	1986	2118.30	4243.18	10776.10	0	1	713.4	2088.68	690.2
2	1986	2428.36	3575.78	11270.90	0	1	714.5	2088.68	703.4
3	1986	1775.66	3589.88	11765.70	0	1	702.4	2088.68	725.0
4	1986	2345.48	3560.80	12142.64	0	1	712.0	2088.68	742.3

a. Metric tons of NFDM. Calculated from monthly data provided by JCTC and compiled by David Johnston, Ministry of Agriculture.

b. J\$ per metric ton of NFDM (weighted average price). Calculated from monthly data provided by JCTC and compiled by David Johnston.

c. National disposable income in millions of J\$. Calculated from National Income and Product, Jamaica, various issues. Linear interpolation between annual observations.

d. Variable used to capture the the change in government price, first quarter of 1982 through the first quarter of 1984.

e. Variable used to capture the the change in government price, second quarter of 1985 through the last quarter of 1986.

f. Consumer price index for meat, poultry, and fish. Calculated from monthly data. The Statistical Institute of Jamaica.

g. J\$ per 200 kg drum of butter oil. Source: David Johnston.

h. Consumer price index for all consumer products. Calculated from monthly data. The Statistical Institute of Jamaica.

Table C2. NFDM data used to calculate the weighted average price NFDMP (Table C1)

QTR	Year	Over Counter		Nestles		Other	
		Quantity ^a	Price ^b	Quantity ^a	Price ^b	Quantity ^a	Price ^b
1	1982	13049	28.88	15532	33.45	18610	57.55
2	1982	15442	28.88	46200	33.45	19779	57.55
3	1982	11964	28.88	71396	33.45	17720	57.55
4	1982	11962	28.88	72290	33.45	23769	57.55
1	1983	14962	28.88	68778	33.45	29437	57.55
2	1983	11186	28.88	56515	33.45	24017	57.55
3	1983	5539	28.88	61484	33.45	21533	57.55
4	1983	7632	28.88	67671	33.45	30436	57.55
1	1984	35456	28.88	54656	33.45	32760	57.55
2	1984	17396	59.95	67296	86.50	23854	90.91
3	1984	42288	59.95	30766	86.50	22799	90.91
4	1984	14869	59.95	51281	86.50	17718	90.91
1	1985	17939	59.95	40166	86.50	23820	90.91
2	1985	36429	88.27	80894	96.34	25442	105.65
3	1985	23718	88.27	33272	96.34	28655	105.65
4	1985	20020	88.27	28447	96.34	22139	105.65
1	1986	24293	88.27	48203	96.34	20821	105.65
2	1986	21720	88.27	63731	70.49	21525	105.65
3	1986	5173	88.27	51189	70.49	21861	105.65
4	1986	6998	88.27	69477	70.49	26850	105.65

a. 50 pound bag. Source: JCTC and compiled by David Johnston.

b. Price per 50 pound bag, J\$. Source: David Johnston.

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Table C3. NFDM Market Shares

Firm	1982	1983	1984	1985	1986	1987a
Condensed, Evaporated etc.	57.8%	63.7%	49.6%	48.1%	60.9%	69.4%
Jamaica Milk Products	100	100	100	100	100	100
Liquid Milk Processors	19.4	21.2	18.7	21.0	17.5	10.1
Challenge Enterprises	2.5	8.7	15.9	12.8	21.2	26.6
Cornwall Dairy	11.2	12.3	5.1	-	-	-
Crema	65.2	54.9	37.8	45.4	55.0	43.5
Island Dairy	4.2	2.9	3.9	1.8	11.4	14.3
United Dairy Farms	16.9	21.2	37.3	40.0	12.4	15.6
Total	100	100	100	100	100	100
Over the Counter	18.3	9.8	26.8	25.8	15.2	15.3
Creole Kitchen	N/A	-	-	-	-	3.0
Facey Commodity	N/A	-	-	5.4	13.3	7.6
Francis Agencies	N/A	-	0.5	2.2	-	-
G.L. Foods	N/A	-	-	-	-	2.7
Geddes Grant	N/A	-	1.4	12.2	15.3	16.6
Grace Kennedy	N/A	38.2	33.8	33.8	17.1	30.6
Hand Arnold	N/A	14.7	10.9	11.2	9.2	8.6
J.H. Mapp	N/A	-	-	-	2.7	5.3
Lascelles	N/A	29.3	34.4	18.9	22.2	9.8
Meat Plus	N/A	-	2.3	1.2	4.0	1.3
Mussons	N/A	17.8	16.7	14.7	15.0	10.3
Seaburg Trading	N/A	-	-	-	-	4.2
Miscellaneous	N/A	-	-	0.4	1.2	-
		100	100	100	100	100
Ice Cream, etc.	3.0	3.4	3.3	3.8	4.3	3.4
A. Benjamin	-	52.4	-	-	-	-
Creamy Corner	19.8	24.0	40.5	26.1	33.9	15.1
Concorde Enterprises	37.7	-	40.6	3.5	-	-
Consolidated Dairy	4.3	8.7	5.3	-	-	1.4
Country Cream	-	-	-	-	-	4.0
Dairy Industries	30.2	9.5	11.9	19.9	13.3	34.8
Frozen Novelties	8.0	5.4	-	-	-	-
Jack Horner	-	-	1.7	2.0	12.9	22.3
Restaurants Jamaica	-	-	-	-	-	1.9
S&S Distributors	-	-	-	48.5	36.8	20.5
Other					3.1	-
	100	100	100	100	100	100
Other	1.5	1.9	1.6	1.3	2.1	1.8

a. January - May, 1987

b. Includes A. Benjamin and Frozen Novelties

c. Source: JCTC and compiled by David Johnston.

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Table C4. NFDM Imports

	Commercial Imports ^a	Total Imports ^b
	-----Metric Tons-----	
1973	-	13850.455
1974	-	26238.129
1975	-	9738.800
1976	-	24197.169
1977	-	7819.064
1978	-	13639.020
1979	-	10304.073
1980	-	11440.793
1981	-	10867.427
1982	7.666	10069.543
1983	9.062	7945.193
1984	9.333	10670.039
1985	8.625	9811.302
1986	8.668	10959.522
1986 ^c	13.551	
1987 ^c	16.754	
1988 ^c	19.237	
1989 ^c	21.580	
1990 ^c	23.784	

a. Source: JCTC, compiled by David Johnston, Ministry of Agriculture.

b. Includes the EEC gift to the school lunch program. Source: External Trade Yearbook, Jamaica, various issues.

c. Projected sales based on JCTC data from 1982-1986 (Table C1). Equation estimated is equation (7) in Appendix B.

Table C5. NFDM prices per 50 pound bag^a

Quarter	Year	JCTC Cost	Weight Price	Over-Counter	Nestles	Other
1	1982	\$ 54.90	\$41.69	\$28.88	\$33.45	\$57.55
2	1982	54.90	38.44	28.88	33.45	57.55
3	1982	54.90	37.13	28.88	33.45	57.55
4	1982	54.90	38.25	28.88	33.45	57.55
1	1983	54.90	39.11	28.88	33.45	57.55
2	1983	54.90	39.20	28.88	33.45	57.55
3	1983	54.90	39.02	28.88	33.45	57.55
4	1983	54.90	40.06	28.88	33.45	57.55
1	1984	54.90	38.56	28.88	33.45	57.55
2	1984	84.95	83.21	59.95	86.50	90.91
3	1984	84.95	75.84	59.95	86.50	90.91
4	1984	84.95	82.72	59.95	86.50	90.91
1	1985	84.95	81.97	59.95	86.50	90.91
2	1985	103.83	95.94	88.27	96.34	105.65
3	1985	103.83	97.22	88.27	96.34	105.65
4	1985	103.83	96.97	88.27	96.34	105.65
1	1986	103.83	96.32	88.27	96.34	105.65
2	1986	103.83	81.17	88.27	70.49	105.65
3	1986	103.83	81.49	88.27	70.49	105.65
4	1986	103.83	80.83	88.27	70.49	105.65
1	1987	126.50	96.22	32.00	70.34	260.00
2	1987	126.50	90.23	32.00	70.34	260.00

a. Source: JCTC¹ and compiled by David Johnston.

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Table C6. The Capacity Utilization of Firms Using NFDM

		Capacity Utilization
A. Condensed and Evaporated Milk Jamaica Milk Products ^a		80%
B. Fluid Milk Processors ^b		
	Imperial Qts.	
Century	33,310	
Challenge	6,662	
Cornwall (Coming back in business)	18,320	
Cremo	5,330	
Island	2,165	
Jamaica Milk Products	14,490	
Rockfield	2,332	
Serge Island	18,320	
United Dairy Farmers	<u>53,296</u>	
	154,225	qts. per 8
hr. day		
@ 16 hours per day, 250 days per year, annual capacity is:		
77,112,500 Imperial quarts.		
1986 grade A milk sales to processors	16,168,149	Imp. qts.
1986 NFDM to processors (Liq. milk Eq.)	<u>15,192,780</u>	Imp. qts.
	31,360,929	Imp. qts.
		40.7%
C. Over the counter ^b		100%

a. Industry sources.

b. David Johnston, Ministry of Agriculture, Hope, Jamaica.

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Table D1. Variables used to estimate the sales of butter oil.

QTR	YR	BUTOILQ ^a	BUTOILP ^b	NDI ^c	NFDMP ^d	CPIALL ^e
1	1983	1830.0	3804.75	5867.50	39.11	362.8
2	1983	543.4	3924.35	6174.20	39.20	374.7
3	1983	615.4	3938.15	6481.00	39.02	397.8
4	1983	790.8	3877.00	6856.10	40.06	411.5
1	1984	661.2	3966.90	7231.30	38.56	437.4
2	1984	752.8	8925.90	7606.40	33.21	474.5
3	1984	507.2	8921.85	7981.50	75.84	524.1
4	1984	535.2	8926.95	8432.80	82.72	541.1
1	1985	285.2	8971.05	8884.00	81.97	564.9
2	1985	522.6	10443.40	9335.30	95.94	608.4
3	1985	490.4	10443.40	9786.50	97.22	650.3
4	1985	242.6	10443.40	10281.30	96.97	667.9
1	1986	365.0	10443.40	10776.10	96.32	690.2
2	1986	443.6	10443.40	11270.90	81.17	703.4
3	1986	505.2	10443.40	11765.70	81.49	725.0
4	1986	310.2	10443.40	12142.64	80.83	742.3

a. Metric tons of butter oil. Calculated from monthly data provided by JCTC and compiled by David Johnston, Ministry of Agriculture.

b. J\$ per metric ton of butter oil (weighted average price). Calculated from monthly data provided by JCTC and compiled by David Johnston.

c. National disposable income in millions of J\$. Calculated from National Income and Product, Jamaica, various issues. Linear interpolation between annual observations.

d. J\$ per 50 pound bag NFDM (weighted average price). Calculated from monthly data provided by JCTC and compiled by David Johnston.

e. Consumer price index for all consumer products. Calculated from monthly data. The Statistical Institute of Jamaica.

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Table D2. Butter oil data used to calculate the weighted average price BUTOILP (Table D1).

QTR	Year	Nestles		Other	
		Quantity ^a	Price ^b	Quantity ^a	Price ^b
1	1983	6842	726.20	2308	863.97
2	1983	1560	726.20	1157	863.97
3	1983	1705	726.20	1372	863.97
4	1983	2542	726.20	1412	863.97
1	1984	1694	726.20	1612	863.97
2	1984	2232	1775.00	1532	1800
3	1984	1586	1775.00	950	1800
4	1984	1564	1775.00	1112	1800
1	1985	330	1775.00	1096	1800
2	1985	1612	2088.68	1001	2088.68
3	1985	1700	2088.68	752	2088.68
4	1985	610	2088.68	603	2088.68
1	1986	1326	2088.68	499	2088.68
2	1986	1769	2088.68	449	2088.68
3	1986	2098	2088.68	428	2088.68
4	1986	814	2088.68	737	2088.68
1	1987	2736	2088.68	704	2088.68

- a. Quantity in number of 200 kg drums.
- b. Price per 200 kg drum.
- c. Source: JCTC and compiled by David Johnston.

Table D3. Butteroil Marketshares

Firm	1982	1983	1984	1985	1986	1987a
Condensed, Evaporated, etc.	74.5	66.9	57.6	55.2	74.0	79.4
Jamaica Milk Products	100	100	100	100	100	100
Liquid Milk Processors	20.1	26.0	33.6	29.6	15.4	13.3
Challenge Enterprises	15.4	15.9	32.4	29.9	51.9	38.2
Cornwall Dairy	11.2	8.4	4.8	-	-	-
Crema	55.5	60.6	33.3	25.4	8.4	35.6
Island Dairy	5.6	4.2	4.0	3.3	19.3	12.9
United Dairy Farms	12.3	10.9	25.5	41.4	20.4	13.3
TOTAL	100	100	100	100	100	100
Ice Cream, etc.	4.8	6.5	3.0	15.0	10.1	6.8
A. Benjamin	-	55.0	-	-	-	-
Creamy Corner	35.4	29.8	42.0	24.5	35.8	30.1
Concorde Enterprises ^b	51.0	-	43.0	4.0	-	-
Consolidated Dairy	4.0	8.6	8.6	2.9	4.3	4.4
Country Cream	-	-	-	-	-	4.4
Frost Ice Cream	-	-	-	1.3	-	-
Frozen Novelties	9.6	6.6	-	-	-	-
Jack Horner	-	-	6.4	8.7	19.4	33.5
S&S Distributors	-	-	-	58.6	35.0	27.6
Others	-	-	-	-	5.5	-
TOTAL	100	100	100	100	100	100
Other	0.6	0.6	0.8	0.2	0.5	0.5

a. January-May

b. Includes A. Benjamin and Frozen Novelties

c. Source: JCTC and compiled by David Johnston.

Table D4. Butteroil Imports

	Metric Tons
1982	3367
1983	3779.6
1984	2456.4
1985	1540.8
1986	1624.0
1986a	1976.3
1987a	2215.54
1988a	2467.32
1989a	2729.16
1990a	2997.27

- a. Projected sales using equation (8) in appendix B.
- b. Source: JCTC and compiled by David Johnston.

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APPENDIX B

B-

APPENDIX B

The equations in this appendix are used to project the future sales of cheese, butter, nonfat dry milk, and butter oil. The numbers in { } are standard errors.

- (1) $CPIALL = (87.197059 - 18.27442 * OBS18 + 3.131953 * (OBS18 ** 2)) / 100;$
 {20.45} {5.23} { .2824}
 Adjusted R² = .9854
- (2) $CPIMPF = 94.786364 + 4.485964 * OBS13 + 3.821628 * (OBS13 ** 2);$
 {40.07} {14.17} {1.06}
 Adjusted R² = .9635
- (3) $NDI = 2888.084091 - 359.12545 * OBS13 + 89.077348 * (OBS13 ** 2);$
 {344.38} {121.80} {9.12}
 Adjusted R² = .9881
- (4) $CPIDP = 119.221402 - 17.524973 * OBS13 + 6.304281 * (OBS13 ** 2);$
 {36.93} {13.06} { .9781}
 Adjusted R² = .9787
- (5) $CHEESEQ = (EXP(-66.613744 - (2.18832 * LOG(PC / CPIALL)))$
 {43.33} {1.44}
- $+ (8.427395 * LOG(NDI / CPIALL)))$
 {3.68}
- $+ (.267717 * .33) + (5.852431 * LOG(CPIMPF / CPIALL))) * 6;$
 { .2326} {4.27}
- Adjusted R² = .3138
- (6) $BUTTERQ = (EXP(-42.771058 - (4.329907 * LOG(PB / CPIALL)))$
 {111.2} {1.35}
- $+ (9.404235 * LOG(NDI / CPIALL)))$
 {10.27}
- $+ (.837304 * LOG((BUTOILP / 5) / CPIALL)))$
 {3.40}
- $+ (1.132183 * LOG(CPIMPF / CPIALL))) * 6;$
 {12.22}
- Adjusted R² = .3443
- (7) $NFDMQ = (-26535 - 6.536843 * (NFDMQ / CPIALL) + 7.961744 * (NDI / CPIALL)$
 {9289} {3.46} {2.40}
- $+ 3331.756943 * (0) + 703.966642 * (1) + 88.34092 * (CPIMPF / CPIALL)$
 {1109} {333} {48.08}
- $+ 34.019256 * ((BUTOILP / 5) / CPIALL)) * 4;$
 {12.03}
- Adjusted R² = .2826

$$\begin{aligned}
 (8) \quad \text{BUTOILQ} &= (\text{EXP}(-15.255345 - (2.336098 * \text{LOG}(\text{BUTOILP}/\text{CPIALL}))) \\
 &\quad \{46.16\} \quad \{1.19\} \\
 &+ (4.404637 * \text{LOG}(\text{NDI}/\text{CPIALL})) \\
 &\quad \{5.92\} \\
 &+ (2.339268 * \text{LOG}((\text{NFDMP}/44.053)/\text{CPIALL}))) * 4; \\
 &\quad \{1.52\} \\
 &\quad \text{Adjusted } R^2 = .1847
 \end{aligned}$$

where EXP means exponential, LOG is the natural log to the base e, 4 is 4 quarters, 6 is for 6 bi-months, * means multiply, and ** means taken to the power of.

Part of the data used in the equations to make projections is:

Year	OBS18	OBS13	OBS10	PC	PB	NFDMP	BUTOILP
1986	17	12	9	\$13938.08	\$10098.6	\$3737.72	\$10443.4
1987	18	13	10	\$16679.7	\$12085	\$4472.93	\$12497.62
1988	19	14	11	\$19341.78	\$14013.77	\$5186.81	\$14492.24
1989	20	15	12	\$22223.71	\$16101.82	\$5959.64	\$16651.58
1990	21	16	13	\$25326.14	\$18349.63	\$6791.61	\$18976.14

where the prices are in dollars per metric ton. The variables are defined in the text. The 1986 price is an actual price. The other prices were projected based on the annual percentage increase of the consumer price index for dairy products, fats, and oils. Those percentages are 19.67%, 15.96%, 14.90%, and 13.96%.