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AEC Staff Paper 87-98

December 1987

A SCENARIO FOR AGRICULTURE IN THE 1990'S—USING "AGMOD"

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An integral facet of marketing is forecasting. Many resources are devoted to looking ahead at the next few months and a year or so ahead. Less effort is expended on forecasting over the long run, generally considered to be five or more years into the future. Yet many crucial decisions are based on some presumptions regarding what will happen in the coming decade or two. Our "wish list" would include not only some method to establish what the world will be like a decade from now but also what will be the path from now until then.

We see "through the glass darkly" in attempting to forecast many years into the future and need to use caveats liberally when doing so. Difficult as it is, we have no choice. We must try. The development of computer technology has enabled us to integrate more information more quickly and efficiently than has been possible in the past. These quantitative tools in combination with the subjective judgement should provide clearer insights about the probable scenarios of the coming decade.

The capacity of micro computer software has expanded in recent years to the point where fairly substantial econometric analysis is possible. One such program is MICRO TSP, commercial software developed by David M. Lilien of Quantitative Micro Software. The most recent version allows one to deal with up to 300 variables and 10,000 data points. Not only is this program convenient for measurement of demand and supply

relationships but it also facilitates integrating them into complex systems. The process is called "model building".

An example of such a model is "AGMOD", developed this past year as a representation of U.S. and world agriculture. The most salient annual data were selected for the model which includes 290 variables and 206 equations. A schematic of the model is presented in Figure 1. The model is capable of generating projections, year by year, for a number of years into the future. The year 2000 has been selected as the termination.

This model or any model of this kind can not encompass all the complexities of U.S. and world agriculture. Essential to the long term projections are the underlying assumptions. It is crucial that these assumptions be reasonable. A valuable trait of the model is that the assumptions can be easily changed. Alternative views can be assessed very quickly to determine what the impact would be. The model is designed to handle "what if" questions. Changes in government crop estimates or modifications of farm programs can also be easily incorporated.

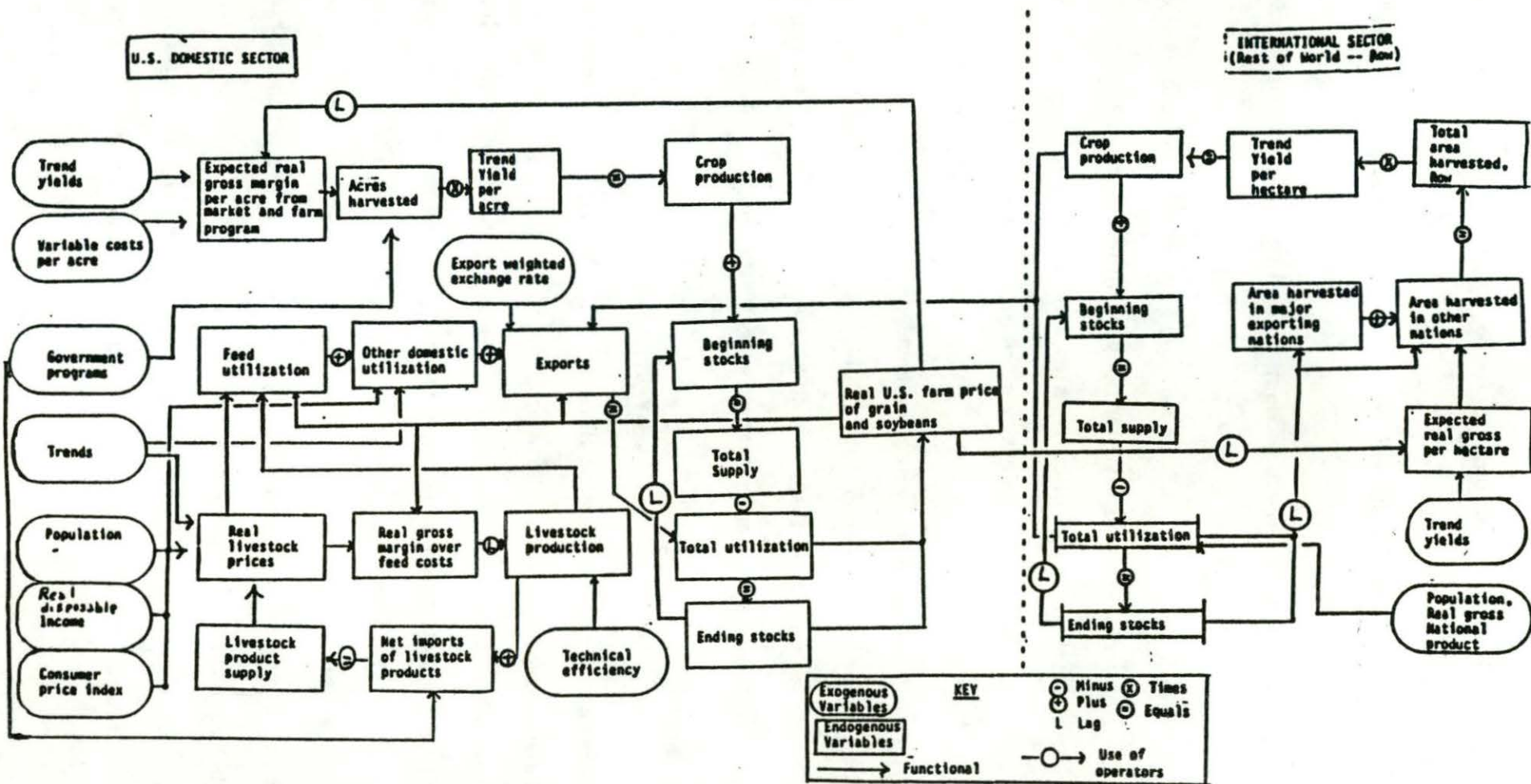
ASSUMPTIONS

Most of the data and analysis span the period from 1960 to 1986. A first step in getting a perspective on the future is to have a comprehensive set of historical data. The assumptions about the future draw heavily from past trends although not entirely. The major assumptions about the 1988-2000 period were as follows:

1. No major war.
2. No major departure from average weather.
3. No major climate shifts
4. Crop yields and livestock production rates will increase in line with past trends.
5. U.S. population will increase by an average of .80 percent per year.

FIGURE 1

AGMOD



6. World population outside of the U.S. will increase by 1.62 percent per year.
7. Real disposable income per capita in the U.S. will increase by 1 percent per year.
8. Real gross domestic product per capita outside of the U.S. will increase by 1 percent per year.
9. Inflation in the U.S. as measured by the CPI will increase by 4 percent per year through 1990 and 3.5 percent per year afterward.
10. Farm mortgage interest rates will converge to 5 percent in real terms, ie. 5 percentage points over the inflation rate.
11. Foreign exchange rates will continue near the low level of 1987 until 1991 when a rise will commence.
12. The Food Security Act will continue through 1990 modified by the budget legislation of December 1987. After 1990, support levels will be held constant in nominal terms at the 1990 rates.

SITUATION

The results of the analysis are illustrated in the charts in Appendix A. Figure A-1 captures the essence of the U.S. farm problem of recent years. This chart depicts the trends from 1960 to 1986 in real gross domestic product per capita outside the U.S. compared with per capita consumption of coarse grain outside the U.S. Rapid economic growth, particularly in the less developed nations, during the 1970's was accompanied by a rapid expansion in consumption of coarse grain mostly through livestock. The worldwide recession which commenced in the early 1980's resulted in an actual decline in per capita consumption of coarse grain outside the U.S.

U.S. agriculture rapidly became export oriented during the 1970's on coarse grain and other products as well. What triggered the recession is not entirely clear but many

believe that rising interest rates resulting from certain excesses of the 1970's and efforts to curb inflation were responsible. The value of the dollar increased which hampered the competitive position of U.S. agriculture in international markets. The result was an actual decline in U.S. agricultural exports during the first half of the 1980's--an event hardly conceivable in the 1970's. Farmers who became highly leveraged were also severely hurt by the unexpectedly high interest rates.

While production increased markedly in some areas of the world to shunt U.S. exports, a major contributing factor was also lagging world demand. This can be seen on both coarse grain and wheat in Figures A-2 and A-3. If even a modest growth rate of 1 percent per year in gross domestic product can be achieved, grain consumption should increase outside the U.S. at a pace that will challenge production. U.S. exports should expand through the mid 1990's.

A handicap to profitable market prices on grain and soybeans is the large carry-over going into the 1987 crop year (Figure A-4). The carryover of wheat in relation to utilization was 82 percent, just under the peak of the year before when the carry over was about equal to annual use. Feed grain carry-over, at two-thirds of annual use, was a record. Soybean carry-over was also relatively high. Prospects are good, as illustrated in Figure A-4 that the carryovers will be down to target levels by the early 1990's.

Reducing carryovers is key to price improvement. For example, real and nominal U.S. corn prices are charted in Figure A-5. If that chart were superimposed in Figure A-4, the close inverse relationship between feed grain carryover and corn prices would be apparent. The scenario for 1988-2000 points to sharply higher corn prices in nominal terms in the early 1990's, followed by a decline, then another rise. In real terms (deflation by the CPI, 1967=1.00), prices will follow the general pattern of the nominal levels but will remain below the decades of the 1960's and 1970's.

FIELD CROPS

The projected reduction in carry over should not be interpreted as the end to the surplus problem. The reduction in stocks will be achieved by holding land out of production, as illustrated in Figures A-6 and A-7. The slack from set aside acres is charted as the difference between the two lines in each figure. The decline into the early 1990's in the total of harvested and set-aside acres represents land going into the Conservation Reserve which is a 10 year commitment. While the set-aside may be phased out, land will remain idle in the Conservation Reserve. The expansion in acreage projected for the mid 1990's could easily be accommodated if the Secretary of Agriculture allows termination of the CR contracts.

The Feed Grain and Wheat Programs have been very attractive relative to not participating in recent years (Figures A-8 and A-9). Real returns to participants will likely edge lower through 1990 while returns to non-participants close the gap. Possibilities are quite real that farm programs as structured today could be phased out in the 1990's due as much to market conditions as a resolve of the Administration.

The projected returns on other crops of importance to Michigan agriculture are presented in Figures A-10 and A-11. Returns from soybeans are expected to increase noticeably into the early 1990's. Improved returns are also projected for dry beans. The outlook for sugar beet returns is very much a judgement call. It all depends on farm legislation. Domestic sugar prices will likely remain well above the international level as long as the current program, due to expire in 1990, remains in effect. As a point of departure, the projected real returns over variable costs to Michigan sugar beet growers were based on the assumption that the support level will remain constant in nominal terms after 1990.

LIVESTOCK

Of major concern to the livestock industry has been the persistent climb in poultry meat and seafood consumption (Figure A-12). Demand is measured by looking at both per capita consumption and price. Demand analysis indicates a noticeable decline for both cattle and hogs since the late 1970's. Some evidence indicates that this down trend leveled off in 1987 but no significant reversals were detected. Projections show a continued shift to "white meat" until the late 1990's. The underlying assumption is that the decline in demand for beef and pork will level off in the 1990's but will not increase.

After declining for many years, the demand for milk strengthened in the 1980's. However, production more than kept pace which necessitated the Dairy Termination Program. As shown in Figure A-13, per capita production, as a proxy for consumption, is expected to be maintained slightly above the levels of recent years. In spite of a continued expansion in milk production in total, milk cow numbers are expected to resume a decline (Figure A-14). Some further decline in per capita production is projected for eggs.

While beef cow numbers turned up slightly on January 1, 1987, odds are that this is not the beginning of a major expansion. More likely, beef cow numbers will stabilize until a clearer indication emerges that demand for beef is strengthening (Figure A-15). This may develop in the late 1990's. Increasing feeder calf prices may generate a small expansion in the meantime, but that will not likely continue as long as beef demand is slipping.

The risky business of cattle feeding is demonstrated in Figure A-16. Returns were relatively favorable in 1987 but are likely to fall off in 1988. Net margins will continue to fluctuate over a wide range. Figure 16 likely understates the prospective variation.

The contrast in variability of net returns over feed costs between milk and hog production can be seen in Figure A-17. As support prices are lowered in 1988 and as feed prices rise, dairy profits are likely to be squeezed in the next few years with little

recovery in the 1990's. Hog profits will decline noticeably in 1988 from the relatively high levels of 1987. While variability will continue, net returns to hog producers in the 1990's will average near the levels of the past.

Egg and turkey producers will also feel the effect of rising market prices on feed grain and meal. However, real net margins are projected to level off from the persistent declines of the 1960's and 1970's (Figure A-18).

FARM LAND

A key indicator of the economic health of agriculture is the land market. The optimism of the 1970's is reflected in Corn Belt farm land prices which reached a peak over \$1700 in 1981 (Figure A-19). Prices have since dropped in half with evidence in 1987 that the market is near a bottom. This is supported by the relationships between returns from major crops and the cost of owning land.

While land prices in some areas have actually increased in the past year, the outlook for returns to land and interest rates would point to a relatively stable land market into the early 1990's. While the higher returns from major crops in the mid 1990's would eventually push up land prices, the real price of land is not likely to reach the peak of the early 1980's--at least in this century.

BUDGET DATA

A series of prices and net margins on major crops and livestock for 1980 to 2000 are tabulated in Appendix B. These are in nominal terms. The assumed level for the Consumer Price Index is also included for estimating real prices and returns. Simply divide the prices or net margins by the CPI to generate real figures in 1967 dollars. These data may be helpful for budgeting a number of years into the future.

CONCLUDING STATEMENT

The set of projections in this paper are presented not to suggest that the future can be forecast with the precision indicated. The purpose is to stimulate interest in long range planning and discussion about the long range prospects. Whether or not the projections are believed, and understanding of past trends can provide a base for readers to construct their own scenarios about the coming decade.

Figure A-1

PER CAPITA CONSUMPTION OF COARSE GRAIN OUTSIDE THE U.S.
 COMPARED WITH REAL GROSS DOMESTIC PRODUCT PER CAPITA

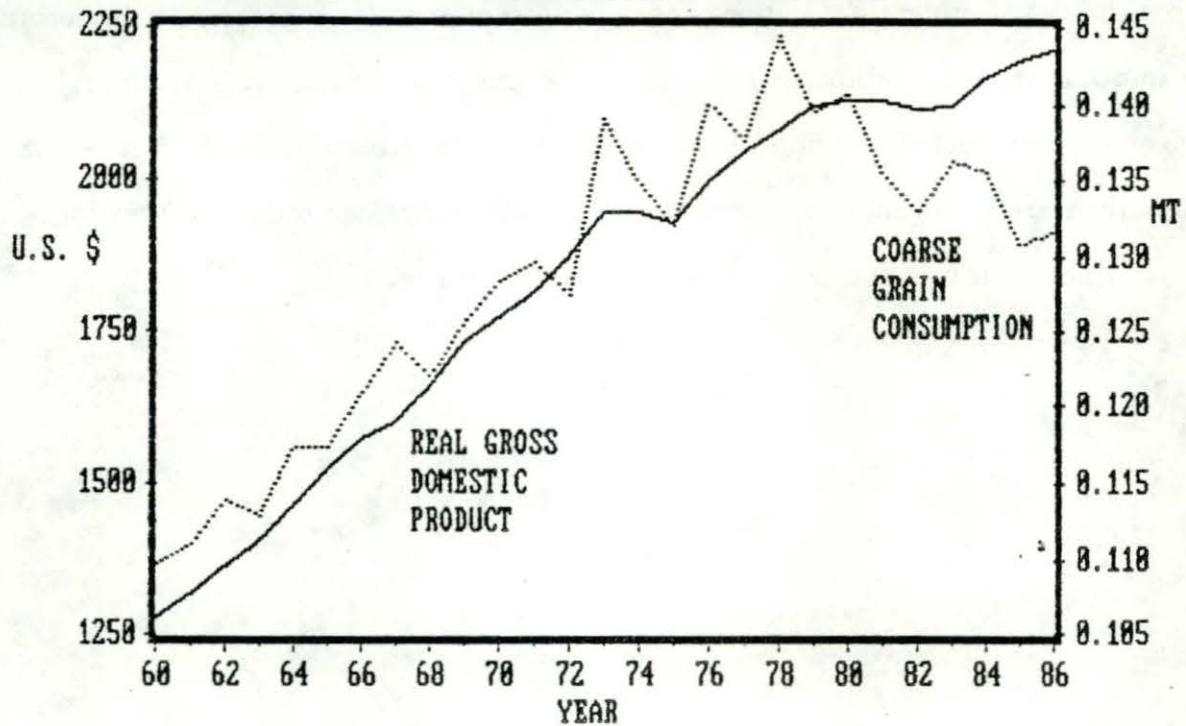


Figure A-2

TRENDS AND PROJECTIONS OF COARSE GRAIN PRODUCTION AND CONSUMPTION
 OUTSIDE OF THE U.S.

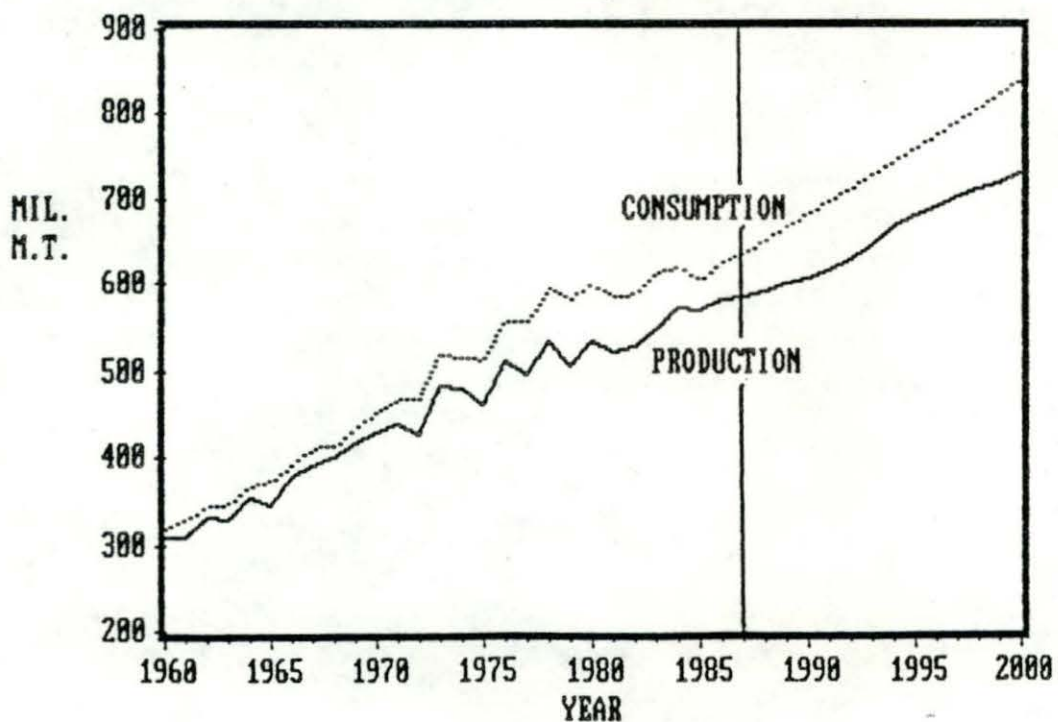


Figure A-3

TRENDS AND PROJECTIONS OF WHEAT PRODUCTION AND CONSUMPTION
OUTSIDE OF THE U.S.

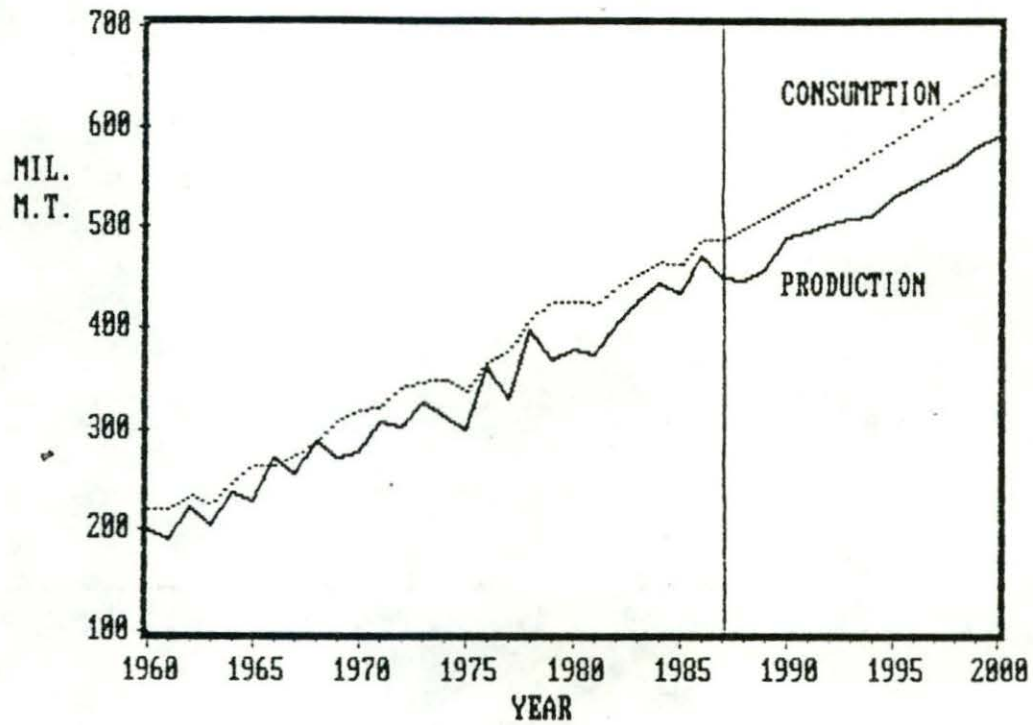


Figure A-4

ENDING STOCKS OF FEED GRAIN, WHEAT, AND SOYBEANS AS A RATIO TO USE
1960 TO 1986 AND PROJECTED TO 2000

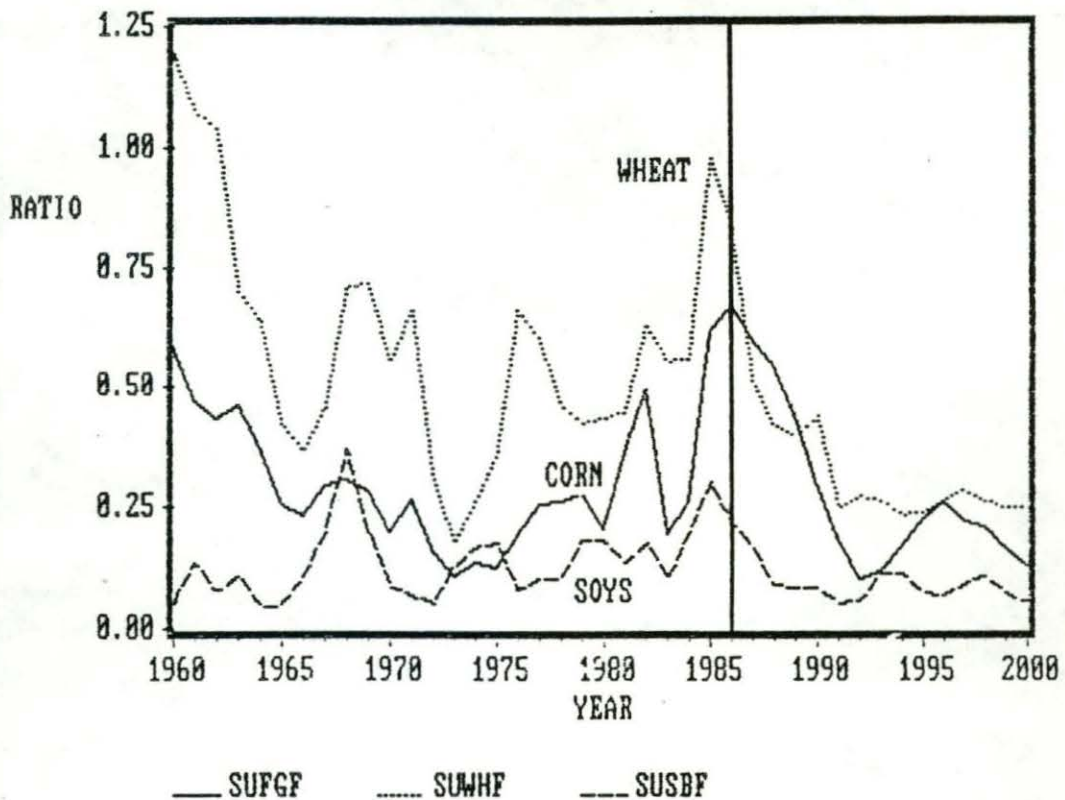


Figure A-5

REAL AND NOMINAL PRICE RECEIVED BY FARMERS FOR CORN*
1968 TO 1987 AND PROJECTED TO 2000

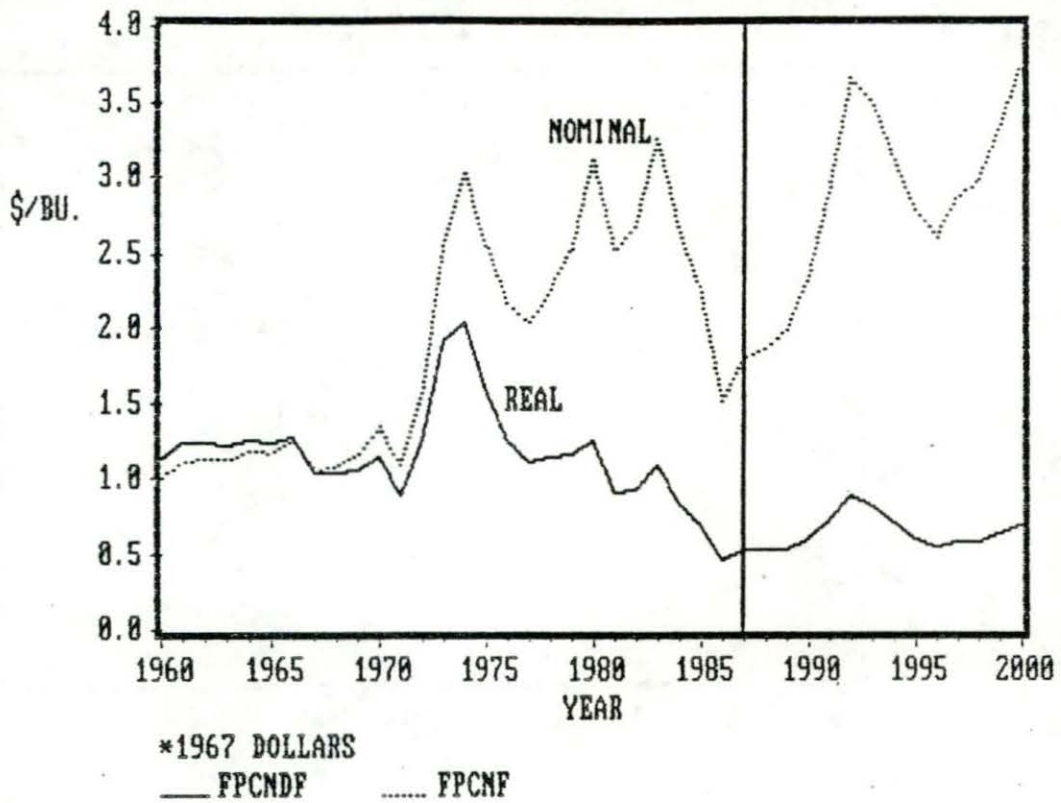


Figure A-6

ACRES OF CORN HARVESTED AND IN SET-ASIDE
1968 TO 1987 AND PROJECTED TO 2000

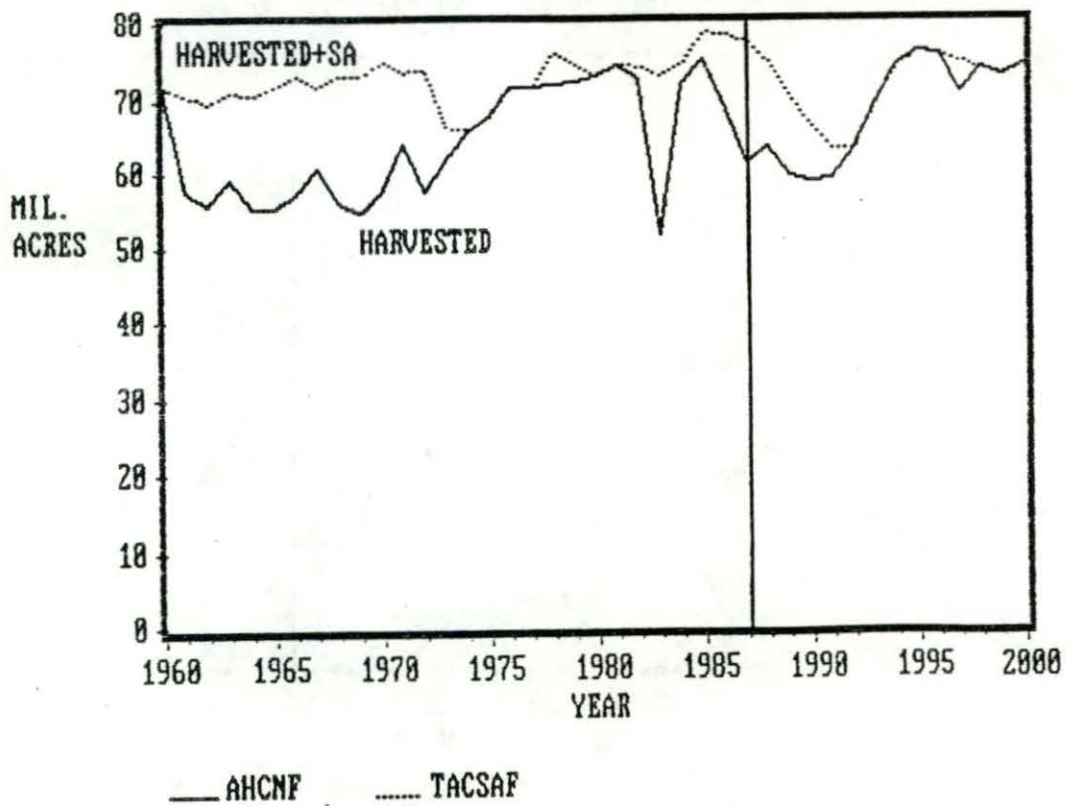


Figure A-7

ACRES OF WHEAT HARVESTED AND IN SET-ASIDE
1968 TO 1987 AND PROJECTED TO 2000

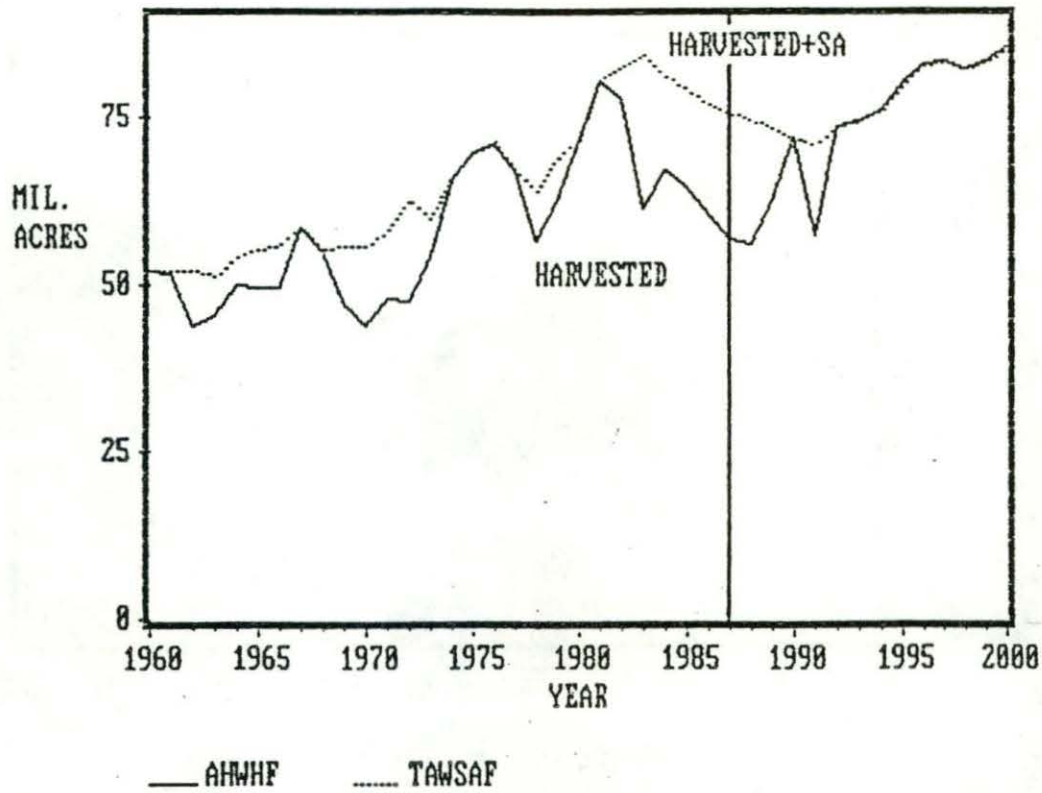


Figure A-8

REAL NET MARGINS OVER VARIABLE COSTS IN CORN PRODUCTION*
1968 TO 1987 AND PROJECTED TO 2000

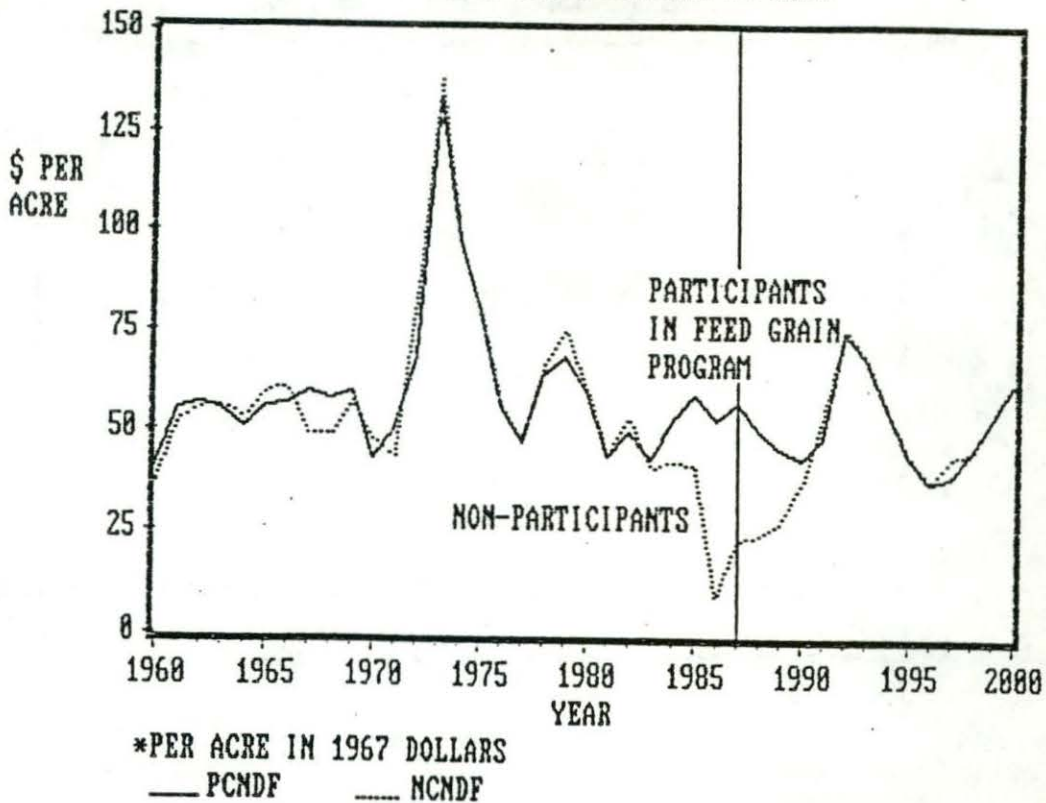


Figure A-9

REAL NET MARGINS OVER VARIABLE COSTS IN WHEAT PRODUCTION*
1968 TO 1987 AND PROJECTED TO 2000

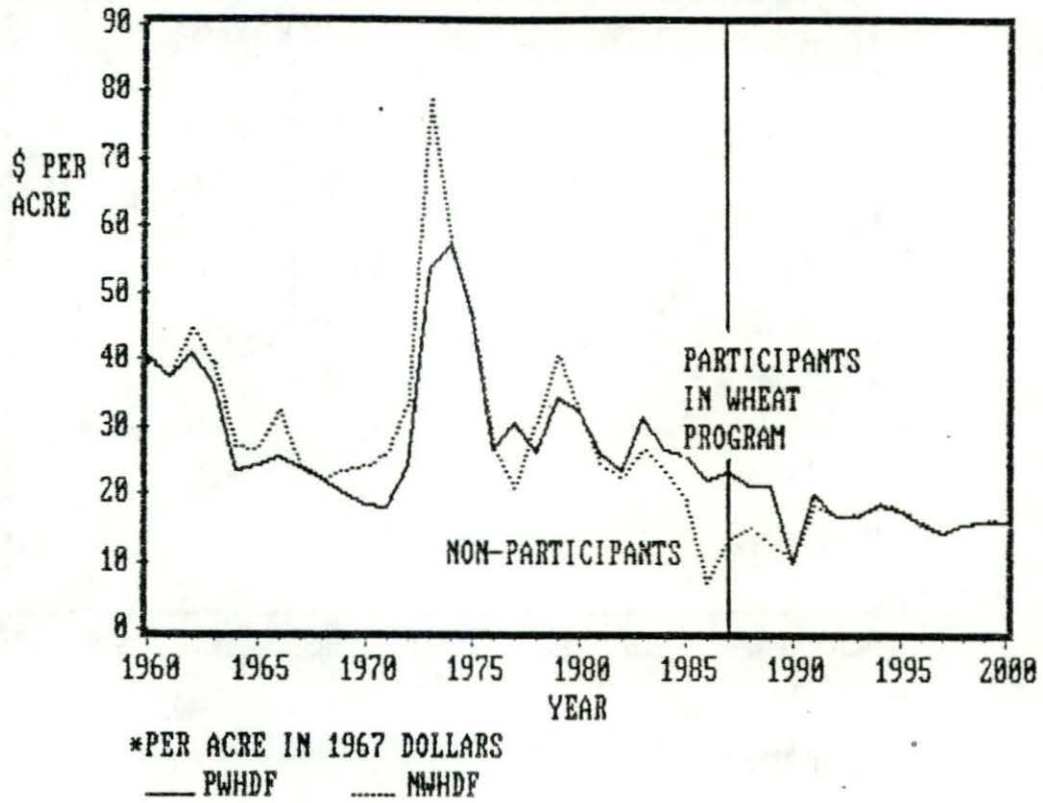


Figure A-10

REAL NET MARGINS OVER VARIABLE COSTS IN SOYBEAN PRODUCTION*
1968 TO 1987 AND PROJECTED TO 2000

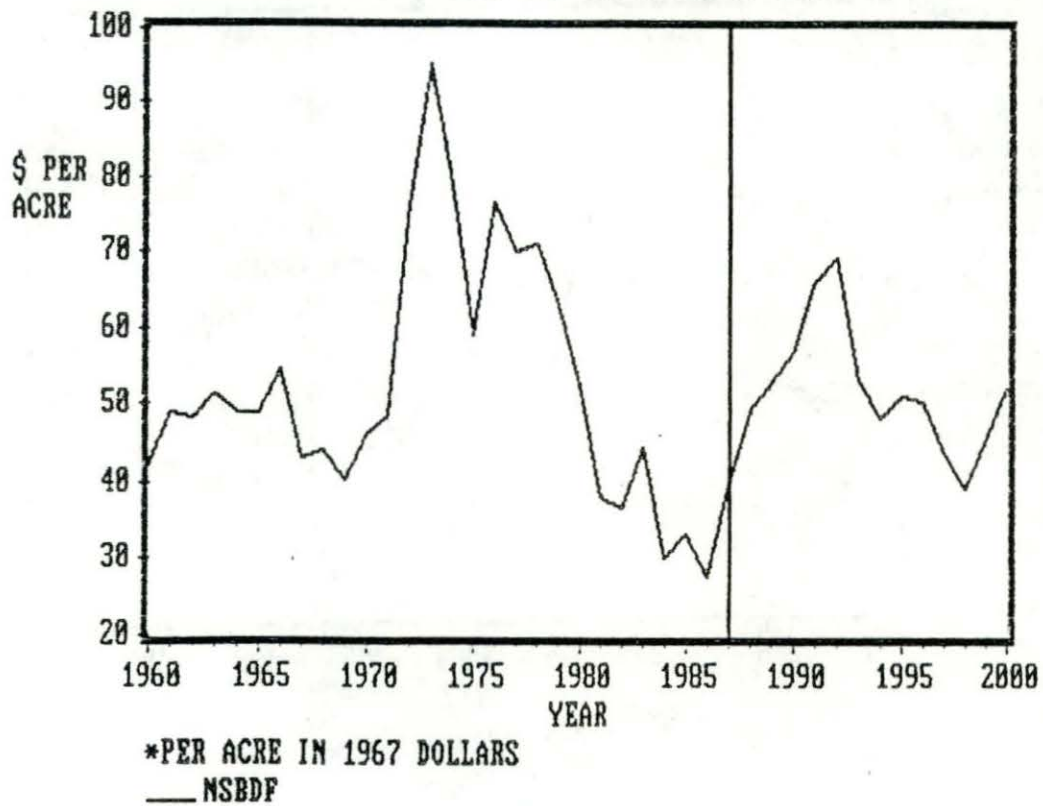
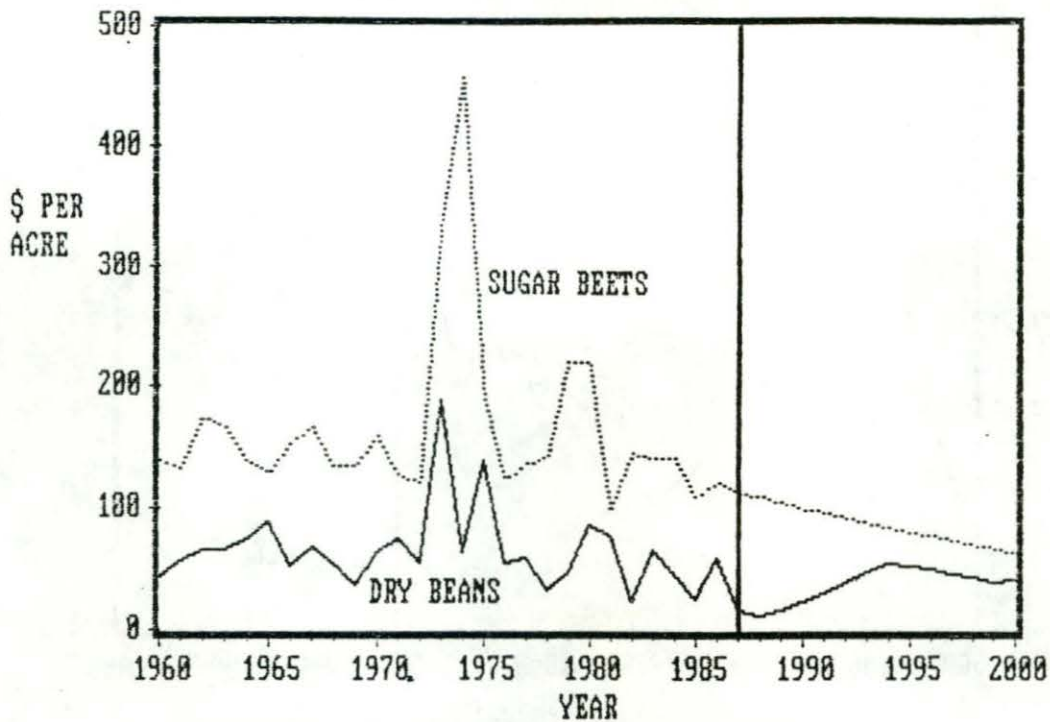


Figure A-11

REAL NET MARGINS OVER VARIABLE COSTS FOR DRY BEANS AND SUGAR BEETS*
1968 TO 1987 AND PROJECTED TO 2000

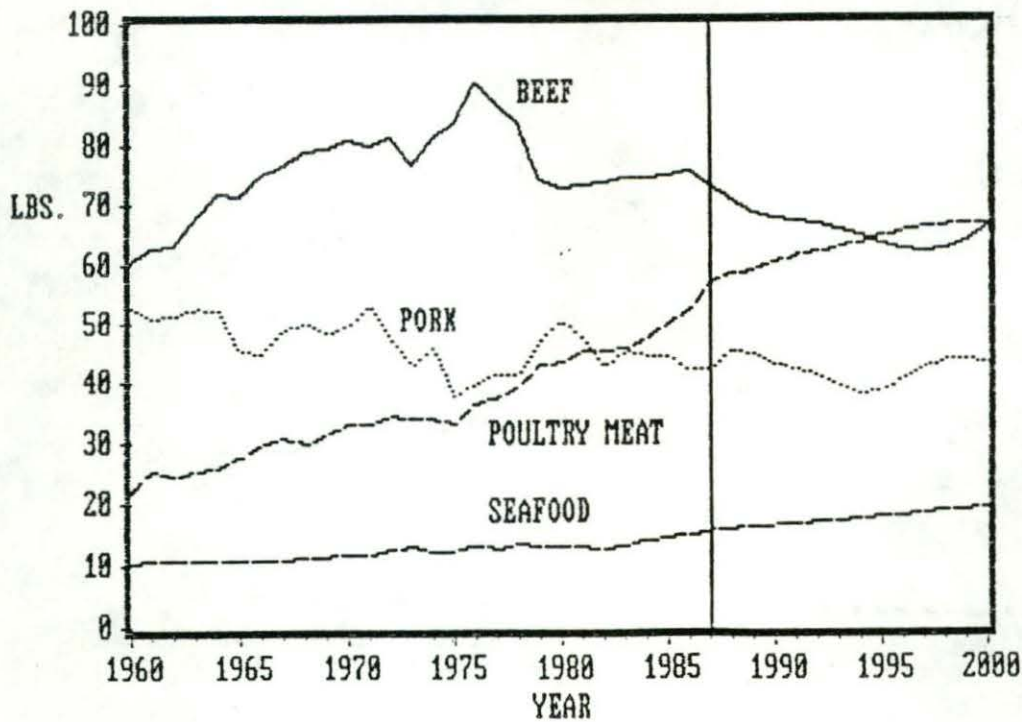


*IN MICHIGAN. REAL MARGINS ARE IN 1967 DOLLARS.

— MDBDMF MSUDMF

Figure A-12

PER CAPITA CONSUMPTION OF BEEF, PORK, POULTRY MEAT AND SEAFOOD*
1968 TO 1987 AND PROJECTED TO 2000



*EDIBLE WEIGHT

— SBFECE SPKECF --- QPMECF -.- CFSCF

Figure A-13

PER CAPITA PRODUCTION OF MILK AND EGGS
1968 TO 1987 AND PROJECTED TO 2000

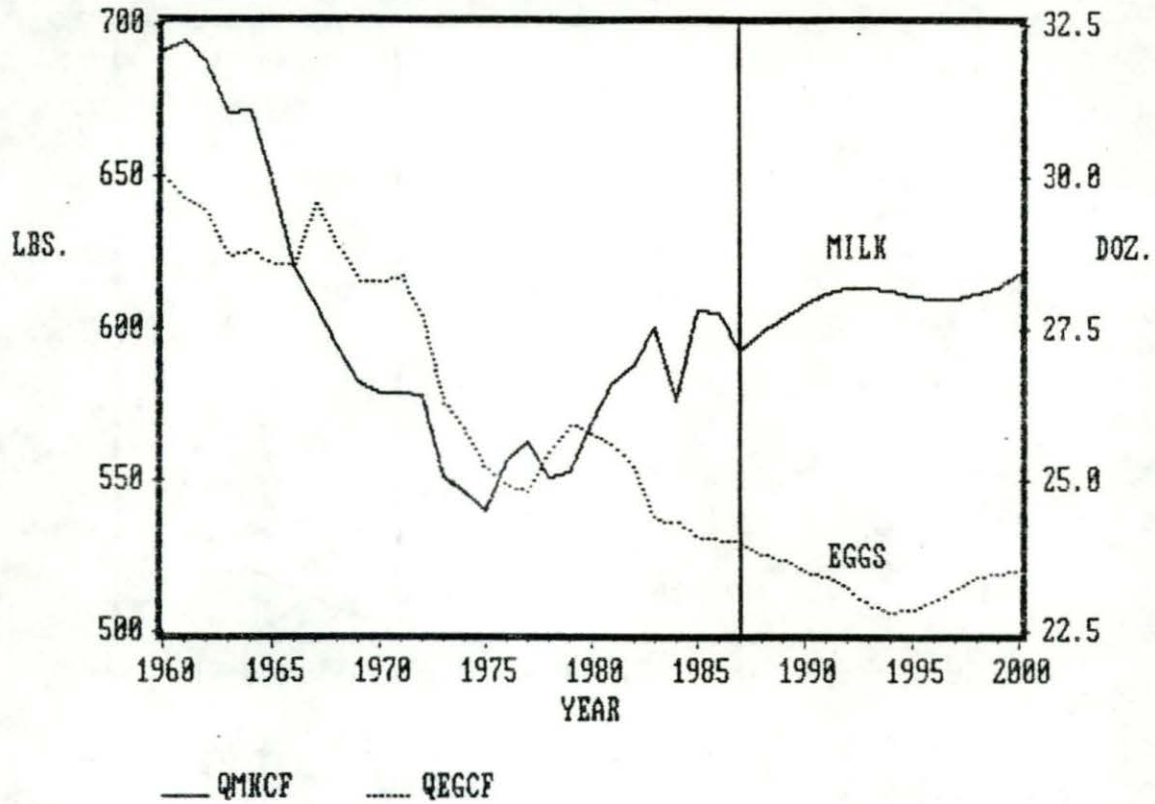


Figure A-14

NUMBER OF MILK COWS ON FARMS AND TOTAL MILK PRODUCTION
1968 TO 1987 AND PROJECTED TO 2000

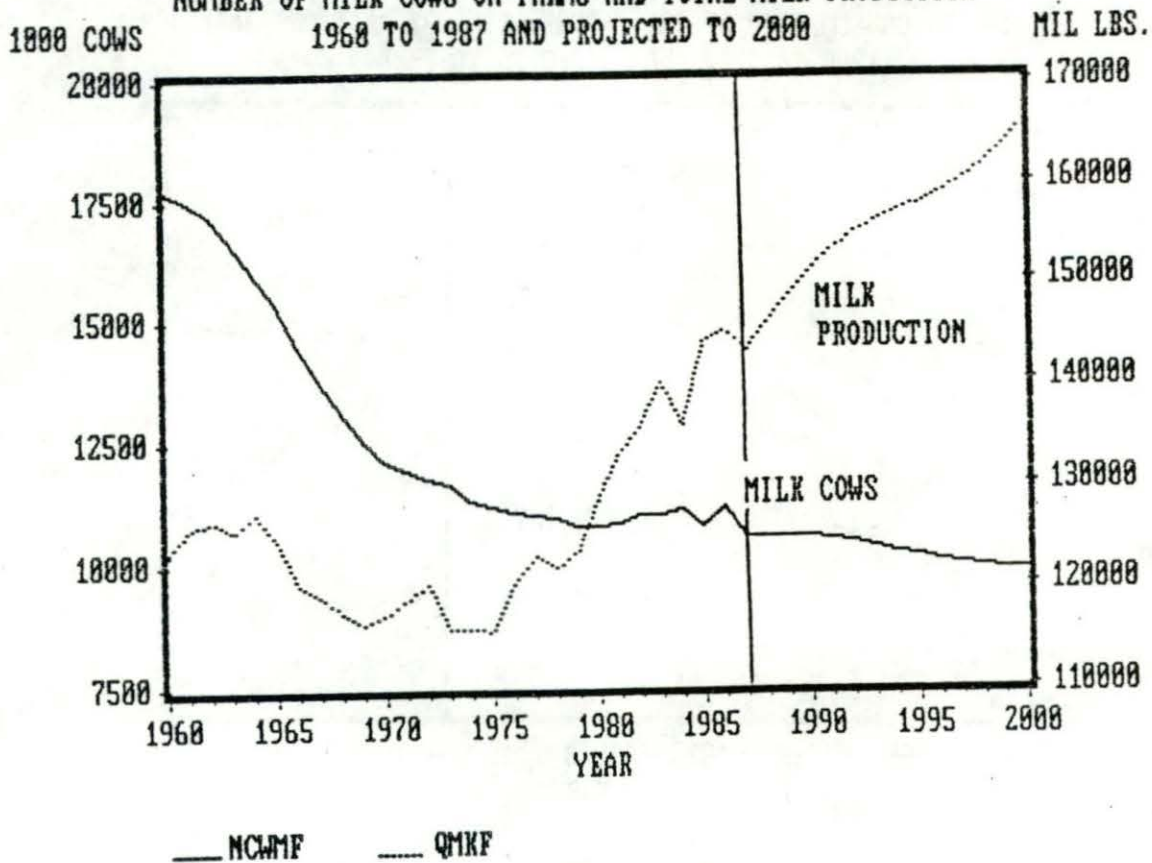


Figure A-15

NUMBER OF BEEF COWS ON FARMS AND REAL PRICE OF FEEDER CALVES*
1960 TO 1987 AND PROJECTED TO 2000

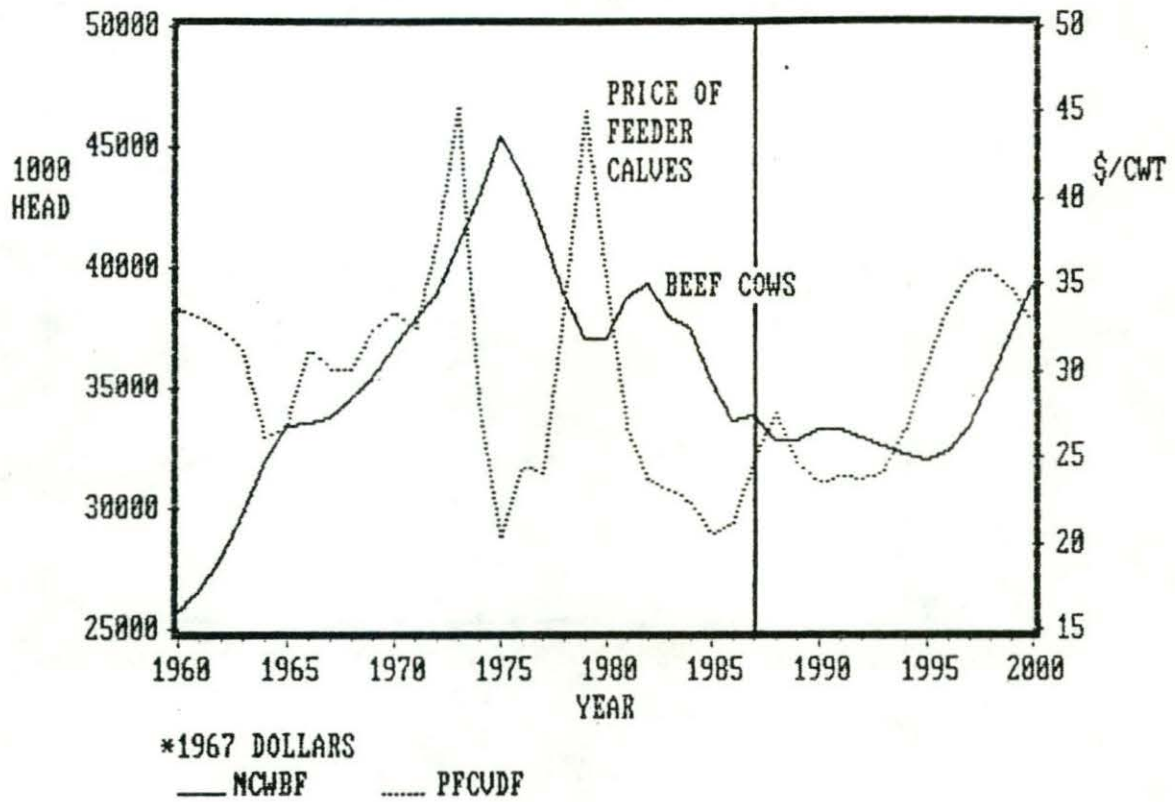


Figure A-16

REAL NET MARGINS IN CATTLE FEEDING OVER COSTS OF FEED AND FEEDER*
1960 TO 1987 AND PROJECTED TO 2000

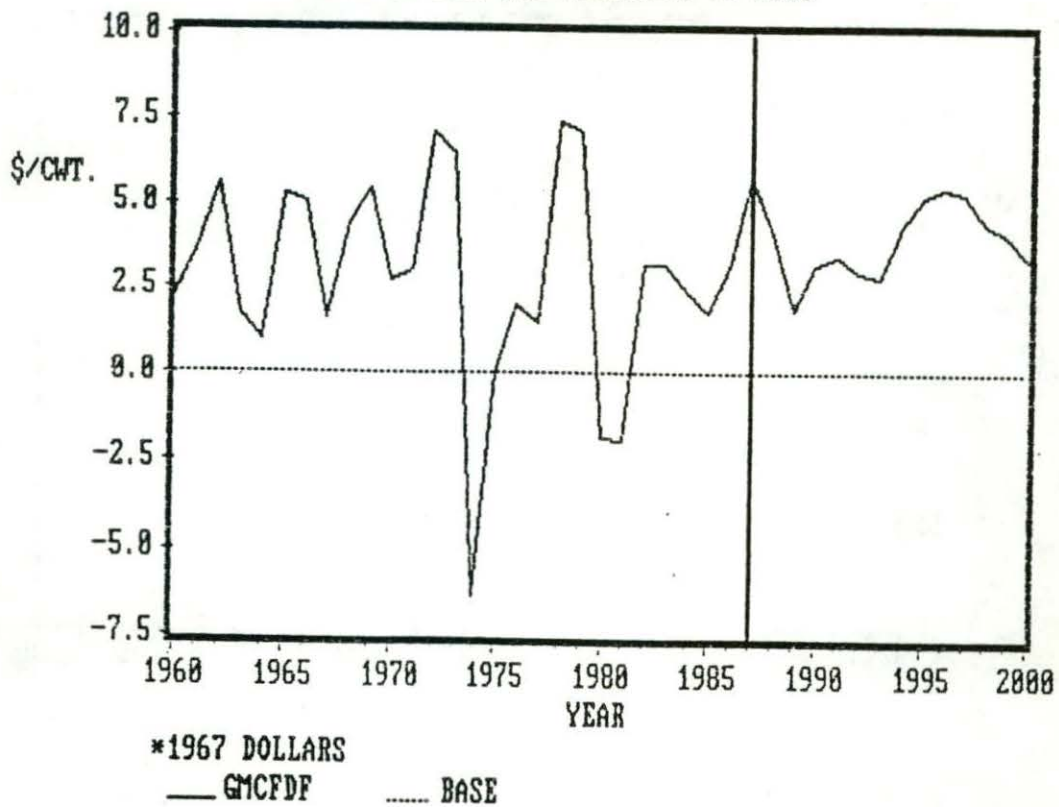


Figure A-17

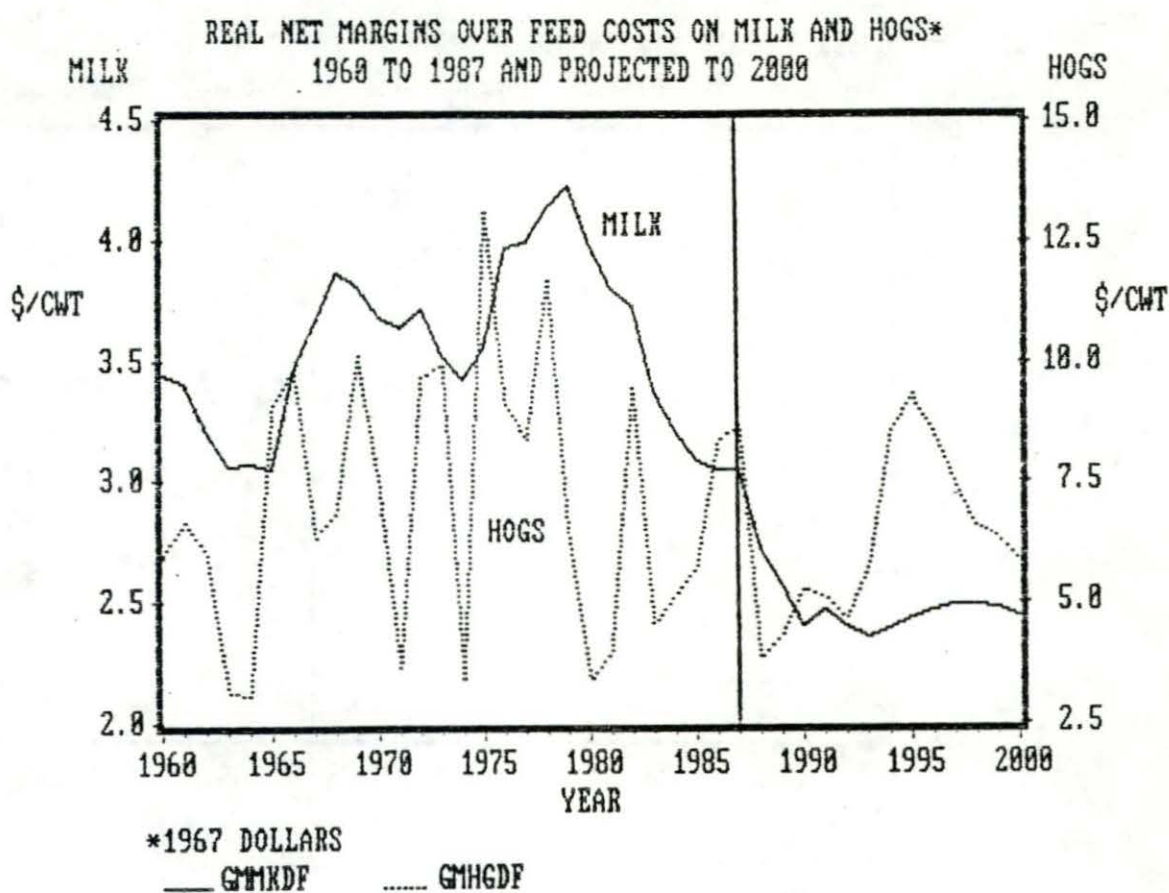


Figure A-18

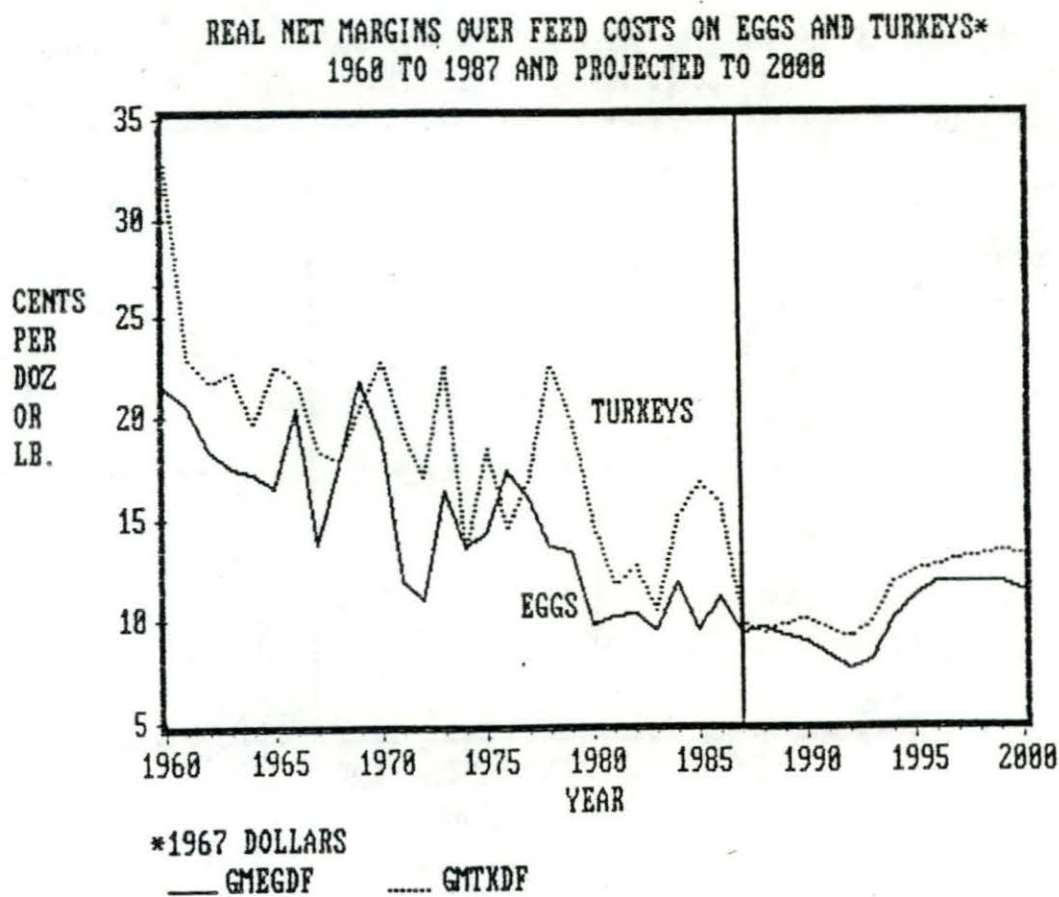
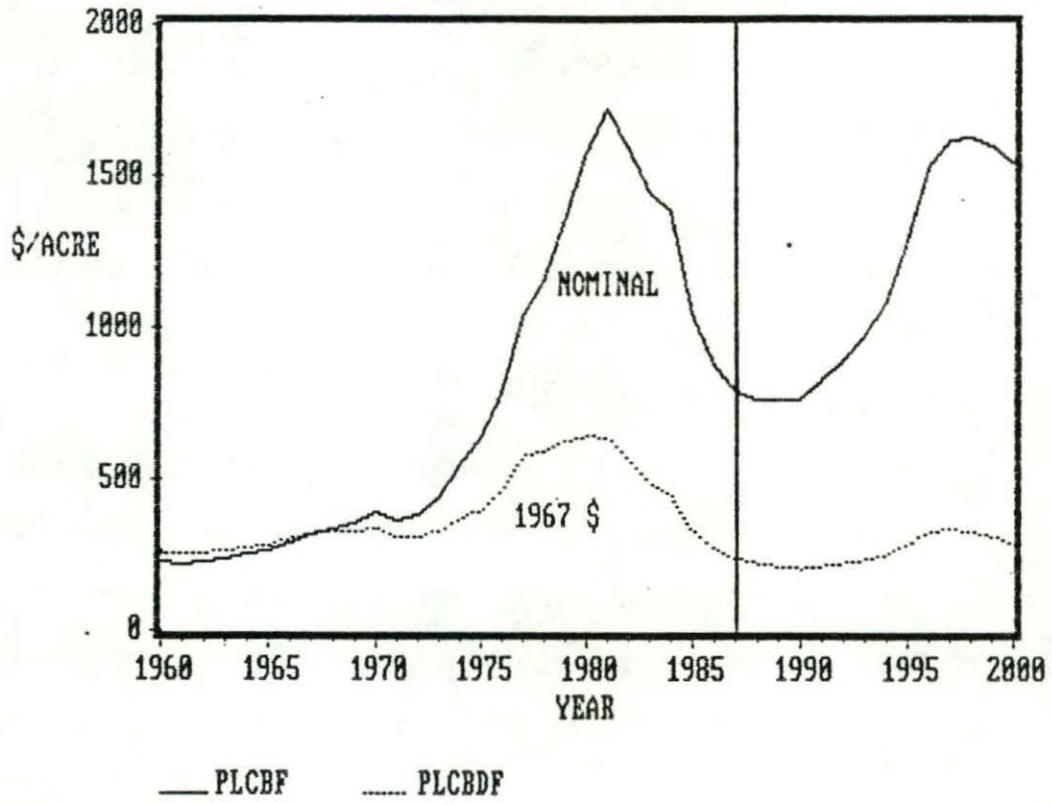


Figure A-19

PRICE OF FARM LAND IN THE CORN BELT
IN NOMINAL AND IN 1967 DOLLARS



Appendix B

**Table on Trends and Projections on Annual Data for
Agricultural Commodities of Importance to Michigan, 1980-1986,
Estimated for 1987 and Projected for 1988-2000**

<u>CODE</u>	<u>DEFINITION</u>
PFCVF	Price of Medium No. 1 feeder steer calves at Kansas City, (\$/cwt).
PSRF	Price of Choice steers at Omaha (\$/cwt).
PBGF	Price of barrows and gilts at seven markets, (\$/cwt).
PBRF	Price of broilers, wholesale, 12 city average, (¢/lb)
PTKF	Price of turkeys, wholesale, 8-16 lb. young hens, NY, (¢/lb).
FPEGF	Price received by farmers for eggs, U.S., (¢/doz).
FPMKF	Price received by farmers for milk, U.S., (\$/cwt).
FPCNF	Price received by farmers for corn, season average, U.S., (\$/bu).
FPSBF	Price received by farmers for soybeans, season average, U.S., (\$/bu).
PSMF	Price of soybean meal, season average, Decatur, IL, (\$/ton).
FPWHF	Price received by farmers for wheat, season average, U.S., (\$/bu).
FPDBMF	Price received by farmers for dry beans in Michigan, season average, (\$/cwt).
FPSUMF	Price received by farmers for sugar beets in Michigan, season average, (\$/ton) ¹
GCNMF	Net margin over variable costs on corn for participants in the Feed Grain Programs, Michigan, (\$/acre). ²
MCNMF	Net margin over variable costs on corn for non-participants in the Feed Grain Programs, Michigan, (\$/acre). ²
GWHMF	Net margin over variable costs on wheat for participants in the Wheat Programs, Michigan, (\$/base acre). ²
MWHMF	Net margin over variable costs on wheat for non-participants in the Wheat Programs, Michigan, (\$/acre). ²

1. 1986 price is estimated.

2. Variable costs include variable cash costs plus allowances for unpaid family labor and interest on operating capital.

MSBMF	Net margin over variable costs on soybeans, Michigan, (\$/acre). ²
MDBMF	Net margin over variable costs on drybeans, Michigan, (\$/acre) ²
MSUMF	Net margin over variable costs on sugar beets, Michigan, (\$/acre). ²
CPI	Consumer Price Index, (1967=1.00)
IRLB	Interest rate charged new borrowers on farm mortgage loans by the Farm Credit Service, (Percent).
GMCFF	Net margin in cattle feeding over cost of feed and feeder, U.S., (\$/cwt).
GMHGF	Net margin in farrow-to-finish hog operations over cost of feed, U.S., (\$/cwt).
GMBRF	Net margin in broiler production over cost of feed, U.S., (¢/lb of dressed weight).
GMTKF	Net margin in turkey production over cost of feed, U.S., (¢/lb of dressed weight).
GMEGF	Net margin in egg production over cost of feed, U.S., (¢/doz).
GMMKF	Net margin in milk production over cost of feed, U.S., (\$/cwt).

2. Variable costs include variable cash costs plus allowances for unpaid family labor and interest on operating capital.

obs	PFCVF	PSRF	PBGF	PBRF	PTKF
1980	86.67	66.96	40.04	46.80	63.60
1981	72.43	63.84	44.45	46.30	60.70
1982	68.16	64.22	55.44	44.00	60.80
1983	68.84	62.36	47.71	50.40	60.50
1984	69.29	65.34	48.86	55.60	74.40
1985	65.82	58.37	44.77	50.80	75.50
1986	69.40	57.76	51.04	54.50	72.20
1987	84.30	64.34	51.50	47.38	53.85
1988	97.32	69.02	39.51	43.97	57.44
1989	90.94	67.65	43.83	47.83	62.42
1990	89.99	71.28	50.63	51.12	67.12
1991	94.62	74.73	55.07	52.12	69.93
1992	97.52	79.84	60.51	55.05	75.04
1993	102.34	86.58	69.76	60.29	82.52
1994	116.98	94.47	79.25	64.76	88.71
1995	138.59	103.13	81.17	65.52	90.91
1996	159.28	112.54	76.69	64.93	92.60
1997	174.29	120.92	72.09	65.24	95.49
1998	180.74	126.45	70.03	66.11	98.81
1999	181.02	129.09	71.54	68.28	103.73
2000	176.31	129.20	74.87	70.56	108.79

obs	FPEGF	FPMKF	FPCNF	FPSBF	PSMF	FPWHF
1980	56.60	13.00	3.11	7.57	218.00	3.91
1981	62.20	13.76	2.50	6.04	183.00	3.65
1982	58.50	13.59	2.68	5.69	187.00	3.55
1983	63.10	13.57	3.25	7.81	188.00	3.53
1984	70.30	13.45	2.63	5.84	125.00	3.39
1985	57.40	12.75	2.23	5.05	154.90	3.08
1986	60.90	12.21	1.50	4.80	162.50	2.42
1987	54.69	12.39	1.78	5.84	200.35	2.56
1988	60.73	12.02	1.84	7.58	232.34	2.77
1989	62.51	11.97	1.98	8.19	248.24	2.62
1990	65.61	11.94	2.33	8.95	266.45	2.43
1991	68.77	12.99	2.91	10.23	300.37	3.31
1992	73.64	13.75	3.64	10.88	320.02	3.21
1993	80.90	14.46	3.48	9.13	275.83	3.31
1994	87.04	14.66	3.10	8.70	265.07	3.56
1995	90.54	14.84	2.77	9.34	273.35	3.54
1996	93.02	15.11	2.60	9.48	269.30	3.40
1997	94.61	15.54	2.86	8.79	255.23	3.32
1998	97.21	16.15	2.96	8.35	247.82	3.52
1999	101.24	16.72	3.34	9.51	277.93	3.67
2000	106.06	17.45	3.74	10.76	305.43	3.75

obs	FPDBMF	FPSUMF	GCNMF	MCNMF	GWDMF	MWHMF
1980	26.40	40.70	168.98	168.98	78.07	78.07
1981	25.60	26.50	85.60	85.60	79.89	79.89
1982	13.70	35.80	128.72	128.30	51.96	39.18
1983	23.20	36.20	143.57	163.91	101.70	72.97
1984	19.60	34.40	114.47	79.06	109.35	89.91
1985	15.00	29.60	124.42	89.19	107.41	80.98
1986	23.75	29.60	121.80	28.91	92.27	25.91
1987	10.50	30.00	151.19	41.07	92.89	48.54
1988	11.24	30.00	149.82	56.16	97.28	69.90
1989	12.57	30.00	140.86	65.71	100.24	60.97
1990	14.39	30.00	131.70	97.64	45.49	45.49
1991	17.16	30.00	142.39	158.15	99.02	93.01
1992	20.10	30.00	232.54	232.54	86.36	86.36
1993	23.99	30.00	216.41	216.41	89.58	89.58
1994	26.50	30.00	177.09	177.09	102.32	102.32
1995	26.97	30.00	140.91	140.91	100.03	100.03
1996	26.82	30.00	121.47	121.47	91.10	91.10
1997	26.62	30.00	135.06	149.55	85.20	85.20
1998	26.13	30.00	159.44	159.44	94.70	94.70
1999	25.77	30.00	200.51	200.51	101.40	101.40
2000	27.14	30.00	245.89	245.89	104.08	104.08

obs	MSBMF	MDBMF	MSUMF	CPI	IRLB
1980	166.08	243.81	540.57	2.47	10.39
1981	92.37	186.09	263.71	2.72	11.27
1982	85.47	79.59	414.01	2.89	12.27
1983	173.24	186.63	417.08	2.98	11.63
1984	73.39	97.74	434.06	3.11	12.21
1985	78.97	86.04	349.87	3.22	11.75
1986	74.04	86.85	391.25	3.28	10.75
1987	134.85	54.79	374.28	3.40	10.00
1988	174.35	43.37	383.16	3.55	9.25
1989	199.18	59.55	379.61	3.69	9.00
1990	231.60	86.09	375.78	3.84	9.01
1991	272.83	116.76	375.47	3.97	8.50
1992	299.16	155.09	372.33	4.11	8.50
1993	237.60	206.53	368.95	4.26	8.50
1994	221.36	235.71	365.28	4.41	8.50
1995	245.86	238.64	361.25	4.56	8.50
1996	251.33	232.31	356.91	4.72	8.50
1997	225.12	224.53	352.21	4.89	8.50
1998	208.27	213.05	347.16	5.06	8.50
1999	252.69	203.13	341.74	5.23	8.50
2000	301.47	217.18	335.93	5.42	8.50

obs	GMCFF	GMHGF	GMBRF	GMTKF	GMEGF	GMMKF
1980	-4.66	8.29	27.96	36.05	24.24	9.82
1981	-5.23	10.68	26.42	31.62	27.79	10.35
1982	9.46	27.20	27.15	36.15	29.72	10.78
1983	9.73	13.44	30.31	31.11	28.18	10.09
1984	7.63	15.87	36.80	46.90	36.70	9.98
1985	5.84	18.32	35.87	53.66	30.47	9.92
1986	10.35	27.23	40.14	51.34	36.64	10.00
1987	19.77	29.36	33.39	33.38	32.10	10.36
1988	14.87	13.49	27.41	33.21	34.19	9.66
1989	6.84	15.76	29.76	35.98	33.87	9.47
1990	12.36	20.16	31.58	38.53	34.52	9.21
1991	13.86	20.15	30.03	37.61	33.15	9.79
1992	12.28	18.96	29.25	37.31	31.27	9.84
1993	12.15	24.06	32.58	41.99	34.31	10.01
1994	19.30	37.09	39.40	51.62	44.06	10.52
1995	24.00	42.25	41.77	56.17	50.87	11.09
1996	25.73	39.94	42.10	59.21	55.55	11.66
1997	25.75	36.24	42.99	62.94	58.06	12.17
1998	22.43	32.97	43.53	65.79	59.43	12.57
1999	21.38	32.87	44.85	69.46	61.81	12.95
2000	18.41	31.54	44.35	70.46	61.89	13.22