SUPPLY MANAGEMENT IN THE MANITOBA EGG INDUSTRY: PERFORMANCE AND IMPLICATIONS OF TRADE LIBERALIZATION.

by

MSAFIRI DAUDI MBAGA

A Thesis

Submitted to the Faculty of Graduate Studies
in Partial Fulfilment of the Requirements
for the Degree of
MASTER OF SCIENCE

Department of Agricultural Economics and Farm Management
University of Manitoba
Winnipeg, Manitoba.

ISBN 0-315-92309-1

Canada

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ABSTRACT

The objectives of this thesis are (a) to develop a model which can be used to analyze the impact of supply management on Manitoba, (b) to develop a framework for analyzing the impact of removal of border controls, (c) undertake empirical analysis within the constraints of data availability, and (d) outline the research required to complete the analysis.

Economic and program criteria were used to evaluate the impact of supply management to egg producers and on Manitoba's economic activity. The analysis of short-run impacts of removing border controls required an estimation of short-run marginal cost in Manitoba. We estimated short-run marginal cost in Manitoba using a Translog cost function.

Results suggest that the province of Manitoba has not benefitted from supply management. However, egg producers have benefitted because egg prices are now more stable than they were before supply management, price levels have increased and substantial economic rents accrue to egg producers.

If supply management in the egg industry were dismantled, it is likely that the immediate effect to Manitoba egg producers will be substantial, however, if egg producers are going to take advantage of the excess capacity which currently exists in Manitoba, then it is likely that in the short-run egg production in Manitoba would not be affected.

ACKNOWLEDGEMENTS

I wish to extend special thanks to my advisor, Dr R.M.A. Loyns, for his understanding,guidance and supervision. I also gratefully acknowledge the guidance and advice extended by Dr B.T. Coyle throughout this thesis and for serving in my committee.

Sincere gratitude is expressed to my thesis committee members, Dr P. Phillips and Ms Penny Kelly(The General Manager of Manitoba Egg Producers Marketing Board) for their constructive criticism, suggestions and support. I also wish to express my thanks and appreciation to all my friends at the Agricultural Economics Annex, and all members of staff in the Agricultural Economics Department for their support. I am very grateful to the Canadian Commonwealth, for providing me with financial support.

Lastly but not least, I am deeply thankful and indebted to my lovely wife Gloria Mbaga for her tremendous support and my son Daudi for having managed to do with very little attention from me while I devoted much of my time on this work.

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CHAPTER ONE

BACKGROUND AND RESEARCH OBJECTIVES

INTRODUCTION

The agricultural sector is considered to be important to the economies of most countries. Although the economic importance of agriculture may be overstated in some cases, it is evident that, for whatever reason, governments design programs to protect or exploit agriculture especially in some developing countries. In developed countries such as Canada, the agricultural sector has received substantial protection intended to stabilize markets for reasons of economic security and sometimes as a consequence of political pressure from the farm lobby (Van Kooten,1987). A host of programs have been generated in the developed countries to achieve national goals in the agricultural sector. Each developed country has initiated programs which are unique, but their common purpose is said to be that of assisting farmers.

In Canada one of these programs is supply management. Production and marketing of eggs in Canada takes place under supply management. For the past 20 years, the egg industry in Manitoba has been under supply management. Supply management has frozen Manitoba's market share (11.5 per cent), and during the period of supply management, the average size of the production units in Manitoba had declined. Various trade agreements (e.g NAFTA) and the recent GATT agreement raise the spectre of reduced or removed border controls in the foreseeable future.

These considerations raise two kinds of policy relevant questions to Manitoba and its egg producers:

(a) Where and how have Manitoba and its egg producers gained or lost from 20 years of supply management?

(b) Is it possible for egg production in Manitoba to survive in the absence of border controls and supply management? Will production in Manitoba fall or rise under an open border situation?

PURPOSE OF THIS STUDY.

The issues raised above are important economic issues for the province of Manitoba and its egg producers. In order to thoroughly analyze these issues and provide useful economic information it is necessary to:

(a) Develop an analytic framework for producing economic information, and

(b) Conduct the empirical analysis.

The research required to reach definitive conclusions in both areas is beyond the scope of this thesis, because definitive conclusions require comprehensive data and analysis of both the short run and long run supply schedule for eggs in Manitoba. The data and resource requirements of that scope of analysis were not available. Therefore this thesis and the research undertaken for it were restricted to the following purposes:

(a) To develop an analytic model which can be used to analyze the major impacts of supply management on Manitoba.

(b) To develop a framework for analyzing the impact of removal of border controls on Manitoba egg farmers,

(c) Undertake empirical analysis on selected aspects of both levels of impacts within the constraints of data availability and resources for the project, and

(d) Outline the research required to complete the analysis of all identified areas where empirical analysis is not feasible.

THE EGG INDUSTRY IN MANITOBA.

Following the enactment of the Farm Products Marketing Agencies Act of 1972, provincial producer boards and federal and provincial governments signed the Comprehensive Marketing plan for shell eggs in December 1972, and the Canadian Egg Marketing Agency(CEMA) was created. The creation of CEMA brought Manitoba egg industry under supply management, and the regulation began to affect egg production in 1973.

It is now 20 years since the Manitoba egg industry came under supply management. Performance during those 20 years suggests that, under supply management, Manitoba's market share has been frozen and both the size and number of production units has declined. For instance, in 1976 Manitoba had 280 registered egg producers, and in 1991 Manitoba had only 225 registered egg producers(Table 1). Average size of units went from 7,459 in 1976, to 9,836 birds in 1983, and has since dropped to 9,606 birds in 1991. Manitoba was, and is, a major exporter province in Canada. In 1991, for instance (Table 2) Manitoba ranked second after Ontario in terms of export of table eggs to other provinces.

TABLE 1: NUMBER OF REGISTERED PRODUCERS BY PROVINCE, 1973 TO 1991.

PROVINCE	1973	1983	1988	1989	1990	1991
		-----	PRODUCING	UNITS	-----	
BC	233	177	162	155	154	153
ALTA	457	254	232	230	228	216
SASK	135	100	81	80	79	79
MAN	280	246	240	240	231	225
ONT	1044	812	704	682	652	632
QUEB	392	247	190	175	171	161
N.B	43	27	23	22	19	19
N.S	65	52	42	40	38	36
P.E.I	58	33	29	27	25	24
NFLD	37	37	31	31	29	32
TOTAL	2,744	1985	1734	1682	1626	1577

Source: CEMA Annual Report 1991.

TABLE 2: ESTIMATED INTERPROVINCIAL MOVEMENT OF TABLE EGGS DURING 1991, IN BOXES OF 15 DOZEN.

PROVINCE	TOTAL SALES	TOTAL PURCHASE	NET IMPORT FROM OTHER PROVINCES	NET EXPORT TO OTHER PROVINCES
	---------	IN BOXES OF	15 DOZENS	----------
B.C.	20,830	209,599	188,769	-
ALTA.	139,823	255,505	115,682	-
SASK.	231,046	69,949	-	161,097
MAN.	632,527	-	-	632,527
ONT.	1,347,887	697,400	-	650,487
QUE.	168,705	1,350,879	1,182,174	-
N.B.	16,278	53,038	36,760	-
N.S.	67,143	6,475	-	60,668
P.E.I.	500	1,160	660	-
NFLD.	-	15,720	15,720	-
YUKON	-	34,804	34,804	-

Source: CEMA, 1991 Annual Report.

According to the 1991-92 Annual Report of the National Farm Products Marketing Council, the market for table eggs has been declining in Canada while the market for processing eggs is growing (Appendix 1 and 2). Currently Manitoba processes substantial amounts of eggs each year. Table 3 reports the only information available related to the processed volume in Manitoba from 1989 to 1991.

TABLE 3: EGGS PROCESSED IN MANITOBA FROM 1989 TO 1992.

YEAR	TO EXPORT PACKERS	TO OTHER PROCESSORS	TOTAL NUMBER OF DOZS PROCESSED
	--------	'000 DOZ	---------
1989	19,633.485	925.650	20,559.135
1990	18,567.090	1,842.720	20,409.810
1991	17,034.825	2,474.400	19,509.225
1992	15,941.865	2,199.750	18,141.615

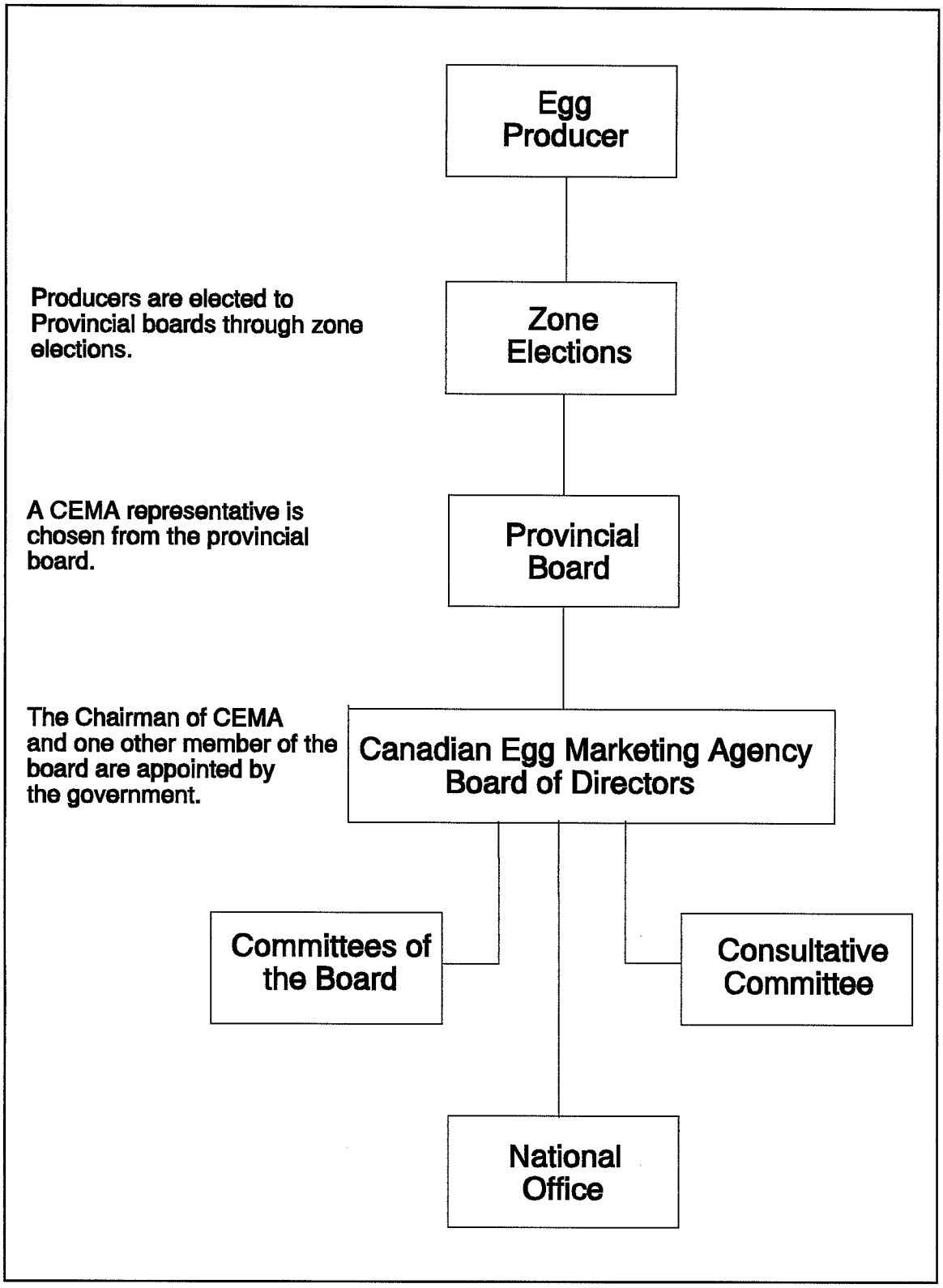
Source: Manitoba Egg Producer's Marketing Board, 1993.

SUPPLY MANAGEMENT AND THE MANITOBA EGG INDUSTRY.

ORGANIZATION.

Figure 1 summarizes the structure of marketing boards for eggs. Regulated egg producers in each province are organized under the provincial marketing boards and all provincial marketing boards have joint jurisdiction with the Canadian Egg Marketing Agency(CEMA) through a federal-provincial agreement. Provincial marketing boards have regulatory powers granted under provincial legislation.

Figure 1: Structure of Canadian Egg Marketing Boards.



The provincial marketing board divides the province's share of the national market by allocating quota to individual producers. In addition the board gathers production data to allow estimation of the supply of eggs and assess levies which finance the operation of the board and the removal of excess table eggs for processing uses. To ensure that producers keep within their production quotas and pay levies, the provincial board monitors producer compliance to the agreement and plan requirements.

Each provincial marketing board appoints a producer to represent the province on the board of the national agency. In addition to the provincial representatives on CEMA's board of directors, the federal government makes two appointments to the board, one being the Chairman. CEMA administers the federal or national component of supply management. CEMA responsibilities include, among other things, administering the central pricing based on the cost of producing eggs, administering a program to provide processors with the eggs they require to meet their market needs, stimulating egg consumption through advertising and promotion, and encouraging the improvement of egg quality and productivity.

EGG PRODUCTION.

When the supply management system was introduced in the 1970's, the market share of each province was determined on a historical basis by taking an average of the previous 5 years' production i.e the average for 1967-1971. Each provincial marketing board then divided the total provincial allocation among producers in the province.

The distribution was achieved by means of a quota, i.e the number of dozens the individual regulated farmer is allowed to produce without penalty.

Supply management started with quotas set by numbers of eggs, but with time this arrangement created monitoring and control problems, because it became evident that all the eggs were not being delivered to graders or processors. Many producers graded their own eggs and sold them directly to consumers and as a result over-supplied the market and exceeded the required supply(CEMA,1982). To solve this problem, quotas were converted to an equivalent number of hens allowed for each producer and under this arrangement quota became all the eggs a producer is able to produce from a given number of hens. The new system, according to CEMA, has induced efficiency by creating incentive for egg producers to increase the rate of lay. The evidence indicates that rate of lay has increased in the past 20 years(Appendix 3 and 4).

The national average number of layers per producer based on the National Farm Product Marketing Council as reported by CEMA increased from 6,574 in 1976 to 11,685 in 1991 as indicated in Table 4. However, in Manitoba the average number of layers per producer increased from 7,459 in 1976 to 9,836 in 1983 and then decreased to 9,606 in 1991. From 1983 to 1991, the average number of layers per producer in Manitoba was below the national average. The data indicate that the egg production units on average have decreased in Manitoba from 1983 while in all other provinces the units have increased in size. There is considerable variation in the average size of units across provinces and Manitoba is among the smallest size.

TABLE 4: AVERAGE NUMBER OF LAYERS PER PRODUCER, 1976 TO 1991.

PROVINCE	1976	1983	1988	1989	1990	1991
	------	-------	HENS	-------	-------	
B.C.	10084	14470	15029	14879	14673	14788
ALTA.	2831	6201	6481	6417	6454	6916
SASK.	3464	7342	8656	9512	9829	10001
MAN.	7459	9836	9178	9687	9646	9606
ONT.	6578	9812	10580	10358	10560	10941
QUE.	8125	13691	16992	17880	17856	18997
N.B.	8926	15527	18164	18424	20906	20919
N.S.	11804	16868	20300	20453	20943	22106
P.E.I.	1636	4355	4923	5078	5375	5618
NFLD.	9736	11976	14252	13687	14339	13016
CANADA	6547	10339	11244	11132	11285	11685

Source: CEMA Annual Report, 1991.

In 1991 quota allocation to each province in terms of the number of layers, and the actual inventory (i.e the actual number of layers in provincial flocks) are as indicated in Table 5. Manitoba's quota allocation in 1991 was about 2,163,199 laying hens. However , the actual number of layers in the provincial flock that year was 2,072,125, or 95.29 per cent of quota allocation. According to the Manitoba Egg Producers Marketing Board the gap between quota allocation and actual number of layers in provincial flocks is due to non-market factors such as mortality.

TABLE 5: TOTAL QUOTA ALLOCATION AND INVENTORIES, 1991.

PROVINCE	ALLOCATION	INVENTORY	PERCENTAGE
---------	---- HENS ----	----------	
B.C	2,262,605	2,184,961	96.61
ALTA.	1,493,769	1,425,874	95.92
SASK.	790,077	716,459	91.19
MAN.	2,163,199	2,072,125	95.84
ONT.	6,914,926	6,579,597	95.29
QUEB.	3,058,515	2,892,577	94.63
N.B.	397,456	372,618	93.77
N.S.	795,829	754,904	94.85
P.E.I.	134,826	128,930	95.72
NFLD.	416,520	378,142	90.83
CANADA	18,427,722	17,506,188	94.94

Source: CEMA Annual Report, 1991.

Note: Inventories are the actual number of layers in Provincial Flocks.

Historical data on the provincial quota allocation for 1973 and 1990 indicate a slight decrease in quota allocated during that period, reflected also in the national quota, which decreased from 475.3 million dozens in 1973 to 448.4 million dozens in 1990 as reported in Table 6.

TABLE 6: PROVINCIAL QUOTA ALLOCATION, 1973 and 1990.

PROVINCE	1973 QUOTA MLN DOZS	% MARKET SHARE	1990 QUOTA MLN DOZS	% MARKET SHARE
B.C.	57.298	12.10	53.735	11.985
ALTA.	41.379	8.70	38.805	8.655
SASK.	22.630	4.76	223	4.733
MAN.	54.230	11.41	50.862	11.344
ONT.	181.420	38.20	170.137	37.946
QUE.	78.650	16.50	73.818	16.464
N.B.	8.690	1.83	9.259	2.065
N.S.	19.520	4.10	18.307	4.083
P.E.I.	3.030	0.64	3.162	0.705
NFLD.	8.480	1.78	9.058	2.020
CANADA	475.327	100.00	448.366	100.00

Source: CEMA Quota Regulations.

PRICING.

In order to operationalize the " COP pricing " policy of CEMA in the spring of 1975, the Canadian Egg Marketing Agency commissioned a consulting firm to carry out a cost of production study. Data gathered were used to develop a pricing formula based on a national survey of egg farmers using a sample of regulated egg producers. Egg producers included in the sample were those with flocks of between 10,000 and 50,000 laying hens. The cost of production formula was made up of the following cost factors measured as the cost for a dozen eggs: Pullets, Feed, Labour, Overhead, Depreciation, and Producer return. A detailed description of these cost factors is included in Chapter 4.

Provincial costs were weighted according to each province's share of national egg production to give a national weighted average producer cost. According to CEMA the national weighted average producer cost was used as the producer farm gate price in Ontario, because almost half of Canadian egg production takes place there. Producer price in Manitoba is determined by taking the Ontario price less transportation and handling costs from Toronto to Manitoba to arrive at a Manitoba base price for eggs. Producer prices in other provinces are calculated by adding transportation and handling costs to the Manitoba base price. In other words the so called COP price system uses an averaging process plus some economics of location theory. Prices in any particular province are likely to equal measured COP by coincidence only.

It is important to note at this point that producer price in Manitoba will always be lower than in other provinces, as indicated in Table 7 and not necessarily equal to Manitoba measured COP. The reason why producer prices are calculated in this fashion

according to the Canadian Egg Marketing Agency (CEMA) is that the so called "Comprehensive Marketing Plan" requires that eggs be permitted to move freely between provinces(CEMA,1982).

TABLE 7: AVERAGE CANADA " A" LARGE EGG PRICE TO PRODUCERS(COP PRICE) BEFORE LEVY IS DEDUCTED, 1987 TO 1991.

PROVINCE	1987	1988	1989	1990	1991
	---	---	CENTS PER	DOZEN ---	---
B.C	99.6	107.1	119.4	118.5	118.0
ALTA.	97.6	105.1	116.4	115.5	114.5
SASK.	96.6	104.1	114.3	113.1	111.5
MAN.	89.7	97.9	109.8	108.5	107.5
ONT.	94.6	102.2	113.6	108.5	108.6
QUE.	97.9	105.1	115.4	111.1	111.5
N.B.	102.7	111.5	123.1	118.8	117.8
N.S.	102.8	111.1	121.6	117.8	116.9
P.E.I.	104.0	112.1	123.6	119.8	119.7
NFLD.	110.4	118.6	131.3	128.0	128.0

Source: Poultry Market Review, 1988-1991.

Note: Price to producers or COP price is the price before levy is deducted.

According to CEMA documents, the Province of Manitoba is treated this way as it is categorised as the major exporting Province and thus the source of much of the interprovincial trade in eggs. The producer price for eggs is updated each month using market information on factors such as feed prices, pullet prices, labour rates, interest rates and farm input indices.

PRICES DEFINED.

Throughout this thesis the following terms will be used to refer to egg prices at the producer level:

(a) Price to producers(or COP price), refers to egg price as established by the cost of production formula. It is also referred in the text as the price to producers before levy deduction.

(b) Base price(actual price per dozen), refers to egg price to producers net of levy i.e the actual take home per dozen after levy deduction.

MARKETING.

Egg producers market their eggs through registered grading stations, although some producers grade their own eggs. Once graded, the producer is paid based on the price determined by CEMA which is based on a cost of production formula outlined earlier. The eggs are then sold in most cases to retail food chains. Eggs declared surplus to the table egg market are sold to the provincial egg boards which act as agents for the

Canadian Egg Marketing Agency. These eggs are either sold to domestic "breakers" for domestic processing or to export markets. Prices paid by the domestic breakers are much lower than the price paid to producers before the levy is deducted(Table 8). Since the supply management system was put in place, each year the Canadian Egg Marketing Agency(CEMA) has had to buy thousands of dozens declared surplus from the table market. Eggs declared surplus from the table market in Manitoba reached 1.35 million boxes of 15 dozens as reported in Table 9.

TABLE 8: MANITOBA AVERAGE GRADE A LARGE EGG PRICE TO PRODUCER BEFORE THE LEVY IS DEDUCTED AND PRICE TO BREAKER, 1987 TO 1992.

YEAR	PRODUCER PRICE (a)	BREAKER PRICE (b)
	---- CTS -----	PER DOZ ----
1987	89.7	59.15
1988	97.9	51.48
1989	109.8	70.09
1990	108.5	69.00
1991	107.5	59.15
1992	105.8	48.41

Source: (a) Table 7.

(b) CEMA, 1993.

TABLE 9: CEMA BUY BACK PROGRAM,1976 TO 1991.

PROVINCE	1976	1984	1988	1990	1991
	---------- BOXES OF 15 DOZENS ----------				
B.C.	298,357	192,419	310,567	264,539	230,572
ALTA.	89,834	196,007	284,446	148,720	180,914
SASK.	40,510	86,346	179,013	142,459	153,023
MAN.	663,999	1,148,497	1,277,668	1,379,842	1,354,537
ONT.	387,183	904,643	1,021,983	1,155,155	1,266,299
QUE.	325,470	396,317	496,863	404,903	244,881
N.B.	1,611	21,919	45,881	281,263	56,431
N.S.	13,551	119,089	235,905	58,588	270,966
P.E.I.	7,075	41,476	68,583	59,561	51,448
NFLD.	1,950	66,270	163,810	174,864	158,749

Source: Poultry Market Review, 1988 to 1991.

Note: CEMA buy back program is a program which removes eggs declared surplus to the table market.

Eggs declared surplus to the table market are either sold to export markets(Table 10) or to domestic processors(Table 11). Each of these outlets generate losses each year. Levies have been charged by CEMA in order to finance the losses and the administrative cost. Table 12 reports the levy revenues in 1990, where 7.5 million Canadian dollars were collected from Manitoba.

TABLE 10: SURPLUS TABLE EGGS SOLD TO EXPORT MARKETS,1986 TO 1990.

	1986	1987	1988	1989	1990
EXPORT SURPLUS	---------- BOXES OF 15 DOZENS ----------				
SURPLUS REMOVED	810,560	1,378,300	1,385,170	832,936	461,983
	------	---------	($ MLNS)	--------	-------
EXPORT REVENUE	5.587	8.691	6.240	4.790	2.937
REMOVAL EXPENSES	12.629	21.115	24.767	23.022	12.599
LOSS	7.042	12.424	18.527	18.212	9.662
	------	--------	(DOLLARS)	--------	-------
AV. COST PER BOX	8.688	9.014	13.375	12.330	11.990

Source: National Farm Products Marketing Council, Annual Report,1986 to 1990.

TABLE 11: SURPLUS TABLE EGGS SOLD TO DOMESTIC PROCESSORS, 1986 TO 1990.

	1986	1987	1988	1989	1990
DOMESTIC SURPLUS			---------- BOXES OF 15 DOZENS ----------		
SURPLUS REMOVED	2,391,780	2,372,625	2,718,248	3,628,718	3,817,919
	---------	--------	($ MLNS)	---------	-------
SALE TO PRCESSRS	24.715	19.281	21.509	35.994	38.138
REMOVAL EXPENSES	37.650	35.813	46.431	64.324	69.721
LOSS	12.935	16.532	24.922	28.330	31.583
	---------	--------	(DOLLARS-	--------	-------
AV. COST PER BOX	5.650	6.968	9.168	7.807	8.272

Source: National Farm Products Marketing Council, Annual Report, 1990-91.

TABLE 12: EGG LEVIES AND LEVY REVENUE BY PROVINCE, 1990.

PROVINCE	TOTAL LEVIES	LEVY REVENUE
	CTS/DOZ	CDN $
B.C.	15.12	7,922,142
ALTA.	15.62	5,045,330
SASK.	15.52	2,480,318
MAN.	15.62	7,502,471
ONT.	16.50	27,116,911
QUE.	15.84	10,274,366
N.B.	15.62	1,440,927
N.S.	15.62	2,736,069
P.E.I.	15.69	421,503
NFLD.	16.62	1,393,589

Source: National Farm Products Marketing Council,

Annual Report, 1990-1991.

PROBLEM STATEMENT.

The legislation passed by the Canadian government in 1972 gave egg producers the authority to set up a supply management system. Under the National Farm Product Marketing Agencies Act, this led to the Manitoba Egg Producers Marketing Board (MEPMB) joining the national plan for eggs in 1973, and hence brought Manitoba eggs under supply management. Supply management was put in place to protect farmers and

maintain the family farm.

Despite all the protection embodied in the system, the number of registered egg producers in Manitoba have decreased as reported earlier in Table 1, and the average size of production units in Manitoba have decreased as well to 9,606 birds in 1991. The average number of layers per month in Manitoba farms as reported in Table 13 have decreased from 3,000,000 in 1972 to 2,228,000 in 1992.

TABLE 13: MONTHLY AVERAGE NUMBER OF LAYING HENS IN MANITOBA FARMS IN YEAR 1963 TO 1992.

YEAR	LAYING HENS '000	YEAR	LAYING HENS '000
1963	2,357	1978	2,568
1964	2,658	1979	2,721
1965	2,623	1980	2,728
1966	2,541	1981	2,645
1967	2,837	1982	2,588
1968	2,953	1983	2,518
1969	3,103	1984	2,521
1970	3,140	1985	2,528
1971	3,272	1986	2,524
1972	3,000	1987	2,542
1973	2,986	1988	2,499
1974	2,762	1989	2,407
1975	2,708	1990	2,355
1976	2,593	1991	2,354
1977	2,580	1992	2,280

Source: (1) Manitoba Agriculture Yearbook, 1963 - 1992.
(2) Rate of Lay Refer Appendix 4.

Veeman (1988) indicated that Manitoba was a major egg-exporting province before supply management because of economic advantages. Historical production statistics support Veeman's argument(Table 14).

TABLE 14: EGG PRODUCTION IN MANITOBA 1961-1990 IN ,000 DOZENS.

YEAR	MANITOBA	CANADA	%GE	YEAR	MANITOBA	CANADA	%GE
	---'000	-DOZNS-			---'000	--DOZNS-	
1961	35,852	430,415	8.33	1976	49,286	454,466	10.84
1962	37,160	433,762	8.57	1977	50,270	458,583	10.96
1963	37,780	417,235	9.05	1978	49,377	459,203	10.75
1964	43,351	435,698	9.95	1979	48,358	462,631	10.45
1965	43,293	431,351	10.04	1980	51,358	488,059	10.52
1966	42,836	416,803	10.28	1981	50,852	495,850	10.25
1967	48,645	442,176	11.00	1982	51,678	489,441	10.56
1968	50,967	452,985	11.25	1983	52,414	496,423	10.56
1969	53,475	464,023	11.52	1984	52,040	477,529	10.89
1970	58,239	490,705	11.75	1985	52,903	472,152	10.20
1971	57,451	499,325	11.51	1986	53,524	472,262	11.33
1972	52,068	468,355	11.12	1987	53,729	475,468	11.30
1973	52,893	461,695	11.46	1988	54,154	473,386	11.44
1974	50,498	459,451	10.99	1989	54,343	478,779	11.35
1975	50,531	462,547	10.92	1990	53,499	479,313	11.16
GROWTH	1961-1972	= 45.23	PERCENT	ANNUAL RATE	= 3.45	PERCENT	
GROWTH	1973-1990	= 1.14	PERCENT	ANNUAL RATE	= 0.105	PERCENT	

Source:(i) Poultry Market Review, Agriculture Canada, 1961-1990.

(ii) Production and Stocks of Eggs and Poultry, Statistics Canada, Catalogue 23-202 and 23-003.

Before the introduction of supply management, Manitoba had grown significantly as indicated in Table 14. In 1971 egg production in Manitoba was 11.51 per cent of Canadian total egg production. However egg production in Manitoba, and Manitoba's share of total egg production in Canada began falling in 1971 i.e before the implementation of supply management. According to Wilson(1990) the observed fall in production had been caused by:

- the egg wars, where provinces created barriers to impede the influx of eggs from other provinces, and as a result surplus products piled up and hence discouraged production. In some cases this even forced egg producers to cut back production altogether.

Another possible reason behind the observed fall in production may have been:

- the expectations egg producers had before the actual implementation of supply management. Egg producers knew that with the implementation of supply management they would be required to cut back production and produce within a specified quota. As rational agents they probably started to make the necessary adjustments in advance.

Prior to 1972 Manitoba exported significant volumes to other provinces and the United States. With the introduction of supply management, Manitoba's market share was frozen. As indicated in Table 14, Manitoba Egg production before supply management increased from 35.852 million dozens in 1961 to 57.451 million dozens in 1971. Egg production under supply management fluctuated between 52 million to 54 million dozens. In 1990 egg production in Manitoba reached 53.499 million dozens. In the last 5 years

there was a cut in national quota by 2 per cent. As a result each province experienced a 2 per cent reduction in the number of laying hens. The cut in national quota together with the fact that Manitoba has excess capacity, which under the current situation it is not possible to utilize, suggests that Manitoba has been significantly impacted by the supply management regime. Manitoba is known to be a low cost Province, for instance Borcherding (1981) observed that Manitoba has about a 10 cent per dozen cost advantage over British Columbia. By virtue of its location Manitoba stands as a low cost producing province especially because of readily available and cheap grain for feed. Feed is one of the most significant cost factors in egg production. In 1991, for instance, the feed component was about 34.9 per cent of the cost of production per dozen as indicated in Figure 2. Quota restrictions in a low cost province together with a shrinking table market has created a disequilibrium in the market. As a result substantial amount of eggs surplus to the table market have to be disposed each year. Thus the issue becomes, has Manitoba gained or lost from supply management?

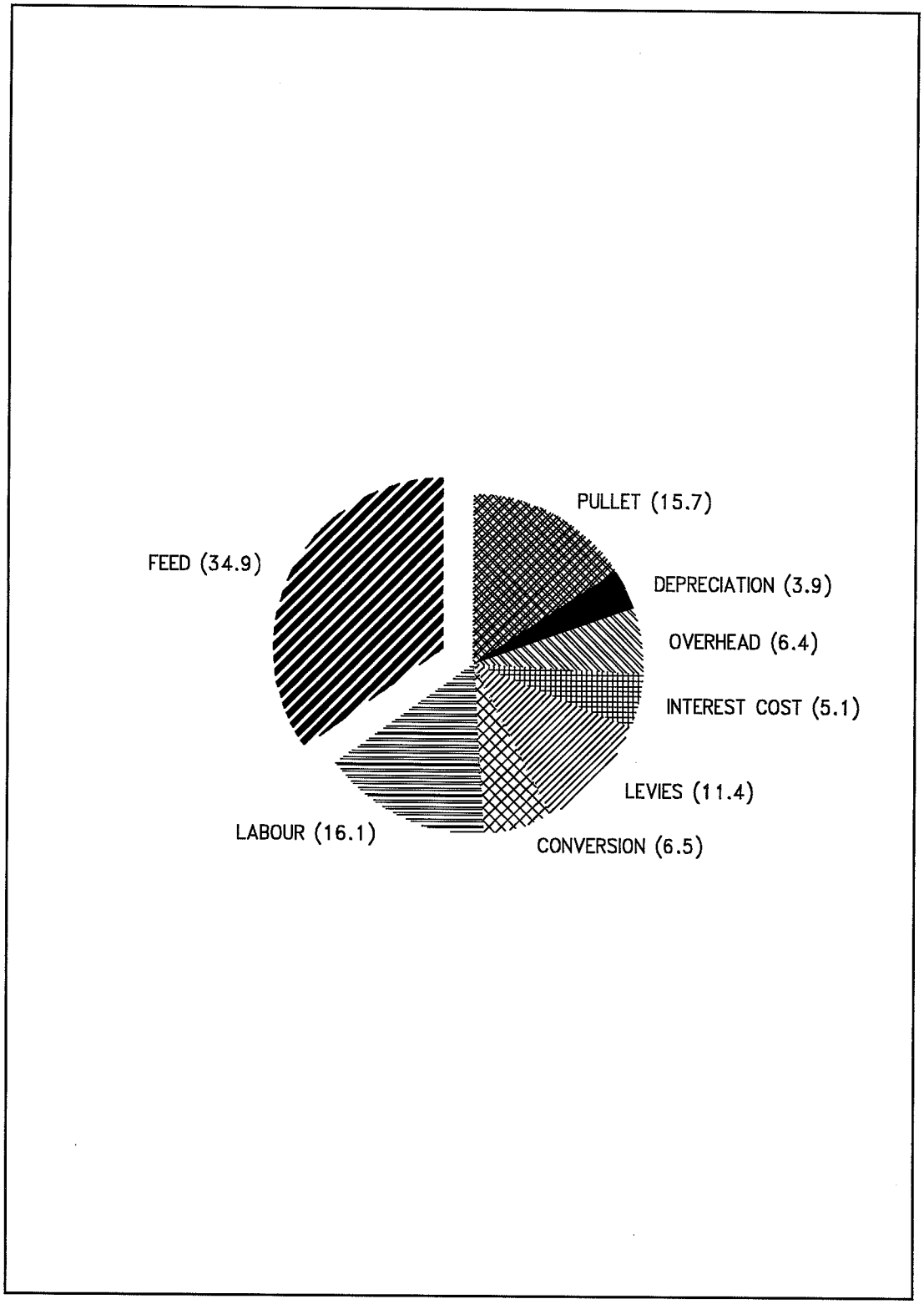
An evolving broader issue is also relevant to the industry, where recent development in the General Agreement on Tariff and Trade (GATT) indicates that supply management runs counter to current world perception of freer Global trade and less restrictive trade between countries.

Agreements reached in December 1993 under GATT require that:

(a) Import Tariffs be reduced by 15 percent over six years.

(b) The minimum access commitments of 3 percent of domestic consumption be increased to 5 percent over six years.

Figure 2: Cost of Production.



Source: CEMA annual report, 1991.

According to the December, 1993 news release by Agriculture and Agri-Food Canada, the tariff equivalent for eggs will be 192.3 percent in 1995, minimum $0.94 per dozen. This amount will be reduced by 15 percent in six years to 163.5 percent in year 2001, minimum $0.80 per dozen. This implies that by year 2001, the level of protection will still be high, something which may, or may not be, acceptable to the U.S under the CUSTA. Following these agreements, the federal minister of agriculture formed a six-member task force to recommend changes that have to be made to the supply management system, in accordance with the new GATT agreements.

In this environment it is important to analyze the potential effects on Manitoba of dismantling supply management. The basic question is whether egg producers can survive in Manitoba under relatively free trade? Knowledge of what will happen is likely to improve current and future investment in the industry in Manitoba and perhaps policy making. This is a significant current issue which can be analyzed jointly with the question of whether Manitoba has gained or lost by being under supply management.

STUDY OBJECTIVES.

The broad objectives of this study are:

(a) to assess the major impacts in Manitoba of the existence of supply management since its inception in 1973; and

(b) to analyze the impacts on Manitoba of removing border controls.

However, because of time and resource constraints, only a portion of the above objectives will be addressed.

The following will be the specific objectives of this study:

(a) to develop an analytic model which can be used to determine whether Manitoba and egg producers have benefitted from supply management;

(b) to develop a framework for analyzing the impact on Manitoba of removing border controls;

(c) undertake empirical analysis on:

(i) selected measures related to whether and how Manitoba and egg producers have benefitted from supply management.

(ii) analyze short-run impacts on Manitoba of removing border controls.

(d) outline the research requirements needed to complete the analysis of long-run impacts of removing border controls.

HYPOTHESES.

The objectives of this study imply that the following hypotheses guide the analysis. First, in dealing at two levels of impacts on supply management, it is possible that the results may be contradictory for the province and for producers. Therefore supply management is expected to have had overall positive benefits for producers but cost Manitoba economic activity.

Second, removal of border controls is expected to have significant effects on the structure of egg production in Manitoba. The conventional wisdom seems to be that the industry

would shrink significantly. For this study it is hypothesized that:

(a) the benefits to individual producers as they now exist would fall; and

(b) the egg industry in Manitoba would grow; and

(c) economic activity in the province derived from egg production would rise.

CHAPTER TWO

LITERATURE REVIEW

INTRODUCTION.

Supply management which essentially involves the use of border controls, production quotas and authority to set prices in order to improve level and stability of farm prices and incomes is a policy response to some form of market failure.

According to Loyns and Begleiter (1981), among the factors that generated market failure in the egg industry were:

- biological nature of egg production which make production unresponsive to instantaneous price changes.
- demand, which as pointed out by many other researchers such as (Cayer 1979; Dodd 1983; Brock 1983), has been relatively price inelastic.

These conditions plus producer lobbying, precipitated the creation of supply management programs. As they have evolved, supply management programs have received much review and have been criticized by many analysts. There is a vast amount of literature on supply management to date which can be broadly grouped into two main schools. The first group is the strongest in terms of the analysis of supply management programs. This school emphasizes analysis of the social cost of supply management and the deadweight loss associated with supply control programs. However, they rarely attach any significant weight to the accomplishments of supply management. The major

proponents of this approach to analyzing boards include Cowper(1979),Borcherding(1981), Loyns and Begleiter(1981), Harling and Thompson(1983), Van Kooten and Spriggs(1984), just to mention a few. The second group argues in favour of supply management based especially on the question of price and income stability. The views expressed in this school discounts or ignores the societal costs of achieving stability. Contributors to this school include Walker(1981), Schmitz(1983),and Proulx, Gouin and Louis(1992).

Recently, a third school has emerged which tries to explore the possibilities of reform to the current system of supply management. Advocates of this school include the Consumers Association of Canada(1990), Moschini and Meilke(1991) and the GATT.

This chapter provides a survey of literature pertaining to the above lines of argument relevant to this study. Each line of argument is presented as a separate section.

RESOURCE DISTORTION ASSOCIATED WITH SUPPLY MANAGEMENT.

According to Wilson (1990) on the basis of his review of the output of several studies, Canadian agricultural policy has achieved stability on the farm at an undue cost burden to consumers and at the expense of efficiency losses in the producing sector.

Barichello (1981) in his work on the economics of Canadian dairy industry regulation estimated an efficiency loss of $208 million and an income transfer of $680 million from consumers to producers, over and above the annual subsidy of about $300 from Canadian tax payers. According to Borcherding (1981) supply management marketing boards contribute to inefficient use of resources, lower productivity and lead to considerable income gains to producers. In his study of the egg industry in British Columbia, he

demonstrated substantial social deadweight loss with the supply management system and showed that a subsidy would cost less. Veeman (1982) estimated that the long-run social loss in allocative efficiency in Canada is quite significant, around 35.1 percent of total annual sales in eggs. Veeman further observed that egg production quota values have increased, regardless of the fact that initially these quotas were handed out freely. She pointed out that a significant effect of high quota value is to make it difficult for the young generation to get into production of supply managed commodities as it requires huge initial investment.

Van Kooten and Spriggs (1984) estimated the social loss due to allocative inefficiency net of rent-seeking costs to be around 0.7 percent of total annual egg industry sales. It is widely "acknowledged" that while producers in supply managed industries gain, consumers lose more than the producers gain (Schmitz 1983). Harling and Thompson (1983), when analyzing the economic effects of intervention in Canadian agriculture, found that during the period 1975 to 1977 domestic market price for eggs were 36 percent higher than imported eggs from the U.S. The two researchers estimated that during the same period egg consumption would have been 3 to 6 percent higher if consumers faced competitive prices.

In a cross-country comparison of government intervention, Harling and Thompson (1985), found that consumers in countries such as Germany, Britain and Canada paid higher product prices and contrary to the general belief, producers have not necessarily benefited. Their results indicated that German egg prices during 1975-1977 were 25 to 30 percent higher than prices of imported eggs, whereas Canadian prices for eggs were

36 to 42 percent higher. According to the two researchers, Canadian prices were higher because of a combined effect of administered price and import control in contrast to Germany where only import controls were in place.

Van Kooten (1988) in his paper on the economic impacts of supply management, estimated the annual loss in consumer surplus measured in 1981 dollars, to be equal to $4.95 per person for eggs, which translates into a total annual loss in consumer welfare of $109 million dollars. Recently in an effort to measure supply management net benefit to producers, de Gorter(1992) used border prices for eggs adjusted to a level comparable to Canadian farm prices. de Gorter observed that producer prices in Canada were higher than the U.S prices adjusted to a level comparable to Canadian farm prices. This unique approach was adopted in this study, in order to determine the benefits of supply management to egg producers in Manitoba.

POSITIVE ASPECTS OF SUPPLY MANAGEMENT.

Until now the General Agreement on Tariff and Trade (GATT), Article XI, allowed quantitative import restrictions in support of supply management for basic agricultural products because, by controlling total supply, supply management does not encourage greater production for the world market. The recent GATT agreement, however calls for the tariffication of quantitative import restrictions which were previously allowed under GATT Article XI.

According to Wilson (1990) supporters of supply management maintain that supply management serves both producers and consumers: producers in terms of reasonable price

and stable income, and consumers by ensuring a stable supply of supply managed commodities such as eggs without volatile price swings. In his book " Farming the System" Wilson indicates that supporters of supply management further argue that agriculture by its nature requires special treatment otherwise the agricultural sector will collapse, because of the risks involved.

In his paper on Monopoly in Resource Allocation in the United States, Harberger (1954) estimated that for United States, the welfare loss from monopolies, was less than 0.10 percent of national income. Commenting on Harberger's finding many scholars concluded that if the estimates are correct, then economists should not bother about monopolies, they should concentrate on other economic issues. Schmitz used the argument in a paper on supply management and cautions that the magnitude of the estimates and even the reliability of the conclusions reached by researchers on the social costs of supply management might be questionable in view of the assumptions and methodology used to arrive at them.

Schmitz argued that, on aggregate, supply management creates negligible welfare losses. He concluded, by saying that:

> **If one could refine the estimates of previous researchers along the lines suggested in his paper; one might actually find that supply management can lead to a welfare improvement. (pg. 151)**

Walker (1981, pg. xvii) estimated that for British Columbia the cost to individual consumers of the supply management system is approximately $20 per year. According to Walker this amount is negligible compared to the benefits emanating from supply management, although he did not demonstrate the benefits.

According to CEMA, supply management guarantees producers reasonable price, stable income and so maintains the viability of small family farm. Proulx, Gouin and Louis (1992, pg. 45-46), argue against the notion that supply management protects and fosters inefficiency. According to their analysis, egg production per layer has increased substantially under supply management to reach and even surpass the levels in the United States. The three indicated that in 1971, the rate of lay was 209 and 223 eggs per hen in Canada and United States respectively, but in 1988, more than 10 years after the implementation of supply management, the rate of lay reached 253 and 251 eggs per hen in Canada and United States respectively.

The 1989 Government report titled "Growing Together" which provided a vision for Canada's Agri-Food industry, however, differ slightly with the above views. In the report the government challenged the supply management system to be more market responsive and that the system should recognize that it is impossible to completely insulate it from the world market place.

SUPPLY MANAGEMENT REFORMS.

As indicated by Wilson, the government is under pressure to reform or even dismantle supply management programs. The Consumers' Association of Canada (CAC) indicated recently that its first choice is the dismantling of supply management system and its replacement with a market-driven and market responsive system. If for some reason this is not possible, then the Association's second choice is a total overhaul of the supply management system. CAC argues that the Canadian Government makes contradictory

statements, in that the Government seeks freer markets for Western grain and cattle farmers but at the same time it wants continued protection from import competition for dairy and poultry farmers. In an environment of increasing international trade liberalization, the CAC predicts that the Canadian government will have to grant greater access to its markets, which means that the government will have to either restructure supply management or dismantle it altogether.

Supply management seems to have very strong support in the farming community and a very strong political appeal (Wilson, 1990, pg. 167-184). This argument was also acknowledged by Veeman (1982) when she said that there is a very strong political desire to perpetuate supply management programs, but with the current philosophy of global integration through freer trade, it is peremptory to reform the supply management system. As part of the efforts to reform various government intervention systems such as the supply management system in Canada, and bring agriculture more fully under GATT rules, an agreement was reached recently under GATT that requires , import tariffs to be reduced by 15 percent over six years and the minimum access commitment of 3 percent of domestic consumption to be increased to 5 percent over six years. Moschini and Meilke (1991), support the idea of transforming Non-Tariff Barriers(NTBs) into Tariffs. According to Moschini and Meilke, tariffs will facilitate the integration of trading countries and the transmission of market signals, contrary to NTB's which essentially disconnect markets.

Although the level of protection will still be higher by the year 2001, it is likely that in the future tariffs will be completely phased out. In which case it is of utmost

importance for Manitoba to have some idea on what to expect when the border controls are removed. It is from this point of view that we find this study to be of interest.

THE RELEVANCE OF REVIEWED LITERATURE TO THIS STUDY.

One of the objectives of this study is to analyze the impacts of supply management and removal of border controls. This chapter contains a review of literature under three schools of thought which are relevant to this study. The first school, uses economic criteria to analyze supply management and suggests that supply management has created significant resource distortions. The second school, uses program criteria to analyze supply management and concludes in favour of supply management, that the system has achieved its objectives and has managed to create price and income stability. The third school suggests the need to reform the supply management system to be in line with the current philosophy of freer trade. Views expressed in the three schools are important in the analysis of the impacts of supply management.

CHAPTER THREE

A FRAMEWORK FOR ANALYSIS.

A significant regulatory regime exists for the Manitoba and Canadian egg industry. The regulation is directed toward stabilizing producer prices and incomes as well as maintaining the family farm, but has secondary objectives such as efficiency in egg production and, ensuring the availability of safe and healthy products to consumers. The basic purpose of this thesis is to examine how supply management has impacted the industry in Manitoba and, in the face of potential reduction of trade barriers, to analyze how the removal of border controls with the United States would affect the industry. The specific objectives of the study are:

(a) to develop a model which can be used to analyze the impact of supply management on Manitoba.

(b) to develop a framework for analyzing the impact of removal of border controls,

(c) undertake empirical analysis within the constraints of data availability, and

(d) outline the research required to complete the analysis.

In order to investigate these objectives, an analytic model which generates testable criteria and observable data must be set up. That is the task of this chapter.

Following is a schematic outline of regulation of egg marketing designed to generate testable propositions.

FIGURE 3: A SCHEMATIC OUTLINE OF REGULATION OF EGG MARKETING.

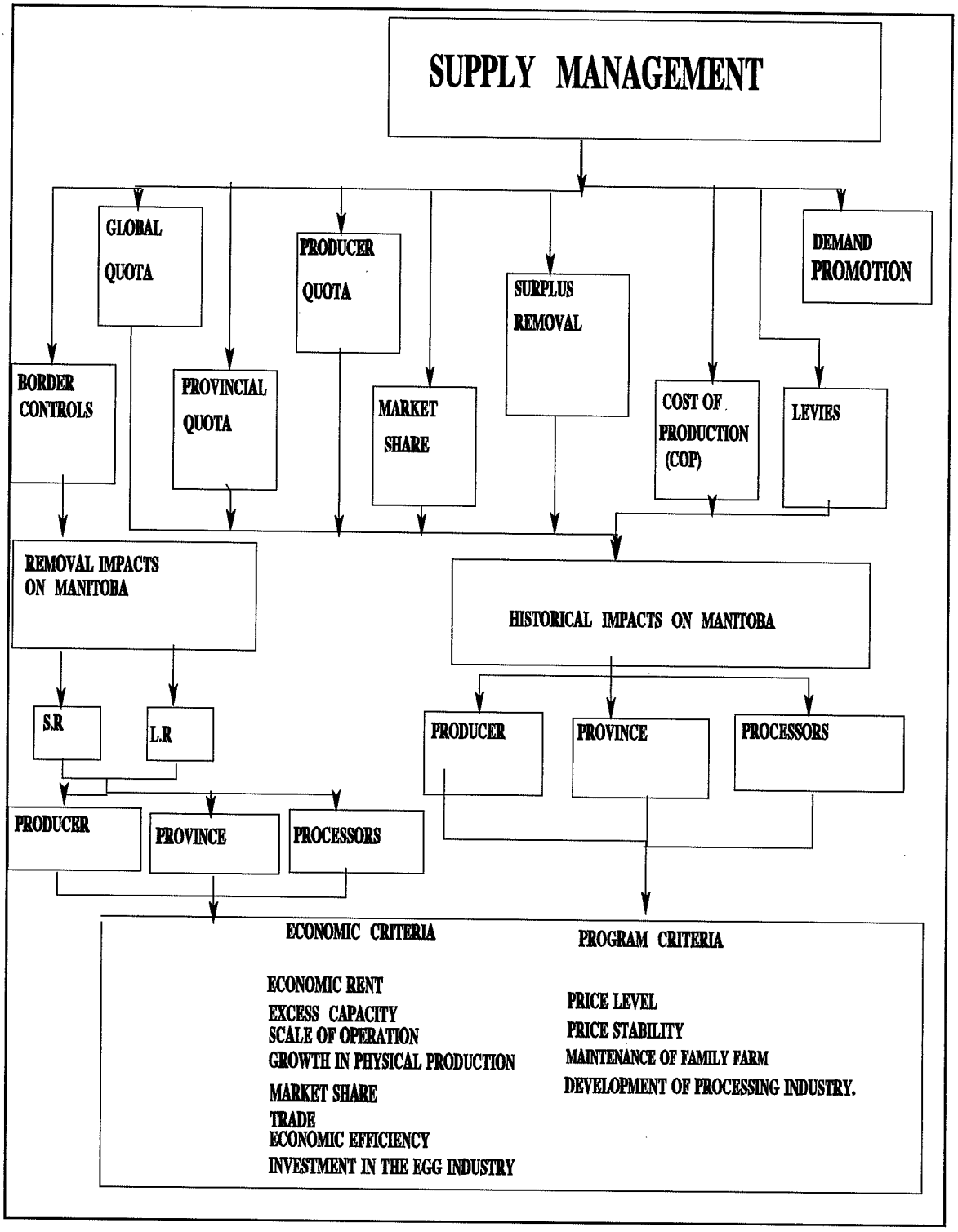


Figure 3 traces the relationship between the important components of the supply management and their impacts on the Manitoba economy and on egg producers. The discussion below provides a brief outline of criteria, rationale and measurement variables to be used to assess the impacts of supply management on provincial economic activity and egg producers.

Supply management has a number of separate control variables. In terms of the objectives of the overall study; volume controls, pricing and demand promotion are related most directly to the main objective. Clearly border controls are related to the objective of determining how removal of border controls would affect this province. The lower levels of Figure 3 indicates the separate impacts evaluated under economic and program criteria.

Economic Criteria.

(a) Economic Rent.

Economic rents measure the price raising impact of supply management. Landsburg(1989) defines rent as a payment to a factor of production in excess of the minimum payment necessary to keep it in production. It is the common economic method of measuring producer benefit (producer surplus) from the existence of a regulatory program. It has been used extensively by many researchers such as Veeman(1982) and Schmitz(1983). As Schmitz showed, the quota system together with quantitative restrictions on imports have created substantial amounts of economic rents to producers

of regulated agricultural commodities such as eggs.

In Figure 4 with the supply restricted output Qm economic surplus to all producers is the area PsPmad. This analysis requires the overall provincial demand and supply curves to be specified and measured and is beyond the scope of this study.

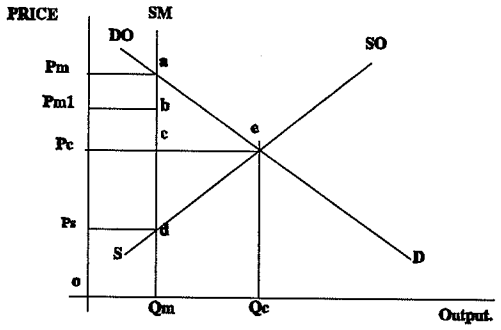


Figure 4: Market.

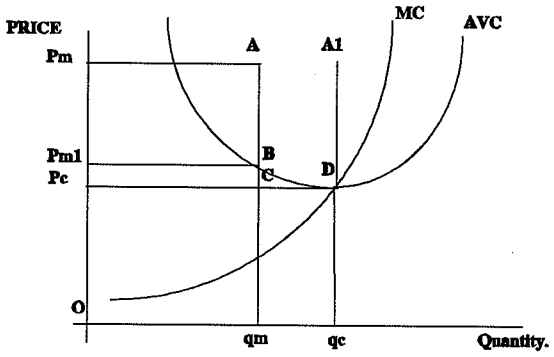


Figure 5: Firm.

In Figure 5 the individual producer is the focus with the cost curves MC and AVC, quota qm, and price pm. This producer realizes economic rent of AB (or Pm - Pm1). The availability of a short-run firm based MC curve for production in Manitoba will provide

a direct method of calculating the magnitude of economic rent due to supply management for producers.

(b) Excess Capacity.

Supply management works by restricting output. Output restriction through quota forces producing units (farms) to operate at higher unit costs than capacity production would allow, and consequently creates excess capacity. It is generally accepted that Manitoba has excess capacity. It is generally assumed that utilization of the excess capacity would increase output, lower unit costs of production, and produce a multiplier effect in terms of overall economic activity. Benefit to egg producers and to the province in terms of increased economic activity would follow. Estimates of reduced costs and multiplier impacts will be estimated.

(c) Size and number of Producers (Scale of Operation).

Economic theory postulates that increased size of operation leads to lower production costs if technological and pecuniary economies exist. Technological economies include: savings in the labour, materials or equipment requirements per unit of output resulting from improved organization or production methods. In 1979, P.S Ross reported in Cowper, indicated that the minimum efficient flock size in Ontario was 20,000 birds, while at that time the average size in U.S in San Diego county was 79,000 birds. It would appear that this is a formidable gap. Assessment of the average size of operation in Manitoba and the direction of change compared with those variables in other provinces,

compared with available information on the minimum efficient size in the United States will be used to assess the impact on Manitoba of supply management.

(d) Growth in physical production.

Growth in output and sales is considered to be one of the major indicators of firm performance. Scherer(1973) considers market size as one of the factors that may limit growth and hence plant size. Although Scherer's study was not dealing with agriculture, his findings are applicable here because production quota generally limits market size. Under the quota system each province is required to produce and market only within its quota allocation. As a result it prevents egg producers from expanding production according to efficiency criteria. As lowest cost producer among Canadian provinces, it would appear reasonable to expect growth in the egg industry in Manitoba.

Assessment of output growth trends before and after supply management will be used as a measure of the impacts on Manitoba and hence benefit or costs from supply management, in relation to Manitoba as a low cost producer.

The egg industry is closely related to the hog industry in terms of input requirements and husbandry practices. Hog production is composed of three main enterprises: farrow-finish, weaner and grower-finisher. In terms of cost per unit, egg production is analogous to the grower-finisher enterprise (Appendix A.5). The hog industry in Manitoba operates relatively freely. In this case, growth in the hog industry in Manitoba will be compared with that of the egg industry before and after supply management to identify appropriate impacts.

(e) Market Share.

Market share is the proportion of total market output or sales accounted for by an individual firm, and is considered to be an important indicator of how a firm is progressing. Market share of an efficient and low cost firm should rise if all regulatory intervention in the market is not a hindrance.

Several studies e.g Ravenscraft(1983) have found that market shares are positively related to profitability. Under supply management each province is only allowed to produce within a specified quota. It is not possible for a province to increase its market share even if it were economically feasible. Assessment of Manitoba's share of total egg production in Canada before supply management and during supply management will be used as a measure of whether Manitoba has benefitted under supply management.

(f) Trade.

Provincial quotas prevent production adjustment between provinces, because each province is required to produce only within its quota. Provincial quotas together with the lack of free interprovincial trade has created a disequilibrium in the market especially for low cost provinces such as Manitoba. The disequilibrium is revealed in terms of surplus table eggs produced each year.

(g) Economic efficiency.

Economic efficiency is an aspect of production which seeks to identify; for a given level of output, that combination of factor inputs which minimizes the cost of producing that output. It deals with the effectiveness of resource allocation. The definition of economic efficiency, implies that under no government intervention low cost producing areas such as Manitoba would expand both in size and production volumes, and technical coefficients such as the rate of lay would improve. Under this criteria we intend to use the evidence on: size and number of producers, excess capacity, Manitoba's production cost advantage, surplus removal and market share to attempt to provide a meaningful assessment of the overall efficiency of supply management as it has evolved.

(h) Investment in the egg industry.

One of the most important characteristics of any industry is how easily a new entrant can join or an established firm leave. In the egg industry quota is a property right and it has a value attached to it. Most recently the quota has been marketed by the board itself. If the market is efficient then the discounted economic value and board price of the quota will be approximately the same. It is intended to use the economic rents generated in this study to produce an economic value which will then be compared to actual board prices.

Program Criteria.

(a) Price Level.

One of the objectives of supply management is to raise price levels and hence the income of egg producers. If supply management is successful in raising price levels, then the price in Manitoba less levies will exceed the price of eggs landed in Manitoba from a possible U.S export base. Therefore we will compare Manitoba price with landed prices from Minnesota.

(b) Price Stability.

Canadian Agricultural Policy has long attempted to cushion agricultural producers from unexpected fluctuations in commodity prices and hence also to protect farm incomes. Supply management is one of the programs set to establish stable agricultural prices. In this study price stability will be used as an indicator of Supply management benefit. Martin and Warley(1978), have used absolute values of prices(mean and standard deviation), to evaluate stability of prices, although sometimes such an approach may not be strong and reliable. In this case we will assess price stability by computing the coefficient of variation of prices under different conditions.

(c) Maintaining Family Farm.

Another policy objective of supply management is maintaining the family farm i.e relative smallness and numbers. There are arguments however, that family farms don't need to be small because there is a trade-off between smallness and efficiency.
The extent to which, supply management has achieved this policy objective will be

discussed together with efficiency problems associated with this objective.

(d) Development of the Processing Industry.

According to the Manitoba Egg Producers Marketing Board(MEPMB), Manitoba is the least cost producing province in Canada, and the province generates substantial table egg surplus. This has to be diverted to the processing market at a price equivalent to landed U.S eggs. The MEPMB claims that Manitoba currently has the largest share of the processing market in Canada because of supply management and the surplus removal program. An attempt will be made to verify this claim as one of the benefits of the supply management program. Having completed discussion on the analytic criteria related to the first objective as summarized in the lower level of the schema, we now move to the second objective of this study.

Second Objective.

As indicated earlier in the schema, border control represents one of the major control variables under supply management, and it is related to the second objective. This involves the assessment of impacts on the Manitoba Egg industry of removing border controls. This requires full knowledge of the supply conditions in Manitoba, both short and long-run, as well as an appropriate border price to be used as a proxy of the price that would prevail in Manitoba if border controls were removed.

Moschini and Meilke(1990) and de Gorter(1991) used this approach in their work. We intend in this study to compare U.S price(border price) with the estimated short-run

marginal cost in order to assess the short-run viability of Manitoba egg industry when border controls are removed.

(a) Short-Run Effects.

In order to assess the short-run impacts of removing border control, we need to have full knowledge of supply conditions in Manitoba. From the theory of the firm, the short-run marginal cost curve above the minimum average variable cost is the firms short-run supply curve, as illustrated in Figure 6 below:

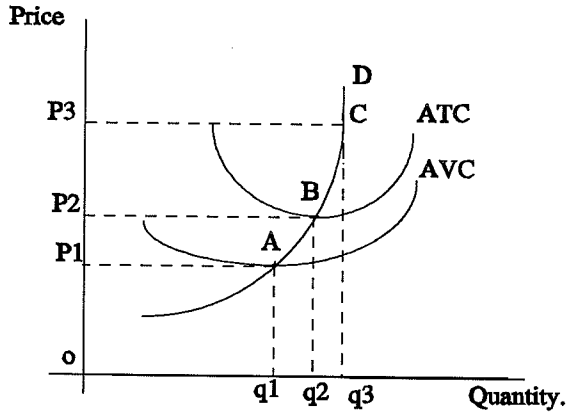


Figure 6: Short-run Cost Curves.

Figure 6 above displays the firm's short-run cost curves and three possible prices, P3 > P2 > P1, P1 is the lowest price that brings forth any output. For any price lower than P1 Total Revenue (TR) will be less than (TVC) as a result the firm will have to shut down. For a producing firm, price P1 is the exit price and point A(the minimum average variable cost) is the exit point. For a potential producer point A is the entry point. At A the firm can either produce or exit because the loss will equal the Total Fixed Cost (TFC)

for either decision. At price P2 the firm produces q2 of output and at this point Total Revenue covers Total Cost and profits are zero. Any price greater than P2 such as P3, and output q3 , yields positive profits. Points A,B, and C on the MC curve are derived from profit maximizing rules. The short-run marginal cost curve above the minimum average cost is the firms short run supply curve, Varian(1987).

Currently Manitoba is said to have excess capacity. If supply controls are removed, egg producers in Manitoba would be able to take advantage of excess capacity. An important question is, what effect would removal of controls have on excess capacity?

Excess capacity, according to Pass and Lowes(1993), is a situation where a firm or industry has more plant to supply a product than it is currently producing. As a result a proportion of the firm or industry's capacity is left idle. Let us assume that the short-run marginal cost (MC) and average cost curve(AVC) for egg producers in Manitoba are as represented in Figure 7, where QM is the producer quota, PM is the administered price. QC and PC are the short-run cost minimizing level of output and price when the excess capacity has been utilized.

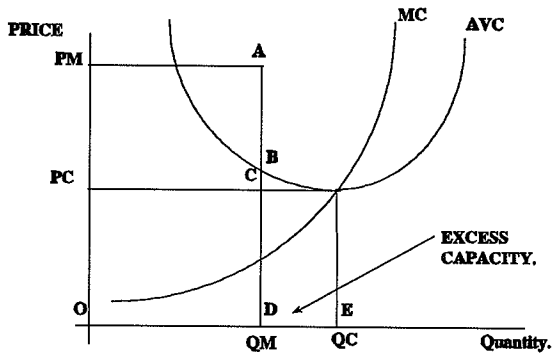


Figure 7: Excess Capacity.

The producer quota QM, as indicated above is to the left of the cost minimizing production level QC. The excess capacity is then measured as the difference between what is being produced now under the quota system and QC(which is the anticipated level of output) when the existing excess capacity has been fully utilized in the short-run after the removal of both the quota and border controls.

(b) Long - Run Effects.

If the supply management system were no longer in place the egg industry in Manitoba would operate in direct competition with the United States. This implies prices in Manitoba would fall. The egg industry in the United States operates in a reasonably competitive environment on both supply and the demand side of the market, with the exceptions that result from subsidies and regulation in industries related to the egg industry. The price that egg producers in Manitoba are likely to face as soon as border controls are removed would be those associated with imports, or potential imports, from the United States. In some contexts(Green, 1990),these are referred to as limit prices. In the trade literature they are also referred to as border prices(de Gorter,1991).

The long-run adjustment in the face of these prices will depend on the nature of long-run supply for eggs in Manitoba. Viner(1931) and Salvatore(1992), provided a useful, and perhaps the only systematic, discussion of this issue. The following discussion was derived from Viner and Salvatore's analysis. According to Viner and Salvatore there are three possible technological conditions under which production may take place in the

long-run, each of which will result in different long-run supply and marginal cost curves:

(i) Increasing Costs.

(ii) Constant Costs.

(iii) Decreasing Costs.

(i) Increasing Costs.

We have an increasing cost industry if input price increases as an industry's resource usage expands. This however, is not likely to happen in Manitoba. If however, it does happen then the egg industry would collapse. Let us say that the industry and the firm (Figure 8 and 9) are in long-run competitive equilibrium producing Q1 and q1 at E and A respectively. A short-run shift in the market demand curve from DD to DD1 will drive the equilibrium price to P2 from P1. At this point each established firm will increase production to C and make CD profits per unit. However, if input prices rise as more firms enter the industry, the firm's cost curves will shift to point B (i.e LRAC1, SRAC1 and SRMC1). The firm and the industry will reach long-run equilibrium at G when the short-run industry supply curve has shifted to SS1. The long-run supply curve will be EG in Figure 9, then the egg industry in Manitoba will be doomed unless excess capacity and size adjustment provides an opportunity for the industry to be competitive.

Figure 8: Increasing Cost Firm.

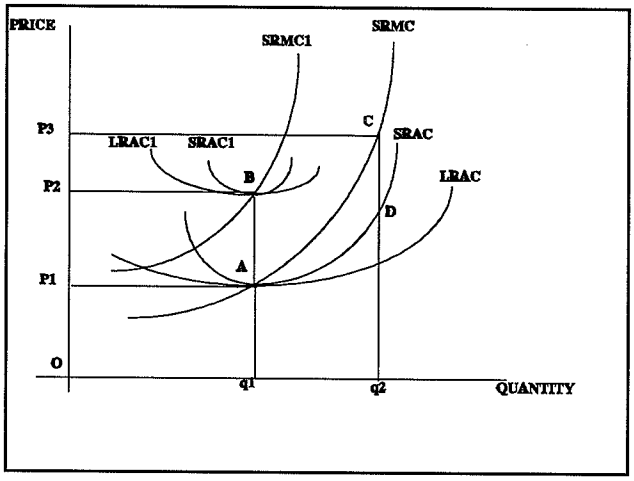
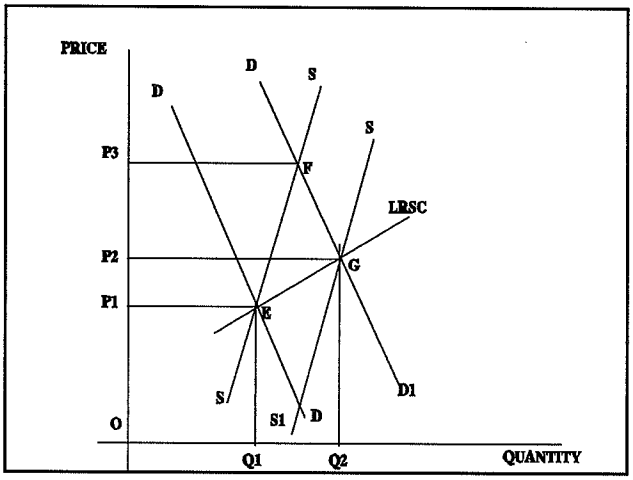


Figure 9: Increasing Cost Industry.



(ii) Constant Costs.

The second case is the constant cost(Table 10 and 11). If initially at price P1, the industry and the firm are in long-run competitive equilibrium producing Q1 and q1 at E and A respectively, a shift in the market demand curve from DD to DD1 will drive market equilibrium price to P2. Each firm will increase output within its existing plant in the short-run and make pure profit. In the long-run more firms will enter the industry, and if input prices remain constant, the market supply of the commodity will increase until the original market equilibrium price P1 is re-established. The long-run supply curve(LRSC) for the industry will become the horizontal line EG. If border price is at the same level or above EG, then the egg industry in Manitoba would survive.

Figure 10: Constant Cost Firm.

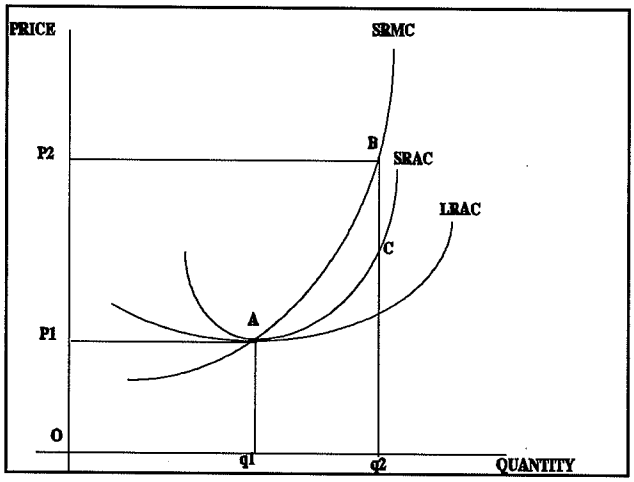
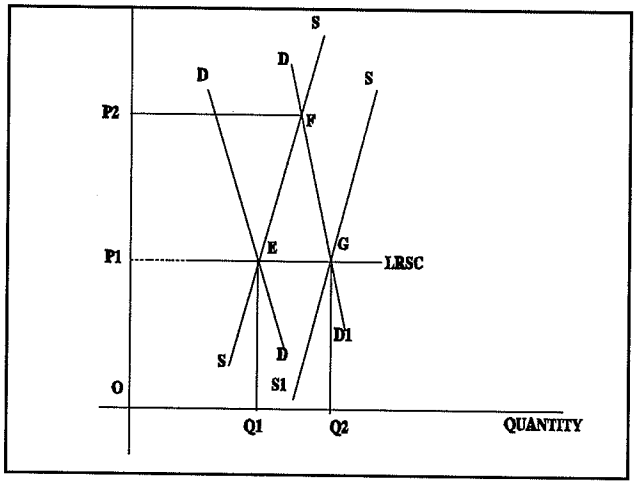


Figure 11: Constant Cost Industry.



(iii) Decreasing Cost Industry.

We have a decreasing cost industry in the long-run if, factor prices fall as more firms enter a perfectly competitive industry and as the industry output is expanded. Let us say initially that the industry and the firm are in long-run competitive equilibrium producing Q1 and q1 at X and A respectively in Figure 12 and 13. If the short-run market demand curve shifts from DD to DD1, the new equilibrium becomes Y. Each firm increases production to q2 and generates BC profits per unit. Short-run profits will attract firms into the industry in the long-run, as a result the short-run industry supply curve shifts from SS to SS1, establishing a new equilibrium at Z for the industry and at D for the firm. Joining market equilibrium points X and Z, we get the negatively sloped long-run supply curve LRSC. In the long-run, if prices fall in Manitoba as the industry adjusts to border prices, this is likely to be the only case where Manitoba can survive or expand production. Consequently long-run adjustment and health of the egg industry in Manitoba will likely depend on this situation.

Figure 12: Decreasing Cost Firm.

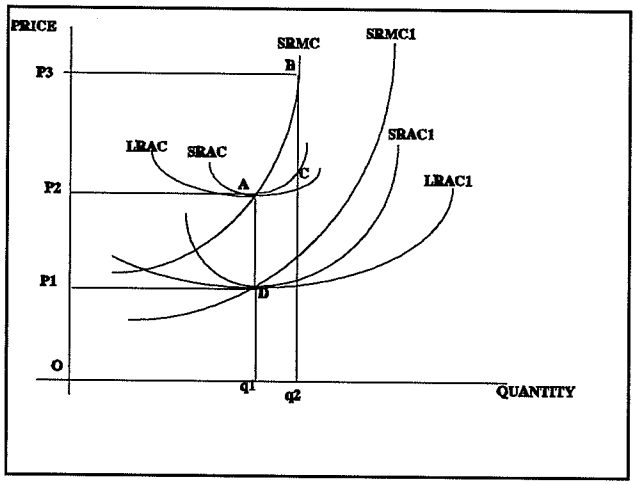
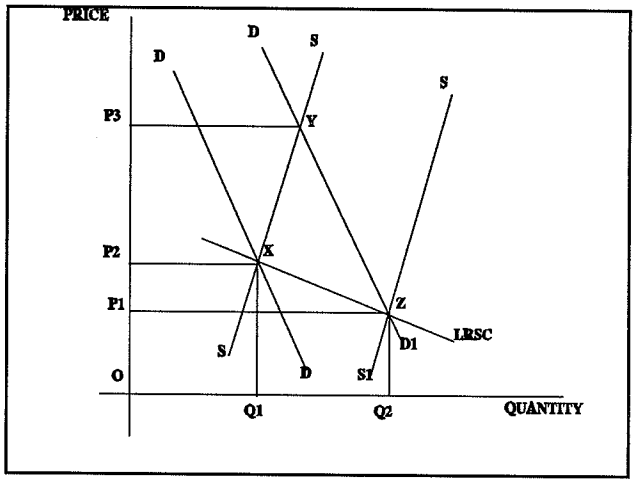


Figure 13: Decreasing Cost Industry.



SUMMARY.

This chapter has provided a discussion of the framework for analyzing the impacts of supply management and removal of border controls. The analysis of impacts of supply management will be based on economic and program criteria. Under each criteria there

are several identified measurement variables. These measurement variables and their corresponding measurement techniques are summarized below and constitute the refutable hypotheses for this thesis.

TABLE 15: A SUMMARY OF CRITERIA, MEASUREMENT VARIABLES AND MEASUREMENT TECHNIQUES.

CRITERIA	MEASUREMENT VARIABLE	MEASUREMENT TECHNIQUE
ECONOMIC	Economic rent.	Short-run supply curve.
	Excess capacity.	Reduced costs and multipliers.
	Scale of operation.	Comparison with U.S.
	Growth in physical production.	Comparison with Manitoba hogs.
	Market share.	Comparison before and after supply management.
	Trade.	Table surplus and interprovincial trade in eggs.
	Economic efficiency.	Comparison to U.S landed prices.
	Investment in the egg industry.	Comparison of discounted quota value with board price.
PROGRAM	Price levels.	Manitoba compared to U.S.
	Price stability.	Coefficient of variation.
	Maintenance of family farm.	Aggregate effects.
	Development of processing industry.	Aggregate assessment of the industry.

CHAPTER FOUR

DERIVATION OF A SHORT-RUN SUPPLY SCHEDULE FOR EGG PRODUCTION IN MANITOBA.

INTRODUCTION.

The previous chapter established a conceptual framework for further analysis of the impacts of supply management on the egg industry in Manitoba. The analysis of both objectives, i.e experience with regulation and effect of removal of border controls, has an important common feature. Analysis of both objectives draws heavily on supply side economics and important parts of the analysis require an empirically estimated short-run supply schedule, for egg production in Manitoba. Obviously assessing impact of removal of border controls also requires an estimate of the nature of the long-run supply schedule but this part of the analysis is beyond the scope and resources of this study. The purpose of this chapter is to provide an estimate of the short-run supply for eggs in Manitoba. Estimation of this relatively simple concept is made difficult by the fact that it is impossible to observe supply responses to price change because regulation has limited egg production for close to 20 years. As a consequence an estimation of the short-run cost function in order to derive short-run marginal cost and hence short-run supply is required. This chapter therefore develops the relevant model and provides a discussion of the

estimation process. Then results of the estimation are presented.

Given that the industry has some level of excess capacity, an effort is made to determine the effect of unused capacity on costs and supply through sensitivity analysis. This chapter ends with a summary of the results of the estimation process and a short-run supply curve that can be used to determine supply management impacts like economic rents and short-run adjustment to removal of border controls.

THEORETICAL FRAMEWORK.

THEORY OF THE FIRM.

As Viner demonstrated, supply theory for any industry begins with the producing firm. There is a relationship between inputs and outputs, which at a general level, can be expressed mathematically in the following way as a function:

$$\mathbf{Y(y,x) = 0} \qquad \mathbf{4.1}$$

Where x is an m-dimensional vector of non-negative inputs and y is an (n-m) dimensional vector of non-negative outputs. Equation 4.1 is a more general representation of the production technology. Let us assume that x in 4.1 represents the inputs used in a poultry farm to produce a single output y which is eggs. Consider a farm (firm) producing the output y according to a concave production function:

$$\mathbf{y=f(x,t)} \qquad \mathbf{4.2}$$

where x - denotes the vector of non-negative inputs, y - represents a single maximum output possible and t is the time trend, which captures the change in technology overtime.

According to Varian (1984), the duality approach to microeconomic theory,

indicates that if the production function in 4.2 has convex isoquants, and if for any level of output y, the cost-minimizing input combination is employed, then there exists a total cost function that is dual to 4.2, defined as:

$$C(w,y,t)=J(y,w_1, ...,W_m,t) \qquad 4.3$$

where the Wi's are the price of the xi's and C(w,y,t)=is the total cost.

Typical of agriculture is the fact that in many instances only a subset of the inputs are variable. Economists have done a lot of research work based on models in which all inputs are variable. Examples include, the extensive work of Binswanger (1974), Berndt and Wood (1976), Ray (1982), Jogensen and Associates (1981) and (1984), and Anderson and Thursby (1986). The earliest empirical implementation of a short-run production model with a flexible functional form is that of Atkinson and Halvorsen (1976), using a translog variable profit function.

Back to the total cost function 4.3, if cost is minimized with respect to a subset of inputs, conditional on the level of output and the level of quasi-fixed inputs, then there exists a variable cost function that is dual to 4.2, defined as:

$$VC(w,y,z,t)=R(y,w_1, ...W_n,Z_1, ...Z_1, t) \qquad 4.4$$

Where the Zi denotes the subset of Xi that are quasi-fixed and for that matter not necessarily in static equilibrium, $VC = \sum_{i=1}^{h} Wi\ Xi$, h + 1 = m and t is the trend variable that proxies technology. The cost function vc(w,y,z,t) has the following classical properties.

1. VC(w,y,z,t) is non-decreasing in W; y,z,t fixed. That is if $W^a \geq W$, then

$$C(w^a, y, z, t) \geq C(w, y, z, t).$$

2. VC(•) is continuous and concave in w.

3. VC(•) is positively linear homogeneous in w for fixed (y,z,t)

4. VC(•) ≥ 0 for $w > 0$, and $y > 0$; z and t fixed, i.e. vc(w,y,z,t) is real-valued and non-negative for all positive factor prices w.

5. VC(w,y,z,t) is monotonically non-decreasing in output y, for fixed (w,z,t); that is if $y^b \geq y$, then $VC(w,y^b,z,t) \geq VC(w,y,z,t)$.

This simply means that increasing output cannot decrease the costs, and hence the minimum variable cost cannot decrease as output expands.

6. VC(w,y,z,t) is non-decreasing in z; w,y and t fixed. That is, if $z^c \geq z$, then $VC(w,y,z^c,t) \geq vc(w,y,z,t)$.

7a. If the variable cost, VC(•) is differentiable in input prices w, then this derivative property also known as Shepherd's lemma:

$$\frac{\partial\, VC(w, y, z, t)}{\partial\, W} = X(w, y, z, t)$$

gives a unique cost-minimizing level of input demands, i.e. if $x_1(w,y,z,t)$ is the ith unique, cost-minimizing input demand then $x_1(w,y,z,t)=dVC(w,y,z,t)/dwi$

7b. If VC(•) is twice differentiable in w, then it follows that:

$$\frac{\partial^2\, VC(w, y, z, t)}{\partial^2\, Wi\ \partial wj} = \frac{\partial^2\, VC(w, y, z, t)}{\partial wj\ \partial wi}$$

which gives a very important symmetry condition for empirical work.

8. VC(•) represents a minimum cost for firms which are cost-minimizers.

By extending the behavioral assumption of cost minimization equation 4.3, to profit maximization behaviour, we can derive the supply response of the firm (farm). Given an output price p, the profit function is expressed as:

$$\Pi(p, w) = \max_{y}(py - C(w,y) \qquad (4.5).$$

In agriculture under free market competition, the decision of what to produce is made before output price is known with certainty, so it is much more realistic to think of p (output price) as representing the expected price; and that producers maximize the expected profit. By applying Hotelling's lemma, the supply function y(p,w) can be derived from the Profit Function as follows:

$$\frac{\partial \Pi(p,w)}{\partial p} = y(p,w) \qquad (4.6(a))$$

Given a random sample of data observations on y (output level), p (output price), w (input price) and an appropriate functional form, the output supply function y(p,w) can be estimated econometrically.

The profit function 4.5 has the following basic properties, which were discussed at length by Chambers (1988):

1. It is decreasing in input price w, and increasing in output price p.

2. It is linearly homogeneous in (w,p).

3. It is convex in (w,p).

4. If is differentiable in (w,p), then this derivative property, which is also known as Hotelling's lemma, allows the derivation of profit maximizing output supply y(w,p) and

input demand x(w,p) as:

$$\frac{\partial \Pi(w,p)}{\partial p} = y(w,p)$$

$$\frac{\partial \Pi(w,p)}{\partial w} = -x(w,p)$$

As in 4.4 we can extend the behaviourial assumption of variable cost minimization to variable profit maximization behaviour conditional on the allocation of quasi-fixed inputs. With the variable profit function, $\Pi(w,p,z)$ where z represent a vector of quasi-fixed input, by applying Hotelling's lemma we can derive the estimating equations for output supply and variable input demands as:

$$\frac{\partial \Pi(w,p,z)}{\partial\, pj} = Y_j(w,p,z) \qquad j = 1, \qquad N \qquad \text{(4.6(}b\text{))}$$

$$\frac{\partial \Pi(w,p,z)}{\partial\, wi} = -X_i(w,p,z) \qquad i = 1, \qquad M \qquad \text{(4.6(}C\text{))}$$

APPLICATION OF THE THEORY IN DEVELOPING A MODEL TO ANALYZE THE MANITOBA EGG INDUSTRY.

JUSTIFICATION FOR THE ANALYSIS AND A BRIEF OVERVIEW OF MANITOBA EGG INDUSTRY.

Most of the studies on supply management such as those of Arcus (1981); Barichello (1982); Forbes, Hughes and Warley (1982); Harling and Thompson (1983); Schmitz (1983); and Veeman (1982), have emphasized the welfare effects. The general conclusion is that supply management gives rise to inefficiency losses because the market clears at a point where the marginal benefit to consumers, represented by market price, differs from the marginal cost of production. Because of this departure from marginal cost pricing, the observed product price tends to be irrelevant in guiding production decisions. This has a direct effect on the estimation of market supply response models. Although most of the past research efforts have overlooked this problem, recent developments in the GATT, have necessitated the need for information on the departure from marginal cost pricing in order to determine the impact of trade liberalization.

Production and marketing of eggs in Manitoba provides a general example of supply management in Canada. Egg production is directly regulated at the federal level by the Canadian Egg Marketing Agency (CEMA) and at the provincial level by the Manitoba Egg Producer's Marketing Board (MEPMB). The price of eggs is set based on the cost of production formula (COP). The cost of production formula reflects the cost of producing in terms of direct cash costs and producer returns. This pricing system

involves supply control and import restrictions. Because of declining demand for table eggs, the system has been generating surplus table eggs, which have to be disposed under the surplus removal program.

MODEL DEVELOPMENT.

To apply the theory of the firm in the analysis of the Manitoba egg industry, some slight adjustments are necessary, because of special characteristics associated with supply managed industries. Egg producers in Manitoba are assumed to have profit maximization as their objective. The industry is assumed to experience both productive input and market constraints. Production cycle takes roughly a year, which means laying hens are replenished after every 52 weeks. As a result some inputs are assumed fixed within the production cycle. These inputs include, building and equipment, and plant administration, repair and maintenance.

Egg prices are set by the Canadian Egg Marketing Agency and the Manitoba Egg Producer's Marketing Board, where egg producers themselves individually have little or no influence at all on the pricing policy, so it is reasonable to assume that an individual egg producer is a price-taker.

Individual egg producers do not have a significant share of the market, which means none of them can individually influence the market. There is a significant barrier to entry in terms of quota, which is the right to produce, so regulated egg producers require egg production quotas to enable them to engage in egg production. However, there are no barriers to exit, because the quota may be disposed of and allocated to other egg

producers, if a farmer wishes to leave the industry. Infact the Manitoba egg producer Marketing Board has already started an auction floor for quota.

The quota barrier to entry into the industry does not provide any significant monopolistic power to egg producers. It is also important to emphasize that egg production quotas are initially the property of the Manitoba Egg Producer's Marketing Board, and are assigned to individual producers solely for their use under the conditions specified by the board. These conditions as of now, allow production quotas to be bought and sold, under minimal board control; so we can reasonably assume that the right to produce is to a large extent owned by the individual egg producer. In addition, characteristically eggs produced by one farmer are no different from eggs produced by others in the industry. All of the above features combined, provide an environment within which individual egg producers make their production decisions. In this study we use aggregate level data, and given the features discussed above, we treat the Manitoba egg industry as a single large farm. Moschini (1989) found the assumption to be sound, especially if a market for the fixed factors and the regulated output quotas exists and if farms optimize over these factors. As indicated above, quotas are bought and sold among egg producers under some control by the egg board. Let us assume that quotas can be rented at a price Quv, i.e. paying Quv gives the producer the right to produce one unit of y per one production period. We also assume that at the output level y produced by a given farmer, the difference between the administrative price (cost of production formula price) and the quota price Quv is just equal to the marginal cost. We then modify the profit function 4.5 to:

$$\Pi\,(p - quv), w) = \underset{y}{Max}\,[(p - quv)y - c(y,w)] \tag{4.7}$$

The first order condition for 4.7 requires that:

$$\frac{\partial C}{\partial Y} = p - quv \tag{4.8}$$

Equation 4.8, indicates that in order to maximize profit, egg producers, choose the output level y, at which the difference between output price and marginal cost is just equal to per unit quota price Quv. Applying Hotelling's lemma to equation 4.5 we obtain the output supply function:

$$\frac{\partial \Pi\,(p - quv), w)}{\partial (p - quv)} = y\,(p - quv), w) \tag{4.9}$$

where (P-Quv) is equal to the marginal cost from equation 4.8. Moschini (1989) indicated that equation 4.9 can be used to estimate the supply response, given an appropriate functional form.

From equation 4.4, we specify a translog variable cost function:

$$
\begin{aligned}
ln\ VC = {} & \lambda o + \pi y ln y + \sum_{i=1}^{n} \tau i\ ln\ wi + \sum_{i=1}^{m} Bi\ ln\ zi \\
& + \tfrac{1}{2}\theta_{yy}(ln\ y)^2 + \tfrac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{m} \theta ij\ ln\ wi\ ln\ wj \\
& + \tfrac{1}{2}\sum_{j=1}^{m}\sum_{j=1}^{m} \delta ij\ ln\ zi\ ln\ zj + \sum_{i=1}^{n} \varrho yi\ ln\ y ln\ wi \\
& + \sum_{i=1}^{n}\sum_{j=1}^{m} \varrho ij\ ln\ wi\ m\ zj + \sum_{i=1}^{m} \psi i\ ln\ y\ ln\ zi \\
& + \phi_t\ T + \tfrac{1}{2}\phi_{tt}\ T^2 + \phi_{ty}\ T\ lnY + \sum_{i=1}^{n} \phi_{twi}\ Tln\ Wi \\
& + \sum_{i=1}^{m} \phi_{tzi}\ T\ ln\ Zi + \epsilon_t \qquad (4.10)
\end{aligned}
$$

where wi = Input prices for Feed, Pullet and labour normalized on the price of energy.

y = output in '000'000 dozens.

VC = Variable cost normalized on the the price of energy.

zi = Quasi-Fixed input levels (Building and Equipment; and Plant, Administration, Repair and Maintenance).

The justification for specifying a Translog cost function is that it is a second order flexible functional form, and so imposes no priori restriction on

$$
C(W^\circ, Y^\circ),\ \partial C(W^\circ, Y^\circ)/\partial W^\circ,\ \frac{\partial C(W^\circ, Y^\circ)}{\partial Y},\ and\ \left[\frac{\partial^2 C(W^\circ, Y^\circ)}{\partial W \partial Y}\right]\ (N+1)\ x\ (N+1)
$$

except for the homogeneity restriction(Chambers,1989).

Next we will estimate a short-run profit function in order to derive the supply function as in equation 4.6(b).

The functional form to be specified is the normalized version of the quadratic form

proposed by Lau (1974), and applied in profit function estimation by Shumway (1984). The normalized quadratic functional form satisfies accepted definitions of flexibility and allows restricted profit to be negative, a possibility which prevents the use of forms (e.g. Translog) that require logarithmic transformation of profit.

We specify the normalized quadratic variable profit function as indicated in 4.11.

$$\tilde{\pi} = \alpha_0 + \sum_{i=1}^{n} \alpha_i W_i + \sum_{j=1}^{m} \beta_j Z_j + \phi_p \bar{\rho} + \tfrac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} \partial_{ij} W_i W_j + \tfrac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{m} B_{ij} Z_i Z_j + \tfrac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{m} \phi_{\bar{p}\bar{p}} \bar{\rho}^2 + \sum_{i=1}^{n=3} \partial_i W_i \bar{\rho} + \sum_{i=1}^{n=3} \sum_{j=1}^{m=2} \varphi_{ij} W_i Z_j + \sum_{i=1}^{m=2} \delta_i Z_i \bar{\rho} + \epsilon_t \qquad (4.11)$$

where $\bar{\pi} = \pi/w4$ = i.e. Profit normalized by W4, input price for energy.

Wi = Represents price W1, ... W3 normalized by W4

$\bar{\rho}$ = (P-Quv) - mc in equation 4.8,normalized by W4.

Zj = Quasi-fixed input levels.

$\bar{\pi}$ is linearly homogeneous by construction, and symmetry restriction require that:

$$\alpha ij = \alpha ij \; and \; \beta ij = \beta ji$$

We can use equation 4.11 and the output supply equation 4.12 below, jointly to estimate all the parameters. Output supply equation obtained by Hotelling's lemma:

$$\frac{\partial \tilde{\pi}}{\partial \bar{\rho}} = Y = \Phi_{\bar{\rho}} = \Phi_{\bar{\rho}\bar{\rho}} \bar{\rho} + \sum_{i=1}^{n=3} \zeta i \, Wi + \sum_{i=1}^{m=2} \delta i \, Zi + \epsilon_t \qquad (4.12)$$

Estimated parameters of the output supply equation 4.12 would be used with the appropriate border price plus transport cost (Pus + T), to obtain the amount of output y, that will be produced in Manitoba under trade liberalization.

Specification of the Translog variable cost function is very crucial in the analysis and the ultimate results. The following section provides a brief discussion of the theory and tests to be performed in order to come up with a resonably correct specification. Also at the end of the next section we provide a brief discussion of the theory a test for condition 4.8.

THE SHORT-RUN TRANSLOG COST FUNCTION.

Developments in duality theory between production and cost functions together with the use of flexible functional forms have enabled a number of useful empirical works to be done. Much of the empirical work, until some years ago, was based on a strong assumption that the production technology operates at full static cost-minimizing input levels where all inputs are fully adjusted to their long-run equilibrium levels within one production period.

To relax the assumption of full static equilibrium, there are two possible approaches that can be pursued. The first approach is to assume that firms are continuously in dynamic equilibrium rather than static equilibrium, however, although the specification of dynamic equilibrium is theoretically attractive and leads to elegant models, these models are difficult to implement empirically (Bernt 1981).

The second approach is to assume that firms are in static equilibrium with respect to a subset of inputs, conditional on the observed levels of the remaining inputs referred to as partial static equilibrium. The inputs that are in partial static equilibrium are the variable inputs and the rest are fixed or quasi-fixed inputs.

Explicit discussion of the theory behind partial static equilibrium cost function, in this case the variable cost function, can be found in Diewert (1974), in his work on the variable profit function of which variable cost function is a special case.

A lot of empirical work has been done so far using models that allow the observed technology to be at a short-run equilibrium where firms minimize variable costs while being constrained by the utilization levels of quasi-fixed factors. However, most of these studies were carried out without conducting the relevant tests for static equilbrium. A classic example is Brown and Christensen (1981).

Tests for static equilibrium over quasi-fixed inputs have been developed and applied by Kulatilaka (1985) and by Schankerman and Nadiri (1986). A recent study by Coyle (1990), also explores in detail the tests of static equilibrium.

In this study, our prior assumptions are that we have three inputs which are variable: feed for the birds , pullets and energy for the buildings. Other inputs such as buildings and equipment, administration, repair and maintenance are classified as quasi-fixed. Labour, on the other hand, seems to fit both sides. Because of the uncertainity on whether to treat labour as variable or fixed, we have to conduct the relevant tests in order to identify inputs which are quasi-fixed by empirical tests.

From 4.10 Shepherd's lemma implies the share equations for variable inputs:

$$SVi = \tau i + \sum_{j=1}^{n} \theta j \; ln \; wj + \sum_{i=1}^{n} \varrho i \; ln \; y + \sum_{j=1}^{m} \varrho j \; ln \; zj + \vartheta ti \; T + \epsilon_t \qquad (4.12).$$

n = 1, 2: Feed and Pullet

m = 1, 2, 3: Labour; Plant, administration,
repair and maintenance;
Building and equipment.

where: Svi = wixi/VC

VC = Normalized variable cost.

wi = Normalized prices of Feed and Pullet.

xi = Quantities of Variable inputs, feed and Pullet.

zi = Quantities of fixed or quasi-fixed inputs.

Static competitive cost minimization over quasi-fixed inputs implies the share equations:

$$Szi = Bi + \sum_{j=1}^{m} \delta j \; ln \; zj + \sum_{j=1}^{m} \varrho j \; ln \; wi + \sum_{i=1}^{m} \psi i \; ln \; y + \varphi \; T + \epsilon_t \qquad (4.13).$$

where Szi = wizi/VC

wi = Normalized prices of variable inputs.

zi = Quantities of quasi-fixed inputs.

Following Coyle (1990), two different types of tests for hypotheses of static equilibrium have to be performed:

(1) Chi-square tests of symmetry restrictions across cost share equations that are implied by static long-run cost minimizing equilibrium. For this test share equations for variable inputs 4.12 would be estimated jointly by Three Stage Least Square(3SLS) with one, two or three of the share equations 4.13 for quasi-fixed inputs, where the symmetry restriction ij = ji is maintained (refer Table 4.1 for results).

(2) Hausman specification tests of the share equations for variable inputs together with the first order conditions for static equilibrium. For this test, 3SLS estimates of share equation 4.13 in two models would be compared. In the first model equations 4.13 would be estimated together with the various first order coditions for Z1, Z2, and Z3 in 4.14, where all symmetry conditions are imposed (refer Table 4.2 for results)

To test for condition 4.8, which assumes that participants in the industry are profit maximizers we have to perform the Hausman specification test. The Hausman specification test would be used here to test whether it is correct to specify condition 4.8 as representing the behaviour of Manitoba egg producers. The M-statistics obtained in this test is Chi-square distributed, and is usually compared with the critical Chi-square value. As indicated earlier, detailed discussion of the theory behind the test is found in Hausman(1978) and Coyle(1990). Condition 4.8 which we intend to test here can also be expressed as:

$$\frac{\partial C}{\partial Y} = \overline{P} - rentalprice(quv) \qquad (4.14(a)$$

Where: $$RentalPrice = Assetprice \times \alpha \qquad (4.14(b))$$

and α = Producer's subjective discount rate.

Equation 4.14(b) is based on the assumption that rents(and discount rate) are constant over infinity time horizon such that:

Asset price = Rental price/α

So: $$\frac{\partial C}{\partial Y} = \overline{P} - \alpha \times assetprice \qquad (4.14(c))$$

The derivative of 4.10 with respect to the log of Y gives us:

$$\frac{\partial \ln C}{\partial \ln Y} = \frac{\partial C}{\partial Y}.\frac{Y}{C} \qquad (4.14(d))$$

Substituting 4.8 in 4.14(d) we get:

$$\frac{\partial \ln C}{\partial \ln Y} = (\overline{P} - quv).\frac{Y}{C} \qquad (4.14(e))$$

Rearanging 4.14(e) gives us:

$$\frac{\partial \ln C}{\partial \ln Y} = \frac{\overline{P}Y}{C} - \frac{quv.Y}{C} \qquad (4.14(f))$$

Where: $$\frac{\partial\ In\ C}{\partial\ In\ y} = \pi y + \theta_{yy} ln\ y + \sum_{i=1}^{n} \varrho yi\ ln\ wi + \sum_{i=1}^{m} \psi i\ ln\ zi + V_t \qquad (4.14(g))$$

And, $$quv = \alpha \times Assetprice \qquad (4.14(h))$$

Substituting 4.14(g) in 4.14(f) and re-arranging we get:

$$\frac{\overline{P}Y}{C} = \pi y + \theta_{yy} ln\, y + \sum_{i=1}^{n} \varrho yi\, ln\, wi + \sum_{i=1}^{m} \psi i\, ln\, zi + \frac{quv.Y}{C} \qquad (4.14(i))$$

For the Hausman specification test equation 4.10 would be estimated first, jointly with the cost-minimizing input demand functions 4.12, and then in the second case equation 4.14(i) would be added and the system would be re-estimated.

Coyle, in his work on the test of static competitive equilibrium in U.S. Agriculture, provides a detailed discussion of the above tests.

In summary, we intend to estimate the Manitoba egg industry marginal cost using the Translog variable cost function 4.10, based on condition 4.8 if this condition holds given the data we have. If condition 4.8 holds we would use the varible profit function to estimate marginal cost, and if condition 4.8 doesnot hold we would use the variable cost function directly to estimate short-run marginal cost, which would give us the short-run supply curve.

DATA SOURCES, DESCRIPTION, MODIFICATIONS AND LIMITATIONS.

DATA SOURCES.

Most of the data used here was obtained from the Manitoba Egg Producer's Marketing Board. Quarterly data for the period, 1975 to 1992 was used in this study because, the first COP survey was conducted in the Spring of 1975.

DATA DESCRIPTION.

In this analysis quarterly data from 1975 to 1992 was used. Following below is a brief description of each of the data used, as reported by the Canadian Egg Marketing Agency (CEMA).

(a) Pullet cost

The pullet cost component is a measure of the cost of twenty-week old laying hens on a per dozen egg basis. The pullet cost factor is calculated by taking the current price per bird and adjusting this for mortality and condemnation losses and then reducing it by the amount of salvage value per bird on disposal. The result is annualized to reflect the fact that the average laying period is slightly beyond one year. The annualized cost per bird is then converted to a cost per dozen by dividing by the annual production per bird. The pullet cost item is expressed in Canadian dollars per dozen.

(b) Feed cost

Feed cost is one of the significant cost items in the cost of production formula. Feed cost in Canadian dollars per dozen is a measure of the volume/amount of feed at current prices required to produce a dozen eggs. Volume of feed is measured by the feed conversion ratio which is calculated by dividing total pounds of feed consumed by total marketable egg production. The feed conversion ratio is weighted and expressed as a national weighted average.

(c) Labour cost

Labour cost in Canadian dollars per dozen is a measure of labour hours and related wage rates paid in an average egg operation. This factor is measured in terms of hours per 1,000 birds per week. Labour hours are broken into management, skilled and general components to reflect the differences in activities and responsibilities related to each component. Wage rates for each labour category are obtained directly from the survey and therefore reflect the actual costs of paid labour. The wage rate for each labour category, by province, is then applied to labour hours to produce the total labour cost per dozen eggs.

(d) Overhead costs

The overhead cost item includes three components: administrative, plant and interest. Administrative overhead measures business and administrative costs and includes non-plant charges such as municipal taxes, insurance, utilities, telephone, supplies and professional fees. Plant overhead includes repairs and maintenance, fuel, electricity and small tools. All these overhead components are expressed as national weighted averages calculated on a per dozen basis. Interest overhead represents the cost of financing both long term and working capital debt requirements of an average egg operation.

For long term debt the current average interest rate paid by producers is applied to the debt portion of capital investment to derive total interest dollars paid and the result is converted to a cost per dozen. Working capital interest overhead cost is calculated in a similar fashion.

(e) Depreciation

Depreciation contributes to the cost of replacing buildings and equipment at the end of their useful life. Depreciation rates for buildings and equipment are calculated based on the economic useful life of the investment, ten years for equipment and twenty years for buildings. The depreciation cost item is expressed as a cost per dozen in the cost of production formula.

(f) Producer return

Producer return provides a return to producers for the equity portions of fixed asset and working capital investment in the egg operation. In the cost of production model, fixed asset investment represents the equity portion of the undepreciated historical capital cost of buildings, equipment and land. The rate of return to the undepreciated equity portion of fixed asset investment, combined with the return for working capital, results in the producer return per dozen.

MODIFICATIONS.

There are two modifications made. First, it was decided that producer return indicated as one of the cost items in the cost of production formula does not fit to be included as a cost of production. As explained earlier, according to CEMA, producer return is supposed to provide return on the equity portion of fixed asset and working capital investment, but these items have already been covered under the interest cost item with an assumption that the opportunity cost of investing in fixed assets and working capital is the interest rate that will be obtained if that money is deposited in a bank. So,

including producer return as part of the production cost will be double counting and as a result will inflate the cost of production. It was also found necessary to group together some of the inputs to form a divisia index of other inputs and leave the main inputs; feed, labour and pullets separate.

LIMITATIONS.

The cost of production formula entails very complicated calculations and involves a multitude of averaging which leaves plenty of room for mistakes. Many of the assumptions are based on an average farmer, which means farmers who have large scale operations are being over compensated. Some of the cost items, for instance producer return, which is intended to provide a measure of the return on the equity portion of the fixed asset and working capital investment, seems to be cumbersome to calculate because the equity portion varies from one farmer to another by size and overtime. So, it is very difficult to determine an average figure which is representative of the whole egg industry in Manitoba without making mistakes. Given these limitations and others which are not discussed here, it is important that the result obtained be used cautiously.

PRELIMINARY TEST RESULTS.

(a) The observed M-value for the test of condition 4.8 as explained in equations 4.14(a) to 4.14(i) was -1135.29 and the critical Chi-square value with 29 degrees of freedom is equal to 42.6 at 95 per cent and 49.6 at 99 per cent. These results reject condition 4.8. As a result, we use the Translog variable Cost function 4.10 directly to estimate marginal cost.

(b) Results for the other two tests related directly to the specification of the Translog Variable cost function are as reported in Table 16 and 17.

Table 16 reports the results of Chi-square tests of the symmetry restrictions implied by static competitive equilibrium for various combinations of quasi-fixed inputs. All calculated Chi-square statistics as indicated were observed to be statistically significant at 95 percent which imply rejection of static competitive equilbrium for all three quasi-fixed inputs Z1, Z2, and Z3. Hence we conclude that the three inputs are not in static equilbrium, which implies that the three inputs can not be considered as variable. However, the chi-square test of symmetry restrictions alone is not conclusive, we further decided to perform the second test, ie. the Hausman specification test which is much more robust.

TABLE 16: CHI-SQUARE TESTS OF SYMMETRY RESTRICTIONS FOR STATIC EQUILBRIUM.

INPUT IN EQUILBRIUM	NUMBER OF RESTRICTION	CHI-SQUARE STATISTICS	CRITICAL X^2 (0.05)	REGION X^2 (0.01)
Z1	2	64.97 *	5.99	9.21
Z2	2	14.44 *	5.99	9.21
Z3	2	12.07 *	5.99	9.21
Z1 , Z3	5	80.53 *	11.07	15.09
Z1 , Z2	5	88.84 *	11.07	15.09
Z2 , Z3	5	36.52 *	11.07	15.09
Z1 , Z2 , Z3	9	115.41 *	16.92	21.70

* Statistically significant, equilibrium rejected at 5 percent.
Where : Z1 = Labour
Z2 = Plant, Admin, Repair and Maintanance.
Z3 = Building and Equipments.

TABLE 17: HAUSMAN SPECIFICATION TESTS OF FIRST ORDER CONDITIONS FOR STATIC EQUILBRIUM.

INPUTS IN EQUILIBRIUM	M - VALUE
Z1	27.086 * *
Z2	32.892 *
Z3	122.812 *

Critical Chi-square value: X^2 (16).05 = 26.3
X^2 (16).01 = 32.0

* Statistically significant at 5 percent.

** Statistically significant at both 5 and 10 percent.

Where : Z1 = Labour.

Z2 = Plant, admin, repair and maintanance.

Z3 = Building and equipments.

Table 17 reports the Chi-square statistics calculated for Hausman specification test. This test concludes that the two inputs Z2 and Z3 are not in static equilibrium, but labour(Z1) is found to be in static equilbrium because static equilbrium is not rejected at 99 percent, as reported on Table 17. This provides statistical evidence that Z2 and Z3 can be considered as quasi-fixed, but the statistical evidence does not allow us to conclude that labour (Z1) should be treated as variable or quasi-fixed. As a result, for analytical purposes we will proceed to estimate marginal cost in two scenarios vis-a-vis the labour variable. In the first scenario we treat labour as quasi-fixed and in the second

scenario we treat labour as variable.

As indicated by Chambers(1989, pg 109), the marginal cost estimated in a situation where there are fewer fixed variables(second scenario), should be less steeply sloped than that estimated where there are more inputs that are fixed(first scenario). Based on theory we expect that in the first scenario where we treat labour as fixed the marginal cost estimates for a given level of output will be higher than in the second scenario where labour is variable. Figure 14 illustrates this argument.

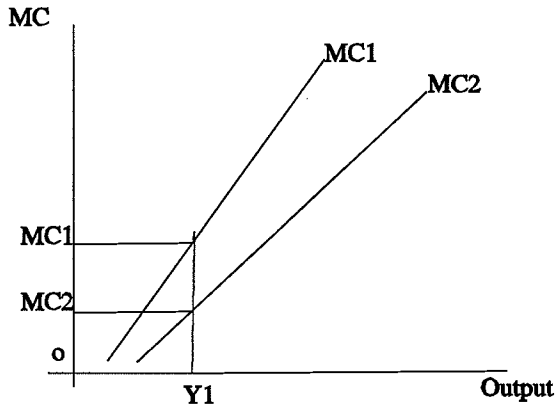


Figure 14: Marginal Cost Curves when Labour treated as variable and as quasi-fixed input.

From the diagram above MC2 represents the marginal cost curve where there are fewer fixed variables and so MC2 is less steeply sloped than MC1 which represents the marginal cost curve where there are more inputs that are fixed. At the same level of unit output say, a dozen eggs, MC2 will be lower than MC1.

SHORT-RUN TRANSLOG COST FUNCTION ESTIMATION, LABOUR TREATED AS QUASI-FIXED.

In this model we treat labour as quasi-fixed and we estimate a short-run Translog cost function jointly with two variable input share equations for feed and pullet imposing the necessary restrictions. The estimated equations are as follows:

$$\begin{aligned} ln\ VC = {} & \lambda o + \pi y ln y + \sum_{i=1}^{n} \tau i\ ln\ wi + \sum_{i=1}^{m} Bi\ ln\ zi \\ & + \tfrac{1}{2}\theta_{yy}(ln\ y)^2 + \tfrac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n} \theta ij\ ln\ wi\ ln\ wj \\ & + \tfrac{1}{2}\sum_{j=1}^{m}\sum_{j=1}^{m} \delta ij\ ln\ zi\ ln\ zj + \sum_{i=1}^{n} \varrho yi\ ln\ y ln\ wi \\ & + \sum_{i=1}^{n}\sum_{j=1}^{m} \varrho ij\ ln\ wi\ In\ zj + \sum_{i=1}^{m} \psi i\ ln\ y\ ln\ zi \\ & + \kappa\ T + \sum_{i=1}^{n} \vartheta ij\ T\ In\ wi + \sum_{i=1}^{n} \varphi ti\ T\ In\ zi + \\ & \omega\ In\ y\ T + \epsilon_t \end{aligned} \tag{4.15}$$

Where: VC = Variable cost normalized on the price of energy.

wi = Normalized input prices for Feed, Pullet and labour.

y = Output in '000'000 dozens

zi = Quasi-Fixed input levels (Building and Equipment, and Plant, Administration,Repair and Maintenance).

T = Time trend.

$$\begin{aligned} SVi = {} & \tau i + \sum_{j=1}^{n} \theta j\ ln\ wj + \sum_{i=1}^{n} \varrho i\ ln\ y \\ & + \sum_{j=1}^{m} \varrho j\ ln\ zj + \varphi\ T + \epsilon_t \end{aligned} \tag{4.16}.$$

Where: n = 1, 2: Feed and Pullet

m = 1, 2, 3: Labour; Plant, administration,

repair and maintenance; Building and equipment.

and Svi = wixi/VC= Variable input share for feed and

pullet.

wi = Normalized prices of Feed and Pullet

zi = Quantities of fixed or quasi-fixed inputs

Constant returns to scale and disembodied technical change will be tested here. Constant returns to scale in production for the cost function implies that doubling output and the quasi-fixed inputs doubles the variable costs. That is,

$$C(W,\lambda Z,\lambda Y,T) = \lambda C(W,Z,Y,T)$$

where λ is any positive scalar. For our Translog cost function 4.15 this test is equivalent to the following restrictions:

$$\pi + \sum_{i=1}^{m} Bi = 1$$

$$\varrho yi + \sum_{j=1}^{m} \varrho ij = 0 \quad \forall i \qquad i = 1,2 \qquad j = 1,2,3$$

$$\theta yy + \sum_{i=1}^{m} \psi i = 0$$

$$\psi j + \sum_{i=1}^{m} \delta ij = 0 \quad \forall i \qquad i = 1,2 \qquad j = 1,2,3$$

$$\omega + \sum_{i=1}^{m} \varphi ij = 0$$

Constant returns to scale was rejected(Table 19), which means that doubling output, and quasi-fixed input jointly does not double the variable costs.

Defining disembodied technical change as a reduction in cost that is independent of any input prices, output, and quasi-fixed inputs, the test implies the restriction:

$$\sum_{i=1}^{n} \vartheta ti = 0 \quad \forall i \qquad i = 1,2$$

$$\omega = 0$$

$$\sum_{i=1}^{m} \varphi ti = 0 \quad \forall i \qquad i = 1,2,3$$

The null hypothesis that technical change was disembodied was rejected at 95 per cent level using Wald's Chi-square test. This implies evidence of embodied technical change. Table 18 presents the parameter estimates of the Translog cost function and Table 19 presents a summary of constant returns to scale and disembodied technical change tests.

TABLE 18: ESTIMATED TRANSLOG VARIABLE COST FUNCTION, LABOUR TREATED AS QUASI-FIXED.

VARIABLE	ESTIMATE	VARIABLE	ESTIMATE
Intercept	-4.5722 *	InW1 * InW1	-0.02720**
	(0.4898)		(0.01617)
InY	0.6286 *	InW2 * InW2	-0.046436*
	(0.1176)		(0.020296)
InY * InY	0.6559 *	InW1 * InW2	-0.17989 *
	(0.04854)		(0.018242)
InZ1	-3.4091 *	InZ1 * InZ1	-0.69346 *
	(0.12774)		(0.03702)
InZ2	0.31835 **	InZ2 * InZ2	-0.011902
	(0.20211)		(0.01415)
InZ3	-0.17033	InZ3 * InZ3	-0.6514 *
	(0.34748)		(0.28342)
InW1	0.77442 *	InZ1 * InZ2	-0.01141
	(0.15889)		(0.04882)
InW2	1.0553 *	InZ1 * InZ3	0.23675 **
	(0.15054)		(0.1560)
InZ1 * InW1	0.000358	InZ2 * InZ3	0.66386 *
	(0.0039)		(0.16895)
InZ1 * InW2	-0.01286 **	InZ1 * InY	0.03303 **
	(0.01227)		(0.01975)
InZ2 * InW1	0.0026119	InZ2 * InY	-0.03748
	(0.00328)		(0.04473)
InZ2 * InW2	0.006671	InZ3 * InY	-0.07485 **
	(0.01222)		(0.06668)
InZ3 * InW1	-0.000711	InW1 * InY	0.004988 **
	(0.009362)		(0.004302)
InZ3 * InW2	-0.051 **	InW2 * InY	0.02327 *
	(0.03359)		(0.01199)

* Significant at 5% level. ** Significant at 10% level.

Note: Values in paratheses are the standard errors.

TABLE 18 Cont.

TABLE 18: ESTIMATED TRANSLOG VARIABLE COST FUNCTION, LABOUR TREATED AS QUASI-FIXED.

VARIABLE	ESTIMATE	VARIABLE	ESTIMATE
T	-0.009782 *	InZ1 * T	0.002636 **
	(0.002528)		(0.001450)
InY * T	0.01731 *	InZ2 * T	-0.002373 **
	(0.001745)		(0.0017677)
InW1 * T	0.002818 *	InZ3 * T	0.004309 **
	(0.0001801)		(0.003674)
InW2 * T	0.005876 *		
	(0.000445)		

* Significant at 5% level. ** Significant at 10% level.

Note: Values in paratheses are the standard errors.

TABLE 19: CONSTANT RETURN TO SCALE AND DISEMBODIED TECHNOLOGY TEST RESULTS.

TEST	NUMBER OF RESTRICTIONS	WALD'S CHI-SQUARE	CRITICAL CHI-SQUARE
CRTS	8	137.01*	15.507
DISEMBODIED TECHNOLOGY	6	44.18*	12.592

Note: * Indicates rejection at 95 per cent.

INTERPRETATION OF ECONOMETRIC RESULTS.

Most of the coefficient estimates in Table 18 were found to be significant at both 5 and 10 percent level. The R^2 was 0.967, the time trend which is usually included to capture the change in technology over time was found to be significant and had negative sign. The coefficients associated with the interaction between input prices W1 and W2 with time trend T are all positive and significant implying that technical change over the period of study was share-using i.e the cost share for Pullet and feed were not independent of the state of technology in the industry and that the impact of these inputs on average cost increased over time. The effect of technology was higher on the cost share for feed and almost half for pullet. In other words the impact of feed input on the average cost overtime was twice that of pullet.

The derivative of the estimated cost function with respect to time was evaluated at all relevant data points. Under the assumption that the trend variable captures technical change, this derivative therefore gives the impact of technological change on variable costs.

Table 20 reports the results of the impact of technological change on variable costs for two years 1991 and 1992 in each quarter. All the calculated values were found to be positive. A positive percentage change in cost implies that cost increased over time with technical change. This is not surprising given the small scale of operations in Manitoba under supply management.

TABLE 20: PERCENTAGE CHANGE IN VARIABLE COSTS DUE TO TECHNICAL CHANGE($\delta InC/\delta T$)

YEAR	QUARTER	$\delta InC/\delta T$
1991	1	0.0287
	2	0.0355
	3	0.0267
	4	0.0247
1992	1	0.0295
	2	0.0428
	3	0.0259
	4	0.0386

SHORT-RUN TRANSLOG COST FUNCTION ESTIMATION, LABOUR TREATED AS VARIABLE.

In this model, labour is treated as a variable input, and a variable cost function in four variable inputs and two fixed inputs is estimated jointly with three variable input share equations for feed, pullet and labour, imposing the relevant restrictions. The estimated equations are as follows:

$$\begin{aligned} ln\ VC = {} & \lambda o + \pi y ln y + \sum_{i=1}^{n} \tau i\ ln\ wi + \sum_{i=1}^{m} Bi\ ln\ zi \\ & + \tfrac{1}{2}\theta_{yy}(ln\ y)^2 + \tfrac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n} \theta ij\ ln\ wi\ ln\ wj \\ & + \tfrac{1}{2}\sum_{j=1}^{m}\sum_{j=1}^{m} \delta ij\ ln\ zi\ ln\ zj + \sum_{i=1}^{n} \varrho yi\ ln\ y ln\ wi \\ & + \sum_{i=1}^{n}\sum_{j=1}^{m} \varrho ij\ ln\ wi\ In\ zj + \sum_{i=1}^{m} \psi i\ ln\ y\ ln\ zi \\ & + \kappa\ T + \sum_{i=1}^{n} \vartheta ij\ T\ In\ wi + \sum_{i=1}^{n} \varphi ij\ T\ In\ zi + \\ & \omega\ In\ y\ T + \epsilon_t \end{aligned} \tag{4.17}$$

where wi = Input prices for Feed and Pullet.

y = Output in '000'000 dozens

zi = Quasi-Fixed input levels (Labour,Building and Equipment, and Plant, Administration, Repair and Maintenance).

$$\begin{aligned} SVi = {} & \tau i + \sum_{j=1}^{n} \theta ij\ ln\ wj + \sum_{i=1}^{n} \varrho yi\ ln\ y \\ & + \sum_{j=1}^{m} \varrho ij\ ln\ zj + \kappa\ T + \epsilon_t \end{aligned} \tag{4.18}.$$

Where n = 1, 2: Feed and Pullet normalized on price of energy.

m = 1, 2, 3: Labour; Plant, administration,

repair and maintenance; Building and equipment.

and Svi = wixi/VC

wi = Normalized prices of Feed and Pullet

zi = Quantities of fixed or quasi-fixed inputs

$$Szi = Bi + \sum_{j=1}^{m} \delta ij \; ln \; zj + \sum_{j=1}^{m} \varrho ij \; ln \; wi + \sum_{i=1}^{m} \psi i \; ln \; y + \varphi \; T + \epsilon_t \qquad (4.19).$$

Where: Szi = wizi/VC

The full set of the parameter estimates for the cost function are as presented in Table 21.

TABLE 21: ESTIMATED TRANSLOG VARIABLE COST FUNCTION, LABOUR AS VARIABLE.

VARIABLE	ESTIMATE	VARIABLE	ESTIMATE
Intercept	2.2360 *	InW1 * InW1	-0.04683 *
	(0.5362)		(0.02224)
InY	0.9438 *	InW1 * InW2	-0.12617 *
	(0.02168)		(0.022206)
InY * InY	0.000486	InW1 * InW3	0.44385 *
	(0.004014)		(0.07296)
InZ1	0.07312 *	InW2 * InW2	0.06197 **
	(0.02641)		(0.04060)
InZ2	-0.005354	InW2 * InW3	-0.12148 *
	(0.05448)		(0.02649)
InW1	-1.2025 *	InW3 * InW3	-0.39586 *
	(0.21056)		(0.02907)
InW2	0.73032 *	InZ1 * InZ1	0.016858 *
	(0.28272)		(0.005980)
InW3	1.5887 *	InZ1 * InZ2	0.023151 **
	(0.25246)		(0.01291)
InZ1 * InW1	-0.003908	InZ2 * InZ2	-0.02002
	(0.004567)		(0.02066)
InZ1 * InW2	-0.009295	InZ1 * InY	-0.03057 * *
	(0.009340)		(0.01708)
InZ1 * InW3	0.002533	InZ2 * InY	-0.01034
	(0.005521)		(0.01669)
InZ2 * InW1	-0.001621	InW1 * InY	0.0014029
	(0.008243)		(0.002144)
InZ2 * InW2	-0.02579 * *	InW2 * InY	0.008901 *
	(0.01671)		(0.003188)
InZ2 * InW3	0.02049 *	InW3 * InY	-0.005314 **
	(0.009975)		(0.002986)

* Significant at 5% level. ** Significant at 10% level.

Note: Values in paratheses are the standard errors.

TABLE 21 Cont.

TABLE 21: ESTIMATED TRANSLOG VARIABLE COST FUNCTION, LABOUR TREATED AS VARIABLE.

VARIABLE	ESTIMATE	VARIABLE	ESTIMATE
T	-0.021745 *	InW3 * T	0.002676 *
	(0.002068)		(0.0002424)
InY * T	0.05777 **	InZ1 * T	0.000056
	(0.00049)		(0.00028)
InW1 * T	0.001959 *	InZ2 * T	0.00006384
	(0.0002082)		(0.0006098)
InW2 * T	0.003494 *		
	(0.0003643)		

* Significant at 5% level. ** Significant at 10% level.

Note: Values in paratheses are the standard errors.

Few coefficients were found to be significant as indicated in Table 21 compared to the estimates in Table 18. The R^2 was found to be equal to 0.98, in this case also the time trend was also found to be significant and had a negative sign. The coefficients associated with the interaction between input prices W1, W2 and W3 with time trend T are all positive and significant implying that technical change over the period of study was share-using i.e the cost share for labour, pullet and feed were not independent of the state of technology in the industry.

Based on the fact that fewer coefficients were found to be significant in this model compared to the situation in which labour is treated as a quasi-fixed input, seems to suggest that labour should be treated as quasi-fixed input. Therefore estimates from the model where labour is treated as quasi-fixed input are used in this study.

MARGINAL COST ESTIMATION, LABOUR TREATED AS QUASI-FIXED.

The derivative of 4.17 with respect to the log of output (InY), gives us:

$$EMC1 = \pi y + \theta_{yy} ln\, y + \sum_{i=1}^{n} \varrho yi\, ln\, wi + \sum_{i=1}^{m} \psi i\, ln\, zi + \omega\, T + V_t \qquad (4.20)$$

From Table 4.3:

EMC1 = 0.628 + 0.655 * InY - 0.033 * In Z1 - 0.0374 * In Z2 - 0.074 * InZ3
+ 0.0049 * In W1 + 0.023 * InW2
+ 0.017 * T + Vt. **(4.21)**

Where: InY = The natural log of output

InZ1, InZ2 and InZ3 are the natural logs of quasi-fixed inputs,Labour; Plant, administration, repair and maintenance and Building and equipment.

Table 4.7 reports the calculated marginal cost from 4.21, together with the 95% confidence interval around the marginal cost, for the four years, ie. 1989 - 1992.

We had to calculate the 95 percent confidence interval here because, the point estimates we get for marginal cost are stochastic, and since we don't know the true value, it is important to know the range at which the true value is found.

TABLE 22: MARGINAL COST ESTIMATES 1990 - 1992, LABOUR AS QUASI-FIXED NPUT.

YEAR	QUARTER	ESTIMATED MARGINAL COST	95% CONFIDENCE INTERVAL OF MC	
			LOWER LIMIT	UPPER LIMIT
1990	1	114.99	85.06	146.46
	2	93.26	64.52	123.47
	3	111.99	84.10	141.38
	4	96.64	73.55	121.11
1991	1	88.19	66.42	111.27
	2	101.26	76.99	126.92
	3	89.73	67.01	113.85
	4	83.59	62.04	106.52
1992	1	88.29	72.55	105.45
	2	122.64	90.97	155.85
	3	84.99	60.21	111.17
	4	105.84	81.69	131.42

Source: Table 18 and equation 4.21.

Note: MC is in Canadian Cents per dozen.

Quarterly marginal cost estimates for three years 1990-1992 are as reported in Table 22. Some of the estimates(Quite a few) show large unexplained variations and the confidence interval is wide for some of the estimates. The variations in the level of MC in some of the quarters may be due to quarterly variation in the cost of production. For

instance one would expect the cost of production to be a little bit higher in the first and fourth quarter because of higher energy costs in winter. During winter heating is required throughout the day and night so energy costs are high. Also birds tends to consume a lot of feed in winter and hence cost per unit may tend to be high. In summer it is warm and for some years extremely hot and this may affect the rate of lay and hence the cost per unit.

CHAPTER FIVE.

ANALYSIS OF THE IMPACTS OF SUPPLY MANAGEMENT AND THE SHORTRUN IMPACTS OF THE REMOVAL OF BORDER CONTROLS.

INTRODUCTION.

The main purpose of this thesis is to analyze the impacts of supply management on the egg industry in Manitoba and to assess the impact of removal of border controls. Based on the analytic criteria from Chapter Three and the short-run supply schedule for egg production in Chapter Four, this chapter reports on empirical analysis of the impacts of supply management to egg producers and the province based on economic and program criteria, and provides some estimates of short-run impacts of removal of border controls.

DATA.

Data required in this case include: egg production levels in Manitoba and Canada before and after supply management, per capita consumption in Canada and U.S, egg prices in Manitoba and the U.S egg prices before and after supply management. The U.S prices used are for the Mid-West, which is considered to be the closest United States producing area to Manitoba. The U.S egg prices are converted to Canadian dollars and then a wholesale margin per dozen is deducted in order to bring the border price to the

same level as the Manitoba producer price. This approach was also used by de Gorter in 1991. Data on the levies charged to Manitoba egg producers during supply management were also used.

ANALYSIS AND RESULTS.

ANALYSIS OF THE IMPACTS OF SUPPLY MANAGEMENT UNDER ECONOMIC CRITERIA.

(a) Economic Rent.

Economic rents is a common economic method of measuring producer benefit from the existence of a regulatory program(Pm - Pm1 in Figure 5). The quota system together with quantitative restrictions on imports have created substantial amount of economic rents to egg producers in Manitoba, as indicated in Table 23. The economic rents have been calculated by taking the revenue per unit minus the variable cost per unit, to arrive at the economic rent per unit.

Table 23, indicates that in 1988 economic rents were around $ 4.96 per bird and this increased to $ 7.23 per bird in 1992, or 31.1 cents per dozen.

TABLE 23: ESTIMATED ECONOMIC RENTS TO EGG PRODUCERS IN MANITOBA, 1988 TO 1992

YEAR	EGG PRICE CTS/DOZ	(a) VRBL COSTS CT/DOZ	RATE OF LAY DOZ/BIRD	RENTS CTS/DOZ	RENTS $/BIRD
1988	88.9	67.09	22.75	21.81	4.96
1989	101.4	77.03	22.42	24.37	5.46
1990	100.2	73.08	23.25	27.12	6.30
1991	99.1	70.00	23.25	29.10	6.76
1992	99.1	68.00	23.25	31.10	7.23

Source: (a) Variable costs from Chapter 4, estimation of short-run supply schedule.

(b) Rate of Lay, Appendix 4.

(b) Excess Capacity.

Manitoba has excess capacity, according to the Manitoba Egg Producers Marketing Board, which has existed since the introduction of supply management and may have increased with the increase in the rate of lay. One piece of evidence is the willingness to produce processing eggs at variable cost, as long as fixed costs are covered by the production quota. The effects have been higher production costs and inefficiency. But under the current quota system it is not possible for egg producers to utilize the available capacity, although it would have been beneficial to egg producers and the province.

Utilization of excess capacity in the short-run(Table 7) would allow egg producers to expand their operation and increase production. Egg producers would benefit as they expand their operation, the industry would expand and the Province would benefit.

The cost of production(figure 2) has two components: there is an absolutely fixed component and a variable component. The variable component is comprised of cost items that are likely to increase as output increases, e.g feeds and pullets. Other costs such as labour, interests and levies would not increase directly as output increases. For the purpose of sensitivity analysis we:

(i) Assume 10, 15, 20 and 25 percent excess capacity.

(ii) Assume 100, 75 and 50 percent saving on the increased output for such costs as labour, interest, and levies.

Table 24, 25 and 26 reports the results of the sensitivity analysis. Cost savings range from as low as 4.88 percent at 50 percent factor cost saving and 25 percent capacity to as high as 9.77 percent at 100 percent factor cost saving and 25 percent capacity. This implies that utilization of excess capacity would lower production costs and as a result would improve efficiency. It is partly this situation which would allow producers to produce for the much lower processing egg market. These results also demonstrate some of the potential for Manitoba producers to meet import competition under border pricing.

TABLE 24: AVERAGE COST SAVING AT 10, 15, 20 AND 25 PERCENT EXCESS CAPACITY, ASSUMING 100 PERCENT COST SAVING ON THE THREE COST ITEMS.

%GE EXCESS CAPACITY	LABOUR	INTEREST	CONVERSION PLUS LEVIES	%GE SAVING
10	1.6	0.51	1.79	3.91
15	2.42	0.76	2.68	5.86
20	3.22	1.02	3.58	7.82
25	4.03	1.27	4.47	9.77

Source: Calculated, based on Figure 2.

TABLE 25: AVERAGE COST SAVING AT 10, 15, 20 AND 25 PERCENT EXCESS CAPACITY, ASSUMING 75 PERCENT COST SAVING ON THE THREE COST ITEMS.

%GE EXCESS CAPACITY	LABOUR	INTEREST	CONVERSION PLUS LEVIES	%GE SAVING
10	1.21	0.38	1.34	2.93
15	1.81	0.57	2.01	4.39
20	2.42	0.76	2.68	5.86
25	3.02	0.95	3.35	7.32

Source: Calculated, based on Figure 2.

TABLE 26: AVERAGE COST SAVING AT 10, 15, 20 AND 25 PERCENT EXCESS CAPACITY, ASSUMING 50 PERCENT COST SAVING ON THE THREE COST ITEMS.

%GE EXCESS CAPACITY	LABOUR	INTEREST	CONVERSION PLUS LEVIES	%GE SAVING
10	0.81	0.25	0.89	1.93
15	1.21	0.38	1.34	2.93
20	1.61	0.51	1.79	3.91
25	2.01	0.64	2.23	4.88

Source: Calculated, based on Figure 2.

(c) Size and Number of Producers.

The number of registered egg producers in Manitoba have decreased from 280 in 1976 to 225 in 1991, despite all the protection embodied in the supply management system. Manitoba is now operating at a smaller size and is not capturing economies of scale that appear to exist in other provinces and in the United States. The average size of operation in Manitoba has gone from 7,459 in 1976 to 9,836 birds in 1983 and in 1991 reached 9,606 layers per producer, while P.S. Ross and Partners(1975) found that significant economies of scale exists in operations with 48,000 birds or more. The average scale of operation in Manitoba is thus small relative to U.S. In the United States, San Diego county for instance, flock size range from 20,000 to 200,000 birds, with an average size of 79,000. The impacts of supply management on the scale of operation and cost has also been experienced in other provinces as well. Borcherding and Dorosh (1980)

for instance found that output restriction through quota allocation have reduced the average size of operation in British Columbia considerably and have raised unit costs from 8 to 16 per cent. Assessment of the San Diego county average size with the average size in Manitoba clearly indicates that, the average size in Manitoba is small and inefficient.

(d) Industry Growth.

During the period from 1961 to 1972 egg output in Manitoba grew by 45.23 per cent or 3.45 percent per year(compounded annual rate), as reported in Table 14. This was the period before supply management was put in place. The Canadian market grew by 8.81 percent during the same period.

During supply management the growth trend has been particularly slowed down, such that for the period 1973 to 1990 output grew by only 1.14 per cent or 0.105 percent per year(compounded annual rate) and the Canadian market grew by 3.82 percent. This significant decline in output growth taken in conjunction with other factors like relative production costs implies that Manitoba has been substantially affected by the regulatory regime. Apparently Manitoba's participation in supply management has cut off economic growth, despite the ability to produce eggs more cheaply than other provinces.

The egg industry closely resembles the hog industry. The hog industry in Manitoba operates relatively freely. Since the hog industry operates freely, a comparison between the two would indicate the analogous effect of supply management on the egg industry. Table 27 reports hog production in Manitoba and Canada, 1961 to 1990 in '000 heads.

TABLE 27: HOG PRODUCTION IN MANITOBA 1961-1990 IN '000 HEADS.

YEAR	MANITOBA	CANADA	%GE	YEAR	MANITOBA	CANADA	%GE
	---'000	HEADS			---'000	HEADS	
1961	611	7616.5	8.0	1976	903	9014.2	10.0
1962	467	7702.5	6.1	1977	914	9080.4	10.1
1963	564	7625.6	7.4	1978	1000	10127.5	9.8
1964	660	8300.3	7.9	1979	1225	12123.0	10.1
1965	620	7940.5	7.8	1980	1256	14214.2	8.8
1966	737	7910.1	9.3	1981	1234	13837.0	8.9
1967	842	9288.0	9.1	1982	1253	13763.0	9.1
1968	778	9210.9	8.4	1983	1450	14161.6	10.2
1969	1053	8653.4	12.2	1984	1649	15232.5	10.8
1970	1358	10687.8	12.7	1985	1742	15604.4	11.2
1971	1234	11440.5	10.8	1986	1805	14945.9	12.1
1972	1308	11086.0	11.8	1987	2017	15281.7	13.1
1973	1295	10746.9	12.0	1988	2145	16420.3	13.1
1974	1073	10896.9	9.8	1989	2071	16588.4	12.5
1975	870	9195.1	9.5	1990	2028	15673.6	12.9

Source: 1. Manitoba Agriculture Yearbook, 1992.

2. CANSIM.

Table 28 reports the comparison between the egg industry(Table 14) and the hog industry(Table 27) in terms of total production and the share of total production in Canada. Table 28 indicates that hog production grew by 101.9 percent between 1961 and 1971 compared to 60.2 percent for eggs. The hog industry share grew by 35 percent from 1961 to 1971(i.e before supply management) compared to 38.2 percent for eggs, implying

that Manitoba's share of total egg production in Canada before supply management was increasing faster than the share of the hog industry.

From 1972 to 1990 in Manitoba grew by 55 percent compared to ony 2.74 percent for eggs. The hog industry's share grew by 9.3 percent from 1972 to 1990(during supply management) compared to only 0.35 percent for eggs, implying that the egg industry has been substantially impacted by the supply management system.

TABLE 28: A COMPARISON BETWEEN THE EGG AND HOG INDUSTRIES, 1961 TO 1990.

	HOG		EGGS	
PERIOD	**PRODUCTION GROWTH**	**SHARE GROWTH**	**PRODUCTION GROWTH**	**SHARE GROWTH**
	---------- PERCENTAGE ----------			
1961 TO 1971	**101.9**	**35.0**	**60.2**	**38.2**
1972 TO 1990	**55.0**	**9.3**	**2.74**	**0.35**

Source: Tables 14 and 27.

(e) Market share.

Manitoba's share of egg production as indicated in Table 14 increased from 8.33 percent in 1961 to 11.51 percent of total production in Canada in 1971, and reached 11.46 percent in 1973. Since then Manitoba's share has been frozen by the regulatory regime. Under this regime of regulation Manitoba has become the largest(relatively) "surplus' producer incurring large surplus removal of eggs surplus to the table market. A fixed

market share, large disposal and low growth in the lowest cost producing province imply significant shortcoming in economic efficiency.

(f) Trade.

Provincial quotas prevent production adjustment between provinces, because each province is required to produce only within its quota. Provincial quotas together with the lack of free interprovincial trade have created an imbalance in the market especially for low cost provinces such as Manitoba. In Manitoba, surplus table eggs produced each year have increased(Table 9). The increase in surplus table eggs together with the lack of free interprovincial trade has created a disequilbrium in the market. An efficient alternative to the current arrangement should probably be, to allow Manitoba to export more of what it produces or to reallocate production shares based on cost advantage.

(g) Economic Efficiency.

The existence of excess capacity in Manitoba is a clear indication that egg producers in Manitoba are not operating at full capacity in accordance with efficiency criteria. Manitoba is considered to be a low cost province, implying that under the case with no government intervention we would expect, natural economic shifts in production to take place in favour of Manitoba. Instead, quota allocations have prevented production adjustment according to efficiency criteria, and as a result the level of efficiency has deteriorated overtime.

Heavy losses are also being experienced each year under the surplus removal program.

Table 2 and 9 together show that large surpluses come from low cost provinces such as Manitoba. This clearly indicates that the industry has reached self sufficiency, as a result it is inefficient and a waste of resources to go on with the current mode of operation that generate table surplus which at the end of the day have to be disposed at a lower price, as reported in Table 10 and 11. An efficient alternative to the current system should probably be, to allow Manitoba to export more of what it produces or to reallocate production shares based on cost advantage.

(h) Investment in the egg industry.

Most recently the quota has been marketed by the Manitoba Egg Producer's Marketing Board through scheduled auctions. We intend to investigate whether the market is efficient. Using the assumption that the quota is the price of entry into the market, it is like an annuity. An annuity will provide a regular return to the firm based on its discount rate. From the estimates of economic rent in Table 23, if the annuity is greater than the rent, the producer will have subsidized the marketing board. If the annuity is less, then he will be receiving an economic "windfall". Only in an efficient market will the economic rent and the annuity be equal.

Table 29 presents the comparison between the economic rent and the quota value. In every case the annuity is less than the economic rent and the producers are indeed earning a windfall profit. This profit has also tended to expand through time.

TABLE 29: THE DISCOUNTED ECONOMIC VALUES AND BOARD PRICE OF THE QUOTA.

YEAR	ECONOMIC RENTS(a)	AVERAGE PRIME RATE(b)	PRESENT VALUE	QUOTA PRICE(c)
	CND $/BIRD	---PERCENT---	-------CND $/BIRD-------	
1990	6.30	15.04	3.45	23.00
1991	6.76	11.02	2.87	26.03
1992	7.23	8.84	1.85	20.93

Source: (a) Economic rents as indicated in Table 23.

(b) Average prime rate represents a simple average of monthly prime rate plus 2 percent, as reported in the Bank of Canada Review, 1991 and 1993.

(c) Quota price as reported by the Manitoba Egg Producer's Marketing Board, 1993.

ANALYSIS OF THE IMPACTS OF SUPPLY MANAGEMENT UNDER PROGRAM CRITERIA.

(a) Price level.

One measure of price impacts is the relationship between Manitoba price and the border price of U.S eggs. Under competition U.S and Manitoba prices would be the same net of transport and other importing costs. We thus compare over time the returns received by Manitoba producers as determined by the COP formula price less levies, which represents the actual price received by Manitoba egg producers(Table 30), with the U.S border price.

TABLE 30: MANITOBA GRADE A LARGE EGG PRODUCER PRICE IN CTS PER DOZ LESS LEVIES, 1978 - 1992.

YEAR	PRICE(a)	LEVIES(b)	BASE PRODUCER PRICE(c)
1978	66.6	8.00	58.60
1979	72.6	8.00	64.60
1980	79.9	8.00	71.90
1981	92.8	8.20	84.60
1982	90.2	8.00	82.20
1983	93.5	8.00	85.50
1984	99.4	9.05	90.35
1985	95.5	10.00	85.50
1986	92.7	9.25	83.45
1987	89.7	9.00	80.70
1988	97.9	9.92	87.98
1989	109.8	15.33	94.47
1990	108.0	15.62	92.38
1991	107.5	15.00	92.50
1992	105.8	15.00	90.80

Note: (a) Price paid to Manitoba egg producers for Grade A large eggs.
(b) Deductions by the Egg Marketing Board and CEMA(See Table 12).
(c) Actual price per dozen received by producers at grading stations in Manitoba.

Source: (i) Manitoba Agriculture Yearbook, 1978 - 1992.
(ii) Poultry Market Review,1978-1991.

Table 31, reports the United States egg prices converted to Canadian dollars using the official exchange rate, plus transport cost to Manitoba. To bring the U.S prices to a level comparable to Manitoba egg producer prices we deduct the wholesale margin in Manitoba. This approach was also used by de Gorter in 1991. As indicated in Table 31, from 1985 to 1992, Manitoba base producer prices are found to be greater than border prices(ranging from 8.12 to 55.3 percent in 1985 and 1992 respectively), which implies that under supply management Manitoba egg producers are paid more per dozen than they would have received in an unregulated market.

It is said that before 1993, the Canadian Government maintained interest rates at a higher level in order to attract foreign investment. As a result the Canadian currency was overvalued. If this is the case, then the spread between U.S and Canadian egg prices is artificial. We decided to perform a sensitivity analysis at different levels of the exchange rate.

Table 32 reports the sensitivity analysis where U.S egg prices are converted to Canadian dollars using the official exchange rate, the 1993 average exchange rate (Globe and Mail 8th Dec, 1993) and the 1993 average exchange rate increased by 10 to 20 percent, together with the Manitoba base producer price.

TABLE 31: UNITED STATES MID-WEST(a) EGG PRICE PLUS TRANSPORT COST EXPRESSED IN CANADIAN CURRENCY PER DOZ, AND THE MANITOBA BASE PRODUCER PRICE, 1985 TO 1992.

YEAR	U.S(b) PRICE CT/DOZ	EXCH-ANGE(c) RATE	PRICE IN CDN CT/DOZ	(d)LESS W/SALE MARGIN	PLUS(e) TRNS COST	NET PRICE CT/DZ	MB BASE PRODUCER PRICE
1985	73	1.3980	102.05	23.0	0.0369	79.08	85.50
1986	74	1.3800	102.12	23.0	0.0389	79.16	83.45
1987	64	1.2990	83.13	23.0	0.0410	60.17	80.70
1988	66	1.1925	78.70	23.0	0.0430	55.74	87.98
1989	86	1.1585	99.63	22.7	0.0420	76.97	94.47
1990	85	1.1599	98.59	23.4	0.0410	75.23	92.38
1991	81	1.1555	93.59	27.6	0.0410	66.03	92.50
1992	69	1.2134	83.72	25.3	0.0430	58.46	90.80

Source: (a) Assuming that the quality of eggs in U.S and Canada is comparable.

(b) Urner Bary price bulletins, 1985-1992.

(c) The exchange rate as quoted by, Bank of Canada(Bank of Canada, 1985-1992).

(d) Wholesale Margins as reported in the Poultry Market Review, 1985-1992.

(e) Transport cost in cts per doz based on de Gorter's Report,1992.

TABLE 32: SENSITIVITY ANALYSIS U.S AND MANITOBA PRODUCER PRICE COMPARISON UNDER DIFFERENT CANADIAN/U.S EXCHANGE RATES, 1985 TO 1992.

YEAR	MANITOBA(a) PRICE TO PRODUCERS	NET LANDED PRICE(b)	NET LANDED PRICE(c)	NET LANDED PRICE(d)	NET LANDED PRICE(e)
1985	85.50	79.08	71.07	80.47	89.89
1986	83.45	79.16	72.36	81.89	91.44
1987	80.70	60.17	59.48	67.73	75.98
1988	87.98	55.74	62.06	70.56	79.08
1989	94.47	76.97	88.12	99.20	110.29
1990	92.38	75.23	86.14	97.08	108.05
1991	92.50	66.03	76.78	87.22	97.67
1992	90.80	58.46	63.63	72.51	81.41

Note: (a) Manitoba price to producer less levies.

(b) Using the official exchange rates as reported by the Bank of Canada.

(c) Using the 1993 average exchange rate as reported by Globe and Mail, December, 18th 1993.

(d) Using the 1993 average exchange rate increased by 10 percent.

(e) Using the 1993 average exchange rate increased by 20 percent.

The sensitivity analysis in Table 32, shows that even when the 1993 average exchange rate is increased by 10 percent, Manitoba egg producer prices less levies are found to be greater than border prices. However, when the 1993 average exchange rate is increased by 20 percent, only a few producer price observations in Manitoba were found to be greater than border price. A major devaluation of Canadian dollars is required to reduce the spread between the U.S and Canadian price to a level that would eliminate the effect of supply management.

(b) Price stability.

Supply management is expected to stabilize producer price. The method of pricing i.e COP, implies that prices should be more stable than those generated in the market. We assess price stability by calculating the coefficient of variation (C.V) of egg prices before and after supply management. The coefficient of variation is the standard deviation of a variable divided by its mean. According to Johnson and Buse(1987), coefficient of variation is a unit-free statistics measuring relative variation in a variable, and is considered to be a strong indicator of relative variability. Table 33 reports, annual egg producer prices in Manitoba for grade A large from 1963 to 1992 and the coefficient of variation for the three periods 1963-1972, 1973-1982 and 1983-1992, that allows us to assess whether the regulatory system has created price stability. We also calculate the coefficient of variation for egg prices in U.S(Mid-West) Table 34 in order to check whether the observed stability here was also experienced in the U.S during the same period of time.

TABLE 33: MANITOBA PRICE IN CENTS PER DOZEN FOR GRADE A LARGE, 1963 TO 1992.

YEAR	PRICE	YEAR	PRICE	YEAR	PRICE
1963	31.0	1973	55.1	1983	93.5
1964	24.0	1974	59.6	1984	99.4
1965	32.9	1975	57.2	1985	95.5
1966	42.7	1976	66.3	1986	92.7
1967	31.6	1977	66.7	1987	89.7
1968	34.7	1978	66.6	1988	97.8
1969	36.6	1979	72.6	1989	109.8
1970	27.2	1980	79.9	1990	108.0
1971	21.9	1981	92.8	1991	107.4
1972	30.4	1982	90.2	1992	105.8
Mean	31.3		70.7		99.96
S.D	5.758		12.482		6.895
C.V	0.1839		0.176		0.0689

Source: (a) Manitoba Agriculture Yearbook, 1963-1974.

(b) Poultry Market Review 1975-1992.

As indicated in Table 33 egg prices before supply management were very unstable. For instance in 1963 the price per dozen was 31 cents. The following year egg prices dropped to 24 cents, before reaching a peak of 42.7 cents per dozen in 1966. From 1966, egg prices in Manitoba plummeted to 21.9 cents per dozen, its lowest point since 1963. When supply management became operational in 1973 prices jumped from 30.4 cents per dozen in 1972 to 55.1 cents per dozen in 1973. From 1973 to 1992 egg producer prices per dozen have increased from 55.1 to 105.8 cents respectively. The calculated coefficient of variation indicates that between 1963 and 1972 egg prices were less stable, coefficient of variation equal to 0.1839. Between 1973 and 1982, which is the period immediately after supply management prices were slightly stable with a coefficient of variation equal to 0.176. From 1983 to 1992 egg prices were fairly stable with a coefficient of variation equal to 0.0689. These results suggests that under supply management egg producer prices are fairly stable as indicated by the decrease in the coefficient of variation from 0.1839 in 1963-1972 to 0.0689 in 1983-1992.

Table 34 compares the U.S and Manitoba egg price variability from 1985 to 1992 and their associated coefficients of variation. Results show that during 1985-1992, egg prices in U.S were less stable(C.V = 0.133) than the Manitoba prices (C.V = 0.072). With the above results we conclude that producer prices in Manitoba are now more stable than they were before supply management.

TABLE 34: U.S MID-WEST EGG PRICE CONVERTED TO CANADIAN DOLLARS AND MANITOBA PRICE.

YEAR	U.S PRICE(a)	MANITOBA PRICE(b)
1985	79.05	95.5
1986	79.12	92.7
1987	60.13	89.7
1988	55.70	97.8
1989	76.93	109.8
1990	75.19	108.5
1991	65.99	107.5
1992	58.42	105.8
Mean	68.81	100.83
S.D.	9.22	7.31
C.V.	0.133	0.072

Source: (a) Table 31, U.S Mid-West egg price without transport cost to Manitoba.

(b) Table 30.

According to Loyns and Lu(1972), U.S egg prices varied systematically throughout the year in the period before supply management, and production and quality distribution also had seasonal patterns. They also pointed out that volume control as a regulatory mechanism is not effective in improving producer returns, the effectiveness can be enhanced by combinations of counter-cyclical production, production scheduling within a year, and methods designed to improve quality of eggs delivered. USDA data(Kohl and Uhl, 1980) show there is a very high seasonal variation in egg prices in the United States. The price regime in Canada is based on volume controls. The regime would have improved producer returns, from the early stages of supply management if the measures suggested by Loyns and Lu above were used in combination with volume controls. It was not until recently that the Egg Marketing Board started to use seasonal pricing to improve egg producers earnings.

(c) Maintanance of Family Farm.

The objective of maintaining family farms seems to have been achieved although the number of farms have decreased a little bit over the years, but not at the same pace as before supply management. In the process, however, the sizes of production units have decreased. An interesting question here is, do family farms have to be very small? The answer is no. It is acceptable for farms to be owned and operated by the family and the size should not necessarily be very small because there is a technical trade-off between size and efficiency.

(d) Development of Processing Industry.

The supply management system has positively contributed towards the development of processing industry in Manitoba by making it possible for processors to get eggs for processing at a price equivalent to the landed price of eggs from the U.S. According to the egg marketing board in Manitoba, the high volume of surplus table eggs realised each year has resulted in the largest egg processing industry in Canada locating in Winnipeg.

(e) Demand Promotion.

The Per Capita consumption is decreasing in Canada relative to the U.S., despite efforts by CEMA and the provincial marketing board to promote demand. Table 35 reports the per capita consumption for eggs in Canada and U.S. The per capita consumption in Canada have decreased from 233 eggs in 1975 to 190 in 1991 which amounts to 18.45 percent decline in per capita consumption. In the United States during the same period, per capita decreased from 271 eggs in 1975 to 235 in 1991 i.e 13.28 percent decline. In the area of demand promotion the supply management system has not achieved much despite all the resources spent towards demand promotion. However, the system is continuing with the struggle to increase consumer awareness as reported in a document titled " Vision 2000", which indicates the strategies and future plans of the Canadian Egg Marketing Agency.

TABLE 35: PER CAPITA CONSUMPTION FOR EGGS IN CANADA AND THE UNITED STATES

YEAR	CANADA	UNITED STATES	YEAR	CANADA	UNITED STATES
	------- EGGS -------			------- EGGS -------	
1975	233	271	1983	222	262
1976	229	271	1984	214	262
1977	223	268	1985	211	257
1978	218	273	1986	204	255
1979	229	278	1987	199	255
1980	227	272	1988	202	247
1981	225	266	1989	197	237
1982	225	266	1990	191	235
			1991	190	235

Source: (a) Poultry Market Review, 1976, 1980, 1985, 1990 and 1991.

(b) USDA Agricultural Statictics, 1991.

SUMMARY.

EVALUATION OF IMPACTS OF SUPPLY MANAGEMENT ON THE EGG INDUSTRY UNDER ECONOMIC CRITERIA SUGGESTS THAT:

(a) The quota system together with quantitative restrictions on imports have created substantial economic rents to egg producers in Manitoba. In 1988 economic rents were around $ 4.96 per bird and this increased to $ 7.23 per bird in 1992, or 31.1 cents per dozen.

(b) Manitoba has excess capacity , but because of quota restrictions the province is unable to take advantage of excess capacity to increase production. Sensitivity analysis shows that utilization of excess capacity would lead to cost saving ranging from 4.88 to 9.77 percent.

(c) The quota system under supply management have reduced the average size of operation in Manitoba to 9,606 layers per producer, while as indicated by P.S Ross and Partners in 1975, there are significant economies of scale in operations with 48,000 birds or more. The average size in Manitoba is too small for egg producers to take advantage of economies of scale.

(d) Before supply management, from 1961-1972 egg output in Manitoba grew by 45.23 per cent, but under supply management(1973-1990) the growth trend has been reduced to 1.14 percent. When the egg industry in Manitoba is compared with the hog industry in Manitoba we find that hog production grew by 101.9 percent between 1961 and 1971 compared to 60.2 percent for eggs. The hog industry's share grew by 35 percent from 1961 to 1972(i.e before supply management) compared to 38.2 percent for eggs. This indicates that Manitoba's share of total egg production in Canada before supply management grew faster than the share of the hog industry. From 1972 to 1990 hog production in Manitoba grew by 55 percent compared to only 2.74 percent for eggs. The hog industry's share grew by 9.3 percent from 1972 to 1990(i.e during supply management for eggs) compared to only 0.35 percent for eggs. This simple comparison

of the two industries suggests that the egg industry has been impacted by the supply management system.

(e) Manitoba's share of total production in Canada before supply management increased from 8.33 percent in 1961 to 11.51 in 1971 and reached 11.46 in 1973. Since then Manitoba's share of total egg production in Canada has been frozen at approximately 11.5 percent of total egg production in Canada.

(f) The system seems to have created inefficiency in Manitoba because, the size and number of producing units have decreased. Excess capacity has been created in Manitoba which means current production levels are lower than the efficient levels, Qc in Figure 7. Manitoba is considered to be a low cost producing province. Under no government intervention, economic efficiency postulates that natural economic shifts in production would have taken place in favour of Manitoba. Instead, Manitoba is restricted to produce within a quota initially set in 1972 based on an average of five years production, without any allowance for growth especially for low cost provinces such as Manitoba. As a result Manitoba's share has remained roughly the same over the years despite the province's potential to produce at relatively lower cost than other provinces in Canada.

EVALUATION OF IMPACTS OF SUPPLY MANAGEMENT UNDER PROGRAM CRITERIA SUGGESTS THAT:

(a) Comparison of returns received by Manitoba egg producers as determined by the COP formula price less levies, with the border price(U.S price) indicated that from 1985 to 1992, Manitoba egg producer prices were higher than the border price. Which implies that under supply management Manitoba egg producers are paid more per dozen than they would otherwise have received under free market. The level of border price in Canadian dollars was found to be sensitive to the prevailing exchange rate.

(b) Between 1963-1972, the period before supply management egg prices were less stable in Manitoba, as indicated by a coefficient of variation equal to 0.1839. Between 1973 and 1982, which is the period immediately after supply management prices were slightly stable with a coefficient of variation equal to 0.176. From 1983 to 1992 price stability improved a lot, as indicated by a coefficient of variation equal to 0.0689. Stability analysis on U.S egg prices from 1985 to 1992 indicated that, U.S prices were less stable (C.V = 0.133) than the Manitoba egg prices (C.V = 0.072).

(c) The objective of maintaining family farms seems to have been achieved although the number of farms have decreased a little bit over the years, but not at the same pace as before supply management. In the process however, the sizes of production units have decreased.

(d) The supply management system has positively contributed towards the development of processing industry in Manitoba by making it possible for processors to get eggs for processing at a price equivalent to landed price of eggs from U.S.

THE FINDINGS ABOVE, SEEM TO SUGGEST THAT:

(i) Egg producers in Manitoba have benefitted substantially from supply management because calculations of economic rents indicate that egg producers received $ 4.96 in 1988 as economic rent per bird and that amount increased to $ 7.33 per bird in 1992. In the absence of supply management such rents would probably disappear.

(ii) It is likely that the province of Manitoba has not beneffited from supply management in the egg industry because provincial economic activity has been affected. Provincial economic activity has been affected as a result of fixed market share, slowed growth in the industry, inefficiency created by quota restrictions which has reduced the size and number of production units, and the under utilization of production capacity.

ANALYSIS OF THE SHORT-RUN IMPACTS OF REMOVING BORDER CONTROLS.

It has been argued that the Canadian dollar was overvalued before 1993. We decided to perform sensitivity analysis at different levels of exchange rate. Table 36, 37 and 38 reports U.S price at three different exchange rates, i.e at official exchange rate, official exchange rate increased by 5 and 10 percent respectively. Table 39 compares the calculated marginal cost in Table 22 from 1990 to 1992 for Manitoba with the United States egg prices converted to Canadian currency, using official exchange rate(Table 36).

TABLE 36: U.S EGG PRICE FROM 1990 TO 1992, CONVERTED TO CANADIAN DOLLARS USING OFFICIAL EXCHANGE RATE.

YEAR	QUARTER	MID-WEST W/S PRICE IN(a) U.S CTS/DOZ	(b) EXCH RATE	PRICE IN CNDN CTS/DOZ	PRICE LESS W/S(c) MARGIN	PRICE PLUS TRNS COST	PRICE IN CTS PER DOZ
1990	1	90.54	1.183	107.11	23.40	0.041	83.75
	2	76.05	1.171	89.05	23.40	0.041	65.69
	3	80.62	1.153	92.95	23.40	0.041	69.59
	4	91.12	1.161	105.79	23.40	0.041	82.43
1991	1	90.40	1.157	104.59	27.60	0.041	77.03
	2	73.00	1.146	83.66	27.60	0.041	56.10
	3	80.00	1.142	91.36	27.60	0.041	63.80
	4	79.20	1.137	90.05	27.60	0.041	61.49
1992	1	67.66	1.182	79.97	25.30	0.043	54.71
	2	65.00	1.197	77.80	25.30	0.043	52.54
	3	68.33	1.208	82.54	25.30	0.043	57.28
	4	74.33	1.263	93.88	25.30	0.043	68.62

Source: (a) Urner Bary Price bulletins.

(b) Exchange rate as quoted by Bank of Canada.

(c) Wholesale Margins as reported by Statistics Canada.

TABLE 37: U.S EGG PRICE FROM 1990 TO 1992,CONVERTED TO CANADIAN DOLLARS USING OFFICIAL EXCHANGE RATE INCREASED BY 5 PERCENT.

YEAR	QUARTER	MID-WEST W/S PRICE IN(a) U.S CTS/DOZ	(b) EXCH RATE	PRICE IN CNDN CTS/DOZ	PRICE LESS W/S(c) MARGIN	PRICE PLUS TRNS COST	PRICE IN CTS PER DOZ
1990	1	90.54	1.242	112.45	23.40	0.041	89.09
	2	76.05	1.229	93.46	23.40	0.041	70.10
	3	80.62	1.211	97.63	23.40	0.041	74.27
	4	91.12	1.219	111.07	23.40	0.041	87.71
1991	1	90.40	1.215	109.84	27.60	0.041	82.28
	2	73.00	1.203	87.82	27.60	0.041	60.26
	3	80.00	1.199	95.92	27.60	0.041	68.36
	4	79.20	1.194	94.56	27.60	0.041	67.00
1992	1	67.66	1.241	83.97	25.30	0.043	58.71
	2	65.00	1.257	81.71	25.30	0.043	56.45
	3	68.33	1.268	86.64	25.30	0.043	61.38
	4	74.33	1.326	98.56	25.30	0.043	73.30

Source: (a) Urner Bary Price bulletins.

(b) Exchange rate as quoted by Bank of Canada.

(c) Wholesale Margins as reported by Statistics Canada.

TABLE 38: U.S EGG PRICE FROM 1990 TO 1992, CONVERTED TO CANADIAN DOLLARS USING OFFICIAL EXCHANGE RATE INCREASED BY 10 PERCENT.

YEAR	QUARTER	MID-WEST W/S PRICE IN(a) U.S CTS/DOZ	(b) EXCH RATE	PRICE IN CNDN CTS/DOZ	PRICE LESS W/S(c) MARGIN	PRICE PLUS TRNS COST	PRICE IN CTS PER DOZ
1990	1	90.54	1.301	117.79	23.40	0.041	94.43
	2	76.05	1.288	97.95	23.40	0.041	74.59
	3	80.62	1.268	102.23	23.40	0.041	78.87
	4	91.12	1.277	116.36	23.40	0.041	93.00
1991	1	90.40	1.273	115.08	27.60	0.041	87.52
	2	73.00	1.261	92.05	27.60	0.041	64.49
	3	80.00	1.562	124.96	27.60	0.041	97.40
	4	79.20	1.251	99.08	27.60	0.041	71.52
1992	1	67.66	1.300	87.96	25.30	0.043	62.70
	2	65.00	1.317	85.61	25.30	0.043	60.35
	3	68.33	1.328	90.74	25.30	0.043	65.48
	4	74.33	1.389	103.24	25.30	0.043	77.98

Source: (a) Urner Bary Price bulletins.

(b) Exchange rate as quoted by Bank of Canada.

(c) Wholesale Margins as reported by Statistics Canada.

TABLE 39: ESTIMATED MARGINAL COST AND THE U.S EGG PRICE FROM, 1990 TO 1992.

YEAR	QUARTER	U.S PRICE(a) PLUS TRANSPORT COST TO MB IN CTS/DOZ	95% CONFIDENCE INTERVAL OF MC LOWER LIMIT	UPPER LIMIT
1990	1	*83.75	85.06	146.46
	2	*65.69	64.52	123.47
	3	69.59	84.10	141.38
	4	*82.43	73.55	121.11
1991	1	*77.03	66.42	111.27
	2	56.10	76.99	126.92
	3	63.80	67.01	113.85
	4	61.49	62.04	106.52
1992	1	54.71	72.55	105.45
	2	52.54	90.97	155.85
	3	57.28	60.21	111.17
	4	68.62	81.69	131.42

Source: Table 22.

Note: * Indicate prices that fall within the 95% confidence interval.

TABLE 40: ESTIMATED MARGINAL COST AND THE U.S. EGG PRICE FROM, 1990 TO 1992 CONVERTED TO CANADIAN DOLLARS USING OFFICIAL EXCHANGE RATE INCREASED BY 10 PERCENT.

YEAR	QUARTER	U.S PRICE(a) PLUS TRANSPORT COST TO MB IN CTS/DOZ	95% CONFIDENCE INTERVAL OF MC	
			LOWER LIMIT	UPPER LIMIT
1990	1	*94.43	85.06	146.46
	2	*74.59	64.52	123.47
	3	78.87	84.10	141.38
	4	*93.00	73.55	121.11
1991	1	*87.52	66.42	111.27
	2	64.49	76.99	126.92
	3	*97.40	67.01	113.85
	4	*71.52	62.04	106.52
1992	1	62.70	72.55	105.45
	2	60.35	90.97	155.85
	3	*65.48	60.21	111.17
	4	77.98	81.69	131.42

Source: Table 22.

Note: * Indicate prices that fall within the 95% confidence interval.

Most of the U.S prices were found to be well below the lower limit of the confidence interval, when official exchange rate is used. This implies that the U.S egg prices from 1990 to 1992 were significantly below the marginal cost in Manitoba. When official exchange rate is increased by 5 and 10 percent, only a few price observations were found to be below the lower limit of the confidence interval.

The question of inefficiency and high cost of production under supply management compared to a relatively unregulated market such as the United States came to light as early as 1979 when supply management was in place for only six to seven years. Cowper (1979), did a comparison of egg production efficiency between San Diego County in the U.S and Ontario in Canada, and observed that the quota system under supply management created scales that are smaller than the estimated minimum scale at which economies of scale are achieved. Cowper's observation supports our findings here. The Manitoba cost of production per unit is found to be well above the border prices. In a relatively unregulated market where there are no border controls, economic theory postulates, that prices between two markets that trade with each other will approximately be equal to the transport cost between those markets. In the event, where the Canadian border controls are dismantled, the results on Table 39 and 40 imply that a lot of structural adjustment will have to take place in Manitoba. This will occur to the point where the difference between the cost of producing a dozen eggs in Manitoba and the United States price would be equal to the transport cost between the two markets.

Our interest, however, is to determine the short-run impact of removing border controls to the Manitoba egg industry. Based on our Translog cost function 4.15 two arbitrary

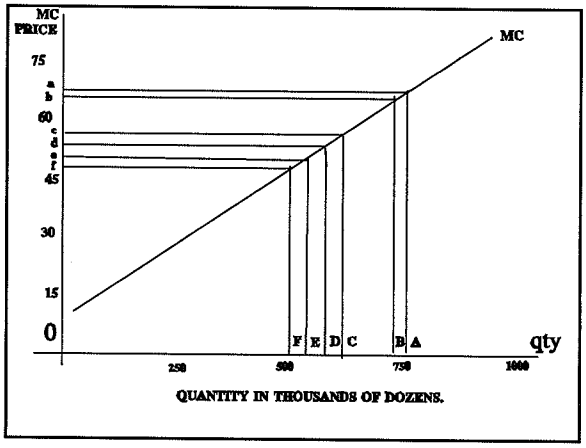
levels of output were used to estimate their associated marginal costs i.e $\delta C/\delta \mathbf{Y1}$ and $\delta C/\delta \mathbf{Y2}$, where **Y1** and **Y2** are 500,000 and 750,000 boxes of 15 dozen eggs, the obtained marginal cost values are as indicated in Table 41.

TABLE 41: ESTIMATED MARGINAL COSTS AT Y1 AND Y2.

OUTPUT IN BOXES OF 15 DOZENS	$\delta C/\delta Y$ (MC)
500,000	47.4
750,000	69.1

The two values of output and their associated MC were plotted as indicated in Figure 15 below and then the U.S egg prices for the four quarters in 1992 (Table 39) were used to read the levels of output that would have been produced in Manitoba if supply management were dismantled. Table 42 reports the actual production and the simulated production levels at each U.S price observation.

Figure 105: Plotted values of MC and U.S prices to determine Manitoba simulated production.



Where: a = 69.1 A = 750,000

b = 68.62 B = 731,250

c = 57.28 C = 612,500

d = 54.71 D = 590,000

e = 52.54 E = 560,000

f = 47.40 F = 500,000

TABLE 42: SIMULATED FREE MARKET PRODUCTION AND THE OBSERVED PRODUCTION UNDER SUPPLY MANAGEMENT.

QUARTER IN 1992	U.S PRICE IN CTS/DOZ	ACTUAL PRODUCTION IN MANITOBA	SIMULATED PRODUCTION
1	54.71	776,451	590,000
2	52.54	766,130	560,000
3	57.28	760,228	612,500
4	68.62	768,425	731,250
Total	Production	3,071,234	2,493,750
Simulated as %ge	of Actual	81.2	

Table 42 indicates that if border controls were removed in 1992, with the same level of cost structure and scale of operation, the cost minimizing level of output in Manitoba would have been only 81.2 per cent of the observed production in Manitoba. Which implies that the 1992 egg production would have dropped by 18.8 percent in the short-run, for egg producers to minimize cost given the average size of operation.

However, Manitoba has excess capacity of between 20 to 25 percent, which means that in the short-run when supply controls are removed, egg producers in Manitoba would be able to utilize the excess capacity to increase production. As a result, it is likely that in the short-run egg production in Manitoba may not decrease as estimated.

To demonstrate the impacts that the utilization of excess capacity might have to the cost of production in Manitoba we conduct sensitivity analysis. Sensitivity analysis as reported in Tables 24 to 26, indicates that at 25 percent excess capacity and 100 percent factor cost saving it is possible to reduce cost by 9.77 percent.

Table 43 reports the U.S egg prices and the estimated marginal cost(Table 40) where the lower limit of estimated marginal cost has been reduced by 9.77 percent. The 9.77 percent reduction in cost(Table 43) together with increase in the official exchange rate by 10 percent(Table 40), clearly make the Manitoba egg industry competitive to the United States.

TABLE 43: ESTIMATED MARGINAL COST REDUCED BY 9.77 PERCENT AND THE U.S. EGG PRICE FROM 1990 TO 1992 CONVERTED TO CANADIAN DOLLARS USING OFFICIAL EXCHANGE RATE INCREASED BY 10 PERCENT.

YEAR	QUARTER	U.S PRICE(a) PLUS TRANSPORT COST TO MB IN CTS/DOZ	95% CONFIDENCE INTERVAL OF MC	
			LOWER LIMIT	UPPER LIMIT
1990	1	*94.43	76.75	146.46
	2	*74.59	58.22	123.47
	3	*78.87	75.88	141.38
	4	*93.00	66.36	121.11
1991	1	*87.52	59.99	111.27
	2	64.49	69.47	126.92
	3	*97.40	60.46	113.85
	4	*71.52	55.97	106.52
1992	1	62.70	65.46	105.45
	2	60.35	82.08	155.85
	3	*65.48	54.33	111.17
	4	*77.98	73.71	131.42

Source: Table 22, 24 and 40.

Note: * Indicate prices that fall within the 95% confidence interval.

THE ROLE AND LIMITATIONS OF THE SHORT-RUN ANALYSIS.

The short-run supply curve analysis as indicated above is useful in explaining the short-run impacts of policy changes. For instance in this study the short-run analysis have given us an idea of what to expect immediately after the supply management system is dismantled. However, the analysis doesnot give enough information to answer questions related to long-run adjustments and is especially weak in predicting the pattern of adjustments.

CHAPTER SIX

LONG RUN IMPACTS OF FREER TRADE: THEORETICAL AND RESEARCH IMPLICATIONS.

INTRODUCTION.

One of the overall objectives of this research is to determine the impact on Manitoba egg producers and egg production of freer trade. Open or reasonably open border with the U.S in egg trade would mean that Manitoba producers would have to compete with U.S production in nearby States. Throughout this study, it has been assumed that Manitoba would move to an import position vis-a-vis nearby States. In particular then, Manitoba would have to compete with landed import price (border prices) from, probably, Minnesota sourced eggs. This would initiate a process of long run adjustment in Manitoba egg production. The purpose of this concluding Chapter of the thesis is to outline the research framework under which the longer run adjustmentS could be analyzed.

THEORY.

According to the conceptual framework developed in figure 3, and summarized in figures 8 to 13, under condition of border pricing the industry in Manitoba would adjust

along its long-run supply curve. Individual firms would have to adjust as well. They would adjust along their long run supply curves in order to meet the price competition from outside, and of course, some firms would exit the industry if they were unable to compete. In this way the aggregate supply produced within Manitoba is determined as well as its distribution among individual producers, consequently the size and number of Manitoba producing units is also determined. As this study has already demonstrated there has been a lid placed on size of firm in Manitoba by supply management and in fact the average size of producing unit has declined slightly in the past two decades. As well, there is sufficient evidence available to postulate scale economies in egg production in Manitoba. Consequently, we would expect firms in competition with the U.S. to expand in size and reduce in number.

The research tasks required to complete the analysis of impacts of removal of border controls, and to assess the viability of the industry, are to determine the nature of the firm and industry supply curves in Manitoba. The conduct of this research is well beyond the scope of this thesis but an outline of the research is provided. Obviously there may be other domestic policies that might have a significant impact on industry viability. One of these is a major change in the amount or method of payment of the Crow benefit. Analysis would need to reflect major changes like this as well.

RESEARCH IMPLICATIONS.

There are several approaches that could be used in order to develop the required set of long run supply schedule estimates that are required. First a literature review would be required to establish if and what may be available from the literature. It is doubtful that significant hard information is available from Canadian sources. However there may be useable information available on the U.S. industry. That leads to the second approach, ideally there would be long-run supply estimates available from a State like Minnesota which could be modified to fit the Manitoba industry for projection purposes. Failing that, or in conjunction with significant U.S information, another approach is to "build" supply response by the engineering approach. Use of this approach is already used to some extent in developing cost of production estimates in eggs and poultry meats. The data generated over the years in the cost of production studies should be an adequate data set provided they can be accessed, including the disaggregations by size of operation. This approach could be used only if the cost of production data were available to the study.

Finally, it may be possible to extend the short-run supply estimation methodology of Chapter 4 to an econometric estimation of long run supply. If an extended series of data are available from the cost of production, and if there is significant variation in the input price data, the cost function approach used for the short-run analysis could be feasible.

At this stage of consideration, the preferred approach would be to attempt to extend the econometric analysis. The approaches are not, however, mutually exclusive since literature review and availability of U.S. counter parts should reinforce any econometric

analysis. Certainly access to detail on the cost of production is essential to any approach.

CONCLUSIONS.

To complete analysis of the impact of border controls removal on the Manitoba egg industry requires knowledge or estimates of the long-run supply relationships at each of the firm and industry levels. There are several ways these could be obtained. A first effort should be a literature review, proceeding to econometric analysis like that already conducted. All of this presumes the cost of production data for Manitoba would be available on a disaggregated basis. Various policy changes, external to the egg sector, have to be considered and the results tested by sensitivity analysis.

This research would complete the project implied by the two major objectives set out at the beginning of this thesis. The research is timely because this is both a relevant issue to the Manitoba egg industry in its management, and to the prospect of genuine freer trade conditions being imposed on the industry.

CONCLUSIONS

This study set out to determine the impacts of supply management in the Manitoba egg industry and the short-run impacts of removal of border controls. There were four objectives of this thesis:

(a) to develop a model which can be used to analyze the impact of supply management on Manitoba.

(b) to develop a framework for analyzing the impact of removal of border controls,

(c) undertake empirical analysis within the constraints of data availability, and

(d) outline the research required to complete the analysis.

To analyze the impacts of supply management on Manitoba we had to collect and analyze data related to producer price for eggs in Manitoba before and after supply management, levies paid by Manitoba egg producers, whole sale margins in Manitoba, exchange rates between Canadian and U.S dollar and the United States egg prices. Economic and program criteria were used to evaluate the impact of supply management to egg producers and on Manitoba's economic activity.

The analysis of short-run impacts of removing border controls required an estimation of short-run marginal cost in Manitoba. We estimated short-run marginal cost in Manitoba

under two scenarios, using a Translog cost function, that is, where labour is treated as quasi-fixed input and as a variable input. The reason why we had to estimate short-run marginal cost under the two scenarios is that the chi-square test of symmetry restrictions for static equilibrium indicated that labour is not in static equilibrium, but when we performed the Hausman specification test of first order conditions for static equilibrium, static equilibrium was not rejected at 99 percent, although it was rejected at 95 percent.

Results suggest that in Manitoba egg prices were volatile before supply management was introduced. During supply Management egg prices determined by the cost of production formula have increased and in fact prices are now more stable.

Before supply management, from 1961-1972 egg output in Manitoba grew by 45.23 percent, or 3.45 percent per year(compounded annual rate), but under supply management (1973-1990) the growth trend has been reduced to 1.14 percent, or 0.105 percent per year(compounded annual rate). This significant decline in output growth taken in conjuction with other factors like relative production costs implies that Manitoba has been substantially affected by the regulatory regime. The regime has apparently cut off Manitoba's economic growth, despite the ability to produce eggs more cheaply than other provinces.

The egg industry resembles the hog industry. The hog industry in Manitoba operates relatively freely. A comparison between the two indicated that from 1972 to 1990 hog production in Manitoba grew by 55 percent compared to only 2.75 percent, implying that the egg industry has been substantially impacted by the supply management system.

Manitoba's share of total production in Canada before supply management increased from 8.33 percent in 1961 to 11.51 in 1971 and reached 11.46 in 1973. Since then Manitoba's share of total egg production in Canada has been frozen at approximately 11.5 percent.

The number of registered egg producers have decreased from 280 in 1976 to 225 in 1991, and the average size of operation has gone from 7,459 in 1976 to 9,836 birds in 1983 and in 1991 reached 9,606 layers per producer. The average size of 9,606 layers per producer is below the minimum efficient size of 20,000, and significantly below the average size in the U.S, San Diego County which is around 79,000 birds per producer.

Manitoba has excess capacity of between 20 to 25 percent, but because of quota restrictions the province is unable to take advantage of excess capacity to increase production. Sensitivity analysis suggests that, the utilization of excess capacity would lead to cost saving, and as a result lower production costs and improve efficiency. Cost saving range from as low as 4.88 percent at 50 percent factor cost saving and 25 percent capacity to as high as 9.77 percent at 100 percent factor cost saving and 25 percent capacity.

Comparison of returns received by Manitoba egg producers as determined by the COP formula price less levies, with the border price(U.S price) indicated that from 1985 to 1992, Manitoba egg producer prices were higher than the border price.

The quota system together with quantitative restrictions have created substantial economic rents to egg producers in Manitoba. In 1988 economic rents were around $ 4.96 per bird and this increased to $ 7.23 per bird in 1992.

The supply management objective of maintaining family farms seems to have been achieved although the number of farms have decreased a little bit over the years, but not at the same pace as before supply management.

The system has positively contributed towards the development of processing industry in Manitoba by making it possible for processors to get eggs for processing at a price equivalent to landed price of eggs from U.S.

Marginal cost estimation in the first scenario, where labour is treated as quasi-fixed in put, almost all coefficients were found to be significant, while in the second scenario only few coefficients were significant. As a result we decided to use the first scenario estimates in this study.

Comparison between the estimated marginal cost in Manitoba from 1990 to 1992 with the United States egg price plus transport cost to Manitoba revealed that the United States price were outside (less than) the 95 per cent confidence intervals of marginal costs in Manitoba. This means that under supply management it is costly to produce a dozen egg in Manitoba than in the United States. If border controls were removed in 1992 with the same level of cost structure and scale of operation, the cost minimizing level of production in Manitoba would have been 81.2 percent of the observed Manitoba egg production in 1992. Which implies that the 1992 egg production would have dropped by 18.8 percent in the short-run, for egg producers to minimize cost given the average size of operation.

The impact of technical change on variable costs (determined by the derivative of cost

with respect to the trend variable) was found to be positive. A positive percentage change in cost implies that cost increased over time with technical change in Manitoba, suggesting that, the available technology is not used optimally to increase output because producers are restricted by quota.

The long-run impact of relaxing supply management will depend on whether the egg industry in Manitoba would exhibit increasing cost, constant cost or decreasing cost in the long-run.

As hypothesized in this study results suggest, first, that the province of Manitoba has not benefitted from supply managemant. However, egg producers have benefitted because egg prices are now more stable than they were before supply management, price levels have increased and substantial economic rents acrue to egg producers.

Secondly, if supply management in the egg industry were dismantled, it is likely that the immediate effect to Manitoba egg producers will be substantial, however, if egg producers are going to take advantage of the excess capacity then it is likely that in the short-run egg production in Manitoba would not be affected.

RECOMMENDATIONS.

1. Egg processing in Canada performed well as indicated in Appendix 1 and 2, while table egg market remained stagnant, we therefore recommend that CEMA should explore possibilities to increase egg production for processing rather than relying heavily on table egg market.

2. Because the processing sector is growing in Manitoba, and we know that egg producers in Manitoba are capable of producing at variable cost, then the egg board should allow egg producers to increase egg production for processing because the table market is shrinking.

SUGGESTIONS FOR FURTHER RESEARCH.

1. This study focussed on the province of Manitoba, where supply management prices and costs were compared with those prevailing in the United States in order to assess the effect of lifting supply controls. Ideally this study should have used farm level data. The use of aggregate data here introduces a measure of aggregation bias. To provide a deeper understanding of the effects of dismantling supply Management in Canada it will be appropriate to use farm level data and include all leading egg producing province.

2. In this study a short-run analysis of the impacts of removing border controls was carried out. The short-run analysis doesnot answer questions related to long-run adjustments, so it would be useful to conduct long-run analysis of the impacts of removing border controls. Such analysis should use farm level data.

APPENDIX A.1: PROCESSED EGG PRODUCTION.

YEAR	FROZEN EGG PRODUCTION IN KGS	LIQUID EGG PRODUCTION IN KGS	DRIED EGG PRODUCTION IN KGS	LIQUID BASIS PRODUCTION
1986	12,660,105	6,271,788	3,007,637	29,186,820
1987	13,485,810	7,979,137	3,672,659	33,402,561
1988	13,512,623	8,544,334	4,034,983	36,816,344
1989	14,159,710	8,860,883	3,559,268	38,227,788
1990	14,833,236	9,705,200	3,749,211	39,649,583
1991	16,118,499	9,556,146	4,261,564	41,576,909

Source: Poultry Market Review, 1987 - 1991.

APPENDIX A.2: INSPECTED EXPORTS OF PROCESSED EGGS IN CANADA, 1986-1991 IN KILOGRAMS.

YEAR	LIQUID	FROZEN	DRIED	TOTAL EXPORT
1986	89,187	858,487	1,085,995	2,033,669
1987	608,921	1,293,878	1,560,921	3,463,720
1988	317,165	1,452,803	1,971,492	3,741,460
1989	627,243	1,012,038	1,160,921	2,800,202
1990	524,174	1,382,426	1,043,739	1,479,538
1991	58,913	1,521,531	1,412,628	1,755,084

Source: Poultry Market Review, 1986-1991.

APPENDIX A.3: RATE OF LAY PER LAYER IN NUMBER OF EGGS, UNITED STATES,AND MANITOBA,BEFORE SUPPLY MANAGEMENT.

YEAR	U.S (a)	MANITOBA (b)
1963	213	193
1964	217	196
1965	218	196
1966	218	191
1967	221	206
1968	220	207
1969	220	207
1970	218	211
1971	223	211
1972	227	208
1973	227	217

Source: (a) USDA

(b) Manitoba Agriculture Yearbook.

APPENDIX A.4: RATE OF LAY PER LAYER IN NUMBER OF EGGS, UNITED STATES, AND MANITOBA, UNDER SUPPLY MANAGEMENT.

YEAR	UNITED STATES	MANITOBA
1974	230	216
1975	232	220
1976	235	226
1977	235	230
1978	239	231
1979	240	229
1980	242	229
1981	243	230
1982	243	259
1983	247	251
1984	245	253
1985	247	253
1986	248	256
1987	248	261
1988	251	273
1989	250	269
1990	252	279

Source: (a) USDA

(b) Manitoba Agriculture Yearbook,1963-1992.

APPENDIX A.5: COST OF PRODUCTION COMPARISON FOR EGGS AND GROWER-FINISHER ENTERPRISE.

COST ITEM	EGG(a) ENTERPRISE	GROWER-FINISHER(b) ENTERPRISE
	---------- PERCENT ----------	
FEED	34.9	32.0
PULLET / WEANLING	15.7	38.5
LABOUR	16.1	10.8
DEPRECIATION	3.9	6.6
OVERHEAD	6.4	6.6
INTEREST	5.1	2.2

Source: (a) CEMA annual report, 1991.

(b) Swine Production Costs, Manitoba Agriculture, 1992.

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