THE UNIVERSITY OF MANITOBA

THE COMPARATIVE ADVANTAGE PRINCIPLE IN PROVINCIAL ALLOCATION OF EGG QUOTAS

by

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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

WINNIPEG, MANITOBA

February, 1977

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ABSTRACT

The establishment of a National Egg Marketing Plan under the jurisdiction of the Canadian Egg Marketing Agency has facilitated the apparently smooth functioning of a quota system for the production and marketing of eggs in Canada. The quota system which functions as a control device was put into effect with the object of stabilizing egg prices in the country and ensuring a favorable return to egg producers.

When the National Egg Marketing Plan was established, the initial provincial quotas that were issued were based on historical production. However, the Plan made provisions for the revision of quotas with the proviso that procedures for future quota allocations take into consideration the principle of comparative advantage. Since a working model for the determination of future quota allocations based on considerations of comparative advantage has not been developed, this study has as one of its objectives the structuring of such a model.

The model which forms the basis of this study has been constructed to reflect the structure of the National Egg Marketing Plan in so far as production and the interprovincial movement of eggs are concerned. The objective of the model is to determine the most efficient arrangement of production and transportation activities such that the total costs to the industry will be a minimum.

The model in this study was based on an estimate of

demand that was 10 percent less than the historically determined quantity. The solution of the model shows that six of the ten provinces in the Plan are competitive in the production of eggs and have operations that minimize total costs. Two of the remaining four provinces have been shown to be non-competitive and have been eliminated from the optimal solution. The other two provinces have had their production levels reduced in order to make their operations competitive.

The report on the interprovincial movement of eggs shows a total of eight transportation activities to effect the optimal interprovincial distribution of eggs. While this number of transportation activities is optimal, given the input data and assumptions of the model, it is quite clear that eight transportation activities are inadequate for the movement of eggs across Canada. The small number of transportation activities in the solution is due mainly to one of the limitations of the model where instead of recognizing several market areas in each province, the provincial capital was assumed to be the only market. It is believed that a larger model void of such aggregation would provide a better idea of the nature of the transportation activities necessary to meet the market demands on the egg industry. It is doubtful however, whether such refinement would effect any significant change in the minimum cost structure presented in the optimal solution of the model.

Finally, the study makes some suggestions, based on the range section of the report, that may serve in policy

formulation. The range section of the optimal solution gives the limits to which activities may deviate from the optimal values and the costs associated with such deviation.

ACKNOWLEDGMENTS

I take this opportunity to express my sincerest appreciation to all those who made the completion of this work possible. I am particularly indebted to those members of staff of the Department of Agricultural Economics and Farm Management of the University of Manitoba, and to my colleagues who helped influence my thinking in agricultural economics.

I am deeply indebted to professor A.W. Wood of the Department of Agricultural Economics and Farm Management for his guidance throughout the preparatory stages of this thesis, and his constructive criticisms of the drafts.

My sincere appreciation is extended to professor W.J. Craddock, advisor and thesis committee chairman, and to professor P. Kondra, for their contributions toward the final draft of this work. I am also indebted to Carlisle Pemberton a colleague and recent Ph.D. graduate from the Department of Agricultural Economics for his assistance in the construction of the mathematical model used in this thesis.

I take this opportunity also, to say thanks much to Angie for the many hours spent in typing the drafts and the final work, and her assistance in the proof reading.

Finally, I shall like to absolve all those mentioned above from any errors that may be contained in this work. Full responsibility for any omissions rests with the author.

This work is dedicated to my mother, Mrs. Olive James, whose encouragement helped me over the more difficult stages of my studentship.

To Olive James

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CHAPTER I

INTRODUCTION

HISTORICAL BACKGROUND

Until the recent (1972) establishment of a national egg marketing board and the adoption of a "National Plan" for the production and orderly marketing of eggs, the Canadian egg industry had been experiencing prolonged cyclical instability in price and quantities marketed.

The cyclical nature of the prices to producers prompted the Canadian Egg Producers Council (C.E.P.C.) to petition the Federal government for a national marketing plan for eggs. Such a plan it was felt would combat the adverse recurrent cycles which resulted in uncertainty and financial hardship for producers and left the industry in a chaotic state.

The proposal for a National Plan envisaged the establishment of a producer run National Agency operating in concert with the separate provincial boards for the development and administration of a quota system whereby the production and marketing of eggs interprovincially and intraprovincially could be effectively controlled.

The Marketing Plan[1] which was subsequently effected

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[1]Part II Schedule 'B', "Federal-Provincial Agreement, Comprehensive Marketing Program for Eggs in Canada", Government House, Ottawa, 1972.

has provisions for the revision of quotas. However quota allocations have so far been based on historical production. Hence, there exists a need for a working model to deal with the problems that will arise when the time comes for the agency and boards to reorganize the present system and allocate quotas to meet an expanding market particularly where the question of comparative advantage is concerned.

The hypothesis of this work is that the historical production patterns used as a basis for quota allocations among the provinces are not compatible with the comparative advantage principle.

STATEMENT OF THE PROBLEM

The egg industry in Canada has had a long history of recurring crises in the sense that the prices for eggs proved to be highly unstable. Loyns and Lu[2] have demonstrated that the demand for eggs in Canada during the 1960-72 period showed a systematic decline. Loyns also demonstrated that the demand for eggs in Canada varies seasonally and that the variability results in demand elasticities that vary from month to month.

The instability in the egg industry it appeared could be divided into two major problem areas; a) the problems associated with persistently low prices due to a persistent

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[2]Loyns, R.M.A. and Lu, C.M. Characteristics of Demand For Eggs In Canada: An Analysis of Cross-Section And Time-Series Data. Research Bulletin 72-3 Department of Agricultural Economics and Farm Management, University of Manitoba September 1972.

decline in demand, and b) the problems emanating from unstable prices due to the seasonal nature of demand and the absence of coordination in production planning.

In the first case, persistently low prices, the effect was mainly manifested in shrinking profits or outright losses to producers. The results were a shift of human resources out of the industry, as many farmers were forced to cease production, and the removal of any incentive on the part of potential producers to enter the industry. One may add that those remaining in the industry and thus enjoying a larger share of the market were still left with the above mentioned problems.

In the latter case of unstable prices major problems existed where prices fluctuated around an already depressed average price. The result in this instance was that producers experienced period of favorable returns and others when returns were not sufficient to meet operating costs. For the consumer it meant periods of low prices, when supplies on the market were relatively higher than demand, and very high prices when supplies were relatively lower than demand.

Price fluctuations around a relatively high average price were no more welcomed than fluctuations around a low average price, since at relatively high prices producers increased production in an attempt to take advantage of the prevailing conditions. The result was usually overproduction and the start of another cycle of declining prices followed by shortages.

This behaviour pattern by producers indicated a general lack of knowledge, on the part of the individual farmers and certain boards, of the supply and demand positions in the egg market. The implication here is that there existed a need to carefully analyze the market for eggs in Canada and to communicate the findings to the producers so that production and marketing could be based on the actual requirements as determined by the market from time to time.

One must hasten to add that over the past two decades the egg industry has had vast improvements in production technology and management skills. Fully automated systems have long since replaced the old methods of hand feeding, cleaning and collection of eggs. New high protein feeds and preventative medication have been introduced. The result has been increased outputs and lower production cost where there is efficient management. The increases in output aggravated an already serious situation. Although the number of producers was reduced by out-migration, production continued to increase. Fewer producers with larger operations are now producing a larger percent of total output. Lower production costs and greater outputs encouraged many producers to remain in the industry in the hope that their management skills would enhance their returns. Strong competition and a disorganized market served to cancel most of the gains from lower production costs. Once the problems facing the producers were recognized, low prices and fluctuating price levels, the next step was to find solutions that would eliminate not only

the symptoms but the underlying causes, which can be described briefly as disorganization in the industry, and ignorance of the market behaviour.

The instability in the egg market led most producers to believe that the establishment of some form of control over production and marketing would eliminate some of their problems. Federal legislation, "The Agricultural Products Marketing Act" of 1949, amended in 1957, gave broader powers to provincial commodity boards that were in operation. Such egg marketing boards were first established in British Columbia, Ontario, and Quebec. During the early 1960's there were no marketing boards in the other provinces. However, by 1972 egg marketing boards were established in all provinces.

It is perhaps necessary at this point to define a marketing board. A marketing board may be described as a mandatory organization with powers to control the production and marketing of specific products and to compel producers under its jurisdiction to conform to its policeis. However, most boards established prior to the implementation of the Comprehensive Egg Marketing Plan did not use the legal powers given them to compel producers to function according to their particular plans.

It was stated previously that egg producers in several provinces believed that the establishment of a board was necessary to solve the problems in the egg market. Hence, the main objective of the producer marketing boards, created as a result of the problems in the industry, was the strengthening

of the producers' position in the market. This the boards hoped to accomplish by controlling production and marketing.

There is evidence to show that the operations of the producer marketing boards in the provinces where they were established did have some results in stabilizing the returns to farmers. Evidence is presented in the variation in proportion of the consumer dollar expenditure on eggs received by producers in provinces with marketing boards compared with those where there were no boards established. Loyns[3] shows that for the period 1969-71, producers operating in provinces with marketing boards received a larger portion of the consumer dollar expenditures on eggs. The evidence suggests that the orderly production and marketing of eggs in those provinces were responsible for the favorable returns to the producers.

The effectiveness of the marketing boards was, however seriously circumscribed since they did not have the complete legal jurisdiction required to exercise control on quantities produced or marketed in their respective provinces. Not only were the provincial boards hampered by a lack of complete legal power in their own provinces, they did not have any jurisdiction over the imports from other provinces or from the United States. Hence, restrictions at the provincial level were not always successful in keeping price levels above

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[3]Loyns, R.M.A. "Canada's National Egg Marketing Policy": Paper to 23rd Annual Poultry Conference. University of Manitoba, October 19, 1972. pp.10,11

production costs. Where the delivered costs to exporting regions were less than cost of production in provinces with marketing boards in operation, eggs would flow into the latter regions thus forcing the board's prices down. It was evident, therefore, that in order for a program of production control and market scheduling to be fully effective it must be administered by an organization with legal power to control the flow of eggs interprovincially and from the United States.

The limitations of provincial boards were soon realized and several provinces sought to deal with the problem by coordinating their efforts in production control and marketing. Once again their efforts proved futile, and the need for a national policy administered by a national organization became more evident especially in the wake of the closing of the Quebec borders to non-Fedco imports and the "Chicken and egg war" that followed.

The enactment in 1971 of Bill C-176[4] The Farm Products Marketing Agencies Act paved the way for the establishment of the Canadian Egg Marketing Agency under whose jurisdiction the National "Plan" for the production and marketing of eggs is administered. The Federal agreement provides for two categories of administration, the Canadian Egg Marketing Agency, and the Provincial Commodity Boards. The former authority has the following responsibilities; determination

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[4]The House of Commons of Canada, Bill C-176 "Farm Products Marketing Agencies Act", Third Session, Twenty eighth Parliament, 19-20 Elizabeth II, 1970-71 as passed 30th December, 1971.

of the total quantities of eggs that are needed in Canada and the allocation of provincial quotas. This involves deciding what quantities of eggs shall be produced in each province, and the quantities that each province markets intraprovincially, interprovincially and to foreign markets. The Agency also attempts to standardize among provinces the size range of flocks exempt from board regulation to more nearly assure that producers of a given size in each province are affected similarly by control program. It is the responsibility of the agency to remove from the shell egg market all eggs that have been produced in excess of quantities demanded but within the quota allocations for the given province. The Agency is also responsible for the establishement of a purchase price for eggs, i.e. a price at which the Agency will buy eggs at three central market points thereby establishing a support price for eggs in Canada.

The provincial commodity boards are mainly responsible for the following: a) the allocation of production quotas among producers under their jurisdiction, b) the regulation of marketing which includes the removal from the market of all eggs that are surplus to the quota allocated to the province. Each commodity board has some authority to set prices within the price range established by the agency at the three central points. However, each board must set its prices with the understanding that such prices cannot be supported by restricting imports from other provinces. Thus it is hoped that free trade among the provinces would be secured. It

appears that the establishment of a Comprehensive Marketing Plan has provided the industry with the potential to solve some of the problems which the producer boards in the different provinces were unable to deal with effectively.

The amendment to the Export and Import Permits Act in May 1974 provided for the control of imports from the United States which, it was held, posed a threat to the National Plan. Loyns[5] has shown that because of the freedom of movement of eggs between Canada and the U.S., price changes in the latter country are reflected in price changes in Canada. A ten percent increase in U.S. producer prices is accompanied by a 6.9 percent change in the same direction in Canadian prices. Loyns[6] concluded that, unless the Federal government moved to protect the Canadian egg market from U.S. influences by tariff restrictions, the success of a national program would be limited because the Canadian market will be subject to the vagaries of the U.S. market.

Though the Agency and Marketing Boards have been able to secure higher returns for their producers the problem of surpluses still exists. It is a well documented fact that price supports usually give producers an incentive to produce more of an already over-abundant product. Hence, the objective of marketing boards in using quotas is to limit supplies so

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[5]Loyns, R.M.A. "Canada's National Egg Marketing Policy": Paper to 23rd Annual Poultry Conference. University of Manitoba, October 19, 1972. pp.10,11.

[6]Loyns, R.M.A. p. 19.

that surpluses are not created.

While the history of marketing board operations under the National Plan shows that some benefits accrued to producers in the form of relatively higher average prices, (see Table 1.1) there are some questions yet to be answered. For example, what will be the long run effect of board operations on producer incomes? One may also question whether the change in producer incomes over some time period would be such that producers would consider themselves better off than they would have been without any boards? The question of the cost of a board's operation is relevant since the cost of establishing an administered price is borne by the consumers. However, there are other costs involved. These are the cost of storage and/or disposal of the surplus products, whether sold at lower prices in otherwise inaccessible markets or destroyed. Another is the opportunity cost which arises from the fact that many producers who would have left the industry as a result of adverse market forces remained in the industry because of the program. The costs that arise here are due to the misallocation of resources. Those resources used by inefficient producers could best be transferred to more efficient ones. In this manner, total excess capacity in the industry could be reduced and the income transfer between the inefficient producers and the more viable operators would be reduced. Inefficient producers in this case whould be defined as those who were unable to compete in a declining market because of size of operation or

TABLE 1.1

Five Year Comparison Of Average Weighted Grade A Large Egg Prices To Producers

	1970	1971	1972*	1973**	1974
	cents/dozen				
Jan	46.8	29.2	30.0	49.6	65.2
Feb	39.1	27.9	26.4	44.9	66.0
Mar	37.9	28.1	32.9	51.3	68.3
Apr	32.9	31.9	33.9	51.7	66.5
May	32.6	29.0	29.9	51.8	64.0
Jun	30.3	27.1	33.4	55.8	63.2
Jul	34.7	28.1	39.7	61.6	63.0
Aug	35.7	33.5	40.1	68.3	63.3
Sept	35.3	31.4	41.9	67.1	64.3
Oct	32.7	32.0	38.2	67.0	65.6
Nov	34.0	36.1	43.5	67.0	59.2
Dec	32.0	38.7	49.1	69.8	66.7
Year	35.3	31.0	36.5	58.8	59.4

Source: Agriculture Canada, Poultry Market Review 1975, Markets Information Services, Poultry Division, Ottawa, 1975.

*Proposal For A National Egg Marketing Plan For Canada Adopted By The Canadian Egg Producers Council August 1972, Ottawa.

**The document, Federal-Provincial Agreement, in respect of the establishment of a Comprehensive Marketing Program, for the purpose of regulating the marketing of Eggs in Canada, was signed by the provincial representatives in 1973.

management practices.

As a final question one might ask whether the cost of the Marketing Plan is justified on economic grounds? It is generally held that administered price programs are not successful as an income enhancing scheme because the low income producers that they are intended to help are small producers and price administered programs tend to benefit higher income producers more than those whose incomes are initially low.

Sinclair[7] concludes that the basic farm problem is one of excess resources in agriculture and not a price problem but rather a problem of low income per farmer resulting from an over supply of farmers.

The relevance of the above discussion to the subject under study may be found by questioning whether a system of production and marketing quotas can alleviate the problems facing the farmers in the egg industry?

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[7]Sinclair, S. "Are Farm Price Supports The Answer" Lecture in the University Extension Series "How Canada's Business System Operates". February 20, 1964.

CHAPTER II

OBJECTIVES AND PROCEDURES OF THE STUDY

Thus far, the approach has been to identify the problems facing the egg industry and to discuss the effects of some of the steps taken by marketing boards in addressing themselves to the task of finding suitable solutions.

Many questions have been raised about the effectiveness and justification of programs to solve farm problems but have not been fully answered. These questions were raised mainly for the purpose of acknowledging the scope of the task facing policy makers who attempt to find solutions to the farm problem, and to illustrate just how intricate the problem really is.

The objective of this thesis is to examine some of the effects of egg marketing board operations on the industry. Specifically the thesis seeks to examine the effect of the allocation of production and marketing quotas for an expanding egg industry. Toward this end a mathematical model solved by linear programming techniques will be developed to determine the proper allocation of quotas among the provinces. The allocation scheme will be based on the comparative advantage principle as recognized in the Egg Marketing Plan.[8]

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[8] "Federal-Provincial Agreement, Comprehensive Marketing Program For Eggs In Canada" Government House, Ottawa, 1972.

The model seeks to determine the most appropriate locations for the production of eggs in order that production and transportation costs will be minimized for the entire industry. The identification of efficient and inefficient regions could then be used to determine the allocation of quotas at the provincial level.

It should be noted at this point that the designation of a given region as being inefficient compared to other regions does not mean that all producing units in the region so designated are inefficient. Similarly, regions identified as efficient may contain units that are inefficient.

Limitations of the Study

The analysis is geared to egg operations at the provincial level and does not take into consideration within province differences in production efficiencies. A study of quota allocations based on comparative advantage in production at the provincial level, while desirable, would be beyond the limits of available resources. However, the model for the interprovincial operation could be adapted to meet similar objectives on a provincial basis, or for regions in contiguous provinces.

Artificial Market Boundaries. Since the program of quota allocations is conducted on an interprovincial basis, the number of regions for which the analysis can be effected is fixed. It should be recognized that the provincial

borders are not necessarily market boundaries[9] delineating separate market areas. It is often the case that market boundaries overlap provincial borders. Thus the provincial borders are in effect artificial market boundaries. These artificial boundaries place severe restrictions on the individual producer since he is compelled by the regulations of the marketing boards to observe these boundaries as market bounds. The restrictions[10] on exports to other provinces, the allocation of quotas on a provincial basis and the price setting policies of the boards, it may be argued, all place restrictions on the individual producer.

If the restrictions on exports were not applied then a producer in Manitoba, for example, could sell any quantity of eggs either in Saskatchewan, Alberta, British Columbia, Ontario or Quebec. For each outlet the farm-gate price would be the price at the market minus the transportation costs which is a function of distance from farm to market. It is obvious that farmers in Manitoba would, in the interest of maximizing profits, ship eggs to those markets with the higher prices. Of course, one must be mindful of the assumptions used here. The assumptions are, that the producer has knowledge of market prices in the different areas and that

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[9]Bressler, R.G. Jr. and King, R.A., Markets, Prices and Interregional Trade. Chapter 7:3, John Wiley & Sons, Inc. N.Y. 1970.

[10]"Federal-Provincial Agreement, Comprehensive Marketing Program for Eggs in Canada", Schedule 'C' Item 7, Government House, Ottawa, 1972.

transfer costs are a linear function of distance.

It would appear, that the division of the country into true market areas would be a better approach to the question of quota allocations for production and marketing. Such a division while desirable may not be readily defensible for this particular work since the Marketing Agency must take into consideration the constitutional powers of each province and recognize the legal provincial boundaries. In addition, the division of the country into distinct market areas would require a greater input of data than is readily available in the egg industry.

Aggregation Problem. As it stands, the analysis involves several methodological problems. Such problems stem from the need for aggregation. Where the aggregation is too universal the applicability of the results to policy formulation becomes limited. As previously stated, too broad an aggregation may yield empirical results that show a given region to be inefficient while some subregions in the aggregate may very well be more efficient than others in regions that are designated as efficient. It is manily because of the aggregation problem that the suggestion was made earlier that the model herein developed be adapted to the analysis of comparative advantage in production on a provincial level or between contiguous provinces. In this way, the problems of aggregation would be reduced and the results would be more useful in policy marking in the distribution and administration of individual quotas.

Methodology

The production cost per dozen eggs for a medium size operation of 15,000-20,000 hens was computed for each of the eleven regions. Much of the cost of production data were obtained from the results of the study by P. S. Ross and Partners.[11] The cost of production data were then combined with transportation cost per dozen to all major "markets" to determine the comparative advantage in production for a given region. The objective of the linear programming model developed from the data is to determine the interregional allocation of quotas which, subject to the demand requirements and production restraints would result in a minimum production and transportation cost for the entire industry.

The plant size used in this analysis has a capacity for 15,000-20,000 pullets, depending on cage population and arrangement, This size was chosen since it appears to be more representative of the size of plants in the medium range, 10,000 to 20,000 pullets.

In computing the overall production level for each province no adjustments were made for the output of unregulated producers since data on this group of producers are very difficult to obtain.

The time period for the analysis is 1974. This time was chosen since it was two years after the Comprehensive

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[11]Ross, P.S. and Partners, "Provincial Models of the Farm-Gate cost of Egg Production For Medium Size Producers", A Report To The Canadian Egg Marketing Agency, July, 1975.

Marketing Program For Eggs[12] herein after referred to as the Egg Marketing Plan, was put into effect. The two year period is significant since it is the period of time that the provinces contracted to remain in the Egg Marketing Plan in order to give it a fair opportunity to achieve its objectives. After the initial two years a province may give notice of its intention to terminate its membership. Finally, 1974 was the latest year for which a complete set of data was available.

It should be stressed at this point that no attempt is made in this work to analyze the implications of the Board's operations where individual producers are concerned. The effects of the Board's operations on the individual producers will be dependent on several factors such as provincial location in relation to major urban centers both in Canada and the U.S., the size of the producing unit, production costs, in particular the cost of feed, the size of the "market" available to the producer, the policy of his particular provincial board with respect to future quota allocations, the capitalization of quotas and the degree of integration in the province. Most of these points are discussed in other reports.

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[12]Part II Schedule 'B', "Federal-Provincial Agreement, Comprehensive Marketing Program for Eggs in Canada", Government House, Ottawa, 1972.

CHAPTER III

THE INTERREGIONAL MODEL

General Assumptions

The analysis of the egg industry is based on several assumptions. The first assumption is that the entire egg industry could be represented mathematically as in the model. The other assumptions that follow pertain to specific parts of the mathematical model.

Each province is assumed to be a distinct producing zone with several producing units. However, these units are not separately identified but considered as a number of homogeneous plants. Production within each region is considered technologically uniform for each of the producing units.

Each province is regarded as a single and distinct demand and supply region for each factor of production and for the final product. The factors of importance are feed, pullets, equipment, labour, land and buildings.

The regions are all separated by a transportation cost per physical unit for the final product and some of the production factors, mainly feed. The physical unit for the product is one dozen eggs graded A large.

The plant capacity in each case is assumed to be standard and capable of housing between 15,000 and 20,000 pullets. It is assumed that producers are operating in

accordance with the regulations[13] governing production quotas.

Finally, the model assumes that all producers behave rationally and seek to minimize their costs, or conversely to maximize their profits.

Structure of the Interregional Model

The model upon which the analysis is based is structured to minimize the total costs of production and transportation for the entire egg industry. In a minimizing model a set of conditions is specified either as maximums, minimums, or equalities which can be satisfied by a combination of activities.

There are four major segments to this model. Each segment is designed to reflect as closely as possible the operation of the industry and the institutional controls placed upon it. The first segment deals with production capacity by province. The constraints in this segment are all maximums. Each constraint in segment one has an RO designation. The constraints thus run from RO1 to RO10 where each number represents a province.

The second segment of the model deals with the quantity demanded in each province. The constraints in this segment are all minimums. Each constraint has an RO designation as in segment one; however the numeric characters

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[13]See Appendix A

differ. The constraints in this segment are numbered from R011 to R020. Each number represents one of the provinces.

Segment three deals with the maximum allowable exports from each province. The constraints in this segment are all maximums in keeping with the institutional constraints on the allowable exports from each province. Each constraint in segment three bears an RO designation as do the constraints in the other sections. The constraints in section three run from R021 to R030.

Segment four of the model is the objective function. The objective function of the model specifies whether the program would be a maximum or a minimum. In the model as aforementioned we seek an optimal solution that is a minimum for the entire egg industry. The real activities of the model are contained in the objective function and are labelled PO x where x stands for a number which is specific for each activity. The activities in the objective function run from P01 to P0100. Activities P01 to P010 represent egg production in each of the ten provinces. The other real activities represent the possible transportation of eggs among the provinces.

It should be pointed out at this stage that not all the shipping activities in the model are in effect realistic. For example shipment of eggs from B.C. to Newfoundland seems unrealistic, since Newfoundland could import eggs from the U.S., Quebec or Ontario. Likewise, it does seem unrealistic to consider shipping eggs from the Atlantic provinces to the western provinces, because of the high costs of transportation

that would be involved and because of the much higher cost of production in the Atlantic provinces. However, since our model is structured to minimize costs, no transportation activities have been omitted. It is expected that in arriving at an optimal solution, the iterations of the model would eliminate all the inappropriate transportation activities since their costs are prohibitive.

We have stated that the structure of the model is such that in the first section, R01 to R010, the restraints are all maximums. Since the restraints in section one are all maximums we have established upper bounds for each restraint in the section. In the second section of the model, restraints R011 to R020, the conditions are all minimums, thus a lower limit has been set on the quantities demanded in each province. Hence in this model the quantity demanded could be as large as possible but the quantity produced must not be in excess of a predetermined value. This fact has been commented on since it provides us with a built in facility for having our market greater than it actually is, in other words it provides for t the expansion of the quantities demanded and hence the allocation of additional quotas to meet the expansion in demand.

Although it has not been done in this study, it is possible, once an optimal solution has been established, to have the quantities demanded expanded by increments of one percent up to some maximum level. The restraint in Section One could then be changed from maximums to minimums thereby establishing lower limits to production. Such limits would

be defensible on economic grounds because they represent optimal (cost minimizing) quantities. If the program is then optimized we will in effect have a report which would indicate to us what our future quota allocations should be, given the degree of expansion in the market.

Such a task has not been undertaken in this study primarily because we are interested in the establishment of a model that would provide for the allocation of present quotas not on historical levels, but based on the comparative advantage in production. Once such a model is established, it may be employed to determine future quota allocations by making the necessary adjustments in the input data. Our hypothesis, it should be recalled, is that the present allocation scheme is not compatible with comparative advantage in production.

General Program Procedure

Production Capacity by Province. The first major segment of the model deals with production capacity by province as was pointed out in an earlier section of this chapter. The production capacity for each province was assumed from historical data to be the average production over a five year period from 1970 to 1974. The choice of the time period was arbitrary. The method used to determine the production capacity for each province follows that used by the Canadian Egg Producers Council in its Proposal For A National Egg Marketing Plan[14] which

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[14]Part II Schedule 'B', "Federal-Provincial Agreement, Comprehensive Marketing Program for Eggs in Canada", Government House, Ottawa, 1972.

it adopted in August 1972. The Proposal set forth by the Council was used by the National Farm Products Marketing Council to develop the National Egg Marketing Plan. The values that were finally assumed to be the production capacities by province for this model were obtained from data published by Statistics Canada,[15] and are presented in Table 3.1.

TABLE 3.1

Average Annual Egg Production Capacities By Province

Province	1970	1971	1972	1973	1974	Total	Average
				000 dozens			
B.C.	57,562	58,341	57,324	56,872	54,942	285,041	57,008
Alta.	43,547	42,143	41,315	41,437	40,769	209,311	41,842
Sask.	25,328	26,187	23,931	22,444	21,019	118,909	23,782
Man.	58,239	55,540	42,068	42,893	50,498	269,238	53,848
Ont.	187,471	192,618	191,091	190,718	189,323	951,221	190,244
Que.	75,945	73,547	64,490	59,518	64,613	338,113	67,623
N.B.	8,409	9,590	9,932	10,340	8,770	47,041	9,408
N.S.	22,226	20,471	17,373	18,228	19,297	97,595	19,519
P.E.I.	2,831	2,490	2,350	2,410	2,363	12,444	2,489
Nfld.	9,147	8,736	8,481	6,835	7,857	41,056	8,039

[15] Statistics Canada, Production Of Eggs And Poultry, Catalogue 23-003, Vol. 27, Nos. 1-12, 1975, Catalogue 23-202, Table 10, 1975.

The figures presented in Table 3.1 are exclusive of eggs produced by unregulated producers[16] and eggs produced for hatching purposes.

Some Definitions. Earlier in this chapter we spoke of the production capacity by province, which was ultimately determined by the historical production patterns in each case. At present the Federal Marketing Agency essentially determines what these levels should be and bases the annual production levels for each province on its determinations.

The capacity output by province referred to in this study does not indicate the maximum possible output for the respective provinces. Capacity output in this context refers to that output for which average variable costs are a minimum. Thus the terms capacity output and optimal output may be regarded as synonymous only in so far as the former is such that it minimizes average variable costs.

Capacity output may also be considered as the designed output of a given plant. Hence, in the context of this study it is the sum of the outputs of the medium sized plants in a given province.

Cost of Production. In the context of this study production is regarded as the entire process of flock procurement[17] and

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[16] Producers whose operations may not be classified as "Commercial" and who therefore are not under the jurisdiction of the marketing board for the province in which they operate.

[17] It is general practice to purchase twenty week old birds from pullet growers to make up a flock. Most White Leghorn birds begin to lay after twenty-two weeks.

management until such time as the pullets are sold as fowl. Some producers engage in hatching operations and hence supply their own pullets for egg production. However, the costs associated with the hatching and rearing of birds before they are placed in laying cages are omitted from the analysis of production costs but are taken at the purchase price since it is felt that such costs are wholly applicable to another industry i.e. the chick growing operation.

The determination of cost of production by province was based on the methodology developed by P.S. Ross And Partners[18] in their report on provincial cost of production in the egg industry. The cost of production by province is presented in Table 3.2.

The separate elements that were identified by P.S. Ross And Partners as contributing to production costs fall into five major categores, (1) overhead, (2) pullet costs, (3) feed, (4) labour, (5) depreciation.

Quantity Demanded by Province. There are two major markets for eggs in Canada; the "shell-egg market" which supplies individual consumers with table eggs, and the "breaker market" which supplies outlets such as bakeries, food processing plants and institutions. The majority of the better quality eggs goes to the shell egg market, while the breaker market

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[18]"Provincial Models Of The Farm-Gate Cost Of Egg Production For Medium Size Producers", A Report To The Canadian Egg Marketing Agency, submitted by P.S. Ross And Partners, July 1975.

TABLE 3.2

1974 Cost Of Production By Province*

Province	Overhead	Depreciation	Pullet	Feed**	Labour	Total
	cents/dozen					
B.C.	4.5	3.2	11.5	35.4	4.3	50.90
Alta.	3.6	2.9	9.6	32.6	1.8	50.50
Sask.	4.7	3.3	9.8	32.9	1.9	52.60
Man.	3.0	2.6	9.8	31.9	1.3	48.60
Ont.	3.2	2.5	9.6	33.2	1.7	50.20
Que.	3.1	2.2	10.3	36.5	1.6	53.70
N.B.	3.0	2.0	10.4	37.0	1.5	53.90
N.S.	4.1	2.7	11.5	40.1	2.3	60.70
P.E.I.	4.2	2.7	11.7	41.3	2.5	62.40
Nfld.	4.2	2.9	12.0	42.3	2.6	64.00

*Cost elements used in this table were calculated by using the P.S. Ross And Partners method as outlined in P.S. Ross And Partners, "Provincial Models Of The Farm-Gate Cost Of Egg Production For Medium Size Producers, Appendix B, A Report To The Canadian Egg Marketing Agency, July 1975".

**Canadian Livestock Feed Board, Grain Facts Vol. V, Nos. 16, 22, 25. Vol. VI, No. 5, 1974.

handles the lower grades, cracked eggs, and such eggs as are surplus to quota needs.

Demand[19] is a schedule of prices and quantities which can be illustrated graphically by a demand curve. The schedule is determined from data showing relationships among several variables such as prices and quantities of a given commodity, consumer incomes and the prices of substitutes and of complementary goods. Since no attempt is made in this study to develop a demand schedule for eggs in Canada, an estimate of consumption is used instead of demand.

For the purpose of computing the quantities of eggs required by province it was first proposed to take the sum of those quantities of eggs sold to the above mentioned markets together with those used by producers as indicative of consumption. This approach was abandoned since sufficient data on the disposition of eggs by province were not available.

It was decided that a measure of consumption by province could be approximated by using the national consumption per capita for 1974, which was reported in the Poultry Market Review 1974 to be 19.0 dozen, times the provincial population according to the 1971 census. The results of the calculations are set out in Table 3.3.

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[19] A detailed account of demand for eggs in Canada may be found in the study by Loyns, R.M.A. and Lu, C.M., Characteristics Of Demand For Eggs In Canada: An Analysis Of Cross-Section And Time-Series Data. Research Bulletin 72-3 Department of Agricultural Economics and Farm Management, University of Manitoba, September 1972.

TABLE 3.3

Estimate Of Quantity Demanded By Province

Province	Population	Consumption Per Capita	Quantity Demanded	Quantity Produced
		---dozen---	-------000 dozen-------	
B.C.	2,441,000	19	46,379	57,008
Alta.	1,747,000	19	33,193	41,842
Sask.	912,000	19	17,328	23,782
Man.	1,014,000	19	19,266	53,848
Ont.	8,171,000	19	155,249	190,244
Que.	6,165,000	19	117,135	67,623
N.B.	670,000	19	12,730	9,408
N.S.	818,000	19	15,542	19,519
P.E.I.	118,000	19	2,242	2,489
Nfld.	546,000	19	10,374	8,031
Total	22,402,000	19	429,438	473,794

Maximum Allowable Exports. The maximum quantity of eggs that can be exported[20] from any province is determined by the regulations set forth in the National Egg Plan. The regulations surrounding the export of eggs from each of the provinces require that no sale of eggs shall be made from any province

[20] Federal-Provincial Agreement, in respect of the establishment of a Comprehensive Marketing Program, for the purpose of regulating the marketing of Eggs in Canada. Schedule 'C' Government House, Ottawa, 1972. A detail of the regulations governing quantities of eggs exported from each province as presented in Schedule 'C' is given in Appendix

unless such sale along with total intraprovincial marketing are not in excess of the quota allocations.

In order to solve the model it was necessary to place upper bounds on the amount which could be exported from each province. There are no lower bounds placed on the quantities exported since the exports from some of the provinces are negligible when compared to the overall production capacity.

Transportation Costs. The cost of transportation plays an important part in the determination of comparative advantage. The determination of transportation cost for the egg industry is complicated by the fact that several means of transportation are employed to move eggs interprovincially. The majority of eggs moving interprovincially is shipped either by truck, rail, or by "piggy back".* Because of the different means of transportation employed, the cost schedules are not readily comparable.

In the context of this study, the cost of transporting eggs interprovincially pertains to the shipping of eggs by truck. The choice of truck rates was made for the following reasons: (a) Actual truck rates are more readily available than train rates, (b) Transportation by truck proves to be a faster means of getting the product to the final market,

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*Large truck trailers are often transported on railroad flat cars to destination points where they are picked up by trucks for delivery to final outlets.

and (c) The trend toward shipping by truck has been increasing over the last ten years especially with the introduction of large trailers equipped with refrigeration systems.

The selection of trucking as the means of transportation does not remove all the complications involved in determining transportation costs. A perusal of the transportation rate schedules from different transport companies shipping eggs between similar points shows that they are not readily comparable since in many cases rates are dependent on minimum load requirements which differ from company to company.

A further complication stems from the fact that in reality eggs are not shipped from a central point in the province to a central point in another and then redistributed. It is more likely the case that shipments made from farms or grading stations in one province are forwarded directly to market points that are close by in contiguous provinces. A typical example is found in the shipment of eggs from the eastern farms in Manitoba to outlets in Western Ontario such as Thunder Bay and Kenora. Clearly the transportation rates that apply in this example are not the same for shipments made between Winnipeg and Toronto. Therefore one finds that there are numerous transportation rates for the shipment of eggs from a given province to another. This proves to be a serious problem for this model since the markets are defined to be the provincial capitals. Because of the numerous different shipping costs that are given for shipments between

the same provinces, it was decided to aggregate transportation costs and consider the transportation costs to be those that are derived for shipping eggs between the capital cities in each province.

It was felt that the transportation costs problem could have been resolved in part by dividing each province into several well defined demand zones. A typical example of such division is had in Ontario, a province which for the purpose of this model could have been divided into two regions, Western Ontario and South Eastern Ontario. This would have been desirable since there are production cost differences[21] between the regions.

In this study no province has been subdivided even though economic and geographical factors suggest that subdivisions would be appropriate in some cases. It was felt that the creation of separate regions within a province would not be readily defensible, since the quotas are granted to provinces and not regions within a given province. Such a division would thus involve finding methods to distribute the provincial quota among the separate regions within the province. A division of the provinces into smaller regions would also involve a larger model and greater input of data. The enlargement of the model it was felt would not substantially improve the results of the study.

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[21]See Cost of Production by P.S. Ross And Partners in Appendix B.

In order to circumvent the problems that arise in attempting to determine transportation costs from the schedules of the trucking companies, it was decided to estimate the transportation costs on a per mile basis using a standard minimum weight of 36,000 pounds. The costs were then converted to a cost per dozen basis for inclusion in the model.

The rates used for the calculation of transportation costs between provinces were obtained from the rate schedules used by trucking companies[22] that are engaged in shipping eggs interprovincially.

It should be pointed out at this stage that the final transportation costs that are presented in Appendix C are exclusive of cost of other services required for the marketing process.

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[22] Canadian Transport Tariff Bureau Association, Rexdale, Ontario, Schedules for east bound rates; Atlantic Provinces Motor Carrier Tariff Bureau Ltd., St. John, New Brunswick; Quebec Tariff Bureau Inc., Montreal, Quebec; Reimer Express Lines Ltd., Winnipeg, Manitoba.

CHAPTER IV

RESULTS OF THE INTERREGIONAL MODEL

Analysis of Section One Optimal Solution

In analyzing the solution of the program one must bear in mind that the objective of the model is to find that combination of activities which results in a minimum cost structure for production and transportation in the entire egg industry.

The minimum cost for the entire program is shown in Section One[23] to be 225,113,191 dollars. This cost is given in the objective function as the first entry under row number 1. The other entries that appear under the Activity column show what quantities of the original values were used in arriving at an optimal solution.

Limiting and Non-Limiting Restraints. We observe in the computer print-out Table 4.1 under the heading Slcak Activity that different quantities of the restraints were employed. Some of the restraints were fully used in effecting the optimal solution, others were only partially used while still others were completely left out of the optimal solution. The identification of the restraints that did not enter the

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[23] Section One Optimal Solution Computer Print-out, Appendix D.

TABLE 4.1

Report On Slcak Activities At Optimal Level

Number	Row	Slack Activity	Shadow Price
		----dozens----	-cents/dozen-
2	R01 Production B.C.	25,732,000	0
3	R02 Production Alta.	0	5.75
4	R03 Production Sask.	0	2.32
5	R04 Production Man.	0	6.58
6	R05 Production Ont.	0	7.30
7	R06 Production Que.	0	5.56
8	R07 Production N.B.	0	6.51
9	R08 Production N.S.	8,104,000	0
10	R09 Production P.E.I.	2,489,000	0
11	R010 Production Nfld.	8,031,000	0
12	R011 Demand B.C.	0	-58.90
13	R012 Demand Alta.	0	-56.25
14	R013 Demand Sask.	0	-54.92
15	R014 Demand Man.	0	-55.18
16	R015 Demand Ont.	0	-57.50
17	R016 Demand Que.	0	-59.26
18	R017 Demand N.B.	0	-60.41
19	R018 Demand N.S.	0	-60.70
20	R019 Demand P.E.I.	0	-60.70
21	R020 Demand Nfld.	0	-63.34
22	R021 Exports B.C.	57,008,000	0
23	R022 Exports Alta.	33,193,000	0
24	R023 Exports Sask.	17,328,000	0
25	R024 Exports Man.	19,266,000	0
26	R025 Exports Ont.	155,249,000	0
27	R026 Exports Que.	57,249,000	0
28	R027 Exports N.B.	9,408,000	0
29	R028 Exports N.S.	19,519,000	0
30	R029 Exports P.E.I.	2,489,000	0
31	R030 Exports Nfld.	8,031,000	0

*Reproduced from computer print-out Section One.

final optimal solution is important for the understanding of the solution of the model and the policy implications contained.

A glance at section one of the optimal solution shows that some of the restraints have zero slack activities and that these very activities have positive dual activities. A zero slack activity for any resource indicates that the resource in question is fully used in the optimal solution and thus limiting to the process in question.

If in the final solution a resource is in excess supply it is indicated by the slack or disposal activity appearing at a positive level in the computer print-out. The corresponding dual activity is always zero indicating that increments of the resource in question would make no further contribution to the process.

In this context, the dual activity values are regarded as shadow prices for the disposal or slack activities. The shadow prices on disposal activities indicate the marginal contribution to income of the last unit of resource. Within the framework of a minimizing model, shadow prices are sometimes regarded as cost penalties when they indicate by how much the cost of the values in the objective function would change if the restraint on a given resource were relaxed by one unit. When the shadow price is associated with real activities that do not enter the solution, and they represent cost penalties since they indicate the extent to which costs would be increased if the activities were forced into the solution.

Limiting Restraints and Policy Implications. The limiting restraints and their shadow prices are presented in Table 4.2 for easy reference.

TABLE 4.2**

Limiting Restraints Optimal Solution

Number	Row	Shadow Prices -cents/dozen-
3	RO2 Production in Alta.	5.75
4	RO3 Production in Sask.	2.32
5	RO4 Production in Man.	6.58
6	RO5 Production in Ont.	7.30
7	RO6 Production in Que.	5.56
8	RO7 Production in N.B.	6.51
12	RO11 Demand in B.C.	-58.90
13	RO12 Demand in Alta.	-56.25
14	RO13 Demand in Sask.	-54.92
15	RO14 Demand in Man.	-55.18
16	RO15 Demand in Ont.	-57.50
17	RO16 Demand in Que.	-59.26
18	RO17 Demand in N.B.	-60.41
19	RO18 Demand in N.S.	-60.70
20	RO19 Demand in P.E.I.	-60.70
21	RO20 Demand in Nfld.	-63.34

**Reproduced from Table 4.1 computer print-out Section One.

Disposal Activities RO2 to RO7. The report on the optimal solution indicates that within the framework of this model production capacities in Alberta, Saskatchewan, Manitoba, Ontario, Quebec and New Brunswick are limiting. Stated differently this means that present(optimal) production

capacities can be increased in each of these provinces up to a certain level without changing the optimal solution i.e. without incurring additional costs. As it stands, the report in Section One does not indicate the extent to which production levels can be increased in each of the above mentioned provinces before the solution becomes non-optimal. However we can obtain some insight into the required increments in production levels that will maintain an optimal solution from an analysis of the Range Report on the model.

The report on RO2 to RO7 in Table 4.2 indicates that in each case the removal of one unit (dozen) of restraint would result in an increase to the overall cost of the program by the amounts shown opposite each restraint. As an example, consider the production restraint in the province of Alberta. The report shows that there will be a cost increase of 5.75 cents per dozen to the overall value of the program for each dozen eggs not produced in the province i.e. each dozen less than the optimal quantity for the province. The shadow prices in the table may be regarded as the implicit costs for marginal contributions of the associated resource. We may extend the interpretation of the shadow price even further and regard it as an opportunity cost. Thus while the removal of one unit (dozen) of restraint would increase the cost of the program, the addition of the marginal unit of restraint, if possible, would act to reduce the cost of the program by the amounts shown.

An examination of the shadow prices in Table 4.2

gives one the impression that the entire program would be better off, ie.e. costs would be further minimized, if increments in production quotas were made to the provinces with limited production capacities in a manner such that Ontario (RO5) receives a proportionally larger share than the other provinces since the marginal contribution from Ontario is largest. The province of Manitoba (RO4) would then receive the next largest share in production quotas followed by New Brunswick (RO7), Alberta (RO2), Quebec (RO6) and Saskatchewan (RO3) in that order. It should be emphasized here that the above analysis is based on the fact that the provinces concerned have been shown in the optimal solution to have capacities for increased production. We recall that in each case the slack activity was zero. The order of priority in allocating further production quotas is based on the values of the shadow prices.

The solution in "Section One" of the computer report should be regarded as an indication of the policy changes that can be effected with the present system as represented by the model, since at this stage we have no knowledge of the range of values involved.

Disposal Activities RO11 to RO20. Activities RO11 to RO20 deal with the quantity demanded in each of the provinces. The optimal solution report indicates a negative shadow price for each restraint. The significance of the negative shadow price is this, if in each case the optimal values of the

restraints in the solution are reduced by one unit then the cost of the program would be reduced in each case by the amount shown as the shadow price, which appears in the computer print-out as the Dual Activity. In other words, the total cost of the egg industry would be reduced if quantity demanded is lowered.

It is perhaps more enlightening to interpret the report on the restraints or disposal activities from R011 to R020 by stating that if the values of the restraints in the optimal solution are increased then the values under the dual column would no longer be cost benefits, but cost penalties instead. The cost of the program would be increased by the values shown under the Dual Activity column of the computer report for each additional dozen eggs demanded in any of the provinces represented by the disposal activities R011 to R020. It is not possible at this stage of the analysis to say how large an increase in demand could be sustained before the solution becomes non optimal. This matter shall be covered in the range analysis in a later chapter.

It is observed in Table 4.2 that the Atlantic provinces (R017 to R020) sustain higher cost penalties compared to the other provinces. Alternatively if the shadow prices are regarded as cost benefits instead of cost penalties we observe that once again the Atlantic provinces appear in a less favorable position when compared to the other provinces since the report on the optimal solution dictates that much larger cost benefits can be obtained by reducing demand in

the Atlantic regions than would be the case for reductions in any of the other provinces. The report on "Section One" of the computer report indicates that within the framework of this model, egg production in the Atlantic provinces, specifically Nova Scotia, Prince Edward Island and Newfoundland, contribute toward higher costs for the industry as a whole.

Non-Limiting Restraints and Policy Implications. The non-limiting restraints in the solution of the model are indicated in Table 4.3.

TABLE 4.3

Non-Limiting Restraints

Restraint	Activity Level	Original Quantity	Percent Employed
	----------000 dozen----------		
R01	31,276	57,008	55
R08	11,415	19,519	58
R09	0	2,489	0
R010	0	8,031	0
R021	0	57,008	0
R022	8,649	41,842	21
R023	6,454	23,782	27
R024	34,582	53,848	64
R025	34,995	190,244	18
R026	10,374	67,623	15
R027	0	9,408	0
R028	0	19,519	0
R029	0	2,489	0
R030	0	8,031	0

Disposal Activity R01. We saw previously that the production capacity for British Columbia shows a zero shadow price. The zero shadow price indicates that the associated resource is in excess supply. The optimal solution report indicates that only 55 percent of the original production capacity that was allotted to British Columbia was actually used. The implication here is that the production levels in British Columbia are in excess by 45 percent. This extra 45 percent value would serve to increase the costs to the entire industry if it was produced. Based on the report on the optimal solution in "Section One", one must conclude that British Columbia would be in an unfavorable position for the receipt of new production quotas.

It should be pointed out here that the results pertain to the model only and are dependent for their validity on the accuracy of the input data. However, the results obtained from the model may serve as a guideline for policy with respect to future quota allocations where the values are good approximations of what actually obtains.

Disposal Activity R08. Production in the province of Nova Scotia is found to be in excess. The original production capacity or share of the national market was entered in the model at 19,519,000 dozens. In the optimal solution of the model only 58 percent of the allotted quantity was employed. This 58 percent or 11,415,000 dozens now represents the optimal production level for Nova Scotia.

The zero dual activity in the report indicates that the production capacity for Nova Scotia as entered in the model was in excess. We know from the optimal solution that production levels in Nova Scotia were in excess by 42 percent.

The policy implication in the case of Nova Scotia is this: if the production levels in the province were in effect at the 19,519,000 dozen level and the objective of the policy makers was to effect an optimal level of production for the industry, then production levels in Nova Scotia must be reduced. The same decision to reduce production levels would be necessary for British Columbia, since as we saw earlier, production in that province was in excess by 45 percent.

Disposal Activities R09 and R010. Production in P.E.I. (R09) and in Nfld. (R010) are considered together since they are the last of the restraints in section one of the model which deals with production capacities in each province.

We observe from the report in section one that in each case the resources are in excess. Specifically the report shows that egg production in P.E.I. and Nfld. is uneconomical compared to the other regions. The absence of any activity in the final optimal solution dictates that there should be no production of eggs in either of these two provinces if the operation of the industry is to remain optimal. It should be pointed out that in no case was there a lower limit for production. If a lower limit was included in the model then the optimal solution would have been much different

from that which was obtained because the model would have been constrained by the lower limits imposed on it.

Disposal Activities R021, 27 to 30. The disposal activities on restraint from R021 to R030 deal with the maximum quantities of eggs that a province can export. A general glance at the report shows that in each case the maximum quantity of export allowed to each province in the initial program is in excess. The optimal solution indicates that exports should come from only five of the ten provinces. Exports from the other five provinces have been completely eliminated. Once again, one cannot say with any degree of certainty whether this result, i.e. the elimination of exports from five provinces, was due to the fact that there was no lower limit placed on the exports from each province, or the comparative costs of transportation.

Activities R021, and R027 to 30 have been grouped for the purpose of analysis because they represent those provinces from which there is no transportation activity in the optimal solution. The report on activities R029 and R030 was to be expected since we saw in an earlier section of the report on Section One that there should be no production in Newfoundland or Prince Edward Island. Since the optimal solution rules out any production in these provinces then it is to be expected that exports would also be eliminated.

The elimination of export activities from British Columbia may be due to several factors; in the first instance

the optimal quantity to be produced in British Columbia is 45 percent less than the quantity that was originally allocated. The reduction in the optimal solution seems to suggest that British Columbia production was in excess or that its cost of production was too high compared to costs in contiguous provinces. We observe further that the quantity demanded in British Columbia is 48.2 percent greater than the quantity produced. If we assume that British Columbia would seek to satisfy its domestic market first before exporting eggs, then we may conclude that there will be no exports from British Columbia since production is less than quantities demanded. Furthermore since the provinces closest to British Columbia can produce eggs more cheaply it is to be expected that they would seek to export eggs to British Columbia provided of course that their landed costs are lower than the cost of eggs in British Columbia.

The elimination of exports from Nova Scotia and New Brunswick is presumably due to the high cost of production relative to production costs in contiguous provinces and the fact that quantity demanded exceeds production capacity in the optimal solution. In British Columbia the quantity demanded is 48 percent greater than the production capacity. The quantity demanded in New Brunswick is 35.3 percent above the production capacity while in Nova Scotia it is 36 percent above.

The exporting provinces are Alberta, Saskatchewan, Manitoba, Ontario and Quebec. The destination of egg exports

from these provinces is given in the Appendix.[24] The report on Section One shows that in the optimal solution Alberta exports 21 percent of its optimal output, while Saskatchewan exports 27 percent. The optimal quantity exported from Manitoba amounts to 64 percent of the total optimal production. The optimal quantity exported from the province of Ontario amounts to 18 percent of total production in that province. The report on Quebec shows that 15 percent of total optimal production should be exported.

Optimal Report Section Two

Real Activities. Section Two of the optimal report deals with the real activities in the solution. In Section Two of the report a Reduced Cost column is included instead of a Dual Activity as in Section One. The Reduced Cost column in the second section of the report indicates the magnitude of the cost penalties that are incurred by forcing into the solution one unit of a given activity that was excluded. We may consider real activity P09 as an example. Activity P09 which did not enter the final solution refers to production in Prince Edward Island. The Reduced Cost column in the report tells us that there will be a cost penalty of 1.7 cents per dozen for each dozen eggs produced in the province. This additional cost will serve to increase the cost to the entire industry. Of course we do not expect that the 1.7 cents per

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[24] See Appendix C Interpretation of Disposal Activities.

dozen penalty would remain constant over an infinite quantity. It is to be expected that the penalty would increase with higher levels of production. Another fitting example of the application of cost penalties can be had from activity P019 which represents the shipment of eggs from British Columbia to Newfoundland. This activity did not enter the final solution. We observe from the values shown under the Reduced Cost column of the computer print-out that there will be a cost penalty of 16.66 cents per dozen for each dozen eggs shipped from Vancouver to Saint John. A complete interpretation of the real activities in the second section is given in the Appendix.[25]

The first eight activities that entered the solution represent production costs in each of the provinces. The report shows that all the capital designated for production was fully used in the following provinces, Alberta, Saskatchewan, Manitoba, Ontario and Quebec, while in British Columbia and New Brunswick only part of the original capital was used in the final solution. The result from British Columbia and New Brunswick follows from the fact that in the final optimal solution the original production capacity was reduced in both provinces.

Section Two of the optimal report also shows that none of the capital for production in Prince Edward Island or Newfoundland was employed in the final solution. This result

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[25] See Appendix C Interpretation of Real Activities.

was to be expected since we saw in the first section of the report that production in the above named provinces was completely eliminated in the optimal solution.

The report on Section Two also indicates that only eight transportation activities are required to satisfy the demands for the entire country. It should however be pointed out that in actual fact more than eight transportation activities would be required to effect a satisfactory distribution of eggs in Canada at minimum costs. This statement rests on the fact that in constructing the model on which this analysis is based the transportation activities were designed to reflect the distribution of eggs among the capital cities only. We recall in chapter one of this work that it was stated that the capital city in each province is not necessarily the "market" for eggs. It is obviously not the only market available.

Because the model is structured to reflect transportation between the capital cities only we may find that in a few cases the transportation costs may be somewhat out of line with actual costs of shipping eggs across provincial borders. The high cost of transportation between some of the demand and supply points may in effect be responsible for the limited number of transportation activities present. It is felt that this model could be further refined with respect to the transportation activities by including a section for transshipment and recognizing several more regions of demand within the provinces. A complete

interpretation of the transportation activities is presented in the Appendix.[26]

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[26] See Appendix C Interpretation of Transportation Activities.

CHAPTER V

POST OPTIMAL REPORT

During the interpretation of the report on the optimal solution, emphasis was placed on the production capacity by province in order to determine whether the original production capacity allotted to each province was in excess or at optimal level. Interest was also focused on the other restraints to determine their optimal or cost minimizing levels.

In "Section One" of the optimal report it was observed that if a disposal activity was in excess supply, the slack activity column for that activity appeared at a positive level. However, the optimal solution did not indicate at what point a given activity would become non optimal, nor what range of values an activity may assume before passing the optimal point.

The report on the real activities in the program Section Two of the optimal solution indicated the increased costs that would occur if any activity not in the final solution was forced into the program. However the report did not specify the range over which the increased costs would apply. In order to determine the range over which a given cost penalty would remain in effect we must look to the range report on the activities in the program and also the report on those

activities that were excluded.

The post optimal or sensitivity analysis seeks to determine the extent to which the optimal values can vary without effecting changes in the optimal solution. The sensitivity analysis also shows the cost penalties that are associated with each deviation in values from the optimal solution. Once again it must be pointed out that the results obtained in this analysis pertain to the values entered in the model and are based on several assumptions which were mentioned in an earlier chapter.

Range Analysis

The range or sensitivity analysis as it is also called is divided into four sections. Each section deals with a specific set of activities or restraints that was reported on in the optimal solution. "Section One" of the range report deals with those activities that were fully used in the optimal solution of the model and are hence limiting. We recall from "Section One" of the optimal solution that activity levels for RO2 to RO7 which represent production capacities in Alberta, Saskatchewan, Manitoba, Ontario, Quebec and New Brunswick, were all fully used. The other activities in "Section One" of the optimal solution that were fully used and thus limiting are disposal activities RO11 to RO20 which represents quantity demanded by province. Activities that were not used to full capacity are considered elsewhere in the range report.

In Section One of the range report, interest is focused on the unit costs and the lower and upper activities.[27] The values under the unit cost column are interpreted as shadow prices which represent the marginal value of the corresponding resources. In the interpretation of a minimizing model such as this one, the shadow prices on the activities represent cost penalties or cost benefits depending on the sign.

The important feature of the shadow prices for the limiting resources is that they can be compared with cost of expanding the resources with which they are associated. If the cost per unit for expansion is less than the shadow prices then the decision would most likely be in favor of expansion other factors taken into consideration.

Section Two of the range report deals specifically with those activities that were excluded from the optimal solution but which nonetheless were part of the model. The information gleaned from Section Two of the range report involves the cost penalties associated with shipping activities that did not enter the final solution. Section Three of the range report deals with activities that are non limiting. Unlike the activities considered under Section Two of the range report, the activities under Section Three do form part of the optimal solution. The activities[28] considered under

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[27] See Appendix E

[28] See Appendix C

"Section Three" are R01, R08, R022, R023, R024, R025, and R025. "Section Four" of the range report deals with the real activities that entered the final solution. The report on Section Four provides information on the extent of the penalty that would result if the optimal values are changed.

It is important to note that in the range report it is possible for any activity to diverge from the optimal solution. Divergence from the optimal solution may be effected by an activity entering at a higher (upper level) or lower (lower level) value than that specified for it in the optimal solution. Each activity that diverts from the optimal solution has an associated cost which may be a penalty or benefit to the entire program. As an example "Section One" of the range report shows that for activity R020 there is in effect a cost penalty of 63.34 cents per dozen associated with a divergence of 40 percent at the upper level. Also associated with each diverging activity is a Limiting Process Column which indicates the activities that are eliminated from the program so as to maintain optimality where a given activity diverges beyond the allotted range. Thus for activity R020 we note that a 40 percent increase would result not only in a penalty cost of 63.34 cents per dozen but also the elimination of activity P053.

Range Analysis Section One Rows at Limit Level

Disposal Activity R02 Production Capacity in Alberta. The production capacity for the province of Alberta was entered

at a level of 41,842,000 dozens in the initial model. The range report confirms that production capacity in Alberta is fully utilized. The shadow price or marginal value product for one unit (dozen) of production in Alberta is 5.75 cents at both levels of production. We recall from "Section One" of the optimal solution report that a value of 5.75 cents was listed under the dual column. However, in "Section One" of the optimal solution report there was no indication of the range of values over which the shadow price was relevant. The range section of the report now provides us with the required values.

The range over which the shadow price of 5.75 cents per dozen is relevant, assuming optimal behaviour, is as follows. If production in Alberta is reduced from 41,842,000 dozens to 33,193,000 dozens then the cost of the entire program would increase by 5.75 cents for each dozen not produced. The total change in production level is 8,649,000 dozens or 79 percent of the optimal production.

Also indicated in the range report is the fact that an increase in production in Alberta from the 41,842,000 dozen level to 73,117,984 dozens would result in a reduction of the total cost of the program of 5.75 cents for each additional dozen eggs produced. This represents a total increase of 74.7 percent over the initial production level specified in the model.

It is important to take note of the report under the column labelled "Limiting Process". The "Limiting Process"

column in the range report indicates those activities that are in the program but which are eliminated at the upper and lower limits of the range over which a given activity remains optimal. Hence we find that at the lower level of the range activity for Alberta, activity P020 would be eliminated, while activity P01 would be eliminated from the program at the upper level. The information in the Limiting Process column should be considered along with the range report in the other columns since it provides information about adjustments to other activities that are needed to keep the solution optimal when a given activity is changed.

The range report seems to suggest that Alberta has some excess capacity and that production could be expanded if optimal conditions exist. It should be noted that the program would remain optimal in the event that Alberta expands its productive capacity only if such expansion were limited to the 74.7 percent value specified in the report. Any expansion in production in Alberta beyond the 74.7 percent level would have to be accompanied by the elimination of production in British Columbia for the program to remain optimal. The result of an increase in production in Alberta beyond the optimal range seems appropriate since the cost of production in British Columbia is higher than any other western province.

Activity Level R03 Production Capacity in Saskatchewan. The production capacity for Saskatchewan entered in the model was 23,782,000 dozens. The entire capacity was used in

the optimal solution.

The range report states that if the production in Saskatchewan were reduced from the original level of 23,782,000 dozens to 17,328,001 dozens, a reduction of 27.1 percent, then there will be a cost penalty of 2.32 cents on each dozen not produced. This cost penalty which will be applicable to the entire industry will remain constant up to the 27.1 percent level after which it will increase. The range report also indicates that an increase in production in Saskatchewan would result in a cost benefit of 2.32 cents for each additional dozen produced. The magnitude of the increase in production for which this cost benefit will remain constant is 73 percent over the optimal value.

In the first instance where a reduction in production was considered, the limiting process is activity P029, a transportation activity representing the shipment of eggs from Saskatchewan to British Columbia. Thus, we observe that in order to maintain an optimal solution there should be no exports from Saskatchewan in the event that production in the province is reduced by 27.1 percent. In the second case where an increase in production was considered, the process to be eliminated, in the event that the increase is taken to the full extent of the range value, is activity R023. This could be interpreted to mean that beyond the range value the cost penalty which would also apply to Saskatchewan's cost of production would make it uneconomical to ship eggs from the province.

Activity R04 Production Capacity in Manitoba. The optimal production for Manitoba is 53,848,000 dozens. The range report shows that for Manitoba a reduction of 8 percent in production levels would incur a cost penalty of 6.58 cents for each dozen not produced. The cost benefit associated with an increase of up to 21 percent over the optimal level is also 6.58 cents for each additional dozen eggs produced.

The limiting process at the upper activity level is P08 production in Nova Scotia. At the lower level the limiting process is P053 a transportation activity for the shipment of eggs from Ontario to Nova Scotia.

Activity R05 Production Capacity in Ontario. The range report shows that for the province of Ontario a reduction in productive capacity from 190,244,000 dozens to 186,117,000 dozens which represents a 2 percent change, would result in a cost penalty of 7.3 cents for each dozen eggs not produced. The limiting process for this reduction if allowed to progress to 7.3 percent is P053 which represents a transportation activity from Ontario to Nova Scotia. On the upper level a change from 190,244,000 dozens to 201,658,999 dozens which represents a 6 percent increase, has an associated cost benefit of 7.3 cents for each additional dozen produced. The limiting process for this activity if it is allowed to go to the full extent of the range value is activity P08 which represents production in Nova Scotia.

Activity R06 Production Capacity in Quebec. For the province of Quebec the optimal production capacity is 67,622,992 dozens. If there is a 6 percent reduction in the level of production there will be a cost penalty of 5.56 cents for each dozen eggs not produced within the 6 percent range. The limiting process in this case is activity P053 which was also a limiting case for changes in production in the province of Ontario. If production levels in Quebec are increased up to a range of 17 percent over the optimal value then there will be a cost benefit of 5.56 cents for each additional dozen eggs produced within the 17 percent range.

Activity R07 Production Capacity in New Brunswick. For the province of New Brunswick a 44 percent reduction in production capacity would result in a cost benefit of 6.51 cents for each dozen eggs not produced within the 44 percent range. The limiting process for this reduction is P053. At the upper activity level we note that there will be a 6.51 cents per dozen cost penalty for each additional dozen eggs produced in excess of the optimal level. This cost penalty will remain constant over a 35 percent range. The limiting process is P052 a transportation activity for the shipment of eggs from Ontario to New Brunswick which is to be expected since at higher production levels New Brunswick would be able to supply its domestic markets. However, the increased costs may make this uneconomical.

Policy Implications for Activities R02 to R07. Our main concern in interpreting the range report is for the policy implications that can be gleaned from the shadow prices and the levels of the activities. The results of "Section One" of the range report for activities R02 to R07 are presented in the following table.[29]

TABLE 5.1

Summary of Range Report
Section One R02 to R07

Province	Row	Activity	Lower Activity Upper Activity	Increase* Reduction	Shadow Price
		--------dozens----------			
Alta.	R02	41,842,000	33,193,000	74.7	5.75
			73,117,984	79.3	-5.75
Sask.	R03	23,782,000	17,328,001	73.0	2.32
			41,110,000	27.1	-2.32
Man.	R04	53,848,000	49,721,000	21.0	6.58
			65,262,999	8.0	-6.58
Ont.	R05	190,244,000	186,117,000	6.0	7.30
			201,658,999	2.0	-7.30
Que.	R06	67,622,992	63,495,992	17.0	5.56
			79,037,991	6.0	-5.56
N.B.	R07	9,408,000	5,281,000	35.0	6.51
			12,729,999	44.0	-6.51

*Expressed as a percent of the activity level.

The values at the upper level of an activity are those that are beneficial to the program since they minimize the

[29] See Appendix E.

cost of production. We observe from Table 5.1 that among the provinces whose production capacities are limiting, Ontario has the largest shadow price, 7.3 cents per dozen, for the smallest change in production levels these being 6 percent and 2 percent. The province of Manitoba is next with a shadow price of 6.58 cents per dozen for production changes of 21 percent and 8 percent. Quebec, New Brunswick, Saskatchewan, and Alberta follow in descending order.

We observe from Section One of optimal solution report that only six provinces, i.e. those represented in Table 5.1, have production capacities that are limiting. This indicates that from the ten provinces in the National Egg Plan those six provinces listed in Table 5.1 are the only ones whose production capacities can be increased without incurring additional costs to the industry. The information in Table 5.1 also tells us that Ontario, Manitoba and Quebec are more competitive in the production of eggs than any of the other provinces.

Table 5.1 shows that at the lower level of production comparatively large reductions in production levels are required of Alberta, New Brunswick, and Saskatchewan in that order for relatively small increases in the total cost of the program when compared with Ontario, Manitoba, or Quebec.

In the province of Alberta a reduction in output up to a maximum range of 79.3 percent of present capacity would result in an increase to the total cost of the program of 5.75 cents per dozen for each dozen not produced. In New

Brunswick there is an added cost of 6.51 cents per dozen for each dozen not produced over a range of 35 percent while in Saskatchewan productive capacity could be reduced to a value of 73 percent with an added cost of only 2.32 cents per dozen.

The implication for policy regarding future quota allocations are these. If the policy on quota calls for a reduction of total output while keeping total cost at a minimum then those provinces with productive capacities that are non limiting eg. British Columbia, Nova Scotia, Prince Edward Island and Newfoundland should be the first to have their productive capacities reduced, or their quotas should be reduced by a larger proportion than those of the provinces with limiting production capacities. This conclusion rests on the report in the Optimal Section which shows that the above named provinces already have excess production.

If reductions in production quotas are required of the provinces with limiting productive capacities then reductions should be made in a manner such that the cost penalty is least over the largest possible range. A consideration of Table 5.1 shows that the program would have the highest cost penalty, 7.3 cents per dozen, if reductions are made to the production capacity in Ontario. In addition the range over which this penalty would remain constant is very small, a mere 2 percent of optimal production. Any reduction beyond this range would incur a larger penalty. In the province of Manitoba the cost penalty associated with a reduction over a range of 8 percent is 6.58 cents per dozen.

Because of the large cost penalties involved and the narrow range over which reductions can be made, one must conclude that it would be uneconomical to make large reductions, if any, in the productive capacities of Ontario, Manitoba or Quebec. The cost penalties for reductions in Saskatchewan, Alberta and New Brunswick are far smaller than those that are applicable to Ontario, Manitoba or Quebec and in addition, the range over which these relatively small cost penalties remain constant is rather large. Hence, the former three provinces, Saskatchewan, Alberta, and New Brunswick should carry a larger proportion of any reduction in quotas that might be made among the provinces whose productive capacities are limiting.

In the event that there is an expansion in the egg market and additional quotas must be allocated, then the policy that would most likely be followed would be one where additional quotas are awarded to those provinces whose productive capacities are limiting since such action would tend to keep costs at a minimum. The additional quotas would hence go to those provinces that have a comparative advantage in production. The provinces listed in Table 5.1 are those that have the comparative advantage in egg production.

The range report in Table 5.1 suggests that the largest proportion of additional quotas should be allocated to those provinces where the greatest cost benefits are derived over the smallest range. Such a policy if put into effect would place Ontario in the most favorable position,

followed by Manitoba, Quebec, New Brunswick, Alberta and Saskatchewan in that order. The provinces with non limiting production quotas would be considered only after capacities in the provinces with limiting capacities are filled. Although the report indicates the line of action to be followed in order to minimize costs while increasing or decreasing quotas, it is hardly likely that such hard line policies would be politically feasible, hence it rests with the adminstrators of the National Egg Plan to determine the quotas to be allocated each province, taking into consideration the cost benefits, cost penalties and ranges over which tehse costs apply.

It is important to remark at this point that the results and conclusions reached in this context relate to the values that were built into the model and are dependent on the assumptions outlined in Chapter three of this work.

The rest of the range report Section One on activities R011 to R020 deals with demand by province. We recall that in the report on the Optimal Solution activities R011 to R020 all had zero slack activities which served to indicate that all of the corresponding resources were used in the optimal solution. The Optimal Solution report also indicated that reductions in the quantity demanded would result in cost benefits to the entire industry. This apparent unlikely result may be due to the fact that we placed a lower bound on the quantity demanded but left our production capacity without a lower bound. The model was thus free to reduce production to the optimal levels but was constrained

to use all the quantity demanded. It is because of the bounds on the restraints that we have the situation where cost benefits can be derived by reducing the restraints R011 to R020.

The range report on R011 to R020 indicates that in each case cost benefits are to be gained by reducing the quantity demanded. This result confirms the findings in the report on the Optimal Solution. The results in the range report seem to suggest that further cost benefits can be derived by reductions in quantity demanded, since the costs of production may be too high to permit production capacities to be fully utilized.

The range report for activities R011 to R020 is presented in Table 5.2.

Some attention must be given to the interpretation of the report on activities R013, R019 and R020. The report shows that the quantity demanded restraint in each case can be reduced to zero. This means a reduction of 100 percent in quantity demanded. Since we assumed that each province will seek to satisfy its domestic market, then a 100 percent reduction in demand can only be interpreted as an elimination of production in the provinces concerned. In the case of Saskatchewan no production would result in a cost saving of 54.92 cents per dozen not produced. The savings for Prince Edward Island R019 not producing is 60.70 cents per dozen while in the case of Newfoundland R020 the saving is 63.34 cents per dozen not produced. The cost saving due to the 100 percent reduction in production for the three provinces

TABLE 5.2

Range Report on Quantity Demanded

Province	Row	Quantity Demanded	Lower Level / Upper Level	Percent Change	Unit Costs
		-------dozens----------			
B.C.	R011	46,378,992	15,103,008	67	-58.89
			72,110,992	55	58.89
Alta.	R012	33,192,992	1,917,008	94	-56.24
			41,841,992	26	56.24
Sask.	R013	17,328,000	0	100	-54.92
			23,781,999	37	54.92
Man.	R014	19,266,000	7,851,001	59	-55.17
			23,393,000	21	55.17
Ont.	R015	155,248,992	143,833,993	7	-57.49
			159,375,992	3	57.49
Que.	R016	117,134,992	105,719,993	10	-59.25
			121,261,992	4	59.25
N.B.	R017	12,730,000	9,408,001	26	-60.40
			16,857,000	32	60.40
N.S.	R018	15,542,000	4,127,001	73	-60.70
			23,646,000	52	60.70
P.E.I.	R019	2,242,000	0	100	-60.70
			6,369,000	184	60.70
Nfld.	R020	10,374,000	0	100	-63.34
			14,501,000	40	63.34

suggests that cost saving due to the current production in these provinces may be uneconomical.

Range Analysis Section Two Columns At Limit Level

The most important feature of this section is the report on the cost penalty that would ensue for each activity

that is forced into the optimal solution. We recall from Chapter three of this work that Section Two reported on those real activities that did not enter the solution. The range report on"Section Two" is presented in the Appendix.[30]

Activity P09 Production in Prince Edward Island. The range report on activity P09 shows that a cost penalty of 1.7 cents per dozen would be incurred if this activity were forced into the optimal solution. We note in Column Three Lower Activity,[31] that the value of 4,127,000 dozens is preceeded by a negative sign. This negative value should be ignored and a value of zero should be substituted in its place since a negative real activity is impractical. We may therefore state that the cost penalty of 1.7 cents would apply to the first dozen eggs produced in Prince Edward Island and will remain constant for a production level of up to 2,241,999 dozens. The cost penalty for production beyond this level would be larger than 1.7 cents.

The upper activity level of 2,241,999 dozen reported in the range report is less than the production capacity which was entered in the original model. This value was the average for a five year period. The difference between the two values is 10 percent. From the range report, we may conclude that the cost penalty for producing eggs in Prince

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[30]See Appendix F.

[31]See Appendix F.

Edward Island would be much higher than the 1.7 cents per dozen reported in the solution. This conclusion rests on the fact that the 1.7 cents per dozen penalty is applicable up to the range level. Any production beyond the range level will result in higher costs and we have just seen that the historically determined production level is 10 percent above the range level.

Column five of the report states that activity P09 would be incorporated into the plan if the cost of production were lowered from 62.39 cents per dozen to 60.69 cents per dozen. The limiting processes for activity P09 are P053 and P054.

Activity P010 Production in Newfoundland. The range report shows that a cost penalty of .66 cents per dozen would be incurred if P010 were forced into the Optimal plan. This cost penalty of .66 cents per dozen will remain constant for a range of production from zero to 8,031,000 dozens. We substitute a value of zero in place of the negative quantity since a negative real activity does not convey any meaning. The report further indicates that activity P010 would be incorporated into the plan if the cost of production were reduced from 64 cents per dozen to 63.34 cents per dozen. The limiting activities are P053 and R010.

The remainder of the real activities dealt with under Section Two are mainly transportation activities and shall not be considered further since our main interest rests with the real activities that entered the plan.

Section Three, Range Report, Rows at Intermediate Level

The report in this section deals with those restraints that were not limiting. The relevant part of the report on this section is the cost penalty column. This column gives us the additional costs that will ensue if any of the non-limiting restraints is forced into the plan.

Activity R01. The report on this restraint indicates that 55 percent of productive capacity was used in the final plan. Also indicated is the fact that any change in the level of production would result in a cost penalty. The cost penalty for an increase in production level is 1.55 cents per dozen for each additional dozen produced. This cost penalty will remain constant for an increase up to a level of 21 percent. Alternatively a 13 percent decrease in the optimal level of R01 would result in a cost penalty of 1.18 cents per dozen. The limiting processes in this case are P038 at the lower level and P031 at the upper level.

Activity R08. The range report on R08 shows that 58 percent of the production capacity was utilized in the final solution. The report shows that a cost penalty will apply for any change in the level of production. Specifically, a cost penalty of 1.18 cents per dozen would ensue for each additional dozen eggs produced. This 1.18 cents per dozen penalty will remain constant for a range of 36 percent above the optimal level. If the optimal level is reduced the cost penalty would be .66 cents for each dozen not produced. This cost penalty will

apply for a reduction of 70 percent below the optimal level. The limiting processes for activity R08 are P010 at the lower level and P038 at the upper level.

Activities R09, R010, R021, R027, R028, R029 and R030. These activities have been grouped together since they all show zero activity level which indicates that they are already in excess and were not used in the final solution. Activity R010 is explained as a reference for the understanding of the other activities in the group.

The range report indicates that none of the productive capacity for Newfoundland was used in the final plan. The Unit Cost column shows that there will be a cost penalty of .66 cents per dozen for any production in Newfoundland. We observe in the Lower Activity, Upper Activity column that the lower activity for R010 is zero. We conclude from this lower activity value that the cost penalty of .66 cents per dozen would commence with the first dozen eggs produced. This cost penalty for production in Newfoundland would remain constant for production up to a level of 10,373,999 dozen after which it will increase.

Activity R022. The range report for R022 shows that 21 percent of the maximum exports allowable was used in the optimal solution. If this 21 percent figure is increased, there will be a cost penalty of .47 cents per dozen for each additional dozen exported from Alberta. This .47 cents per dozen cost penalty would apply over a range increase of 75 percent of

the optimal quantity.

The penalty for a reduction in export quota is 5.75 cents per dozen. The zero value at the lower activity[32] indicates that the 5.75 cents per dozen cost penalty would remain constant for reductions over a range of 100 percent below the optimal value.

Activity R023. The optimal exports for Saskatchewan is shown to be 27 percent of the original quantity that was entered in the model. The range report shows that any increase or decrease in the optimal value would incur a cost penalty. Specifically, a cost penalty of 1.44 cents per dozen would apply if the optimal value was increased. This cost penalty would hold for an increase of up to 64 percent over the optimal value. The cost penalty for a reduction in exports from the optimal quantity is 2.32 cents per dozen. This cost penalty will remain constant for a reduction of 100 percent from the optimal value. The limiting processes for R023 are P040 at the upper level and R03 at the lower level.

Activity R024. The report indicates that 64 percent of the allowable exports were used in the final solution. The report indicates that there will be a cost penalty for any divergence from the optimal quantity. Specifically, there will be a 1.55 cents per dozen cost penalty if the quantity in the optimal solution is increased. This cost penalty will

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[32] See Appendix G.

be applicable for an increase of 16 percent over the optimal value. If the optimal quantity is reduced the cost penalty will then be 6.58 cents per dozen and will be applicable over a range of 12 percent. The limiting processes for this activity are R04 and P031.

Activity R025. The report on the maximum allowable exports for Ontario indicates that 18 percent of the original programmed value entered the optimal solution. The report also shows that any deviation from the optimal value would result in a cost penalty. Specifically, if the optimal value is increased the cost penalty incurred would be 1.34 cents per dozen. This penalty will remain constant for a reduction of up to 12 percent below the optimal value. The limiting processes for R025 are R05 at the lower level and P041 at the upper level.

Activity R026. The maximum exports for the province of Quebec is 15 percent of the original programmed value. The report shows that a cost penalty of .66 cents per dozen would be incurred if the optimal quantity is increased. Furthermore, this optimal cost penalty would remain constant for an increase of up to 32 percent above the optimal value. A decrease in the optimal quantity would result in a cost penalty of 11 cents per dozen for each dozen not exported. The cost penalty for a reduction in exports will remain constant for a reduction of 100 percent. The limiting activities are P082 at the lower level and P061 at the upper level.

Policy Implications of Section Three of The Range Report. We know from the optimal report that the restraints dealt with under Section Three of the Range Report are all non-limiting. Since these restraints are in excess, it is obvious that policies aimed at minimizing costs would be directed toward decreasing these restraints. However, Section Three of the report shows that reductions from the optimal quantities of those restraints that entered the final solution would result in a cost penalty. Therefore, the problem facing policy makers would involve making a decision about which restraints could be reduced most and at least costs to the program

Activities R09, R010, R021, R027, R028, R029 and R030, are definitely contributing more to increasing the cost of the industry than the other activities considered under Section Three. Because the above named activities have been eliminated from the optimal solution it would seem appropriate to reduce their activity levels first before reducing the levels of those activities that entered the final solution. The activities in the final optimal solution have positive activity levels. The absence of the above named activities from the final optimal solution is an indication that reductions in their levels would result in cost benefits to the program.

If reductions in the levels of those activities that entered the optimal solution are required, then it is to be expected that policy makers would take into consideration the cost penalties involved and the range over which these penalties would remain in effect. Table 5.3 shows the non-limiting

activities that entered the optimal solution and the cost penalties incurred for deviations from the optimal levels. The complete report is presented in the computer print out in the Appendix.[33]

TABLE 5.3

Non Limiting Restraints Range Report

Restraint	Activity Level ----dozens----	Activity as % of Optimal Quantity	Cost Penalty Lower Level / Upper Level
R01	31,276,000	55	1.18 / 1.55
R08	11,414,992	58	.66 / 1.18
R022	8,649,008	21	5.75 / .47
R023	6,454,000	27	2.32 / 1.44
R024	34,582,016	64	6.58 / 1.55
R025	34,992,008	18	7.30 / 1.34
R026	10,374,000	15	.11 / .66

The range report shows that Manitoba, R024, has the highest level of exports entering the optimal solution. The report also shows that the cost penalty for reducing Manitoba's

[33] See Appendix G

export level is the second highest among the exporting provinces. These results seem to indicate that reductions in the exports of eggs from Manitoba would involve larger cost penalties for the program than reductions from other regions.

Range Report Section Four Columns At Intermediate Level

The activities considered under this section are the real activities that entered the final optimal solution of the model. The main function of the range report in this section is to indicate the magnitude of the cost penalties that would accrue if departures from the optimal solution should occur. Section Four of the report is presented in the Appendix.[34]

Activity P01. The range report for production in British Columbia shows that there will be a cost penalty for any deviation from the optimal. The cost penalty for an increase in production is 1.55 cents per dozen for each extra dozen produced, compared with 1.18 cents per dozen for each dozen not produced. The cost penalty associated with an increase in production is applicable for a change from 31,275,984 dozens to 37,729,982 dozens which represents an increase of 21 percent. At the lower level the 1.18 cents per dozen penalty will be applicable over a range of 13 percent.

The values under the Upper cost Lower cost column indicate that the cost of production in British Columbia may

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[34] See Appendix H

vary from 57.34 cents per dozen to 60.07 cents per dozen before any changes in the optimal level of production are effected. The range of values for production cost is 1.18 cents per dozen above the original cost and 1.55 cents per dozen below. These deviations represent a 2 percent increase in cost at the upper level and a 3 percent reduction at the lower level. However, if a full 2 percent increase in production cost is realized then the level of production in the optimal solution will drop to 27,148,985 dozens. This reduction in production level due to a 2 percent change in cost of production represents a 13.1 percent change from the optimal production capacity for British Columbia. Alternatively, if the cost of production is reduced by 3 percent, then production levels should increase by 21 percent. The policy implication here is this, if the cost of production for British Columbia increased by 2 percent or more over the original cost of production then production levels in that province should be reduced by 13 percent to keep the cost of production at a minimum. Alternatively, a 3 percent reductiom in production cost would allow for a 21 percent increase in production levels. Since British Columbia's production capacity is already in excess, as reported in Section One of the Optimal Solution, then the 3 percent reduction in production cost without the accompanying rise in production levels would put the province in a better competitive position.

There is a noticeable difference between the range report for British Columbia and the report for the other

provinces with limiting production capacities in the optimal solution. In the Lower Activity Upper Activity Column we see that the upper activity for each of the provinces with limiting production capacities is identical to the optimal quantity shown under the Activity column. Hence, there is only a lower activity report for each of these provinces. The upper activity level is identical to the optimal productive capacity because in each case the production capacity is at the limit. This situation suggests that those provinces with limiting productive capacities are in a more favorable position for the allocation of additional quotas than British Columbia, or for that matter those provinces whose productive capacities were excluded from the Optimal solution. Since the productive capacities of the provinces represented by P02, P03, P04, P05, P06 and P07 are limiting, then additions to their present quotas, if available, would result in cost benefits to the entire industry. This is the interpretation of the infinity unit cost[35] associated with the upper activity in each case. Unfortunately, the range report does not indicate how much benefit would be derived for a given unit increase in production. The infinity unit cost report may also be interpreted to mean that no more cost benefits are to be obtained once the level of production reaches the optimal level. If the latter interpretation is used, we can substitute zero for the infinity entry in each case.

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[35] See Appendix H.

An important question that is not answered in this study is whether the capacity output in the provinces coincides with the physical limits of production. If the capacity output is identical to the physical limits then additional quotas awarded to those provinces based on the capacity output levels being limiting would not result in cost minimization but increased costs for the entire industry since additional facilities may have to be erected to meet the additonal production levels.

The negative infinity value which appears at the lower cost for activities P02, P03, P04, P05, P06 and P07 should be substituted by a value of zero since it is more meaningful to have the cost of production vary from zero to the level specified in the program and which appears as the input cost in the computer print-out.

Activity P02. Section Four of the range report indicates that there will be a cost penalty of 5.75 cents per dozen for each dozen less than the optimal quantity for Alberta. The change in production for which this cost penalty remains constant is 21 percent below the optimal quantity. If production is reduced to the full extent of the range, then activity R02 would be eliminated from the optimal solution. We note here that activity R02 is the production capacity restraint for Alberta.

The cost of production in Alberta may vary from 50.50 cents per dozen to 56.25 cents per dozen before any change in the optimal production level is effected. However, if the cost

of production is allowed to vary to the full extent of the range, then the level of production would decline by 21 percent.

Activity P03. If the optimal production level in Saskatchewan is reduced, there will be a cost penalty of 2.32 cents for each dozen that is not produced. This cost penalty of 2.32 cents per dozen would remain constant over a range of 27 percent below the optimal level after which it would increase.

If the cost of production in Saskatchewan should increase by 4 percent over the input cost, then the level of production must decrease by 27 percent in order to maintain the optimal solution. An increase in production cost that is less than 4 percent would not affect the level of production. The limiting process for a 27 percent decline in production is R03.

Activity P04. The range report for production in Manitoba indicates that there will be a cost penalty of 6.58 cents per dozen if the optimal level of production is reduced. This cost penalty will remain constant for a decrease of 8 percent below the optimal level. The cost of production in Manitoba may vary from 48.59 cents per dozen which is the original input cost to 55.17 cents per dozen which represents a 14 percent increase in production cost, before any change in the optimal level of production is brought about. If the cost of production in Manitoba should change to 55.17 cents per dozen, thus increasing to the full extent of the range, then the level of production must drop by 8 percent to 49,720,985

dozens in order for the solution to remain optimal. The limiting process that will accompany a reduction in production level is activity R04.

Activity P05. The optimal production level for Ontario is 190,243,984 dozens. The range report shows that there will be a cost penalty of 7.3 cents per dozen if production is reduced below the optimal figure. The cost penalty will remain constant if production is reduced to an amount that is less than 2 percent below the optimal level. If, however, production is reduced to 2 percent or lower then the cost penalty will be greater than 7.3 cents per dozen.

The cost of production for Ontario may increase by 15 percent before the optimal level of production is affected. Thus the production cost may change from 50.2 cents per dozen to 57.5 cents per dozen before a change in production level becomes necessary. If the increase in cost of production should reach or exceed 57.5 cents per dozen then the level of production must decline by 2 percent for the solution of the plan to remain optimal.

Activity P06. The range report for production in the province of Quebec shows that a cost penalty of 5.56 cents per dozen will result from a reduction in the optimal level of production. This cost penalty will remain constant for a range of less than 6 percent below the optimal production level. Once the level of production is reduced to 6 percent or over the cost penalty will increase.

The original cost of production for Quebec is 53.7 cents per dozen. The range report shows that cost of production in Quebec can vary from 53.7 cents per dozen to 59.26 cents per dozen before any change in the level of production is effected. However, if the cost of production changes a full 10 percent to 59.26 cents per dozen, then the optimal level of production must drop by 6 percent in order to keep the Plan optimal.

Activity P07. The original cost of production in New Brunswick is 53.89 cents per dozen. However, this cost may vary by 12 percent to 60.4 cents per dozen before the optimal production level must change to keep the program optimal. Once the 12 percent level of increase in cost of production is attained, the level of production declines by 44 percent in order to maintain the optimal solution of the Plan.

If the optimal level of production in New Brunswick is reduced a cost penalty will apply. The cost penalty for a reduction in production is 6.51 cents per dozen for each dozen not produced. This cost penalty will remain constant for changes less than 12 percent below the optimal output. At the 12 percent level or below, the cost penalty would increase.

The range report on the activities considered so far, with the exception of Activity P01, did not indicate a cost for an increase in production. In effect the report showed the unit costs to be infinite. The infinite unit cost indicates that the cost savings for additions of the limited

resource to the Plan are substantial. However this model does not report on the possible cost benefits to be derived from forcing more of the limited resources into the plan. We can however conclude that it would be good policy to extend the production quotas of those provinces for which productive capacities have been shown to be limited.

We are in a position to come to the above conclusion even though the infinity value shown under the unit cost column does not carry a minus sign because we know from the previous section of the report that the activities considered are limited. Since these activities are limited one would desire more of them not less. We would therefore expect that additions of the limited resources would contribute to the minimization of total costs. Activity P08 is not limited and hence the unit cost values which appear for deviations from the optimal levels are indeed cost penalties.

Activity P08. The range report for Nova Scotia shows that there will be a cost penalty of 1.18 cents per dozen for each additional dozen produced above the optimal quantity. This cost penalty will remain at a constant level for a range of up to 36 percent above the optimal production level. Once the increase in production reaches the 36 percent level then the cost penalty would no longer be constant but would increase substantially.

At the lower level of production we find that a cost penalty of .66 cents per dozen will apply for each dozen that

is not produced. This cost penalty will be constant over a range of less than 70 percent. If the reduction in production is carried to the full 70 percent then the cost penalty would increase.

The cost of production in Nova Scotia was calculated to be 60.7 cents per dozen. We observe from the range report that this cost of production may vary from 59.52 cents per dozen to 61.36 cents per dozen before the optimal level of production is affected. Thus for a one percent increase in the cost of production the level of production must decline by 70 percent. If on the other hand, the cost of production declines by two percent then the level of production would increase by 36 percent. The range report shows that production in Nova Scotia is very sensitive to cost of production changes especially to increases.

The first part of the range report, Section Four, which deals with activities P01 to P08, is presented in the table which follows. Activities that follow P08 in Section Four of the range report all apply to transportation and shall be considered separately.

We observe from Table 5.4 that, Alberta (P02), Saskatchewan (P03), Manitoba (P04), Ontario (P05), Quebec (p06) and New Brunswick (P07) are most sensitive to reductions in production levels. The most sensitive province in so far as reduction in production levels is concerned appears to be Ontario (P05) where a reduction as small as two percent would result in a cost penalty of 7.30 cents per dozen. The province

TABLE 5.4

Range Report Section Four
Optimal Producing Units

Column	Activity	Range *L.A. U.A.	Range % Change	Cost Penalty	Cost Range **U.C. L.C.	Cost %+ Change U.C. L.C.
	-dozens-			--cents/dozen--		
P01	31,275,984	27,148,985	13	1.18	60.07	2.0
		37,729,982	21	1.55	57.34	2.6
P02	41,841,984	33,192,985	21	5.75	56.25	11.3
		41,841,984	0		0	
P03	23,781,984	17,327,986	27	2.32	54.91	4.4
		23,781,984	0		0	
P04	53,847,984	49,720,985	8	6.58	55.17	13.5
		53,847,984	0		0	
P05	190,243,984	186,116,985	2	7.30	57.50	14.5
		190,243,984	0		0	
P06	67,622,992	63,495,993	6	5.56	59.26	10.3
		67,622,992	0		0	
P07	9,407,999	5,281,000	44	6.51	60.40	12.1
		9,407,999	0		0	
P08	11,414,999	3,384,000	70	.66	61.36	1.0
		15,541,998	36	1.18	59.25	1.94

*L.A. Lower Activity; U.A. Upper Activity.

**U.C. Upper Cost; L.C. Lower Cost

+This column gauges the sensitivity of the activities to changes in the input costs in the objective function.

of Quebec (P06) is next with a cost penalty of 5.56 cents per dozen for a reduction of 6 percent. The report for the province of Manitoba (P04), which is the third most sensitive region in so far as reduction in production is concerned, shows a 6.58 percent cost penalty for an 8 percent decline. Alberta (P02), Saskatchewan (P03), and New Brunswick (P07) are next in line in the order in which they appear here.

The policy implications for the results appearing in Table 5.4 seem to be along the following lines. If reductions in production levels are required to steer the industry toward an optimal output level, then those provinces appearing in Table 5.4 should either be the last to have their quotas reduced or should be required to reduce their quotas by a smaller quantity than provinces not appearing in Table 5.4. For those provinces that do not appear in Table 5.4 reductions in production should be such that larger reductions are required from Nova Scotia (P08) and British Columbia (P01). The reductions in Nova Scotia (P08) should be larger than in British Columbia (P01) since the cost penalty in Nova Scotia (P08) is only .66 percent over a wide range of up to 70 percent, compared to the cost penalty and range in British Columbia (P01) which are 1.18 cents per dozen and 13 percent. Reductions made from the other provinces appearing in Table 5.4 should be calculated in accordance with the cost penalties and ranges shown in the table. Hence one would expect the magnitude of reductions to be such that the least reduction is required of Ontario (P05) with Quebec (P06), Manitoba (P04),

Alberta (P02), Saskatchewan (P03) and New Brunswick (P07) being required to reduce by progressively larger amounts.

Table 5.4 also shows that future allocation of production quotas should be made in such a manner that the largest quotas are allocated to the province with the highest percentage change in the "% change column". The values in this column show by how much costs must change before changes in production level must be effected to maintain the optimal solution. The required changes are displayed under the column labelled "% Range Change". Thus Ontario (P05) would be in the most favorable position for future allocations since the province couls sustain a 14.5 percent increase in cost of production before any changes are required in production levels. If the 14.5 percent increase in cost does occur then the production levels should be reduced by only two percent to maintain the optimal solution. The provinces that would be next in line would be Manitoba (P04), Quebec (P06), Alberta (P02), Saskatchewan (P03), and New Brunswick (P07) in that order followed by British Columbia (P01) and Nova Scotia (P08). We note from Table 5.4 that Ontario (P05), Quebec (P06) and Manitoba (P04) are the most competitive provinces in the production of eggs.

The rest of the activities considred under Section Four of the range report deal with transportation of eggs interprovincially. We have noted in an earlier section that there are only eight transportation activities in the optimal solution. An explanation for this apparently low number of

transportation activities was also presented in an earlier section of this study.

The report Section One shows that demand in British Columbia will exceed supplies at optimal production levels given the input costs. In the optimal solution British Columbia's production was 55 percent less than the original value specified in the model. It is because of the reduction in production level that the quantity demanded in British Columbia exceeds supplies. Thus British Columbia must import eggs from other provinces where cost of production and transportation are cheaper than the cost to British Columbia to produce the additional 45 percent to satisfy the quantities demanded. There are thus two transportation activities into British Columbia, P020 from Alberta and P029 from Saskatchewan.

Activity P020. The quantity of eggs transported to British Columbia from Alberta is 8,649,000 dozens. This represents 20 percent of Alberta's optimal production level. The report for P020 indicates that there will be a cost penalty of .47 cents per dozen if the quantity exported to British Columbia is increased. The .47 cents cost penalty will remain constant for an increase in exports of up to 75 percent above the optimal quantity.

The negative lower activity which appears in the computer print-out, Section 4, page 27, should be disregarded since a negative transportation activity is improbable. One may however, substitute zero for the negative value and

interpret the results as follows. If the level of exports from Alberta to British Columbia is reduced there will be a constant cost penalty of 3.13 cents per dozen for each dozen not transported. This cost penalty will remain constant until the level of exports is reduced to zero.

The report on P020 shows that transportation costs may vary from 2.65 cents per dozen up to 5.78 cents before there is any change in the optimal quantities transported. If the transportation costs reaches 5.78 cents then there will be no exports from Alberta to British Columbia. The increase in transportation costs presented here represents a change of 118 percent. Transportation costs from Alberta to British Columbia may also be decreased by 18 percent before affecting the quantities exported. However, at the 18 percent reduction level, which would see a new transportation cost of 2.15 cents per dozen, the quantities exported would increase by 75 percent.

Activity P029. The quantity of eggs exported from Saskatchewan to British Columbia represents 27 percent of Saskatchean's optimal production. The report indicates a cost penalty of 1.44 cents per dozen if exports are increased beyond the optimal level. This cost penalty of 1.44 cents per dozen will remain constant for an increase of up to 64 percent. If the level of exports is allowed to increase to 64 percent or over, the cost penalty will then rise. Alternatively, if exports are reduced there will also be a cost penalty. The

cost penalty that will be applicable for a reduction in exports is .47 cents per dozen. This cost penalty will remain constant until exports are reduced to zero.

The cost of transportation for eggs shipped from Saskatchewan to British Columbia may vary from 3.98 cents per dozen to 4.45 cents per dozen which represents a 12 percent increase. Alternatively transportation costs may be reduced by 36 percent to a low price of 2.54 cents per dozen before a change is effected in the optimal quantities exported. If the full 12 percent increase in cost of transportation is realized, then exports from Saskatchewan to British Columbia will cease. On the other hand a reduction in transportation cost below 36 percent will result in an increase of exports as high as 64 percent above the optimal quantities shipped.

Activity P042. The optimal quantity to be exported from Manitoba to Quebec represents 64 percent of Manitoba's optimal production. The report shows that a cost penalty will apply if the optimal quantity exported is increased or reduced. The cost penalty that will be applicable for an increase in the quantity exported is 1.55 cents per dozen. The cost penalty will remain constant for an increase of 19 percent above the optimal quantity exported. A reduction in the quantity exported will result in a constant cost penalty of 1.18 cents per dozen for each dozen not exported. This cost penalty will remain constant for a range of 10 percent below

the optimal quantity. Beyond the 10 percent range the cost penalty will increase.

The report on the cost of transporting one dozen eggs from Manitoba to Quebec shows that the cost of 4.08 cents per dozen may be reduced by 38 percent to 2.53 cents per dozen before a change in the optimal quantity is effected. If the cost of transportation is allowed to drop by the full 38 percent then the quantity shipped will increase by 19 percent to the level of 41,035,982 dozens.

The transportation cost may also increase up to a value of 29 percent before the optimal quantity to be exported is changed. However, if the increase in cost is allowed to reach the 29 percent level then the quantities exported will decline by 10 percent to a level of 30,454,985 dozens.

Activity P051. The optimal level of exports from Ontario to Quebec represents 13 percent of Ontario's optimal production level. We see in the range report that there will be a cost penalty if we deviate from the optimal quantity exported. Specifically, a 13 percent increase in the optimal level of exports will incur a cost penalty of .66 cents per dozen for each additional dozen exported up to the 13 percent level. This cost penalty will presumably be larger for increases beyond 13 percent. If the optimal exports are reduced by 41 percent then there will be a constant cost penalty of .11 cents per dozen for each dozen not exported up to the 41 percent level.

The cost of transporting one dozen eggs was entered at 1.76 cents per dozen in the original model. The report indicates that the cost of transportation may increase to a level of 6 percent above the optimal before any change in the optimal export level is effected. Once the 6 percent increase is attained the optimal export level will decline by 41 percent. Alternatively, a 38 percent reduction in transportation cost will result in an increase of 13 percent in export levels.

Activity P052. Ontario's exports to New Brunswick represents 1.7 percent of Ontario's optimal production. Any increase in the level of exports up to 67 percent above the optimal will result in a cost penalty of 1.39 cents per dozen for each additional dozen exported. This cost penalty will increase at or beyond the 67 percent level of increase. The report also indicates that there will be a constant cost penalty of .66 cents per dozen if exports are reduced by 100 percent from the optimal quantities.

The input cost of 2.91 cents per dozen for tranporting eggs from Ontario to New Brunswick may vary between 1.52 cents per dozen and 3.57 cents per dozen before any changes in the optimal export level are effected. Specifically, if the cost of transportation increases by 23 percent to 3.57 cents per dozen then the export level will decline to zero. If on the other hand, the cost of transportation is reduced by 52 percent to 1.52 cents per dozen then exports may increase by 67 percent over the optimal level.

Activity P053. The range report for this activity shows that there will be a constant cost penalty of .11 cents per dozen for each additional dozen exported over a range of 251 percent above the optimal amount. Alternatively a cost penalty of .86 cents per dozen will come into effect for a reduction of up to 100 percent in exports.

The report on the cost of transportation shows that the input cost of 3.20 cents per dozen may vary between a low of 3.09 cents per dozen and a high of 4.01 cents per dozen before any changes in export levels are effected. If the cost of transportation were reduced to 3.09 cents per dozen, a 3 percent reduction, there will be an increase in exports by 251 percent over the optimal quantity. If however, the cost of transportation is increased to 4.01 cents per dozen or 27 percent, then exports will decline by 100 percent.

Activity P054. The quantity of eggs transported in this activity represents 1.1 percent of Ontario's total optimal production. The report indicates that there will be a cost penalty of .71 cents per dozen for each additional dozen eggs shipped from Ontario to Prince Edward Island. This .71 cents cost penalty will remain constant for an increase of up to 111 percent over the optimum export levels with increases beyond this level incurring higher cost penalties. If the exports from Ontario to Prince Edward Island are reduced then a cost penalty of .81 cents per dozen would apply. This cost penalty of .81 cents per dozen will remain constant over a range of 100 percent.

The input cost of transporting one dozen eggs from Ontario to Prince Edward Island was 3.2 cents per dozen. However, the range report shows that this cost may vary between 2.49 cents per dozen and 4.01 cents per dozen before any changes in the optimal quantities shipped are effected. If the cost of transportation is increased to 4.01 cents per dozen, a 25 percent increase, then exports to Prince Edward Island would cease altogether. On the other hand a 22 percent decrease in cost of transportation to 2.49 cents per dozen would result in a 111 percent increase in the quantities exported.

Activity P064. The quantity of eggs transported in this activity represents 15.3 percent of Quebec's optimal production. The range report indicates that a constant cost penalty of 5.39 cents per dozen would apply if the quantities exported from Quebec to Newfoundland were to increase. The cost penalty would remain constant for a deviation up to 39.7 percent above the optimal quantities to be exported. If the increase in exports is allowed to reach 39.7 percent the cost penalty would increase. The report also indicates that a constant cost penalty of .11 cents per dozen would apply for reduction in exports. This cost penalty would hold constant for a reduction of 100 percent.

The input cost for transporting eggs from Quebec to Newfoundland was 4.08 cents per dozen. However the transportation cost may vary from 4.08 to 4.19 cents per dozen

before any change in quantities exported is effected. If the cost is allowed to increase to 4.19 cents then exports from Quebec to Newfoundland would cease altogether.

Policy Implications on Exports

The range report on exports is presented in Table 5.5 in summary form. The complete report is presented in the computer print-out[36] in the Appendix.

Table 5.5 shows that only eight transportation activities were used in the final solution. It was stated previously in this work that the author felt eight transportation activities to be inadequate to satisfy the needs of the country. However, since the costs of transportation reflect the movement between the capital city in each province only and no provisions were made for shipments between contiguous regions across provincial borders, then the number of transportation activities should be considered acceptable.

One may conclude from Table 5.5 that Manitoba is the most competitive province for the export of eggs. We observe in Table 5.5 that 64 percent of Manitoba's optimal production may be exported, compared to 17.9 percent from Ontario, the province with the next highest percentage exports.

The report indicates, under the Cost Penalty Column, that increases in exports from Saskatchewan to British Columbia would incur a larger cost penalty than increases in exports

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[36] See Appendix H Range Report Section Four Columns at Intermediate Level, Computer print-out page 27.

TABLE 5.5

Range Report Optimal Exports

From	To	*% of Production	Cost Penalty L.A. U.A.	**% Deviation L.A. U.A.	Cost Range U.C. L.C.	% Cost+ Range U.C. L.C.
			-cts/doz-		-cts/doz-	
P020 Alta.	B.C.	20	3.13	100	5.78	11.7
			.47	75	2.18	11.8
P029 Sask.	B.C.	27	.47	100	4.45	36.1
			1.44	64	2.54	11.8
P042 Man.	Que.	64	1.18	10	5.26	37.9
			1.55	19	2.53	28.9
P051 Ont.	Que.	13	.11	41	1.87	37.5
			.66	13	1.10	6.25
P052 Ont.	N.B.	1.7	.66	100	3.57	47.7
			1.39	67	1.52	22.6
P053 Ont.	N.S.	2.1	.86	100	4.06	3.4
			.11	251	3.09	26.8
P054 Ont.	P.E.I.	1.1	.81	100	4.01	22.1
			.71	111	2.49	25.3
P064 Que.	Nfld.	15.3	.11	100	4.19	132
			5.39	40	1.31	2.69

*Quantity exported expressed as a percent of the optimal production.

**Deviations from the optimal export levels are expressed as percentages. The associated cost penalties are presented in the Cost Penalty column.

+This column gauges the sensitivity of the export levels to the cost of transportation.

from Alberta. In addition, the range over which the smaller cost penalty incurred by Alberta would remain constant is wider than the range for Saskatchewan. Since both Alberta and Saskatchewan ship eggs to British Columbia in the optimal Plan, one must conclude that Alberta stands in a more favorable position than Saskatchewan for the allocation of additional export quotas. The range report indicates that the cost penalty for Alberta will be .47 cents per dozen over a 75 percent range, compared with a cost penalty of 1.44 cents over a 64 percent range.

If we now compare exports to Quebec from Manitoba and Ontario we would observe that Manitoba exports a larger share of her optimal production to Quebec than does Ontario. This fact is perhaps responsible in part for the large cost penalty of 1.18 cents per dozen and narrow range of 10 percent for an increase in Manitoba's exports to Quebec. The cost penalty for additional exports from Ontario to Quebec on the other hand is only .66 cents per dozen and is constant over a 13 percent range. One would hence expect that additional exports going to Quebec would come from Ontario given the input values in the model. The cost penalty for a reduction in exports from Manitoba to Quebec is shown to be 1.18 cents per dozen over a 10 percent range compared with .11 cents per dozen over a 41 percent range for reductions in Ontario's exports to Quebec. Since the cost penalty incurred by Manitoba is larger and the range over which the penalty remains constant is smaller than the same values for Ontario,

one would expect that policies aimed at reducing exports to Quebec would require that larger cuts be made from Ontario than from Manitoba. Table 5.5 also indicates that a comparatively high cost penalty of 5.39 cents per dozen would be incurred if exports from Quebec to Newfoundland were increased.

Information presented in the last two columns of Table 5.5 could prove useful in gauging the sensitivity of quantities exported to transportation cost. A close monitoring of changes in cost of transportation could provide valuable information on optimal quantities to be exported. As an example we note that a 17.7 percent increase in the cost of transportation for eggs shipped from Alberta to British Columbia would result in the termination of exports, while a decrease in the costof transportation by 11.8 percent would result in a possible increase in exports by 75 percent over the optimal value.

Conclusion

Several policies have been adopted by provincial and federal agencies in an attempt to solve the income problem in the egg industry. However, most of the policies have had only a limited degree of success. The Federal-Provincial Egg Plan with its system of quotas adminstered by marketing boards has obtained the largest measure of success thus far.

The continued success of the National Egg Plan hinges on the willingness of the member provinces to participate in the scheme and to accept the regulations. There is, however,

some suspicion on the part of many member provinces that the Plan is not properly adminstered. It is assumed that the suspicion is due to the fact that adjustments in production quotas are based on historical precedents which may not meet with the approval of all members.

Dissatisfaction among the member provinces in the Egg Plan usually relates to the demand from the provinces for additional production quotas. Most provinces tend to base their demands for increased production quotas on their costs of production. Cost of production figures, while they serve some purpose are a poor base for developing policies for quota allocations. The changes in production quotas made since the establishment of the National Egg Plan have not been in accordance with the principle of comparative advantage as was agreed on in the National Plan. Thus, changes in production quotas have placed the entire industry in a non-optimal position.

A mathematical model such as the one employed in this study would provide a more efficient administrative tool than would costof production schedules. Policies formed on the basis of the results in the model would correspond more closely to the agreement in the National Plan which dictates that future allocations in production quotas be made with reference to several factors one of which is the principle of comparative advantage.

A mathematical model has a distinct advantage in that it can be used to determine which province has a comparative

advantage. The mathematical model can also provide precise information on the cost impact that changes in production quotas in the various provinces would have on the industry. Finally, the mathematical model lends itself to refinements and can easily be updated to reflect actual changes in the industry.

The most important problem that may impede the use of a mathematical model for policy implementation is the fact that the results may not be politically tenable. It would indeed be quite a task for policy makers to insist that all egg production in Prince Edward Island and Newfoundland cease completely, especially as the National Egg Plan has no provisions for the cessation of production in any province. It will also be untenable to demand that British Columbia reduce its production by 55 percent and accept additional supplies from Alberta and Saskatchewan, yet these are the actions that are called for in the optimal solution of the model.

The results of this study, the accuracy of which turns on the input data and assumptions about the industry, show that six of the ten provinces in the Plan are minimizing costs and are thus in a more favorable position to fill additonal production quotas without changing the activities in the optimal solution. The six provinces are Ontario, Manitoba, New Brunswick, Alberta, Quebec, and Saskatchewan. The result of the mathematical model also shows that Ontario enjoys a comparative advantage over the other provinces in the

production of eggs. This result for Ontario coincides with the historical findings whereon the original production quotas for the province were based. The province of Manitoba is next in line behind Ontario in production efficiency, followed by New Brunswick, Alberta, Quebec and Saskatchewan, respectively. This ranking is based primarily on the marginal contributions that would accrue to the National Egg Plan if additional production quotas were allocated to each of the six provinces and does not relate to the share of the total production that each province received. The range report indicates that Ontario, Manitoba and Quebec are more competitive in the production of eggs than any of the other three provinces which were described in the optimal solution as being more efficient.

The share of the total production that each of these provinces received in the optimal solution is presented in the table below. It should be noted however that the total output in the optimal solution is 429 million dozens compared to the total production in the original Plan which was 475 million dozens. This represents a difference of 9.6 percent or 46 million dozen eggs.

TABLE 5.6

Optimal Production Distribution
Values And Provincial Shares

Province	Optimal Production	Provincial Share Percent	Provincial Share National Plan
	-------dozens-----		
B.C.	31,276,000	7.28	12.05
Alta.	41,842,000	9.74	8.70
Sask.	23,782,000	5.53	4.7
Man.	53,848,000	12.53	11.40
Ont.	190,244,000	44.30	38.16
Que.	67,623,000	15.74	16.55
N.B.	9,408,000	2.19	1.82
N.S.	11,415,000	2.65	4.10
P.E.I.	0	0	.637
Nfld.	0	0	1.78

APPENDIX A

FEDERAL-PROVINCIAL AGREEMENT
COMPREHENSIVE MARKETING PROGRAM

Quota System

2. (1) The Agency shall, by order or regulation establish a quota system by which quotas are assigned to all members of classes of egg producers in each province to whom quotas are assigned by the appropriate Board or Commodity Board.

(2) The Agency, in establishing a quota system, shall assign quotas in such manner that the number of dozens of eggs produced in a province and authorized to be marketed in interprovincial and export trade in the year 1973, when taken together with the number of dozens of eggs produced in the province and authorized to be marketed in intraprovincial trade in the same year, pursuant to quotas assigned by the appropriate Board or Commodity Board, and the number of dozens of eggs produced in the province and anticipated to be marketed in the same year, other than as authorized by a quota assigned by the Agency or by the appropriate Board or Commodity Board, will equal the number of dozens of eggs set out in section 3 of this Plan for the province.

3. For the purposes of subsection 2(2) of this Plan, the number of dozens of eggs set out in this section for a province is the number of dozens set out in Column II of an item of the following table in respect of the province set out in Column I of that item, such number of dozens representing the percentage set out in Column III of that item.

APPENDIX A

FEDERAL-PROVINCIAL AGREEMENT
COMPREHENSIVE MARKETING PROGRAM

TABLE 3.4

Column I Province	Column II National Share	Column III % of National Share
1. British Columbia	57,240,000	12.055
2. Alberta	41,344,000	8.704
3. Saskatchewan	22,611,000	4.760
4. Manitoba	54,189,000	11.409
5. Ontario	181,267,000	38.161
6. Quebec	78,647,000	16.556
7. New Brunswick	8,683,000	1.828
8. Nova Scotia	19,504,000	4.106
9. Prince Edward Island	3,028,000	0.637
10. Newfoundland	8,477,000	1.785

4. (1) No order or regulation shall be made where the effect thereof would be to increase the aggregate of

(a) the number of dozens of eggs produced in a province and authorized by quotas assigned by the Agency and by the appropriate Board or Commodity Board to be marketed in intraprovincial, interprovincial and export trade, and

(b) the number of dozens of eggs produced in a province and anticipated to be marketed in intraprovincial, interprovincial and export trade other than as

authorized by quotas assigned by the Agency and by the appropriate Board or Commodity Board to a number that exceeds, on a yearly basis, the number of dozens of eggs set out in section 3 of this plan for the province unless the Agency has taken into account

(c) the principle of comparative advantage of production,

(d) any variation in the size of the market for eggs,

(e) any failures by egg producers in any province or provinces to market the number of dozens of eggs authorized to be marketed,

(f) the feasibility of increased production in each province to be marketed, and

(g) comparative transportation costs to market areas from alternative sources of production

(2) No order or regulation shall be made where the effect thereof would be to decrease the aggregate of

(a) the number of dozens of eggs produced in a province and authorized by quotas assigned by the Agency and by the appropriate Board or Commodity Board to be marketed in intraprovincial, interprovincial, and export trade, and

(b) the number of dozens of eggs produced in a province and anticipated to be marketed in intraprovincial,

interprovincial and export trade other than as authorized by quotas assigned by the Agency and by the appropriate Board or Commodity Board, to a number that, on a yearly basis, is less than the number of dozens of eggs set out in Section 3 of this Plan for the province unless at the same time the number of dozens of eggs produced in each other province and so authorized to be marketed in intraprovincial, interprovincial and export trade is decreased proportionately.

APPENDIX B

COST OF EGG PRODUCTION*

Region	Cost Elements					Farm Gate Total
	Depreciation	Pullet	Feed	Labour	Overhead	
	cents/dozen					
B.C.	2.8	12.0	37.9	3.1	4.5	60.3
Alta.	3.5	9.5	31.5	0.8	3.5	48.8
Sask.	3.4	9.8	33.7	1.7	4.8	53.4
Man.	1.0	9.5	30.7	0.4	1.9	43.5
South West Ont.	1.7	9.8	31.4	1.0	3.1	47.0
Ont. Other	1.8	9.1	37.1	1.8	3.0	52.8
Que.	1.6	10.3	40.5	1.9	3.0	57.3
Atlantic	1.9	10.1	40.3	3.6	4.8	60.7
Average All Regions	2.0	10.0	35.6	1.8	3.4	52.8
Cost Element as a Percentage of Total Farm Gate Cost	3.8%	18.9%	67.4%	3.4%	6.5%	100.0%
Cost Element as a Percentage of Total Cost	2.9%	11.6%	51.8%	2.6%	4.9%	76.8%

*P.S. Ross And Partners "Provincial Models Of The Farm-Gate Cost Of Egg Production For Medium Size Producers, A Report To The Canadian Egg Marketing Agency", July 1975.

APPENDIX C

INTERPRETATION OF RESTRAINTS AND ACTIVITIES OF THE INTERPROVINCIAL MODEL

Section One Maximum Production Capacity By Province

Restraint Designation	Interpretation
R01	Maximum Production Capacity British Columbia
R02	Maximum Production Capacity Alberta
R03	Maximum Production Capacity Saskatchewan
R04	Maximum Production Capacity Manitoba
R05	Maximum Production Capacity Ontario
R06	Maximum Production Capacity Quebec
R07	Maximum Production Capacity New Brunswick
R08	Maximum Production Capacity Nova Scotia
R09	Maximum Production Capacity Prince Edward Island
R010	Maximum Production Capacity Newfoundland

Section One Quantity Demanded By Province

R011	Quantity Demanded in British Columbia
R012	Quantity Demanded in Alberta
R013	Quantity Demanded in Saskatchewan
R014	Quantity Demanded in Manitoba
R015	Quantity Demanded in Ontario
R016	Quantity Demanded in Quebec
R017	Quantity Demanded in New Brunswick
R018	Quantity Demanded in Nova Scotia
R019	Quantity Demanded in Prince Edward Island
R020	Quantity Demanded in Newfoundland

APPENDIX C

INTERPRETATION OF RESTRAINTS AND ACTIVITIES OF THE INTERPROVINCIAL MODEL

(continued)

Section One Maximum Interprovincial Exports

R021	Maximum Exports from British Columbia
R022	Maximum Exports from Alberta
R023	Maximum Exports from Saskatchewan
R024	Maximum Exports from Manitoba
R025	Maximum Exports from Ontario
R026	Maximum Exports from Quebec
R027	Maximum Exports from New Brunswick
R028	Maximum Exports from Nova Scotia
R029	Maximum Exports from Prince Edward Island
R030	Maximum Exports from Newfoundland

Section Two Real Activities

P01	Production in British Columbia
P02	Production in Alberta
P03	Production in Saskatchewan
P04	Production in Manitoba
P05	Production in Ontario
P06	Production in Quebec
P07	Production in New Brunswick
P08	Production in Nova Scotia
P09	Production in Prince Edward Island
P010	Production in Newfoundland

APPENDIX C

INTERPRETATION OF RESTRAINTS AND ACTIVITIES OF THE INTERPROVINCIAL MODEL

(continued)

Section Two Transportation Activities

	From	To
P011	British Columbia	Alberta
P012	British Columbia	Saskatchewan
P013	British Columbia	Manitoba
P014	British Columbia	Ontario
P015	British Columbia	Quebec
P016	British Columbia	New Brunswick
P017	British Columbia	Nova Scotia
P018	British Columbia	Prince Edward Island
P019	British Columbia	Newfoundland
P020	Alberta	British Columbia
P021	Alberta	Saskatchewan
P022	Alberta	Manitoba
P023	Alberta	Ontario
P024	Alberta	Quebec
P025	Alberta	New Brunswick
P026	Alberta	Nova Scotia
P027	Alberta	Prince Edward Island
P028	Alberta	Newfoundland
P029	Saskatchewan	British Columbia
P030	Saskatchewan	Alberta
P031	Saskatchewan	Manitoba

APPENDIX C

INTERPRETATION OF RESTRAINTS AND ACTIVITIES OF THE INTERPROVINCIAL MODEL

(continued)

Section Two Transportation Activities

P032	Saskatchewan	Ontario
P033	Saskatchewan	Quebec
P034	Saskatchewan	New Brunswick
P035	Saskatchewan	Nova Scotia
P036	Saskatchewan	Prince Edward Island
P037	Saskatchewan	Newfoundland
P038	Manitoba	British Columbia
P039	Manitoba	Alberta
P040	Manitoba	Saskatchewan
P041	Manitoba	Ontario
P042	Manitoba	Quebec
P043	Manitoba	New Brunswick
P044	Manitoba	Nova Scotia
P045	Manitoba	Prince Edward Island
P046	Manitoba	Newfoundland
P047	Ontario	British Columbia
P048	Ontario	Alberta
P049	Ontario	Saskatchewan
P050	Ontario	Manitoba
P051	Ontario	Quebec
P052	Ontario	New Brunswick
P053	Ontario	Nova Scotia

APPENDIX C

INTERPRETATION OF RESTRAINTS AND ACTIVITIES OF THE INTERPROVINCIAL MODEL

(continued)

Section Two Transportation Activities

P054	Ontario	Prince Edward Island
P055	Ontario	Newfoundland
P056	Quebec	British Columbia
P057	Quebec	Alberta
P058	Quebec	Saskatchewan
P059	Quebec	Manitoba
P060	Quebec	Ontario
P061	Quebec	New Brunswick
P062	Quebec	Nova Scotia
P063	Quebec	Prince Edward Island
P064	Quebec	Newfoundland
P065	New Brunswick	British Columbia
P066	New Brunswick	Alberta
P067	New Brunswick	Saskatchewan
P068	New Brunswick	Manitoba
P069	New Brunswick	Ontario
P070	New Brunswick	Quebec
P071	New Brunswick	Nova Scotia
P072	New Brunswick	Prince Edward Island
P073	New Brunswick	Newfoundland
P074	Nova Scotia	British Columbia
P075	Nova Scotia	Alberta

APPENDIX C

INTERPRETATION OF RESTRAINTS AND ACTIVITIES OF THE INTERPROVINCIAL MODEL

(continued)

Section Two Transportation Activities

P076	Nova Scotia	Saskatchewan
P077	Nova Scotia	Manitoba
P078	Nova Scotia	Ontario
P079	Nova Scotia	Quebec
P080	Nova Scotia	New Brunswick
P081	Nova Scotia	Prince Edward Island
P082	Nova Scotia	Newfoundland
P083	Prince Edward Island	British Columbia
P084	Prince Edward Island	Alberta
P085	Prince Edward Island	Saskatchewan
P086	Prince Edward Island	Manitoba
P087	Prince Edward Island	Ontario
P088	Prince Edward Island	Quebec
P089	Prince Edward Island	New Brunswick
P090	Prince Edward Island	Nova Scotia
P091	Prince Edward Island	Newfoundland
P092	Newfoundland	British Columbia
P093	Newfoundland	Alberta
P094	Newfoundland	Saskatchewan
P095	Newfoundland	Manitoba
P096	Newfoundland	Ontario
P097	Newfoundland	Quebec

APPENDIX C

INTERPRETATION OF RESTRAINTS AND ACTIVITIES OF THE INTERPROVINCIAL MODEL

(continued)

Section Two Transportation Activities

P098	Newfoundland	New Brunswick
P099	Newfoundland	Nova Scotia
P0100	Newfoundland	Prince Edward Island

SECTION 1 - ROWS

NUMBER	...ROW..	AT	...ACTIVITY...	SLACK ACTIVITY	..LOWER LIMIT.	..UPPER LIMIT.	.DUAL ACTIVITY
1	OBJ	BS	22511319110.0	22511319110.0-	NONE	NONE	1.00000
2	R01	BS	31276000.0000	25732000.0000	NONE	57008000.0000	.
3	R02	UL	41842000.0000	.	NONE	41842000.0000	5.75000
4	R03	UL	23782000.0000	.	NONE	23782000.0000	2.32000
5	R04	UL	53848000.0000	.	NONE	53848000.0000	6.58000
6	R05	UL	190244000.000	.	NONE	190244000.000	7.30000
7	R06	UL	67623000.0000	.	NONE	67623000.0000	5.56000
8	R07	UL	9408000.00000	.	NONE	9408000.00000	6.51000
9	R08	BS	11415000.0000	8104000.00000	NONE	19519000.0000	.
10	R09	BS	.	2489000.00000	NONE	2489000.00000	.
11	R010	BS	.	8031000.00000	NONE	8031000.00000	.
12	R011	LL	46379000.0000	.	46379000.0000	NONE	58.90000-
13	R012	LL	33193000.0000	.	33193000.0000	NONE	56.25000-
14	R013	LL	17328000.0000	.	17328000.0000	NONE	54.92000-
15	R014	LL	19266000.0000	.	19266000.0000	NONE	55.18000-
16	R015	LL	155249000.000	.	155249000.000	NONE	57.50000-
17	R016	LL	117135000.000	.	117135000.000	NONE	59.26000-
18	R017	LL	12730000.0000	.	12730000.0000	NONE	60.41000-
19	R018	LL	15542000.0000	.	15542000.0000	NONE	60.70000-
20	R019	LL	2242000.00000	.	2242000.00000	NONE	60.70000-
21	R020	LL	10374000.0000	.	10374000.0000	NONE	63.34000-
22	R021	BS	.	57008000.0000	NONE	57008000.0000	.
23	R022	BS	8649000.00000	33193000.0000	NONE	41842000.0000	.
24	R023	BS	6454000.00000	17328000.0000	NONE	23782000.0000	.
25	R024	BS	34582000.0000	19266000.0000	NONE	53848000.0000	.
26	R025	BS	34995000.0000	155249000.000	NONE	190244000.000	.
27	R026	BS	10374000.0000	57249000.0000	NONE	67623000.0000	.
28	R027	BS	.	9408000.00000	NONE	9408000.00000	.
29	R028	BS	.	19519000.0000	NONE	19519000.0000	.
30	R029	BS	.	2489000.00000	NONE	2489000.00000	.
31	R030	BS	.	8031000.00000	NONE	8031000.00000	.

SECTION 2 - COLUMNS

NUMBER	COLUMN	AT	ACTIVITY	INPUT COST	LOWER LIMIT	UPPER LIMIT	REDUCED COST
32	P01	BS	31276000.0000	58.90000		NONE	
33	P02	BS	41842000.0000	50.50000		NONE	
34	P03	BS	23782000.0000	52.60000		NONE	
35	P04	BS	53848000.0000	48.60000		NONE	
36	P05	BS	190244000.000	50.20000		NONE	
37	P06	BS	67623000.0000	53.70000		NONE	
38	P07	BS	9408000.00000	53.90000		NONE	
39	P08	BS	11415000.0000	60.70000		NONE	
40	P09	LL		62.40000		NONE	1.70000
41	P010	LL		64.00000		NONE	.66000
42	P011	LL		2.65000		NONE	5.30000
43	P012	LL		3.98000		NONE	7.96000
44	P013	LL		4.90000		NONE	8.62000
45	P014	LL		9.80000		NONE	11.20000
46	P015	LL		10.80000		NONE	10.44000
47	P016	LL		13.30000		NONE	11.79000
48	P017	LL		15.40000		NONE	13.60000
49	P018	LL		15.30000		NONE	13.50000
50	P019	LL		21.10000		NONE	16.66000
51	P020	BS	8649000.00000	2.65000		NONE	
52	P021	LL		1.80000		NONE	3.13000
53	P022	LL		2.96000		NONE	4.03000
54	P023	LL		7.68000		NONE	6.43000
55	P024	LL		8.36000		NONE	5.35000
56	P025	LL		10.50000		NONE	6.34000
57	P026	LL		10.90000		NONE	6.45000
58	P027	LL		10.70000		NONE	6.25000
59	P028	LL		15.30000		NONE	8.21000
60	P029	BS	6454000.00000	3.98000		NONE	
61	P030	LL		1.80000		NONE	.47000
62	P031	LL		1.81000		NONE	1.55000
63	P032	LL		5.93000		NONE	3.35000
64	P033	LL		6.63000		NONE	2.29000
65	P034	LL		8.96000		NONE	3.47000
66	P035	LL		10.20000		NONE	4.42000
67	P036	LL		9.70000		NONE	3.92000
68	P037	LL		14.10000		NONE	5.68000
69	P038	LL		4.90000		NONE	1.18000
70	P039	LL		2.96000		NONE	1.89000
71	P040	LL		1.18000		NONE	1.44000
72	P041	LL		3.66000		NONE	1.34000
73	P042	BS	34582000.0000	4.08000		NONE	
74	P043	LL		8.48000		NONE	3.25000
75	P044	LL		9.46000		NONE	3.94000
76	P045	LL		8.56000		NONE	3.04000
77	P046	LL		13.03000		NONE	4.87000
78	P047	LL		9.80000		NONE	8.40000
79	P048	LL		7.68000		NONE	8.93000
80	P049	LL		5.93000		NONE	8.51000

NUMBER	COLUMN	AT	ACTIVITY	INPUT COST	LOWER LIMIT	UPPER LIMIT	REDUCED COST
81	P050	LL	.	3.66000	.	NONE	5.98000
82	P051	BS	25304000.0000	1.76000	.	NONE	.
83	P052	BS	3322000.00000	2.91000	.	NONE	.
84	P053	BS	4127000.00000	3.20000	.	NONE	.
85	P054	BS	2242000.00000	3.20000	.	NONE	.
86	P055	LL	.	7.41000	.	NONE	1.57000
87	P056	LL	.	10.80000	.	NONE	11.16000
88	P057	LL	.	8.36000	.	NONE	11.37000
89	P058	LL	.	6.63000	.	NONE	10.97000
90	P059	LL	.	4.08000	.	NONE	8.16000
91	P060	LL	.	1.73000	.	NONE	3.49000
92	P061	LL	.	1.81000	.	NONE	.66000
93	P062	LL	.	2.30000	.	NONE	.86000
94	P063	LL	.	2.25000	.	NONE	.81000
95	P064	BS	10374000.0000	4.08000	.	NONE	.
96	P065	LL	.	13.30000	.	NONE	14.81000
97	P066	LL	.	10.50000	.	NONE	14.66000
98	P067	LL	.	8.96000	.	NONE	14.45000
99	P068	LL	.	8.84000	.	NONE	14.07000
100	P069	LL	.	2.91000	.	NONE	5.82000
101	P070	LL	.	1.81000	.	NONE	2.96000
102	P071	LL	.	1.71000	.	NONE	1.42000
103	P072	LL	.	1.68000	.	NONE	1.39000
104	P073	LL	.	5.30000	.	NONE	5.01000
105	P074	LL	.	15.30000	.	NONE	17.10000
106	P075	LL	.	10.90000	.	NONE	15.35000
107	P076	LL	.	10.20000	.	NONE	15.98000
108	P077	LL	.	9.46000	.	NONE	14.98000
109	P078	LL	.	3.20000	.	NONE	6.40000
110	P079	LL	.	2.30000	.	NONE	3.74000
111	P080	LL	.	1.71000	.	NONE	2.00000
112	P081	LL	.	1.70000	.	NONE	1.70000
113	P082	LL	.	2.75000	.	NONE	.11000
114	P083	LL	.	15.30000	.	NONE	17.10000
115	P084	LL	.	10.70000	.	NONE	15.15000
116	P085	LL	.	9.70000	.	NONE	15.48000
117	P086	LL	.	8.56000	.	NONE	14.08000
118	P087	LL	.	3.20000	.	NONE	6.40000
119	P088	LL	.	2.25000	.	NONE	3.69000
120	P089	LL	.	1.68000	.	NONE	1.97000
121	P090	LL	.	1.70000	.	NONE	1.70000
122	P091	LL	.	3.35000	.	NONE	.71000
123	P092	LL	.	21.18000	.	NONE	25.62000
124	P093	LL	.	15.30000	.	NONE	22.39000
125	P094	LL	.	14.10000	.	NONE	22.52000
126	P095	LL	.	13.03000	.	NONE	21.19000
127	P096	LL	.	7.41000	.	NONE	13.25000
128	P097	LL	.	6.08000	.	NONE	10.16000
129	P098	LL	.	5.30000	.	NONE	8.23000
130	P099	LL	.	2.75000	.	NONE	5.39000
131	P0100	LL	.	3.35000	.	NONE	5.99000

SECTION 2 - COLUMNS AT LIMIT LEVEL

NUMBER	COLUMN	AT	ACTIVITY	INPUT COST	LOWER LIMIT / UPPER LIMIT	LOWER ACTIVITY / UPPER ACTIVITY	UNIT COST	UPPER COST / LOWER COST	LIMITING PROCESS	AT
40	P09	LL	62.39999		NONE	4127000.00000-	1.70000-	INFINITY	P053	LL
						2241999.00000	1.70000	60.69999	P054	LL
41	P010	LL	64.00000		NONE	4127000.00000-	.66000-	INFINITY	P053	LL
						8030999.00000	.66000	63.34000	R010	UL
42	P011	LL	2.65000		NONE	8649000.00000-	5.30000-	INFINITY	P020	LL
						33192992.0000	5.30000	2.65000-	P022	UL
43	P012	LL	3.98000		NONE	6453999.00000-	7.96000-	INFINITY	P029	LL
						17300000.0000	7.96000	3.98000-	R023	UL
44	P013	LL	4.90000		NONE	4127000.00000-	8.62000-	INFINITY	P053	LL
						11414999.0000	8.62000	3.72000-	P08	LL
45	P014	LL	9.80000		NONE	4127000.00000-	11.20000-	INFINITY	P053	LL
						11414999.0000	11.20000	1.40000-	P08	LL
46	P015	LL	10.80000		NONE	4127000.00000-	10.44000-	INFINITY	P053	LL
						11414999.0000	10.44000	.36000	P08	LL
47	P016	LL	13.30000		NONE	4127000.00000-	11.79000-	INFINITY	P053	LL
						3321999.00000	11.79000	1.51000	P052	LL
48	P017	LL	15.40000		NONE	8104000.00000-	13.60000-	INFINITY	P08	UL
						11414999.0000	13.60000	1.80000	P08	LL
49	P018	LL	15.30000		NONE	4127000.00000-	13.50000-	INFINITY	P053	LL
						2241999.00000	13.50000	1.80000	P054	LL
50	P019	LL	21.09999		NONE	4127000.00000-	16.65999-	INFINITY	P053	LL
						10373999.0000	16.65999	4.44000	P064	LL
52	P021	LL	1.80000		NONE	6453999.00000-	3.13000-	INFINITY	P029	LL
						8649000.00000	3.13000	1.33000-	P020	LL
53	P022	LL	2.96000		NONE	4127000.00000-	4.03000-	INFINITY	P053	LL
						8649000.00000	4.03000	1.07000-	P020	LL
54	P023	LL	7.68000		NONE	4127000.00000-	6.43000-	INFINITY	P053	LL
						8649000.00000	6.43000	1.25000	P020	LL
55	P024	LL	8.36000		NONE	4127000.00000-	5.35000-	INFINITY	P053	LL
						8649000.00000	5.35000	3.01000	P020	LL
56	P025	LL	10.50000		NONE	4127000.00000-	6.34000-	INFINITY	P053	LL
						3321999.00000	6.34000	4.16000	P052	LL

NUMBER	COLUMN	AT	ACTIVITY	INPUT COST	LOWER LIMIT / UPPER LIMIT	LOWER ACTIVITY / UPPER ACTIVITY	UNIT COST / UNIT COST	UPPER COST / LOWER COST	LIMITING PROCESS	AT / AT
57	P026	LL		10.90000	NONE	8104000.00000- 8649000.00000	6.45000- 6.45000	INFINITY 4.45000	R08 P020	UL LL
58	P027	LL		10.70000	NONE	4127000.00000- 2241999.00000	6.25000- 6.25000	INFINITY 4.45000	P053 P054	LL LL
59	P028	LL		15.30000	NONE	4127000.00000- 8649000.00000	8.21000- 8.21000	INFINITY 7.09000	P053 P020	LL LL
61	P030	LL		1.80000	NONE	8649000.00000- 6453999.00000	.47000- .47000	INFINITY 1.33000	P020 P029	LL LL
62	P031	LL		1.81000	NONE	4127000.00000- 6453999.00000	1.55000- 1.55000	INFINITY .26000	P053 P029	LL LL
63	P032	LL		5.93000	NONE	4127000.00000- 6453999.00000	3.35000- 3.35000	INFINITY 2.58000	P053 P029	LL LL
64	P033	LL		6.63000	NONE	4127000.00000- 6453999.00000	2.29000- 2.29000	INFINITY 4.34000	P053 P029	LL LL
65	P034	LL		8.96000	NONE	4127000.00000- 3321999.00000	3.47000- 3.47000	INFINITY 5.49000	P053 P052	LL LL
66	P035	LL		10.20000	NONE	8104000.00000- 6453999.00000	4.42000- 4.42000	INFINITY 5.78000	R08 P029	UL LL
67	P036	LL		9.70000	NONE	4127000.00000- 2241999.00000	3.92000- 3.92000	INFINITY 5.78000	P053 P054	LL LL
68	P037	LL		14.10000	NONE	4127000.00000- 6453999.00000	5.68000- 5.68000	INFINITY 8.42000	P053 P029	LL LL
69	P038	LL		4.90000	NONE	11414999.0000- 4127000.00000	1.18000- 1.18000	INFINITY 3.72000	P08 P053	LL LL
70	P039	LL		2.96000	NONE	8649000.00000- 4127000.00000	1.89000- 1.89000	INFINITY 1.07000	P020 P053	LL LL
71	P040	LL		1.18000	NONE	6453999.00000- 4127000.00000	1.44000- 1.44000	INFINITY .26000-	P029 P053	LL LL
72	P041	LL		3.66000	NONE	25303984.0000- 34591984.0000	1.34000- 1.34000	INFINITY 2.32000	P051 P042	LL LL
74	P043	LL		8.48000	NONE	25303984.0000- 3321999.00000	3.25000- 3.25000	INFINITY 5.23000	P051 P052	LL LL
75	P044	LL		9.46000	NONE	25303984.0000- 4127000.00000	3.94000- 3.94000	INFINITY 5.52000	P051 P053	LL LL

NUMBER	•COLUMN•	AT	•••ACTIVITY•••	••INPUT COST••	••LOWER LIMIT• ••UPPER LIMIT•	LOWER ACTIVITY UPPER ACTIVITY	•••UNIT COST•• •••UNIT COST••	••UPPER COST•• ••LOWER COST••	LIMITING PROCESS•	AT AT
76	P045	LL	•	8•56000	• NONE	25303984•0000- 2241999•00000	3•04000- 3•04000	INFINITY 5•52000	P051 P054	LL LL
77	P046	LL	•	13•03000	• NONE	57248992•0000- 10373999•0000	4•87000- 4•87000	INFINITY 8•16000	R026 P064	UL LL
78	P047	LL	•	9•80000	• NONE	11414999•0000- 4127000•00000	8•40000- 8•40000	INFINITY 1•40000	P08 P053	LL LL
79	P048	LL	•	7•68000	• NONE	8649000•00000- 4127000•00000	8•93000- 8•93000	INFINITY 1•25000-	P020 P053	LL LL
80	P049	LL	•	5•93000	• NONE	6453999•00000- 4127000•00000	8•51000- 8•51000	INFINITY 2•58000-	P029 P053	LL LL
81	P050	LL	•	3•66000	• NONE	34581984•0000- 19265984•0000	5•98000- 5•98000	INFINITY 2•32000-	P042 R024	LL UL
86	P055	LL	•	7•41000	• NONE	57248992•0000- 10373999•0000	1•57000- 1•57000	INFINITY 5•84000	R026 P064	UL LL
87	P056	LL	•	10•80000	• NONE	11414999•0000- 4127000•00000	11•16000- 11•16000	INFINITY •36000-	P09 P053	LL LL
88	P057	LL	•	8•36000	• NONE	8649000•00000- 4127000•00000	11•37000- 11•37000	INFINITY 3•01000-	P020 P053	LL LL
89	P058	LL	•	6•63000	• NONE	6453999•00000- 4127000•00000	10•97000- 10•97000	INFINITY 4•34000-	P029 P053	LL LL
90	P059	LL	•	4•08000	• NONE	34581984•0000- 19265984•0000	8•16000- 8•16000	INFINITY 4•08000-	P042 R024	LL UL
91	P060	LL	•	1•73000	• NONE	25303984•0000- 57248992•0000	3•49000- 3•49000	INFINITY 1•76000-	P051 R026	LL UL
92	P061	LL	•	1•81000	• NONE	25303984•0000- 3321999•00000	•66000- •66000	INFINITY 1•15000	P051 P052	LL LL
93	P062	LL	•	2•30000	• NONE	25303984•0000- 4127000•00000	•86000- •86000	INFINITY 1•44000	P051 P053	LL LL
94	P063	LL	•	2•25000	• NONE	25303984•0000- 2241999•00000	•81000- •81000	INFINITY 1•44000	P051 P054	LL LL
96	P065	LL	•	13•30000	• NONE	3321999•00000- 4127000•00000	14•81000- 14•81000	INFINITY 1•51000-	P052 P053	LL LL
97	P066	LL	•	10•50000	• NONE	3321999•00000- 4127000•00000	14•66000- 14•66000	INFINITY 4•16000-	P052 P053	LL LL

NUMBER	COLUMN	AT	ACTIVITY	INPUT COST	LOWER LIMIT / UPPER LIMIT	LOWER ACTIVITY / UPPER ACTIVITY	UNIT COST / UNIT COST	UPPER COST / LOWER COST	LIMITING PROCESS	AT AT
98	P067	LL		8.96000	NONE	3321999.00000- 4127000.00000	14.45000- 14.45000	INFINITY 5.49000-	P052 P053	LL LL
99	P068	LL		8.84000	NONE	3321999.00000- 9408000.00000	14.07000- 14.07000	INFINITY 5.23000-	P052 R027	LL UL
100	P069	LL		2.91000	NONE	3321999.00000- 9408000.00000	5.82000- 5.82000	INFINITY 2.91000-	P052 R027	LL UL
101	P070	LL		1.81000	NONE	3321999.00000- 9408000.00000	2.96000- 2.96000	INFINITY 1.15000-	P052 R027	LL UL
102	P071	LL		1.71000	NONE	3321999.00000- 4127000.00000	1.42000- 1.42000	INFINITY .29000	P052 P053	LL LL
103	P072	LL		1.68000	NONE	3321999.00000- 2241999.00000	1.39000- 1.39000	INFINITY .29000	P052 P054	LL LL
104	P073	LL		5.30000	NONE	3321999.00000- 2241999.00000	5.01000- 5.01000	INFINITY .29000	P052 P054	LL LL
105	P074	LL		15.30000	NONE	11414999.0000- 8104000.00000	17.09999- 17.09999	INFINITY 1.79999-	P08 R08	LL UL
106	P075	LL		10.90000	NONE	8649000.00000- 8104000.00000	15.35000- 15.35000	INFINITY 4.45000-	P020 R08	LL UL
107	P076	LL		10.20000	NONE	6453999.00000- 8104000.00000	15.98000- 15.98000	INFINITY 5.78000-	P029 R08	LL UL
108	P077	LL		9.46000	NONE	4127000.00000- 19265984.0000	14.98000- 14.98000	INFINITY 5.52000-	P053 R024	LL UL
109	P078	LL		3.20000	NONE	4127000.00000- 19518992.0000	6.40000- 6.40000	INFINITY 3.20000-	P053 R028	LL UL
110	P079	LL		2.30000	NONE	4127000.00000- 19518992.0000	3.74000- 3.74000	INFINITY 1.44000-	P053 R028	LL UL
111	P080	LL		1.71000	NONE	4127000.00000- 3321999.00000	2.00000- 2.00000	INFINITY .29000-	P053 P052	LL LL
112	P081	LL		1.70000	NONE	4127000.00000- 2241999.00000	1.70000- 1.70000	INFINITY .	P053 P054	LL LL
113	P082	LL		2.75000	NONE	4127000.00000- 10373999.0000	.11000- .11000	INFINITY 2.64000	P053 P064	LL LL
114	P083	LL		15.30000	NONE	2241999.00000- 2488999.00000	17.09999- 17.09999	INFINITY 1.79999-	P054 R029	LL UL

NUMBER	•COLUMN•	AT	•••ACTIVITY•••	••INPUT COST••	••LOWER LIMIT• ••UPPER LIMIT•	LOWER ACTIVITY UPPER ACTIVITY	•••UNIT COST•• •••UNIT COST••	••UPPER COST•• ••LOWER COST••	LIMITING PROCESS•	AT AT
115	P084	LL	•	10.70000	• NONE	2241999.00000- 2488999.00000	15.15000- 15.15000	INFINITY 4.45000-	P054 R029	LL UL
116	P085	LL	•	9.70000	• NONE	2241999.00000- 2488999.00000	15.48000- 15.48000	INFINITY 5.78000-	P054 R029	LL UL
117	P086	LL	•	8.56000	• NONE	2241999.00000- 2488999.00000	14.08000- 14.08000	INFINITY 5.52000-	P054 R029	LL UL
118	P087	LL	•	3.20000	• NONE	2241999.00000- 2488999.00000	6.40000- 6.40000	INFINITY 3.20000-	P054 R029	LL UL
119	P088	LL	•	2.25000	• NONE	2241999.00000- 2488999.00000	3.69000- 3.69000	INFINITY 1.44000-	P054 R029	LL UL
120	P089	LL	•	1.68000	• NONE	2241999.00000- 2488999.00000	1.97000- 1.97000	INFINITY .29000-	P054 R029	LL UL
121	P090	LL	•	1.70000	• NONE	2241999.00000- 2488999.00000	1.70000- 1.70000	INFINITY •	P054 R029	LL UL
122	P091	LL	•	3.35000	• NONE	2241999.00000- 2488999.00000	.71000- .71000	INFINITY 2.64000	P054 R029	LL UL
123	P092	LL	•	21.17999	• NONE	10373999.0000- 4127000.00000	25.62000- 25.62000	INFINITY 4.44000-	P064 P053	LL LL
124	P093	LL	•	15.30000	• NONE	8649000.00000- 4127000.00000	22.39000- 22.39000	INFINITY 7.09000-	P020 P053	LL LL
125	P094	LL	•	14.10000	• NONE	6453999.00000- 4127000.00000	22.51999- 22.51999	INFINITY 8.41999-	P029 P053	LL LL
126	P095	LL	•	13.03000	• NONE	10373999.0000- 8031000.00000	21.18999- 21.18999	INFINITY 8.15999-	P064 R030	LL UL
127	P096	LL	•	7.41000	• NONE	10373999.0000- 8031000.00000	13.25000- 13.25000	INFINITY 5.84000-	P064 R030	LL UL
128	P097	LL	•	6.08000	• NONE	10373999.0000- 8031000.00000	10.16000- 10.16000	INFINITY 4.08000-	P064 R030	LL UL
129	P098	LL	•	5.30000	• NONE	10373999.0000- 3321999.00000	8.23000- 8.23000	INFINITY 2.93000-	P064 P052	LL LL
130	P099	LL	•	2.75000	• NONE	10373999.0000- 4127000.00000	5.39000- 5.39000	INFINITY 2.64000-	P064 P053	LL LL
131	P100	LL	•	3.35000	• NONE	10373999.0000- 2241999.00000	5.99000- 5.99000	INFINITY 2.64000-	P064 P054	LL LL

SECTION 3 - ROWS AT INTERMEDIATE LEVEL

NUMBER	...ROW..	AT	...ACTIVITY...	SLACK ACTIVITY	..LOWER LIMIT. ..UPPER LIMIT.	LOWER ACTIVITY UPPER ACTIVITY	...UNIT COST.. ...UNIT COST..	..UPPER COST.. ..LOWER COST..	LIMITING PROCESS.	AT AT
2	R01	BS	31276000.0000	2573200.0000	NONE 57008000.0000	27149001.0000 37729998.0000	1.18000 1.55000		P038 P031	LL LL
9	R08	BS	11414992.0000	8104000.00000	NONE 19518992.0000	3383993.00000 15541992.0000	.66000 1.18000		P01C P038	LL LL
10	R09	BS	1.00000	2488999.00000	NONE 2489000.00000	1.00000 2241999.00000	INFINITY 1.70000		NONE P09	LL
11	R010	BS	1.00000	8030999.00000	NONE 8031000.00000	1.00000 10373999.0000	INFINITY .66000		NONE P01C	LL
22	R021	BS	.	57008000.0000	NONE 57008000.0000	. 33192992.0000	INFINITY 5.30000		NONE P011	LL
23	R022	BS	8649008.00000	33192992.0000	NONE 41842000.0000	. 15103007.0000	5.75000 .47000		R02 P030	UL LL
24	R023	BS	6454000.00000	17328000.0000	NONE 23782000.0000	. 10581000.0000	2.32000 1.44000		R03 P040	UL LL
25	R024	BS	34582016.0000	19265984.0000	NONE 53848000.0000	30455016.0000 41036015.0000	6.58000 1.55000		R04 P031	UL LL
26	R025	BS	34995008.0000	155248992.000	NONE 190244000.000	30868008.0000 69576992.0000	7.30000 1.34000		R05 P041	UL LL
27	R026	BS	10374000.0000	57248992.0000	NONE 67622992.0000	. 13695999.0000	.11000 .66000		P082 P061	LL LL
28	R027	BS	.	9408000.00000	NONE 9408000.00000	. 2241999.00000	INFINITY 1.39000		NONE P072	LL
29	R028	BS	.	19518992.0000	NONE 19518992.0000	. 10373999.0000	INFINITY .11000		NONE P082	LL
30	R029	BS	1.00000	2488999.00000	NONE 2489000.00000	1.00000 10373999.0000	INFINITY .71000		NONE P091	LL
31	R030	BS	.	8031000.00000	NONE 8031000.00000	. 4127000.00000	INFINITY 5.39000		NONE P099	LL

ECTION 4 - COLUMNS AT INTERMEDIATE LEVEL

NUMBER	.COLUMN.	AT	...ACTIVITY...	..INPUT COST..	..LOWER LIMIT. ..UPPER LIMIT.	LOWER ACTIVITY UPPER ACTIVITY	...UNIT COST.. ...UNIT COST..	..UPPER COST.. ..LOWER COST..	LIMITING PROCESS.	AT AT
32	P01	BS	31275984.0000	58.89999	. NONE	27148985.0000 37729982.0000	1.18000 1.55000	60.07999 57.34999	P038 P031	LL LL
33	P02	BS	41841984.0000	50.50000	. NONE	33192985.0000 41841984.0000	5.75000 INFINITY	56.25000 INFINITY-	R02 NONE	UL
34	P03	BS	23781984.0000	52.59999	. NONE	17327986.0000 23781984.0000	2.32000 INFINITY	54.91999 INFINITY-	R03 NONE	UL
35	P04	BS	53847984.0000	48.59999	. NONE	49720985.0000 53847984.0000	6.58000 INFINITY	55.17999 INFINITY-	R04 NONE	UL
36	P05	BS	190243984.000	50.20000	. NONE	186116985.000 190243984.000	7.30000 INFINITY	57.50000 INFINITY-	R05 NONE	UL
37	P06	BS	67622992.0000	53.70000	. NONE	63495993.0000 67622992.0000	5.56000 INFINITY	59.26000 INFINITY-	R06 NONE	UL
38	P07	BS	9407999.00000	53.89999	. NONE	5281000.00000 9407999.00000	6.51000 INFINITY	60.40999 INFINITY-	R07 NONE	UL
39	P08	BS	11414999.0000	60.70000	. NONE	3384000.00000 15541999.0000	.66000 1.18000	61.36000 59.52000	P010 P038	LL LL
51	P020	BS	8649000.00000	2.65000	. NONE	8678984.00000- 15102998.0000	3.13000 .47000	5.78000 2.18000	P021 P030	LL LL
60	P029	BS	6453999.00000	3.98000	. NONE	26738977.0000- 10588998.0000	.47000 1.44000	4.45000 2.54000	P030 P040	LL LL
73	P042	BS	34581984.0000	4.08000	. NONE	30454985.0000 41035982.0000	1.18000 1.55000	5.26000 2.53000	P038 P031	LL LL
82	P061	BS	25303984.0000	1.76000	. NONE	14929986.0000 28625982.0000	.11000 .66000	1.87000 1.10000	P082 P061	LL LL
83	P052	BS	3321999.00000	2.91000	. NONE	53926977.0000- 5563997.00000	.66000 1.39000	3.57000 1.52000	P061 P072	LL LL
84	P053	BS	4127000.00000	3.20000	. NONE	53121976.0000- 14500998.0000	.86000 .11000	4.06000 3.09000	P062 P082	LL LL
85	P054	BS	2241999.00000	3.20000	. NONE	55006977.0000- 4730998.00000	.81000 .71000	4.01000 2.49000	P063 P091	LL LL
95	P064	BS	10373999.0000	4.08000	. NONE	9144977.00000- 14500998.0000	.11000 5.39000	4.19000 1.31000-	P082 P099	LL LL

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