THE UNIVERSITY OF MANITOBA

THE IMPACTS OF CHANGES IN STATUTORY GRAIN RATES AND RAIL BRANCH LINE CONFIGURATION ON FARM SIZE IN MANITOBA

by

KRIS LINTON OLSEN

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ABSTRACT

The Impacts of Changes in Statutory Grain Rates and Rail Branch Line Configuration on Farm Size in Manitoba

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Western Canadian grain producers have benefitted from low rail rates established originally by the Crowsnest Pass Agreement of 1897. These rates have reduced one element of their production costs and increased farm income. However, it has been argued that this effect has been offset by reduced railway service; the railways have been reluctant to make large-scale improvements in their grain handling systems due to the high revenue losses associated with export grain movement. Despite the abundance of statutory grain at primary elevator positions on the Prairies, the unreliability of adequate supplies at the terminal port facilities may jeopardize Canada's position in international grain markets. A possible solution to counter this very serious situation is replacement of the current statutory freight rates with compensatory rates which reflect the actual costs involved in transporting export grain by rail.

The general objective of this study was to determine the impacts of replacement of statutory freight rates on export grain with compensatory rates and branch line rationalization on the structure of farm size in Manitoba, with special reference to small farms. Specifically, the objectives were: (1) to determine if changes in transport costs due to replacement of statutory rates and branch line rationalization would

have detrimental effects on small producers and enhance the trend towards larger farm sizes; (2) differentiate the various impacts on a regional basis; and (3) modify an existing model to permit more complete inter-regional trade of intermediate commodities between all crop districts in Manitoba.

Several components were incorporated into the study framework to formulate the data base for the linear programming model used to conduct the final analysis. Firstly, market conditions present circumstances which generate the prevailing supply and demand situation which in turn determine the relative commodity prices. Secondly, farm gate prices for the six principal crops currently being transported under statutory freight rates, were directly affected by transportation costs. Changes in the rail freight rate structure and/or the branch line configuration, which directly influence transport costs, were proportionately reflected in the relative price levels of these commodities. In turn, these prices eventually determined the relative profitability of specific commodities upon which the production-decision process was based.

The model was used to estimate six comparative scenarios: (1) 1978 market conditions, statutory freight rates, the branch line configuration as of December 31, 1978 including all the recommendations of the Hall Commission and PRAC, 1978 farm gate prices, $\pm$20 percent production flexibility, minimum production levels for small farms; (2) same as (1) except for the minimum production levels being removed for small farms; (3) same as (1) except rail rates were changed to 3.4 times the statutory level, farm gate prices were adjusted to account for increased transport costs; (4) same as (1) with production flexibility range expanded to -20 percent to +40 percent; (5) 1978 market conditions, 4.0 times the

statutory rates, 1978 farm gate prices adjusted for increased 1985 transportation costs, ±20 percent production flexibility, no minimum production levels for small farms; and (6) same as (5) with expanded production flexibility to a range of -20 percent to +40 percent. Comparisons between each of these scenarios with Scenario II indicated the potential impacts on gross value of production and net farm income of increased transportation costs on all farm sizes.

The specific findings of this study are outlined as follows:

1. The greatest impact on the value of production of small farms was the removal of the minimum production requirements for small farms. The net income losses generated by high production costs on small farms and the normative nature of the production allocation process, restricted production on small farms to only commodities in which a profit could be generated. On this basis, a large proportion of the total production of each commodity was allocated to large farm sizes.
2. Replacement of statutory freight rates with compensatory rates and branch line rationalization decreased the gross value of production and net farm income levels on all farm sizes. The burden of increased transportation costs enhanced the trend towards increased farm size.
3. There was a large potential for increased production of oilseeds, special crops, and livestock to offset a large proportion of the value of production and income losses generated by the increased transportation costs. Shadow prices for these commodities indicated strong profit potentials for expanded production.

4. Expanded interregional trade of intermediate commodities such as feed grains, stocker cattle, and weanling pigs, between crop districts had the potential to increase production levels by permitting districts to make fuller use of their comparative advantage.

The availability of intermediate commodities became less of a constraining factor to those regions which possessed the potential to produce greater quantities of final commodities such as fed beef or market hogs. Low production levels of certain intermediate commodities were compensated for by the transportation of these constraining commodities from other regions that produced these commodites in more abundance.

ACKNOWLEDGEMENTS

It is with deep appreciation that I acknowledge the many people who played such an important part in making this thesis possible. First and foremost, I thank my major advisor, Dr. E. W. Tyrchniewicz, who, with unlimited patience, tolerated my many non-standard deviations from the normative and linear path of academia. Secondly, I thank my major co-advisor, Dr. C. F. Framingham, for without his constant guidance and assistance, I would still be trying to solve my first infeasibility. The opportunity for me to watch the velvet hammer in action was an education in itself. I also express my thanks to Professor R. Harris, whose helpful comments on my final draft brought a whole new meaning of the term long-run average cost (LAC) to me.

Fortunately for me, my life in the Annex was not filled solely with supply and demand curves. I sincerely thank my favourite set of deviations, the North Lab Lovelies and the Annex Animals, who, when they weren't deviating me from taking life too seriously, were plotting future deviations that made our office life anything but routine.

Lastly, I am indebted to the people who helped me through the technical intricacies of model building and thesis writing. I thank Neil Longmuir, who shared with me many of the frustrations of working with a computer that thought it knew everything and we knew nothing. And finally, to all the girls, Gisele Perrault, Cathy Watt, Laverne Coulson, and Lynn Fordyce, who had the difficult task of translating my often illegible writing into the legible text which follows.

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INTRODUCTION

Introduction to the Problem

The railways have always been an important part of the western Canadian economy. The necessity for Prairie agricultural commodities to be linked with domestic and foreign markets has been largely fulfilled by the railways. The railways' contributions to "place utility", which is the value added to products by moving them from areas of abundance to areas where these commodities are more scarce and in higher demand, have been vital to an area such as the Prairies that exports the majority of the commodities it produces. With virtually no alternatives to rail for long distance transport of export grain, western farmers have been heavily reliant upon the railways' performances to meet Canadian export commitments. Consequently, any factors affecting the railways' abilities to fulfill these functions have led to widespread producer concern.

Despite the importance of the railways' roles, they have found it increasingly unprofitable to transport grain under the current freight rate structure. This has allegedly prevented the railways from maintaining their rolling stock, branch line network, and service at levels adequate enough to meet current Canadian export grain commitments. A major source of this disparity has been attributed to the maintenance of the statutory freight rates for export grain made law in 1925 with

amendments to the Railway Act.[1] These amendments were based on the former Crowsnest Pass Agreement of 1897, which was intended to promote agricultural development and expansion on the Prairies. One of the major components of the Crowsnest Pass Agreement was reduced rail rates on export grains. Mounting criticism over the way the Agreement was being implemented between 1897 and 1925, forced the Federal government to terminate the Crowsnest Pass Agreement in 1925. In its place, the Federal government made amendments to the Railway Act which set 1899 grain and flour rates moving eastward to the Lakehead as statutory rates for all rail lines and all railway companies. By 1931, the statutory rates were extended to cover grain and grain by-products moving westward to Vancouver and northward to Churchill.[2] These rates were guaranteed by Parliament and had no time limit placed on them. The 1974 Snavely Commission and a follow-up study in 1977, established numerical estimates for the costs involved in the transportation of statutory

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[1]For more detailed readings on the Crowsnest Pass and Statutory rate Agreements, see the following: R. Sokal, E. W. Tyrchniewicz, and C. F. Framingham, "Statutory Freight Rates on Grain: Background and Economic Effects", Special Report prepared for the Manitoba Department of Agriculture (Winnipeg: University of Manitoba, May, 1979); A. W. Currie, Canadian Transport Economics (Toronto: University of Toronto Press, 1967); G. W. Wilson and L. Darby, "Transportation on the Prairies", The Royal Commission on Consumer Problems and Inflation (Ottawa: Queen's Printers, 1968); The Grain Handling and Transportation Commission, Grain and Rail in Western Canada, Vol. I (Ottawa: Ministry of Supply and Services, 1977), pp. 32-39; Booz-Allen and Hamilton and IBI Group, "Grain Transportation and Handling in Western Canada", Report prepared for the Department of Industry, Trade and Commerce, The Grains Group (Ottawa: Queen's Printer, July, 1979).

[2]H. L. Purdy, Transport Competition and Public Policy in Canada (Vancouver: University of British Columbia, 1972), pp. 176-177. For a detailed list of all commodities presently moving under statutory rates see: Canada Grains Council, "Report to the Grain Handling and Transportation Committee" (Winnipeg: Canada Grains Council, June, 1977).

grains.[3] Under the current rate structure, the Snavely Commission determined that producers contributed $114.8 million or 32.4% of the variable costs incurred by the railways in the transportation of the statutory grain in 1977. This compared to $63.7 million or 18.0% contributed by the Federal government and $175.5 million or 49.6% of the total cost being covered by the railways. Overall, a revenue shortfall comparing variable costs incurred over the revenues received from the transportation of all statutory grains amounted to $239.2 million, which was a 52% increase over the 1974 revenue shortfall of $157.4 million. To cover the losses incurred by the railways, Snavely estimated that rates would have to increase 3.1 times the statutory rates in 1977. Only at this level could an equilibrium between revenues and the variable costs be achieved.

More recently, a report by Booz-Allen and Hamilton Inc. and the IBI Group, cited the statutory rates as being a primary source of many grain transportation problems.[4] The losses currently being incurred by the railways have been further exemplified by the increasing profitability of transporting other bulk commodities such as coal, sulphur, and potash. This gap between the revenue margins of transporting these commodities as compared to the revenue losses obtained through statutory

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[3] See the following for further details: The Commission on the Costs of Transporting Grain by Rail, Report, Vol. I (Ottawa: Supply and Services, October, 1976); Snavely, King and Associates, 1977 Costs and Revenues Incurred by the Railways in the Transportation of Grain Under Statutory Rates (Washington, D.C.: Report for the Ministry of Transport, Federal Government of Canada, September, 1978), pp. 78-82.

[4] Booz-Allen and Hamilton Inc., Op. cit., pp. X-4, X-5.

grain movement, has acted as a substantial disincentive to the railways for further investment in plant improvements, locomotives, and freight cars for the purpose of moving grain. The Report concurs that the railways are rapidly exhausting their physical and economic capacities to underwrite the costs of grain transportation. Further, the Booz-Allen and Hamilton report warns that all their recommendations necessary to meet Canada's further grain export potential would be largely negated if the statutory rates issue was not resolved.

Several Federal and Provincial government programs along with some capital expenditures by private industry, have attempted to maintain the handling and transportation costs for statutory grain at current levels.[5] The Federal branch line rationalization and rehabilitation program has spent over $300 million to abandon uneconomical branch lines and upgrade some of the remaining lines to handle hopper cars. Joint programs between the Federal and Provincial governments and the Canadian Wheat Board, have increased the railways' rolling stocks by the purchase of over 15,000 new hopper cars and rehabilitated another 5,000 existing boxcars. Over $400 million in terminal port facilities and over $248 million in expanding and rehabilitating the country elevator system, has been spent by the elevator companies in the last five years to increase the efficiency of the system. Improved cooperation between the Wheat Board, the grain companies, and the railways, have helped reduce the average turn around time for rail cars from Manitoba

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[5]All of the following figures except turn around time, were obtained from the following, The Canadian Wheat Board, "Tallying grain industry investments", Grain Matters (November, 1979), pp. 1-2.

country collection points to Thunderbay and back from 21 days to 17 days.[6] The railways themselves have committed $32 million to increase their locomotive horsepower by purchasing 75 new locomotives. This will help reduce operating costs by increasing train sizes and travelling speeds.

Despite the attempts to maintain and improve the present grain transportation system it is uncertain how long the government will tolerate the grain transport system dependency on government assistance. Increasing the grain producer's proportion of the total cost of transporting statutory grains by modifying the statutory rate structure has been viewed as a very significant factor in the continued maintenance of western Canada's position as a grain exporter. From the wide range of proposals, one of the more straightforward scenarios calls for the replacement of statutory rates with compensatory rates.[7] Instead of the current statutory rate structure, a new set of compensatory rates would be established to offset the current revenue shortfalls in transporting grain by rail.[8]

The consequences of a rate increase may have a significant effect on the structure of western Canadian agriculture. Every grain producer

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[6]Personal communication from Mr. Norman Cobb of Manitoba Pool Elevators based on Canadian Wheat Board memos.

[7]Several alternatives besides complete abolition of the Statutory rates have been suggested. For further details, see: Railway Compensation Sub-Committee, "Report to the Grain Handling and Transportation Committee". (Winnipeg: Canada Grains Council, 1977).

[8]According to Section 276 of the Railway Act, a freight rate is deemed compensatory when it exceeds the variable or out-of-pocket costs of the movement of the traffic concerned as determined by the Canadian Transport Commission. See Parliament of Canada, Revised Statutes of Canada, 1970, Vol. VI. (Ottawa: Queen's Printer for Canada, 1970), p. 6451.

would be faced with increments in his transportation costs and a corresponding decline in his net farm income. In particular, smaller farms may have the most trouble adjusting due to their limited resource and production bases. As a result, some of these smaller operations may no longer be able to remain economically viable. In this manner, replacement of statutory rates with compensatory rates may enhance the trend towards increased farm size.

In the constantly changing realm of western Canadian agriculture, the trend towards ever increasing farm size is threatening to engulf the small producers. An article by Veeman and Veeman, indicated that the number of farms in western Canada have been steadily decreasing while average farm size has been increasing.[9] Evidence found in the 1976 Canada Census, indicated that the total number of farms in Manitoba had decreased 20% from 37,363 in 1951 to 29,963 in 1976. The average farm size, in the same period, increased from 261 acres to 427 acres.[10] Faced with unfavourable price conditions and high production costs, small producers are unable to take advantage of economies of size inherent on larger farm sizes. This limitation may not allow smaller producers the flexibility to adapt to new cost conditions imposed by compensatory rates. Under constant price conditions, this cost increment is expected to force many of these small producers out of business.

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[9] T. S. Veeman and M. M. Veeman, "The Changing Organization, Structure, and Control of Canadian Agriculture," American Journal of Agricultural Economics, Vol. 60, No. 5, December, 1978, pp. 759-768.

[10] Statistics Canada, 1976 Census of Canada - Agriculture, Manitoba (Ottawa: Ministry of Industry, Trade and Commerce, March, 1978), Table 3.

Scope and Objectives

Through the use of a linear programming model originally developed by Framingham, Craddock and Baker,[11] replacement of statutory rates with compensatory rates and branch line rationalization will have detrimental effects on small producers and continue the trend towards larger farm sizes. Further, this study will break down the differential effects these policies will have on the various production levels of different agricultural commodities on a regional basis.

This study will also remove a major limitation present within the model adopted in this analysis.[12] In former applications of the model, all interregional transportation of grains and livestock were restricted to adjacent crop districts. This had a restraining effect on many districts by preventing them from taking full advantage of the comparative advantage present within each district. For example, the Interlake region of Manitoba may have had the potential for increased livestock production, yet it couldn't produce enough grain or import enough grain from adjacent crop districts to satisfy the feed requirements

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[11] C. F. Framingham, L. B. B. Baker and W. J. Craddock, Farm Income, Employment and Manitoba Agriculture: A Linear Programming Approach to Consideration of Policy Alternatives, Research Bulletins 78-1, Vol. 1 and 2 (Winnipeg: Department of Agricultural Economics, University of Manitoba, October, 1978).

[12] For further discussion of the limitations present in former studies utilizing this model, see: E. W. Tyrchniewicz, C. F. Framingham, J. A. MacMillan and J. W. Craven, "The Abandonment of Uneconomic Branch Lines and Unremunerative Grain Rates: Effects on Agriculture and Regional Development," The Logistics and Transportation Review, Vol. 14, No. 4, 1978, pp. 411-431; K. Olsen, E. W. Tyrchniewicz and C. F. Framingham, "Impacts of Changes in Statutory Grain Rates and Rail Branch Line Configurations on Manitoba's Agricultural Economy". Report prepared for the Manitoba Department of Agriculture (Winnipeg: University of Manitoba, March, 1980).

for this expansion. Similar to this problem was the Southwest region of Manitoba's potential to fulfill the Interlake's feed demands but the constraints of the model prohibited the transfer of feed grains to anywhere except adjacent crop districts. By removing this constraint, this study will determine whether expanded interregional trade will allow producers to take better advantage of the comparative advantages present in each region. As well, the study will focus on smaller producers to consider whether this expansion will assist small producers to remain economically viable.

Organization of Thesis

The remainder of this thesis is designed to determine the impacts of replacement of statutory freight rates with compensatory rates and branch line rationalization on different farm sizes. Chapter 2 gives a theoretical overview of farm structure and its relationship to economies of size. This chapter further explains the relationship between the theory of economies of size and the linear programming model used in this study. Chapter 2 concludes with a theoretical explanation of the significance of interregional trade.

Chapter 3 outlines the details and limitations of the linear programming model utilized in this study. Chapter 4 describes the details of each scenario examined and lists the results of each analysis conducted. Chapter 5 summarizes the major conclusions and implications derived from the analysis.

Chapter 2

THE COMPONENTS OF FARM STRUCTURE

This chapter examines the theoretical basis for this analysis. The purpose of this chapter is to give a theoretical overview by: (1) defining and examining farm structure; (2) explaining the theory of economies of size and its pertinence to agriculture; (3) examining the factors effecting farm structure; (4) showing the relationship between economies of size and the model used in this analysis; (5) examining the theory behind interregional trade; and (6) explaining the theoretical hypothesis behind this analysis.

Defining Farm Structure

The concept of farm structure has many interpretations and cannot be precisely defined. Generally, farm structure is composed of several different components:[13]

> "- Organization of resources into farming units;
> - Size, management and operations of those units;
> - Form of business organization (i.e., partners, corporations, etc.);
> - Manner in which the firm procures its inputs and markets its products;
> - Extent of ownership and control of the resources that comprise the farming unit."

These components form the basis by which different groups can be separated and compared. However, the actual structures of enterprises

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[13] J. B. Penn, "The Structure of Agriculture: An Overview of the Issue," in Structure Issues of American Agriculture. Agricultural Economic Report 438 (Washington, D.C.: USDA Economics, Statistics and Cooperatives Service, November, 1979), p. 5.

are relatively minor. More important are the performances of the alternate structural forms for agriculture and the relative priority levels assigned each of these forms. The nature of some of these forms are:[14]

"- Quantity, quality and price of food available for consumers;
- Care and preservation of the environment;
- Relationship to rural communities;
- Welfare of the participants;
- Efficiency of resource use and contribution to national economic growth;
- Flexibility and adaptability to new consumer trends, technological changes, environmental shocks, etc."

This study was primarily concerned with the last two elements and their pertinence with respect to the performance of small farms within the Manitoban agricultural system.

Economics of Size in Agriculture

Related to this discussion are the questions of the existence of economies of size in modern farming and the possibility that one particular farm size could best achieve the most efficient operation.[15] The static theory of economies of size is usually viewed in terms of long and short-run situations.[16] Referring to Figure 1, the short-run average total cost curves (SAC) assume that one or more resources are available

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[14] Ibid., p. 5-9.

[15] For a description of the differences between economies of size and economies of scale, see: J. P. Madden, Economies of Size in Farming (Washington, D.C.: Economic Research Service, U.S.D.A., February, 1967), p. 1.

[16] For more detailed theory regarding firm sizes and cost curve formulation, see: J. P. Madden, Op. cit., pp. 2-6; J. Viner, "Cost Curves and Supply Curves" in A.E.A. Readings in Price Theory, Vol. 6, edited by K. E. Boulding and G. J. Stigler (Chicago: Richard D. Irwin, 1952), pp. 198-232; A. A. Walters, "Production and Cost Functions: An Econometric Survey," Econometrica, Vol. 31, No. 1 and 2, 1965, pp. 1-66.

THEORETICAL ILLUSTRATION OF SHORTRUN AVERAGE COST CURVES AND ENVELOPE CURVE

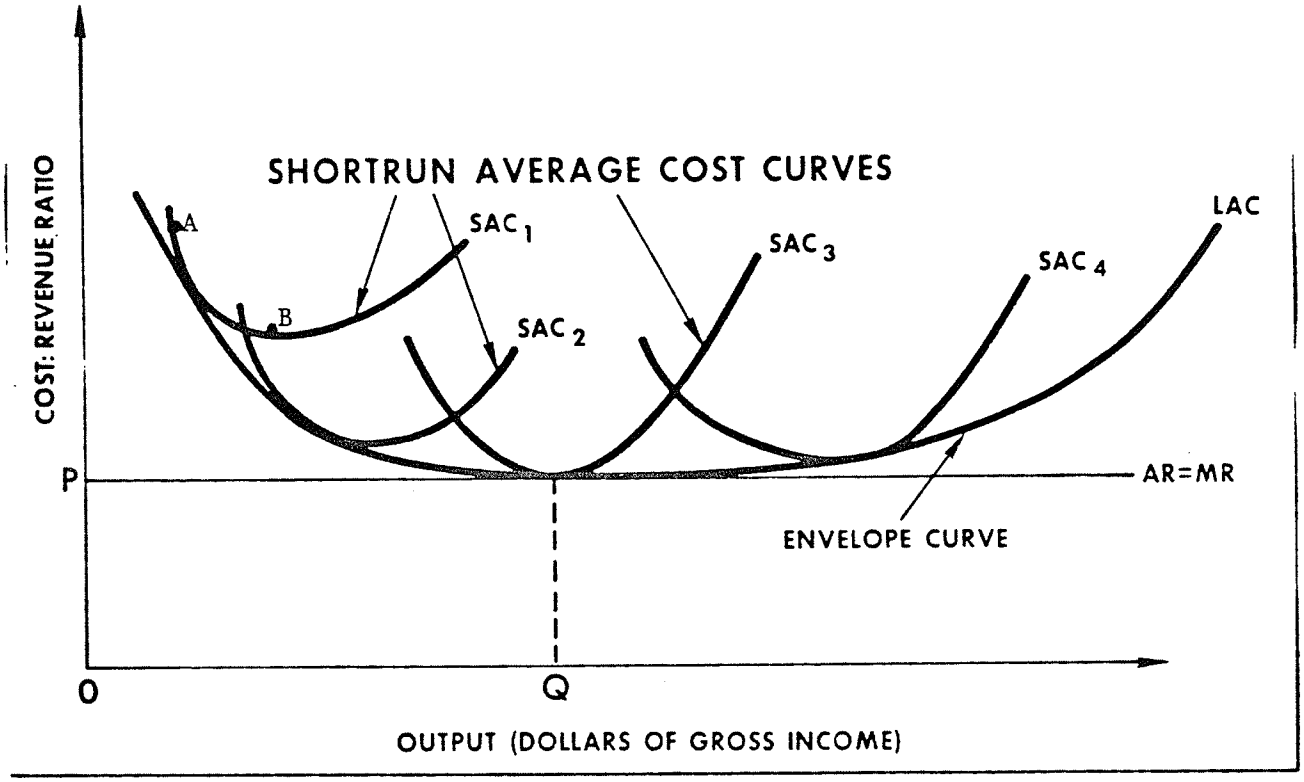

Figure 1

Source: J.P. Madden, Economies of Size in Farming (Washington, D.C.: Economic Research Service, U.S.D.A., February, 1967), p. 3.

only in specific fixed quantities. The typical "U" shape of these SAC curves are summarized by Madden and Partenheimer as follows:

> "Average costs per unit of output decline with an initial increase of output as fuller utilization of resources is achieved and fixed costs are spread over more units. Eventually, however, average costs level off and then rise, as variable resources must be added in increasing proportions to the fixed resources to reach greater levels of output. A separate SAC curve applies for each level of the fixed resources, i.e., for each size of plant."[17]

All resources are variable in the long run. A curve that is drawn tangent to all the SAC curves approximates the long-run economies-of-size curve (LAC). This curve represents the average total cost of production that would be experienced by firms of different sizes under assumed price relationships and technologies in the static sense.

There are three main principles implicit within the theory of economies of size. Firstly, a firm will continue producing in the short-run, as long as revenue is great enough to cover the variable costs. In this instance, average variable costs must be less than or equal to the average revenue (price). The second principle states that a firm can remain in production in its present form in the long-run only if revenue is great enough to cover the total costs. Thirdly, under atomistic competition, prices will shift towards a level such that all but normal profits will be erased and all firms are producing at the lowest points on their average total cost curves (level Q in Figure 1).

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[17] J. P. Madden and E. J. Partenheimer, "Evidence of Economies and Diseconomies of Farm Size" in Size, Structure and Future of Farms edited by A. G. Ball and E. O. Heady (Ames, Iowa: Iowa State University Press, 1972), pp. 92-93. For empirical evidence and methods of analysing economies of size, see the following: J. P. Madden, Op. cit., pp. 24-71; J. P. Madden and E. J. Partenheimer, Op. cit., pp. 93-98.

Within the framework of this conventional theory lies four major factors; the length of run, divisibility of resources and costs, uncertainty, and coordination, which significantly limit the applicability of the theory to actual situations. An exact demarcation of where the long-run starts and the short-run ends is a very difficult undertaking. The short-run implies that at least one resource is available in a fixed quantity within a specific production period while the quantity of all resources is variable in the long-run. Due to the varying lengths of time each class of resources are held fixed within an actual farm production cycle, the short-run can be regarded as a large number of successively longer lengths of run, as additional resources are allowed to vary in quantity. This eventually leads to the long-run situation where all components are variable. Complicating this issue is that there is no predetermined order in which these resources become variable. Further, the length of run and the amount of time a certain subset of resources is held fixed, are fictional time periods that cannot be related by any amount of calendar time. Both these items may be in continual change and are highly dependent on the producer's frame of mind. Madden uses the following description of distinguishing between the long and short-run:

> "Let us denote the variable resources as subset V, and the fixed resources as subset F... The firm will tend to continue operating as long as it receives enough revenue to at least cover the cost of all the variable resources. As the planning horizon is lengthened, these resources are conceptually shifted from the fixed to the variable subset, and the revenue must be correspondingly larger if the firm is to remain in production. In the longest possible run, all the firm's resources are in the variable subset (V), and the fixed subset (F) becomes empty. Therefore, in the long-run, revenues must be equal to or greater than total cost -- including the direct cash cost of operating expense

> items, and the opportunity cost of all other resources. In other words, average total cost must be less than or equal to average revenue if the firm is to remain in production indefinitely in its present form."[18]

Paralleling the difficulties in distinguishing between fixed and variable resources, is the problem of resource divisibility. Divisible resources such as electricity and custom-hired services are usually fully utilized while other discrete resources such as animals or equipment, are often underutilized. The significance of these features is that full utilization is a partial means of lowering average cost of production by spreading the resource cost over more units of output. This would result in a movement along a short-run average cost curve to a more efficient position, such as the movement from point A to point B along SAC_1 in Figure 1. Each separate SAC curve represents an individual firm possessing a different set of production factors with one factor held in a fixed quantity. The theoretical long-run situation is represented by the LAC line in Figure 1. The LAC curve is drawn tangent to each of the theoretically "infinite" number of possible firm sizes that may lie between the SAC curves, as shown in Figure 2a.

The problem of divisibility and its effect on the shape of the LAC curve was discussed by Chamberlin.[19] He pointed out that in some instances, there are not infinite numbers of SAC curves between different firm sizes due to technical or physical constraints. In these cases, the LAC curve would be better represented by the "scallop" shape of the

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[18] J. P. Madden, Op. cit., pp. 5-6.

[19] E. H. Chamberlin, The Theory of Monopolistic Competition (Cambridge: Harvard University Press, 1956), pp. 230-248.

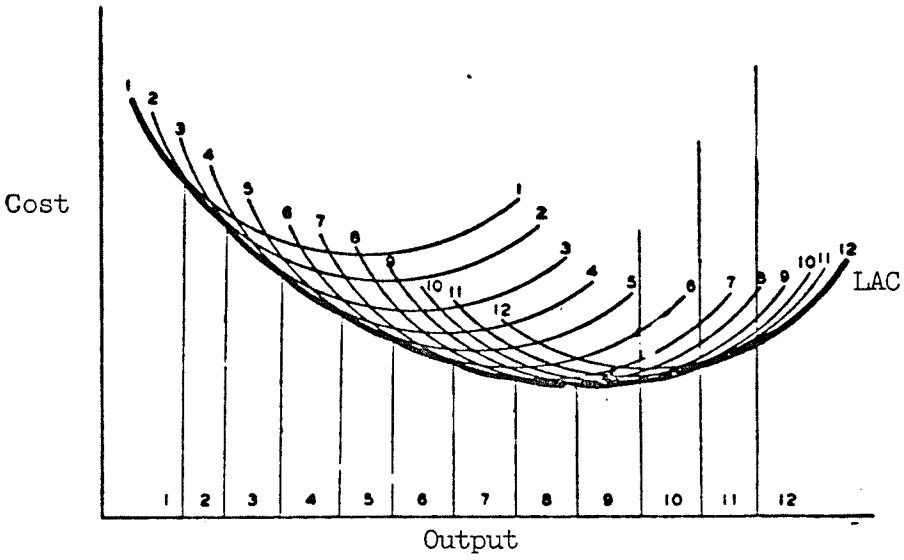

Figure 2a

Theoretical Derivation of the Long Run Envelope Curve

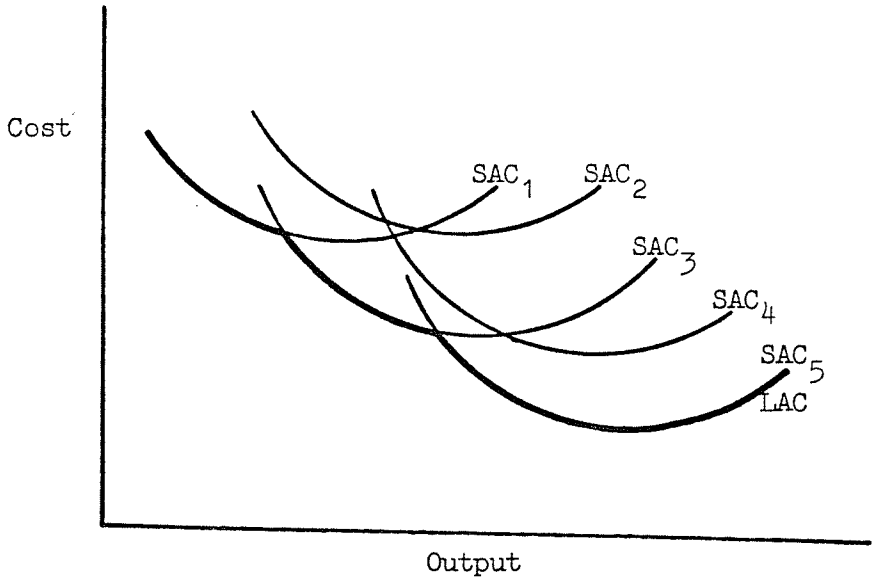

Figure 2b

Scalloped Long Run Average Cost Curve with Finite Plant Sizes

Source: E.H. Chamberlin, The Theory of Monopolistic Competition, (Cambridge: Harvard University Press, 1956), pp. 232-233.

individual SAC curves, as shown by the solid line in Figure 2b. As such, the contribution of the individual firm curves to the aggregate LAC curve would be finite. As described by Chamberlin:

> "Even in the case of gaps... the trend of the curve is governed by the nature of the movement from plant to plant, rather than the movement within any particular plant curve. At the same time,... the behaviour of the curve (LAC) within any particular segment is governed by the fixed factor analysis... If by divisibility is meant merely the substitution of a smooth curve for the actual scalloped one, the substituted curve must at least be a reasonable fit to the one it replaces, and not involve an arbitrary assumption which carries it off on a tangent."[20]

However, several other factors besides low production costs are important in the producer's attempt to maximize net income. Among these are incompatability of full utilization of one discrete resource with full utilization of certain other resources, capital limitations, and uncertainty safeguards such as using an oversized combine to decrease the time the crop lies in the field. As such, the attainment of minimum average costs and full utilization of resources are of primary importance in theory, but are less significant to actual producers.

The final two factors, uncertainty and coordination, further limit the applicability of conventional micro-theory to the farm firm. Under perfect competition, where there exists no uncertainty, firms will maximize profit or minimize losses at equilibrium by producing at the minimum level Q of the LAC curve in Figure 1. However, the amount of risk present and the degree of coordination required are major considerations in any producer's managerial decisions. As such, some returns to these elements in the form of profit can be expected and the average

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[20] Ibid., pp. 243-244.

revenues on actual farms are not expected to be at the minimum point on their respective LAC. Increments in the levels of uncertainty are usually paralleled by the degree of coordination required to operate properly. For example, when a producer increases the acreage of a specific crop on his farm, the impact on the producer's net income of a crop failure or a price drop for that specific crop becomes more substantial. As well, the producer must ensure he uses proper management practises on this crop, as he no longer possesses the diversification necessary to absorb a management error. From a definition quoted by Madden and Partenheimer:[21]

> "...coordination is essentially a dynamic function, reacting to changes in the pecuniary and technical situations that occur under conditions of uncertainty. Thus the need for coordination is a feature of uncertainty and disequilibrium, rather than of perfectly competitive static equilibrium."

In this manner the presence of uncertainty and coordination difficulties forces farm enterprises to hold production below the profit maximizing level.

There are three major factors that have effected farm structure in recent years.[22] Technology has dramatically effected farm structure by increasing output utilizing the same or decreased levels of inputs, increasing the productivity of input factors by using new techniques such as fertilizers, and reducing input factors through new technologies adopted by input suppliers. The major impact of these changes has been to increase the optimal or least-cost farm size.

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[21] J. P. Madden and E. J. Partenheimer, Op. cit., p. 100.

[22] Based on article by E. M. Babb, "Some Causes of Structural Change in U.S. Agriculture" in Structural Issues of American Agriculture, Agricultural Economics Report 438 (Washington, D.C.: USDA Economics, Statistics and Cooperatives Service, November, 1979), pp. 51-60.

Secondly, farm size expansion has been restricted for locations and/or commodities associated with higher levels of uncertainty due to producers' reluctance to assume more financial responsibility. As shown by Madden, production costs rapidly decline to the point where a farm could be run by a modern one or two-man operation.[23]

From this point onwards, however, the average cost was virtually constant while the total profit curve had a constant upwards slope, as shown in Figure 3. As a result, small and large farms had similar cost structures, but larger farms yielded considerably higher profits. A review by Miller stated that increased farm size beyond the point where economies of size were important was primarily to obtain larger incomes rather than lower unit costs.[24] A plausible explanation of why so few enterprises have expanded to larger sizes was that the promise of greater potential profits was offset by the greater degrees of uncertainty and the difficulties of coordinating the operations of these larger firms. As Madden describes it,

> "...the profit potential may be less than the sum of a) the opportunity cost farmers place on their labor and on their task of supervising and coordinating the efforts of several hired men, plus b) the opportunity cost they place on their risk-bearing services.[25]

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[23] J. P. Madden, Op. cit., pp. 19-21. Madden found in above study that average cost was almost constant over a wide range, from $60,000 to $235,000 of output, representing cotton farms of 440 to 1,800 acres. A modern one-man operation consisted of 6-row machinery and achieved as low an average total cost as any of the larger producers.

[24] T. A. Miller, "Economies of Size and Other Growth Incentives" in Structural Issues of American Agriculture, Agricultural Economics Report 438 (Washington, D.C.: USDA Economics, Statistics and Cooperatives Service, November, 1979), p. 112.

[25] J. P. Madden, Op. cit., p. 21.

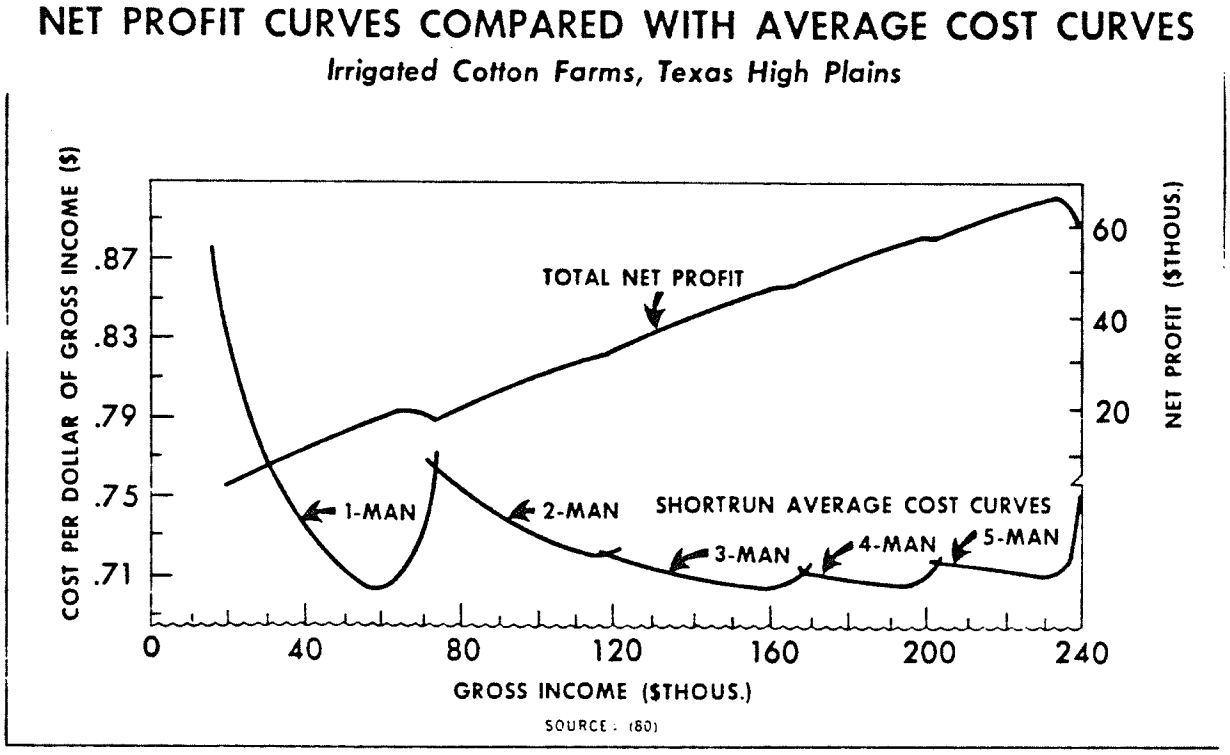

Figure 3

Source: J.P. Madden, Economies of Size in Farming (Washington, D.C.: Economic Research Service, U.S.D.A., February, 1967). p. 20.

This is further evidenced by a trend in the United States where a significant proportion of all farmland sales went to medium-sized family farms rather than larger corporate and family farms.[26] With current land prices accounting for over 75% of the total value of assets in American agriculture at the end of 1977, large corporate farm businesses could not afford the high opportunity cost of immobilizing large sums of capital necessary to invest in farmland. Medium-sized farms in turn held the large sums of land capital required at nominal rates of return in order to achieve personal goals such as status, pride, freedom of production, inheritance, etc.

Agricultural programs such as crop and hail insurance, deficiency payments, and contract growing, reduce the levels of risk and promoted the further expansion of farm sizes.

Closely paralleling this was the third factor effecting farm structure, the expectations for prices. Uncertainty as to the level for prices and the corresponding income, have inhibited producer expansion decisions. These expectations have been subject to many forces such as weather, changes in export demand, availability of market information, government policies, etc., all of which effect the uncertainty of prices. To some extent, some measure of this uncertainty has been removed by various agencies such as marketing boards and contract growing.

This analysis utilized the concept of economies-of-size within the technique of linear programming. Included in the LP model were cost figures representing actual production costs for every commodity produced

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[26] P. M. Raup, "Some Questions of Value and Scale in American Agriculture" American Journal of Agricultural Economics, Vol. 60, No. 2, May, 1978, pp. 303-308.

on three distinct farm sizes. From these three cost points, A, B, and C in Figure 4, for a specific commodity, it is conceivable that three short-run cost curves, as shown in Figure 4, could be constructed around these points.[27] This is based on the logic that each point represents a set of production factors that, in the short-run, have at least one fixed factor. If the entire production process of each of these firms was plotted, maintaining the one production factor fixed, the final diagram would be the standard "U" shaped short-run average cost curve (SAC) shown in Figure 4. In this particular case, SAC_1 represents the cost curve for small farms, SAC_2 represents medium farms, and SAC_3 represents large farms. In aggregate, Figure 4 shows the economies-of-size present in the LP model that can be obtained by the various farm sizes.

Figure 4 may also be used to demonstrate the method of production allocation in the LP model. Consider the hypothetic price level, P_1, and all firms are producing at the lowest point of their SAC curves. At P_1, production allocation will first be allotted to large farms, which possess the largest profit level (D). Production will continue to be allocated to large farms until minimum or maximum production levels have been reached or resource constraints such as land availability, prevent further production of specific commodities. Production will next be allocated to medium farms who possess a lower profit margin (E), until the production-limiting factors previously mentioned are encountered.

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[27] Note that these cost points do not necessarily represent the least-cost point for any SAC curve. These points merely serve as a realistic base from which hypothetic cost curves can be constructed.

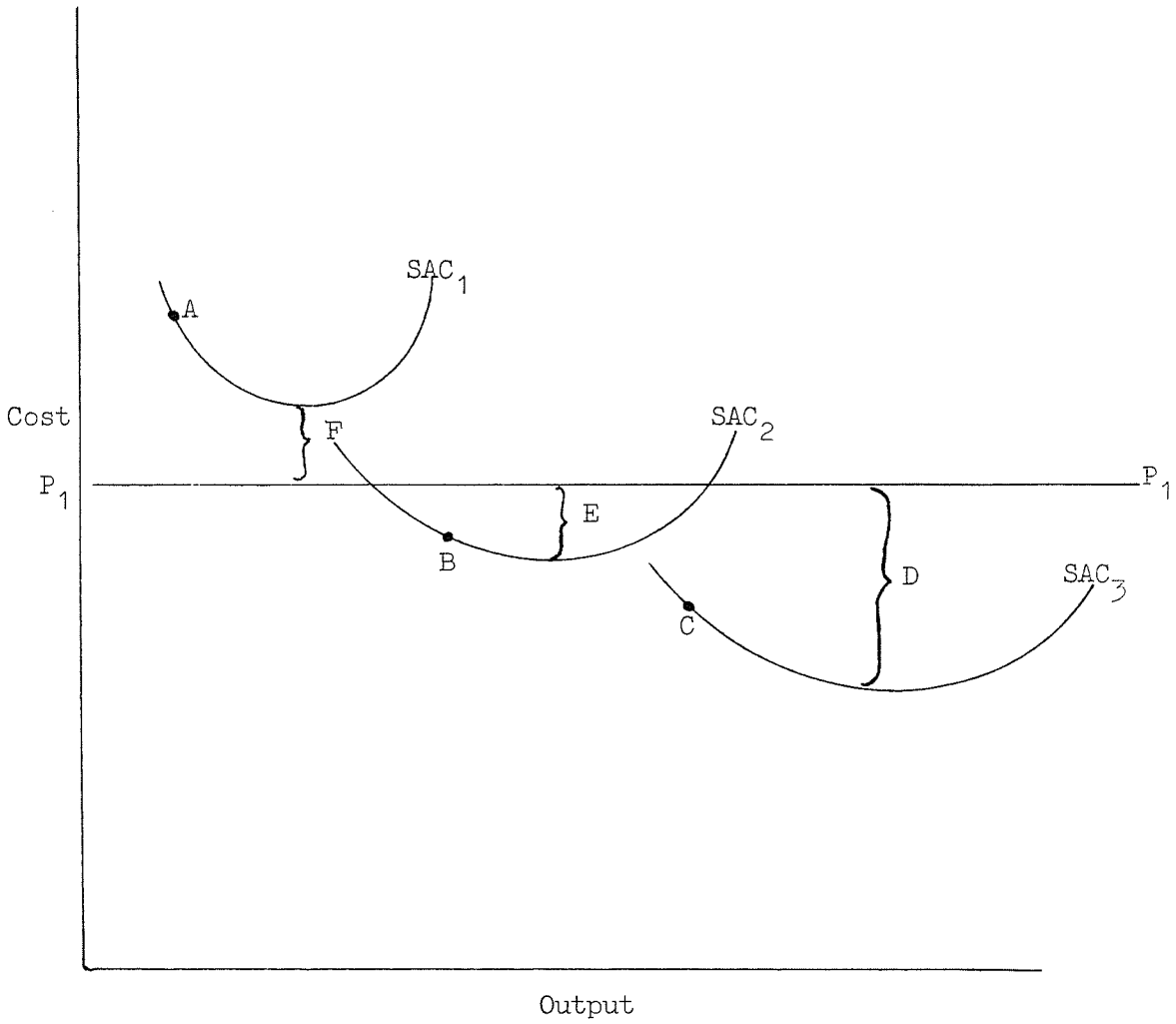

Figure 4

Hypothetical Cost Curves for the Three Farm Sizes
Used in the Linear Programming Analysis

Finally, production will only be allocated to small producers to meet minimum production levels and/or fulfill minimum provincial demand levels, as, in this example, small producers are incurring a net loss (F).

These cost curves were not changed in any of the later scenarios used in the analysis. With changes in the freight rate structure for statutory grains, the price levels will change between the various scenarios. This has the effect of lowering the price levels, which affects the relative profitability of producing statutory grains and the allocative process between the different farm sizes.

Interregional Trade

Inherent in the previous discussion was that increases in firm efficiency could be achieved by taking advantage of economies of size. Further gains in efficiency can be obtained by exploiting the comparative advantage present within various regions. Generally, comparative advantage occurs when a region (firm or individual) tends to specialize in the production of the commodity in which it has the highest advantage to do so and to obtain by trade the commodities in which it has the least comparative advantage.[28] As each region possesses a different endowment of natural resources, climate, production possibilities, etc., trade can benefit each region by transferring demands for resources scarce and more expensive in one region to other regions that possess abundant resources that are relatively cheap. In this manner, the total output of the

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[28] R. G. Bressler and R. A. King, Markets, Prices and Interregional Trade (Toronto: John Wiley and Sons, Inc., 1970), p. 345.

combined regions can be increased.[29] Referring to Figure 5, there is the opportunity cost curve (OCC_1), afb, for region 1 producing at point C in the absense of trade. The relative commodity prices are represented by the slope of the line ec. A second region's OCC_2, pcq, also producing in isolation at point C and having prices represented by line dc, is superimposed and inverted upon region 1. The combined output of the two regions without trade is represented by the point h. If trade is established between the two regions, the product price will equalize at some intermediate level (line gf) and each region will produce at the point f where the opportunity costs are equal to the inverse price ratio. This moves the OCC for region 2 to rfs and the combined outputs of both commodities are increased to point j on the combined opportunity cost curve mjn. As a result, point h is inefficient in relation to the combined production possibilities for the two regions and overall production efficiency is increased.

Theoretical Hypothesis

Stemming from this theoretical discussion, some hypotheses may be formulated as to the potential impacts of changes in the transportation costs on small producers. With the initial removal of the production bounds that had formerly guaranteed the presence of small farms in the production process, it is highly probable that a large majority of the production potential formerly held by small farms will no longer exist. As the allocation of commodity production levels is primarily based on the relative profitability of producing that commodity and the

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[29] Ibid., pp. 324-325.

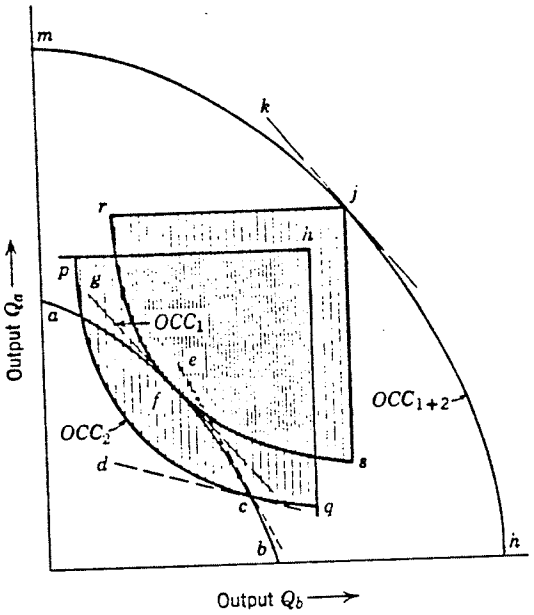

Figure 5

The Advantage of Interregional Trade

Source: R.G. Bressler and R.A. King, Markets, Prices and Interregional Trade, (Toronto: John Wiley and Sons, Inc., 1970) p. 324.

availability of scarce resources, it is conceivable that the production formerly held by small farms will shift to medium and/or large farms. This would be caused by existing economies of size that would permit medium and large farms to produce certain commodities at a higher level of profitability than is possible by small producers. As transportation costs increase in later scenarios, the "profitability potential" of small farms is expected to continue to fall. Consequently, there should be a minimal amount of production allocated to small farms in later scenarios.

However, within the framework of the model, the final allocation of commodity production levels between farm sizes may be restricted by certain production constraints. In these instances, production would be allocated until some production maximum or minimum or resources limitations, was obtained for the two bounded farm sizes (medium and large). The remaining production would then be allocated to small farm sizes. As such, production would be allocated to these small farms on a "residual" basis rather than on a production profitability (efficiency) basis. To determine if this situation exists, a scenario would be required that contained expanded production bounds for medium and large farms. In this manner, these increased production limits would alleviate some of the existing "residual production allocation effects", and/or indicate if the production trend towards or away from one farm size continued past the original production bounds.

A point to recall in this discussion is that production in these instances is allocated purely in terms of profitability and resource availability within specified production bounds. For these reasons, production will be allocated to the farm size having the largest profitability,

which may bias the model towards large farm sizes. It must be remembered that, although production may be allocated within the model according to economies of size, two very important constraints to this theory are not directly considered (i.e., risk and uncertainty). These factors were indirectly taken into consideration by weighting the price levels according to production trends and by considering actual production cost data which included some return to risk and uncertainty.

A new component of the model which allowed for increased interregional trade was intented to reduce the resource constraints of some districts. In former analyses, some districts were not able to make full use of their comparative advantage due to resource limitations, such as feed grain shortages, that could be obtained from other districts. The expanded interregional trade should increase the production of intermediate commodities such as feed grains and stocker animals as districts are allowed to make better use of their inherent comparative advantage.

Chapter 3

ANALYTICAL FRAMEWORK

This chapter describes the procedures used in this analysis. The exact numerical details of the base data are given in Appendix A. Included in this chapter are: (1) a description of the study framework used to formulate the basis for the LP analysis; (2) a detailed description of the components that make up the LP model; and (3) the limitations of this analysis.

Study Framework

Several smaller components were used to formulate the data base for the linear programming model in this analysis, as shown in Figure 6. Each of these components varied depending upon the scenario being examined. In many instances, these changes were directly responsible for the production shifts occurring in each scenario. These scenarios are described in detailed in Chapter 4. The details of each of these components are dealt with below.

Market Conditions

Market conditions referred to the circumstances which resulted in the 1978 prevailing supply and demand situation. This in turn generated prices for the given range of products included in the study. These market conditions were used to determine the relative profitability of producing each commodity within the LP. The derivation of these prices are shown in Appendix A.

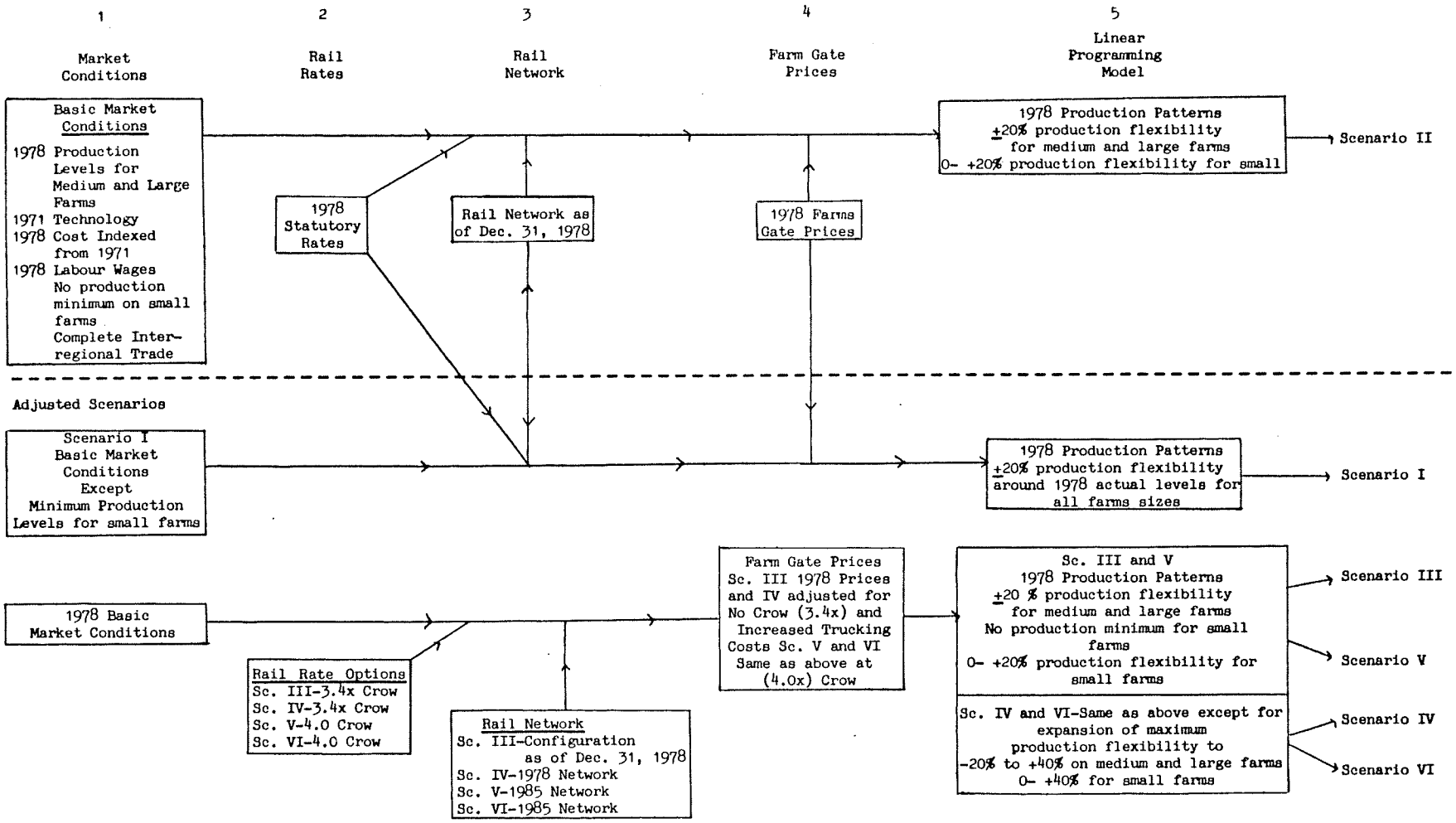

Figure 6

Study Framework

Source: With modifications from K. Olsen, E.W. Tyrchniewicz, and C.F. Framingham, "Impacts of Changes in Statutory Grain Rates and Rail Branch Line Configurations on Manitoba's Agricultural Economy." Report prepared for the Manitoba Department of Agriculture (Winnipeg: University of Manitoba, March 1980) p. 8.

Rail Rates

This component of the framework isolated the rate options that were considered under alternative transport policies. The policies considered in this study were: the existing statutory rates on grain and 100 percent payment by farmers of the costs of transporting grain at the "compensatory" rates as determined by Snavely, King and Associates.[30] Any changes in rail rates for grain directly affected the farm-gate prices and therefore, the comparative profitability of producing specific crops.

Rail Routes

This component isolated the effects of alternate rail line configuration recommended by the Hall Commission and the Prairie Rail Action Committee (PRAC).[31] The Canadian Transport Commission PHAER program output described the farm-elevator delivery patterns which were associated with each elevator.[32] This information was used to generate an "alternative delivery point" matrix for those permit holders whose current delivery point elevators were abandoned. Evaluation of the physical implications of alternative rail route options on farm-elevator delivery patterns was made using the PHAER program. The volume and distance data generated by the program were combined with cost data for farm and commercial trucking to derive estimates of the costs involved with each

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[30] Snavely, King and Associates, Op. cit.

[31] The Grain Handling and Transportation Commission, Op. cit.; Prairie Rail Action Committee. Report, December, 1978 (Ottawa: Supply and Services, 1979).

[32] M. S. Fleming and W. E. Bell, "PHAER, Producers' Haul and Elevator Receipts". The Logistics and Transportation Review, Vol. 9, No. 2, 1973, pp. 119-130.

option. These costs were in turn combined with the increased costs associated with abandonment of statutory freight rates for export grains mentioned previously. These increased costs were directly subtracted from initial farm-gate prices.[33]

Farm-Gate Prices

Farm-gate prices refer primarily to the six principal crops, wheat, oats, barley, flax, rapeseed, and rye, currently being transported under statutory rates. Only the prices of these commodities were directly affected by changes in transportation costs. Historical marketing trends with respect to the types of grain that have been marketed over the last twelve years were taken into consideration and used in the calculation of the initial farm-gate prices.[34] As mentioned, both the increased costs of transporting these grains by farm truck to primary elevators and then by rail to export terminals at Thunderbay, were subtracted from these initial farm-gate prices. These changes in farm-gate prices were directly responsible for production and income changes within the LP solutions as a result of changes in transportation costs directly influencing price and the relative profitability of producing these commodities.

Farm-gate prices for all other commodities were not directly affected by changes in transport costs, however, the relative profitabilities of producing these commodities as compared to the statutory grains were increased with abandonment of statutory rates and branch line

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[33] See Appendix A.

[34] See Appendix A.

rationalization. The transportation costs for these "non-statutory" commodities were included in the calculation of total production costs dealt with later in this chapter.

The Linear Programming Model

A linear programming model developed by Framingham, et. al.,[35] was used to estimate the impacts of changes in statutory grain rates and branch line configurations on the farm structure of Manitoba agriculture, especially with respect to smaller farm enterprises.

Figure 7 is a schematic illustration of the components of a linear programming type model couched in terms of the dimensions of the study conducted. As indicated in Figure 7, Part A, a linear programming model contains three main components:

1. An objective function;
2. A set of constraints; and
3. A set of alternative activities.

The objective is so named in a linear programming approach because it is, by definition, the factor to be maximized or minimized. When linear programming is applied in an agricultural policy analysis context, the variable maximized or minimized in the objective function is usually one public policy objective.

Linear programming model constraints, as the term suggests, constrain or restrict the extent to which the objective function may be maximized or minimized. They include resource constraints, minimum and/or maximum production levels, and objective constraints.

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[35] C. F. Framingham, L. B. B. Baker and C. J. Craddock, Op. cit.

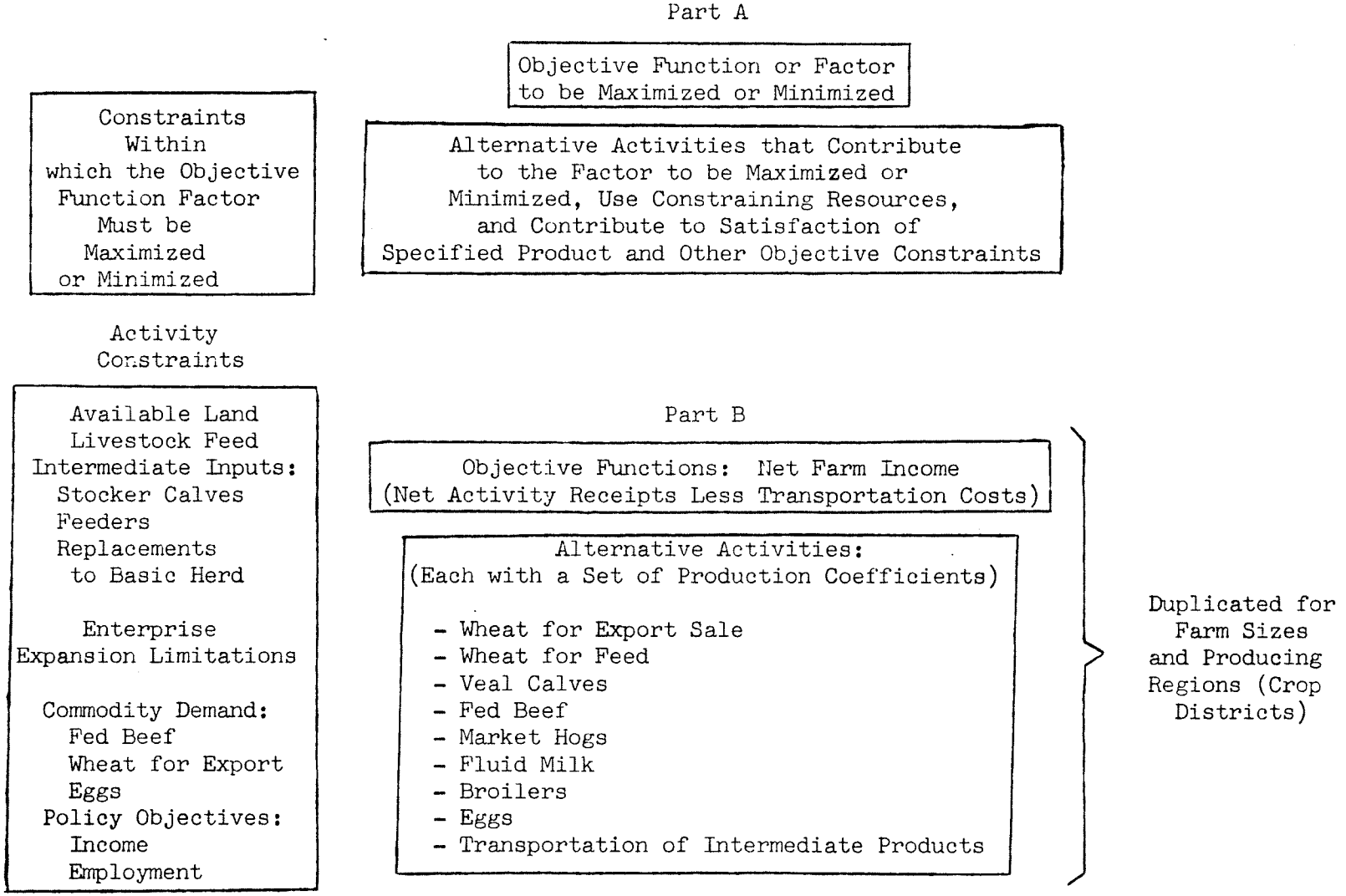

Figure 5

Overview of the Major Components of a Linear Programming Model

Alternative activities in a linear programming model are alternative ways of increasing or decreasing the objective function which, using constraining resources, produces products to satisfy production constraints and contributes to satisfaction of objective constraints. Producing wheat, which yields net income, uses land, produces wheat for export, and provides employment, is one example. Solving a linear programming problem involves selection of the alternative activities that maximize (minimize) the objective function within the constraints imposed. The set of activities that maximizes (minimizes) the objective function within the constraints imposed is the solution.

Figure 7, Part B, illustrates the contents of the three components of the linear programming model applied in this study.

The following discussion of model components provides elaboration presented to further clarify the model's contents and orientation. For exact details of the equations used in this model, please refer to Appendix A.

The Objective Function

The model's objective function was defined in terms of net income to Manitoba agriculture. Its parameters were simply the net return to provincial agriculture after all costs were paid. The changes in the transportation costs for grain resulted in a re-shuffling of the agricultural production mix necessary to achieve maximization of net farm income. The impacts of these alternate transport policies were determined by examining the final regional distribution of agricultural commodity production and net farm income.

Model Constraints

Commodity Output Constraints

The essence of this study centered around the control of the production allocation process between the different farm sizes. Removal of the minimum production levels for small farm sizes allowed for the examination of the impacts of increased transportation costs on small farms. This was initially measured in terms of the small farm's ability to compete for commodity production with medium and large farms. The terms of reference for the comparison were production costs, technology, and resource availability. Minimum output levels were established at 80% of the 1978 actual production levels, for medium and large farms in each crop district to prevent the possibility of a normative production distribution dominated primarily by larger farm sizes.[36] Conceptually, this could be the result if no restrictions were placed on production allocation and the model implicitly allocated production between the various farm sizes according to the LP's maximization of net farm income criteria. Ensuring that both medium and large farms were represented in the final solution allowed for a more "natural" production shift spread over the three farm sizes.

Maximum output levels were established for all commodities on all farm sizes. These limits were generally set to allow for a short-run production adjustment of 20% above the 1978 actual production levels.

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[36]These minimum output levels were established at 20 percent below the 1978 actual production to allow for a reasonable production range in the event of a decreasing trend in some commodities. For a complete listing of the commodity constraint levels see: K. Olsen, E. W. Tyrchniwiecz, C. F. Framingham, Op. cit., Appendix A.

Further production increments up to a maximum of 40% above the 1978 actual production levels were also permitted for all commodities except those whose markets were closely regulated and would most likely not experience dramatic increases or decreases in production levels. These commodities included potatoes, sugar beets, milk, cream, eggs, broilers, and turkeys.

Production output was further constrained by provincial export commodity demands. This included all commodities available for trade after all the internal requirements specified by the technical consistency constraints had been fulfilled. The provincial demand constraints for wheat, oats, and barley were calculated by multiplying the total actual production figure for each crop by the average percentage of grain that was exported from 1973-1978, as shown in Table 1. The provincial demand constraint was set at 80 percent of this value and allowed to range up to 20 percent or 40 percent above the actual provincial demand value. The other major commodity categories constrained by provincial demand were flax, rapeseed, rye, sunflowers, potatoes, sugar beets, beef veal calves, finished beef, dairy veal calves, market hogs, milk, cream, eggs, broilers and turkeys. It was assumed that total provincial demand for these commodities equalled total production.

Land Constraints

Land constraints were specified for each of the 12 crop districts and for the two land categories within each crop district. The amount of available land was calculated from the 1976 Canada Census[37] and is shown

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[37]Statistics Canada, Op. cit. Refer to Figure 8 for pictorial view of provincial crop districts used in the analysis.

Table 1

Export and Domestic Marketing of Prairie Grain

	Bulk Exports		Domestic		Total Marketing[a]
	thousands of tonnes (percentage)				
Wheat[b]	12,140	(81.62)	2,733	(18.38)	14,873
Oats	179	(24.93)	539	(75.07)	718
Barley	3,306	(65.53)	1,739	(34.47)	5,045
Flax	293	(81.39)	67	(18.61)	360
Rapeseed	839	(69.22)	373	(30.78)	1,212
Rye	195	(73.58)	70	(26.42)	265

[a]Total "export and domestic" marketing do not include the amount of grain and oilseeds used for seed requirements, livestock feed, wastage, and dockage. In this analysis, it was assumed that the "total marketing" figures represent the total amount of grain sold outside the Prairie provinces in both domestic (largely eastern Canada) and export markets.

[b]Includes durum wheat.

Source: Canada Grains Council. Canadian Grains Industry Statistical Handbook '78 (Winnipeg: Canada Grains Council, 1979), pp. 33-35, 67.

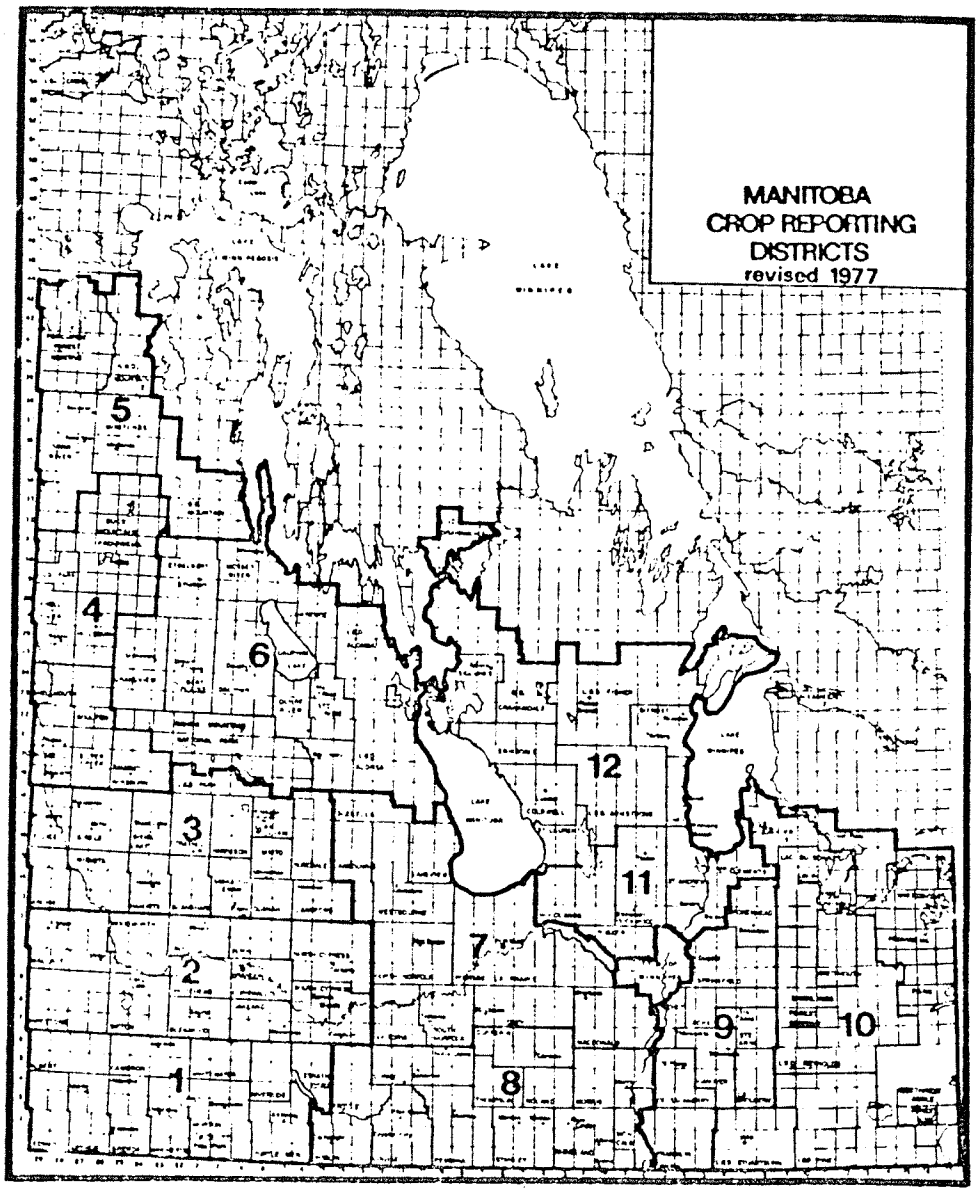

Figure 8

Provincial Crop Districts Used in Analysis

Crop Districts 1, 2, 3 - Southwest Region
Crop Districts 4, 5, 6 - Northwest Region
Crop Districts 7, 8 - Central Region
Crop Districts 9, 10 - Eastern Region
Crop Districts 11, 12 - Interlake Region

Source: Manitoba Department of Agriculture, 1978 Yearbook, Manitoba Agriculture, (Winnipeg: MDA, 1979).

on Table 2. Soil type 1 was land used primarily for crops and tame hay. Soil type 2 was land available for unimproved and community pastures. Improved pasture land was assumed to be used for dairy cows producing fluid milk and cream. Unimproved pasture land was used for all other livestock that had pasture included in their feeding program.

Technical Consistency Constraints

Within the model, it was necessary to specify, for example, that feed supplies and animals placed on feed were in balance. Grain consumed by livestock had to equal grain produced and/or purchased for livestock feed. All livestock such as calves, weanlings and stocker cattle that were produced had to equal the corresponding levels of livestock animals fed. Total feed produced for sale had to equal the total amount of feed sold. Minimum levels of one or more of wheat, oats and barley were required in each livestock ration. Finally, the levels of hay produced had to equal the quantity of hay consumed.

Income and Employment Constraints

The income and employment constraints in the model were used for analysis of alternate income and employment policies. As such, they can be specified for any given situation under analysis. For example, it would be possible to set the net income constraint of small farms at $8,000 per farm and to analyze the production mix necessary to meet this objective. If the solution was infeasible or unbounded, the input data cannot achieve the desired income levels and a new objective level would have to be choosen.

Table 2

Available Land in Manitoba

Crop Districts	Soil Type 1[a] (acres)	Soil Type 2		
		Improved Pasture	Unimproved Pasture	Community Pasture
1	1,333,185	61,559	274,676	23,870
2	1,360,282	95,064	381,340	10,240
3	1,326,693	57,172	426,586	98,320
4	585,488	38,168	188,330	29,284
5	532,438	60,476	94,282	50,920
6	979,854	94,060	565,143	95,670
7	1,732,437	109,741	244,883	54,620
8	1,907,648	46,252	172,288	--
9	853,105	38,199	122,799	4,400
10	180,233	29,571	76,254	12,560
11	583,929	33,451	125,754	27,760
12	547,603	78,264	93,060	38,580
Total	11,922,895	741,977	2,765,395	446,224

[a]This includes all crop land, summerfallow and tame hay.

Source: Statistics Canada, 1976 Census of Canada, Agriculture, Manitoba Cat. No. 96-807, Vol. 13-1 (Ottawa: Statistics Canada, March 1978).

The data requirements for the employment and income constraint rows are labor required per unit of output of each commodity that can be produced and the income realized from its production. The income from each unit of commodity produced in the model is the net income value specified for use in the objective function component plus the labor required to produce the commodity in question times the 1978 minimum wage.

Alternative Activities Component

A separate production activity was required for each commodity produced on each farm size. As well, activities to transport feed grains, weanlings, stocker calves, etc., between crop districts were required. Each activity required technical coefficients to relate it to each of its corresponding model constraints. Other model activities and their technical coefficients were similarly specified.

Other Dimensions of the Model

Commodities and Production Alternatives Included in the Analysis

It is possible to construct a model including all agricultural commodity production. However, a number of commodities are produced in very small quantities, and the general applicability of the model is not seriously affected by their exclusion. Therefore, the commodities included in the analysis consisted of that group of commodities accounting for over 95 percent of each subregion's total revenue in 1970.

The types of enterprise or production activities included as alternative means of producing each of the crop and livestock commodities analyzed were specified on the basis of a farm crop production practices

survey in the case of crops and information contained in the Farm Data Handbook[38] compiled by the Economics Branch of the Manitoba Department of Agriculture. The types of enterprise specified for each commodity produced were as follows:

Crops. One type of enterprise was specified for each crop commodity produced. Three identical activities were provided for the production of wheat, oats and barley. For example, the first produced wheat for export sale, the second produced wheat for feed, and the third produced wheat for sale as feed.

Restriction of each crop commodity's production to one enterprise type (activity) was made possible through the identification of composite acre units of production. A composite acre of production consisted of two parts: that part produced on summerfallow and that part produced on stubble. The proportion of production from each acre produced on summerfallow was based on information concerning crops seeded on summerfallow provided by the Manitoba Crop Insurance Corporation.

Livestock. Veal enterprises were of two types. One type was that of veal produced from a suckling beef calf raised to 300 pounds on pasture. The other was that of producing a 300-pound veal calf through confined rearing of a newborn dairy calf on milk supplement and other ingredients required to provide an adequate ration.

Beef enterprises consisted of two similar sets of activities depending on whether the calves came from a beef or dairy herd. The

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[38]Manitoba Department of Agriculture, Farm Data Handbook (Winnipeg: Economics Branch, Manitoba Department of Agriculture, 1972). Please refer to Table 3 for a list of the commodities included in the analysis.

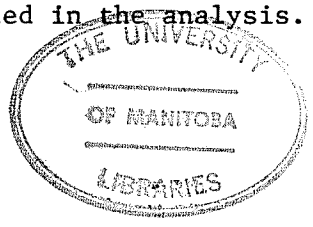

Table 3

Commodities Included in the Analysis[a]

Crops	Livestock
Wheat	Veal
Oats	Beef
Barley	Pork
Flax	Turkeys
Rapeseed	Broilers
Rye	Eggs
Sunflowers	Cream
Sugar Beets	Fluid Milk
Potatoes	

[a]Except for sunflowers and sugar beets each commodity could be produced in all subregions. Production of those two crops was restricted to the following subregions:

Sunflowers--1, 2, 3, 4, 6, 7, 8, 9, 10 and 11.

Sugar Beets--7, 8, 9, and 11

activities contained in each set were:

1. Produce and rear a newborn calf from birth to 500, 700, 1,050, or 1,170 pounds.
2. Rear a 500-pound calf to 1,050 or 1,170 pounds.
3. Rear a 700-pound stocker animal to 1,050 pounds.

Combination of activities under (1) above with those under (2) or (3) provided base animals for items (2) and (3). The only restriction was that all animals fed be produced within Manitoba, i.e., net imports of feeding enterprise animals (500-pound calves and 700-pound stocker cattle) were assumed to be zero.

Hog enterprises consisted of three types:

1. A farrow to weanling enterprise.
2. A farrow to finished hog enterprise.
3. A weanling to finished hog enterprise.

Weanling-finished hog enterprises were restricted to weanlings available from Manitoba hog enterprises, i.e., net Manitoba weanling imports were assumed to be zero.

Two milk production enterprises were included in the analysis. One provided for the production of fluid milk, the other cream.

Poultry enterprises for each of egg, broiler chicken and turkey production were provided.

Activities to produce each of the livestock product types discussed above and activities to transport feed grain and animals between different regions completed the livestock sector.

Interregional Trade

A transportation matrix was established which permitted inter-district movement of feed grains and livestock. The purpose of this matrix was to enhance regional comparative advantage by allowing regions to "export" commodities they produce in abundance to other crop districts where these commodities are more scarce. This interregional trade was limited to intermediate commodities such as feed grains, stocker calves, stocker cattle, and weanling hogs. Transportation costs were estimated according to the distance between "representative" centres within each crop district as shown on Tables 4 and 5.

Size of Enterprise

Enterprise size variation was included in the analytical model. Three farm sizes were included for each of the enterprise activities contained in the model. The composition of each of the three sizes is indicated in Table 6.

Other Model Dimensions

Since the model was structured to allow selection of minimum-cost livestock rations, a problem arose regarding the contribution of livestock enterprises to net income. The net income from each livestock enterprise became a function of the cereal grains components of the ration implicit in the solution. In order to overcome this problem and allow model selection of minimum-cost rations, an average cost per unit of grain fed was determined. This was possible since the price per mega-calorie of cereal grain was similar for each of wheat, oats, and barley, and variation in proportion of each grain fed was restricted to that quantity above the minimum ration requirement specified for a particular

Table 4

Interregional Mileages and Trucking Costs for Feed Grains in Manitoba[a]

	Crop District 1 DELORAINE	Crop District 2 BRANDON	Crop District 3 SHOAL LAKE	Crop District 4 ROBLIN	Crop District 5 SWAN RIVER	Crop District 6 DAUPHIN	Crop District 7 PORTAGE LA PRAIRIE	Crop District 8 MORDEN	Crop District 9 STE. ANNE	Crop District 10 LAC DU BONNET	Crop District 11 STONEWALL	Crop District 12 ARBORG
Mileage	71											
Wheat	0.26											
Oats	0.15											
Barley	0.24											
Mileage	141	69										
Wheat	0.33	0.26										
Oats	0.19	0.15										
Barley	0.31	0.24										
Mileage	225	153	80									
Wheat	0.44	0.37	0.26									
Oats	0.25	0.21	0.15									
Barley	0.41	0.35	0.24									
Mileage	286	214	156	76								
Wheat	0.54	0.44	0.37	0.26								
Oats	0.30	0.25	0.21	0.15								
Barley	0.50	0.41	0.35	0.24								
Mileage	177	104	88	61	109							
Wheat	0.41	0.30	0.26	0.26	0.30							
Oats	0.23	0.17	0.15	0.15	0.17							
Barley	0.38	0.28	0.24	0.24	0.28							
Mileage	150	79	116	209	259	149						
Wheat	0.33	0.26	0.30	0.44	0.50	0.33						
Oats	0.19	0.15	0.17	0.25	0.28	0.19						
Barley	0.31	0.24	0.28	0.41	0.47	0.31						
Mileage	134	135	188	281	330	220	71					
Wheat	0.33	0.33	0.41	0.54	0.60	0.44	0.26					
Oats	0.19	0.19	0.23	0.30	0.34	0.25	0.15					
Barley	0.31	0.31	0.38	0.50	0.56	0.41	0.24					
Mileage	198	160	202	289	340	231	81	78				
Wheat	0.41	0.37	0.44	0.54	0.60	0.47	0.26	0.26				
Oats	0.23	0.21	0.25	0.30	0.34	0.27	0.15	0.15				
Barley	0.38	0.35	0.41	0.50	0.56	0.44	0.24	0.24				
Mileage	241	204	241	315	368	259	123	158	63			
Wheat	0.47	0.44	0.47	0.57	0.63	0.50	0.30	0.37	0.26			
Oats	0.27	0.25	0.27	0.32	0.36	0.28	0.17	0.21	0.15			
Barley	0.44	0.41	0.44	0.53	0.59	0.47	0.28	0.35	0.24			
Mileage	211	148	191	248	322	187	69	98	53	73		
Wheat	0.44	0.33	0.41	0.47	0.57	0.41	0.26	0.26	0.26	0.26		
Oats	0.25	0.19	0.23	0.27	0.32	0.23	0.15	0.15	0.15	0.15		
Barley	0.41	0.31	0.38	0.44	0.53	0.38	0.24	0.24	0.24	0.24		
Mileage	285	234	272	238	289	180	143	165	112	138	91	
Wheat	0.54	0.47	0.50	0.47	0.54	0.41	0.33	0.37	0.30	0.33	0.26	
Oats	0.30	0.27	0.28	0.27	0.30	0.23	0.19	0.21	0.17	0.19	0.15	
Barley	0.50	0.44	0.47	0.44	0.50	0.38	0.31	0.35	0.28	0.31	0.24	

(Continued)

Footnote (Continued)

[a]Mileage represents highway distance between selected central points within each crop district. Mileage taken from: Manitoba Department of Highways, Manitoba Official Highway Map, (Winnipeg: Queen's printers), 1979. Trucking costs per bushel taken from average between Manitoba Trucking Association 1979 rate schedule and quotations from John Holland Trucking Company, 1979.

Table 5

Interregional Mileages and Trucking Costs for Livestock in Manitoba[a]

	Crop District 1 DELORAINE	Crop District 2 BRANDON	Crop District 3 SHOAL LAKE	Crop District 4 ROBLIN	Crop District 5 SWAN RIVER	Crop District 6 DAUPHIN	Crop District 7 PORTAGE LA PRAIRIE	Crop District 8 MORDEN	Crop District 9 STE. ANNE	Crop District 10 LAC DU BONNET	Crop District 11 STONEWALL
Mileage	71										
Beef	0.94[b]										
	4.72[c]										
	6.60[d]										
Pork	0.47										
Mileage	141	69									
Beef	1.24	0.91									
	6.20	4.53									
	8.68	6.35									
Pork	0.62	0.45									
Mileage	225	153	80								
Beef	1.53	1.30	0.96								
	7.63	6.50	4.81								
	10.68	9.10	6.74								
Pork	0.76	0.65	0.48								
Mileage	286	214	156	76							
Beef	1.68	1.50	1.30	0.94							
	8.42	7.50	6.50	4.72							
	11.78	10.50	9.10	6.60							
Pork	0.84	0.75	0.65	0.47							
Mileage	177	104	88	61	109						
Beef	1.37	1.12	1.01	0.87	1.13						
	6.85	5.60	5.05	4.35	5.64						
	9.58	7.83	7.07	6.09	6.09						
Pork	0.68	0.56	0.51	0.44	0.57						
Mileage	150	79	116	209	259	149					
Beef	1.28	0.96	1.15	1.48	1.61	1.28					
	6.38	4.81	5.75	7.40	8.05	6.38					
	8.94	6.74	8.05	10.36	11.27	8.94					
Pork	0.64	0.48	0.58	0.74	0.81	0.64					
Mileage	134	135	188	281	330	220	71				
Beef	1.22	1.22	1.41	1.67	1.81	1.52	0.91				
	6.11	6.11	7.05	8.35	9.07	7.60	4.55				
	8.55	8.55	9.87	11.69	12.69	10.64	6.37				
Pork	0.61	0.61	0.71	0.84	0.91	0.76	0.46				
Mileage	198	160	202	289	340	231	81	78			
Beef	1.44	1.31	1.44	1.72	1.83	1.54	0.96	0.95			
	7.22	6.57	7.22	8.60	9.12	7.70	4.81	4.76			
	10.10	9.19	10.10	12.04	12.82	10.78	6.74	6.67			
Pork	0.72	0.66	0.72	0.86	0.92	0.77	0.48	0.48			
Mileage	241	204	241	315	368	259	123	158	63		
Beef	1.55	1.23	1.55	1.76	1.92	1.61	1.18	1.35	0.89		
	7.75	6.14	7.75	8.79	9.62	8.05	5.92	6.75	4.45		
	10.85	8.59	10.85	12.30	13.46	11.27	8.26	9.45	6.23		
Pork	0.78	0.62	0.78	0.88	0.96	0.31	0.59	0.68	0.45		
Mileage	211	148	191	248	322	187	69	98	53	73	
Beef	1.48	1.28	1.41	1.57	1.78	1.68	0.91	1.11	0.85	0.93	
	7.40	6.38	7.05	7.86	8.90	8.40	4.55	5.55	4.25	4.65	
	10.36	8.94	9.87	10.99	12.46	11.76	6.37	7.77	5.95	6.51	
Pork	0.74	0.64	0.71	0.79	0.89	0.84	0.46	0.56	0.43	0.47	

(Continued)

Footnote (Continued)

[a]Mileage represents highway distance (in miles) between selected central points within each crop district. Mileage taken from: Manitoba Department of Highways, Manitoba Official Highway Map, (Winnipeg: Queen's Printers), 1979). Trucking costs in dollars per animal taken from average between Manitoba Trucking Association 1979 rate schedule and quotations from John Holland Trucking Company, 1979.

[b]100 lb. beef calf.

[c]500 lb. beef stocker.

[d]700 lb. beef stocker.

[e]50 lb. pork weanling.

Table 6

Farm Size Composition Used in the Analysis

	Small	Medium	Large
Crops[a]	Less than $19,950 in capital value of machinery and land investment	$19,950-49,949	49,950 and over
Beef	Less than 33 cows	33-77 cows	78 cows and over
Hogs	1-9 sows	10-29 sows	30 sows and over
Weaning to Finish	1-49 feeders	50-199 feeders	200 feeders and over
Dairy	1-19 dairy cows	20-49 dairy cows	50 dairy cows and over
Poultry[b]	Less than $50,000	$50,000-$100,000	over $100,000
Chickens, broilers and turkeys	Capital value invested in poultry equipment and barns		

[a]Production was allocated according to the capital value of machinery used for crop production taken from the 1976 Canada Census.

[b]Production was allocated according to the capital value of land, buildings, machinery, and equipment used for poultry production taken from the 1976 Canada Census.

Source: Statistics Canada, 1976 Census of Canada, Agriculture Manitoba Cat. No. 96-807, (Ottawa: Statistics Canada, March 1978).

grain. To the extent that this procedure resulted in variance of estimated income per animal unit from the true value, net farm income as estimated through the income constraint was an approximation of the corresponding objective function value.

Limitations of the Model

The technique of linear programming involves a normative optimization process. Consequently, maximization of net farm income was the major objective upon which production decisions were based. However, many producers, especially the smaller ones, have other objectives besides maximization of net farm income, that they take into consideration for making managerial decisions. The model is limited in that it allocates production on the narrow basis of income maximization. As such, production allocation is based on favourable price levels combined with low production costs whereas many other non-economic factors, in reality, need to be considered.

The LP model operated within a static, closed economy. Risk and uncertainty factors were indirectly taken into account in so far as they influenced price and cost structures for the base period, 1978. A limiting assumption is that the levels of risk and uncertainty are assumed to remain constant over all the scenarios examined. With prices remaining static within each scenario, no dynamic price changes derived from supply and demand fluctuations created by alterations in provincial production patterns, were considered. No out-of-province price or production influences such as increased cattle production in Alberta were taken into account. The model assumed marketing efficiencies in that all commodities produced were sold in some market. Marketing and transportation

inefficiencies were not considered. This was also true for any possible benefits resulting from branch line rationalization and compensatory freight rates such as better rail service, lower elevator costs, incentives for increased producer efficiency, etc.

Although "production efficiency" was a very significant part of the production allocation process, it was not the sole determinant upon which production amongst the various farm sizes, was assigned. As mentioned, production minimum and maximum levels were specified to ensure the presence of medium and large farms. After these limits had been attained in some instances, "residual production" necessary to meet provincial demand constraints, were allocated to small producers. This decision was not made according to the "efficiency criterion", but rather to fulfill "production criteria" established by the provincial demand constraints. Further, the re-allocation process of small farm production between medium and large farms was limited to upper and lower bounds that may not accurately represent the situation given that small farms were, by-in-large, being phased out. As such, medium and large farms were not permitted to expand production beyond the limits they were expected to reach without the attrition of small farm sizes.

The LP model was constructed utilizing representative farms in each size class. This assumed all farms within each class were the same and average, and possess mixed enterprises. As such, results cannot be directed towards a specific farm enterprise type such as a medium dairy farm, but rather to medium-sized farms in general. Further, the actual division of the farms into the three different size categories was made on a somewhat arbitrary ground. It is possible that the rigid demarquation of the limits to each size class is a limitation in that the

boundaries may have placed too many or too few farm units into a particular category.

Another data limitation of this model involved the production cost data. This analysis was based on a 1971 study which incorporated 1971 technological practises with 1971 costs indexed to 1978 values. This was the best data source available and an update on this portion of the program is currently underway.

The last major limitation of this analysis centered around the calculation of "per farm" figures from aggregate net income figures. This calculation involved a simple division of total aggregate net farm income figures, as determined by the LP, for the three farm sizes in the five principal study regions, by the corresponding number of farms in that category. The major limitation was the number of farms in each size category remained constant throughout the entire analysis. This led to an underestimation of net farm income levels for small farms. With the gradual attrition of small farms by high production costs and low income levels the number of small farms will likely decline. As such, the remaining net farm income will have to be spread over a smaller number of farms. Consequently, the net farm income levels for medium and large farms may be overestimated, as no provisions were made in this analysis to account for increased numbers of these farm sizes.

Chapter 4

RESULTS OF THE ANALYSIS

This chapter describes in detail, the results of the linear programming analysis described in the previous chapters. The exact numerical results are shown in Appendix B. This chapter includes: (1) a detailed description of each scenario analyzed; (2) the detailed results of the analysis between Scenario I and Scenario II; (3) the detailed results of the comparison between Scenario II, Scenario III, and Scenario IV; (4) the detailed results of the comparison between Scenario II, Scenario V, and Scenario VI; and (5) a determination of the sensitivity of the analysis by examining the shadow prices for each commodity produced in this analysis.

Description of Scenarios

The study drew a comparison between the current (1978) situation in terms of freight rates and branch line configurations (Scenario II) with five alternate scenarios as depicted in Table 7. Scenario I represented the present normative Manitoba agricultural environment, which ensured the presence of small producers by imposing minimum production limits at 20 percent below the 1978 actual production levels for all farm sizes. The major purpose of this scenario was to determine the major impact of removal of these minimum production limits in Scenario II, on small farm production levels and income. This helped illustrate the possible trends when farms were permitted to take better advantage of their economies of size and production efficiency.

Table 7

Description of Scenarios Analyzed

	Market Conditions	Rail Rates	Rail Routes	Farm Gate Prices	L.P. Model
Scenario I 1978 situation with Statutory Rates With Small Farms	1978 Production Levels for all farm sizes 1971 Technology 1978 Costs Indexed from 1971 1978 Labour Wages	Present Statutory Rates	Configuration as of Dec. 31, 1978 including all abandonments recommended by Hall and P.R.A.C.	1978 Prices	1978 Production Patterns for all farm size (with ±20% production flexibility)
Scenario II 1978 situation with Statutory rates without Small Farms	Same as I Except No production minimum for small farms 1978 Production Levels for medium and large farms	Present Statutory Rates	Same as I	Same as I	No minimum production level for small farms. (0-120% production flexibility) 1978 production patterns for medium and large farms (±20% production flexibility)
Scenario III 1978 situation with Compensatory Rates without small farms (±20% production flexibility) for medium and large farms	Same as II	3.4 x Crow	Same as I	1978 Prices Adjusted for No Crow (3.4 x Crow) and increased Trucking Costs	II Adjusted for No Crow Rates (3.4 x)
Scenario IV 1978 situation with Compensatory without small farms (-20% to +40% production flexibility) for medium and large farms	Same as II except Production flexibility expanded to +40% above 1978 actual	Same as II	Same as I	Same as II	Same as II except expanded production maximum to +40% of 1978 actual level
Scenario V 1985 Situation with Compensatory Rates without Small Farms (±20% production flexibility) for medium and large farms	Same as II	4.0 x Crow	1985 Configurtion including all abandonments Recommended by Hall and P.R.A.C.	1978 Prices Adjusted for No Crow (4.0 x Crow) and increased Trucking Costs	II Adjusted for No Crow Rates (4.0 x)
Scenario VI 1985 situation with Compensatory (-20% to +40% production flexibility) for medium and large farms without small farms	Same as IV	Same as V	Same as V	Same as V	Same as V Except for Expansion of Production Flexibility to -20% to +40%

Source: K. Olsen, E.W. Tyrchniewicz, and C.F. Framingham, "Impacts of Changes in Statutory Grain Rates and Rail Branch Line Configurations on Manitoba's Agricultural Economy." Report prepared for the Manitoba Department of Agriculture (Winnipeg: University of Manitoba, March 1980) p. 4.

Scenario I reflected the 1978 market conditions utilizing 1971 production techniques for crops and livestock. Production costs were farm size specific and based on 1971 figures indexed up to 1978 levels.[39] Livestock and crop production were based on 1978 figures. Crop yields for 1978 were estimated using regression techniques from Manitoba Crop Insurance Commission data for 1960-1976. This was done to remove possible biases from being introduced due to abnormal yield conditions present in actual 1978 data.[40] The rail rates for transporting export grain by rail were the existing statutory rates. These rates were directly reflected in farm gate prices for the six principal crops produced in Western Canada, namely wheat, oats, barley, flax, rapeseed, and rye. Only the prices of these six crops were affected by changes in the statutory rates. All prices were based on 1978 average figures.

A regional linear programming model for Manitoba agriculture incorporating all of these factors provided the technique for comparison of several budget alternatives to determine the optimal levels and pattern of agricultural production that yielded the maximum net income to farmers in each of Manitoba's twelve crop districts. Production adjustments on medium and large farms were limited to ranges of ± 20 percent of the actual 1978 production levels. This reflected a reasonable production flexibility which permitted producers to alter their present production patterns in response to price changes.

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[39] Market conditions for 1978 reflect the supply and demand situation which generated the price levels for each commodity. These conditions along with farm size categories and indexing procedures are explained more fully in Appendix A.

[40] See Appendix A for explanation.

Scenario I also served as a basis for determining the impacts of the expanded transportation matrix for intermediate commodities such as feed grains and stocker animals. This scenario was compared with a similar study done for the Manitoba Provincial government that did not allow for complete intra-provincial movement of these commodities. As explained later, the numbers are not directly comparable due to the different definitions of provincial demand used in each analysis. However, significant changes in production trends indicated the influence of this new matrix on regional production levels.

Scenario II was the comparative base for this study. This scenario removed the minimum production limits on small farms only, permitting them a potential production range from 0 to 120 percent of the original 1978 production level for small farms. The data base was exactly the same as Scenario I except for this feature.

Scenario III was essentially a duplicate of Scenario II except for the incorporation of compensatory rail rates and increased costs associated with branch line rationalization. Based on the 1977 Snavely report, the compensatory rates were assumed to be 3.4 times the current rates. The figure 3.4 was used to account for increases in rail costs from the 1977 Snavely calculations caused by inflation. The rail network was the actual configuration as of December 31, 1978. This included all lines that had been abandoned according to the recommendations of the Hall Commission as of December 31, 1978.[41] The Canadian Transport Commission PHAER (Producers' Haul and Elevator Receipts) model was used to estimate alternate delivery patterns of grain under the new rail

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[41]The Grain Handling and Transportation Commission, Op. cit.

configuration.[42] This model identified the alternative delivery points, the number of permit holders diverted to these alternate points, and the extra distance required to reach these new points. This information was combined with farm trucking costs, elevator operating costs, and rail costs on an individual elevator location basis and was used to calculate cost increases per bushel as a result of rail line abandonment and rail rate changes. This rate increase directly affected the farm gate prices of the six principal crops which in turn decreased the relative profitability of producing each of these crops in order to maximize net farm income. The minimum production levels for small farms were still removed. The major purpose of this scenario was to determine the further impacts of abandonment of statutory rates and branch line rationalization on small farm production levels and income and compare this to the "economies of size impacts" of Scenario I.

Scenario IV took Scenario III and expanded the upper production bounds to +40 percent beyond the 1978 actual production level. This new range was applied to the six principal crops, sunflowers, calves, stocker cattle, fed beef, and weanling and market hogs. Contract crops such as potatoes and sugar beets as well as livestock enterprises that were highly regulated by marketing boards such as dairy and poultry, remained at the $\pm$20 percent ranges. The major purpose of this scenario was to determine the extent to which the production re-allocation process was constrained by the initial 20 percent range. Further, this scenario determined the final levels of output that could be attained after production was allowed to expand to +40 percent of the 1978 actual production

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[42] M. S. Fleming and W. E. Bell, Op. cit., pp. 119-130.

levels.

Scenario V was used to estimate the production adjustments that would be expected to occur in response to the imposition of 1985 rail transportation costs to the base 1978 Manitoba agricultural environment. The basic rail configuration was altered to reflect the proposed 1985 network after the abandonment of all lines recommended by the Hall Commission and the Prairie Rail Action Committee (PRAC). Once again, the PHAER model was used to calculate the extra cost per bushel incurred by rail branch line abandonment. These costs were in turn added to increased rail rates which were raised to a level of 4.0 times the current statutory rates to reflect the expected 1985 situation, taking into consideration real cost increases other than inflationary influences and limited any production responses to only the effects of increased transport charges as reflected in farm gate prices. Production flexibilities were restricted to within the initial ranges $\pm$20 percent of the 1978 actual production.

Scenario VI was similar to Scenario III except for the expansion of the production flexibility from a maximum range of $\pm$20 percent to a new range of +20 percent to +40 percent. The expansion of this range was to determine to what extent production was constrained by the 20 percent maximum increment and the role of livestock production in countering the decline in net farm income resulting from increased transportation costs for grain.

Analysis and Results

Comparison Between Scenario I and Scenario II

The first comparison was made between Scenario I (1978

transportation network under statutory rates with minimum production levels for small farms) and Scenario II (1978 transportation network under statutory rates with no minimum production levels for small farms).

Farm Size Impacts

With the removal of the imposed minimum production levels, small farms' value of production significantly decreased in Scenario II, as shown on Table 8. Provincially, the total value of production for all farm sizes fell by $48.3 million. Specifically, small farms' value of production declined by $95.9 million while the value of production on medium and large farms rose $25.4 and $22.2 million, respectively.

The detailed production fluctuations on small farms are described in Tables B1 - B4 in Appendix B. Total gross value of crop production declined by $52.0 million on small farms as a proportion of the grains formerly produced on small farms to satisfy the minimum production requirements, were shifted to medium and large farms. There were reductions in production on small farms of export wheat, barley, flax, rapeseed, and rye. A portion of the sunflower production capacity formerly held by small producers, was taken over by medium producers. Wheat, oats, and barley for feed and for sale as feed declined on small farms due to the lower livestock numbers and removal of the minimum production levels.

Livestock value of production on small farms declined by $44.0 million due to the removal of the imposed minimum production levels. Calf, milk, cream, and egg production shifted from small to medium and large producers.

Table 8

Summary of Provincial and Regional Gross Farm Production Value and Changes Under Various Scenarios
(in thousands of dollars)

Region	Farm Size	Scenario II	Scenario I	Difference II-I	Scenario III	Difference III-II	Scenario IV	Difference IV-II	Scenario V	Difference V-II	Scenario VI	Difference VI-II
Province	Total	1,136,598	1,184,882	-48,284	1,083,940	-52,658	1,160,140	23,542	1,072,750	-63,848	1,148,606	12,008
	Small	74,019	169,947	-95,928	73,469	- 550	73,565	- 454	72,662	- 1,357	73,409	- 610
	Medium	362,279	336,850	+25,429	339,629	-22,650	361,955	- 324	336,937	-25,342	358,817	- 3,462
	Large	700,287	678,066	+22,221	670,827	-29,460	724,604	24,317	663,138	-37,149	716,400	16,113
Interlake	Total	114,208	122,004	- 7,796	111,181	- 3,027	119,073	4,865	110,557	- 3,651	120,797	6,589
	Small	7,127	17,116	- 9,989	6,827	- 300	6,513	- 614	6,827	- 300	6,513	- 614
	Medium	31,186	30,864	322	30,613	- 573	32,369	- 1,183	30,429	- 757	32,203	1,017
	Large	75,881	74,015	+ 1,866	73,728	- 2,153	82,543	6,662	73,275	- 2,606	82,074	6,193
Eastern	Total	128,868	132,159	- 3,291	126,585	- 2,283	129,951	1,083	126,004	- 2,864	129,505	637
	Small	7,738	16,647	- 8,909	7,738	0	6,624	- 1,114	7,738	0	6,776	- 962
	Medium	37,653	33,128	4,525	36,954	- 699	36,710	- 943	36,781	- 872	36,533	- 1,120
	Large	83,460	82,365	1,025	81,878	- 1,582	86,596	3,136	81,469	- 1,991	86,177	2,717
Central	Total	373,140	393,641	-20,501	352,542	-20,598	378,777	5,637	348,913	-24,227	375,043	1,903
	Small	22,652	57,689	-35,037	22,432	- 220	23,778	1,126	22,372	- 280	23,709	1,057
	Medium	124,242	112,190	12,052	112,549	-11,693	117,543	- 6,699	111,364	-12,878	116,541	- 7,701
	Large	226,232	223,741	2,491	217,544	- 8,688	237,439	11,211	215,161	-11,071	234,777	8,545
Southwest	Total	347,721	358,006	-10,285	330,181	-17,540	350,541	2,820	325,858	-21,863	346,040	- 1,681
	Small	21,035	49,025	-27,990	21,058	23	22,312	1,277	20,334	- 701	22,252	1,217
	Medium	105,600	99,527	6,073	100,419	- 5,181	105,417	- 183	99,872	- 5,728	104,239	- 1,361
	Large	221,070	209,435	11,635	208,687	-12,383	222,795	1,725	205,637	-15,433	219,531	- 1,539
Northwest	Total	160,304	169,051	- 8,747	152,935	- 7,369	162,272	1,968	151,207	- 9,097	160,529	225
	Small	15,437	29,371	-13,934	15,384	- 53	14,159	- 1,278	15,352	- 85	14,122	- 1,315
	Medium	51,738	51,621	117	48,888	- 2,850	53,140	1,402	48,369	- 3,369	52,572	834
	Large	93,119	88,039	5,080	88,649	- 4,470	94,962	1,843	87,472	- 5,647	93,821	702

Crop production on medium and large farms rose $13.2 million and $14.8 million, respectively, as a portion of the production formerly held by small farms was transferred to medium and large producers by the removal of the minimum production levels for small farms. This change primarily effected the areas of export wheat, barley for sale as feed, and feed wheat, oats, and barley. There was a small shift in export oats from medium to large farms, as large farms diverted oats to export markets from local feed markets. Large farms also shifted barley production out of export markets into barley for sale as feed and feed barley.

The value of livestock production increased $9.9 million and $7.4 million on medium and large farms respectively due to increments in calf, milk, and cream production formerly held by small farms. There was a decline in market hog production on medium farms. This was caused by feed sources formerly supplying hog producers, being diverted to support expanded cattle numbers on medium and large farms. There was a shift in egg production from small to medium producers. The relative production rise on medium and large farms derived from the removal of minimum production levels for small producers, indicated that these larger farm sizes possessed a better production comparative advantage for livestock production.

The shift in production on small farms away from commodities with high production costs and low rates of return into commodities small producers could produce "efficiently", led to a net farm income increment of $1,596 per farm. The per farm net income results are shown on Table 9.

Table 9

Estimated Provincial and Regional Net Farm Income Levels Per Farm and Income Changes Per Farm Under Various Scenarios

Region	Farm Size	Scenario II	Scenario I	Difference II-I	Scenario III	Difference III-II	Scenario IV	Difference	Scenario V	Difference	Scenario VI	Difference
Province	Total	3,582	2,685	+ 897	2,540	-1,042	3,045	- 537	2,268	-1,314	2,761	- 821
	Small	441	- 1,185	+1,596	409	- 32	493	52	402	- 39	483	42
	Medium	1,177	1,132	45	550	- 627	815	- 362	326	- 851	630	- 547
	Large	15,064	14,148	+ 916	11,041	-4,023	12,930	-2,134	10,094	-4,970	11,858	-3,206
Interlake	Total	613	- 87	+ 700	500	- 113	943	330	+ 909	296	906	293
	Small	- 100	- 1,218	-1,118	- 93	7	- 88	12	- 93	7	- 88	22
	Medium	- 969	- 979	+ 10	- 1,006	- 37	- 979	- 10	- 1,024	- 55	- 1,034	- 65
	Large	6,854	5,989	+ 865	6,134	- 720	9,100	2,246	5,946	- 908	8,980	2,126
Eastern	Total	680	69	+ 611	409	- 271	494	- 186	333	- 347	418	- 262
	Small	- 56	- 1,109	+1,053	- 56	0	- 35	21	- 56	0	- 36	20
	Medium	- 1,621	- 1,696	+ 75	- 1,776	- 155	- 1,448	173	- 1,820	- 199	- 1,492	129
	Large	8,208	8,023	+ 185	6,727	-1,481	6,519	-1,689	6,311	-1,897	6,106	-2,102
Central	Total	3,591	2,393	+1,198	2,273	-1,318	2,814	- 777	1,892	-1,699	2,405	-1,186
	Small	704	- 2,385	-3,089	624	- 80	667	- 37	612	- 92	651	- 53
	Medium	948	1,122	- 174	125	- 823	468	- 480	- 169	-1,117	198	- 750
	Large	11,490	10,830	+ 660	7,737	-3,753	9,254	-2,236	6,720	-4,770	8,102	-3,388
Southwest	Total	6,421	5,540	+ 881	4,696	-1,726	5,361	-1,060	4,261	-2,160	4,920	-1,501
	Small	990	- 473	+1,463	965	- 25	1,172	182	957	- 33	1,152	162
	Medium	3,112	2,789	+ 323	2,140	- 972	2,400	- 712	1,773	-1,339	2,156	- 956
	Large	22,092	21,148	+ 944	16,002	-6,090	18,229	-3,863	14,701	-7,391	16,687	-5,405
Northwest	Total	3,762	2,887	+ 875	2,846	- 916	3,424	- 338	2,646	-1,116	3,208	- 554
	Small	351	- 782	+1,133	305	- 46	407	56	295	- 56	396	- 45
	Medium	1,678	1,648	+ 30	1,082	- 596	1,380	- 298	940	- 738	1,232	- 446
	Large	19,387	17,423	+1,964	14,968	-4,419	17,700	-1,687	14,027	-5,360	16,676	-2,711

Net farm income rose by $45 per medium farm and $916 per large farm. The majority of these increases were caused by increased livestock production, in particular calves, milk, and cream production. The removal of the minimum production levels for small farms led to an overall increase in net per farm income as each farm size in every region was allowed to produce primarily those commodities in which they more nearly achieved the comparative advantage to do so.

Regional Impacts

The gross value of production in the Interlake for small farms declined $10.0 million as shown in Table 9. Medium and large farms experienced a $0.3 and a $1.9 million increment in their respective gross value of production.

Crop production on small farms generally decreased in the Interlake region. Production of oats and sunflowers (in crop district 11) increased on medium farms while oats and flax production rose on large farms. This still amounted to a $2.5 million decrease in the aggregate value of crop production over the Scenario I levels, (see Appendix B). Livestock production fell for most commodities on small farms except for cream, broilers, and turkeys. Cream production on all three farm sizes rose while broiler and turkey production remained constant. A portion of the stocker calf production on small farms was shifted to medium and large production. Feed supplies formerly used for market hog production on medium farms, were shifted to support increased cattle numbers on medium and large farms. These changes in livestock production reduced the aggregate value of production by a further $5.3 million. Net farm incomes rose on small, medium and large farms by $1,118, $10 and

$865 per respective farm, in the Interlake region.

The Eastern region's value of production fell $8.9 million on small farms. Increased livestock production increased the gross value of production on medium and large farms by $4.5 million and $1.0 million, respectively.

Small farms in the Eastern region experienced an overall decrease in crop production except for potatoes and sugar beets which remained constant (see Appendix B). Oats and flax on medium farms and oats production on large farms rose slightly. These increases were offset by decreased production of these crops by small farms. The total value of production fell by $4.0 million in the Eastern region. Reduced production of calves by small farms did not cancel a general increase in calf production by medium and large farms. Small farms also reduced production of stocker cattle, fed beef, weanling hogs, and milk. All farm sizes increased cream production and medium farms further increased milk production, some of which had formerly been produced by small farms. Total livestock production increased the gross value of production by $0.7 million. The elimination of some small producers with inefficient production techniques and high production costs, led to an overall increase of net farm income in the Eastern region of $1,053, $75, and $185 per small, medium, and large farm, respectively.

Small farms had a $35.0 million reduction in their gross value of production in the Central region. Conversely, medium and large farms increased their respective gross value of production by $12.1 million and $2.5 million.

Substantial decreases in most crops on small farms (rapeseed, potatoes, and sugar beets remaining constant) in the Central region offset increments of wheat, oats, and barley on medium farms. Crop production remained constant on large farms. The value of production for crops fell $13.7 million overall in the Central region. Livestock enterprises on small farms decreased production (broilers and turkey remaining constant). These reductions offset increased calf, milk, and cream production on medium and large farms. A portion of egg production formerly held by small farms was shifted to medium enterprises. In total, gross livestock value of production declined in the Central region by $6.8 million. Net farm income rose $3,089 per small farm in the Central regions as small farms produced only those commodities in which they possessed the economic comparative advantage to do so. Net farm income fell on medium farms by $174 per farm as medium producers were forced to assume "non-optimal" production practises formerly held by small producers, to meet aggregate provincial demand levels. Large farms in the Central region experienced a $660 increase in net farm income.

In the Southwest region, the gross value of small farm production declined by $28.0 million. A portion of this reduction was replaced by increased value of production of $6.1 million and $11.6 million on medium and large farms respectively.

Increased production of wheat, oats, and flax on medium and large farms in the Southwest region as well as barley on medium farms only were balanced by decreased production of wheat, oats, barley, flax, rye, and sunflowers on small farms. The gross value of crop production declined marginally by $0.3 million. Decreased livestock production on small farms except for poultry, offset increments in production of calves on medium

farms and calves, milk, and cream on large farms. Medium enterprises shifted out of market hog production in favour of increased stocker cattle numbers. Total livestock value of production for the Southwest region fell by $10.0 million. Despite these losses in gross values of production, net per farm income increased by $1,463, $323, and $944 on small, medium, and large farms, respectively, in the Southwest region.

Small farms experienced a $13.9 million reduction in gross value of production in the Northwest region. Medium and large producers expanded their respective value of production by $0.1 million and $5.1 million.

The Northwest region's gross value of crop production fell $3.4 million primarily due to decreased wheat, oats, barley, flax, rapeseed, and rye production on small farms. Production of flax rose slightly on medium farms while there were significant increases in wheat, oats, barley, and flax production on large farms. A general decrease in all livestock commodities except broilers (which remained constant) also occurred on small farms. Production of calves and turkeys on medium farms and calves, milk, and cream on large farms rose. Net farm income increased on all farm sizes in the Northwest region. Respectively, on small, medium, and large farms, the net per farm income increments were $1,133, $30, and $1,964.

Interregional Trade Comparison

The comparison was made between Scenario I of this study and Scenario I of the provincial government report done by Olsen, Tyrchniewicz and

Framingham, to determine the effects of interregional trade.[43] This comparison was severely limited by the different definitions of provincial demand used in each study. The provincial government report established provincial demand for wheat, oats, and barley, at zero. The LP was then permitted to allocate the production of these crops, after all feed requirements had been satisfied, based on the availability of land within the production bounds established for each crop in every crop district. The present analysis differed in that minimum provincial demand levels were established for wheat, oats, and barley. These levels reflected the "expected" minimum export levels based on past export trends as shown in Table 1. Consequently, provincial demand in this analysis was dependent on past marketing trends rather than land availability. As the two studies were quantitatively different, a qualitative comparison between the two could be made. Generally, the gross production changes were small and could not be specifically related to the expanded transportation matrix. However, some trends indicated that production was increased by the expansion. Regionally, the Interlake region increased oats and market hog production in Scenario I of this study compared to Scenario I of the Olsen, et al. study. The Eastern region increased production of oats, calves, and market hogs. The Central region expanded wheat, oats, and barley production, but reduced its market hog numbers. The Southwest increased wheat, oats, and market hog numbers while lowering production of barley, calves, fed beef, and weanling hogs. The decreased barley production was linked to the reduced

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[43] K. Olsen, E. W. Tyrchniewicz, and C. F. Framingham, Op. cit., Appendix A. For exact details of the comparisons made, consult Appendix A of the aforementioned publication and Appendix B of this analysis.

production of calves and fed beef. Finally, the Northwest region lowered its production of wheat, oats, barley, calves, weanling, and market hogs.

An implication of these trends was that increased wheat, oats, and barley production in the Central and Southwest regions, were used to support expanded market hog production in the Interlake and Eastern regions as well as increased calf production in the East. This was a result of wheat, oats, and barley forming a significant proportion of both calf and market hog rations. Further, the trend was especially evident in the Central region where wheat, oats, and barley production rose despite no other changes in livestock production except for decreased market hog production. Increased oat production in the Interlake, Eastern, and Southwest regions, was used to support increased market hog production in those respective districts. The reduced feed grain, calf, and weanling production in the Northwest may have been a result of these commodities being imported from other regions. However, the failure of an increase in final commodities such as finished beef or market hogs made this possibility highly unlikely.

As mentioned, these implications were qualitative and would have been better illustrated had greater production shifts occurred. It was conceivable that the full impacts of the expanded matrix were restrained by the nature of the production bounds found within the linear programming model. In many instances production in areas possessing a comparative advantage to produce livestock or feed grains, were already producing at the maximum limit permitted by the +20 percent production flexibility range. As such, no further production of these commodities in these regions was possible despite the increase availability of intermediate commodities that could be imported from other regions. As well it was

possible that in some instances, the increased cost of transportation was too large to warrant importation of these intermediate commodities from other regions. As can be seen in Table 10, the relative income levels have a range between the two scenarios of 0.1 and 14.0 percent. The generally higher overall income levels found in the Olsen et al. study as compared to this analysis, are largely a result of the different definitions of provincial demand used in each analysis.

Comparison Between Scenario II, Scenario III, and Scenario IV

This section utilized Scenario II (base 1978 situation under statutory rates with ±20 percent production flexibility ranges) as the basis for comparison with two other scenarios. Scenario III represented the 1978 situation with compensatory freight rates with ±20 percent ranges. Scenario IV represented the same situation as Scenario III except that the maximum production flexibility constraint expanded to +40 percent from +20. This analysis first determined the potential impacts on each farm size's value of production and net income level of replacement of statutory freight rates with compensatory rates and branch line rationalization in 1978 (Scenario III). Secondly, this analysis determined the extent to which production on the other farm sizes was prevented from assimilating production formerly held by small farms because of the +20 percent maximum production increment of Scenario III.

Farm size impacts. Replacement of the present statutory rates with compensatory rates combined with branch line rationalization, resulted in a provincial reduction of gross value of production in Scenario III of $52.7 million, as shown in Table 8. More specifically, this broke down into a $0.6 million, a $22.7 million, and a $29.5 million

Table 10

Region	Farm Size	Scenario I Net Farm Income/Farm[a]	Scenario I Net Farm Income/Farm[b]	Percent Difference Between Olsen Sc. I and Olsen et. al. Sc. I
Province	Small	-1,155	-1,185	2.6
	Medium	1,230	1,132	8.0
	Large	14,729	14,148	3.9
	Average	2,867	2,685	
Southwest	Small	- 440	- 473	7.5
	Medium	2,883	2,789	3.3
	Large	22,089	21,148	4.3
	Average	5,794	5,540	
Northwest	Small	- 761	- 782	2.8
	Medium	1,681	1,648	2.0
	Large	17,456	17,423	0.1
	Average	2,915	2,887	
Central	Small	-2,302	-2,385	3.6
	Medium	1,270	1,122	11.6
	Large	11,655	10,830	7.1
	Average	2,693	2,393	
Eastern	Small	-1,103	-1,109	0.5
	Medium	-1,488	-1,696	14.0
	Large	8,463	8,023	5.2
	Average	204	69	
Interlake	Small	-1,232	-1,218	1.1
	Medium	-1,082	- 979	9.5
	Large	5,606	5,989	6.8
	Average	- 185	- 87	

[a]Taken from: K. Olsen, E.W. Tyrchniewicz, and C.F. Framingham, Impacts of Changes in Statutory Grain Rates and Rail Branch Line Configuration on Manitoba's Agricultural Economy. Report prepared for the Manitoba Department of Agriculture, March 1980, Table 3.

[b]Taken from this study, Table 9.

reduction in gross value of production on small, medium, and large farms, respectively, in Scenario III. The expanded production ranges of Scenario IV largely offset the value of production effects of compensatory rates and branch line rationalization. Provincial total gross value of production losses were reduced to $0.5 million on small farms and $0.3 million on medium farms. Large farms experienced the most significant increase of $24.3 million.

The value of crop production on small farms declined by $0.3 million in Scenario III as a result of decreased production of oats and reduced value of rapeseed production (as shown in Appendix B). There was a significant increase in sunflower production as the profitability of producing this crop was enhanced by the increased transportation costs on the six "statutory" grains. The increased production maximum ranges of Scenario IV continued the trend away from oats production. There was a significant rise in rapeseed production in Scenario IV as "efficient" producers took advantage of the increased ranges to expand their own production. This resulted in a gross crop value of production increment in Scenario IV of $1.7 million on small farms. There was a shift in sunflower production from small to medium and large farms. The value of livestock production on small farms declined in Scenario III by $0.2 million and by $2.2 million in Scenario IV. Both scenarios experienced a general decline in milk production. The majority of the gross value of livestock production decline in Scenario IV was caused by a large reduction in market hog production on small farms which offset small increments in calf, stocker cattle, and fed beef production. The increased production maximum limits permitted hog production on large farms to absorb a large proportion of the production formerly held by

small farms. The combination of these revenue reductions in Scenario III resulted in net farm income declining by $32 per small farm as shown on Table 9. Increased rapeseed and cattle production on small farms in Scenario IV offset reductions in sunflowers, market hogs, and milk to increase small farm net income by $52 per farm.

Gross value crop production on medium farms fell by $21.1 million in Scenario III and $17.2 million in Scenario IV, as a result of decreased wheat, barley, and rye production, as shown in Appendix B. Generally, medium farms reduced production of export wheat and barley; wheat, oats, and barley for sale as feed; and feed wheat. There was a small increase in feed barley production in Scenario III and a larger increase in feed oats and barley in Scenario IV to support increased livestock production. Flax and rapeseed production remained constant in Scenario III despite increased transportation costs. Scenario III also had a significant increase in sunflower production as land formerly held in grain production was switched into sunflowers, whose profitability had been enhanced by the increased transport costs on the other principal crops. This increment in sunflowers was also present in Scenario IV although the magnitude of the increase was not as great due to increased production of oats, flax, and rapeseed, which utilized land formerly diverted to sunflower production. The gross value of livestock production remained constant in Scenario III, with a slight reduction in calf production being largely offset by an increase in fed beef production. The increased production limits in Scenario IV permitted a substantial increase in stocker cattle and fed beef production on medium farms. As before, increased market hog production on large farms took over a large portion of the market hog market formerly produced by medium producers. In total,

livestock gross value of production for medium farms declined by $0.1 million in Scenario III and increased by $11.9 million in Scenario IV. The increased transport costs and lower value of production in Scenario III reduced net farm income on medium farms by $627 per farm. A significant portion of this income loss was recovered when the production maximums were expanded in Scenario IV to +40 percent above the 1978 actual production levels. Net farm income still fell $362 per farm in Scenario IV but medium producers were able to make better use of the comparative advantage they possessed to produce specific commodities to reduce the impact of increased transportation costs.

Crop production remained fairly constant on large farms in Scenario III except for reductions in wheat and rye and an increase in sunflower production. Primarily caused by increased transportation costs, the gross value of crop production on large farms fell by $29.9 million in Scenario III, as shown in Appendix B. There was a shift out of feed oats and barley into oats for sale as feed and export barley. Sunflower production replaced some of the acreage formerly held by wheat. Scenario IV experienced increased production of oats, barley, rapeseed, rye, and sunflowers, which still resulted in a $10.1 million loss in the gross value of crop production on large farms. Only export wheat and flax continued to decrease. There were large increments in oats and barley for sale as feed as large farms diverted their production from export to local feed markets. As well, to support the large expansion in livestock numbers in Scenario IV, feed wheat, oats, and barley production rose. Livestock production on large farms in Scenario III was largely constrained by the 20 percent maximum range, allowing only a negligible increase in the gross value of livestock production of $0.4 million

through increased calf and milk production. Expanded production of calves, stocker cattle, fed beef, market hogs, and milk increased the gross value of livestock production in Scenario IV by $34.4 million on large farms. After the production constraints, that contributed to the reduction of net per farm income by $4,023 in Scenario III, were expanded, the net farm income loss in Scenario IV was reduced to $2,134 per large farm.

Regional impacts.[44] The gross total value of production in the Interlake region in Scenario III declined $0.3 million, $0.6 million, and $2.2 million for small, medium, and large farms, respectively. These losses continued on small farms in Scenario IV, as the value of production fell by $0.6 million. However, the gross value of production rose by $1.2 million on medium farms and by $6.7 million on large farms in Scenario IV, due primarily to increased livestock production arising from the expanded production bounds.

There was limited crop production on small farms in the Interlake region in both Scenarios III and IV, such as potato and sugar beet production in crop district 11. Production of calves, stocker cattle, fed beef, and milk slightly declined in both scenarios. The removal of "non-optimal" small producers in the Interlake region, resulted in a $7 per small farm in Scenario III and a $12 per farm in Scenario IV increase in net per farm income in the Interlake.

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[44]Please note that all general value of production figures are obtained from Table 8. All per farm net income figures are shown on Table 9. A detailed description of the individual commodity distributions are given in Appendix B.

The value of crop production on medium and large farms in the Interlake region declined although most crop production remained constant. Decreased production of oats on medium farms, and flax and rye on large farms in Scenario II combined with increased transport costs for the six principal crops, resulted in a gross value of production decline of $0.6 million on medium farms and $2.3 million on large farms in the Interlake. Net farm income declined as well by $37 per medium farm and $720 per large farm in Scenario III. Livestock production on medium and large farms was largely constrained by the -20 percent maximum limit as there was only a slight increase in calf production on large farms. The expanded maximum ranges in Scenario IV did not significantly change crop production on medium and large farms. However, there were substantial changes in the value of livestock production as stocker cattle and fed beef numbers increased by $1.8 million on medium farms and increments of calf, stocker cattle, fed beef, and market hog production amounting to $8.7 million on large farms. This reduced the impact of increased transport costs on net farm income as income fell by only $10 per medium farm and increased income on large farms by $2,246 per farm in the Interlake.

The Eastern region had no change in the value of production on small farms in Scenario III while medium and large farms lowered their respective value of production by $0.7 million and $1.6 million. Scenario IV resulted in further value of production losses amounting to $1.1 million on small farms and $0.9 million on medium farms. Large farms increased their value of production by $3.1 million in Scenario IV in the Eastern region.

Small farm crop production in the Eastern region was restricted to only sunflowers, potatoes, and sugar beets, all of which were not directly effected by replacement of statutory rates in Scenario III and whose production levels did not change in response to the increased production ranges in Scenario IV. Livestock production did not change in Scenario III. All gains in the value of livestock production in Scenario IV derived from increased calf, stocker cattle, and fed beef production were nullified by a substantial decrease in market hog production. There was a shift in market hog production from small to large farms. As a result of identical production patterns on small farms in the Eastern region, there was no change in net per farm income in Scenario III. The removal of inefficient small hog producers in Scenario IV, helped increase net farm income by $21 per small farm in the Eastern region.

Crop production on medium and large farms in the Eastern region remained constant although the gross values of crop production fell by $0.7 million on medium farms and $1.6 million on large farms due to the increased transportation costs for export grains. With the increased production maximums in Scenario IV, medium farm production of oats, rapeseed, and sunflowers increased while large farms' production increased for oats, barley, flax, rapeseed, and sunflowers. The value of crop production in Scenario IV still fell by $0.5 million on medium farms and $0.9 million on large farms in the East. Livestock production levels for both farm sizes experienced a general increase in calf, stocker cattle, and fed beef production. However, a large transfer of market hog production from medium to large farms negated the increments in the gross value of livestock production on medium farms. Consequently, the gross value of livestock production for medium farms fell by $0.5

million while the value of production for large farms increased $4.1 million. With the limited role livestock played in Scenario III of offsetting the increased transportation costs for export grains, net farm income declined $155 per medium farm and $1,481 per large farm in the Eastern region. The expanded production ranges and the transfer of some of the inefficient medium market hog production to large producers in Scenario IV permitted net farm income on medium farms to increase $173 per farm. Large farms experienced a further drop in net farm income of $1,689 per farm to a partial extent due to increased costs associated with producing enough feed to support expanded livestock production, being greater than the relative revenues associated with producing the animals. This refers in particular to market hog production. The increased transportation costs for export grains also helped lower net farm income of large farms in the Eastern region.

All three farm sizes reduced their value of production levels in the Central region in Scenario III. The value of production fell by $0.2 million, $11.7 million, and $8.7 million on small, medium, and large farms, respectively. The value of production in Scenario IV increased by $1.1 million on small farms and $11.2 million on large farms. Medium farms in the Central region had a $6.7 million reduction in their total value of production in Scenario IV.

Small farms in the Central region experienced no change in crop or livestock production in either scenario except for an increase in rapeseed, stocker cattle, and fed beef production in Scenario IV. Net farm income on small farms fell by $80 per farm in Scenario III due to increased transportation costs. This loss was reduced by increased production of rapeseed and livestock in Scenario IV to $37 per small

farm in the Central region.

Increased transportation costs in Scenario III, reduced the gross value of crop production on medium and large farms in the Central region by $11.7 million and $8.7 million, respectively. There were no major changes in livestock production for either farm size. Medium farms reduced their production of export wheat, barley, and rye. Increased production of rapeseed in Scenario IV on medium farms reduced this production value loss to $9.7 million. Increased calf, stocker cattle, and fed beef production amounting to $3.0 million helped lower the intial net income reduction for medium farms from $823 per farm in Scenario III to $480 per farm in Scenario IV. Increased production of wheat, oats, barley, rapeseed, and rye on large farms increased the gross value of crop production by $4.2 million. Increased calf, stocker cattle, fed beef, and market hog production increased large farms' gross livestock value of production in the Central region by $7.0 million. These increments helped reduce the loss in net farm income from $3,753 in Scenario III to $2,236 per large farm in the Central region in Scenario IV.

Small farms in the Southwest region had a gross value of production increment of $0.02 million in Scenario III. This contrasted with a $5.2 million and a $12.4 million reduction in the value of production on medium and large farms, respectively. The expanded production ranges in Scenario IV, increased the value of production in the Southwest by $1.3 million on small farms and $1.7 million on large farms. Medium farms still experienced a small reduction in the value of production in Scenario IV of $0.2 million.

Small farms in the Southwest region had an increase in the gross value of crop production of $0.02 million due to increased sunflower

production in Scenario III. Oat production in this scenario fell on small farms while livestock production remained constant. Increased rapeseed production in Scenario IV further increased the value of crop production by $0.3 million. Increased production of calves, stocker cattle, and fed beef offset reduced market hog production on small farms. This resulted in an increase of $1.0 million in the gross value of livestock production. Net farm income for small farms in Scenario III decreased by $25 per farm. Increased rapeseed and livestock production in Scenario IV countered this reduction by increasing net farm income in the Southwest region by $182 per small farm.

In the Southwest, the crop production value for Scenario III on medium farms fell by $5.3 million despite reductions in wheat production only. Barley for export and feed as well as sunflower production rose on medium farms. Large farms experienced a $12.6 million crop production value reduction in Scenario III as a result of increased transport costs. Export wheat production also declined on large farms while production of flax and sunflowers increased. Livestock adjustments in Scenario III were limited to a slight decrease in calf production along with increased fed beef production on large farms. With the expansion of the production maximums in Scenario IV, the decrease in medium farms' value of crop production still amounted to a loss of $5.2 million, despite increased oats, flax, rapeseed, and rye production. Export wheat declined on medium farms as land formerly held in wheat production was converted into one of the other crops in which production had increased. The value of crop production on large farms dropped by $8.2 million in Scenario IV despite increased production of oats, barley, flax, rapeseed, and rye. Only export wheat production declined. Livestock production in Scenario IV

amounted to a $5.0 million increment in the gross value of livestock production on medium farms. This was caused by increased calf, stocker cattle, and fed beef production. These commodities plus market hogs and milk increased the livestock production value on large farms by $9.9 million in the Southwest region. As a result of increased livestock production on both farm sizes, the net farm income reductions of $972 per medium farm and $6,090 per large farm incurred in Scenario III were lowered to $712 and $3,863, respectively in the Southwest region.

In the Northwest region in Scenario III, the gross values of production declined for small, medium, and large farms by $0.05 million, $2.9 million, and $4.5 million, respectively. This decline in the value of production continued in Scenario IV for only small farms, whose value of production dropped by $1.3 million. Medium and large farms in the Northwest had increments in their respective value of production in Scenario IV of $1.4 million and $1.8 million.

Crop production in the Northwest region did not change on small farms in Scenario III. There was a $0.1 million decline in the gross value of crop production resulting from increased transportation costs. The expanded upper range in Scenario IV increased this crop production value by $0.5 million with increases in rapeseed and sunflower production. Both scenarios experienced small production value increments of stocker cattle and fed beef amounting to $0.1 million in Scenario III and $0.9 million in Scenario IV. Net farm income for small farms in the Northwest region declined by $46 per farm in Scenario III. This loss was overcome by increased rapeseed, sunflower, and livestock production in Scenario IV, as small farm net income rose $56 per farm in the Northwest region.

Production in Scenario III remained unchanged on both of the other farm sizes except for a reduction in wheat production on medium farms and increased production of feed barley on large farms. The value of crop production fell $2.9 million on medium farms and $4.5 million on large farms in Scenario III. There was a slight increase of $0.5 million in the value of livestock production derived from increased calf and fed beef production on large farms. As a consequence of increased transportation costs on export grains, net farm income declined on medium and large farm sizes in Scenario III by $596 and $4,419, respectively, in the Northwest region. Scenario IV brought about increased production of flax, rapeseed, rye, and sunflowers on medium farms, which reduced the gross crop production value loss to $1.2 million. Export wheat on medium farms continued to decline. Large farms reduced production of wheat, oats, barley, and flax, and increased production of rapeseed, rye, and sunflowers. The total gross value of crop production decrease for large farms in Scenario IV was $2.9 million. Medium farms increased livestock production value by $2.6 million with expanded stocker cattle and fed beef production. There was a small shift in calf and market hog production frm medium to large producers. Increased large farm production of calves, stocker cattle, fed beef, and market hogs, increased the value of livestock production by $4.8 million. In total, for Scenario IV, net farm income in the Northwest region for medium farms still fell $298 per farm. Net farm income also fell by $1,687 per large farm in the Northwest in Scenario IV.

Comparison Between Scenario II, Scenario V, and Scenario VI

This analysis compared the base Scenario II (1978 situation under statutory freight rates at ±20 percent range) with Scenario V (1985 situation with compensatory rates at ±20 percent production ranges) and Scenario VI (1985 situation with compensatory rates at -20 to +40 percent ranges). The initial comparison was to further determine the impacts of replacement of statutory freight rates and branch line rationalization in 1985 (Scenario V). Scenario VI determined the extent to which special crops and livestock production could offset the decreased revenues resulting from increased transportation costs for export grains when the production maximum ranges were expanded.

Farm size impacts.[45] Provincially, the gross value of production losses increased beyond the levels of the previous section. The value of production in Scenario V for small, medium, and large farms respectively declined by $1.4 million, $25.3 million, and $37.1 million. The expanded production flexibility of Scenario VI, removed a large proportion of this value of production decline. Consequently, the value of production declined by $0.6 million on small farms and $3.5 million on medium farms. The value of production on large farms increased by $16.1 million in Scenario VI.

Small farms experienced a gross reduction in the value of crop production in Scenario V of $0.5 million, caused by declining production value from rapeseed production combined with reduced oat production.

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[45]Aggregate farm value of production figures obtained from Table 8. All net per farm income figures came from Table 9. The exact commodity distributions and value of production figures by farm size are shown in detail in Appendix B.

This decline was slightly offset by a small increase in sunflower production. Oats production continued to fall on small farms in Scenario VI, and sunflower production shifted from small to medium and large farms. Only rapeseed production rose on small farms in Scenario VI, which led to an increase in the gross value of crop production by $1.6 million. Significant reductions in market hog and milk production in Scenario V created a gross decline in the value of livestock production of $0.9 million despite small increments of stocker cattle and fed beef numbers. The transfer of market hog and milk production value from small farms to large farms continued in Scenario VI still exceeded the value of increased calf, stocker cattle, and fed beef production on small farms. Consequently, the gross value of livestock production fell $2.2 million. Decreased hog production did not adversely effect small farm income, as net farm income declined $39 per farm in Scenario V primarily due to increased transportation costs where as in Scenario VI, net farm income rose $42 per small farm as a result of increased cattle production.

There was a general reduction in the value of crop production on medium farms as a result of increased transportation costs in Scenario V. Only sunflower production increased while wheat, oats, barley, flax, and rye production declined. The gross crop production value fell by $24.5 million with major production drops in export wheat and barley. There was a slight increase in feed barley production as barley production for export shifted into local feed barley markets. The expanded production maximums in Scenario VI altered this pattern as the value of crop production losses were reduced to $20.4 million by increased production of feed oats, flax, rapeseed, and sunflowers. Livestock production in Scenario V

was tightly constrained by the upper maximum production bounds. As a result, the gross value of livestock production on medium farms rose marginally by $0.7 million with small increments in fed beef and market hog production being largely offset by decreased calf production. The livestock production value rose in Scenario VI by $11.9 million due to increased calf, stocker cattle, and fed beef production. Market hog production fell as production formerly held by medium producers was taken over by large farms. The production constraints in Scenario V prevented livestock production from offsetting the effects of increased transport costs on export grains. As such, net farm income on medium farms fell by $851 per farm in Scenario V. This was reduced to a net decline of $547 per medium farm in Scenario VI due to increased livestock production.

Large farms gross value of crop production fell by $37.6 million despite only production reductions of export wheat and rye in Scenario V. There was a small shift from feed barley into export barley as large producers could produce barley for export at a profit while feed barley was available from medium producers who had substituted feed barley for export barley production. Besides increased barley production, there were also increments in flax and sunflower production. Increased oats, barley, rapeseed, rye, and sunflower production in Scenario VI reduced declines in the gross value of crop production on large farms to $18.3 million. The general reduction in export wheat continued, but there were substantial increases in feed wheat, oats, and barley as well as oats and barley for sale as feed to support the large increase in livestock production. The expansion of sunflower production in Scenario VI was inhibited by the parallel expansion of feed grains and rapeseed production, which competed more favourably and were required in greater

quantities for feed than were sunflowers. A portion of flax production was replaced in favour of expanded rapeseed acreage. The narrow constraints of Scenario V limited livestock expansion to only a $0.4 million increase in the value of calf, fed beef, and milk production. However, livestock production value jumped $34.4 million in Scenario VI due to the expanded production maximums. There was increased calf, stocker cattle, fed beef, market hogs, and milk production. Consequently, the fall in net farm income on large farms in Scenario V of $4,970 per farm, was reduced to $3,206 per large farm in Scenario VI as a result of increased livestock production, partially offsetting the increased transportation costs of export grain.

Regional impacts. The gross value of production in the Interlake region declined by $0.3 million, $0.8 million, and $2.6 million, on small, medium, and large farms, respectively, in Scenario V. Small farm value of production in Scenario VI fell by $0.6 million while the production value of medium and large farms rose by $1.0 million and $6.2 million, respectively, in the Interlake region.

Crop production on small farms in the Interlake region remained unchanged for both scenarios. The value of livestock production for calf, stocker cattle, and fed beef, declined in Scenario V and Scenario VI by $0.08 million and $0.2 million, respectively. Despite these gross revenue reductions, net farm income on small farms increased by $7 per farm in Scenario V and $22 per farm in Scenario VI in the Interlake.

Medium farms in the Interlake lowered their production of oats and rye in Scenarios V and VI while the production of all other crops remained unchanged. Increased freight rates lowered the gross value of

crop production by $0.7 million in both scenarios. The value of livestock production on medium farms in Scenario VI rose by $1.8 million due to increased stocker cattle and fed beef production. Calf production fell as production switched to large farms in the Interlake. Constrained livestock production in Scenario V lowered net income on medium farms by $55 per farm. The loss of calf production contributed to a reduction in Scenario VI of $65 per medium farm in the Interlake.

The value of crop production on large farms in the Interlake fell $2.8 million in Scenario V, with production declining for flax and rye only. This trend continued in Scenario VI, with declining production of flax and rye being countered slightly by an increase in feed oats. Crop value of production on large farms in the Interlake fell by $2.5 million in Scenario VI. A small increase in the value of calf production amounting to $0.15 million on large farms, was the only change in livestock production for Scenario V. Scenario VI experienced a $8.7 million increase in the value of livestock production caused by increased production of calves, stocker cattle, fed beef, and market hogs. The increased market hog production had generated the increased supply of feed oats produced on large farms. This increased livestock production had a substantial effect on net farm income on large farms. This converted an original $908 decline in per farm net income into a $2,126 increase in net per farm income on large farms in the Interlake.

Small farms in the Eastern region had no change in their value of production in Scenario V. Medium and large farms experienced gross reductions in their respective value of production by $0.9 million and $2.0 million in Scenario V. Small and medium farms' values of production

declined by $1.0 million and $1.1 million, respectively, in Scenario VI. The production value on large farms in the Eastern region rose by $2.7 million in Scenario VI.

Small farm production in the Eastern region was limited to sunflowers, potato, and sugar beet production, which remained unchanged in both scenarios. Livestock production did not change and as such, there was no change in net farm income on small farms in the Eastern region in Scenario V. Increased production of calves, stocker cattle, fed beef, and milk was nullified by a large decline in market hog production, some of which was taken over by large producers. The increased cattle and milk production combined with the reduction of some inefficient small hog producers (in terms of production costs when compared to medium and large producers), led to a net per farm income increase of $20 in the Eastern region.

There was a $0.9 million reduction in the gross value of crop production on medium farms in the Eastern region in Scenario V. This was primarily due to increased transportation costs on export grains as only flax production dropped slightly. There was no change in livestock productions in Scenario V. Increased production of oats, rapeseed, and sunflowers slightly reduced the drop in gross crop production values in Scenario VI to $0.7 million. Reductions in calf and market hog production offset gross revenue increases from expanded stocker cattle and fed beef production. Net farm income on medium farms in the Eastern region fell $199 per farm in Scenario V. The switching of the livestock production mix in Scenario VI increased net farm income by $129 per farm.

Large farms in the Eastern region lost $2.0 million in the gross crop value of production due to changes in the statutory rates in Scenario V, although production levels remained constant. Livestock production did not change due to the limited production ranges in this scenario. Net farm income fell by $1,897 per large farm in the Eastern region in Scenario V. Increased production of oats, barley, flax, rapeseed, and sunflowers in Scenario VI lowered the loss in crop production value to $1.3 million. The value of livestock production increased by $4.1 million as a result of expanded calf, stocker cattle, fed beef, and market hog production. This increase was adequate to entirely overcome income losses incurred by increased transportation costs in Scenario VI, as net farm income declined on large farms by $2,102 per farm in the Eastern region.

The Central region experienced a general decline in gross value of production in Scenario V of $0.3 million, $12.9 million, and $11.1 million on small, medium, and large farms, respectively. These losses were partially offset by the expanded production ranges in Scenario VI. The value of production increased $1.1 million on small farms and $8.5 million on large farms in the Central region. Medium farms still possessed a $7.7 million reduction in their value of production in Scenario VI, although this loss was not as severe as the production value decline in Scenario V.

The Central region experienced no change in crop or livestock production patterns on small farms in Scenario V. There was a $0.3 million reduction in the gross value of crop production brought about by increased transport costs for rapeseed. Rapeseed, stocker cattle, and fed beef production on small farms rose in Scenario VI. The production

increments reduced the impact of increased transport costs on net farm income from a reduction by $92 per farm in Scenario V to a reduction by $53 per farm in Scenario VI in the Central region.

Medium farms in Scenario V reduced production of export wheat, barley, and rye as crop production value in the Central region dropped $12.9 million. There was no change in livestock production in Scenario V. Medium producers in Scenario VI experienced similar reductions in wheat, barley, and rye as well as oats production. Only rapeseed production increased to slightly reduce the gross crop production value drop to $10.7 million. However, the expanded production ranges on medium farms permitted limited expansion of stocker cattle and fed beef production in the Central region. These increments helped reduce the $1,117 per medium farm loss in net farm income incurred in Scenario V to $750 per farm in Scenario VI in the Central region.

In Scenario V, large farm production levels remained unchanged for both crops and livestock, despite suffering a gross loss of $11.1 million in crop production value in the Central region. The expanded production ranges of Scenario VI permitted increased production of wheat, oats, barley, rapeseed, and rye, which increased the value of crop production by $1.6 million. The value of livestock production on large farms in Scenario VI also rose by $7.0 million through increased production of calves, stocker cattle, fed beef, and market hogs. This reduced the net income loss of $4,770 per large farm in Scenario VI to $3,388 per farm in Scenario VI in the Central region.

Reductions in the value of production of $0.7 million, $5.7 million, and $15.4 million on small, medium and large farms, respectively, accompanied the establishment of compensatory rates and branch line

rationalization in the Southwest region in Scenario V. Expansion of the production ranges increased the value of production in Scenario VI on small farms to $1.2 million. The value of production losses were lowered on medium and large farms to $1.4 million and $1.5 million, respectively, in Scenario VI, in the Southwest region.

Oats and market hog production fell on small farms in the Southwest region in Scenario V. There was an increase in sunflower production on small farms. Oats, sunflower, and market hog production on small farms fell in Scenario VI while rapeseed, calf, stocker cattle, and fed beef production marginally increased. Consequently, the decline in net farm income of $33 per small farm in Scenario V was changed into a net gain of $162 per small farm in the Southwest region in Scenario VI.

Medium farms in the Southwest region increased production of barley and sunflowers while lowering export wheat production in Scenario V. The gross value of crop production fell $6.4 million. Small increases in fed beef and market hogs offset a reduction in calf production, to increase the gross value of livestock production in Scenario V by $0.7 million on medium farms. The expanded ranges of Scenario VI increased production of oats, flax, rapeseed, and rye on medium farms. Crop production value still fell $6.4 million with reduced production of wheat and barley. Significant increments in calf, stocker cattle, and fed beef production brought the gross value of livestock production in Scenario VI to $5.0 million. Increased livestock production resulted in net farm income falling by only $956 per medium farm in Scenario VI as compared to a reduction of $1,339 per farm in Scenario V in the Southwest region.

Scenario V resulted in reduced wheat production and increased flax and sunflower production on large farms in the Southwest. The gross value of crop production fell $15.7 million while livestock production value rose only $0.2 million as a result of increased milk production. Scenario VI continued to reduce wheat production while oats, barley, flax, rapeseed, and rye production expanded. The value of crop production on large farms declined by $11.5 million. The value of livestock production rose $9.9 million as calf, stocker cattle, fed beef, market hog, and milk production increased. This reduced the $7,391 per large farm reduction in net farm income in Scenario V to a $5,405 per farm reduction in net farm income in Scenario V.

The Northwest region had reduced value of production levels on all farm sizes in Scenario V. Small, medium, and large farms experienced lowered value of production levels by $0.1 million, $3.4 million, and $5.6 million, respectively. Only small farms had a further production value decline of $1.3 million in Scenario VI. The gross value of production for medium and large farms in the Northwest region, increased respectively by $0.8 million and $0.7 million in Scenario VI.

In the Northwest region, small farm crop production remained unchanged in Scenario V although there were very small increments in stocker cattle and fed beef production. Production of rapeseed, sunflowers, stocker cattle, and fed beef production increased in Scenario VI. There was a large reduction in market hog production on small farms in the Northwest region. Net farm income on small farms declined by $56 per farm in Scenario V and increased by $45 per farm in Scenario VI.

The value of crop production on medium farms in the Northwest region declined by $3.4 million in Scenario V with reduced production of

wheat, flax, and rye. Livestock production remained constant in Scenario V. Increased medium farm production of rapeseed and sunflowers slightly offset the decreased production levels of wheat, flax, and rye, and the value of crop production in Scenario VI fell by $1.7 million. Increased stocker cattle and fed beef production offset reduced calf and market hog numbers, to raise the livestock gross production value by $2.6 million. Medium net farm income fell by $738 per farm in Scenario V. Increased livestock production lowered this loss to $446 per medium farm in Scenario VI in the Northwest.

Large farms in the Northwest increased barley and lowered flax production in Scenario V. Overall, there was a $5.7 million value of production loss for crops. Livestock production on large farms remained virtually unchanged, except for a very small increase in fed beef production. Production of wheat, oats, barley, and flax continued to drop in Scenario VI while rapeseed, rye, and sunflower production increased. The value of crop production losses were reduced to $4.1 million. Large increases in calf, stocker cattle, fed beef, and market hog production on large farms in Scenario VI, increased the value of livestock production $4.8 million. The impact of the increased livestock production was to reduce the income loss to large farmers from $5,360 per farm in Scenario V to $2,711 per farm in Scenario VI. These losses were a direct result of increased transportation costs brought about by replacement of statutory freight rates for export grains and branch line rationalization.

Sensitivity of the Analysis

Commodity pricing plays an integral role in the production-decision process of linear programming. The environment in which these prices

are determined in turn generates the linear programming allocation process whereby scarce resources are allocated between alternate production processes. The significance of the final analysis is, then, highly dependent on the sensitivity of any linear programming solution to price changes. The sensitivity of the final solution can be determined through examination of the "shadow-prices" of the specific commodities.[46]

This analysis examined the shadow prices of Scenario II and Scenario VI. These two scenarios represented the two extremes between which the other four scenarios lay. From Table 11, crop production was generally insensitive to moderate price changes, except for sunflowers. Up to a 10 percent price change, in aggregate, would have a significant impact on the production of sunflowers. An example of the relative stability of the other crop commodities would be, for example, rapeseed. On small farms in crop district 1 in Scenario II, it would take over a 32% price drop to significantly alter rapeseed production.

Livestock commodity prices were slightly more variable as shown in Table 12. Calf prices for dairy and beef were moderately sensitive to price changes depending upon the region being examined. For example, in Scenario II a 5% change in beef calf prices would increase production on medium farms in crop district 7. Stocker cattle prices for dairy and beef were insensitive to price changes, in aggregate. In the same

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[46]Shadow prices are defined by Heady and Candler as "Positive $Z_j - C_j$ values indicate that an increase in the jth real activity will decrease profit. These quantities for disposal activities do have positive economic meaning. They represent the marginal value products of the corresponding resources and are sometimes called shadow prices." E. O. Heady and W. Candler, Linear Programming Methods (Ames, Iowa: Iowa State University Press, 1958), p. 85.

Table 11

Shadow Price Comparison for Crop Activities in Scenario II and Scenario VI

Crop District		Beef Calves 500 Sc. II	Beef Calves 500 Sc. VI	Beef Calves 700 Sc. II	Beef Calves 700 Sc. VI	Finished Beef Sc. II	Finished Beef Sc. VI	Dairy Calves 500 Sc. II	Dairy Calves 500 Sc. VI	Dairy Calves 700 Sc. II	Dairy Calves 700 Sc. VI	Dairy Finished Sc. II	Dairy Finished Sc. VI
1	Small	57.79	51.05	- 85.83	- 96.64	-[a]	-	12.14	16.53	-14.56	-	-	-
	Medium	51.16	41.61	- 85.83	- 96.64	-	-	- 2.74	2.98	-30.88	-17.65	-	-
	Large	18.22	9.75	- 78.16	- 85.57	-18.23	-22.27	-13.18	-7.46	-45.94	-32.71	-	-
2	Small	-	- 2.21	-110.49	-122.48	-	-	10.02	13.68	-48.98	-26.68	-	-
	Medium	- .52	5.96	-132.46	-141.23	-	-	- 3.66	-	-68.33	-46.02	-	-
	Large	-30.25	-35.69	-147.52	-156.29	-	-	-14.10	-10.44	-83.39	-61.08	-	-
3	Small	100.66	93.15	- 82.54	- 94.37	-	-	-	-	-14.17	-	-	-
	Medium	96.60	88.33	- 82.54	- 94.37	-	-	-	4.73	-28.73	-14.97	.72	-
	Large	63.21	53.19	- 92.19	-104.02	-	-	-10.44	-5.71	-43.07	-30.03	-	-
4	Small	42.99	34.85	-68.33	- 81.61	-	-	-	18.54	- 3.09	1.71	-	4.33
	Medium	32.71	24.57	-76.49	- 89.86	-	-	- 4.05	4.24	-25.97	-10.92	3.62	-
	Large	3.00	-	-91.56	-110.07	-	-	-14.49	- 6.20	-37.01	-25.98	-	-
5	Small	30.55	23.38	-63.26	- 75.41	-	-	20.48	34.41	-	7.07	-	5.27
	Medium	26.16	12.32	-74.31	- 81.42	-	-	11.78	15.12	-24.12	- 6.47	2.34	-
	Large	- 3.56	-10.73	-89.38	-103.16	-	-	1.34	4.68	-35.58	-20.53	-	-
6	Small	3.63	9.57	-112.60	-104.41	-	-	-	13.15	-53.86	-18.31	-	-
	Medium	-	4.89	-130.88	-121.65	-	-	-13.05	-	-72.88	-37.33	-	-
	Large	-26.57	-18.16	-149.10	-143.39	-	-	23.49	-10.44	-87.94	-52.39	-	-
7	Small	16.07	11.38	- 86.19	- 96.92	-	-	19.12	24.58	-27.17	- 8.60	-	-
	Medium	9.44	4.68	-106.20	-116.87	-	-	1.50	6.96	-48.67	-30.11	-	-
	Large	-13.61	-18.37	-127.94	-138.61	-	-	- 8.94	- 3.48	-63.73	-45.17	-	-
8	Small	26.81	21.90	- 64.67	- 75.41	-	-	-	34.50	- 5.64	7.02	-	-
	Medium	17.94	12.92	- 83.29	- 93.93	-	-	5.02	10.38	-27.63	- 9.23	-	-
	Large	- 5.11	-10.13	-105.03	-115.67	-	-	- 5.42	- .06	-42.69	-24.29	-	-
9	Small	-	5.89	- 97.09	-108.08	-	-	-	-	-78.49	-53.89	-	-
	Medium	11.96	1.97	-123.35	-127.65	-	-	- 1.94	3.38	-61.05	-41.75	-	-
	Large	-17.77	-21.08	-135.70	-144.28	- 2.44	- 4.61	-12.38	- 7.06	-76.11	-56.81	-	-
10	Small	5.78	3.04	- 91.20	-106.90	-	-	18.58	18.58	-36.03	-12.74	-	-
	Medium	-	- .53	-113.33	-131.24	-	-	-	-	-58.43	-35.13	-	-
	Large	-23.12	-28.26	-135.00	-148.31	-	-	-10.44	-10.44	-73.49	-50.19	-	-
11	Small	28.10	27.27	- 83.98	- 93.60	-	-	-	-	-23.31	- 1.31	-	-
	Medium	29.73	23.05	-108.19	-111.96	-	-	- 3.75	2.67	-81.46	-30.72	25.90	-
	Large	-	-	-123.25	-133.70	-	-	-14.19	- 7.77	-79.54	-35.78	19.61	-
12	Small	-	33.71	- 60.39	- 81.01	-	-	16.67	31.72	-	11.40	-	-
	Medium	23.06	23.06	- 76.13	- 96.65	-	-	4.48	11.22	-21.49	- 6.71	-	-
	Large	-	-	- 97.86	-118.38	-	-	- 5.96	-	-36.55	-20.99	-	-

(Continued)

Table 11 (Continued)

Crop District		Weanlings		Finished Hogs		Milk		Cream		Eggs		Broilers		Turkeys	
		Sc. II	Sc. VI	Sc. II	Sc. VI	Sc. II	Sc. VI	Sc. II	Sc. VI	Sc. II	Sc. VI	Sc. II	Sc. VI	Sc. II	Sc. VI
1	Small	7.84	5.27	.66	1.43	.03	.02	.02	.01	-.01	-.01	-.26	-.29	-1.53	-1.69
	Medium	7.83	5.27	.66	1.43	.02	.02	.01	.01	-.01	-.01	-.26	-.29	-1.53	-1.69
	Large	6.12	3.56	-1.16	-.39	0.0	-0.0	.01	-.01	-.08	-.08	-.39	-.42	-1.58	-1.74
2	Small	7.44	5.21	-	-	.02	.02	.01	-	-.02	-.02	-.27	-.30	-1.62	-1.76
	Medium	7.44	5.21	-	.66	.02	.01	.01	.01	-.02	-.02	-.27	-.30	-1.62	-1.76
	Large	5.73	3.50	-1.82	-1.20	-0.0	-0.0	-.01	-.01	-.09	-.09	-.40	-.43	-1.67	-1.81
3	Small	8.54	6.19	.76	1.14	.03	.02	.02	-	-0.0	-.01	-.24	-.27	-1.37	-1.55
	Medium	8.54	6.19	.76	1.14	.02	.02	.01	.01	-0.0	-.01	-.24	-.27	-1.37	-1.55
	Large	6.83	4.48	-1.06	- .68	0.0	-0.0	-.01	-.01	- .07	-.36	-.36	-.40	-1.42	-1.60
4	Small	9.12	6.89	-	2.51	.03	.02	.02	-	-	.01	-.22	-.25	-1.25	-1.44
	Medium	9.12	6.89	2.52	2.51	.02	.02	.01	.01	.01	.01	-.22	-.25	-1.25	-1.44
	Large	7.41	5.18	.70	.69	-0.0	-0.0	-.01	-.01	-.06	-.06	-.35	-.38	-1.30	-1.49
5	Small	9.26	7.07	3.24	3.46	.03	.03	.02	.02	-	.01	-.27	-.25	-1.05	-1.22
	Medium	9.26	7.07	3.24	3.46	.02	.02	.01	.01	.01	.01	-.22	-.25	-1.05	-1.22
	Large	7.55	5.36	1.42	1.64	0.0	0.0	-0.0	-0.0	-.06	-.06	-.35	-.38	-1.64	-1.81
6	Small	6.42	5.61	-2.10	-	.02	.02	.01	.01	-.05	-.03	-.30	-.31	-1.76	-1.87
	Medium	6.42	5.61	-2.10	.27	.01	.01	0.0	.01	-.05	-.03	-.30	-.31	-1.76	-1.87
	Large	4.71	3.90	-3.92	-1.55	-.01	-0.0	-.01	-.01	-.12	-.10	-.43	-.44	-1.81	-1.92
7	Small	8.44	5.83	.44	1.43	0.0	0.0	-0.0	-0.0	-	-	-.26	-.28	-1.56	-1.70
	Medium	8.44	5.83	.44	1.43	-.01	-.01	-.01	- .01	-	-	-.26	-.28	-1.56	-1.70
	Large	6.72	4.11	-1.38	-.39	-.02	-.02	-.02	-.02	-.07	-.07	-.39	-.41	-2.14	-2.28
8	Small	9.85	7.24	2.16	3.14	.01	.01	-	-	-	.03	-.22	-.24	-1.32	-1.46
	Medium	9.85	7.24	2.16	3.14	-0.0	-0.0	-.01	-.01	.03	.03	-.22	-.24	-1.32	-1.46
	Large	8.13	5.52	.34	1.32	- .02	-.02	-.02	-.02	-.04	-.04	-.35	-.37	-1.90	-2.04
9	Small	7.66	5.10	1.00	-	0.0	-	-0.0	-0.0	-.01	-.01	-.29	-.31	-1.82	-1.94
	Medium	7.66	5.10	-1.00	.06	- .01	-.01	- .01	- .01	-.01	-.01	-.29	-.31	-1.82	-1.94
	Large	5.94	3.38	-2.82	-1.76	- .02	-.02	- .02	- .02	-.08	-.08	-.42	-.44	-2.40	-2.52
10	Small	7.59	5.00	- .48	-	0.0	0.0	- .01	- .01	-.03	-.03	-.30	-.32	-1.78	-1.89
	Medium	7.59	5.00	- .48	-	- .01	-.01	- .01	- .01	-.03	-.03	-.30	-.32	-1.78	-1.89
	Large	5.87	3.27	-2.30	-1.82	- .02	-.02	- .03	- .03	-.10	-.10	-.43	-.45	-1.83	-1.94
11	Small	8.46	6.02	.42	-	-	0.0	-0.0	-0.0	-	-	-.26	-.28	-1.60	-1.73
	Medium	8.46	6.02	.42	1.80	- .01	-.01	- .01	- .01	0.0	-.01	-.26	-.28	-1.60	-1.73
	Large	6.74	4.29	-1.40	-.02	- .02	-.02	- .02	- .02	- .07	-.06	-.39	-.41	-2.18	-2.31
12	Small	9.71	7.00	2.59	3.09	0.0	0.0	-0.0	-0.0	-	.01	-.26	-.29	-1.50	-1.68
	Medium	9.71	7.00	2.59	3.09	-0.0	-.01	- .01	- .01	.01	.01	-.26	-.29	-1.50	-1.68
	Large	7.99	5.28	.77	1.27	- .02	-.02	- .02	- .02	- .06	-.07	-.39	-.42	-1.55	-1.73

[a] "-" indicates that the commodity involved was not a constrained or limiting factor and as such, no shadow price was calculated.

Table 12

Shadow Price Comparison for Livestock Activities
in Scenario II and Scenario VI

Crop District		Wheat		Oats		Barley		Flax		Rapeseed		Rye		Sunflowers		Potatoes		Sugar Beets	
		Sc. II	Sc. VI	Sc. II	Sc. VI	Sc. II	Sc. VI	Sc. II	Sc. VI	Sc. II	Sc. VI	Sc. II	Sc. VI	Sc. II	Sc. VI	Sc. II	Sc. VI	Sc. II	Sc. VI
1	Small	.87	.87	.23	.24	.29	.29	-[a]	2.00	-2.06	-2.14	-	.38	-	0.0	-1.51	-1.51	*[b]	*
	Medium	.25	.25	-.13	-.12	-.08	-.08	.64	.64	-2.80	-2.89	-.15	-.08	.01	0.0	-1.51	-1.51	*	*
	Large	-	-	-.27	-.26	-.21	-.21	-	-	-3.14	-3.22	-.33	-.26	.01	0.0	-1.51	-1.51	*	*
2	Small	.30	.75	-	.19	.16	.36	.08	.76	-2.72	-2.30	-	1.19	-	0.0	-1.51	-1.51	*	*
	Medium	-.18	.27	-.29	-.10	-.16	.05	-.84	-.17	-3.25	-2.83	.28	.69	-	0.0	-1.51	-1.51	*	*
	Large	-.45	-	-.44	-.24	-.31	-.11	-1.46	-.78	-3.60	-3.18	.02	.43	-	0.0	-1.51	-1.51	*	*
3	Small	.82	.82	.47	.50	.39	.35	-	1.65	-1.63	-1.77	-	1.40	-	0.0	-1.45	-1.49	*	*
	Medium	.30	.30	.13	.15	.06	.02	.62	.56	-2.31	-2.46	.86	.83	0.0	0.0	-1.45	-1.49	*	*
	Large	-	-	-.07	-.04	-.12	-.15	-.10	-.16	-2.76	-2.91	.56	.54	0.0	0.0	-1.45	-1.49	*	*
4	Small	.67	.99	.72	.89	-	.75	-	1.70	-1.36	-1.09	-	.67	-0.0	-0.0	-1.52	-1.52	*	*
	Medium	-.09	.23	.12	.30	.08	.21	-.39	.09	-2.44	-2.17	-.24	.06	-0.0	-0.0	-1.52	-1.52	*	*
	Large	-.42	-.10	-.11	.07	-.15	-	-1.03	-.55	-2.92	-2.65	-.50	-.20	-0.0	-0.0	-1.52	-1.52	*	*
5	Small	.64	.82	1.06	1.13	.99	1.05	1.82	2.01	-1.29	-1.24	1.66	1.78	*	*	-1.49	-1.49	*	*
	Medium	.05	.23	.49	.57	.50	.56	.49	.68	-2.09	-2.04	1.00	1.12	*	*	-1.49	-1.49	*	*
	Large	-.18	-	.30	.37	.31	.38	-	.18	-2.43	-2.37	.75	.86	*	*	-1.49	-1.49	*	*
6	Small	1.57	1.90	1.39	.97	.97	.97	-	6.55	-	1.08	-	2.32	-0.0	-0.0	-1.53	-1.53	*	*
	Medium	.87	1.20	.82	.41	.40	.40	4.16	4.65	- .46	-.19	1.18	1.48	-0.0	-0.0	-1.53	-1.53	*	*
	Large	.25	.58	.41	-	-	-	2.20	2.69	-1.43	-1.15	.59	.90	-0.0	-0.0	-1.53	-1.53	*	*
7	Small	1.22	1.50	.63	.76	.75	.86	-	4.26	- .28	- .05	-	.98	-	.01	-1.45	-1.45	-	-
	Medium	.32	.60	.04	.17	.16	.27	1.78	2.23	-1.55	-1.32	-.06	.20	.01	.01	-1.45	-1.45	-	-
	Large	0.0	.28	-.13	-	0.0	.11	.86	1.30	-2.02	-1.79	-.28	-.02	.01	.01	-1.45	-1.45	-	-
8	Small	.79	1.12	.50	.64	.54	.69	2.75	3.20	-1.16	- .92	-	.31	-	.01	-1.45	-1.45	-	-
	Medium	-.02	.27	-.05	.09	-	.12	.94	1.39	-2.25	-2.01	-.57	-.30	.01	.01	-1.45	-1.45	-	-
	Large	-.30	-.01	-.21	-.07	-.15	-.03	.11	.56	-2.65	-2.41	-.74	-.47	.01	.01	-1.45	-1.45	-	-
9	Small	-	2.11	.38	.53	1.19	1.30	-	5.06	-	.86	-	2.14	-	.01	-1.46	-1.47	-.13	-.13
	Medium	.71	.98	-.26	-.12	.43	.54	2.57	3.01	-.63	-.41	.74	.99	.01	.01	-1.46	-1.47	-.13	-.13
	Large	.25	.52	-.47	-.32	.18	.29	.89	1.32	-1.61	-1.39	.37	.62	.01	.01	-1.47	-1.47	-.13	-.13

(Continued)

Table 12 (Continued)

Crop District		Wheat Sc. II	Wheat Sc. VI	Oats Sc. II	Oats Sc. VI	Barley Sc. II	Barley Sc. VI	Flax Sc. II	Flax Sc. VI	Rapeseed Sc. II	Rapeseed Sc. VI	Rye Sc. II	Rye Sc. VI	Sunflowers Sc. II	Sunflowers Sc. VI	Potatoes Sc. II	Potatoes Sc. IV	Sugar Beets Sc. II	Sugar Beets Sc. VI
10	Small	-	2.03	.66	1.04	-	1.07	-	1.71	-	1.15	-	2.52	-0.0	-0.0	-1.52	-1.52	*	*
	Medium	.91	1.16	-	.38	.42	.39	-.18	.23	-.62	.41	1.45	1.68	-0.0	-0.0	-1.52	-1.52	*	*
	Large	.35	.60	-.38	-	.03	-	-1.21	-.80	-1.58	-1.37	.96	1.19	-0.0	-0.0	-1.52	-1.52	*	*
11	Small	1.97	2.24	.82	.86	1.23	1.34	-	3.33	-	8.12	-	1.54	-	.01	-1.47	-1.47	-.16	-.16
	Medium	.75	1.02	-	.04	.37	.48	1.15	1.59	5.28	5.50	.23	.48	.01	.01	-1.47	-1.47	-.16	-.16
	Large	.29	.56	-.22	.19	.15	.26	-.33	.11	3.06	3.28	-.10	.15	.01	.01	-1.47	-1.47	-.16	-.16
12	Small	1.12	1.44	-	.67	1.09	1.24	-	2.77	3.32	3.58	-	.62	-	-	-1.51	-1.51	*	*
	Medium	.43	.75	-.25	.03	.37	.52	.74	1.22	1.43	1.69	-.16	.13	-	-	-1.51	-1.51	*	*
	Large	.05	.37	-.59	-.37	.02	.17	-.20	.28	.47	.73	-.40	-.11	-	-	-1.51	-1.51	*	*

[a] "-" indicates that the commodity involved was not a constrained or limiting factor and as such, no shadow price was calculated.

[b] "*" indicates that no commodity was produced in that region.

example as above, it would take over a 22% decline in stocker beef cattle prices to reduce production on medium farms. The difference between the calf and the stocker markets can be associated to the strength of the fed beef markets. The favourable prices for fed beef generated a strong demand, and a corresponding higher price, for stocker animals. However, the strength of these two markets was not transferred to the calf markets. The poor price environment for calves may be indicative of an abundance of cheap calves resulting from over-production of breeding herds in response to the favourable stocker cattle and fed beef markets. This abundance of cheap calves will eventually enter the stocker and fed beef markets, resulting in depressed prices in both markets.

Weanling hog production was generally insensitive to price changes while finished hog production was sensitive. The market conditions for weanling hog production generated such unfavourable price conditions that it would take over a 16% increase in prices to increase weanling production on medium farms in crop district 1 in Scenario II. In the same example for market hogs, only a 1% increase in prices would effect hog production. This example shows the volatility of the market hog market, where small price changes could elicit large production responses. As well, the relative production stability and high production costs present in the weanling markets are evident, as much larger price changes are necessary to elicit a response. This also indicates the depressed price environment for weanling producers. Milk, cream, and egg prices were sensitive to price changes. On medium farms in crop district 10, an 8% decrease in milk prices, a 14% decrease in cream prices, and a 5% decrease in egg prices, would lower production of the respective commodities in Scenario II. This indicated an unfavourable price to cost relationship,

where the given prices were barely sufficient to cover production costs. Broiler and turkey production were insensitive to price changes. For example, on large farms in crop district 9 in Scenario II, a 28% decrease in broiler prices and a 27% decrease in turkey prices would have to occur to significantly effect production of these commodities.

Chapter 5

SUMMARY AND CONCLUSIONS

This final chapter presents the results described in the previous chapter in a more condensed form as conclusions. This chapter includes: (1) a summary of the analysis; (2) the conclusions of this analysis; and (3) suggestions for further research.

Summary of the Analysis

The major objective of this study was to determine the impacts of increased transportation costs for export grains created by the replacement of statutory rates with compensatory rates and branch line rationalization on the viability of small producers and the nature of the farm structure in Manitoba. This objective was in keeping with several previously quoted articles, whose major conclusions were that the trend towards larger farm sizes was due in part to the economies of size present in larger farms which generally provided higher levels of income to larger scaled operators. A major deterrent to this trend was the presence of risk and uncertainty which tended to limit expansion to medium sized farms.

A further objective was to examine the effects of interregional trade of intermediate commodities (wheat, oats, barley, calves, stocker cattle, and weanling hogs). The expanded transportation matrix allowed any unused production capacity to be brought into production, when feasible.

A linear programming model was used to estimate the final production and income impacts on all agricultural producers in Manitoba of changes within the basic study framework. Changes in price and cost data resulting from replacement of statutory freight rates and branch line rationalization in the various scenarios, altered the production mix of commodities necessary to achieve the maximization of net farm income within the limits set by the constraints defined in the model. See Chapter 4 and Table 7 for a detailed description of the scenarios considered in this analysis. These changes, when compared to the base Scenario II, estimated the normative impacts of these increased transportation costs on farm size structure in Manitoba.

In this context, the first comparison made between Scenario II and Scenario I indicated that net farm income improved when production was allocated on a comparative advantage basis (Table 13). In Scenario I, the production bounds were established for all three farm sizes while no lower production minimum was set for small farms in Scenario II. The end result was, although production levels declined on small farms in Scenario II as compared to Scenario I while production rose on medium and large farms, net farm income on small farms increased by $1,596 per farm. This compared to increments of $45 and $916 on medium and large farms, respectively. Under the conditions of Scenario II, small farms produced only those commodities in which they possessed a comparative to do so. Small producers were no longer forced to produce certain commodities that were uneconomical for them to do so when compared to medium and large producers, simply to fulfill minimum production requirements.

Table 13

Summary of Adjustments of Provincial Production and Net Income per Farm Between Scenario I and Scenario II

	Production Adjustments		Estimated Income[a] Change per Farm	
	Adjustment - Commodity from Scenario I	Size of Farm - Production Shift	Farm Size	
Scenario I	Base	Base	Small Medium Large	-1,185 1,132 14,148
Scenario II	Small Decrease -export wheat -wheat for sale as feed -feed wheat -export barley -barley for sale as feed -feed barley -oats for sale as feed -feed oats -flax -rapeseed -rye -sunflowers	Small -shift from small to medium producers in sunflower production	Small	1,596
	Decrease -calves -milk -cream -eggs	-shift from small to medium and large producers for calf, milk, cream, and egg production		
	Medium Decrease -export oats Increase -export wheat -feed wheat -barley for sale as feed -feed barley -feed oats	Medium -shift from export oats production on medium farms to production on large farms	Medium	45
	Decrease -market hogs Increase -calves -milk -cream -eggs	-shift from small to medium farms for egg production		

Table 13 (Continued)

	Production Adjustments		Estimated Income Change per Farm	
	Adjustment - Commodity from Scenario I	Size of Farm - Production Shift	Farm Size	
Scenario II	<u>Large</u> Increase -export wheat -feed wheat -barley for sale as feed -feed barley -export oats -feed oats	<u>Large</u> -shift in export oat production from medium to large farms -shift from large farm production of export barley into barley for sale as feed and feed barley	Large	916
	Increase -calves -milk -cream			

[a]These income figures represent the difference between Scenario I (the base Scenario) and Scenario II.

Despite this net increase in farm income, many production activities on small farms ended primarily due to the cost-income squeeze created by economic pressures promoting economies of size. Small farms remained economically viable in the production of oilseeds, limited special crops, and livestock. However, even in these instances, the value of production amounting to $74.0 million on small farms was low when compared to $362.3 million and $700.3 million on medium and large farms, respectively, in Scenario II. This difference was also reflected in net farm income levels which ranged from $441 per small farm to $1,177 per medium farm to $15,064 per large farm.

The expanded transportation matrix permitting complete interregional trade between all crop districts in Manitoba, had a minimal impact on net farm income. However, there was qualitative evidence that increased feed grain production in some regions, especially the Central region, was linked to expanded calf and market hog production in the Interlake and Eastern regions. The full potential impacts of this increased interregional trade were limited by the linear programming constraints which restricted any commodity production expansion to within +20 percent of the 1978 actual production level and to different definitions of final provincial demand.

The third comparison made between Scenario II, Scenario III, and Scenario IV, (Table 14) estimated the normative impacts of removal of the statutory freight rates and branch line rationalization on farm production and income levels in 1978. All minimum production levels had been removed for small farms. Any production and/or income changes were a direct result of increased transportation costs. Generally, the gross value of production declined on all farm sizes in Scenario III, with

Table 14

Summary of Adjustments of Provincial Production
and Net Income per Farm

	Production Adjustments		Estimated Income[a] Change per Farm	
	Adjustment - Commodity from Scenario II	Size of Farm - Production Shift	Farm Size	
Scenario II	Base	Base	Small Medium Large	441 1,177 15,064
Scenario III	Small Decrease -export oats -rapeseed -sunflowers	Small -shift from small farm sunflower production to medium and large farms	Small	-32
	Decrease -milk			
	Medium Decrease -export wheat -wheat for sale as feed -feed wheat -export barley -barley for sale as feed -oats for sale as feed Increase -feed barley -sunflowers	Medium	Medium	-627
	Decrease -calves -market hogs Increase -fed beef	-shift from medium market hog production to large farms		
	Large Decrease -export wheat -rye Increase -sunflowers	Large -shift from feed oats into oats for sale as feed -shift from feed barley into export barley	Large	-4,023
	Increase -calves -milk			

Table 14 (Continued)

	Production Adjustments		Estimated Income Change per Farm	
	Adjustment - Commodity from Scenario II	Size of Farm - Production Shift	Farm Size	
Scenario IV	Small Decrease -export oats -sunflowers Increase -rapeseed	Small	Small	52
	Decrease -milk -market hogs Increase -calves -stocker cattle -fed beef	-shift in hog production from small to large producers		
	Medium Decrease -export wheat -wheat for sale as feed -feed wheat -export barley -barley for sale as feed -oats for sale as feed Increase -feed oats -feed barley -flax -rapeseed -sunflowers	Medium	Medium	-362
	Decrease -market hogs Increase -stocker cattle -fed beef	-shift in market hog production from medium to large producers		
	Large Decrease -export wheat -flax Increase -oats for sale as feed -barley for sale as feed -feed wheat -feed oats -feed barley -rapeseed -rye -sunflowers	Large	Large	-2,134

Table 14 (Continued)

	Production Adjustments		Estimated Income Change per Farm	
	Adjustment - Commodity from Scenario II	Size of Farm - Production Shift	Farm Size	
Scenario IV	Large Increased -calves -stocker cattle -fed beef -market hogs -milk	Large	Large	
Scenario V	Small Decrease -export oats -rapeseed Increase -sunflowers	Small	Small	-39
	Decrease -market hogs -milk Increase -stocker cattle -fed beef	-shift in market hog and milk production from small to large producers		
	Medium Decrease -export wheat -export barley -export oats -flax -rye Increase -feed barley -sunflowers	Medium -shift from export barley to feed barley	Medium	-851
	Decrease -calves Increase -fed beef -market hogs			
	Large Decrease -export wheat -rye Increase -export barley -flax -sunflowers	Large -shift from feed barley into export barley	Large	-4,970

Table 14 (Continued)

	Production Adjustments		Estimated Income Change per Farm	
	Adjustment - Commodity from Scenario II	Size of Farm - Production Shift	Farm Size	
Scenario V	Large Increase -calves -fed beef -milk	Large	Large	
Scenario VI	Small Decrease -export oats -sunflowers Increase -rapeseed	Small -shift of sunflower production from small to medium and large farms	Small	+42
	Decrease -market hogs -milk Increase -calves -stocker cattle -fed beef	-shift of market hog and milk production from small to large farms		
	Medium Decrease -export wheat -export barley -oats for sale as feed -barley for sale as feed -feed barley Increase -feed oats -flax -rapeseed -sunflowers	Medium	Medium	-547
	Decrease -market hogs Increase -calves -stocker cattle -fed beef	-shift in market hog production from medium to large farms		
	Large Decrease -export wheat -flax Increase -export barley -barley for sale as feed	Large	Large	-3,206

Table 14 (Continued)

	Production Adjustments		Estimated Income Change per Farm	
	Adjustment - Commodity from Scenario II	Size of Farm - Production Shift	Farm Size	
Scenario VI	Large -oats for sale as feed -feed wheat -feed oats -feed barley -rapeseed -rye -sunflowers	Large	Large	
	Increase -calves -stocker cattle -fed beef -market hogs -milk			

[a]These income figures represent the difference between the base Scenario II and the other four scenarios.

medium farms bearing the brunt of the reductions. The value of provincial production dropped $0.6 million on small farms, while medium and large farms' gross value of production fell $22.7 million and $29.5 million, respectively. Consequently net farm income also fell, $532 per small farm, $627 per medium farm and $4,023 per large farm in Scenario III. The expanded production maximums in Scenario IV reduced a large proportion of these losses primarily through increased oilseed and livestock production. This led to smaller reductions in the value of production on small and medium farms of $0.5 million and $0.3 million, respectively. The value of production rose by $24.3 million on large farms. A similar trend for net farm income continued in Scenario IV. Net farm income on small farms increased by $52 per farm while the other farm sizes recorded lowered net income reductions of $362 per medium farm and $2,134 per large farm. The differences in the income and production levels between Scenario III and Scenario IV, indicated the potential for oilseed and livestock production to offset the potential impacts resulting from the institution of compensatory rates and branch line rationalization.

The final comparison was made between Scenario II, Scenario V, and Scenario VI, to determine the long term impacts of higher transportation costs in 1985. These higher costs further reduced the gross value of production in Scenario V by $1.4 million on small farms, $25.3 million on medium farms, and $37.1 million on large farms. Net income in this scenario also fell by $39 per small farm, $851 per medium farm, and $4,970 per large farm. These reductions were primarily due to the increased transport costs and the inability of livestock production to sufficiently offset these income reductions. The removal of this limitation in Scenario VI reduced the value of production losses on small and

medium farms by $0.6 million and $3.5 million, respectively. The gross value of production increased by $16.1 million on large farms. These production levels resulted in net farm income increments of $42 per small farm. Net income fell by $547 per medium farm and $3,206 per large farm in Scenario VI.

The price of each commodity is very important to the production allocation process of linear programming. Consequently, the significance of the final results are highly dependent on the sensitivity of the linear programming solution to price changes. This analysis determined that all crop commodities (except sunflowers), stocker cattle, weanling hogs, broilers, and turkey production were generally insensitive to price changes. Sunflowers, beef and dairy calves, market hogs, milk, cream, and egg production were sensitive to price changes.

Conclusions

The normative nature of this model and the distinct economic advantages generated by economies of size inherent in large farm sizes, posed the greatest deterrent to the economic viability of small farms. The value of production on small farms dropped $95.9 million in Scenario II with the removal of the imposed production minimums on small farms. Despite these reduced production levels, net farm income rose $1,596 per small farm due to termination of unprofitable production arising from higher production costs on small farms. Production on small farms became limited to only a small production of specialized commodities such as oilseeds, potatoes, sugar beets, and livestock. In the face of fluctuating commodity prices and spiralling production costs, it is inevitable that the cost-income squeeze estimated in this study would

eventually confront small producers. Under these circumstances, it is highly unlikely the majority of these producers would be able to continue operation and many would probably be fored to sell out. Had the production minimums been removed for medium farms as well, production on this farm size might have decreased slightly in some instances. However, production for the most part, would remain constant for two reasons: (1) the profitability of producing specific commodities on medium farms; and (2) provincial demand requirements.

Replacement of statutory freight rates with compensatory rates and branch line rationalization led to general gross values of production and net income reductions on all farm sizes. The gross value of production declined by $52.7 million and $63.8 million in Scenario III and Scenario V, respectively. This resulted in respective net farm income decreases of $1,042 per farm and $1,324 per farm in Scenario III and Scenario V. Although the per farm impacts were more pronounced on medium and large farms value of production and net income levels, a further reduction in net farm income on small farms resulting from increased transportation costs would definitely enhance the trend towards increased farm sizes. However, it is expected that any changes in transportation policy would not significantly accelerate the current trend towards larger farm sizes. As shown in earlier chapters, the economic advantages derived though economies of size on larger farm sizes are the motivating forces behind this trend. This becomes evident when the net income changes are compared between the scenarios in which structural changes were implemented (Scenarios I and II), and the scenarios in which transportation policy changes were implemented (Scenarios II, III, IV, V, and VI). In the first instance, comparison between Scenario I and Scenario

II revealed a 56 percent decline in provincial gross value of production resulting from removal of the minimum production levels on small farms. In the latter case, comparison between Scenario II and the potentially most severe scenario examined, Scenario V, provincial value of production on small farms declined by 2 percent. Consequently, the trend towards larger farm sizes should be recognized as a "fact of life" upon which changes in the current rail freight rate and branch line structures will only play a minor role. Further, any changes in Canadian transport policy with regards to the statutory rates should not be expected to compensate for or alter this trend, which is derived from economic factors of which transportation plays only a minor role.

There is a large potential for increased production of oilseeds, special crops, and livestock to offset a large proportion of the value of production and net income losses generated by increased transportation costs. In crop district 1 on medium farms in Scenario II for example, an additional acre of rapeseed will raise net income by $2.80. The production of one additional beef stocker animal will raise net income by $85.83. The expanded production maximums lowered the value of production losses to $23.5 million in Scenario IV and $12.0 million in Scenario VI. Net farm income losses were also reduced to $537 per farm and $821 per farm in Scenario IV and Scenario VI, respectively, due to expanded oilseed and livestock production. In order to take full advantage of this potential, new and/or expanded marketing facilities must be developed in order to accommodate this expanded production without adversely affecting the relative price levels of these commodities. Such facilities would include the modernization of the Canadian grain handling system to ensure steady and reliable export supplies, a more aggressive marketing attitude

in foreign grain markets, and the increased prominence of Canadian livestock in world markets.

Further, in recognition of the large potential for expanded production of specific commodities in offsetting the increased transportation costs and the fact that this potential most likely exists in Saskatchewan and Alberta as well, a "benefit-sharing" program between the three Prairie provinces would have to be established. This would ensure the benefits derived from this expanded production as well as the burden of increased transportation rates, was shared equitably between all three provinces.

The introduction of complete interregional trade within Manitoba indicated the potential for increased production as districts were able to make fuller use of the comparative advantage to produce specific commodities by "importing" intermediate commodities that had formerly limited production. However, the full potential was not realized due to the specification of production constraints within the model and the lack of an existing analysis that could be directly compared to the scenarios examined in this model.

Suggestions for Further Research

The transportation models such as the PHAER and routes programs, used in this study to determine the price impacts of compensatory rates and branch line rationalization, were quite dated. These models should be reformulated to more accurately reflect the current situation. The linear programming model requires an extensive re-working. The major flaw currently present in the model, is the dated cost of production figures based on 1971 technology. New production cost figures would

greatly improve the credibility of the results. Provisions should also be made to permit the inclusion of special crops such as corn and field peas as well as the inclusion of import-export relationships with other provinces, the United States, and the rest of the world markets. Such modifications would eliminate the need for assumptions of no intermediate product imports or exports and remove a degree of the "closed" economy that limits the interpretation of policy implications on national issues.

In as much as the +40 percent range was a constraint to the expansion of production levels, it was also an estimate of the expected production levels deemed necessary to maintain commodity output levels consistent with increments in consumer demand over time. The original figures of 20 and 40 percent were arbitrarily selected as reasonable levels of demand expansion that could be matched by equivalent increments in commodity output in the years being considered. To more accurately estimate the degree of production ranges necessary to meet demand levels within a specified year, a demand model for Canadian agricultural commodities should be developed. This model would be designed to estimate the expansion of demand that could be expected in a specified year. As such, demand would be more closely linked to supply levels determined by the production ranges and more accurately reflect the economic environment of the study period.

In lieu of the potential impact of the cost-income squeeze estimated in this analysis, a cost-benefit analysis would be useful to determine whether or not the benefits derived from a program designed to prevent the attrition of small farms by rising costs offset the costs incurred to finance such a program. Besides the substantial costs

involved to finance such a program, many non-economic questions can be raised, such as should the economic process that would eventually eliminate these producers be altered; are small producers a necessary part of the Manitoba agrarian structure; couldn't the money be better used in other areas such as for the promotion of small businesses or assistance to fishermen, etc? A cost-benefit analysis would help answer some of these questions. Further, any numerical results obtained from such cost-benefit analysis could be incorporated into the linear programming model to determine the potential production and income impacts on small farms and the related influence such a program would have on other farm sizes.

In order to estimate the full potential of the expanded interregional trade matrix, and further analysis could expand the production bounds beyond the +40 percent maximum range used in this study. This could be accomplished in either one of two ways. Firstly, production of all commodities could be expanded beyond the existing limits until all the available resources necessary to produce a specific commodity in a certain region had been exhausted. The presence of any production increments beyond this point would indicate the impact of interregional trade within that region. The second method would be to simply expand the production maximum range for final commodity groups in specific areas while not changing the production levels for intermediate products. In this manner, expansion of these final commodities would hinge on the availability of intermediate input commodities from other regions once the available intermediate commodites had been exhausted in the original regions.

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APPENDIX A

THE DATA

All of the components of the equations described in the previous section were represented by an initial data base used to depict present production conditions found within Manitoban agriculture. The interaction of these various components through the use of linear programming, established the optimal combination of all of these factors that allowed for maximization of the objective function, net farm income. Alterations of any specific component of this optimal solution caused a change in the combination of the various other components necessary to achieve maximization of the objective function. The usefulness of linear programming was that the effects of changes within the original optimal solution could be determined by measuring: (a) how the final level of the objective function was effected in this case, net farm income, and (b) how the production levels of the various components were effected by the restructuring of the combination of the input components necessary to achieve maximization of the objective function.

Through the aforementioned specification of the input constraints, this study utilized linear programming techniques for the dual purposes of determing (a) the production and income effects of increased transportation costs brought about by abandonment of statutory rates and branchline rationalization on farm sizes and, (b) the impact of interregional trade on the enhancement of the comparative advantage inherent in various regions.

The Equations of the Model

The following is a detailed explanation of the system of equations used in this analysis and how they are interrelated.

The study's objective function provided for maximization of the factor net farm income.

Constraints in the model were of five main types. Available land was the resource constraint imposed on alternative activities. A second type of constraint was intermediate enterprise input requirements such as stock calves, feeder cattle, weanling hogs, and livestock feeds constraining livestock production. Thirdly, constraints concerning the extent of output expansion or contraction feasible in a future planning frame were assumed and imposed. Fourthly, the extent of provincial product demand with an assumed production flexibility was imposed. Finally, income and employment policy requirements were included as constraints.

Figure A1 shows examples from each of the three model components translated into mathematical terms.

The objective function stated that net income from Manitoba's agricultural industry (Y) is equal to the sum of net income r_{ijkp} for each unit of product X_{ijkp} produced in all 12 provincial regions i and on the three farm sizes j, for all commodities p.

The constraints numbered I-V and related to alternative activities were specified as follows:

I. Maximum land use could not exceed available land. In other words, land, L_{ik}, available in each producing region (crop district) i of each soil type k was required to be as great or greater than the total land actually used to produce the output levels X_{ijkp} when used at the rate of a_{ijkp} per unit of output.

II. Feed grain required must be provided through production or shipment from or to other regions. That type of requirement is provided through Equation II. Metabolizable energy M_p (livestock feed grain) per unit of feed product "p" produced times the level of feed product b_{ijkp} produced per unit of activity X_{ijkp} times the level of X_{ijkp} minus the level of energy f_p required to produce livestock product "p" times livestock production levels plus feed grain shipped in

$$\sum_{p=14}^{16} m_p \sum_{v=1}^{12} T_{vip}$$

minus feed grain shipped out must equal zero.

III. Constraint type III set specified minimum output levels for medium and large farm sizes in each crop district. No minimum production levels were established for small farm sizes. That is a minimum level of production of product p in region i on medium and large farm sizes. R_{ijp} had to be produced through introduction of activities X_{ijkp} producing b_{ijkp} units per unit of activity.

IV. There was an upper limit placed on Manitoba production of each agricultural product. That is, provincial production of each product p was equaled

$$\sum_{i=1}^{12} \sum_{j=1}^{3} \sum_{k=1}^{2} b_{ijkp} X_{ijkp}$$

could not exceed specified upper bound levels p_p.

V. Constraint type V required that farm income levels be reached. As stated in Equation V, net income plus return to labor Y_{ij} was required to reach a specified minimum in each region i and on each farm size 'j' through production activities X_{ijkp} yielding y_{ijkp} per unit of activity.

The mathematical equations not presented in Figure 6 are similar in nature. The entire set of equations and accompanying definitions of terms follows:

Maximize the objective function

$$Y = \sum_{i=1}^{12} \sum_{j=1}^{3} \sum_{k=1}^{2} \sum_{p=1}^{40} r_{ijkp} X_{ijkp} - \sum_{i=1}^{12} \sum_{v=1}^{12} \sum_{p=14}^{16} t_{vip} T_{vip}$$

$$- \sum_{i=1}^{12} \sum_{v=1}^{12} \sum_{p=17}^{41} c_{vip} A_{vip} \qquad (1)$$

subject to the following constraints:

Land Availability

$$\sum_{j=1}^{3} \sum_{p=1}^{40} a_{ijkp} X_{ijkp} \leq L_{ik} \text{ for all i and k} \qquad (2)$$

Livestock Feed Supplies

$$\sum_{j=1}^{3} \sum_{k=1} \sum_{p=11}^{13} m_p b_{ijkp} X_{ijkp} - \sum_{j=1}^{3} \sum_{p=17}^{40} f_p X_{ij3p} +$$

$$\sum_{p=14}^{16} m_p \sum_{v=1}^{12} T_{vip} - \sum_{p=14}^{16} m_p \sum_{v=1}^{12} T_{ivp} = 0 \text{ for all } i \qquad (3)$$

Intermediate Livestock Commodity Supplies

$$\sum_{j=1}^{3} s_{ij3pq} X_{ij3p} - \sum_{j=1}^{3} s'_{ij3pq} X_{ij3p} + \sum_{v=1} A_{vip} - \sum_{v=1}^{12} A_{ivp} =$$

0 for all i and q and for p = 17-41 (4)

Supplies of Feed Grain for Sale

$$\sum_{j=1}^{3} \sum_{k=1} b_{ijkp} X_{ijkp} - \sum_{v=1}^{12} T_{ivp} = 0 \text{ for all } i \text{ and for } p = 14, 15, 16 \qquad (5)$$

Minimum Oats in Livestock Rations

$$\sum_{j=1}^{3} \sum_{k=1} m_{12} b_{ijk12} - \sum_{p=17}^{40} f'_{1p} X_{ij3p} + m_{15} \Sigma T_{iv15}$$

$$- m_{15} \Sigma T_{vi15} \geq 0 \text{ for all } i \text{ and } v \qquad (6)$$

Minimum Barley in Livestock Rations

$$\sum_{j=1}^{3} \sum_{k=1} m_{13} b_{ijk13} X_{ijk13} - \sum_{17}^{40} f'_{2p} X_{ij3p} + m_{16} \Sigma T_{iv16}$$

$$- m_{16} \Sigma T_{vi16} \geq 0 \text{ for all } i \text{ and } v \qquad (7)$$

Hay Supplies

$$\sum_{j=1}^{3} b_{ij3,10} X_{ij3,10} - h_p X_{ij3p} = 0 \text{ for all } i \text{ and for}$$

p = 17-32, 36, 37 (8)

Regional and Provincial Commodity Maximums and Minimums

$$\sum_{k=1}^{2} b_{ijkp} X_{ijkp} \geq R_{ijp} \text{ for all i and j and for p =}$$

1-9, 18-20, 26-28, 33, 34, 36-40 (9)

$$\sum_{k=1}^{2} b_{ijkp} X_{ijkp} \leq R'_{ijp} \text{ for all i and j and for p =}$$

1-9, 18-20, 26-28, 33, 34, 36-40 (10)

$$\sum_{i=1}^{12} \sum_{j=1}^{3} \sum_{k=1}^{2} b_{ijkp} X_{ijkp} \geq P_p \text{ for p = 1-9, 17, 20, 25, 34, 36-40} \quad (11)$$

$$\sum_{i=1}^{12} \sum_{j=1}^{3} \sum_{k=1}^{2} b_{ijkp} X_{ijkp} \leq P'_p \text{ for p = 1-9, 17, 20, 25, 34, 36-40} \quad (12)$$

Income Constraints

$$\sum_{k=1}^{2} \sum_{p=1}^{40} y_{ijkp} X_{ijkp} \geq Y_{ij} \text{ for all i and j} \quad (13)$$

Labor Constraints

$$\sum_{k=1}^{2} \sum_{p=1}^{40} l_{ijkp} X_{ijkp} \geq LH_{ij} \text{ for all i and j} \quad (14)$$

with the subscripts identified as follows:

i and v = regions 1-12;

j = farm and enterprise sizes 1-3;

k = soil types; 1 is crop land; 2 is pasture land;

p = commodity produced; p = 1-9 are crops produced for sale to final provincial demand or for export; p = 10 is hay; p = 11-13 are cereals produced for feed within a region; p = 14-16 are cereals produced for sale as feed in other regions; and p = 17-41 are livestock commodities;

q = intermediate livestock commodities 1-6;

r = cereal feed types 1-2;

and with the variables identified as follows:

Y = net revenue; that is, return to management after deducting;
(1) operator and hired labor at the minimum wage,
(2) interest and depreciation, and
(3) operating costs;

r_{ijkp} = net revenue from the production of one unit of commodity p in region i on farm size j;

X_{ijkp} = the quantity of commodity p produced in region i on farm size j

t_{vip} = transportation cost per unit of crop commodity p transported from region v to region i;

T_{vip} = quantity of crop commodity p transported from region v to region i and allowed only where region v is adjacent to region i;

c_{vip} = transportation cost per unit of livestock of commodity type p produced on farms in region v transported to farm in region i;

A_{vip} = number of livestock animals of commodity type p produced on farms in region v transported to farms in region i and allowed only where region v is adjacent to region i;

L_{ik} = land with soil quality k available in region i;

a_{ijkp} = the commodity p per unit requirement for land in region i on farm size j;

R_{ijp} = the minimum level of production of commodity p allowed in region i on farms with enterprise size j;

R'_{ijp} = the maximum level of production of commodity p allowed in region i on farms with enterprise size j;

b_{ijkp} = per unit yield of commodity p in region i on farms of size j;

P_p = minimum provincial consumption plus export demand for commodity p;

P'_p = maximum provincial consumption plus export demand for commodity p;

Y_{ij} = minimum income requirement for farms of size j in region i;

y_{ijkp} = net revenue from commodity p produced in region i on farms of size j;

LH_{ij} = minimum labor hours required on farms of size j in region i;

L_{ijkp} = labor hours required per unit of commodity p produced on farms of size j in region i;

m_p = metabolizable energy provided per unit of commodity p produced;

f_p = metabolizable energy required per unit of commodity p produced;

s_{ijkpq} = supply of intermediate livestock inputs of type q produced per unit of commodity p produced on farms of size j in region i;

s'_{ijkpq} = amount of intermediate livestock inputs of type q required per unit of commodity p produced on soil quality k on farms of size j in region i;

f'_{rp} = minimum requirement for feed of type r per unit of commodity p produced; and

h_p = hay requirement per unit of commodity p produced.

CROP COMPONENTS OF THE OBJECTIVE FUNCTION

Costs of production for crops were indexed from 1971 levels determined by Framingham, et. al.[1] These costs included labor, machinery, fertilizer, chemicals, seed cleaning and treatment, investment in land and buildings, taxes, and overhead.

Wheat, oat, and barley prices were calculated using grain inspections data reported in Grain Trade of Canada for the years 1966-1977.[2] The historical data was used to give a representative production weighing to the various cereal grades grown in Manitoba. On Table A1, the percentage distribution by grade was calculated by dividing the bushels inspected of each grade by the total bushels for all grades inspected. The percentages were expanded to 100 percent and used to weigh the realized grade prices to obtain a weighed average realized price including initial, interim, and final payments.

Farm gate prices were calculated by subtracting the handling and elevation charges as well as the freight charges to Thunder Bay from the weighed prices as shown on Tables A2, A3 and A4.

Rye, flax, and rapeseed prices were the yearly averages taken from the Winnipeg cash grain prices, on a Thunder Bay basis.[3] The numbers are

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[1] See the following for further details, C.F. Framingham, L.B.B. Baker, and W.J. Craddock, op. cit., pp. 27-59.

[2] Dominion Bureau of Statistics, Grain Trade of Canada, Catalogue No. 22-201 (Ottawa: Queen's Printers, annual), Table 9.

[3] Canadian Grains Industry. Canadian Grains Statistical Handbook, 1978. (Winnipeg: Canada Grains Council, 1979.

Table A1

Weighted Prices (1978) for Wheat, Oats, and Barley

	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1966-77 $\bar{\Sigma}$	Weighted Percent	Realized Price[a]	Weighted Price
	.....Percent of quantity produced.....														
Wheat[b]															
1 CW	49.88	78.47	48.59	43.53	53.69	71.89	65.13	58.16	31.29	21.65	62.1	53.13	62.65	3.274	2.051161
2 CW	26.80	14.05	10.27	20.55	22.12	14.10	16.63	21.77	16.10	30.96	21.5	19.53	23.03	3.097	.713239
3 CW	9.29	3.00	6.64	14.88	16.15	8.72	8.46	3.93	14.52	17.79	6.9	10.02	11.82	2.917	.344789
3 Util.	.72	.16	.23	.91	.87	.23	.65	.52	9.13	8.47	1.4	2.12	2.50	2.454	.061350
	86.69	95.68	65.73	79.87	92.83	94.94	90.87	84.38	71.04	78.87	91.9	84.80	100.00		3.170539
Oats[c]															
2 CW[d]	.12	.83	.13	.45	.53	.89	.24	.31	.04	.19	.6	.40	.44	1.20	.005280
3 CW[e]	31.08	25.95	21.91	10.71	17.15	30.66	24.26	17.47	19.00	15.20	22.7	21.46	23.60	1.20	.283200
Ex. 3 CW[e]	.96	7.12	1.04	3.06	4.83	6.96	1.44	.94	.22	.27	1.1	2.54	2.79	1.20	.033480
Ex. 1 Feed	19.24	17.14	11.16	9.85	13.01	10.06	17.39	11.15	7.06	7.58	5.8	11.77	12.94	1.16	.150104
1 Feed	38.38	40.01	28.87	53.62	56.19	45.52	48.91	57.00	49.83	58.89	60.5	48.88	53.76	1.15	.618240
2 Feed	4.25	6.15	2.81	5.49	4.74	3.92	4.78	4.40	6.02	5.42	5.3	4.85	5.33	1.10	.058630
3 Feed	.74	1.04	.59	1.79	1.02	.44	.93	.81	1.84	1.23	.9	1.03	1.13	1.06	.011978
	94.77	98.24	66.51	84.97	97.47	98.45	97.95	92.08	84.01	88.78	96.9	90.93	100.00		1.160912
Barley															
2 CW 6[f]	.21	4.07	2.16	.82	.30	.52	.32	.22	.02	.01	.1	.80	.91	2.20	.020020
3 CW 6[g]	19.58	13.02	13.29	10.69	11.18	12.65	10.77	10.86	5.82	4.02	9.2	11.01	12.46	2.18	.271628
2 CW 2[f]	.40	1.53	.30	1.17	.74	.98	.23	.30	.04	.03	0.0	.52	.59	2.25	.013275
3 CW 2[g]	4.80	3.33	6.21	4.98	5.49	6.01	7.97	8.22	3.43	3.01	3.4	5.17	5.85	2.23	.130455
1 Feed	47.07	57.51	41.38	53.30	66.24	68.82	65.41	57.55	55.49	63.22	70.0	58.73	66.47	1.92	1.276224
2 Feed	10.86	14.08	10.87	15.56	11.64	8.00	5.33	6.39	12.92	14.53	9.8	10.91	12.35	1.91	.235885
3 Feed	1.54	1.67	1.34	1.27	1.03	.68	.49	.72	1.90	1.87	1.0	1.21	1.37	1.83	.025071
	84.26	95.21	75.55	87.79	96.62	97.66	90.52	84.26	79.62	86.69	97.5	88.35	100.00		1.972558

[a]The Realized Price (basis Thunder Bay) for wheat and barley by grade obtained from; Canadian Wheat Board, Annual Report 1977-1978 (Winnipeg: Canadian Wheat Board, 1978), pp. 43-44.

[b]The new grading system for wheat was introduced in 1972-1973. The percentage figures by grade have been readjusted prior to 1972-1973 to conform with the new grading system.

(continued)

Table A1 (Continued)

[c]The Realized Price (basis Thunder Bay) by grade for oats obtained from Mr. Norman Cobb, Manitoba Pool Elevators, Winnipeg, Manitoba.

[d]1 CW in 1973-1974.

[e]2 CW in 1973-1974.

[f]1 CW in 1973-1974.

[g]2 CW in 1973-1974.

Source: Dominion Bureau of Statistics, Grain Trade of Canada, Catalogue No. 22-201 (Ottawa: Queen's Printers, annual).

Table A2

Freight Rate and Handling and Elevation Charges Adjustment, with Resulting Elevator Wheat Prices by Crop District

Crop District	Freight Rates to Thunder Bay[a] ¢ per cwt.	¢ per bu.	Handling and Elevation Charges[b] ¢ per bu.	Farm Gate Price[c] $ per bu.
1	18	10.8	17.21	2.89
2	18	10.8	17.21	2.89
3	18	10.8	17.21	2.89
4	18	10.8	17.21	2.89
5	19	11.4	17.21	2.88
6	16	9.6	17.21	2.90
7	15	9.0	17.21	2.91
8	15	9.0	17.21	2.91
9	15	9.0	17.21	2.91
10	14	8.4	17.21	2.91
11	15	9.0	17.21	2.91
12	16	9.6	17.21	2.90

[a]Crows Nest Pass rates expressed in cents per 100 pounds. These are converted to cents per bushel as the linear programming model is specified to handle grain in bushels, not hundredweights.

[b]Handling and elevation charges as laid down by Manitoba Pool Elevators, 1978.

[c]The Farm Gate Price is the price of wheat ($3.17 per bushel) previously calculated, less freight rates and handling and elevation charges.

Table A3.

Freight Rate and Handling and Elevation Charges Adjustment, with Resulting Elevator Oat Prices by Crop District

Crop District	Freight Rates to Thunder Bay[a] ¢ per cwt.	¢ per bu.	Handling and Elevation Charges[b] ¢ per bu.	Farm Gate Price[c] $ per bu.
1	18	6.12	15.15	.95
2	18	6.12	15.15	.95
3	18	6.12	15.15	.95
4	18	6.12	15.15	.95
5	19	6.46	15.15	.94
6	16	5.44	15.15	.96
7	15	5.10	15.15	.96
8	15	5.10	15.15	.96
9	15	5.10	15.15	.96
10	14	4.76	15.15	.96
11	15	5.10	15.15	.96
12	16	5.44	15.15	.96

[a]Crows Nest Pass rates expressed in cents per 100 pounds. These are converted to cents per bushel as the linear programming model is specified to handle grain in bushels, not hundredweights.

[b]Handling and elevation charges as laid down by Manitoba Pool Elevators, 1978.

[c]The Farm Gate Price is the price of oats ($1.16 per bushel) previously calculated, less freight rates and handling and elevation charges.

Table A4.

Freight Rate and Handling and Elevation Charges Adjustment, with Resulting Elevator Barley Prices by Crop District

Crop District	Freight Rates to Thunder Bay[a] ¢ per cwt.	¢ per bu.	Handling and Elevation Charges[b] ¢ per bu.	Farm Gate Price[c] $ per bu.
1	18	8.64	17.05	1.72
2	18	8.64	17.05	1.72
3	18	8.64	17.05	1.72
4	18	8.64	17.05	1.72
5	19	9.12	17.05	1.71
6	16	7.68	17.05	1.73
7	15	7.20	17.05	1.73
8	15	7.20	17.05	1.73
9	15	7.20	17.05	1.73
10	14	6.72	17.05	1.73
11	15	7.20	17.05	1.73
12	16	7.68	17.05	1.73

[a]Crows Nest Pass rates expressed in cents per 100 pounds. These are converted to cents per bushel as the linear programming model is specified to handle grain in bushels, not hundredweights.

[b]Handling and elevation charges as laid down by Manitoba Pool Elevators, 1978.

[c]The Farm Gate Price is the price of barley ($1.97 per bushel) previously calculated, less freight rates and handling and elevation charges.

for the period August, 1977 to July, 1978. The average cash grain prices and elevation charges are shown on Table A5.

The farm gate prices for rye, flax, and rapeseed were determined by subtracting the freight charges, handling, and elevation charges from the initial average cash prices, as shown on Tables A6, A7 and A8.

Using the Manitoba Crop Insurance Commission yield data, total production figures were calculated for every major crop in each crop district. These production figures were allowed to fluctuate, depending upon the scenario between the limits shown on Tables A9-A17.

Sunflower, potato, and sugar beet yield data were four-year averages taken from 1975-1978. Only these years were utilized due to the dramatic change in yield trends brought about by the introduction of new hybrid varieties, especially in sunflowers, around 1975. Prices were taken on a three-year average as 1978 prices were not yet available.

	SUNFLOWERS		POTATOES		SUGAR BEETS	
	Yield	Price	Yield	Price	Yield	Price
1975	1,065	.095	12.42	35.00	140.63	3.89
1976	1,060	.10	12.45	30.00	106.76	3.57
1977	1,061	.10	17.44	31.00	148.65	3.90
1978	1,182	-	17.37	-	175.70	-
$\bar{X}_{yield}$	1,092 lbs/acre		14.92 tons/acre		142.94 cwt/acre	
Average price	$0.0983/lb.		$32.00/ton		$3.49/cwt	

Sources: Sunflowers--John Rogowski, Manitoba Department of Agriculture.
Sugar Beets--Gerry Zednie, Manitoba Sugar Company.
Potatoes--Garth Stone, Manitoba Department of Agriculture.

Table A5 ,

Average Cash Grain Prices and
Elevation Charges, 1977-78

	1977-1978 Average Cash Price[a]	Elevation and Handling Charges[b]
	.....dollars/bushel.....	
Rye[c]	2.6240	.1862
Flax[d]	5.7090	.2475
Rapeseed[e]	6.7119	.2224

[a]Winnipeg cash prices from: Canadian Grains Council, "Canadian Grains Inudstry, Statistical Handbook, 1978" (Winnipeg: Canada Grains Council, 1979), pp. 137-139.

[b]Elevation and handling charges received from Mr. N. Cobb, Manitoba Pool Elevators, June, 1979.

[c]Rye is represented by 1 C.W. which prior to 1977-78 was represented by 1 and 2 C.W.

[d]Flax is the average price of 1 and 2 C.W.

[e]Rapeseed is represented by Number 1 Canadian.

Table A6

Freight Rate and Handling and Elevation Charges Adjustment, with Resulting Elevator Flax Prices by Crop District

Crop District	Freight Rates to Thunder Bay[a] ¢ per cwt.	¢ per bu.	Handling and Elevation Charges[b] ¢ per bu.	Farm Gate Price[c] $ per bu.
1	18	10.08	24.75	5.36
2	18	10.08	24.75	5.36
3	18	10.08	24.75	5.36
4	18	10.08	24.75	5.36
5	19	10.64	24.75	5.36
6	16	8.96	24.75	5.37
7	15	8.40	24.75	5.38
8	15	8.40	24.75	5.38
9	15	8.40	24.75	5.38
10	14	7.84	24.75	5.38
11	15	8.40	24.75	5.38
12	16	8.96	24.75	5.37

[a]Crows Nest Pass rates expressed in cents per 100 pounds. These are converted to cents per bushel as the linear programming model is specified to handle grain in bushels, not hundredweights.

[b]Handling and elevation charges as laid down by Manitoba Pool Elevators, 1978.

[c]The Farm Gate Price is the price of flax ($5.71 per bushel) previously calculated, less freight rates and handling and elevation charges.

Table A7

Freight Rate and Handling and Elevation Charges Adjustment, with Resulting Elevator Rapeseed Prices by Crop District

Crop District	Freight Rates to Thunder Bay[a] ¢ per cwt.	¢ per bu.	Handling and Elevation Charges[b] ¢ per bu.	Farm Gate Price[c] $ per bu.
1	18	10.08	22.24	6.39
2	18	10.08	22.24	6.39
3	18	10.08	22.24	6.39
4	18	10.08	22.24	6.39
5	19	10.64	22.24	6.38
6	16	8.96	22.24	6.40
7	15	8.40	22.24	6.41
8	15	8.40	22.24	6.41
9	15	8.40	22.24	6.41
10	14	7.84	22.24	6.41
11	15	8.40	22.24	6.41
12	16	8.96	22.24	6.40

[a]Crows Nest Pass rates expressed in cents per 100 pounds. These are converted to cents per bushel as the linear programming model is specified to handle grain in bushels, not hundredweights.

[b]Handling and elevation charges as laid down by Manitoba Pool Elevators, 1978.

[c]The Farm Gate Price is the price of rapeseed ($6.71 per bushel) previously calculated, less freight rates and handling and elevation charges.

Table A8

Freight Rate and Handling and Elevation Charges Adjustment, with Resulting Elevator Rye Prices by Crop District

Crop District	Freight Rates to Thunder Bay[a] ¢ per cwt.	¢ per bu.	Handling and Elevation Charges[b] ¢ per bu.	Farm Gate Price[c] $ per bu.
1	18	9.00	18.62	2.35
2	18	9.00	18.62	2.35
3	18	9.00	18.62	2.35
4	18	9.00	18.62	2.35
5	19	9.50	18.62	2.34
6	16	8.00	18.62	2.36
7	15	7.50	18.62	2.36
8	15	7.50	18.62	2.36
9	15	7.50	18.62	2.36
10	14	7.00	18.62	2.37
11	15	7.50	18.62	2.36
12	16	8.00	18.62	2.36

[a]Crows Nest Pass rates expressed in cents per 100 pounds. These are converted to cents per bushel as the linear programming model is specified to handle grain in bushels, not hundredweights.

[b]Handling and elevation charges as laid down by Manitoba Pool Elevators, 1978.

[c]The Farm Gate Price is the price of rye ($2.62 per bushel) previously calculated, less freight rates and handling and elevation charges.

Table A9

Wheat

Crop District	1978 Production	Farm Size	80%	120%	140%
	....bushels....		.....bushels.....		
1	11,688,600	1	1,309,123	1,963,685	2,290,966
		2	2,524,738	3,787,106	4,418,291
		3	5,517,019	8,275,529	9,654,784
2	9,786,920	1	1,096,135	1,644,203	1,918,236
		2	2,035,679	3,053,519	3,562,439
		3	4,697,722	7,046,582	8,221,013
3	9,948,750	1	716,310	1,074,465	1,253,543
		2	2,308,110	3,462,165	4,039,193
		3	4,934,580	7,401,870	8,635,515
4	3,523,500	1	338,256	507,384	591,948
		2	761,076	1,141,614	1,331,883
		3	1,719,468	2,579,202	3,009,069
5	4,390,000	1	456,560	684,840	798,980
		2	1,053,600	1,580,400	1,843,800
		3	2,001,840	3,002,760	3,503,220
6	4,934,760	1	473,737	710,605	829,040
		2	1,026,430	1,539,645	1,796,883
		3	2,447,641	3,671,461	4,283,372
7	12,184,030	1	1,364,611	2,046,917	2,388,070
		2	2,826,695	4,240,042	4,946,716
		3	5,555,918	8,333,877	9,722,856
8	17,902,650	1	2,148,318	3,222,477	3,759,557
		2	4,153,415	6,230,122	7,268,476
		3	8,020,387	12,030,581	14,035,678
9	7,198,720	1	748,667	1,123,000	1,310,167
		2	1,554,924	2,332,385	2,721,116
		3	3,455,386	5,183,078	6,046,925
10	758,880	1	60,710	91,066	106,243
		2	115,350	173,025	201,862
		3	431,044	646,566	754,327
11	3,359,070	1	349,343	524,015	611,351
		2	698,687	1,048,030	1,222,701
		3	1,639,226	2,458,839	2,868,646
12	2,481,000	1	198,480	297,720	347,340
		2	416,808	625,212	729,414
		3	1,369,512	2,054,268	2,396,646

Table A10

Oats

Crop District	1978 Production	Farm Size	80%	120%	140%
	....bushels....		.....bushels.....		
1	4,195,220	1	469,865	704,797	822,263
		2	906,168	1,359,251	1,585,793
		3	1,980,144	2,970,216	3,465,252
2	5,061,960	1	566,940	850,409	992,144
		2	1,052,888	1,579,332	1,842,553
		3	2,429,741	3,644,611	4,252,046
3	2,611,200	1	188,006	282,010	329,011
		2	605,798	908,698	1,060,147
		3	1,295,155	1,942,733	2,266,522
4	1,567,840	1	150,513	225,769	263,397
		2	338,653	507,980	592,644
		3	765,106	1,147,659	1,338,935
5	1,159,130	1	120,550	180,824	210,962
		2	278,191	417,287	486,835
		3	528,563	792,845	924,986
6	2,076,750	1	199,368	299,052	348,894
		2	431,964	647,946	755,937
		3	1,030,068	1,545,102	1,802,619
7	5,458,310	1	611,331	916,996	1,069,829
		2	1,266,328	1,899,492	2,216,074
		3	2,486,989	3,733,484	4,355,731
8	3,210,240	1	385,229	577,843	674,150
		2	744,776	1,117,164	1,303,357
		3	1,438,188	2,157,281	2,516,828
9	2,799,600	1	291,158	436,738	509,527
		2	604,714	907,070	1,058,249
		3	1,343,808	2,015,712	2,351,664
10	580,260	1	46,421	69,631	81,236
		2	88,200	132,299	154,349
		3	329,588	494,382	576,778
11	1,582,800	1	164,611	246,917	288,070
		2	329,222	493,834	576,139
		3	772,406	1,158,610	1,351,711
12	1,007,140	1	80,571	120,857	141,000
		2	169,200	253,799	296,099
		3	555,941	833,912	972,897

Table A11

Barley

Crop District	1978 Production	Farm Size	80%	120%	140%
	....bushels....		.....bushels.....		
1	7,119,080	1	797,337	1,196,005	1,395,340
		2	1,537,721	2,306,582	2,691,012
		3	3,360,206	5,040,309	5,880,360
2	8,492,250	1	951,132	1,426,698	1,664,481
		2	1,766,388	2,649,582	3,091,179
		3	4,076,280	6,114,420	7,133,490
3	9,749,560	1	701,968	1,052,952	1,228,445
		2	2,261,898	3,392,847	3,958,321
		3	4,835,782	7,253,673	8,462,618
4	3,228,440	1	309,930	464,895	542,378
		2	697,343	1,046,015	1,220,350
		3	1,575,479	2,363,218	2,757,088
5	3,869,350	1	402,412	603,619	704,222
		2	928,644	1,392,966	1,625,127
		3	1,764,424	2,646,635	3,087,741
6	2,172,110	1	208,523	312,784	364,914
		2	451,799	677,698	790,648
		3	1,077,367	1,616,050	1,885,391
7	12,254,010	1	1,372,449	2,058,674	2,401,786
		2	2,842,930	4,264,395	4,975,128
		3	5,587,829	8,381,743	9,778,700
8	13,818,000	1	1,658,160	2,487,240	2,901,780
		2	3,205,776	4,808,664	5,610,108
		3	6,190,464	9,285,696	10,833,312
9	4,770,120	1	496,092	744,139	868,162
		2	1,030,346	1,545,519	1,803,105
		3	2,289,658	3,434,486	4,006,901
10	371,280	1	29,702	44,554	51,979
		2	56,435	84,652	98,760
		3	210,887	316,331	369,052
11	3,605,700	1	374,993	562,489	656,237
		2	749,986	1,124,978	1,312,475
		3	1,759,582	2,639,372	3,079,268
12	1,521,920	1	121,754	182,630	213,069
		2	255,683	383,524	447,444
		3	840,100	1,260,150	1,470,175

Table A12

Flax

Crop District	1978 Production	Farm Size	80%	120%	140%
	....bushels....		.....bushels.....		
1	1,512,192	1	169,366	254,049	296,390
		2	326,633	489,950	571,609
		3	713,755	1,070,632	1,249,071
2	1,097,712	1	122,944	184,416	215,152
		2	228,324	342,486	399,567
		3	526,902	790,353	922,078
3	415,950	1	29,948	44,923	52,410
		2	96,500	144,751	168,876
		3	206,311	309,467	361,045
4	70,269	1	6,746	10,119	11,805
		2	15,178	22,767	26,562
		3	34,291	51,437	60,010
5	260,097	1	27,050	40,575	47,338
		2	62,423	93,635	109,241
		3	118,604	177,906	207,557
6	210,040	1	20,164	30,246	35,287
		2	43,688	65,532	76,455
		3	104,180	156,270	182,315
7	1,604,540	1	179,708	269,563	314,491
		2	372,253	558,380	651,443
		3	731,670	1,097,505	1,280,423
8	2,088,480	1	250,618	375,926	438,581
		2	484,527	726,791	847,923
		3	935,639	1,403,459	1,637,369
9	314,916	1	32,751	49,127	57,315
		2	68,022	102,033	119,038
		3	151,160	226,740	264,529
10	66,248	1	5,300	7,950	9,275
		2	10,070	15,105	17,622
		3	37,629	56,443	65,851
11	378,222	1	39,335	59,003	68,836
		2	78,670	118,005	137,673
		3	184,572	276,859	323,002
12	178,350	1	14,268	21,402	24,969
		2	29,963	44,944	52,435
		3	98,449	147,674	172,286

Table A13

Rapeseed

Crop District	1978 Production	Farm Size	80%	120%	140%
	....bushels....		.....bushels.....		
1	2,269,447	1	254,178	381,267	444,812
		2	490,201	735,301	857,851
		3	1,071,179	1,606,768	1,874,563
2	1,650,067	1	184,808	277,211	323,413
		2	343,214	514,821	600,624
		3	792,032	1,188,048	1,386,056
3	2,344,948	1	168,836	253,254	295,463
		2	544,028	816,042	952,049
		3	1,163,094	1,744,641	2,035,415
4	1,003,975	1	96,382	144,572	168,668
		2	216,859	325,288	379,503
		3	489,940	734,910	857,395
5	2,717,565	1	282,627	423,940	494,597
		2	652,216	978,323	1,141,377
		3	1,239,210	1,858,814	2,168,617
6	931,186	1	89,394	134,091	156,439
		2	193,687	290,530	338,952
		3	461,868	692,802	808,269
7	2,733,588	1	306,162	459,243	535,783
		2	634,192	951,289	1,109,837
		3	1,246,516	1,869,774	2,181,403
8	4,076,192	1	489,143	733,715	856,000
		2	945,677	1,418,515	1,654,934
		3	1,826,134	2,739,201	3,195,735
9	215,648	1	22,427	33,641	39,248
		2	46,580	69,870	81,515
		3	103,511	155,267	181,144
10	72,168	1	5,773	8,660	10,104
		2	10,970	16,454	19,197
		3	40,991	61,487	71,735
11	238,368	1	24,790	37,185	43,383
		2	49,581	74,371	86,766
		3	116,324	174,485	203,566
12	429,156	1	34,332	51,499	60,082
		2	72,098	108,147	126,172
		3	236,894	355,341	414,565

Table A14

Rye

Crop District	1978 Production	Farm Size	80%	120%	140%
	....bushels....		.....bushels.....		
1	888,542	1	99,517	149,275	174,154
		2	191,925	287,888	335,869
		3	419,392	629,088	733,936
2	862,594	1	96,611	144,916	169,068
		2	179,420	269,129	313,984
		3	414,045	621,068	724,579
3	308,438	1	22,208	33,311	38,863
		2	71,558	107,336	125,226
		3	152,985	229,478	267,724
4	112,995	1	10,848	16,271	18,983
		2	24,407	36,610	42,712
		3	55,142	82,712	96,498
5	317,361	1	33,006	49,508	57,760
		2	76,167	114,250	133,292
		3	144,717	217,075	253,254
6	53,960	1	5,180	7,770	9,065
		2	11,224	16,836	19,641
		3	26,764	40,146	46,837
7	722,223	1	80,889	121,333	141,556
		2	167,556	251,334	293,223
		3	329,334	494,001	576,334
8	457,266	1	54,872	82,308	96,026
		2	106,086	159,129	185,650
		3	204,855	307,283	358,497
9	54,089	1	5,625	8,438	9,844
		2	11,683	17,525	20,446
		3	25,963	38,944	45,435
10	17,867	1	1,429	2,144	2,501
		2	2,716	4,074	4,753
		3	10,148	15,223	17,760
11	30,240	1	3,145	4,717	5,504
		2	6,290	9,435	11,007
		3	14,757	22,136	25,825
12	14,190	1	1,135	1,703	1,987
		2	2,384	3,576	4,172
		3	7,833	11,749	13,708

Table A15

Sunflowers

Crop District	1978 Production	Farm Size	80%	120%	140%
	....pounds.....		.....pounds.....		
1	18,385,621	1	2,059,190	3,088,784	3,603,582
		2	3,971,294	5,956,941	6,949,765
		3	8,678,013	13,017,019	15,186,523
2	37,625,842	1	4,214,094	6,321,141	7,374,665
		2	7,826,175	11,739,262	13,695,806
		3	18,060,404	27,090,606	31,605,707
3	4,669,774	1	336,224	504,336	588,392
		2	1,083,388	1,625,081	1,895,928
		3	2,316,209	3,474,312	4,053,364
4	424,952	1	40,795	61,193	71,392
		2	91,790	137,684	160,632
		3	207,377	311,065	362,909
5	-	1			
		2			
		3			
6	821,730	1	78,886	118,329	138,051
		2	170,920	256,380	299,110
		3	407,578	611,367	713,262
7	56,889,541	1	6,371,629	9,557,443	11,150,350
		2	13,198,372	19,797,558	23,097,154
		3	25,941,630	38,912,445	45,397,854
8	109,264,260	1	13,111,711	19,667,567	22,945,495
		2	25,349,308	38,023,962	44,361,290
		3	48,950,388	73,425,583	85,663,180
9	5,449,244	1	566,721	850,082	991,762
		2	1,177,037	1,765,555	2,059,814
		3	2,615,637	3,923,456	4,577,365
10	164,346	1	13,148	19,722	23,008
		2	24,981	37,471	43,716
		3	93,349	140,023	163,360
11	826,426	1	85,948	128,922	150,410
		2	171,897	257,845	300,819
		3	403,296	604,944	705,768
12	-	1			
		2			
		3			

Table A16

Potatoes

Crop District	1978 Production	Farm Size	80%	120%	140%
	.hundredweight.		.....hundredweight.....		
1	4,612	1	516	774	904
		2	996	1,494	1,743
		3	2,176	3,265	3,810
2	1,492,171	1	167,123	250,685	292,466
		2	310,372	465,557	543,150
		3	716,242	1,074,363	1,253,424
3	3,538	1	255	382	446
		2	821	1,231	1,436
		3	1,755	2,632	3,071
4	767	1	74	110	129
		2	166	249	290
		3	374	561	655
5	3,538	1	368	552	644
		2	849	1,274	1,486
		3	1,613	2,420	2,823
6	17,368	1	1,667	2,501	2,918
		2	3,613	5,419	6,322
		3	8,615	12,922	15,075
7	1,276,193	1	142,934	214,400	250,134
		2	296,077	444,115	518,134
		3	581,944	872,916	1,018,402
8	2,143,183	1	257,182	385,773	450,068
		2	497,218	745,828	870,132
		3	960,146	1,440,219	1,680,255
9	62,106	1	6,459	9,688	11,303
		2	13,415	20,122	23,476
		3	29,811	44,716	52,169
10	767	1	61	92	107
		2	117	175	204
		3	436	653	762
11	284,076	1	29,544	44,316	51,702
		2	59,088	88,632	103,404
		3	138,629	207,944	242,601
12	460	1	37	55	64
		2	77	116	135
		3	254	381	444

Table A17

Sugar Beets

Crop District	1978 Production	Farm Size	80%	120%	140%
	.....tons.....		.....tons.....		
1	-	1			
		2			
		3			
2	-	1			
		2			
		3			
3	-	1			
		2			
		3			
4	-	1			
		2			
		3			
5	-	1			
		2			
		3			
6	-	1			
		2			
		3			
7	48,796	1	5,465	8,19[illegible]	9,56-
		2	11,321	16,9[illegible]1	19,[illegible]11
		3	22,251	33,376	3[illegible],939
8	250,808	1	30,097	45,145	52,6[illegible]0
		2	58,187	87,281	101,8[illegible]8
		3	112,362	168,543	19[illegible],[illegible]3[illegible]
9	47,984	1	4,990	7,486	8,7[illegible]3
		2	10,365	15,547	18,13[illegible]
		3	23,032	34,548	40,307
10	-	1			
		2			
		3			
11	5,419	1	564	845	9[illegible]6
		2	1,127	1,691	1,97[illegible]
		3	2,644	3,967	4,62[illegible]
12	-	1			
		2			
		3			

LIVESTOCK COMPONENTS OF THE OBJECTIVE FUNCTION

Livestock rations were based on the recommended rations found in Principles and Practises of Commercial Farming.[1] All feed and production costs were derived using the techniques described by Framingham, et. al.[2]

Production constraints were also set for the livestock sector at 80, 120, and 140 percent of 1978 production levels. These constraints are shown on Tables A18-A30.[3]

SELLING PRICES OF LIVESTOCK PRODUCTS

Finished Beef

The selling price of finished beef used was $53.24 per cwt.[4] The average prices for each grade, for both steers and heifers, were weighted by the number of steers or heifers in each class to secure a

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[1] Faculty of Agriculture, Principles and Practises of Commercial Farming (Winnipeg: Faculty of Agriculture, University of Manitoba, 1977).

[2] C.F. Framingham, L.B.B. Baker, and W.J. Craddock, op. cit., pp. 59-88.

[3] For a detailed description of the methods involved in calculating the livestock constraints, see C.F. Framingham, L.B.B. Baker, and W.J. Craddock, op. cit., pp. 90-108.

[4] This price was established based on average prices received from the market reporter, Livestock Division, Production and Marketing Branch, Agriculture Canada, St. Boniface Stock Yards, January, 1979.

Table A18

Beef Calves (500 Pounds)[a]

Crop District	1978 Production	Farm Size	80%	120%	140%
1	38,519	1	3,082	4,622	5,393
		2	10,477	15,715	18,334
		3	17,257	25,865	30,199
2	39,217	1	3,451	5,177	6,040
		2	9,412	14,118	16,471
		3	18,510	27,766	32,393
3	31,023	1	4,964	7,446	8,687
		2	9,430	14,146	16,503
		3	10,424	15,636	18,242
4	21,321	1	2,900	4,350	5,075
		2	6,652	9,978	11,641
		3	7,505	11,257	13,133
5	8,649	1	1,661	2,491	2,906
		2	2,766	4,152	4,844
		3	2,490	3,736	4,358
6	37,838	1	4,843	7,265	8,476
		2	9,081	13,621	15,891
		3	16,346	24,520	28,606
7	30,698	1	3,930	5,894	6,877
		2	7,367	11,051	12,893
		3	13,262	19,892	23,208
8	26,463	1	5,081	7,621	8,891
		2	7,622	11,432	13,338
		3	8,468	12,702	14,819
9	7,500	1	1,620	2,430	2,835
		2	1,380	2,070	2,415
		3	3,000	4,500	5,250
10	7,143	1	1,200	1,800	2,100
		2	1,829	2,743	3,200
		3	2,686	4,028	4,700
11	13,000	1	1,976	2,964	3,458
		2	2,496	3,744	4,368
		3	5,928	8,892	10,374
12	44,737	1	3,579	5,369	6,264
		2	8,232	12,348	14,406
		3	23,978	35,968	41,962
Total	306,108				

[a]Numbers include veal calves at 300 pounds.

Table A19

Beef Stocker Calves (700 Pounds)

Crop District	1978 Production	Farm Size	80%	120%	140%
1	26,808	1	2,145	3,217	3,753
		2	7,292	10,938	12,761
		3	12,010	18,014	21,017
2	25,218	1	2,219	3,329	3,884
		2	6,052	9,078	10,591
		3	11,903	17,855	20,831
3	20,957	1	3,353	5,029	5,867
		2	6,371	9,557	11,150
		3	7,042	10,562	12,323
4	14,955	1	2,034	3,050	3,559
		2	4,666	6,998	8,165
		3	5,264	7,896	9,212
5	5,624	1	1,080	1,620	1,890
		2	1,800	2,700	3,150
		3	1,620	2,430	2,835
6	25,334	1	3,242	4,864	5,674
		2	6,080	9,120	10,640
		3	10,945	16,417	19,153
7	21,257	1	2,721	4,081	4,761
		2	5,102	7,652	8,928
		3	9,183	13,775	16,071
8	17,746	1	3,407	5,111	5,963
		2	5,119	7,679	8,959
		3	5,670	8,506	9,923
9	4,940	1	1,067	1,601	1,868
		2	909	1,363	1,590
		3	1,976	2,964	3,458
10	5,210	1	875	1,313	1,532
		2	1,334	2,000	2,334
		3	1,959	2,939	3,429
11	8,009	1	1,218	1,826	2,131
		2	1,538	2,306	2,691
		3	3,652	5,478	6,391
12	30,142	1	2,411	3,617	4,220
		2	5,546	8,320	9,706
		3	16,156	24,234	28,273
Total	206,200				

Table A20

Beef Fed Beef (1,000, 1,050, and 1,170 Pounds)

Crop District	1978 Production	Farm Size	80%	120%	140%
1	35,142	1	2,811	4,217	4,920
		2	9,558	14,338	16,727
		3	15,744	23,616	27,552
2	35,785	1	3,149	4,723	5,510
		2	8,589	12,883	15,030
		3	16,890	25,336	29,558
3	28,326	1	4,532	6,798	7,931
		2	8,611	12,917	15,070
		3	9,518	14,276	16,656
4	19,471	1	2,648	3,972	4,634
		2	6,075	9,113	10,632
		3	6,854	10,280	11,994
5	7,900	1	1,518	2,276	2,656
		2	2,530	3,794	4,427
		3	2,277	3,415	3,984
6	34,528	1	4,419	6,629	7,734
		2	8,286	12,430	14,501
		3	14,916	22,374	26,103
7	28,019	1	3,586	5,380	6,276
		2	6,725	10,087	11,768
		3	12,104	18,156	21,182
8	24,164	1	4,639	6,959	8,119
		2	6,959	10,439	12,179
		3	7,733	11,599	13,532
9	6,844	1	1,478	2,218	2,587
		2	1,259	1,889	2,204
		3	2,738	4,106	4,791
10	6,509	1	1,094	1,640	1,914
		2	1,666	2,500	2,916
		3	2,447	3,671	4,283
11	11,872	1	1,805	2,707	3,158
		2	2,279	3,419	3,989
		3	5,414	8,120	9,474
12	40,785	1	3,263	4,895	5,711
		2	7,505	11,257	13,133
		3	21,860	32,790	38,255
Total	279,351				

Table A21

Dairy Calves (500 Pounds)[a]

Crop District	1978 Production	Farm Size	80%	120%	140%
1	1,481	1	663	995	1,161
		2	308	462	539
		3	214	320	374
2	4,783	1	1,951	2,927	3,415
		2	1,454	2,182	2,545
		3	421	631	736
3	3,977	1	1,686	2,530	2,951
		2	1,114	1,670	1,949
		3	382	572	668
4	1,679	1	752	1,128	1,316
		2	430	644	752
		3	162	242	283
5	1,351	1	757	1,135	1,324
		2	249	373	435
		3	76	114	133
6	2,162	1	882	1,324	1,544
		2	640	960	1,120
		3	207	311	363
7	9,302	1	2,456	3,684	4,298
		2	2,754	4,130	4,819
		3	2,233	3,349	3,907
8	8,537	1	2,458	3,688	4,302
		2	3,825	5,737	6,693
		3	546	820	956
9	12,500	1	1,400	2,100	2,450
		2	4,000	6,000	7,000
		3	4,600	6,900	8,050
10	2,857	1	937	1,405	1,639
		2	1,073	1,609	1,877
		3	297	445	519
11	5,000	1	920	1,380	1,610
		2	1,080	1,620	1,890
		3	2,000	3,000	3,500
12	5,263	1	1,979	2,969	3,464
		2	1,726	2,590	3,021
		3	506	758	885
Total	58,892				

[a]Numbers include veal calves at 300 pounds.

Table A22

Dairy Stocker Calves (700 Pounds)

Crop District	1978 Production	Farm Size	80%	120%	140%
1	671	1	301	451	526
		2	139	209	244
		3	97	145	169
2	1,909	1	779	1,169	1,364
		2	580	870	1,015
		3	168	252	294
3	1,719	1	729	1,093	1,275
		2	482	722	843
		3	165	247	288
4	821	1	368	552	644
		2	210	316	368
		3	78	118	137
5	548	1	307	461	538
		2	101	151	176
		3	30	46	53
6	923	1	377	565	659
		2	274	410	479
		3	88	132	154
7	4,159	1	1,098	1,646	1,921
		2	1,291	1,847	2,155
		3	998	1,498	1,747
8	3,665	1	1,055	1,583	1,847
		2	1,642	2,462	2,873
		3	234	352	410
9	5,151	1	577	865	1,009
		2	1,648	2,472	2,884
		3	1,896	2,844	3,318
10	1,390	1	456	684	798
		2	511	767	895
		3	145	217	253
11	1,851	1	341	511	596
		2	400	600	700
		3	740	1,110	1,295
12	2,271	1	854	1,280	1,494
		2	745	1,117	1,303
		3	218	325	382
Total	25,078				

Table A23

Dairy Fed Beef (1,000, 1,050, and 1,170 Pounds)

Crop District	1978 Production	Farm Size	80%	120%	140%
1	952	1	426	640	746
		2	198	298	347
		3	137	205	239
2	3,093	1	1,262	1,892	2,208
		2	940	1,410	1,645
		3	273	409	477
3	2,571	1	1,090	1,636	1,908
		2	720	1,080	1,260
		3	246	370	431
4	1,086	1	486	730	851
		2	278	418	487
		3	104	156	182
5	872	1	488	732	854
		2	161	241	281
		3	49	73	85
6	1,398	1	570	856	998
		2	414	620	724
		3	134	202	235
7	6,019	1	1,589	2,383	2,780
		2	1,782	2,672	3,118
		3	1,445	2,167	2,528
8	5,524	1	1,591	2,387	2,785
		2	2,474	3,712	4,330
		3	354	530	619
9	8,087	1	906	1,358	1,585
		2	2,588	3,882	4,529
		3	2,976	4,464	5,208
10	1,848	1	606	910	1,061
		2	680	1,020	1,190
		3	192	288	336
11	3,234	1	595	893	1,042
		2	698	1,048	1,222
		3	1,294	1,940	2,264
12	3,409	1	1,282	1,922	2,243
		2	1,118	1,678	1,957
		3	327	491	573
Total	38,093				

Table A24

Fluid Milk Production

Crop District	1978 Production	Farm Size	80%	120%	140%
1	6,918,131	1	3,099,322	4,648,984	5,423,814
		2	1,438,971	2,158,457	2,518,200
		3	996,211	1,494,317	1,743,370
2	34,375,623	1	14,025,254	21,037,882	24,544,195
		2	10,450,189	15,675,283	18,287,830
		3	3,025,054	4,537,582	5,293,845
3	24,718,082	1	10,480,466	15,720,700	18,340,816
		2	6,921,063	10,381,595	12,111,861
		3	2,372,936	3,559,404	4,152,638
4	6,773,945	1	3,034,727	4,552,091	5,310,773
		2	1,734,130	2,601,194	3,034,727
		3	650,298	975,448	1,138,022
5	9,182,676	1	5,142,298	7,713,448	8,999,022
		2	1,689,612	2,534,418	2,956,821
		3	220,384	330,576	385,672
6	7,997,797	1	3,646,995	5,470,493	6,382,242
		2	2,367,348	3,551,022	4,142,859
		3	767,789	1,151,683	1,343,630
7	92,937,697	1	24,535,552	36,803,328	42,937,216
		2	27,509,558	41,264,338	48,141,727
		3	22,305,047	33,457,571	39,033,833
8	69,081,084	1	19,895,352	29,843,028	34,816,366
		2	30,948,326	46,422,488	54,159,570
		3	4,421,190	6,631,784	7,737,082
9	156,663,084	1	17,546,266	26,319,398	30,705,965
		2	50,132,187	75,198,281	87,731,328
		3	57,652,015	86,478,023	100,891,027
10	25,199,508	1	8,265,438	12,398,158	14,464,517
		2	9,273,419	13,910,129	16,228,484
		3	2,620,749	3,931,123	4,586,310
11	53,628,512	1	9,867,646	14,801,470	17,268,381
		2	11,583,758	17,375,638	20,271,577
		3	21,451,405	32,177,107	37,539,958
12	26,552,000	1	9,983,552	14,975,328	17,471,216
		2	8,709,056	13,063,584	15,240,848
		3	2,548,992	3,823,488	4,460,736
Total	514,026,139				

Table A25

Milk Production by Cream Shippers

Crop District	1978 Production	Farm Size	80%	120%	140%
1	4,965,869	1	2,224,710	3,337,064	3,893,242
		2	1,032,901	1,549,351	1,807,576
		3	715,085	1,072,627	1,251,398
2	6,587,377	1	2,687,650	4,031,474	4,703,387
		2	2,002,562	3,003,844	3,504,484
		3	579,689	869,533	1,014,455
3	8,512,918	1	3,609,477	5,414,215	6,316,584
		2	2,383,617	3,575,425	4,171,329
		3	817,240	1,225,860	1,430,170
4	6,030,655	1	2,724,134	4,086,200	4,767,234
		2	1,556,648	2,334,972	2,724,134
		3	583,743	875,615	1,021,551
5	4,357,803	1	2,440,370	3,660,554	4,270,647
		2	801,836	1,202,754	1,403,213
		3	244,037	366,055	427,064
6	10,539,803	1	4,806,150	7,209,226	8,410,763
		2	3,119,782	4,679,672	5,459,618
		3	1,011,821	1,517,731	1,770,686
7	10,539,803	1	2,782,508	4,173,762	4,869,389
		2	3,119,782	4,679,672	5,459,618
		3	2,529,553	3,794,329	4,426,717
8	14,694,916	1	4,232,136	6,348,204	7,406,238
		2	6,583,322	9,874,984	11,520,814
		3	940,474	1,410,712	1,645,830
9	14,694,916	1	1,645,830	2,468,746	2,880,203
		2	4,702,373	7,053,559	8,229,152
		3	5,407,729	8,111,593	9,463,525
10	4,560,492	1	1,495,841	2,243,761	2,617,721
		2	1,678,261	2,517,391	2,936,956
		3	474,290	711,436	830,008
11	6,384,688	1	1,174,782	1,762,174	2,055,869
		2	1,379,093	2,068,639	2,413,412
		3	2,553,875	3,830,813	4,469,282
12	9,425,016	1	3,543,806	5,315,708	6,201,660
		2	3,091,406	4,637,108	5,409,960
Total		3	904,802	1,357,202	1,583,402
	101,344,256				

Table A26

Weanlings (50 Pounds)

Crop District	1978 Production	Farm Size	80%	120%	140%
1	60,535	1	8,233	12,349	14,407
		2	14,044	21,066	24,577
		3	26,151	39,227	45,765
2	109,455	1	11,383	17,075	19,921
		2	26,270	39,404	45,972
		3	49,911	74,867	87,345
3	58,838	1	11,768	17,652	20,594
		2	16,004	24,006	28,007
		3	19,298	28,948	33,772
4	8,446	1	3,581	5,371	6,266
		2	2,162	3,244	3,784
		3	1,014	1,520	1,774
5	33,556	1	7,517	11,275	13,154
		2	15,302	22,952	26,778
		3	4,026	6,040	7,046
6	43,696	1	14,682	22,022	25,693
		2	14,682	22,022	25,693
		3	5,594	8,390	9,789
7	195,288	1	6,250	9,374	10,937
		2	20,310	30,464	35,542
		3	129,671	194,507	226,925
8	266,198	1	19,166	28,750	33,541
		2	55,369	83,053	96,895
		3	138,423	207,635	242,241
9	185,053	1	10,363	15,545	18,136
		2	22,206	33,310	38,861
		3	115,473	173,209	202,077
10	21,755	1	5,394	8,092	9,440
		2	2,438	3,656	4,266
		3	9,572	14,358	16,751
11	105,905	1	5,930	8,896	10,378
		2	16,945	25,417	29,653
		3	61,849	92,773	108,235
12	43,815	1	8,062	12,092	14,108
		2	9,114	13,670	15,949
		3	17,877	26,815	31,284
Total	1,132,540				

Table A27

Finished Hogs (200 Pounds)

Crop District	1978 Production	Farm Size	80%	120%	140%
1	47,837	1	6,506	9,758	11,385
		2	10,333	15,499	18,082
		3	21,431	32,147	37,505
2	85,172	1	10,902	16,354	19,079
		2	19,078	28,618	33,387
		3	38,157	57,235	66,774
3	46,602	1	15,658	23,488	27,402
		2	18,268	27,402	31,969
		3	3,355	5,033	5,872
4	6,443	1	3,093	4,639	5,412
		2	1,289	1,933	2,255
		3	773	1,159	1,352
5	25,949	1	7,474	11,210	13,079
		2	9,965	14,947	17,438
		3	3,321	4,981	5,811
6	33,627	1	17,217	25,825	30,129
		2	7,802	11,702	13,653
		3	1,883	2,825	3,296
7	152,427	1	9,755	14,633	17,072
		2	23,169	34,753	40,545
		3	89,018	133,526	155,781
8	206,796	1	23,161	34,741	40,531
		2	81,065	121,597	141,863
		3	61,212	91,818	107,121
9	144,748	1	11,580	17,370	20,265
		2	28,950	43,424	50,662
		3	75,269	112,903	131,720
10	16,681	1	3,737	5,605	6,539
		2	3,737	5,605	6,539
		3	5,872	8,808	10,276
11	82,701	1	5,293	7,939	9,262
		2	24,479	36,719	42,839
		3	36,389	54,583	63,680
12	33,627	1	9,415	14,123	16,477
		2	15,334	23,002	26,835
		3	2,152	3,228	3,766
Total	882,610				

Table A28

Eggs

Crop District	1978 Production	Farm Size	80%	120%	140%
1	913,821	1	29,242	43,864	51,174
		2	73,105	109,657	127,933
		3	628,709	943,063	1,100,240
2	2,081,923	1	66,622	99,932	116,588
		2	166,554	249,830	291,469
		3	1,423,363	2,148,545	2,506,636
3	1,088,496	1	34,832	52,248	60,956
		2	87,080	130,620	152,390
		3	748,885	1,123,327	1,310,548
4	281,551	1	9,010	13,514	15,767
		2	22,524	33,786	39,417
		3	193,707	290,561	339,988
5	209,739	1	6,712	10,068	11,746
		2	16,779	25,169	29,364
		3	144,300	216,450	252,525
6	790,318	1	25,290	37,936	44,258
		2	63,226	94,838	110,645
		3	543,738	815,608	951,542
7	10,121,718	1	323,895	485,843	566,817
		2	809,738	1,214,606	1,417,041
		3	6,963,742	10,445,612	12,186,548
8	9,241,245	1	295,720	443,580	517,510
		2	739,300	1,108,950	1,293,775
		3	6,357,976	9,536,964	11,126,458
9	17,691,952	1	566,142	849,214	990,750
		2	1,415,356	2,123,034	2,476,873
		3	12,172,063	18,258,095	21,301,111
10	3,102,684	1	99,286	148,928	173,750
		2	248,214	372,322	434,375
		3	2,134,647	3,201,971	3,735,633
11	2,295,157	1	73,445	110,167	128,528
		2	183,613	275,419	321,322
		3	1,579,068	2,368,602	2,763,369
12	1,777,982	1	56,895	85,343	99,567
		2	142,238	213,358	248,917
		3	1,223,252	1,834,878	2,140,691
Total	49,596,586				

Table A29

Broilers

Crop District	1978 Production	Farm Size	80%	120%	140%
1	3,780	1	121	181	211
		2	302	454	529
		3	2,601	3,901	4,551
2	40,050	1	1,282	1,922	2,243
		2	3,204	4,806	5,607
		3	27,554	41,332	[illegible]
3	94,410	1	3,021	4,531	5,286
		2	7,553	11,329	13,217
		3	64,954	97,432	[illegible]
4	4,410	1	141	211	246
		2	353	529	617
		3	3,034	4,552	5,310
5	4,500	1	144	216	252
		2	360	540	630
		3	3,096	4,644	[illegible]
6	12,780	1	409	613	715
		2	1,022	1,534	1,790
		3	8,793	13,189	15,387
7	31,230	1	999	1,499	1,749
		2	2,498	3,747	[illegible]
		3	21,486	32,230	37,601
8	80,820	1	2,586	3,880	4,526
		2	6,466	9,699	[illegible]
		3	55,604	83,406	[illegible]
9	582,030	1	18,625	27,937	32,593
		2	46,562	69,844	[illegible]
		3	400,437	600,655	[illegible]
10	20,160	1	645	967	1,128
		2	1,613	2,419	[illegible]
		3	13,870	20,806	[illegible]
11	20,970	1	671	1,007	1,175
		2	1,663	2,495	[illegible]
		3	14,427	21,641	[illegible]
12	4,860	1	155	233	271
		2	389	583	680
		3	3,344	5,016	[illegible]
Total	900,000				

Table A30

Turkeys

Crop District	1978 Production	Farm Size	80%	120%	140%
1	2,500	1	20	30	35
		2	120	180	210
		3	1,860	2,790	3,255
2	114,909	1	919	1,379	1,609
		2	5,516	8,274	9,653
		3	85,492	128,238	149,611
3	4,319	1	34	52	60
		2	207	311	363
		3	3,214	4,820	5,624
4	2,614	1	21	31	36
		2	126	188	220
		3	1,945	2,917	3,403
5	1,591	1	13	19	22
		2	76	114	133
		3	1,184	1,776	2,072
6	47,055	1	377	565	659
		2	2,258	3,388	3,952
		3	35,009	52,513	61,265
7	111,386	1	891	1,337	1,560
		2	5,346	8,020	9,356
		3	82,871	124,307	145,025
8	28,528	1	228	342	399
		2	1,370	2,054	2,397
		3	21,225	31,837	37,143
9	518,171	1	4,145	6,217	7,253
		2	24,872	37,308	43,526
		3	385,519	578,279	674,659
10	19,436	1	155	233	272
		2	933	1,399	1,632
		3	14,461	21,691	25,306
11	162,532	1	1,300	1,950	2,275
		2	7,802	11,702	13,653
		3	120,924	181,386	211,617
12	123,547	1	988	1,482	1,729
		2	5,930	8,896	10,378
		3	91,919	137,879	160,859
Total	1,136,588				

weighted average price for each of steers and heifers. The two resulting prices were then weighted by the numbers of each sex to determine the average price per cwt. The results are as shown below.

1. Steers

Class	Number Slaughtered	Average Price Per cwt	Weighted Average Price Per cwt
A_1-A_2 $1,000^+$	17,510	58.05	
A_1-A_2 $1,000^-$	8,217	57.56	55.14
A_3-A_4	1,002	53.66	
B-C	3,605	49.80	
	30,334		

2. Finished Heifers

Class	Number Slaughtered	Average Price Per cwt	Weighted Average Price Per cwt
A_1-A_2 850^+	8,658	52.45	
A_1-A_2 850^-	5,809	53.48	50.63
A_3-A_4	1,027	51.42	
B-C	6,491	45.53	
	21,985		

Weighting factor for steers = $\frac{30,334}{52,319} = .58$

Weighting factor for heifers = $\frac{21,985}{52,319} = .42$

Average price for slaughtered animals = .58(55.14) + .42(50.63) = 53.24

Feeders (700 pounds)

The same procedure was followed that was used for finished animals. Prices were obtained from the same source. Calculations were as follows:

1. Steers: feeders

Class	Number Sold	Average Price Per cwt	Average Price
800+	13,493	58.78	
700-800	5,687	60.84	57.70
600-700	5,998	60.91	
Common 600+	9,387	52.21	
	34,565		

2. Heifers: feeders

Class	Number Sold	Average Price Per cwt	Average Price
700+	4,942	51.76	
600-700+	3,517	53.95	
500-600	5,057	54.47	51.69
Common 500+	6,334	48.16	
	19,850		

Weighting factor for steers = $\frac{34,565}{54,412} = .635$

Weighting factor for heifers = $\frac{19,847}{54,412} = .365$

Average price per cwt for feeders = .635(57.70) + .365(51.69) = 55.51 per cwt

Stockers (500 pounds)

Again the same procedure as was used for feeders and finished animals is used for stockers, with the information coming from the same source (Agriculture Canada). The results are as follows:

1. Steers: stockers

Class	Number Sold	Average Price Per cwt	Weighted Average Price Per cwt
500-600	7,422	54.43	
400-500	8,815	74.09	65.09
300-400	5,978	77.12	
Common 300-600	12,181	59.19	
	34,396		

2. Heifers: stockers

Class	Number Sold	Average Price Per cwt	Weighted Average Price Per cwt
400-500	6,438	61.20	
300-400	1,209	64.86	59.85
Common 300-500	2,494	53.93	
	10,141		

Weighting factor for steers = $\frac{34,396}{44,537} = .77$

Weighting factor for heifers = $\frac{10,141}{44,537} = .23$

Average price = .77(65.09) + .23(59.85) = 63.89 per cwt

Veal

The weighted average price of $56.70 per cwt for 300-pound veal calves was derived using the prices and numbers sold in each grade given by the Market Reporter, Livestock Division.

Grade	Number Slaughtered	Average Price
Good	2,279	74.90
Butcher	4,370	55.57
Common	4,043	47.67
	10,692	

Weighted average price = 56.70 per cwt

Cows

The same procedure as used for calculating veal prices was used for cows, using the same source of information. The resulting average price is as follows:

Class	Number Sold	Average Price Per cwt
D_1-D_2	19,304	40.66
D_3-D_5	10,901	37.75
	30,205	

Average price per cwt = $39.23 per cwt

Bulls

A price of $47.27 per cwt was used as given by the Livestock Division, Agriculture Canada.

Milk And Cream

Milk prices were obtained from the monthly Manitoba Milk Pool Reports.[1] Production weights based on the pounds of Grade A and Grade B milk produced were calculated and used to adjust the respective prices. The Canadian Dairy Commission subsidy payments were added to the weighted prices as shown on Table A31.

A cream price of $0.07 per pound was obtained from Mr. Minenglish, of the Manitoba Milk Marketing Board.

Hogs[2]

The average price of $67.04 per cwt for finished hogs indexed at 100. The value of a 25-pound weanling was estimated to be half of the value of one hundredweight of an index 100 market hog with .70 dressed weight. The value for weanlings in this analysis was $50.26 per weanling. The average prices for dressed sows and boars were $48.11 per cwt and $27.21 per cwt, respectively.

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[1] Manitoba Milk Marketing Board, "Manitoba Milk Pool Results, January-December, 1978" (Winnipeg: Manitoba Milk Marketing Board, 1978).

[2] These figures obtained from: Agriculture Canada, Canada Livestock and Meat Trade Report, Volumes 58 and 59 (Ottawa: Agriculture Canada, 1979).

Table A31

Weighted 1978 Milk Prices[a]

Month	Production Weight	Grade A Price	Production Weight	Grade B Price	Weighted Group Milk Prices		Subsidy Payment		Net Price
January	98.92	11.00	1.08	8.83	10.98	+	1.44	=	12.42
February	98.87	11.04	1.13	8.83	11.02	+	1.44	=	12.46
March	98.78	11.12	1.22	9.14	11.10	+	1.44	=	12.54
April	99.12	10.99	.88	9.13	10.97	+	1.44	=	12.41
May	98.82	11.06	1.18	9.19	11.04	+	1.44	=	12.48
June	98.88	11.53	1.12	9.38	11.51	+	1.44	=	12.95
July	98.67	11.46	1.33	9.37	11.43	+	1.44	=	12.87
August	98.52	11.56	1.48	9.38	11.53	+	1.44	=	12.97
September	99.18	11.58	.82	9.37	11.56	+	1.44	=	13.00
October	99.65	11.71	.35	9.39	11.35	+	1.44	=	12.79
November	99.79	11.77	.21	9.38	11.79	+	1.44	=	13.23
December	99.46	11.54	.54	9.38	11.59	+	1.44	=	13.03

Average Milk Price = $12.76 per cwt.

[a]Prices received from Manitoba Milk Pool Reports - 1978 Monthly Reports. Subsidy payments were based on information received from Mr. Minenglish, Manitoba Milk Marketing Board, at $2.66 per cwt of Grade B milk, which was quoted at 54 percent of the pooled milk production.

Poultry[1]

The method of calculating these prices is described in Framingham, et. al.[2] A weighted average price of 60.05 cents per dozen was used. An average liveweight price of $1.52 per animal was used for broilers. A value of $8.89 per animal was used for turkeys.

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[1]These figures obtained from Lee Foster, Poultry Division, Production and Marketing Branch, Agriculture Canada.

[2]C.F. Framingham, L.B.B. Baker, and W.J. Craddock, op. cit., pp. 78-80.

APPENDIX B

This appendix contains the actual production and value figures for all the commodities examined in this study within the five principle study regions of Manitoba. These numbers represent the normative optimal production solution directly obtained from the linear programming model. It is this production mix which will achieve maximization of net farm income. The reader is advised to note the differences with respect to the changes between various scenarios as follows:

(i) The production and value changes between Scenario I and Scenario II are the differences of Scenario I subtracted from Scenario II.

(ii) The production and value changes between Scenario II and the other four scenarios are the differences of Scenario II subtracted from each of the other four scenarios.

The following measurement units apply to Tables B1 to B24:

(a) all production values are in thousands of dollars.

(b) wheat, oats, barley, flax, rapeseed, and rye production figures are in thousands of bushels.

(c) sunflower production figures are in thousands of pounds.

(d) potato production figures are in thousands of hundredweights.

(e) sugar beet production figures are in thousands of tons.

(f) all livestock production figures are in thousands of animals.

(g) fluid milk and cream production figures are in thousands of pounds.

(h) egg production figures are in thousands of dozens.

(i) broilers and turkey production figures are in thousands of animals.

Table B1

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
PROVINCE TOTAL																						
WHEAT	76528	221931	79313	230009	-2785	-8078	72139	191891	-4389	-30040	71926	191325	-4602	-30606	72128	187533	-4400	-34398	71880	186889	-4648	-35042
OATS	30450	29232	31325	30072	-875	-840	30369	24903	-81	-4329	32399	26567	1949	-2665	30369	23688	-81	-5544	32365	25245	1915	-3987
BARLEY	62465	108064	67644	117025	-5179	-8961	62552	96330	87	-11734	64968	100052	2503	-8012	62428	92394	-37	-15670	64976	96164	2511	-11900
FLAX	6557	35214	6857	36822	-300	-1608	6557	33771	0	-1443	6557	33771	0	-1443	6557	33378	0	-1836	6557	33378	0	-1836
RAPESEED	21916	140263	22092	141394	-176	-1131	21916	135880	0	-4383	25489	158036	3573	17773	21916	134784	0	-5479	25489	156762	3573	16499
RYE	3419	8069	3833	9047	-414	-978	3326	7086	-93	-983	3661	7799	242	-270	3314	6894	-105	-1175	3643	7578	224	-491
SUNFLOWERS	164874	16487	164874	16487	0	0	180701	18070	15827	1582	161718	16171	-3156	-315	180528	18052	15654	1565	161718	16171	-3156	-315
POTATOES	6345	24048	6345	24049	0	-1	6345	24048	0	0	6345	24048	0	0	6345	24048	0	0	6345	24048	0	0
SUGAR BEETS	423	13555	423	13555	0	0	423	13555	0	0	423	13555	0	0	423	13555	0	0	423	13555	0	0
VEAL CALVES	16	2772	21	3591	-5	-819	16	2772	0	0	16	2772	0	0	16	2772	0	0	16	2772	0	0
STOCKER CALVES	276	48792	277	48886	-1	-94	277	48797	1	5	318	56063	42	7271	277	48797	1	5	318	56063	42	7271
STOCKER CATTLE	276	132190	277	132444	-1	-254	277	132202	1	12	318	151888	42	19698	277	132202	1	12	318	151888	42	19698
FED BEEF	298	115999	302	117528	-4	-1529	299	116236	1	237	342	133104	44	17105	299	116236	1	237	342	133104	44	17105
WEANLING HOGS	793	39907	906	45555	-113	-5648	793	39907	0	0	793	39907	0	0	793	39907	0	0	793	39907	0	0
MARKET HOGS	793	79814	906	91110	-113	-11296	793	79814	0	0	793	79814	0	0	793	79814	0	0	793	79814	0	0
FLUID MILK	411222	53458	465143	60468	-53921	-7010	411222	53458	0	0	411222	53458	0	0	411222	53458	0	0	411222	53458	0	0
CREAM	81075	5675	81581	5710	-506	-35	81075	5675	0	0	81075	5675	0	0	81075	5675	0	0	81075	5675	0	0
EGGS	59515	35709	59515	35709	0	0	59515	35709	0	0	59515	35709	0	0	59515	35709	0	0	59515	35709	0	0
BROILERS	1079	1641	1079	1641	0	0	1079	1641	0	0	1079	1641	0	0	1079	1641	0	0	1079	1641	0	0
TURKEY	1363	12123	1363	12125	0	-2	1363	12123	0	0	1363	12123	0	0	1363	12123	0	0	1363	12123	0	0

Table B2

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
PROVINCE SMALL																						
WHEAT	0	0	9260	26854	-9260	-26854	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OATS	156	150	3274	3143	-3118	-2993	89	73	-67	-77	0	0	-156	-150	89	69	-67	-81	0	0	-156	-150
BARLEY	0	0	7424	12844	-7424	-12844	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FLAX	0	0	898	4823	-898	-4823	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAPESEED	2673	17108	2849	18239	-176	-1131	2673	17108	0	-535	3118	19336	445	2228	2673	16440	0	-668	3118	19180	445	2072
RYE	0	0	414	978	-414	-978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUNFLOWERS	3637	363	26944	2694	-23307	-2331	6520	652	2883	288	232	23	-3405	-340	6520	652	2883	289	232	23	-3405	-340
POTATOES	909	3446	909	3446	0	0	909	3446	0	0	909	3446	0	0	909	3446	0	0	909	3446	0	0
SUGAR BEETS	61	1973	61	1973	0	0	61	1973	0	0	61	1973	0	0	81	1973	0	0	61	1973	0	0
VEAL CALVES	0	0	6	1044	-6	-1044	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STOCKER CALVES	4	802	48	8628	-44	-7826	4	768	0	-34	7	1241	3	439	4	768	0	-34	7	1241	3	439
STOCKER CATTLE	48	23383	49	23637	-1	-254	49	23395	1	12	52	24932	4	1549	49	23395	1	12	52	24932	4	1549
FED BEEF	48	18929	52	20423	-4	-1494	48	18943	0	14	51	20037	3	1108	48	18943	0	14	51	20037	3	1108
WEANLING HOGS	0	0	112	5648	-112	-5648	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MARKET HOGS	55	5577	148	14898	-93	-9321	55	5577	0	0	5	508	-50	-5069	48	4907	-7	-670	5	508	-50	-5069
FLUID MILK	2855	371	129522	16837	-126667	-16466	1170	152	-1685	-219	1170	152	-1685	-219	1170	152	-1685	-219	1170	152	-1685	-219
CREAM	14203	994	33367	2335	-19164	-1341	14203	994	0	0	14203	994	0	0	14203	994	0	0	14203	994	0	0
EGGS	1232	739	2196	1317	-964	-578	1232	739	0	0	1232	739	0	0	1232	739	0	0	1232	739	0	0
BROILERS	43	65	43	65	0	0	43	65	0	0	43	65	0	0	43	65	0	0	43	65	0	0
TURKEY	13	119	13	121	0	-2	13	119	0	0	13	119	0	0	13	119	0	0	13	119	0	0

Table B3

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
PROVINCE MEDIUM																						
WHEAT	22950	66556	20251	58729	2699	7827	19475	51804	-3475	-14752	19475	51804	-3475	-14752	19475	50636	-3475	-15920	19475	50636	-3475	-15920
OATS	8636	8291	7457	7158	1179	1133	8623	7071	-13	-1220	8865	7269	229	-1022	8623	6726	-13	-1565	8865	6915	229	-1376
BARLEY	18607	32190	16553	28638	2054	3552	18691	28784	84	-3406	16938	26084	-1669	-6106	18567	27480	-40	-4710	16938	25068	-1669	-7122
FLAX	1943	10434	1816	9753	127	681	1938	9980	-5	-454	1998	10294	55	-140	1930	9825	-13	-609	1987	10116	44	-318
RAPESEED	6238	39923	6238	39923	0	0	6238	38676	0	-1247	7257	44996	1019	5073	6238	38364	0	-1559	7257	44633	1019	4710
RYE	1097	2590	1097	2590	0	0	1012	2156	-85	-434	1093	2328	-4	-262	1000	2080	-97	-510	1074	2235	-23	-355
SUNFLOWERS	53209	5320	53209	5320	0	0	57122	5712	3913	391	53281	5328	72	7	56950	5695	3741	374	53280	5328	71	7
POTATOES	1773	6723	1774	6724	-1	-1	1773	6723	0	0	1773	6723	0	0	1773	6723	0	0	1773	6723	0	0
SUGAR BEETS	121	3887	121	3887	0	0	121	3887	0	0	121	3887	0	0	121	3887	0	0	121	3887	0	0
VEAL CALVES	6	1027	6	1143	0	-116	7	1353	1	326	2	466	-4	561	8	1414	2	387	3	530	-3	-497
STOCKER CALVES	98	17396	88	15620	10	1776	96	16942	-2	-454	102	18005	4	609	95	16879	-3	-517	101	17939	3	543
STOCKER CATTLE	89	42789	89	42789	0	0	89	42789	0	0	104	49930	15	7141	89	42789	0	0	104	49930	15	7141
FED BEEF	97	37990	97	38019	0	-29	98	38173	1	183	114	44427	17	6437	98	38173	1	183	114	44427	17	6437
WEANLING HOGS	214	10802	214	10802	0	0	214	10802	0	0	214	10802	0	0	214	10802	0	0	214	10802	0	0
MARKET HOGS	263	26519	283	28494	-20	-1975	263	26519	0	0	246	24765	-17	-1754	270	27189	7	670	246	24765	-17	-1754
FLUID MILK	231613	30109	162757	21158	68856	8951	231613	30109	0	0	231613	30109	0	0	231613	30109	0	0	231613	30109	0	0
CREAM	41728	2921	31451	2201	10277	720	41728	2921	0	0	41728	2921	0	0	41728	2921	0	0	41728	2921	0	0
EGGS	7109	4265	6144	3686	965	579	7109	4265	0	0	7109	4265	0	0	7109	4265	0	0	7109	4265	0	0
BROILERS	107	164	107	164	0	0	107	164	0	0	107	164	0	0	107	164	0	0	107	164	0	0
TURKEY	81	727	81	727	0	0	81	727	0	0	81	727	0	0	81	727	0	0	81	727	0	0

Table B4

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
PROVINCE LARGE																						
WHEAT	53577	155375	49801	144424	3776	10951	52664	140087	-913	-15288	52451	139520	-1126	-15855	52652	136897	-925	-18478	52404	136252	-1173	-19123
OATS	21657	20790	20594	19770	1063	1020	21657	17758	0	-3032	23533	19297	1876	-1493	21657	16892	0	-3898	23499	18329	1842	-2461
BARLEY	43857	75874	43666	75543	191	331	43860	67545	3	8329	48030	73967	4173	-1907	43860	64914	3	-10960	48038	71096	4181	-4778
FLAX	4614	24780	4142	22245	472	2535	4619	23790	5	-990	4558	23477	-56	-1303	4627	23552	13	-1228	4570	23261	-44	-1519
RAPESEED	13004	83231	13004	83231	0	0	13004	80630	0	-2601	15113	93703	2109	10472	13004	79980	0	-3251	15113	92948	2109	9717
RYE	2321	5478	2321	5478	0	0	2314	4929	-7	-549	2568	5470	247	-8	2314	4813	-7	-665	2568	5342	247	-136
SUNFLOWERS	108028	10802	108028	10802	0	0	117058	11705	9030	903	108205	10820	177	18	117058	11705	9030	903	108205	10820	177	18
POTATOES	3661	13878	3661	13878	0	0	3661	13878	0	0	3661	13878	0	0	3661	13878	0	0	3661	13878	0	0
SUGAR BEETS	240	7693	240	7693	0	0	240	7693	0	0	240	7693	0	0	240	7693	0	0	240	7693	0	0
VEAL CALVES	10	1745	8	1403	2	342	8	1419	-2	-326	13	2306	3	561	7	1358	-3	-387	13	2242	3	497
STOCKER CALVES	173	30593	139	24637	34	5956	176	31086	3	493	209	36816	36	6223	176	31149	3	556	209	36882	36	6289
STOCKER CATTLE	138	66018	138	66018	0	0	138	66018	0	0	161	77026	23	11008	138	66018	0	0	161	77026	23	11008
FED BEEF	152	59080	152	59086	0	6	152	59120	0	40	176	68639	24	9559	152	59120	0	40	176	68639	24	9559
WEANLING HOGS	578	29105	578	29105	0	0	578	29105	0	0	578	29105	0	0	578	29105	0	0	578	29105	0	0
MARKET HOGS	474	47717	474	47717	0	0	474	47717	0	0	542	54540	68	6823	474	47717	0	0	542	54540	68	6823
FLUID MILK	176753	22977	172862	22472	3891	505	178437	23196	1684	219	178437	23196	1684	219	178437	23196	1684	219	178437	23196	1684	219
CREAM	25143	1760	16762	1173	8381	587	25143	1760	0	0	25143	1760	0	0	25143	1760	0	0	25143	1760	0	0
EGGS	51174	30704	51174	30704	0	0	51174	30704	0	0	51174	30704	0	0	51174	30704	0	0	51174	30704	0	0
BROILERS	928	1411	928	1411	0	0	928	1411	0	0	928	1411	0	0	928	1411	0	0	928	1411	0	0
TURKEY	1268	11276	1268	11276	0	0	1268	11276	0	0	1268	11276	0	0	1268	11276	0	0	1268	11276	0	0

Table B5

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
INTERLAKE TOTAL																						
WHEAT	4124	11980	4672	13572	-548	-1592	4124	11052	0	-928	4124	11052	0	-928	4124	10784	0	-1196	4124	10784	0	-1196
OATS	2643	2537	2809	2697	-166	-160	2630	2196	-13	-341	2949	2463	306	-74	2630	2090	-13	-447	2949	2345	306	-192
BARLEY	3605	6237	4102	7096	-497	-859	3605	5588	0	-649	3605	5588	0	-649	3605	5389	0	-848	3605	5389	0	-848
FLAX	533	2865	445	2393	88	472	391	2022	-142	-843	391	2022	-142	-843	391	1999	-142	-866	391	1999	-142	-866
RAPESEED	474	3041	534	3420	-60	-379	474	2953	0	-88	474	2953	0	-88	474	2927	0	-114	474	2927	0	-114
RYE	43	103	48	113	-5	-10	35	75	-8	-28	37	79	-6	-24	35	73	-8	-30	37	77	-6	-26
SUNFLOWERS	575	58	575	58	0	0	575	58	0	0	575	58	0	0	575	58	0	0	575	58	0	0
POTATOES	341	1294	341	1294	0	0	341	1294	0	0	341	1294	0	0	341	1294	0	0	341	1294	0	0
SUGAR BEETS	6	208	6	208	0	0	6	208	0	0	6	208	0	0	6	208	0	0	6	208	0	0
VEAL CALVES	2	466	3	624	-1	-158	2	434	0	-32	6	1059	4	593	2	434	0	-32	6	1059	4	593
STOCKER CALVES	49	8744	50	8936	-1	-192	50	8893	1	149	62	11068	13	2324	50	8893	1	149	62	11068	13	2324
STOCKER CATTLE	50	24138	50	24209	0	-71	50	24113	0	-25	57	27533	7	3395	50	24113	0	-25	57	27533	7	3395
FED BEEF	55	21514	56	21924	-1	-410	55	21491	0	-23	63	24489	8	2975	55	21491	0	-23	63	24489	8	2975
WEANLING HOGS	105	5318	119	6022	-14	-704	105	5318	0	0	105	5318	0	0	105	5318	0	0	105	5318	0	0
MARKET HOGS	96	9708	126	12685	-30	-2977	96	9708	0	0	105	10623	9	915	96	9708	0	0	105	10623	9	915
FLUID MILK	69073	8979	76144	9898	-7071	-919	67388	8760	-1685	-219	66218	8608	-2855	-371	67388	8760	-1685	-219	66218	8608	-2855	-371
CREAM	17199	1203	12647	885	4552	318	17199	1203	0	0	17199	1203	0	0	17199	1203	0	0	17199	1203	0	0
EGGS	4529	2717	4788	2872	-259	-155	4529	2717	0	0	4529	2717	0	0	4529	2717	0	0	4529	2717	0	0
BROILERS	30	47	30	47	0	0	30	47	0	0	30	47	0	0	30	47	0	0	30	47	0	0
TURKEY	343	3051	343	3051	0	0	343	3051	0	0	343	3051	0	0	343	3051	0	0	343	3051	0	0

Table B6

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
INTERLAKE SMALL																						
WHEAT	0	0	547	1591	-547	-1591	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OATS	0	0	245	235	-245	-235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BARLEY	0	0	496	859	-496	-859	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FLAX	0	0	53	288	-53	-288	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAPESEED	0	0	59	378	-59	-378	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RYE	0	0	4	10	-4	-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUNFLOWERS	0	0	85	8	-85	-8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POTATOES	44	168	44	168	0	0	44	168	0	0	44	168	0	0	44	168	0	0	44	168	0	0
SUGAR BEETS	0	27	0	27	0	0	0	27	0	0	0	27	0	0	0*	27	0	0	0	27	0	0
VEAL CALVES	0	0	1	213	-1	-213	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STOCKER CALVES	0	59	7	1268	-7	-1209	0	26	0	-33	0	0	0	-59	0	26	0	-33	0	0	0	-59
STOCKER CATTLE	7	3382	7	3453	0	-71	7	3357	0	-25	6	3315	-1	-67	7	3357	0	-25	6	3315	-1	-67
FED BEEF	6	2718	8	3129	-2	-411	6	2695	0	-23	6	2601	0	-117	6	2695	0	-23	6	2601	0	-117
WEANLING HOGS	0	0	13	703	-13	-703	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MARKET HOGS	0	0	17	1745	-17	-1745	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FLUID MILK	2855	371	19851	2580	-16996	-2209	1170	152	-1685	-219	0	0	-2855	-371	1170	152	-1685	-219	0	0	-2855	-371
CREAM	5305	371	4718	330	587	41	5305	371	0	0	5305	371	0	0	5305	371	0	0	5305	371	0	0
EGGS	0	0	167	100	-167	-100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BROILERS	1	1	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0
TURKEY	3	30	3	30	0	0	3	30	0	0	3	30	0	0	3	30	0	0	3	30	0	0

Table B7

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
INTERLAKE MEDIUM																						
WHEAT	1115	3240	1115	3240	0	0	1115	2989	0	-251	1115	2989	0	-251	1115	2917	0	-323	1115	2917	0	-323
OATS	650	624	583	559	67	65	637	532	-13	-92	625	522	-25	-102	637	506	-13	-118	625	497	-25	-127
BARLEY	1005	1739	1005	1739	0	0	1005	1558	0	-181	1005	1558	0	-181	1005	1503	0	-236	1005	1503	0	-236
FLAX	108	583	108	583	0	0	108	561	0	-22	108	561	0	-22	108	554	0	-29	108	554	0	-29
RAPESEED	121	779	121	779	0	0	121	756	0	-23	121	756	0	-23	121	750	0	-29	121	750	0	-29
RYE	9	23	9	23	0	0	8	18	-1	-5	8	18	-1	-5	8	18	-1	-5	8	18	-1	-5
SUNFLOWERS	172	17	172	17	0	0	172	17	0	0	172	17	0	0	172	17	0	0	172	17	0	0
POTATOES	88	336	88	336	0	0	88	336	0	0	88	336	0	0	88	336	0	0	88	336	0	0
SUGAR BEETS	1	54	1	54	0	0	1	54	0	0	1	54	0	0	1	54	0	0	1	54	0	0
VEAL CALVES	0	144	1	185	-1	-41	0	112	0	-32	0	71	0	-73	1	174	1	30	0	136	0	-8
STOCKER CALVES	13	2329	12	2192	1	137	13	2362	0	33	13	2309	0	-20	13	2299	0	-30	12	2243	-1	-86
STOCKER CATTLE	12	5890	12	5890	0	0	12	5890	0	0	14	6874	2	984	12	5890	0	0	14	6874	2	984
FED BEEF	13	5336	13	5336	0	0	13	5336	0	0	15	6212	2	876	13	5336	0	0	15	6212	2	876
WEANLING HOGS	26	1310	26	1310	0	0	26	1310	0	0	26	1310	0	0	26	1310	0	0	26	1310	0	0
MARKET HOGS	39	4003	52	5234	-13	-1231	39	4003	0	0	39	4003	0	0	39	4003	0	0	39	4003	0	0
FLUID MILK	30217	3928	20292	2638	9925	1290	30217	3928	0	0	30217	3928	0	0	30217	3928	0	0	30217	3928	0	0
CREAM	6705	469	4470	312	2235	157	6705	469	0	0	6705	469	0	0	6705	469	0	0	6705	469	0	0
EGGS	325	195	417	250	-92	-55	325	195	0	0	325	195	0	0	325	195	0	0	325	195	0	0
BROILERS	3	4	3	4	0	0	3	4	0	0	3	4	0	0	3	4	0	0	3	4	0	0
TURKEY	20	183	20	183	0	0	20	183	0	0	20	183	0	0	20	183	0	0	20	183	0	0

Table B8

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
INTERLAKE LARGE																						
WHEAT	3008	8740	3008	8740	0	0	3008	8063	0	-677	3008	8063	0	-677	3008	7867	0	-873	3008	7867	0	-873
OATS	1992	1912	1981	1902	11	10	1992	1663	0	-249	2324	1941	332	29	1992	1584	0	-328	2324	1848	332	-64
BARLEY	2599	4497	2599	4497	0	0	2599	4029	0	-468	2599	4029	0	-468	2599	3886	0	-611	2599	3886	0	-611
FLAX	424	2281	283	1521	141	760	283	1461	-141	-820	283	1461	-141	-820	283	1444	-141	-837	283	1444	-141	-837
RAPESEED	353	2262	353	2262	0	0	353	2197	0	-65	353	2197	0	-65	353	2177	0	-85	353	2177	0	-85
RYE	33	79	33	79	0	0	26	56	-7	-23	28	61	-5	-18	26	55	-7	-24	28	59	-5	-20
SUNFLOWERS	403	40	403	40	0	0	403	40	0	0	403	40	0	0	403	40	0	0	403	40	0	0
POTATOES	208	789	208	789	0	0	208	789	0	0	208	789	0	0	208	789	0	0	208	789	0	0
SUGAR BEETS	3	126	3	126	0	0	3	126	0	0	3	126	0	0	3	126	0	0	3	126	0	0
VEAL CALVES	1	321	1	225	0	96	1	321	0	0	5	988	4	667	1	260	0	-61	5	923	4	602
STOCKER CALVES	36	6354	31	5475	5	879	36	6503	0	149	49	8758	13	2404	37	6567	1	213	50	8825	14	2471
STOCKER CATTLE	31	14865	31	14865	0	0	31	14865	0	0	36	17344	5	2479	31	14865	0	0	36	17344	5	2479
FED BEEF	34	13459	34	13459	0	0	34	13459	0	0	40	15675	6	2216	34	13459	0	0	40	15675	6	2216
WEANLING HOGS	79	4008	79	4008	0	0	79	4008	0	0	79	4008	0	0	79	4008	0	0	79	4008	0	0
MARKET HOGS	56	5705	56	5705	0	0	56	5705	0	0	65	6620	9	915	56	5705	0	0	65	6620	9	915
FLUID MILK	36000	4680	36000	4680	0	0	36000	4680	0	0	36000	4680	0	0	36000	4680	0	0	36000	4680	0	0
CREAM	5188	363	3458	242	1730	121	5188	363	0	0	5188	363	0	0	5188	363	0	0	5188	363	0	0
EGGS	4203	2522	4203	2522	0	0	4203	2522	0	0	4203	2522	0	0	4203	2522	0	0	4203	2522	0	0
BROILERS	26	40	26	40	0	0	26	40	0	0	26	40	0	0	26	40	0	0	26	40	0	0
TURKEY	319	2838	319	2838	0	0	319	2838	0	0	319	2838	0	0	319	2838	0	0	319	2838	0	0

Table B9

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
EASTERN TOTAL																						
WHEAT	5556	16170	6366	18525	-810	-2355	5556	15030	0	-1140	5556	15030	0	-1140	5556	14725	0	-1445	5556	14725	0	-1445
OATS	3519	3378	3820	3667	-301	-289	3519	2973	0	-405	4071	3440	552	62	3519	2868	0	-510	4074	3320	555	-58
BARLEY	3587	6206	4113	7115	-526	-909	3587	5614	0	-592	3606	5643	19	-563	3587	5470	0	-736	3607	5500	20	-706
FLAX	290	1564	323	1741	-33	-177	285	1481	-5	-83	295	1530	5	-34	285	1468	-5	-96	295	1516	5	-48
RAPESEED	303	1942	331	2123	-28	-181	303	1889	0	-53	353	2204	50	262	303	1877	0	-65	353	2190	50	248
RYE	50	119	57	136	-7	-17	50	109	0	-10	50	109	0	-10	50	107	0	-12	50	107	0	-12
SUNFLOWERS	3989	398	4556	455	-567	-57	3989	398	0	0	4022	402	33	4	3989	398	0	0	4022	402	33	4
POTATOES	75	285	75	285	0	0	75	285	0	0	75	285	0	0	75	285	0	0	75	285	0	0
SUGAR BEETS	57	1842	57	1842	0	0	57	1842	0	0	57	1842	0	0	57	1842	0	0	57	1842	0	0
VEAL CALVES	7	1290	4	770	3	520	7	1290	0	0	7	1243	0	-47	7	1290	0	0	7	1243	0	-47
STOCKER CALVES	19	3475	19	3478	0	3	19	3475	0	0	23	4067	4	592	19	3475	0	0	23	4067	4	592
STOCKER CATTLE	20	9559	20	9560	0	1	20	9559	0	0	23	11156	3	1597	20	9559	0	0	23	11156	3	1597
FED BEEF	22	8875	23	8950	-1	-75	22	8875	0	0	26	10358	4	1483	22	8875	0	0	26	10358	4	1483
WEANLING HOGS	149	7526	165	8318	-16	-792	149	7526	0	0	149	7526	0	0	149	7526	0	0	149	7526	0	0
MARKET HOGS	193	19480	193	19480	0	0	193	19480	0	0	182	18357	-11	-1123	193	19480	0	0	182	18357	-11	-1123
FLUID MILK	179517	23337	175626	22831	3891	506	179517	23337	0	0	179517	23337	0	0	179517	23337	0	0	180688	23489	1171	152
CREAM	23106	1617	15404	1078	7702	539	23106	1617	0	0	23106	1617	0	0	23106	1617	0	0	23106	1617	0	0
EGGS	24953	14972	24953	14972	0	0	24953	14972	0	0	24953	14972	0	0	24953	14972	0	0	24953	14972	0	0
BROILERS	722	1098	722	1098	0	0	722	1098	0	0	722	1098	0	0	722	1098	0	0	722	1098	0	0
TURKEY	645	5735	645	5735	0	0	645	5735	0	0	645	5735	0	0	645	5735	0	0	645	5735	0	0

Table B10

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
EASTERN SMALL																						
WHEAT	0	0	809	2355	-809	-2355	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OATS	0	0	337	324	-337	-324	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BARLEY	0	0	525	909	-525	-909	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FLAX	0	0	38	204	-38	-204	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAPESEED	0	0	28	180	-28	-180	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RYE	0	0	7	16	-7	-16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUNFLOWERS	19	1	586	58	-567	-57	19	1	0	0	23	2	4	1	19	1	0	0	23	2	4	1
POTATOES	9	37	9	37	0	0	9	37	0	0	9	37	0	0	9	37	0	0	9	37	0	0
SUGAR BEETS	7	239	7	239	0	0	7	239	0	0	7	239	0	0	7	239	0	0	7	239	0	0
VEAL CALVES	0	0	0	137	0	-137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STOCKER CALVES	0	152	4	766	-4	-614	0	152	0	0	1	177	1	25	0	152	0	0	1	177	1	25
STOCKER CATTLE	4	2129	4	2130	0	-1	4	2129	0	0	5	2484	1	355	4	2129	0	0	5	2484	1	355
FED BEEF	4	1843	4	1918	0	-75	4	1843	0	0	5	2150	1	307	4	1843	0	0	5	2150	1	307
WEANLING HOGS	0	0	15	792	-15	-792	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MARKET HOGS	22	2310	22	2310	0	0	22	2310	0	0	5	508	-17	-1802	22	2310	0	0	5	508	-17	-1802
FLUID MILK	0	0	25811	3355	-25811	-3355	0	0	0	0	0	0	0	0	0	0	0	0	1170	152	1170	152
CREAM	4712	329	3141	219	1571	110	4712	329	0	0	4712	329	0	0	4712	329	0	0	4712	329	0	0
EGGS	998	598	998	598	0	0	998	598	0	0	998	598	0	0	998	598	0	0	998	598	0	0
BROILERS	28	43	28	43	0	0	28	43	0	0	28	43	0	0	28	43	0	0	28	43	0	0
TURKEY	6	57	6	57	0	0	6	57	0	0	6	57	0	0	6	57	0	0	6	57	0	0

Table B11

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
EASTERN MEDIUM																						
WHEAT	1670	4860	1670	4860	0	0	1670	4518	0	-342	1670	4518	0	-342	1670	4426	0	-434	1670	4426	0	-434
OATS	1009	968	995	955	14	13	1009	852	0	-116	1146	968	137	0	1009	822	0	-146	1146	934	137	-34
BARLEY	1086	1880	1086	1880	0	0	1086	1700	0	-180	1086	1700	0	-180	1086	1657	0	-223	1086	1657	0	-223
FLAX	83	447	78	420	5	27	78	404	-5	-43	78	404	-5	-43	78	401	-5	-46	78	401	-5	-46
RAPESEED	86	553	86	553	0	0	86	538	0	-15	100	627	14	74	86	534	0	-19	100	623	14	70
RYE	14	34	14	34	0	0	14	31	0	-3	14	31	0	-3	14	30	0	-4	14	30	0	-4
SUNFLOWERS	1214	121	1214	121	0	0	1214	121	0	0	1220	122	6	1	1214	121	0	0	1220	122	6	1
POTATOES	20	76	20	76	0	0	20	76	0	0	20	76	0	0	20	76	0	0	20	76	0	0
SUGAR BEETS	15	497	15	497	0	0	15	497	0	0	15	497	0	0	15	497	0	0	15	497	0	0
VEAL CALVES	3	600	1	314	2	286	3	600	0	0	1	189	-2	-411	3	600	0	0	1	189	-2	-411
STOCKER CALVES	7	1246	6	1132	1	114	7	1246	0	0	8	1566	1	320	7	1246	0	0	8	1566	1	320
STOCKER CATTLE	6	3151	6	3151	0	0	6	3151	0	0	7	3678	1	527	6	3151	0	0	7	3678	1	527
FED BEEF	7	2848	7	2848	0	0	7	2848	0	0	8	3324	1	476	7	2848	0	0	8	3324	1	476
WEANLING HOGS	24	1239	24	1239	0	0	24	1239	0	0	24	1239	0	0	24	1239	0	0	24	1239	0	0
MARKET HOGS	49	4930	49	4930	0	0	49	4930	0	0	35	3568	-14	-1362	49	4930	0	0	35	3568	-14	-1362
FLUID MILK	89108	11584	59405	7722	29703	3862	89108	11584	0	0	89108	11584	0	0	89108	11584	0	0	89108	11584	0	0
CREAM	9570	669	6380	446	3190	223	9570	669	0	0	9570	669	0	0	9570	669	0	0	9570	669	0	0
EGGS	2495	1497	2495	1497	0	0	2495	1497	0	0	2495	1497	0	0	2495	1497	0	0	2495	1497	0	0
BROILERS	72	109	72	109	0	0	72	109	0	0	72	109	0	0	72	109	0	0	72	109	0	0
TURKEY	38	344	38	344	0	0	38	344	0	0	38	344	0	0	38	344	0	0	38	344	0	0

Table B12

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
EASTERN LARGE																						
WHEAT	3886	11309	3886	11309	0	0	3886	10512	0	-797	3886	10512	0	-797	3886	10299	0	-1010	3886	10299	0	-1010
OATS	2510	2409	2487	2388	23	21	2510	2121	0	-288	2924	2471	414	62	2510	2045	0	-364	2927	2386	417	-23
BARLEY	2500	4325	2500	4325	0	0	2500	3913	0	-412	2519	3942	19	-383	2500	3813	0	-512	2520	3843	20	-482
FLAX	207	1116	207	1116	0	0	207	1076	0	-40	217	1125	10	9	207	1067	0	-49	217	1115	10	-1
RAPESEED	216	1389	216	1389	0	0	216	1351	0	-38	252	1576	36	187	216	1342	0	-47	252	1566	36	177
RYE	36	85	36	85	0	0	36	78	0	-7	36	78	0	-7	36	76	0	-9	36	76	0	-9
SUNFLOWERS	2755	275	2755	275	0	0	2755	275	0	0	2778	277	23	2	2755	275	0	0	2778	277	23	2
POTATOES	45	171	45	171	0	0	45	171	0	0	45	171	0	0	45	171	0	0	45	171	0	0
SUGAR BEETS	34	1105	34	1105	0	0	34	1105	0	0	34	1105	0	0	34	1105	0	0	34	1105	0	0
VEAL CALVES	4	689	1	318	3	371	4	689	0	0	6	1053	2	364	4	689	0	0	6	1053	2	364
STOCKER CALVES	11	2076	8	1579	3	497	11	2076	0	0	13	2322	2	246	11	2076	0	0	13	2322	2	246
STOCKER CATTLE	8	4278	8	4278	0	0	8	4278	0	0	10	4993	2	715	8	4278	0	0	10	4993	2	715
FED BEEF	10	4184	10	4184	0	0	10	4184	0	0	12	4882	2	698	10	4184	0	0	12	4882	2	698
WEANLING HOGS	125	6287	125	6287	0	0	125	6287	0	0	125	6287	0	0	125	6287	0	0	125	6287	0	0
MARKET HOGS	121	12239	121	12239	0	0	121	12239	0	0	141	14279	20	2040	121	12239	0	0	141	14279	20	2040
FLUID MILK	90409	11753	90409	11753	0	0	90409	11753	0	0	90409	11753	0	0	90409	11753	0	0	90409	11753	0	0
CREAM	8823	617	5882	411	2941	206	8823	617	0	0	8823	617	0	0	8823	617	0	0	8823	617	0	0
EGGS	21460	12876	21460	12876	0	0	21460	12876	0	0	21460	12876	0	0	21460	12876	0	0	21460	12876	0	0
BROILERS	621	944	621	944	0	0	621	944	0	0	621	944	0	0	621	944	0	0	621	944	0	0
TURKEY	599	5333	599	5333	0	0	599	5333	0	0	599	5333	0	0	599	5333	0	0	599	5333	0	0

Table B13

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
CENTRAL TOTAL																						
WHEAT	26643	77532	28475	82862	-1832	-5330	24566	66084	-2077	-11448	26571	71477	-72	-6055	24566	64487	-2077	-13045	26571	69750	-72	-7782
OATS	8274	7943	8898	8542	-624	-599	8274	6867	0	-1076	7979	6623	-295	-1320	8274	6578	0	-1365	7942	6314	-332	-1629
BARLEY	22092	38219	23952	41438	-1860	-3219	21045	32620	-1047	-5599	22469	34828	377	-3391	20922	31487	-1170	-6732	22469	33817	377	-4402
FLAX	2524	13579	2954	15894	-430	-2315	2524	13049	0	-530	2524	13049	0	-530	2524	12910	0	-669	2524	12910	0	-669
RAPESEED	8171	52380	8171	52380	0	0	8171	50869	0	-1511	9533	59347	1362	6967	8171	50460	0	-1920	9533	58870	1362	6490
RYE	1211	2859	1347	3180	-136	-321	1127	2425	-84	-434	1288	2769	77	-90	1127	2363	-84	-496	1288	2698	77	-161
SUNFLOWERS	113439	11343	132923	13292	-19484	-1949	113439	11343	0	0	113439	11343	0	0	113439	11343	0	0	113439	11343	0	0
POTATOES	4103	15551	4103	15551	0	0	4103	15551	0	0	4103	15551	0	0	4103	15551	0	0	4103	15551	0	0
SUGAR BEETS	359	11504	359	11504	0	0	359	11504	0	0	359	11504	0	0	359	11504	0	0	359	11504	0	0
VEAL CALVES	3	609	4	830	-1	-221	3	617	0	8	2	397	-1	-212	3	617	0	8	2	397	-1	-212
STOCKER CALVES	54	9643	55	9709	-1	-66	54	9635	0	-8	62	10943	8	1300	54	9635	0	-8	62	10943	8	1300
STOCKER CATTLE	56	26805	56	26805	0	0	56	26805	0	0	63	30390	7	3585	56	26805	0	0	63	30390	7	3585
FED BEEF	60	23654	62	24215	-2	-561	60	23654	0	0	68	26799	8	3145	60	23654	0	0	68	26799	8	3145
WEANLING HOGS	343	17284	369	18562	-26	-1278	343	17284	0	0	343	17284	0	0	343	17284	0	0	343	17284	0	0
MARKET HOGS	298	30064	331	33374	-33	-3310	298	30064	0	0	321	32302	23	2238	298	30064	0	0	321	32302	23	2238
FLUID MILK	127776	16610	141308	18370	-13532	-1760	127776	16610	0	0	127776	16610	0	0	127776	16610	0	0	127776	16610	0	0
CREAM	23944	1676	20187	1413	3757	263	23944	1676	0	0	23944	1676	0	0	23944	1676	0	0	23944	1676	0	0
EGGS	23649	14189	23374	14024	275	165	23649	14189	0	0	23649	14189	0	0	23649	14189	0	0	23649	14189	0	0
BROILERS	134	204	134	204	0	0	134	204	0	0	134	204	0	0	134	204	0	0	134	204	0	0
TURKEY	167	1492	167	1492	0	0	167	1492	0	0	167	1492	0	0	167	1492	0	0	167	1492	0	0

Table B14

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
CENTRAL SMALL																						
WHEAT	0	0	3512	10222	-3512	-10222	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OATS	0	0	996	956	-996	-956	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BARLEY	0	0	3030	5242	-3030	-5242	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FLAX	0	0	430	2315	-430	-2315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAPESEED	1192	7646	1192	7646	0	0	1192	7426	0	-220	1391	8663	199	1017	1192	7366	0	-280	1391	8594	199	948
RYE	0	0	135	320	-135	-320	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUNFLOWERS	0	0	19483	1948	-19483	-1948	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POTATOES	600	2274	600	2274	0	0	600	2274	0	0	600	2274	0	0	600	2274	0	0	600	2274	0	0
SUGAR BEETS	53	1706	53	1706	0	0	53	1706	0	0	53	1706	0	0	*53	1706	0	0	53	1706	0	0
VEAL CALVES	0	0	1	286	-1	-286	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STOCKER CALVES	0	0	12	2156	-12	-2156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STOCKER CATTLE	12	5927	12	5928	0	-1	12	5927	0	0	12	6034	0	107	12	5927	0	0	12	6034	0	107
FED BEEF	12	4785	13	5346	-1	-561	12	4785	0	0	12	4787	0	2	12	4785	0	0	12	4787	0	2
WEANLING HOGS	0	0	25	1277	-25	-1277	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MARKET HOGS	0	0	32	3310	-32	-3310	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FLUID MILK	0	0	44430	5776	-44430	-5776	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CREAM	4184	292	7014	491	-2830	-199	4184	292	0	0	4184	292	0	0	4184	292	0	0	4184	292	0	0
EGGS	0	0	781	468	-781	-468	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BROILERS	5	8	5	8	0	0	5	8	0	0	5	8	0	0	5	8	0	0	5	8	0	0
TURKEY	1	14	1	14	0	0	1	14	0	0	1	14	0	0	1	14	0	0	1	14	0	0

Table B15

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
CENTRAL MEDIUM																						
WHEAT	9056	26355	7375	21463	1681	4892	6980	18776	-2076	-7579	6980	18776	-2076	-7579	6980	18322	-2076	-8033	6980	18322	-2076	-8033
OATS	2383	2288	2011	1930	372	358	2383	1978	0	-310	2011	1669	-372	-619	2383	1894	0	-394	2011	1598	-372	-690
BARLEY	7218	12488	6048	10464	1170	2024	6172	9566	-1046	-2922	6048	9375	-1170	-3113	6048	9103	-1170	-3385	6048	9103	-1170	-3385
FLAX	856	4609	856	4609	0	0	856	4429	0	-180	856	4429	0	-180	856	4382	0	-227	856	4382	0	-227
RAPESEED	2369	15190	2369	15190	0	0	2369	14752	0	-438	2764	17210	395	2020	2369	14633	0	-557	2764	17072	395	1882
RYE	410	968	410	968	0	0	326	702	-84	-266	353	759	-57	-209	326	684	-84	-284	353	739	-57	-229
SUNFLOWERS	38547	3854	38547	3854	0	0	38547	3854	0	0	38547	3854	0	0	38547	3854	0	0	38547	3854	0	0
POTATOES	1189	4509	1189	4509	0	0	1189	4509	0	0	1189	4509	0	0	1189	4509	0	0	1189	4509	0	0
SUGAR BEETS	104	3336	104	3336	0	0	104	3336	0	0	104	3336	0	0	104	3336	0	0	104	3336	0	0
VEAL CALVES	1	281	2	385	-1	-104	1	209	0	8	0	161	-1	-40	1	209	0	-72	0	161	-1	-120
STOCKER CALVES	19	3508	19	3399	0	109	20	3582	0	-8	20	3631	0	41	20	3582	1	74	20	3631	1	123
STOCKER CATTLE	19	9373	19	9373	0	0	19	9373	0	0	22	10937	3	1564	19	9373	0	0	22	10937	3	1564
FED BEEF	21	8471	21	8471	0	0	21	8471	0	0	25	9885	4	1414	21	8471	0	0	25	9885	4	1414
WEANLING HOGS	75	3805	75	3805	0	0	75	3805	0	0	75	3805	0	0	75	3805	0	0	75	3805	0	0
MARKET HOGS	104	10481	104	10481	0	0	104	10481	0	0	104	10481	0	0	104	10481	0	0	104	10481	0	0
FLUID MILK	87686	11399	58457	7599	29229	3800	87686	11399	0	0	87686	11399	0	0	87686	11399	0	0	87686	11399	0	0
CREAM	14554	1018	9703	679	4851	339	14554	1018	0	0	14554	1018	0	0	14554	1018	0	0	14554	1018	0	0
EGGS	3666	2200	2610	1566	1056	634	3666	2200	0	0	3666	2200	0	0	3666	2200	0	0	3666	2200	0	0
BROILERS	13	20	13	20	0	0	13	20	0	0	13	20	0	0	13	20	0	0	13	20	0	0
TURKEY	10	89	10	89	0	0	10	89	0	0	10	89	0	0	10	89	0	0	10	89	0	0

Table B16

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
CENTRAL LARGE																						
WHEAT	17586	51176	17586	51176	0	0	17586	47307	0	-3869	19591	52701	2005	1525	17586	46164	0	-5012	19591	51427	2005	251
OATS	5890	5655	5890	5655	0	0	5890	4889	0	-766	5968	4953	78	-702	5890	4683	0	-972	5931	4715	41	-940
BARLEY	14873	25731	14873	25731	0	0	14873	23053	0	-2678	16421	25452	1548	-279	14873	22384	0	-3347	16421	24713	1548	-1018
FLAX	1667	8970	1667	8970	0	0	1667	8619	0	-351	1667	8619	0	-351	1667	8528	0	-442	1667	8528	0	-442
RAPESEED	4608	29543	4608	29543	0	0	4608	28690	0	-853	5377	33472	769	3929	4608	28460	0	-1083	5377	33203	769	3660
RYE	801	1891	801	1891	0	0	801	1722	0	-169	934	2009	133	118	801	1678	0	-213	934	1958	133	67
SUNFLOWERS	74892	7489	74892	7489	0	0	74892	7489	0	0	74892	7489	0	0	74892	7489	0	0	74892	7489	0	0
POTATOES	2313	8766	2313	8766	0	0	2313	8766	0	0	2313	8766	0	0	2313	8766	0	0	2313	8766	0	0
SUGAR BEETS	201	6461	201	6461	0	0	201	6461	0	0	201	6461	0	0	201	6461	0	0	201	6461	0	0
VEAL CALVES	1	328	0	158	1	170	2	408	0	0	1	235	-1	-173	2	408	1	80	1	235	0	-93
STOCKER CALVES	34	6135	23	4153	11	1982	34	6053	0	0	41	7311	7	1258	34	6053	0	-82	41	7311	7	1176
STOCKER CATTLE	24	11503	24	11503	0	0	24	11503	0	0	28	13418	4	1915	24	11503	0	0	28	13418	4	1915
FED BEEF	26	10396	26	10396	0	0	26	10396	0	0	31	12127	5	1731	26	10396	0	0	31	12127	5	1731
WEANLING HOGS	268	13479	268	13479	0	0	268	13479	0	0	268	13479	0	0	268	13479	0	0	268	13479	0	0
MARKET HOGS	194	19582	194	19582	0	0	194	19582	0	0	216	21820	22	2238	194	19582	0	0	216	21820	22	2238
FLUID MILK	40089	5211	38420	4994	1669	217	40089	5211	0	0	40089	5211	0	0	40089	5211	0	0	40089	5211	0	0
CREAM	5205	364	3470	242	1735	122	5205	364	0	0	5205	364	0	0	5205	364	0	0	5205	364	0	0
EGGS	19982	11989	19982	11989	0	0	19982	11989	0	0	19982	11989	0	0	19982	11989	0	0	19982	11989	0	0
BROILERS	115	175	115	175	0	0	115	175	0	0	115	175	0	0	115	175	0	0	115	175	0	0
TURKEY	156	1388	156	1388	0	0	156	1388	0	0	156	1388	0	0	156	1388	0	0	156	1388	0	0

Table B17

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
SOUTH WEST TOTAL																						
WHEAT	28952	83665	28116	81249	836	2416	27021	71329	-1931	-12336	25080	66205	-3872	-17460	27010	69589	-1942	-14076	25033	64496	-3919	-19169
OATS	12258	11644	11953	11354	305	290	12191	9833	-67	-1811	14017	11306	1759	-338	12191	9345	-67	-2299	14017	10746	1759	-898
BARLEY	25626	44073	27193	46768	-1567	-2695	26757	40667	1131	-3406	28195	42853	2569	-1220	26757	39240	1131	-4833	28195	41349	2569	-2724
FLAX	2780	14902	2684	14385	96	517	2927	15007	147	105	2931	15026	151	124	2935	14870	155	-32	2942	14908	162	6
RAPESEED	7517	48031	7517	48031	0	0	7517	46477	0	-1554	8770	54223	1253	6192	7517	46051	0	-1980	8770	53726	1253	5695
RYE	1734	4076	1953	4589	-219	-513	1734	3672	0	-404	1887	3995	153	-81	1734	3567	0	-509	1887	3882	153	-194
SUNFLOWERS	45373	4536	48544	4854	-3171	-318	61199	6119	15826	1583	41935	4193	-3438	-343	61199	6119	15826	1583	41935	4193	-3438	-343
POTATOES	1799	6818	1799	6818	0	0	1799	6818	0	0	1799	6818	0	0	1799	6818	0	0	1799	6818	0	0
SUGAR BEETS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VEAL CALVES	2	400	6	1127	-4	-727	2	430	0	30	0	20	-2	-380	2	430	0	30	0	20	-2	-380
STOCKER CALVES	96	16927	94	16708	2	219	95	16778	-1	-149	107	18936	11	2009	95	16778	-1	-149	107	18936	11	2009
STOCKER CATTLE	92	44254	92	44257	0	-3	92	44254	0	0	107	51155	15	6901	92	44254	0	0	107	51155	15	6901
FED BEEF	95	37256	95	37289	0	-33	96	37439	1	183	112	43541	17	6285	96	37439	1	183	112	43541	17	6285
WEANLING HOGS	151	7625	183	9203	-32	-1578	151	7625	0	0	151	7625	0	0	151	7625	0	0	151	7625	0	0
MARKET HOGS	148	14958	188	18904	-40	-3946	148	14958	0	0	157	15870	9	912	148	14958	0	0	157	15870	9	912
FLUID MILK	26716	3472	52809	6864	-26093	-3392	28401	3691	1685	219	28401	3691	1685	219	28401	3691	1685	219	28401	3691	1685	219
CREAM	8587	601	16052	1123	-7465	-522	8587	601	0	0	8587	601	0	0	8587	601	0	0	8587	601	0	0
EGGS	4889	2933	4889	2933	0	0	4889	2933	0	0	4889	2933	0	0	4889	2933	0	0	4889	2933	0	0
BROILERS	165	252	165	252	0	0	165	252	0	0	165	252	0	0	165	252	0	0	165	252	0	0
TURKEY	146	1298	146	1298	0	0	146	1298	0	0	146	1298	0	0	146	1298	0	0	146	1298	0	0

Table B18

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
SOUTH WEST SMALL																						
WHEAT	0	0	3121	9020	-3121	-9020	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OATS	156	148	1224	1163	-1068	-1015	89	71	-67	-77	0	0	-156	-148	89	68	-67	-80	0	0	-156	-148
BARLEY	0	0	2450	4214	-2450	-4214	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FLAX	0	0	322	1727	-322	-1727	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAPESEED	911	5825	911	5825	0	0	911	5636	0	-189	1063	6576	152	751	911	5585	0	-240	1063	6516	152	691
RYE	0	0	218	513	-218	-513	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUNFLOWERS	3437	343	6609	660	-3172	-317	6321	632	2884	288	0	0	-3437	-343	6321	632	2884	289	0	0	-3437	-343
POTATOES	251	954	251	954	0	0	251	954	0	0	251	954	0	0	251	954	0	0	251	954	0	0
SUGAR BEETS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VEAL CALVES	0	0	1	269	-1	-269	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STOCKER CALVES	3	586	14	2503	-11	-1917	3	586	0	0	6	1063	3	477	3	586	0	0	6	1063	3	477
STOCKER CATTLE	14	6817	14	6820	0	-3	14	6817	0	0	15	7473	1	656	14	6817	0	0	15	7473	1	656
FED BEEF	14	5553	14	5585	0	-32	14	5553	0	0	15	6107	1	554	14	5553	0	0	15	6107	1	554
WEANLING HOGS	0	0	31	1577	-31	-1577	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MARKET HOGS	6	670	38	3872	-32	-3202	6	670	0	0	0	0	-6	-670	0	0	-6	-670	0	0	-6	-670
FLUID MILK	0	0	27605	3588	-27605	-3588	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CREAM	0	0	8521	596	-8521	-596	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EGGS	196	117	196	117	0	0	196	117	0	0	196	117	0	0	196	117	0	0	196	117	0	0
BROILERS	6	10	6	10	0	0	6	10	0	0	6	10	0	0	6	10	0	0	6	10	0	0
TURKEY	1	12	1	12	0	0	1	12	0	0	1	12	0	0	1	12	0	0	1	12	0	0

Table B19

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
SOUTH WEST MEDIUM																						
WHEAT	7886	22789	6868	19848	1018	2941	6868	18131	-1018	-4658	6868	18131	-1018	-4658	6868	17696	-1018	-5093	6868	17696	-1018	-5093
OATS	3544	3366	2818	2677	726	689	3544	2858	0	-508	4034	3253	490	-113	3544	2717	0	-649	4034	3092	490	-274
BARLEY	7218	12413	6334	10894	884	1519	8349	12689	1131	276	6719	10212	-499	-2201	8349	12243	1131	-170	6719	9853	-499	-2560
FLAX	765	4103	651	3491	114	612	765	3924	0	-179	822	4217	57	114	765	3878	0	-225	822	4167	57	64
RAPESEED	2066	13201	2066	13201	0	0	2066	12774	0	-427	2410	14903	344	1702	2066	12657	0	-544	2410	14766	344	1565
RYE	538	1266	538	1266	0	0	538	1140	0	-126	586	1242	48	-24	538	1108	0	-158	586	1206	48	-60
SUNFLOWERS	12880	1287	12880	1287	0	0	16793	1679	3913	391	12880	1287	0	0	16793	1679	3913	392	12880	1287	0	0
POTATOES	468	1773	468	1774	0	-1	468	1773	0	0	468	1773	0	0	468	1773	0	0	468	1773	0	0
SUGAR BEETS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VEAL CALVES	0	0	1	182	-1	-182	2	430	0	30	0	20	-2	-380	2	430	2	430	0	20	0	20
STOCKER CALVES	38	6721	31	5481	7	1240	34	6157	-1	-149	39	6977	4	671	34	6157	-4	-564	39	6977	1	256
STOCKER CATTLE	31	14971	31	14971	0	0	31	14971	0	0	36	17469	5	2498	31	14971	0	0	36	17469	5	2498
FED BEEF	33	12867	33	12868	0	-1	33	13050	0	183	38	15090	5	2223	33	13050	0	183	38	15090	5	2223
WEANLING HOGS	56	2831	56	2831	0	0	56	2831	0	0	56	2831	0	0	56	2831	0	0	56	2831	0	0
MARKET HOGS	47	4794	55	5538	-8	-744	47	4794	0	0	47	4794	0	0	54	5464	7	670	47	4794	0	0
FLUID MILK	18810	2445	18810	2445	0	0	18810	2445	0	0	18810	2445	0	0	18810	2445	0	0	18810	2445	0	0
CREAM	5419	379	5419	379	0	0	5419	379	0	0	5419	379	0	0	5419	379	0	0	5419	379	0	0
EGGS	487	292	487	292	0	0	487	292	0	0	487	292	0	0	487	292	0	0	487	292	0	0
BROILERS	16	25	16	25	0	0	16	25	0	0	16	25	0	0	16	25	0	0	16	25	0	0
TURKEY	8	77	8	77	0	0	8	77	0	0	8	77	0	0	8	77	0	0	8	77	0	0

Table B20

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
SOUTH WEST LARGE																						
WHEAT	21066	60875	18126	52380	2940	8495	20153	53198	-913	-7677	18211	48073	-2855	-12802	20141	51892	-925	-8983	18165	46800	-2901	-14075
OATS	8557	8128	7909	7513	648	615	8557	6902	0	-1226	9983	8052	1426	-76	8557	6560	0	-1568	9983	7653	1426	-475
BARLEY	18408	31659	18408	31659	0	0	18408	27977	0	-3682	21476	32640	3068	981	18408	26996	0	-4663	21476	31495	3068	-164
FLAX	2014	10799	1710	9166	304	1633	2161	11082	147	283	2108	10809	94	10	2169	10991	155	192	2119	10740	105	-59
RAPESEED	4539	29004	4539	29004	0	0	4539	28066	0	-938	5296	32743	757	3739	4539	27808	0	-1196	5296	32443	757	3439
RYE	1196	2810	1196	2810	0	0	1196	2531	0	-279	1300	2753	104	-57	1196	2459	0	-351	1300	2675	104	-135
SUNFLOWERS	29054	2905	29054	2905	0	0	38084	3808	9030	903	29054	2905	0	0	38084	3808	9030	903	29054	2905	0	0
POTATOES	1079	4089	1079	4089	0	0	1079	4089	0	0	1079	4089	0	0	1079	4089	0	0	1079	4089	0	0
SUGAR BEETS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*0	0	0	0	0	0	0	0
VEAL CALVES	2	400	3	675	-1	-275	0	0	0	0	0	0	0	0	0	0	-2	-400	0	0	-2	-400
STOCKER CALVES	54	9620	49	8723	5	897	56	10034	0	0	61	10894	5	860	56	10034	2	414	61	10894	7	1274
STOCKER CATTLE	47	22465	47	22465	0	0	47	22465	0	0	54	26211	7	3746	47	22465	0	0	54	26211	7	3746
FED BEEF	48	18835	48	18835	0	0	48	18835	0	0	57	22343	9	3508	48	18835	0	0	57	22343	9	3508
WEANLING HOGS	95	4794	95	4794	0	0	95	4794	0	0	95	4794	0	0	95	4794	0	0	95	4794	0	0
MARKET HOGS	94	9493	94	9493	0	0	94	9493	0	0	110	11076	16	1583	94	9493	0	0	110	11076	16	1583
FLUID MILK	7906	1027	6394	831	1512	196	9591	1246	1685	219	9591	1246	1685	219	9591	1246	1685	219	9591	1246	1685	219
CREAM	3168	221	2112	147	1056	74	3168	221	0	0	3168	221	0	0	3168	221	0	0	3168	221	0	0
EGGS	4205	2523	4205	2523	0	0	4205	2523	0	0	4205	2523	0	0	4205	2523	0	0	4205	2523	0	0
BROILERS	142	216	142	216	0	0	142	216	0	0	142	216	0	0	142	216	0	0	142	216	0	0
TURKEY	135	1207	135	1207	0	0	135	1207	0	0	135	1207	0	0	135	1207	0	0	135	1207	0	0

Table B21

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
NORTH WEST TOTAL																						
WHEAT	11251	32512	11683	33762	-432	-1250	10870	28550	-381	-3962	10594	27824	-657	-4688	10870	27826	-381	-4686	10594	27118	-657	-5394
OATS	3755	3566	3842	3650	-87	-84	3755	3016	0	-550	3380	2715	-375	-851	3755	2866	0	-700	3380	2580	-375	-986
BARLEY	7553	12990	8283	14245	-730	-1255	7556	11409	3	-1581	7091	10707	-462	-2283	7556	10981	3	-2009	7098	10315	-455	-2675
FLAX	429	2300	449	2410	-20	-110	428	2194	-1	-106	415	2126	-14	-174	420	2127	-9	-173	404	2041	-25	-259
RAPESEED	5449	34816	5538	35387	-89	-571	5449	33618	0	-1198	6357	39221	908	4405	5449	33309	0	-1507	6357	38860	908	4044
RYE	378	888	427	1003	-49	-115	378	796	0	-92	398	838	20	-50	365	746	-13	-142	379	774	1	-114
SUNFLOWERS	1496	149	1496	149	0	0	1496	149	0	0	1745	174	249	25	1496	149	0	0	1745	174	249	25
POTATOES	26	98	26	98	0	0	26	98	0	0	26	98	0	0	26	98	0	0	26	98	0	0
SUGAR BEETS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VEAL CALVES	0	6	1	238	-1	-232	0	0	0	-6	0	51	0	45	0	0	0	-6	0	51	0	45
STOCKER CALVES	56	9998	57	10051	-1	-53	56	10011	0	13	62	11044	6	1046	56	10011	0	13	62	11044	6	1046
STOCKER CATTLE	57	27425	57	27604	0	-179	57	27462	0	37	66	31644	9	4219	57	27462	0	37	66	31644	9	4219
FED BEEF	63	24693	64	25142	-1	-449	63	24769	0	76	71	27908	8	3215	63	24769	0	76	71	27908	8	3215
WEANLING HOGS	42	2150	68	3446	-26	-1296	42	2150	0	0	42	2150	0	0	42	2150	0	0	42	2150	0	0
MARKET HOGS	55	5600	66	6663	-11	-1063	55	5600	0	0	26	2659	-29	-2941	55	5600	0	0	26	2659	-29	-2941
FLUID MILK	8138	1057	19253	2502	-11115	-1445	8138	1057	0	0	8138	1057	0	0	8138	1057	0	0	8138	1057	0	0
CREAM	8237	576	17288	1210	-9051	-634	8237	576	0	0	8237	576	0	0	8237	576	0	0	8237	576	0	0
EGGS	1494	896	1510	906	-16	-10	1494	896	0	0	1494	896	0	0	1494	896	0	0	1494	896	0	0
BROILERS	26	39	26	39	0	0	26	39	0	0	26	39	0	0	26	39	0	0	26	39	0	0
TURKEY	61	545	61	546	0	-1	61	545	0	0	61	545	0	0	61	545	0	0	61	545	0	0

Table B22

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
NORTH WEST SMALL																						
WHEAT	0	0	1268	3665	-1268	-3665	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OATS	0	0	470	446	-470	-446	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BARLEY	0	0	920	1583	-920	-1583	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FLAX	0	0	53	289	-53	-289	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAPESEED	568	3632	657	4203	-89	-571	568	3507	0	-125	663	4091	95	459	568	3475	0	-157	663	4054	95	422
RYE	0	0	49	115	-49	-115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUNFLOWERS	179	17	179	17	0	0	179	17	0	0	209	20	30	3	179	17	0	0	209	20	30	3
POTATOES	3	11	3	11	0	0	3	11	0	0	3	11	0	0	3	11	0	0	3	11	0	0
SUGAR BEETS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VEAL CALVES	0	0	0	138	0	-138	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STOCKER CALVES	0	4	10	1934	-10	-1930	0	3	0	-1	0	0	0	-4	0	3	0	-1	0	0	0	-4
STOCKER CATTLE	10	5124	11	5302	-1	-178	10	5161	0	37	11	5622	1	498	10	5161	0	37	11	5622	1	498
FED BEEF	10	4027	11	4442	-1	-415	10	4063	0	36	11	4389	1	362	10	4063	0	36	11	4389	1	362
WEANLING HOGS	0	0	25	1296	-25	-1296	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MARKET HOGS	25	2596	36	3659	-11	-1063	25	2596	0	0	0	0	-25	-2596	25	2596	0	0	0	0	-25	-2596
FLUID MILK	0	0	11824	1536	-11824	-1536	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CREAM	0	0	9970	697	-9970	-697	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EGGS	37	22	53	32	-16	-10	37	22	0	0	37	22	0	0	37	22	0	0	37	22	0	0
BROILERS	1	1	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0
TURKEY	0	3	0	5	0	-2	0	3	0	0	0	3	0	0	0	3	0	0	0	3	0	0

Table B23

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
NORTH WEST MEDIUM																						
WHEAT	3221	9309	3221	9309	0	0	2841	7461	-380	-1848	2841	7461	-380	-1848	2841	7272	-380	-2037	2841	7272	-380	-2037
OATS	1048	996	1048	996	0	0	1048	842	0	-154	1048	842	0	-154	1048	800	0	-196	1048	800	0	-196
BARLEY	2077	3573	2077	3573	0	0	2077	3137	0	-436	2077	3137	0	-436	2077	3019	0	-554	2077	3019	0	-554
FLAX	128	691	121	650	7	41	128	659	0	-32	132	679	4	-12	121	612	-7	-79	121	612	-7	-79
RAPESEED	1594	10185	1594	10185	0	0	1594	9834	0	-351	1859	11474	265	1289	1594	9744	0	-441	1859	11368	265	1183
RYE	124	291	124	291	0	0	124	261	0	-30	130	274	6	-17	111	228	-13	-63	111	228	-13	-63
SUNFLOWERS	394	39	394	39	0	0	394	39	0	0	459	45	65	6	394	39	0	0	459	45	65	6
POTATOES	6	26	6	26	0	0	6	26	0	0	6	26	0	0	6	26	0	0	6	26	0	0
SUGAR BEETS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VEAL CALVES	0	1	0	75	0	-74	0	0	0	-1	0	22	0	21	0	0	0	-1	0	22	0	21
STOCKER CALVES	20	3590	19	3413	1	177	20	3592	0	2	19	3518	-1	-72	20	3592	0	2	19	3518	-1	-72
STOCKER CATTLE	19	9399	19	9399	0	0	19	9399	0	0	22	10967	3	1568	19	9399	0	0	22	10967	3	1568
FED BEEF	21	8463	21	8491	0	-28	21	8463	0	0	25	9912	4	1449	21	8463	0	0	25	9912	4	1449
WEANLING HOGS	32	1616	32	1616	0	0	32	1616	0	0	32	1616	0	0	32	1616	0	0	32	1616	0	0
MARKET HOGS	22	2308	22	2308	0	0	22	2308	0	0	19	1916	-3	-392	22	2308	0	0	19	1916	-3	-392
FLUID MILK	5791	752	5791	752	0	0	5791	752	0	0	5791	752	0	0	5791	752	0	0	5791	752	0	0
CREAM	5478	383	5478	383	0	0	5478	383	0	0	5478	383	0	0	5478	383	0	0	5478	383	0	0
EGGS	134	80	134	80	0	0	134	80	0	0	134	80	0	0	134	80	0	0	134	80	0	0
BROILERS	2	3	2	3	0	0	2	3	0	0	2	3	0	0	2	3	0	0	2	3	0	0
TURKEY	3	33	3	32	0	1	3	33	0	0	3	33	0	0	3	33	0	0	3	33	0	0

Table B24

Production and Value Differences between Statutory and Nonstatutory Grain Rail Rates

COMMODITY	SCENARIO II		SCENARIO I		DIFFERENCE		SCENARIO III (20% RANGE)		DIFFERENCE		SCENARIO IV (40% RANGE)		DIFFERENCE		SCENARIO V (20% RANGE)		DIFFERENCE		SCENARIO VI (40% RANGE)		DIFFERENCE	
	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE	OUTPUT	VALUE
NORTH WEST LARGE																						
WHEAT	8029	23203	7193	20786	836	2417	8029	21088	0	-2115	7753	20362	-276	-2841	8029	20553	0	-2650	7753	19845	-276	-3358
OATS	2706	2570	2323	2207	383	363	2706	2173	0	-397	2331	1873	-375	-697	2706	2065	0	-505	2331	1779	-375	-791
BARLEY	5475	9417	5284	9088	191	329	5478	8272	3	-1145	5014	7570	-461	-1847	5478	7961	3	-1456	5020	7295	-455	-2122
FLAX	300	1609	274	1470	26	139	299	1534	-1	-75	282	1447	-18	-162	299	1514	-1	-95	282	1428	-18	-181
RAPESEED	3286	20998	3286	20998	0	0	3286	20275	0	-723	3834	23655	548	2657	3286	20089	0	-909	3834	23437	548	2439
RYE	254	597	254	597	0	0	254	535	0	-62	267	564	13	-33	254	518	0	-79	267	546	13	-51
SUNFLOWERS	922	92	922	92	0	0	922	92	0	0	1076	107	154	15	922	92	0	0	1076	107	154	15
POTATOES	15	60	15	60	0	0	15	60	0	0	15	60	0	0	15	60	0	0	15	60	0	0
SUGAR BEETS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VEAL CALVES	0	5	0	25	0	-20	0	0	0	-5	0	28	0	23	0	0	0	-5	0	28	0	23
STOCKER CALVES	36	6403	26	4703	10	1700	36	6415	0	12	42	7526	6	1123	36	6415	0	12	42	7526	6	1123
STOCKER CATTLE	27	12902	27	12902	0	0	27	12902	0	0	31	15054	4	2152	27	12902	0	0	31	15054	4	2152
FED BEEF	31	12201	31	12207	0	-6	31	12241	0	40	35	13606	4	1405	31	12241	0	40	35	13606	4	1405
WEANLING HOGS	10	534	10	534	0	0	10	534	0	0	10	534	0	0	10	534	0	0	10	534	0	0
MARKET HOGS	6	695	6	695	0	0	6	695	0	0	7	743	1	48	6	695	0	0	7	743	1	48
FLUID MILK	2347	305	1638	212	709	93	2347	305	0	0	2347	305	0	0	2347	305	0	0	2347	305	0	0
CREAM	2759	193	1839	128	920	65	2759	193	0	0	2759	193	0	0	2759	193	0	0	2759	193	0	0
EGGS	1322	793	1322	793	0	0	1322	793	0	0	1322	793	0	0	1322	793	0	0	1322	793	0	0
BROILERS	22	34	22	34	0	0	22	34	0	0	22	34	0	0	22	34	0	0	22	34	0	0
TURKEY	57	508	57	508	0	0	57	508	0	0	57	508	0	0	57	508	0	0	57	508	0	0