SPATIAL DIFFUSION OF ECONOMIC IMPACTS OF INTEGRATED ETHANOL-CATTLE PRODUCTION COMPLEX IN SASKATCHEWAN

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SUMMARY OF DISSERTATION

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SPATIAL DIFFUSION OF ECONOMIC IMPACTS OF INTEGRATED ETHANOL-CATTLE PRODUCTION COMPLEX IN SASKATCHEWAN.

In Saskatchewan, diversification of agriculture and the food sector is a major strategy for economic development. During the 1990s, diversification through ethanol production, along with its linkages with cattle feeding has attracted much public attention. Communities of different sizès in Saskatchewan, seeking economic opportunities have shown interest in ethanol production because of the perceived benefits a region can capture from such a project. In spite of this interest and perceived benefits, there was no information on the type and magnitude of economic impacts which would accrue to different sized communities. This study was undertaken to fill this information gap by developing knowledge of the economic impacts various levels of communities could capture from ethanol-cattle production complexes. Since Saskatchewan communities operate in a hierarchical fashion and are classified into seven levels using central place theory, questions concerning economic development should be viewed in a regional hierarchical framework.

A seven-region hierarchically-based interregional input-output model for the Saskatchewan economy was constructed using Supply-Demand Pool (SDP) method in combination with logical assumptions regarding trade patterns within the central place region. It was assumed that higher-level regions are surplus regions in goods produced by non-primary sectors, and hence ship excess supply to producers and final users in the dominated lower-level regions and outside of the province. On the other hand, it was assumed that the hinterland region dominates trade in goods in the primary sectors. The hinterland earned income by producing and supplying goods and services in the primary sectors to the higher-level regions and outside the province. The model consisted of 14 aggregated sectors, seven household sectors, and allowed for net flows of labor income through commuting patterns of workers who resided in the seven regions. At the same time the consumption expenditures of residents in a particular region were adjusted for outshopping purchases. The estimated model was used to assess the economic impacts from the construction phase and operation phase of an integrated ethanol-cattle production complex across six hierarchical regions.

The major findings of this study were that under both phases of the project, intraregional output and labor income impacts occurring in the higher-level regions were larger than those in the lower-level regions. Also, the higher-level regions experienced

larger interregional impacts and had spillover coefficients of smaller magnitude compared to lower-level regions. The intraregional output and labor income impacts tended to decrease as one moves down the hierarchy from top to bottom regions. On the other hand the spillovers or leakages were increasing as one moves down the hierarchy from higher-level regions to lower-level regions. The higher-level regions have more diversified economies and smaller leakages of income and spending than lower-level regions. On the other hand, lower-level regions experienced large income leakages through input purchases and consumer spending in neighbouring higher-level regions. The results indicate that lower-level regions will not benefit more than higher-level regions from the development of an integrated ethanol-cattle production complex. Thus, if the goal of public funding of ethanol projects is to maximize impacts in the project-region, then higher-level regions would be preferred to lower-level regions. This raises a concern that the opportunity of pursuing regional development through ethanol processing, may not reach all those communities who need it the most, especially the smaller communities. It is important to mention that integrated ethanol-cattle production continues to enjoy subsidies from the governments. However, the results of this study did not address the costs associated with using subsidies to promote ethanol development.

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ABSTRACT

Musaba, E.C. Ph.D University of Saskatchewan, Saskatoon, September 1996. Spatial Diffusion of Economic Impacts of Integrated Ethanol-Cattle Production Complex in Saskatchewan. Advisor: Prof. S. N. Kulshreshtha

In Saskatchewan, agriculture is an important sector of the economy. Adverse factors such as decline in world commodity prices get transmitted into reduce farm incomes for regions like Saskatchewan that are highly dependent on foreign exports of wheat and barley. In addition a combination of factors such as the labor-saving technology adopted in agriculture over the years and other natural-resource based activities, and consoldation of the trade centre system, have created unbalanced regional growth. Most rural communities have lower incomes and high levels of unemployment than urban centres. At the same time the viability rural communities is threatened by population loss. In an attempt to alleviate the problems affecting most rural communities, the government in Saskachewan has recognized the need to develop an economically and environmentally sustainable agriculture. In this regard, diversification of agriculture and the food sector was selected as a major strategy for economic development. During the 1990s, diversification through ethanol production, along with its linkages with cattle feeding, has attracted much public attention. Communities of different sizes in Saskatchewan seeking economic opportunities have shown interest in ethanol production because of the perceived benefits a region can capture from such a project. In spite of this interest and the perceived benefits, no information on the type and magnitude of economic impacts which would accrue to different sized communities existed. This study was undertaken to fill this information gap by establishing facts on the economic impacts various levels of communities could capture from ethanol-cattle production complexes. Since Saskatchewan communities operate in a hierarchical fashion and are classified into seven levels using central place theory, questions concerning economic development should be viewed in a regional hierarchical framework.

A seven-region hierarchically-based interregional input-output model for the Saskatchewan economy was constructed using the Supply-Demand Pool (SDP) method in combination with the logical assumptions regarding trade patterns within the central place region. It was assumed that higher-level regions are surplus regions in goods produced by non-primary sectors, and hence ship excess supply to producers and final

users in the dominated lower-level regions and outside of the province. On the other hand, it was assumed that the hinterland region dominates trade in goods in the primary sectors. The hinterland earned income by producing and supplying goods and services in the primary sectors to the higher-level regions and outside the province.The model consisted of 14 aggregated sectors seven household sectors, and allowed for net flows of labour income through commuting patterns of workers who resided in the seven regions. At the same time the consumption expenditures of residents in a particular region were adjusted for outshopping purchases. The estimated model was used to assess the economic impacts from both the construction and operation phase of an integrated ethanol-cattle production complex across six hierarchical regions.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 Background

Agriculture plays an important role in the culture and the economy of Saskatchewan. During 1992, approximately 17.6 percent of the provincial labor force was engaged in agriculture and, similarly, agriculture accounted for 7.3 percent of the provincial gross domestic product (GDP) at factor cost (Saskatchewan Bureau of Statistics, 1993). Agricultural production contributes about $4 billion per annum to the Saskatchewan economy. Most rural communities in the province are largely dependent, either directly or indirectly on agricultural pursuits. In many such communities, the economic performance and viability are determined primarily by the level and stability of farm income. In short, because of the interdependence between agriculture and non-agriculture sectors in the economy, the fortunes (or misfortunes) influencing the agriculture sector get transmitted to non-agricultural sectors, and through that to the region as a whole.

Agriculture in Saskatchewan is dominated by production of cereal crop, notably wheat and barley. In addition, on account of low local usage, much of this production is destined for exports. In fact, about 50-80 percent of annual wheat and barley production is exported to foreign countries (Saskatchewan Agriculture and Food, 1993, p.15 and p.26). This dependency on world grain markets subjects Saskatchewan producers to fluctuations in grain prices, which has caused instability in income for agricultural producers and related sectors. In addition to extreme fluctuations in farm income levels, prices for cereal crops have declined since peaking in the early 1980's. The index of farm product prices for crops was 151.1 (based 1986=100) in 1981, which has declined to almost 90 percent by the mid-1990's (Statistics Canada, Cat. No. 62-003). This decline in grain commodity prices has translated into reduced farm incomes.

Apart from the adverse world market influences on agriculture, the performance of rural communities has been affected by other factors[1]. One such factor is the substitution of capital for labor in agriculture. While this has increased productivity per person, such mechanization has resulted in lesser employment opportunities on farms, resulting in part, in outmigration of farm families from rural areas. This has also been accompanied by expansion of farm holdings, adding further fuel to rural outmigration. This loss in rural population has led to a loss of economic activity and employment in small rural communities and has threatened their viability. Partially as a result of dwindling population base in many rural communities, and partially as a response to changes in fiscal realities, many public and private services (elevators, schools, hospitals, post offices, among others) are being consolidated to the detriment of smaller centres. A second factor affecting economic viability of smaller rural communities is the increasing tendency of rural dwellers to shop in urban centres, encouraged by lower prices and availability of a wider variety of goods and services. Thus, smaller communities have been by-passed in the process which led to the loss of trade and service outlets in smaller communities. A third factor is that led to consolidation of the trade centre system is improvements in transportation and communication. However, consolidation has not occurred randomly; it proceeded systematically with regard to the type of community benefiting from consolidation and the spacing of those centres that have expanded during this process. Furthermore, the effects of adopting labor-saving technologies in natural resource based industries, such as mining, oil and gas, and forestry, have also contributed to reduced incomes and increased unemployment in rural communities which depend on natural resource development.

An analysis of the growth and redistribution of population in the Prairie region between 1961 and 1991 found that the process of consolidation has contributed to the growth of every community in the top three functional classifications[2] in the Prairie

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[1] A detailed discussion of these other factors, is provided by Stabler et al. (1992).

[2] Functional classification refers to communities classified according to the number and complexity of functions that they perform. Saskatchewan communities are defined into six functional classifications. For details see Stabler et al. (1992).

provinces, although some communities in the Partial Shopping Centre (PSC, fourth) classfication have also gained population and businesses through consolidation. However, the two lowest functional classifications generally experienced a declined in importance. This suggests that there is some imbalance in regional growth between urban and rural communities. The rural communities have lower incomes and higher unemployment rates than urban centres.

Within agriculture, in addition to the surplus labor created by labor-saving technology, problem of underemployment[3] also exists. This is caused by the seasonality of production, high fixed costs of entry, and exit difficulties. Immobility of farmers due to remoteness from major urban centres has also limited their non-farm employment opportunities. Underemployed labor on farms adjusts by taking up employment in diversified (more-labor intensive) on-farm pursuits and non-farm employment opportunities. However, on-farm diversification, as it has evolved to date, appears less profitable than diversification into non-farm employment (Olfert, 1992).

Decline in rural economic activities has been a matter of public concern in Saskatchewan (like in other parts of Canada and all over the industrialized world). Some of the measures undertaken have involved direct assistance to farmers. For example, to alleviate the negative effects of low commodity prices on agricultural producers, the governments in most countries, including Canada, have intervened in agriculture by providing financial assistance programs to stabilize farm incomes. Many of these government supported farm programs cannot be continued forever because of budget deficit restrictions[4]. Arguably, subsidizing agricultural commodity prices in a highly competitive industry characterized by low income elasticities of demand cannot lead to permanent income improvements.

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[3] Underemployment means that a portion of the labor resource (person-years) can be diverted to non-farm uses without reducing farm income.

[4] The Federal Minister of Agriculture has indicated plans to reduce annual federal farm safety net spending from $850 million to $600 million over three years (Agriculture and Agri-Food Canada, undated [Received in 1995], p. ii)

It is also noted that long-term productivity improvements and economies of size will not remove the problem if climatic and physical constraints of agricultural production on the Canadian Prairies is such that the labor resource on family farms is fully employed during peak times but is unemployed or underemployed during off-season (Olfert, 1992). Under these circumstances, rural development programs may include stabilizing incomes of agricultural producers, and the creation of non-farm employment opportunities in stagnant rural areas. Another factor in the rural development debate is that population growth is critical to maintaining the viability of rural communities, since increasing population densities provide the critical mass to support local business and consumer services. This appears to be the key to sustaining rural communities as we know them (Trant and Brinkman, 1992).

Faced with uncertain world grain markets, declining government financial support to agriculture, and the problem of underemployment of farm families, Saskatchewan government has recognized the need to continually develop an economically and environmentally sustainable agriculture and food industry in the province. The province has identified three strategies. These were (1) To provide the opportunity for farm families to manage their land, and have better control of their future and be economically successful; (2) To diversify the agriculture and food sector and add value to agricultural products; and (3) To promote production, marketing, research, education and training institutions which contribute to the development of family farms, diversification and value added production (Saskatchewan Agriculture and Food, 1994). These three strategies, in the context of community viability, have been interpreted primarily as developing and expanding of community-based industries with the opportunity to add value to locally grown products.

Within the scope of economic diversification and value added production, Saskatchewan producers have initiated several new enterprises, including introduction of new pulse crops, development of a seed potato industry, production of exotic animals and identification of new value added products such as ethanol, among others. Interest in ethanol production is probably because of the expectation that it can provide a stable market for grain producers. This is because ethanol as a gasoline additive, is sold into a market in which prices are determined by factors not closely related to those that affect prices for grains. Also it creates employment opportunities in the local community, thus stimulating economic activity therein. Furthermore, the integration of a feedlot with an ethanol processing plant can encourage further diversification of the local agricultural economy through producing straw, silage, barley and other requirements for the feedlot. The presence of an ethanol-cattle production complex in a community might even attract local farmers to diversify into cow-calf operations to supply feeder calves to the feedlot and the starting of custom feeding for the feedlot. Another incentive for interest in ethanol production is that it can be blended with fuel to promote energy security, and at the same time reduce environmental damages associated with carbon-based fuels used in the transportation sector. Ethanol is also used to replace lead as an octane enhancer in gasoline and may provide a number of additional environmental benefits. Ethanol fuel burns cleaner than fossil fuel. It produces less carbon monoxide (CO), carbon dioxide (CO_2), and nitrogen oxide (N_2O) in air emissions than regular gasoline. Thus, it causes less air pollution and global warming. However, the downside is that it releases volatile organic compounds (VOCs), which increase ground level smog, especially in larger cities (OECD, 1984, p.98).

In the 1980s and 1990s, as grain markets were not lucrative, various provincial governments in Canada and grain producers showed interest in producing ethanol from local grains (wheat, barley, corn[5]), as well as from other agricultural feedstock such as artichokes (see Baker, Thomassin and Hemming, 1990). With some financial assistance from the various levels of government, one such ethanol producing facility became a reality in 1991 in Lanigan, Saskatchewan. This facility, known as the Pound-Maker Plant, is an integrated ethanol production and feedlot operation. This has been emulated by other Prairie communities as a model for community-based diversification strategy. The

[5] Corn was suggested as a source of ethanol in USA

Poundmaker complex represents a unique integrated system of producing ethanol from agricultural grains and feeding cattle on the by-products of this process. The production complex has shown potential of providing a market for grains (wheat and barley), forages, and feeder calves for farmers in close proximity to the production complex, and has generated almost 50 jobs in the community. Because of these potential benefits, many communities in Saskatchewan have been interested in diversifying their local economies through ethanol production. In terms of rural development, the direct and indirect impacts of ethanol production on various types of rural communities need to be known.

Since government subsidies are used to promote the development of ethanol fuel, it is essential to understand the pros and cons associated with the use of public funds. According to economic theory, a subsidy is desirable for projects whose net social benefits exceed the respective net private benefits. Since the society is better off with the project in place, the private investors need the subsidy to undertake it. Thus, for the ethanol production, subsidy will be economically desirable if private rate of return in such investment is below the accepted level, and if social rate of return is higher than the private one. In this context, if the ethanol fuel program is aimed at improving the environmental quality through reduced air emissions in the transportation sector, then the cost of the ethanol program could be justified by the expected environmental benefits in the future from reduced global warming and acid rain. In essence, these expected environmental benefits represent an externality to the private-investor in ethanol production[6]. Investigation of all direct and indirect benefits from ethanol production requires a comprehensive assessment to be conducted from the society's stand-point.

Coming back to the subsidy for ethanol production in the context of rural community development, it can be argued that if the ethanol fuel program is oriented towards improving the well-being of farmers or rural communities, instead of providing massive subsidies for ethanol production, the same objective could be achieved through

[6] In other words, the prevailing market price of ethanol does not include the net environmental benefits to society in the future.

lump-sum transfers, and thereby avoiding distortions caused by subsidies. Interestingly, Murphy (1992, p.355), noted that the 1990 tax-transfer system in Canada, actually imposed a lighter tax burden and significantly more cash transfers to rural residents than to urban residents, mainly because of federal programs. With the exception of social assistance, rural Canadians continue to receive higher transfers in every transfer category, especially unemployment insurance and family allowances. Although rural residents continue to receive these transfers on ground of higher rates of self employment and unemployment, some people in society are totally opposed to using tax-payers' money in this manner. When subsidies are provided using taxes, this causes a leakage of disposable income and consequent effects on the rest of the economy through reduced consumer spending. On the other hand, others have argued that one goal for rural policy entails using income transfers, including taxes and subsidies, to compensate for situations where market outcomes are inconsistent with social objectives (Apedaile, 1992). The major issue becomes the social willingness to pay for the goods and services produced by rural enterprises based on an ongoing judgment of their importance in both the public and the private interest and on social standards for well-being of all citizens as a nation.

This study recognized that the use of public funds dollars to promote ethanol development is a controversial issue. This study, however, takes the position that the policy-makers in Saskatchewan have taken into account the pros and cons before launching the ethanol fuel program. The policy-makers understand that without subsidies ethanol development may not take place. In essence, beside the goals of encouraging efficiency in resource allocation, governments have social objectives which address unbalanced regional growth, redistribution of income, and environmental concerns. In terms of this study, the focus is to understand how the development of the ethanol production complex will affect various communities in Saskatchewan.

1.2 Need for the Study

Study of effectiveness of ethanol production in terms of rural community development can be supported on several grounds. In the context of a comprehensive assessment of ethanol production, rural development benefits are one of the significant contributors to the total benefits. Knowledge of how ethanol production affects a given community can be very useful in addressing rural development issues surrounding such projects. Impacts of such projects on target groups versus leakages to other groups in the society would enhance the ability of policy-makers design better economic development programs for rural areas.

A case for ethanol production in rural areas can also be made on grounds that in many smaller communities new employment opportunities are relatively few. Yet, these communities are facing rapidly declining population, and high levels of underemployment, caused in part, by immobility of human resources. Knowledge of what type of economic impacts are created by ethanol production on different sized communities will be useful in this regard.

A preliminary review of relevant studies suggests that up until now, only one study (see Stabler et al., 1993) has been conducted to study the impacts of ethanol production in Saskatchewan. The study by Stabler et al.(1993) focused on the impacts at the Partial Shopping center (PSC) level. The PSC is one level out of the six functional levels that could be used to classify various communities in the province. Since the above study did not investigate the economic impacts of locating similar ethanol-cattle production complexes in other types of communities, there is a need to provide such information.

An ethanol project may impact various stakeholders differently. Various stakeholders at the community level include: grain producers, private investors, federal and provincial and local governments, local businesses, and local residents. The grain producers are seeking alternative markets for grain. Private investors see ethanol as an investment opportunity. Federal and provincial governments see ethanol as an opportunity for strengthening the rural communities. Local business see ethanol as a boost to local economic activity and increased demand for their goods and services. The local residents are interested in ethanol because it generates employment. Because, ethanol production will impact on many parties or sectors, it is important to provide disaggregated information of the magnitude by which various sectors will be affected.

1.3 Problematic Situation

The problem addressed in this study concerns the development of knowledge of how ethanol production complexes will impact different-sized communities in Saskatchewan. This is important because ethanol production complexes will generate different impacts and benefits in various communities depending on the economic base of the communities and the actions and reactions of economic agents in them.

In addition, the prospect of ethanol production generates economic impacts on not only the project region but also neighboring regions. Based on the expected benefits of an ethanol project, governments have provided subsidies for such a project as a means to strengthen rural communities, and farmers have shown interest in the projects. For assessment purposes, the effectiveness of such projects should be measured in terms of total impacts, which include both the direct and the indirect impacts. Spillover effects should also be measured because impacts are not confined only to the target region, but also spill into adjacent regions. For modeling the indirect impacts; input-output analysis is the appropriate technique. Furthermore, the interregional (or multi-regional) input-output framework is the preferred framework for addressing the spillover effects.

Studies such as Stabler et al. (1992) have suggested that the communities in Saskatchewan operate in a hierarchical manner and can be classified using the Central Place theory. Within this hierarchy, lower-level centres depend upon higher-level centres for their supply of goods and services. The shopping patterns of residents at different levels of the hierarchy tend to conform to the hierarchical structure of the region. The outshopping tends to increase as one moves down the hierarchy from higher-level centres to lower-level centres.

Given the hierarchical structure of the province and the desire to measure total impacts of ethanol, including spillover effects, for the Saskatchewan economy, it follows that the problem addressed in this study requires use of a technique involving both central place theory and input-output analysis.

1.4 Objectives of the Study

The primary objective of this study is to develop an appropriate analytical tool for measuring the economic effect of establishing an ethanol production facility in various types of communities operating in an hierarchical order. This objective is met through the following sub-objectives:

(1) To develop an economic impact analysis model based on hierarchically-based interregional economic structure of the province of Saskatchewan;

(2) To simulate the direct and spillover impacts of integrated ethanol-cattle production complex across hierarchical level of communities in the province;

(3) To measure the differences in spillover effects captured by various types of communities under alternative location decision for the complex; and

(4) To draw policy implications of the spatial diffusion of economic impacts for future integrated ethanol-feedlot development in Saskatchewan.

1.5 Scope of the Study

The analysis contained in this report is based on the economic structure of the Saskatchewan economy as it existed in 1992. These results are, therefore, particular to this situation. In addition, details on the ethanol-cattle production complex used in this study are based on information obtained from the Pound-Maker plant located at Lanigan, Saskatchewan. The model used in this study is also conditioned by the hierarchical level of communities used for its development.

1.6 Organization of the Thesis

The remaining report is organized as six chapters. Chapter Two, presents an overview of the state of the ethanol industry in Canada. This is supplemented by a review of the state-of-the-art used in existing studies of economic impacts of ethanol production. Furthermore, an attempt has been made to identify the gaps and limitations in the existing studies and the relevant issues that need to be addressed by future studies.

In Chapter Three, two appropriate conceptual frameworks used to study the economic impacts of ethanol-cattle production in Saskatchewan are presented: Input-Output analysis and Central Place theory. The concept of economic impact and the conceptual input-output model as the basic tool for impact analysis are also discussed Both single-region and multi-region (including interregional) input-output models are described, including an examination of the types of impacts captured by interregional input-output models.

Chapter Four, presents the empirical model. As mentioned above, this model was based on an interregional input-output analysis framework coupled with a hierarchical level of communities.

Chapter Five, presents the methodology used for constructing the study model and the process of conducting economic impact analysis of the Ethanol-Cattle Production complex. Sources of data and various underlying assumptions are also described.

Chapter Six, sets out the results of the spatial economic impacts of constructing and operating an integrated Ethanol-Cattle Production complex in six different regions in

Saskatchewan. Discussion follow on the policy implications of such results, for both community leader and public officials.

Chapter Seven, provides a summary of the study and its major conclusions are reported. A brief discussion of study methodology and results is followed by major limitations of the study and directions for further research.

CHAPTER 2
LITERATURE REVIEW

This chapter has two goals: First, it presents the background and an overview of the situation facing the ethanol industry in Canada. Second, it presents a review of the state-of-the-art used in economic impact studies of ethanol production. The chapter is divided into five sections. In Section 2.1, a historical development of the ethanol industry in general is briefly discussed. In Section 2.2, presents a review of the state of the ethanol production industry in Canada. Section 2.3 provides an insight into the state-of-the-art used in studies of economic impacts of ethanol production. It reviews the methodology used by past studies. Section 2.4 points to gaps and limitations of past studies, followed by Section 2.5 which identifies relevant issues that should be addressed by future studies.

2.1 Historical Development of the Ethanol Industry

During the last quarter century, interest in ethanol production has emerged from at least three sources. Ethanol started to attract public attention in the United States of America (USA) during the energy crisis of the mid-1970s. Alcohol produced from agricultural products promised a partial solution to the crisis. This led to the development of a large ethanol industry in the United States and Brazil. For the United States, ethanol production helps solve many problems: (1) it reduces dependency on oil imports, (2) it is used as an octane-enhancer to replace lead in unleaded gasoline as required under the federal Clean Air Act, and (3) it creates an alternative market for grain, and thereby reduces grain surpluses, government farm program payments, storage costs and increases grain prices for the farmers. In USA, the stated goal of the Energy Security Act of 1980 was that, by 1990, alcohol would be equivalent to at least 10% of the domestic gasoline consumption, or 8.4 billion gallons, based on the Energy's gasoline forecasts (Chattin and Doering, 1984). However, because petroleum prices fell rather than continuing to increase, the development of alternative fuels faded from public attention. In Brazil, the development of the ethanol industry was aimed at reducing the foreign exchange cost of imported petroleum oil.

Within the USA, the second round of interest in ethanol production came from concerns for the `farm problem' caused by over-production of grain. During the early 1980s over production of grain and weak demand led to corn stocks of almost 2.4 billion bushels and corn prices at the farm level approaching $2.00 per bushel. Policy makers started searching for ways to utilize corn stocks and raise farm prices (Chattin and Doering, 1984). The third, and more recent round of interest in the production of ethanol is derived from environmental concerns. As lead has been phased out of gasoline, there is a renewed interest in using ethanol as the octane booster in gasoline.

The development of the ethanol industry in the US has been driven by federal government legislation and a variety of grants, guaranteed loans, and tax incentives (Coon and Wilson, 1986). Recently, some states, for example, Ohio, have mandated the use of ethanol-blended gasoline in large fleet vehicles. The other factor that is driving ethanol production in the US has been the rise in consumer awareness regarding environmental benefits and lobbying pressure organized through the American Automobile Association.

2.2 An Overview of the Canadian Ethanol Industry Situation

Compared to the ethanol industries of the United States and Brazil, that of Canada is still in an infancy stage. The interest in ethanol production in Canada is arising from a number of sources including (1) environmental concerns; (2) grain disposal problem (low commodity prices); (3) need to diversify grain markets; and (4) community development opportunity. Development of ethanol is assisted by both federal and provincial governments through a variety of programs. An overview of the Canadian ethanol industry is presented in this section in terms of: (1) Production and consumption,

(2) Constraints facing the industry, (3) Government programs, and (4) Future prospects of the industry.

2.2.1 Ethanol Production and Consumption in Canada

The annual consumption of transportation fuels in Canada is about 51 billion litres (Canada Energy Use, 1988). Of this 34 billion litres is gasoline and 16.6 billion litres is diesel fuel. The share for Western Canada in the national gasoline consumption is about 28 percent. The existing motor vehicles designed for gasoline can use a blended gasoline containing up to 10 percent ethanol. This means that if there was an E10-blend[7] legislation to mandate using ethanol-blended gasoline, the market demand for ethanol in Canada would be almost 3.4 billion litres per year. The share for Western Canada, would create a market demand of around 0.9 billion litres of ethanol per annum. The current levels of ethanol production are far below the potential demand[8] expected if the E10-legislation was to be in place. These estimates indicate clearly a potential demand for ethanol.

On the supply side, it is known that ethanol production in Canada is still in its infancy stage. Currently, there are about five ethanol plants that are operating, ranging from a small plant in Kerrobert, Saskatchewan, to a large plant in Triverton, Ontario (see Table 2.1). In addition, three other plants are in planning stages. These include a mid-sized plant for Saskatchewan to be located in Weyburn and two mega-projects for Ontario to be located in Chatham and Cornwall. Four other plants remain possibilities, three in Alberta and one in Saskatchewan (Western Producer, Special Issue, August 1995).

[7] E10-blend refers to ethanol blended gasoline containing 10 percent ethanol.

[8] The potential demand for ethanol is usually estimated on the premise that ethanol will enter the market at a 10 percent blending level.

Table 2.1. Location, Production Capacity and Status of Ethanol Plants in Canada

Site	Province	Capacity (million litres)	Status
Lanigan	Saskatchewan	10	Operating
Kerrobert	Saskatchewan	7	Operating
Minnedosa	Manitoba	7	Operating
Triverton	Ontario	-	Operating
Timiskkaming	Quebec	-	Operating
Weyburn	Saskatchewan	-	Announced
Chatham	Ontario	-	Announced
Cornwall	Ontario	-	Announced

- Not available

2.2.2 Constraints Facing the Ethanol Industry in Canada

A number of factors have limited the development of the ethanol industry in Canada. The following are noteworthy:

(1) Communities are discouraged by the fact that ethanol production is not economically viable unless supported by government subsidy;

(2) Communities that want to establish ethanol plants must raise large initial sums of capital to cover expenses for feasibility studies and business plans before construction of the plant can start;

(3) Lack of capital remains a major constraint. Banks, faced with a new industry, are not willing to supply credit easily. Perhaps banks would be willing to lend money for ethanol projects if government support is guaranteed for a long term. The banks also require that signed contracts with buyers be in place before financing is approved.

(4) Gasoline refiners (fuel companies) have reservations about the availability of a continuous and sufficient supply of feedstock (grain) to support an ethanol

industry which in turn must significantly contribute to their octane requirements (Heath, 1989, p.60-61).

(5) Grain prices is another factor behind the slow progress of the ethanol industry in Canada. It is known that many producers gain interest in ethanol only when grain prices are low, and many quickly lose their interest in ethanol when grain prices are high. Currently, the grain prices have risen compared to the low prices experienced since the late 1980's. If farmers have a long-term commitment to diversification through ethanol production, the current rise of grain prices should not be a limiting factor.

(6) Lack of government legislation mandating the use of ethanol-blended gasoline in motor vehicles is another factor slowing the growth of the industry

As indicated above, the development of an ethanol industry in Canada is constrained by a number of factors ranging from cost of production for ethanol, huge initial start-up capital, unwillingness by banks to supply credit to a new and unfamiliar industry, etc. The future development of the industry will depend on the measures to be taken to overcome these constraints. A successful ethanol industry will require the close alliance of the agricultural industry (grain farmers and feedlot operators), the ethanol producers, the oil refiners, the distributors, both federal and provincial governments, the marketer and ultimately the consumer (Heath, 1989, p. 94). Ethanol production and distribution will have to be just one part of a fully integrated system in order to minimize the risks associated with the development of a new industry and at the same time to maximize the returns. One successful example in Saskatchewan worth mentioning is the Pound-Maker ethanol-cattle production complex. The Pound-Maker complex is organized under some strategic partnership arrangements involving local farmers, Mohawk Oil and Saskatchewan Wheat Pool. The local area farmers own 56 percent of the company's shares, Mohawk oil owns 22 percent of the shares and Saskatchewan Wheat Pool holds the remaining 22 percent. Each partner brings unique qualities to the alliance and draws different benefits from the relationship (Star Phoenix, November 27, 1993).

2.2.3 Government Programs Aimed at the Ethanol Industry in Canada

Even though the ethanol industry in Canada is affected by the above mentioned factors, some effort has been made by both federal and provincial governments to support the growth of the industry. The major instrument used has been the excise tax credit on ethanol-blended gasoline. This tax credit offered differs among provinces in terms of the level of tax credit per litre and period of coverage. For example, in Ontario the government provides a 14.7 cent per litre road tax exemption until the year 2010. The federal government provides an exemption of 10 cent-per-liter from excise tax on fuel for a decade (1995-2005). The two programs give Ontario ethanol producers a 24.7 cent-per-litre incentive for a decade.

In Saskatchewan and Manitoba, ethanol producers were offered some good initial support for the Lanigan and Minnedosa plants but that support has dwindled recently. In Saskatchewan the ethanol sellers and producers were offered a 40-cent tax credit per litre of ethanol sold for four years. This translates into a 4-cent tax credit per litre of ethanol-blended gasoline. This program ended in 1993 for new producers while those already in the program were allowed to continue until their four years were over. In Manitoba, the initial support was 3.5 cent per litre of ethanol-blended gasoline, but it has been reduced to 2.5 cents.

The above shows that there are differences in the level of government support between Eastern and Western Canada. Eastern Canada, in particular Ontario, is providing a higher level of support and over a longer time period compared to Western Canada. Some have argued that two new large-scale ethanol plants were proposed for Ontario, one in Chatham and another in Cornwall, because of its government's higher support levels (Western Producer, August 1995).

2.2.4 Future of the Ethanol Industry in Saskatchewan and Canada

The interest in ethanol production among Saskatchewan communities is beginning to dwindle for the various reasons listed above. This raises concerns regarding the future of the industry in Saskatchewan as well as other provinces. One issue concerns the structure of the ethanol industry in future in terms of the size and number of plants that will be adequate to satisfy demand. Currently, in Western Canada, the existing plants are small and community-based. Wildeman has argued (see Western Producer, August 3, 1995, p. 62) that if many communities do not take up the challenge, large Multinational Companies (MNC) such as Archer Daniels, and Cargill may enter the industry. This will result in a situation where the communities will be deprived of the full benefits from ethanol. The control by a large MNC, will reduce the industry to only a few large scale plants, instead of many small community-based ethanol plants the size of the Pound-Maker complex. However, the future of the industry and the structure that is likely to emerge remain uncertain because they can be influenced by government policies and market conditions.

2.3 Review of the State-of-the-Art of Ethanol Impact Studies

In this section, reviews some of the studies concerned with the impacts of producing ethanol using agricultural products. The review serves identify the types and magnitude of impacts, relevant issues addressed in past studies, and the methods most commonly used to assess economic impacts. Impacts can also be non-economic (social and environmental). However, this review is limited to economic impact assessment, and does not include studies dealing with the assessment of social or environmental impacts.

A review of studies of the impacts of ethanol reveals that such impacts can vary from substantial to minimal. The size of these impacts depends on the type of feedstock, products, and scale of ethanol production. Furthermore, the economic impacts can be at several levels: the farm, industry or the wider economy. In addition, to a certain extent, estimated impacts may also be different on account of the methodology used.

The studies reviewed in this section are divided into three categories: (1) Agricultural Sector Models, (2) Multi-Sector Models and (3) Descriptive Studies. A brief description of each category and the major issues covered by the studies is presented in the following three sub-sections.

2.3.1 Agricultural Sector Models

Production of agriculturally-derived ethanol on a large scale can be expected to impact agricultural production. A number of studies using agricultural sector models have evaluated ethanol production's impacts on agricultural commodity prices, net farm income, land-use patterns, and crop export levels. These models have either a regional or a national focus, and are based on partial equilibrium, in which disturbances originating in agriculture are assumed to have no influence on the rest of the economy. Basic linkages between agriculture and other sectors of the economy are ignored. Such agricultural sector models have been built using three major methodologies described below.

(1) Econometric Simulation Models: Include studies by Meekhof et al. (1980) and Hertzmark et al. (1980) which focused on short-run impacts, and studies by LeBlanc and Prato (1983) and Webb (1981) which considered higher levels of ethanol production and model to the year 1990 and 2000, respectively. Generally speaking, these studies simulated impacts on acreage and price of corn and soybeans, as well as on corn stocks, exports, and cost of government programs in the U.S.

(2) Quadratic Programming Models: These studies have analyzed the impacts of different levels of ethanol on prices of corn and soybean as well as the substitution effects of the ethanol's by-product. Studies by LeBlanc (1983) and Chattin and Doering (1984) are included here.

(3) Linear Programming Models: These studies addressed the question of adequacy of land, soil, and energy resources to meet input requirements for ethanol production. Included among these studies are Turhollow and Heady (1986), and Gould (1982). The study by Gould is unique in that it considered the environmental and energy use impacts of a corn based ethanol production.

A summary of levels of ethanol production modeled and selected results from agricultural sector models is presented in Table 2.2. These studies indicated that large scale ethanol production would cause corn prices to increase, but the magnitudes vary between 5% and 41%. Chattin and Doering (1984) found that larger alcohol programs may raise the prices of field crops by only 6-9%, much below the price increases indicated by earlier studies (see Table 2.2). Thus, the study by Chattin and Doering (1984) casts some doubts concerning the recommendation that alcohol programs would serve to boost commodity prices.

Table 2.2. Selected Results of previous studies on the effects of ethanol production.

Study	Year of Results	Ethanol Production (10^9 L)	Percent Change in Price	
			Corn	Soybeans
Hertzmark et al. (1980)	1983	3.8	5	<1
Meekhoff et al. (1980)	1984/85	15.1	38	-6
LeBlanc & Prato (1983)	1990	31.8	41	14
Webb (1981)	2000	37.9	37	-9
LeBlanc (1983)	long run	34.8	23 to 25	20 to 23
Chattin & Doering (1984)	long run	31.8	6 to 9	5 to 9

The effect of ethanol production on soybean prices is ambiguous (negative or positive). The increase in corn production displaces soybean acreage which causes soybean prices to rise (Meekhoof et al., 1980). Contrary to this, studies by LeBlanc and Prato (1983) and Gavett (1986) stated that higher corn prices increase production at the expense of soybean production, and the high protein by-products from ethanol replace soybean meal in livestock feed rations and depress prices of soybeans.

These studies have indicated that larger levels of alcohol production (above 7.75 billion litres[9] per year) require more grain, and cause corn prices to rise, stocks of corn to fall to low levels, exports to decline, and government expenditures to increase greatly. Gavett et al. (1986) added that large ethanol subsidies, which are required to sustain the industry, would offset any savings in agricultural commodity programs. Increased ethanol production could also raise the consumer expenditure for food. Any benefits of higher income to farmers would be more than offset by increased government costs and consumer food expenditures. Perhaps direct cash payments to maize growers would be more economical than attempting to boost farm income through ethanol subsidies.

In Canada, the study by Agriculture Canada (1987) found that ethanol production would increase feed grain prices in the West by approximately 2% and in the East by 6% for a 3% ethanol and 5% methanol blend. In addition, western grain exports to the international market would decline and imports of corn from the United States into eastern Canada would increase. Supply response for corn in Eastern Canada and for barley in the Western Canada was minimal. Savings from government programs, such as WGSA, ASA and WGTA, due to increased prices and a decrease in Western exports were estimated to total almost $31 million.

2.3.2 Multi-Sector Models

Multi-sectoral models attempt to capture sectoral interdependence arising from the flow of goods and services among sectors. Two types of commonly used multisectoral models are: (1) Fixed-price linear models, and (2) Flexible-price linear or nonlinear models. For situations where price impacts are negligible, and yet sectoral linkages are important, the fixed-price linear models, such as input-output models and

[9] The volume, 7.75 billion litres is equal to 2 billion gallons

economic base models, are relevant. For analyzing both the price impacts and substitution effects, the flexible-price linear or nonlinear models, for instance the computable general equilibrium model (CGE), are preferred.

Few studies have addressed the impacts of an agro-based ethanol industry under the fixed price linear models. Studies by Coon and Wilson (1986), and Thomassin, Henning, and Baker (1992) used the input-output analysis, whereas the study by Stabler, Olfert and Brown (1993) used the economic base model.

Coon and Wilson (1986) used an input-output table of North Dakota to analyze the economic impacts of a 42.6 million litre ethanol plant using barley. For each dollar the plant spends in the state, another $1.81 is generated through the multiplier process for a total impact of $2.81.

Thomassin, Henning and Baker (1992) used the Canadian national input-output model to estimate the macroeconomic impacts of a 100 ML ethanol industry based on Jerusalem artichoke, an agricultural feedstock. They found that, if established in western Canada, the plant would increase industrial output by $154 million, GDP by $50 million and employment by 1,365 jobs. Further, the plant would provide additional benefits to the environment, the agriculture sector and energy security of the country.

Stabler, Olfert and Brown (1993) analyzed the impact of the 10 ML ethanol-cattle (Poundmaker) complex on the non-agricultural local economy. Using the economic base model, the results indicated that the plant has an income multiplier of 1.32 and an employment multiplier of 1.39. Furthermore, the study indicated that Saskatoon was the major beneficiary of the economic activity at Poundmaker complex, on account of leakages in consumer expenditures. Unlike input-output analysis, economic base models cannot capture interindustry transactions in that they divide the economy into two sectors: basic and non-basic sectors.

The I-O studies have been conducted using mostly single-region input-output models either at the national or state level. Since the demand effects of some economic stimulus in one region spread into other regions, the existing studies have neglected the spatial impacts. Furthermore, because the differences in the industrial structures of sub-regions could lead to different impacts from a particular economic stimulus, the use of single-region models is again questionable. If the purpose of such studies is to generate information which would lead to a better understanding of how some economic stimulus affects various sub-regions within a larger region, a multi-regional model will be more appropriate than a single-region model. Furthermore, a multi-regional framework would estimate both direct and indirect impacts including the spillovers and feedbacks of ethanol production in a region.

2.3.3 Descriptive Studies

A number of important issues related to impacts of ethanol have been covered in many research reports and papers. In summary, the review of descriptive existing studies indicated that ethanol production has at least three important problems:

(1) Stand-alone ethanol plants are uneconomical without government subsidies. However, integration of ethanol plants with cattle feeding can improve the viability of both plants (Shafer, 1988; Coxworth and Olsen, 1990).

(2) Ethanol produced from grain (e.g corn) causes environmental degradation from increased soil erosion, leading to soil, water, and air pollution, and from increased emissions of global-warming gases (Pimentel, 1991; D'Souza et al. 1988).

(3) Ethanol production is energy inefficient, requiring considerably more energy input than is contained in the ethanol produced (Pimentel,1991). However, Brown (1980) reported that if the energy value of the by-product, distillers grain, is included, there is a slight net energy gain of 5 percent.

The preceding three sub-sections provided a review of the studies of impacts of ethanol production conducted using agricultural sector models, multi-sector models and descriptive studies. The limitations identified in the reviewed studies and the implications for the present study are briefly discussed in the next section.

2.4 Limitations of Existing Studies

Existing studies of economic impacts of ethanol production suffer from several limitations. These are summarized below:

(1) Both the agricultural sector models and input-output models have analyzed the impacts of stand-alone ethanol plants on the regional or national economy. However, none of these models has been applied to investigate the impacts of an ethanol plant which is integrated with a feedlot.

(2) Analysis of the impacts of ethanol has been conducted using single region models. These include national or state input-output models or economic base models. However, the demand effects generated by an economic stimulus in favor of one region are usually captured by the neighbouring region(s) through import leakages. Thus, to adequately analyze these impacts, the appropriate models ought to incorporate spatial impacts.

(3) In Saskatchewan the economic impacts of an integrated ethanol-cattle production complex has been conducted for Lanigan, a community that can be classified as a Partial Shopping Centre in the six-tier hierarchical classification of communities. Thus, none of these studies have analyzed economic impacts of an ethanol-cattle production complex for communities found at other levels of the hierarchical regions.

2.5 Implications of the Review for the Present Study

In view of the limitations identified in existing studies, it is important to provide some direction to future studies estimating impacts of ethanol.

(1) It is noted that some communities in Saskatchewan are interested in establishing ethanol plants using the Poundmaker ethanol-cattle production complex as a model. In spite of this new interest, very little empirical evidence is available as to the magnitude of total impact captured by the local community when such communities differ in size and related economic activities. Therefore, one problem that ought to be addressed by future studies is that of providing knowledge of economic impacts of integrated ethanol-cattle production complex for communities in Saskatchewan of various sizes at various levels of the hierarchy.

(2) Because of the presence of leakages of economic impacts from the project region into adjacent regions, the use of single-region models is questionable. To adequately measure the economic impacts of ethanol production (due to some policy change) where the impacts include leakages, a spatial or multi-regional model is more appropriate.

(3) Although it has been argued that the spatial impact framework would be necessary to analyze the effects of ethanol at community or smaller-area level, such an attempt has not been made for the Saskatchewan economy. Thus, there is a need to develop models that can adequately assess the spatial impacts of integrated ethanol and cattle production in Saskatchewan.

(4) Given the interdependent nature of sectors in an economy, the need to measure the magnitude of economic impacts of ethanol for various communities requires use of an input-output technique. The I-O method is preferred over other

methods of impact analysis because it can provide detailed breakdown of impacts by sector within a single-region as well as in a multi-region situation.

(5) Existing studies have revealed that stand alone ethanol plants are not usually economically viable in the absence of government subsidies. However, integration of an ethanol plant with a cattle feedlot can improve the viability of both plants (Shafer, 1988; Coxworth and Olsen, 1990). For this reason the Saskatchewan government is in support of ethanol plants that are integrated with cattle[10]. In this respect the relevant issue to study is the impact of an integrated ethanol-cattle production complex.

In summary, the appropriate model for estimating economic impacts of ethanol production should include both the interindustry linkages within single regions as well as interregional linkages. Unlike the single-region model, the multi-regional model can provide estimates of impacts on the local economies including spillover and feedback effects. Ignoring these spillovers and feedback effects by using a single region model may lead to overestimating the total impact of final demand changes on the region.

[10] In a seminar on the future of Saskatchewan Agriculture held at University of Saskatchewan in February 1995, the Saskatchewan Minister of Agriculture, Mr. Cunningham, indicated that it is current policy to support integrated plants rather than stand alone plants.

CHAPTER 3

CONCEPTUAL BACKGROUND: INPUT-OUTPUT THEORY AND CENTRAL PLACE THEORY

This chapter sets out the relevant conceptual framework to be used in the current study. Since the problematic situation indicated the need for assessing spatial impacts of ethanol production in Saskatchewan communities, and since such a study has not been carried out, two conceptual frameworks -- input-output theory and central place theory -- were considered relevant in designing such a study. It should be noted that the Central Place theory becomes relevant because other existing studies (Stabler et. al., 1992) of Saskatchewan economy have suggested that these communities interact in a hierarchical fashion appropriately described by this theory. The chapter is divided into five sections. Section 3.1 presents taxonomy of economic impacts. Section 3.2 provides discussion on basic input-output analysis, including the concept of a transactions table and the rectangular input-output model. In Section 3.3, an interregional input-output model and the type of impacts captured by such models are discussed. Section 3.4 analyzes the role of Central Place theory in regional modeling and Section 3.5 provides the summary.

3.1 Taxonomy of Economic Impacts: Direct and Secondary

The total economic impacts of a change in an industry can be broadly classified into two types: direct impacts and secondary impacts. The direct impacts of an industry are equivalent to the direct contributions made by it to the economy. The most common measures of this impact are the level of production, in terms of goods and services sold by the establishment, and employment generated.

The direct economic activity of a sector (such as ethanol and/or beef production) creates a series of ripple effects in the economic system. The following four are noteworthy:

(1) The sector would purchase its input requirements from other industries in the province.

(2) The sector would hire some factors of production, such as labor and capital, and part of the value of production of this sector would be paid to them. The owners of these factors of production would gain personal income and pay direct and indirect taxes to the government, and have more income to spend on personal consumption.

(3) The products of produced by the sector may become inputs in the production process of some other sectors in the region. For example, ethanol is blended with regular gasoline, and beef cattle is an input in the production of meat and meat products.

(4) The firms using the output of the industry in the direct impact category would also compensate owners of factors of production. This money would also be re-spent in the economy through purchases of goods and services, and payments to governments.

These types of effects are referred to as secondary impacts of a change. Thus the total impact of a sector is the sum of the direct impact and secondary impacts. The secondary impacts can be further broken down into four types, using two criteria—the impacts sector's source of that secondary impact, and type of linkage between.

On the basis of source of impact, there are two types of impacts:

(1) Indirect or Industrial Support Impact is that change in the output (or other measures) of various industries which results from purchases of inputs by the direct impact sector. Various measures that are used include output (or sales) of goods and services, total value added, household incomes, and employment levels.

(2) The Induced or Income-Induced Impact is that change in the output (or other measure) of various industries which results from the spending of household incomes generated by the direct impact plus indirectly impacted sectors.

Another way of naming these impacts is to call them Type I and Type II secondary impacts. Type I impacts include only industry support impacts resulting from the production activity of a sector. Type II secondary impacts include both industry support as well as income induced impacts.

On the basis of the type of linkages, impacts can be identified as Impacts due to backward linkages, and Impacts due to forward linkages. The backward linkages are those which result from purchases of goods and services and primary resources (factors of production). The forward linkages of a sector are those which result from the further transformation of the products produced by the direct impact industry.

3.2 Basic Input-Output Model

An input-output analysis attempts to quantify, at a point in time, the economic interdependencies in an economy of a region (nation, state, province, etc.). An Input-Output (I-O) model reveals the ways in which the various sectors of the region's economy are meshed together and are linked to the potential sources of economic stimuli (Davis, 1993, p.53). The model is capable of providing several types of information, First, it is an excellent descriptive tool, showing in detail the structure of an existing regional economy along with the size of individual industrial sectors, behavior and interaction with the rest of the economy. Second, it shows the relative importance of various sectors in terms of their sales and input purchases. Third, it serves to predict how the economy will respond to exogenous changes in final demand. Therefore, it is useful in prescriptive exercises where various actions are being considered and the relative merits of each action are determined based on its outcome (Hastings and Brucker, 1993, p.2).

Impact Analysis

One of the major uses of input-output information, in the format of an input-output model, is to assess the effect on an economy of changes in elements that are exogenous to the model of that economy. Impact analysis is the term used when the exogenous changes occur because of the actions of only one "impacting agent" or a small number of such agents and when the changes are expected to occur in the short run (e.g., next year) (Miller and Blair, 1985, p.100). Impact analysis involves translating the assumed changes in final-demand elements via the appropriate Leontief inverse, to corresponding changes that would be needed in the outputs of the industrial sectors of a national or regional economy. The standard input-output model for impact analysis is $X = (I-A)^{-1}Y$.

Several summary measures derived from the elements of $(I-A)^{-1}$ are often employed in impact analysis; these are known as input-output multipliers. The notion of multipliers rests upon the difference between the initial effect of an exogenous (final demand) change and the total effects of that change.

An input-output model produces a variety of multipliers. The two major types of multipliers are referred to as Type I and Type II multipliers. Type I multipliers are obtained using the "open" I-O model. These estimate only the indirect (industry-support) impacts. When the I-O model includes the household sectors (this is closing the model with respect to household), the multiplier matrix results in both industry-support as well as income-induced impacts. These multipliers are called Type II multipliers.

Most often multipliers are related to final demand. Thus, a conventional multiplier is defined as the change in "total economic activity" in the region resulting from one unit change in the final demand of a commodity or a sector. The economic activity can be measured in terms of output, income, value-added, imports, and employment.

There are two other types of multipliers that can be estimated: Pseudo-multipliers and ratio multipliers. A pseudo-multiplier is the total change in the economic activity in the region resulting from one unit change in the output of a given sector. The ratio multiplier is the total change in the economic activity in the region resulting from one unit change in the direct economic activity of a given sector.

3.2.1 The Concept of a Transaction Table

The flow of goods and services between the sectors is measured in dollar terms and referred to as transactions. All the transactions between various sectors in an economy are organized and presented in a transactions table. The transactions table is used to produce a table of direct requirements which shows how much of each input is required to produce one dollar of output. Using the direct requirements, a table of total (direct and indirect) requirements can be established. These requirements can be used to determine the impact on the entire economy of a final demand change in any one sector or combination of sectors.

3.2.2 The Format of a Transaction Table

There are two basic formats of transactions tables: (1) Square format[11], and (2) Rectangular format. The square transactions table is based on the industry-by-industry accounting system. This restricts mapping of commodities on a one-to-one basis to industrial sectors. The number of sectors and the number of commodities are the same. The UN System of accounts removes this restriction (Hewings and Jensen, 1986). Hence it is possible to detail transactions in rectangular matrices in which the number of commodities may be greater than the number of industries. Since in Canada the input-output models follow the rectangular format, in the next section the discussion focuses on the basic concept of rectangular input-output model.

3.2.3 Rectangular Input-Output Model

The rectangular table is based on the commodity-by-industry accounts. Accounting for secondary production is the only difference between industry and commodity accounts; that is, if no secondary production exists, the industry and commodity accounts will be identical. In principle, there is no reason why the number and definition of commodities should have a one-to-one relationship with the definition and classification of industrial sectors.

Basing the accounting framework on the commodity-industry accounts, generates the rectangular transactions table. In this case the supply and disposition of commodities and factors of production are shown in terms of five matrices (see Figure 3.1) of the transactions table. The five matrices include (i) "Use" matrix $[U]$, which contains the values of intermediate input commodities or sectoral demand matrix; (ii) "Make" matrix $[V]$, which represents various commodities produced by each sector in the economy; (iii) Matrix $[F]$ representing commodity purchases by the final demand sectors; (iv) Matrix $[YI]$ which represents the sectoral purchases of the primary inputs; and, (v) Matrix $[YF]$ which represents the purchase of primary inputs by the final demand sectors.

[11] For further details on input-output models based on a square format of a transaction table refer to Miller and Blair (1985, p.305).

	Commodities	Industries	Final Demand	Total
COMMODITIES		U	F	q
INDUSTRIES	V			g
PRIMARY INPUTS		YI	YF	
TOTAL	q'	g'		

Figure 3.1. The Rectangular Input-Output Tableau

The vector q' provides an estimate of the total value of each commodity produced in the economy. The sum across each row of the V matrix is the total value of each industry's output (g).

In the I-O accounting framework, the total cost of an industry's production must equal the total value of the products produced by that industry; that is, vector g' is equal to vector g. Similarly, the total value of demand for a commodity (intermediate plus final demand) is equal to the total value of the commodities supplied: $q_i = q'_I$

The accounting framework provides two relationships that can be used to estimate the total impact on the economy of a change in the demand for goods produced. The first is that the total value of a commodity's output is equal to the value of the intermediate plus final demand for that commodity. In other words,

$$q = U.I + F.I \tag{3.1}$$

where I refers to a row vector operator consisting of ones.

The second relationship defines the total value of each industry's output as being equal to the value of each commodity produced by that industry:

$$g = V.I \tag{3.2}$$

The rectangular I-O model is based on two major assumptions:

Assumption One: The inputs used by each sector are directly proportional to the level of output produced by that sector.

Assumption Two: The share of an industry in producing a commodity remains constant. Thus, demand for domestically produced commodities is allocated among industries according to fixed market shares.

These two assumptions are used in formalizing the I-O model, and the method of determining secondary impacts (see Kulshreshtha et al., 1991, p. 39). Let B be a *NC* X *NS* matrix of technical coefficients, showing the amount of commodity *i* required to produce one unit of output by industry *j*. *NC* refers to the number of commodities and *NS* refers to the number of sectors. Each element of B is obtained as follows:

$$b_{ij} = u_{ij} / g_j \tag{3.3}$$

and the matrix B can be written as:

$$B = \begin{bmatrix} b_{11} & \cdots & b_{1NS} \\ \vdots & & \vdots \\ b_{NC1} & \cdots & b_{NC,NS} \end{bmatrix}$$

Let D be a *NS* X *NC* matrix of market share coefficients, representing the proportion of commodity *i* produced by industry *j*, such that

$$d_{ji} = v_{ji} / q_j \tag{3.4}$$

and matrix D can be expressed as:

$$D = \begin{bmatrix} d_{11} \cdots d_{1,NS} \\ \vdots \quad\quad \vdots \\ d_{NC1} \cdots d_{NC,NS} \end{bmatrix}$$

The total output of industry G can be estimated as the market share of the industry times its output or

$$g = D.q \tag{3.5}$$

and total value of commodity output (q) is derived from equation (3.1)

$$q = Bg + F \tag{3.6}$$

In other words, the total output of commodties is equal to their intermediate plus final demands, where the intermediate demand is arrived at using the per unit requirement (B) and the level of output of the industry (g). Substituting equation (3.6) into equation (3.5), yields:

$$g = D[Bg + F] \tag{3.7}$$

$$g = DBg + DF \tag{3.8}$$

By simple matrix manipulation, equation *(3.8)* can be solved for sectoral output:

$$G = (I\text{-}DB)^{-1}DF \tag{3.9}$$

where, I is NS X NS identity matrix, G is vector of total sectoral output, DF is matrix of final demand expressed in terms of sectors, B is matrix of direct requirements, D is the matrix of market share coefficients, and $(I\text{-}DB)^{-1}$ is the matrix of multipliers (Leontief inverse matrix).

Equation (3.9) summarizes the fundamental relationship between an estimate of sectoral output needed to meet final demand. In other words, the change in sectoral output is proportional to a change in its final demand:

$$\Delta G = [(I\text{-}DB)^{-1}D]\ \Delta F \qquad (3.10)$$

Thus, if the final demand of a sector is known, using the multipliers matrix one can obtain the output of various industries needed to meet the level of final demand. The sum of output of all sectors triggered by an increase in final demand of a sector provides the output multiplier effect-- a sum of both direct and secondary impacts. This equation also provides the method of performing an economic impact analysis of a given option (project or program).

3.2.4 General Assumptions of Input-Output Analysis

When an input-output model and its associated multipliers are used for comparative static analyses, some rather rigid assumptions must be made about the nature of the production process. Most of these limitations arise from the two assumptions indicated in Section 3.2.3. The most significant assumptions according to Miller and Blair (1985) and Hastings and Brucker (1993) include the following:

(1) The output of each sector is produced with a unique set of inputs, and there is no substitution between inputs.

(2) The amount of input purchased by a sector is determined solely by its level of output. Thus, price effects, changing technology, or economies of scale are ignored.

(3) There are no constraints on resources (supply is infinite and perfectly elastic).

(4) Local resources are efficiently employed (no underemployment of resources).

In short, this model assumes that market structure, state of technology, relative prices and geographic distribution of economic interaction are fixed and that the supply of inputs and demand for output are elastic.

3.3 The Interregional Input-Output Model

It is evident that in the national input-output model no account is taken of space. A nation essentially is a spaceless point, where all production, consumption and transactions take place at one single location. This feature becomes very unsatisfactory when variations and differences in economic activity over space are of interest. The introduction of space thus comes up as natural extension of the original Leontief model (Toyomane, 1988, p.13).

The most comprehensive and systematic input-output model of the space economy was formulated by Isard (1951). The Isard model, or "ideal" interregional input-output (IRIO) model, divides a national economy not only into sectors but also into regions. Consequently, the commodity flows are now marked by their regiona,l as well as sectoral, origin and destination.

3.3.1 <u>A Simple Two Region Interregional Model</u>

The interregional input-output approach is illustrated in this section using the basic structure of a two-region interregional input-output model. Following Miller and Blair (1985, p.58-59), for the two-region case, with three sectors in region R and two sectors in region S, the output of sector 1 in region R would be expressed as

$$X_1^R = Z_{11}^{RR} + Z_{12}^{RR} + Z_{13}^{RR} + Z_{11}^{RS} + Z_{12}^{RS} + Y_1^R \quad (3.11)$$

The first three terms on the right-hand side represent the sales from sector 1 in region R to three sectors (itself and two others) within the region; the next two terms are the interregional trade flows from sector 1 in region R to the two sectors that are in region S. The last term, Y_1^R, represents sales to final demand for output of sector 1 in region R.

There would be similar equations for X_1^R and X_3^R, and also for X_1^S and X_2^{RS}. The region input coefficients for region R are given as

$$a_{ij}^{RR} = Z_{ij}^{RR} / X_j^R \quad (3.12)$$

There will also be a set for region S, namely,

$$a_{ij}^{SS} = Z_{ij}^{SS} / X_j^S \quad (3.13)$$

These interregional trade coefficients are found similarly where the denominators are gross outputs of sectors in the receiving region. For example we have

$$a_{ij}^{RS} = Z_{ij}^{RS} / X_j^S \tag{3.14}$$

Substituting from equation (3.12) for Z_{ij}^{RR} and from equation (3.13) for Z_{ij}^{RS} , Equation (3.11) can be re-expressed as

$$X_1^R = a_{11}^{RR} X_1^R + \ldots + a_{13}^{RR} X_3^R + a_{11}^{RS} X_1^S + a_{12}^{RS} X_2^S + Y_1^R \tag{3.15}$$

There will be similar expressions for X_1^R, X_2^R, X_3^R, X_1^S, and X_2^S . If all the terms involving X^R and X^S are moved to the left, Equation (3.15) becomes,

$$(1 - a_{11}^{RR}) X_1^R + \ldots + a_{13}^{RR} X_3^R + a_{11}^{RS} X_1^S + a_{12}^{RS} X_2^S = Y_1^R \tag{3.16}$$

There are similar equations that have Y_2^R, Y_3^R, Y_1^S, and Y_2^S on the right hand sides. Note that the regional coefficients for each region are contained in the following matrices: For region R as: $A^{RR} = Z^{RR}(X^R)^{-1}$, and for region S as: $A^{SS} = Z^{SS}(X^S)^{-1}$, and the trade coefficient matrices are represented by $A^{RS} = Z^{RS}(X^S)^{-1}$ and $A^{SR} = Z^{SR}(X^R)^{-1}$. Using these four matrices, the output relationships for a two-region case can be represented compactly as

$$\begin{aligned} &(1 - A^{RR})X^R - A^{RS}X^S = Y^R \\ &- A^{RS}X^R + (1 - A^{SS})X^S = Y^S \end{aligned} \tag{3.17}$$

where superscripts R and S denote regions, A^{RR} and A^{SS} are matrices of intraregional input-output coefficients and A^{SR} and A^{RS} are matrices of interregional trade coefficients.

The two-region interregional input-output model can still be represented as

$$(I - A)X = Y \tag{3.18}$$

where

$$(I - A) = \begin{bmatrix} I - A^{RR} & - A^{RS} \\ - A^{SR} & I - A^{SS} \end{bmatrix}$$

$$X = \begin{bmatrix} X^R \\ X^S \end{bmatrix} \quad \text{and} \quad Y = \begin{bmatrix} Y^R \\ Y^S \end{bmatrix}$$

A solution for the level of regional output is given by equation (3.19), such that,

$$X = (I\text{-}A)^{-1}Y \tag{3.19}$$

In order to use the above type of interregional model, not only is stability of the regional input coefficients necessary, but also the trade coefficients are assumed to be unvarying over time. Thus, both the structure of production in each region and trade patterns between regions are "frozen" in the model. For a given level of final demands in either or both regions, the necessary gross outputs in both regions can be found in the usual input-output fashion, by pre-multiplying Y by the inverse of the $(I\text{-}A)$ matrix.

3.3.2 Types of Impacts in an Interregional Input-Output Model

The advantage of using an IRIO model is that it captures the magnitude of effects on each sector in each region; interregional linkages are made specific by sector in the supplying region and sector in the receiving region. The accompanying disadvantage is the increased data needs.

The importance of interregional input-output models lies in their ability to measure both intra-regional and interregional impacts of some exogenous change in final one or more demand elements for a given region. The interregional impacts can be measured in terms of

(1) Feedback Effects

(2) Spillovers.

(1) Feedback Effects: Following Hewings (1985, p.58), these effects may occur in the following fashion. Assume that we have two regions, *R* and *S*, and that a new activity had been created in region *R*, for example, a new government installation such as a military base employing hundreds of people. The new expenditures in region *R* will create increased output in that region; this increased output in region *R* will necessitate new imports from region *S*. In order to meet these new import requirements, industries in

region S will have to expand their production and thus they may require imports from region R. Hence, output in region R may increase again as a result of the fact that it increased in the first place. These additional demands are known as the feedback effects.

Hewings (1985) noted that the empirical evidence on the magnitude of feedback effects is scanty. Some empirical evidence suggests that these interregional feedback effects may be relatively small - considerably less than five percent - in a wide variety of real-world situations (Miller, 1986). The results of Miller (1986) have been contrasted by the estimates of Greytak (1970, 1974) who found that the errors of neglecting feedback effects are very significant. The reason for the lack of substantial evidence on this point is the near absence of interregional models for most countries.

(2) Spillovers: The concept of interregional spillover is another way of looking at economic leakages from a region. Spillovers indicate the effect of a change in economic activity for an important sector in one region on economic activity in the other region. Generally speaking, small and less self-sufficient regions will have lower output and income multipliers because more spending leaks or spills into adjacent regions (Hamilton et al., 1991). The ratio of spillover secondary effects to those captured by the region is the spillover coefficient. The spillover coefficient is a relative measure of the economic linkages between two linked economies (e.g., the core and the periphery).

The consequence of interregional spillovers can be important in a regional project analysis. Miller (1986) examined the possibility that spillovers could be the basis of interregional feedback, where development in one region can spill back to further stimulate economic activity in the first region. If such feedbacks are significant, an I-O model for a small and less self-sufficient region would underestimate the extent of project impacts (Hamilton et al., 1991).

The spillover relationships have been illustrated in a few studies. For example, Hamilton et al. (1991, 1994) reported a study of the Pecos River case in the U.S Supreme Court between Texas and New Mexico. Similarly, Robison et al. (1993) reported a study for a central-place trade region centered on Salt Lake city, Utah, which addressed the spatial diffusion of economic effects from lower- to higher-order subregions and explored rural to urban spillovers using summary measures of interconnectedness. A study by Hughes and Holland (1994) used a core-periphery input-output model of the Washington state economy to illustrate spillover effects.

3.4 Central Place Theory and Regional Input-Output Modeling

In the preceding sections, the conceptual aspects of I-O analysis as well as types of impacts captured by interregional I-O models were discussed. In this section the focus is on Central Place theory and its relationships with regional Input-Output analysis. Central place theory, as suggested by Christaller (1966) and Losch (1954), explains the spatial structure of trade within regions. In this context, distinct regions exist, conditioned by trade patterns and characterized by predictably hierarchical patterns of cities, towns, villages, hamlets. According to Parr (1987), there are two types of goods and services in a central place hierarchy, namely "central place" goods and services and "specialized" goods and services. Central place goods consist of services and manufactured goods which are produced for consumer demand and/or intermediate demand. The demand for central place goods tends to be widely dispersed, while the supply of these goods is heavily market-oriented, to the virtual exclusion of other orientations. As a consequence, supply points are fairly centrally located within their respective market (demand areas). Thus, there exists a correspondence between the spatial distribution of supply and the spatial distribution of demand, the strength of this correspondence being determined by the interaction between high transportation costs (which favor many supply points) and economies of scale (which favor fewer supply points). These are the essential location characteristics of central place goods which distinguish them from other types of economic activity.

The specialized goods are items for which production is unique to particular regions. These regions are chosen for reasons ranging from low-cost energy, low-cost labor, nearness to other types of specialized goods, land price considerations, and the set of net agglomeration economies (Parr, 1987). Specialized goods and services include agricultural products, timber, input-oriented manufacturing, among others.

At the top of the hierarchy are regional centers offering a full array of goods and services and dominating all lower-order places with regard to provision of these items. Lower in the hierarchy, the array of available goods and services progressively diminishes. Patterns of sub-dominance and sub-regions emerge. At the bottom of the hierarchy are the lowest-level places, such as rural hamlets with little more than a post office and general store, which dominate hinterland of isolated homesteads.

Higher-level places derive income from exporting commodities (often processed) outside the region, and from providing consumer and business goods and services to dominated lower-level places within the region. At the same time lower-level places get their income from exporting agricultural and other unprocessed primary products outside the region or to higher-level places for processing and export.

The hierarchically structured regions[12] have distinct patterns of dominance, an internal balance of trade, and are typically characterized by relatively closed markets for labor, consumer goods and business inputs. The hierarchical structure determines the internal workings of the region and conditions the transmission of economic impacts from one location to another (Hamilton, et al 1991, 1994).

Mulligan (1979) was the first to demonstrate that central place theory is compatible with the regional I-O model. The full integration of input-output analysis with the principles of hierarchical trading systems were first presented by Robison and Miller (1991). This framework explicitly models both the structure of each regional economy and the spatial linkages between regions. In this way, the impact of an event in one region can be traced to all other regions. This framework, by incorporating central place theory and Input-Output analysis, provides a deeper understanding of the workings of regional economies than is obtainable from a single approach.

3.5 Summary

In this chapter, the relevant conceptual framework for this study was presented. The following discussion focused first on the conceptual framework underlying an input-output model, the tool used for measuring secondary economic impacts in the context of a single-region as well as interregional I-O model. Second, it dealt with the central place theory as a framework for regional modeling. This discussion establlished that central place theory facilitates description of regions in terms of goods and services they provide to themselves and to other regions thus highlighting compatibility of central place theory (CPT) with regional I-O model. The appropriateness of the two conceptual frameworks (I-O and CPT) in regional modeling and impact analysis established as also a new approach that advances our understanding of regional economies in greater detail than

[12] These hierarchically structured regions which form the separable functional units of the larger national economy are the functional economic areas of Fox and Kumar (1965).

that obtained from using a single framework. This study focuses on the application of these findings, as will be discussed further in the next chapter.

CHAPTER 4

STUDY MODEL: HIERARCHICAL INTERREGIONAL INPUT-OUTPUT MODEL OF SASKATCHEWAN

This chapter presents the conceptual study model. The chapter is divided into six sections. Section 4.1 lays out considerations involved in developing the study model. The specification of the regions and specification of the sectors are discussed in Section 4.2 and Section 4.3, respectively. Since the place of work, where income is earned, is different from the place of consumer purchases, the issues pertaining to the treatment of income and consumption patterns are dealt with in Section 4.4. The conceptual study model, the hierarchical interregional input-output model of Saskatchewan, is presented in Section 4.5. The final section of this chapter is the summary, which establishes the link between Chapter 4, the study model with the empirical estimation of the model, the subject of Chapter 5.

4.1 Considerations Involved in Developing the Study Model

The selection of the study model was influenced by a number of factors, of which the following are worthy noting:

(1) In light of the objective of this study [which required determining the impacts including spillovers and feedback effects, of ethanol-cattle production complex in various regions in Saskatchewan], a multi-regional model was found to be appropriate. Furthermore, for capturing spillovers and feedback effects the relevant model is an interregional input-output model. Hence, an interregional I-O model was found to be suitable for this study.

(2) In order to reduce the costs of developing a classification of regions, it was decided to use an existing classification. The various regions in Saskatchewan have been identified as operating in a hierarchical manner and explained using central place theory (Stabler et. al., 1992). In this regard, it was decided that the study model should contain central- place-theory -based regions.

(3) It was found that the 50 sectors contained in the provincial transaction table if used to develop a seven region table would generate a table too large to invert.

Thus the number of sectors required in the model had to be fewer, still keeping some disaggregation of sectors wherever possible.

(4) One characteristic of residents in various communities in Saskatchewan is the necessity to commute. This arises because the place-of-residence is not the same location as their place-of-work. The study model should be flexible enough to accommodate these commuting patterns of workers for various regions. This can be achieved through disaggregation of labor wages and salaries in the value added portion of the input-output table.

(5) Another characteristic of residents in the various communities of the province is that they make consumer purchases of goods and services from firms located in their home-community, as well as through outshopping outside their home-community. Thus, the study model should be flexible and capable of including these consumption and shopping aspects. The input-output model handles these through disaggregation of the household expenditure vector.

(6) Many sectors are required to show impacts of an Ethanol-Cattle production complex on other sectors of regional economies. Thus, I-O is selected because it provides the most detailed disaggregation of sectors.

Each of the above considerations is further elaborated in various sections of this chapter.

4.2 Specification of the Regions

To guide selection of the number of regions to include in the model, two approaches were considered. The first approach required demarcating a trade center region in the province and using actual communities within that region. This approach, however, is difficult to implement without causing some regional bias. The second approach sought to select all communities in the province, but combined them into aggregate groups based on some criteria such as population size. This approach takes away some regional bias, and produces a model which contain general attributes of various communities in the province. The drawback of this approach is that, by combining places, a spatial aggregation bias is inevitable. For specification of regions for this study, the second approach was followed and thus the spatial aggregation bias could be a concern. However, the comforting news comes from Miller and Blair (1981), who showed that spatial aggregation of IRIO models generally seems to introduce only modest bias[1] of 2.7% to 3.96% in magnitude (see Miller and Blair, 1985, p.184).

The number of regions to include in the study model was influenced by regionalization and central place considerations. The number of regions needed to be few so that the model would be operational and can be inverted. The number of regions was also determined by the availability of data at the regional level.

Regions are usually defined according to political or administrative units, to simplify data and model building, and because questions are usually based on political units (Hamilton et al., 1991). A preferable way to classify regions is in terms of functional economic areas or according to some economic activity, e.g. agricultural regions, or crop districts. A review of existing studies revealed that the classifications so far applied to the province of Saskatchewan include (1) Rural and urban economic regions (see Kulshreshtha, 1991), (2) Agricultural soil zones (Saskatchewan Agriculture), (3) Six-tier functional level of communities (Stabler et al. 1992), (4) Provincial/Administrative units such as City, Town, Rural Municipality, Village, Indian Reserve, and Hamlet (Statistics Canada[2], 1993). (5) Census Subdivision- the criterion used by Statistics Canada for collecting census data. (6) Labour market areas (Stabler, Gruel, and Olfert, 1994).

The above listed six ways to classify the province of Saskatchewan differ in terms of the purpose of their classification but all follow some political /administrative areas except the agricultural soil zones. For this study the desirable regions are those which provide an acceptable representation of the communities found in Saskatchewan in terms of economic base (industrial structure) and size. Furthermore, the desirable regions were those that can be used in estimating the impacts of establishing an integrated ethanol-cattle production complex in communities of different sizes. Of the five listed classifications, the central-place-theory based classification, provided by Stabler et al. (1992), satisfied the criteria for selecting study regions. Therefore, the selection of the study regions in this study followed the six-tier functional level classification with minor adjustment.

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[1] Total aggregation bias is defined as the difference between the vector of total outputs in the aggregated system and the vector obtained by aggregating the total outputs in the original unaggregated system. (see Miller and Blair, 1985, p.178).

[2] See Statistics Canada. Catalogue No. 92-301E.

The seven study regions in this study represent functional levels of communities formed using CSDs as basic building units. Since the CSDs are administrative units, the formed study regions are not functional economic regions. This is because, each of these regions does not have a closed market for labor, consumer purchases and producer goods and services. One unfortunate consequence of using such regions is that it is impossible to account for cross-hauling i.e. the simultaneous importing and exporting of the same commodity, this could lead to unbiased estimates of secondary project impacts (Hamilton et al., 1991).

The classification of the communities into six levels by Stabler et al.(1992) was based on 598 communities. One limitation of this study is that not all communities found in Saskatchewan were covered by the six-tier classification. Hence, for the sake of completeness, the missing regions were added to this classification.

In this study, the province was divided into seven study regions. This was facilitated by the availability of (1) a six-tier functional classification of Saskatchewan communities developed by Stabler et al. (1992) and (2) regional data at the census subdivision (CSD[3]) level reported in 1991 census (Statistics Canada). The classification involved using a coded list of 598 communities by name and cluster category (1 to 6) provided by Stabler et al (1992, p. 48-61), to sort the CSD located in the 17 divisions (excluding Division 18) into the six functional groups or regions. A complete list of CSDs is presented in Appendix A. Since the total number of CSDs from the 17 divisions is more than the 598 communities used by Stabler et al.(1992), any CSD remaining unclassified at this point was assigned to one of the six categories on the basis of population size. After the allocation on the basis of population size was completed, the next stage involved assigning any remaining CSD plus all the CSD from Division 18 into a category referred as 'rest of Saskatchewan' (ROS), to form the seventh region. This category represents the hinterland surrounding the cities, towns, etc., and northern Saskatchewan.

[3] A census subdivision (CSD), refers to municipalities (as determined by provincial legislation). They include cities, towns, hamlets, resorts, villages etc. A division by provincial law, refers to intermediate geographic areas between the province and the census subdivision. In 1991 Census, the province of Saskatchewan was composed of 18 divisions and 953 census subdivisions (CSDs)

A comparison of distribution of communities in this study, and in Stabler et al. (1992), is shown in Table 4.1. The seven regions[4] refer to (1) Primary wholesale retail (PWR); (2) Secondary wholesale retail (SWR); (3) Complete shopping centres (CSC); (4) Partial shopping centre (PSC); (5) Full convenience centre (FCC); (6) Minimum Convenience centre (MCC); and (7) Rest of Saskatchewan (ROS).

Table 4.1. Classification of 1991 Census Sub Divisions (CSDs) by Functional Level in the Saskatchewan Trade Centre Hierarchy

	Number of Communities	
Functional Level	STABLER et al. CLUSTERS	THIS STUDY
1. PWR	2	2
2. SWR	8	8
3. CSC	6	6
4. PSC	46	50
5. FCC	117	113
6. MCC	419	306
7. ROS	none	326
TOTAL	598	811

One advantage of using the census data to group the regions was that a correponding employment profile by industry for each region was developed at the same time. Each region is composed of communities with similar population size, commercial and industrial structure, employment distribution and size. Finally, defining the provincial economy in this manner leads to a hierarchically related set of regions and provides an opportunity to develop a hierarchically-based interregional economic structure of the province.

4.3 Specification of Sectors

Since the major objective of this study was to estimate economic impacts in an interregional framework, use of an I-O model with 50 sectors was considered to be

[4] For details on the seven regions see Appendix A.1.

unfeasible[5]. A re-specification of sectors was, therefore, required. This involved aggregating the 50 sectors into a smaller number of sectors. From the literature it is known that aggregation of sectors causes a sectoral aggregation bias. Miller and Blair (1985, p.174-189) have discussed the issue of aggregation in input-output models. According to Miller and Blair (1985) an aggregation bias will vanish under two conditions: First, if two or more sectors have identical interindustry structures (i.e equal columns in the A matrix), then aggregation of these sectors will result in zero total aggregation bias. Second, if some sectors are aggregated and the new final demands occur only in unaggregated sectors, the aggregation bias will vanish. This study might not satisfy the two conditions, but it is accepted that the aggregation is required to make the model feasible even though it causes aggregation bias.

The choice of the number of sectors included in this study was influenced by four considerations: (1) the purpose of the study and the desire to represent in a fairly disaggregate form those sectors that are most directly affected by the establishment of an integrated ethanol-feedlot plant; (2) the choice to use a simple aggregation of the sectoring scheme used for the disaggregate Saskatchewan I-O table; (3) the need for sectors to be adequate to exhibit the industrial structures of the study regions, and (4) considerations of quality and availability of data at regional level for various sectors. In the final analysis, 14 sectors, as listed in Table 4.2, were selected for use in this study. Furthermore, three agriculture sub-sectors were selected in order to demonstrate the impacts of the ethanol-cattle plant on various farm enterprises. The Canadian Prairie Spring (CPS) wheat sector was included because it represents the special and preferred type of wheat for ethanol processing. The cattle sector was included in order to demonstrate how the new sector was going to affect the cattle farms enterprises. The third subsector, called the other agriculture sector, was created to show how this sector which is the supplier of forages, hay, feed grains to the ethanol-cattle sector will be affected by the ethanol-cattle plant.

[5] Size of matrix for (50 + 1) sectors and 7 regions is 357 by 357. Such a matrix is too large to invert.

Table 4.2. Sectoral Classification of the Fourteen-Sector Model

SECTOR	I-O Medium Level Aggregation of Industries Number
(1) Integrated Ethanol -Cattle	none
(2) Canadian Prairie Spring Wheat	*
(3) Cattle	*
(4) Other Agriculture	*
(5) Fishing and Forestry	2-3
(6) Mining & Related	4-7
(7) Manufacturing	8-28
(8) Construction	29
(9) Transport & Storage	30-32, 50
(10) Communication and Utilities	33-34
(11) Wholesale Trade	35
(12) Retail Trade	36
(13) FIRE**	37-40
(14) Services.	41-49

* Belong to the Agriculture sector

** FIRE refers to the Financial, insurance, and real estate sector

4.4 Treatment of Income and Consumption Patterns in the Study Model

It is known that employment income (i.e., wages, salaries) is a major source of household income in Saskatchewan. The residents of a particular community are either employed within their home-community or outside the home-community. Workers, whose place-of-work and place-of-residence are in one location, are referred to as non-commuters, whereas, workers whose place-of-residence is different from the place-of-work are referred to as out-commuters. The latter become in-commuters in the other regions.

In view of this commuting aspect, the total employment in a given place-of-work is a sum of non-commuting workers and the in-commuting workers. Since there are seven regions, then it follows that total sectoral employment in a given region is made up of workers from the seven regions in the province. Thus, the labor income row in the I-O table needed to be disaggregated into the seven categories of workers employed in each regional sector.

Regarding consumption expenditure, it is known that residents of a given region make purchases of consumer goods and services in their home-community and in other regions of province. Since there are seven regions, then personal expenditures for residents of any region needed to be disaggregated according to purchases made from sectors within the home-community, and those from the other six regions in the model.

4.5 Study Model: Hierarchical Interregional Input-Output Model of Saskatchewan

In order to achieve the stated objectives of this study, a hierarchical interregional input-output model of Saskatchewan was developed. This model represents a spatial disaggregation of the provincial economic structure into seven regions. The economic structure of each region is represented in the form of a regional input-output table containing 14 aggregated goods and services producing sectors. The model is closed with respect to seven household sectors, i.e., one household sector per region. The labor payment row is split into seven categories of workers drawn from the seven regions of the model. Government expenditure and private investment are also included in the final demand. The seven regions are linked through hierarchically-based interregional trade in output of 14 aggregated sectors. The basic relationships underlying this model are summarized below.

First the outflow relationship for each sector i located in region R is given as

$$X_i^R = \sum_j^{14} Z_{ij}^{RS} + \sum C_i^{RS} + \sum Y_i^{RS} + F_i^R$$

$$(i = 1,\dots,14;\ R,S = 1,\dots,7) \qquad (4.1)$$

where,

X_i^R = gross production of sector i in region R

Z_{ij}^{RS} = intermediate deliveries from sector i in region R to sector j in region S

C_i^{RS} = deliveries of goods by sector i located in region R to consumers in region S

Y_i^{RS} = other final demand deliveries of goods from sector i in region R to region S

$F_i^R =$ exports by region R to buyers outside of the province.

Secondly, the equivalent inflow of factors needed to support the same intraregional production levels of each sector i located in region S is given by

$$X_j^{S*} = \sum_j^{14} Z_{ji}^{RS} + W_j^S + V_j^S + M_j^S$$

$$(i, j=1,\dots,14;\ R,\ S=1,\dots,7) \qquad (4.2)$$

where

X_j^{S*} = gross production of sector j in region S

W_j^S = labor income from sector j in region S

V_j^S = value added to sector j in region S

M_i^S = imports from outside of the province to sector i in region S

Equation (4.1) specifies that the total supply (outflow) by each sector is the sum of intermediate and final demand sales in all the seven regions including exports sold outside the province. Similarly, equation (4.2) states that the total inputs needed for production in each sector are the sum of intermediate input purchases from all regions, plus payments for labor and capital resources used and inputs imported from outside the province. It is important to note that this model satisfies one input-output accounting condition in that the total output of each sector is equal to the total purchases by that sector. This condition applies at both the provincial and the regional level.

The schematic form of the seven region interregional input-output model for Saskatchewan is shown in Figure 4.1. The seven regions are denoted as: (1) PWR; (2) SWR; (3) CSC; (4) PSC; (5) FCC; (6) MCC; and, (7) ROS. The sum of the elements along each row gives the total sectoral output by region. This is equivalent to the output relationship expressed by equation (4.1).

	Inter- and Intra-regional Intermediate Transactions							Inter- and Intra-regional Final demand Transactions							
	PWR	SWR	CSC	PSC	FCC	MCC	ROS	pe1	...	pe7	ofd1**	...	ofd7	Exports	Total
PWR	Z^{11}	Z^{12}	Z^{13}	Z^{14}	Z^{15}	Z^{16}	Z^{17}	c^{11}	...	c^{17}	y^{11}	...	y^{17}	f^{1}	X^{1}
SWR	Z^{21}	Z^{22}	...	...	...	....	Z^{27}	c^{21}	...	c^{27}	y^{21}	...	y^{27}	f^{2}	X^{2}
CSC	Z^{31}	....	Z^{33}	....	.....	....	Z^{37}	c^{31}	...	c^{37}	y^{31}	...	y^{37}	f^{3}	X^{3}
PSC	Z^{41}	.....	.....	Z^{44}	....	....	Z^{47}	c^{41}	...	c^{47}	y^{41}	...	y^{47}	f^{4}	X^{4}
FCC	Z^{51}	....	....	....	Z^{55}	....	Z^{57}	c^{51}	...	c^{57}	y^{51}	...	y^{57}	f^{5}	X^{5}
MCC	Z^{61}	....	....	....	....	Z^{66}	Z^{67}	c^{61}	...	c^{67}	y^{61}	...	y^{67}	f^{6}	X^{6}
ROS	Z^{71}	Z^{72}	Z^{73}	Z^{74}	Z^{75}	Z^{76}	Z^{77}	c^{71}	...	c^{77}	y^{71}	...	y^{77}	f^{7}	X^{7}
Labor Income	w^{1}	w^{2}	w^{3}	w^{4}	w^{5}	w^{6}	w^{7}	cw^{1}	...	cw^{7}	yw^{1}	...	yw^{7}		w^{p}
ovad*	v^{1}	v^{2}	v^{3}	v^{4}	v^{5}	v^{6}	v^{7}	cv^{1}	...	cv^{7}	yv^{1}	...	yv^{7}		v^{p}
Imports	m^{1}	m^{2}	m^{3}	m^{4}	m^{5}	m^{6}	m^{7}	cm^{1}	...	cm^{7}	ym^{1}	...	yv^{7}		m^{p}
Total	X^{1}	X^{2}	X^{3}	X^{4}	X^{5}	X^{6}	X^{7}	C^{1}	..	C^{7}	OFD^{1}	..	OFD^{7}	F^{P}	

* Other value added

** Other final demand

Figure 4.1 Schematic Seven-Region Interregional Input-Output Model

A glossary of the notation used in Figure 4.1 is given below:

Z^{RR} = 14x14 matrix of intraregional interindustry transactions in region R. (R=1,...,7)

Z^{RS} = 14x14 matrix of intermediate sales from sectors in region R to sectors in region S. ($R \neq S$ =1,...,7)

C^{RR} = 14 x 1 vector of sales made by sectors in region R to consumers residing in region R. (R =1,...,7)

C^{RS} = 14x1 vector of sales by sectors in region R to the household sector in region S. ($R \neq S$ =1,...,7)

Y^{RR} = 14x1 vector of sales by sectors in region R to the other final demand sectors (Investment + Government expenditure) in region R. (R =1,...,7)

F^{R} = 14x1 vector of exports from sectors in region R to buyers outside Saskatchewan province.

W_j^R = labor income from sector j in region R

V_j^R = value added to sector j in region R

M_i^R = imports from outside of the province to sector i in region R

pe^R = consumption expenditures by residents of region R

On the other hand, the sum of the elements along each column gives the total inputs purchased by sectors in that region, and is the equivalent of the inflow relationship captured by equation (4.2).

In this model, both the intrarregional and interregional flows form a major part of the total transactions. Owing to the wide variation in the economic bases from region to region, regional production levels in various sectors may differ vastly from their respective internal demand for products from the sectors. These regional imbalances are usually satisfied by imports from other regions and the rest of the world. Thus, there exists for each region some production and spatial patterns of trade with other regions in the Saskatchewan economy.

4.6 Summary

In this chapter the considerations involved in the selection of the study model were discussed. Aspects of specification of regions and sectors, and the treatment of income and consumption were also dealt with. The suggested model is a hierarchical seven-region interregional model of Saskatchewan. The next chapter outlines the methodology used to construct this model and the procedures followed in application of this model for impact analysis of the ethanol-cattle production complex in various regions of Saskatchewan.

CHAPTER 5

STUDY METHODOLOGY

The previous chapter presented a hierarchical interregional input-output model of Saskatchewan. The purpose of this chapter is to present the methods used to construct the study model and its application for the economic impact analysis of establishing an ethanol-cattle production complex in various regions of Saskatchewan. The chapter is divided into eight sections. The selection of the study methodology is discussed in Section 5.1, followed by an overview of the methodology which in Section 5.2. Preparation of the Provincial Transactions Table started with the updating to 1992, the subject covered in Section 5.3. The disaggregation of the agriculture sector into three subsectors is briefly presented in Section 5.4. The preparation of regional I-O matrices, and determination of interregional trade flows are discussed in Sections 5.5 and 5.6, respectively. Section 5.7 layouts the impact analysis, and the last section summarizes the chapter.

5.1 Reasons for the Methodology

As noted in Chapter 4, development of the study model required estimation of seven regional input-output tables and corresponding interregional trade matrices, in addition to sectoral output, final demand components and final payments by sector and region. Thus, to guide the choice of the relevant techniques to use in developing the study model, the various approaches to regional and hierarchical regional modeling are reviewed and presented in this section.

5.1.1 Approaches to Regional Modeling

To meet part of the requirements of the study model, seven regional I-O tables were needed. Since there were no tables for the seven regions in existence, these had to be estimated. The methods for estimating regional models were reviewed in order to identify the most suitable approaches to use in this study. The three major approaches to regional modeling are (1) Survey method, (2) Non-survey method, and (3) Hybrid method. These methods are reviewed below.

(1) Survey Method: The survey methods involve collecting primary data collection and producing the most accurate table, but are very expensive in terms of time and money. In practice, due to their high costs, survey methods are rarely used in constructing regional input-output models.

(2) Non-Survey Methods: The non-survey methods attempt to estimate regional tables without recourse to primary data, using procedures which modify tables assembled from survey data for larger regions or national tables. Non-survey methods are quick and less expensive but produce models that are less accurate. Examples of non-survey methods[6] include (i) The Location Quotients, (ii) Supply-Demand Pool, (iii) Regional Purchase Coefficient, and (iv) Iterative Methods, e.g; RAS.

(3) Hybrid Methods: Between the two extremes of survey and non-survey methods lies a broad spectrum of methods variously termed partial survey or hybrid methods, which incorporate both survey and mechanically produced estimates into the process of constructing an input-output table. A review of the literature of regional I-O model development indicates that the hybrid method is the state-of-the-art technique. The hybrid approach is the most cost-effective in the sense of maximizing accuracy subject to the constraints of limited time, cost and other resources (West, 1980). An example of the hybrid method is GRIT -- Generation of Regional Input Out-Output Tables first used in Australia. It should be noted that in the absence of superior knowledge, the hybrid method breaks down into the non-survey method.

Of the three approaches above, the non-survey method was selected for constructing the regional input-output tables in this study. The reasons for selecting this method are as follows: (1) it is less costly in terms of money and time, and (2) it requires less regional data. Furthermore, the other approaches did not seem feasible. The survey method was beyond the budget of this study, and the hybrid method suffered a serious lack of superior data.

Among the non-survey techniques, the simple location quotient (SLQ) and supply-demand pool (SDP) method were chosen because these required less data than

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[6] For a detailed discussion of non-survey methods for input-output modeling see Round (1983) and Miller and Blair (1985).

other methods, and argubly produce estimates of similar accuracy. The implemention of the SLQ requires two steps: (1) producing the regional coefficients and (2) equalizing the table using some balancing technique such as RAS. On the other hand, the SDP method produces a balanced regional table just in one step. Thus, in this study the SDP method was selected for estimating the regional tables.

5.1.2 Approaches to Hierarchical Regional Modeling

Approaches to hierarchical regional modeling involve the techniques that are used to estimate regional input-output model for regions that are related in central place hierarchy. An example is the recent work of Robison and Miller (1991), who extended the regional I-O model to interregional model in a central place hierarchy. This Robison-Miller (1991) (R-M) approach involves two stages. First, regional (community) input-output coefficients are estimated according to the standard Supply-Demand Pool technique (Schaffer and Chu, 1969). Second, the gross interregional shipments are estimated internally based on assumptions regarding the hierarchical structure of trade and a spatial extension of the supply and demand pool logic. Using this approach, Robison and Miller (R-M) constructed an intercommunity I-O model of a rural region in southwest Idaho. The other application of the R-M approach is by Robison et al. (1993) who constructed an interregional I-O model for a functional economic trade region centred on Salt-Lake City, Utah.

The SDP approach is usually criticized on grounds that it overestimates intraregional trade and can lead to underestimation of interregional trade flows. Robison and Miller (1988) asserted, however, that the maximum intraregional trade assumption of the SDP technique is reasonable, provided the region is in some sense a functional economic area; i.e., the region exhibits some degree of market closure for labor and other business and consumer goods and services. Likewise, the maximum trade assumption in the interregional context appears reasonable, provided the larger region exhibits some degree of closure; i.e. it is in some sense a functional economic area (Robison et al., 1993).

The trade flows for central place goods are assumed to be strictly one-way in the Christaller sense; i.e., the central place goods flow from the higher-order region to lower-order regions in the hierarchy. This assumption reduces the number of interregional elements to be estimated. For cases where feedback linkages are important, the assumption of strict hierarchical trade would be inappropriate and may be required to be relaxed. The justification for ignoring the feedback effects is found in the literature which indicates that these are relatively small (Miller, 1966, 1969).

One concern with the R-M approach is that it is applicable only to regions with defined central place linkages. The classification of regions according to central place linkages is a very expensive task. It is also debatable as to whether the benefit of modeling these linkages justifies the added costs. It is, however, emphasized that integrated input-output analysis and central place theory provides a fuller understanding of the workings of connected economies (Robison and Miller, 1991).

In this study the approach developed by Robison and Miller (1991) was found to be the appropriate modeling technique. The choice of this study approach was influenced by a number of factors. (1) The approach is less expensive; (2) The availability of hierarchical classification of the Saskatchewan economy provided an opportunity to use this new approach; (3) The lack of detailed regional data on commodity shipments called for a technique that uses less data. Therefore, in this study the approach of Robison and Miller (1991) was applied to estimate the model as presented in Figure 4.1.

5.2 Overview of the Methodology

In order to implement the SDP method and hierarchical modeling a number of steps were followed and these are summarized in the overview of the methodology presented in Figure 5.1. The major steps followed in the construction of the study model and its application are discussed in detail under sections 5.3 to 5.8 in this chapter. As shown in Figure 5.1, the starting point was the 1984 Saskatchewan transactions table containing 50 sectors.

Step One involved updating the above table from 1984 to reflect economic conditions in 1992, using the McMenamin and Haring (M-H)[7] procedure. Further details are discussed in Section 5.3.

[7] For further details see McMenamin and Haring (1974)

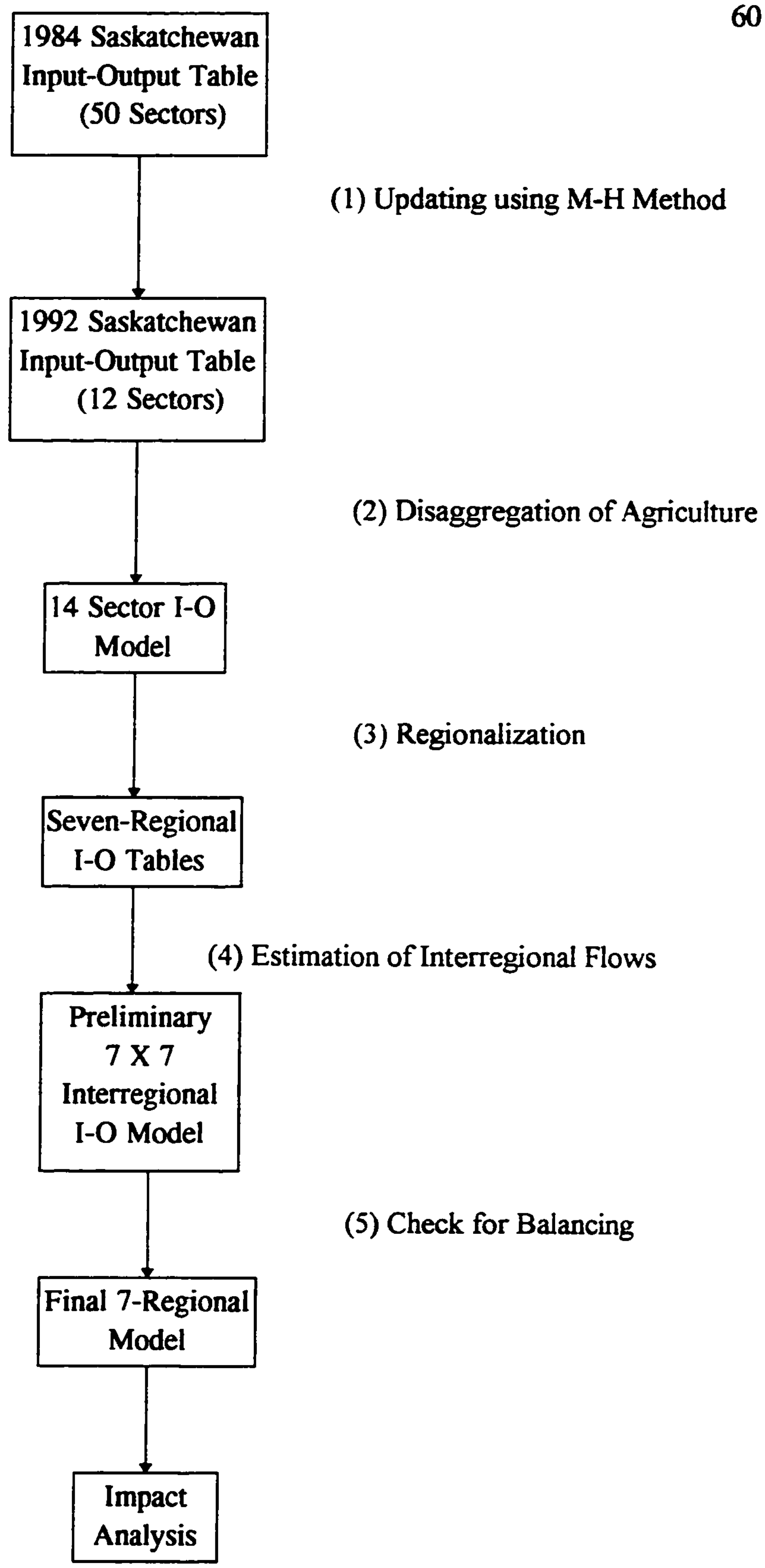

Figure 5.1 Overview of the Study Methodology

Step Two was the disaggregation of the single agriculture sector into three sub-sectors. At this stage a 14-sector I-O model of the province was prepared. More details on this procedure are given Section 5.4

Step Three was regionalization of the Provincial Table. The method selected for regionalization was the Supply-Demand Pool (SDP) method. More details on the procedure and sources of data are provided in Section 5.5.

Step Four was estimation of the interregional trade flows for regions that are hierarchically structured. Details of the procedures followed are given in Section 5.6.

Step Five involved checking to ensure the model was balanced. Futhermore, it included disaggregation of labor income according to commuting patterns, and adjusting consumption to income. More details on these procedures are provided in Section 5.6.

Step 6 is the procedure for impact analysis. Details on this procedure are presented in Section 5.7.

5.3 Updating of the Provincial Transactions Table for 1992

The starting point for the construction of the study model was the 50-sector transactions table of 1984 for the province of Saskatchewan, supplied by Statistics Canada. In order to reflect the economic conditions in 1992, the existing 1984 Saskatchewan I-O table was updated to the 1992 economic situation. In the literature, there are two methods for updating I-O tables the RAS method developed by Stone and Brown (1962), and the H-M updating technique (McMenamin and Haring, 1974). Updating of input-output tables involves estimating an input-output table for a certain date (called Year 1) from a table constructed for an earlier date (called Year 0, or base-Year). Both techniques employ a bi-proportional adjustment algorithm that adjusts each of the technical coefficients, a_{ij}, of the base-year table to account for changes which have taken place between the year 0 and year 1. These changes are of the following types: (1) Changes in the relative levels of prices, (2) Substitution effects, and (3) Fabrication effects (that is, the changes in the degree to which intermediate inputs have uniformly increased or decreased in weight in the fabrication of a given commodity).

The RAS method requires the following data as input: (1) Coefficients of the base-year table; (2) Total gross output vector for the target year; and (3) The vector of total intermediate inputs and total intermediate sales for the target year. On the other hand, the H-M approach (McMenamin and Haring, 1974) uses less data than the RAS method demands. The data needed for the procedure include (1) An input-output table for the base year, and (2) Total gross output vector for target year. McMenamin and Haring (1974), in their appraisal of the nonsurvey I-O table estimating procedures, found that the RAS and H-M method produce satisfactory estimates of output multipliers. However, the cost-effectiveness of H-M is high since only the gross output and gross outlay vectors need to be collected. Otherwise, the two techniques have similar weaknesses. In this study the provincial table was updated using the H-M approach.

The updating procedure involved estimating the output for the 50 sectors in Saskatchewan during 1992. Sectoral outputs were obtained from various government publications. When such estimates were not available, approximations were made using sectoral gross domestic product (GDP) or employment as proxies under the assumption that sectoral GDP (and sectoral employment) is proportional to sectoral output. The estimated sectoral output vector for 1992 is presented in Appendix B (Table B.1).

In addition to output estimates, the updating procedure required an estimate of provincial final demand aggregates for 1992. These were obtained from various Statistics Canada and Saskatchewan Bureau of Statistics publications. The final demand categories included personal expenditures, total exports, investments and government expenditures, total imports, total wages and salaries, and total subsidies. These aggregates, together with the estimated output vector for 1992, became the key input in the updating of the 1984 Saskatchewan industry by industry transactions table to 1992 using the H-M updating technique. The updating procedure was implemented through a MACRO program developed on a LOTUS 123 Spreadsheet (Kulshreshtha, 1993).

5.4 Disaggregation of the Agriculture Sector

In Section 4.3, 14 sectors were selected to be included in the study model. However, the updating procedure above produced a 50-sector sector model for 1992. In order to come up with this list of 14 sectors, a number of modifications were applied to the 50-sector table. First, the 49 sectors, leaving agriculture, were aggregated into 10 sectors using the small aggregation of Statistics Canada (Statistics Canada, 1993).

Second, the single agriculture sector contained in the 50-sector provincial table was disaggregated into three subsectors, namely, Canadian Prairie Spring (CPS) Wheat, Cattle, and Other agriculture. Third, a new sector representing the integrated ethanol-cattle production complex was introduced in the table (see Table 4.2). The new sector produces ethanol and cattle in an integrated manner; i.e., the by-products of ethanol processing are fed to feeder cattle in an adjacent feedlot.

Of interest in this section is the procedure used to disaggregate the agriculture sector. The procedure[8] involved determination of the output matrix and input (use) matrix for agriculture and then distributing these measures among the three sub-sectors of agriculture using various proxies. The details on disaggregation are presented in Appendix C. The procedure and data sources used closely followed mechanics of disaggregation reported by Kulshreshtha et al. (1991).

Once the modifications presented above were completed, the 14-sector input-output table of Saskatchewan for 1992 was obtained, which is shown in Table 5.1. The next stage involved using this table for generating regional input-output matrices.

5.5 Preparation of Regional I-O Matrices

The seven region I-O matrices for the study model were estimated using the Supply-Demand Pool (SDP) method. The SDP method estimated I-O table for each region by modifying the I-O coefficients for the province using self-supply ratios (SSR) as proxies for regional purchase coefficients. Before applying the SDP approach, some regional data were required. These data included regional output, regional gross requirements, regional consumption, regional other final demand, and out-of-province exports from each region. The tasks followed in determination of these various data are discussed in the next four sub-sections.

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[8] Details on disaggregation of the agriculture sector are presented in Appendix C.

Table 5.1. Estimated Saskatchewan Input-Output Table for 1992 (million dollars)

	1	2	3	4	5	6	7	8	9	10	11	12	13	P.E	OFD	Exports	Total
1. Ethanol-Cattle	0.9	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.7	0.3	42.2	46.5
2. Cattle	0.0	10.9	6.2	0.6	0.2	116.1	0.2	0.0	0.0	0.1	5.2	0.2	1.7	12.3	4.4	675.3	833.5
3. Other Agric	0.0	186.8	115.1	0.5	0.7	227.0	3.7	0.4	0.2	0.5	4.1	0.4	8.5	78.1	17.9	2605.7	3249.5
4. Forest & Fishing	0.0	0.0	0.2	11.2	0.0	63.8	0.5	0.0	0.0	0.2	0.0	0.0	1.0	10.8	0.5	6.9	95.2
5.Mining	0.2	2.8	12.9	0.0	62.7	58.1	195.4	3.6	81.5	0.6	2.1	4.7	3.1	25.9	25.3	3071.4	3550.4
6. Manufg.	2.4	35.7	135.4	3.3	25.3	151.2	203.1	45.9	9.6	11.1	14.2	10.7	265.4	574.0	130.4	2134.9	3752.4
7. Construction	0.7	4.9	30.8	1.5	38.7	17.7	2.1	67.3	48.4	2.0	10.2	218.3	8.1	14.8	2591.1	3.4	3060.0
8. Transport & Storage	0.3	3.2	15.6	3.8	14.1	32.2	18.7	246.1	6.9	7.0	6.0	4.0	49.3	112.2	35.6	1907.5	2462.5
9. Communic & Utilities	1.2	14.0	65.4	0.2	85.8	89.3	13.5	63.6	44.0	36.8	84.2	168.2	156.3	728.4	161.0	146.4	1858.1
10. Wholesale	0.6	6.9	32.1	0.4	13.2	36.4	48.2	13.6	2.7	4.5	2.5	3.9	61.9	167.9	81.7	525.3	1001.6
11. Retail	0.3	3.6	16.8	0.4	10.0	8.5	29.0	14.0	5.1	2.2	2.5	8.3	79.2	1353.3	113.4	94.9	1741.5
12 FIRE*	3.7	33.8	172.3	2.0	369.5	32.6	33.4	49.8	88.9	34.8	93.0	243.6	74.9	2462.0	154.7	758.2	4607.4
13. Services	4.0	46.7	219.4	6.8	197.6	179.8	112.2	98.8	58.2	76.1	118.9	200.2	329.9	1300.2	675.0	529.4	4153.1
14. Labor Income	8.2	75.9	407.5	30.3	373.6	767.4	922.4	591.3	613.5	523.2	913.7	1087.5	1310.8	596.5	2810.0	0.3	11032.1
15. Non-Labor Value Added	19.5	170.6	932.1	14.7	1854.8	152.4	440.3	382.9	737.6	189.0	304.9	2309.5	465.0	1044.6	558.5	404.1	9980.5
16. Imports	4.5	237.7	1087.6	19.6	504.2	1817.9	1037.2	885.0	161.5	113.6	180.1	347.8	1338.2	4524.3	1866.6	0.0	14125.8
Total	46.5	833.5	3249.5	95.2	3550.4	3752.4	3060.0	2462.5	1858.1	1001.6	1741.5	4607.4	4153.1	13006.0	9226.5	12905.9	65550.0

* FIRE is the abbreviation for Financial, Insurance and Real Estate sector.

5.5.1 Determination of Regional Output

To determine regional output, it was assumed that technology and labor productivity underlying each of the regions is identical to that of the province. Then the regional sectoral output was calculated by allocating the total provincial sectoral output for 1992 across the seven regions proportional to each region's share of the total provincial employment for that sector, as shown in equation (5.1).

$$X_i^R = (E_i^R / E_i^P)\, X_i^P \qquad (5.1)$$

where,

X_i^R is the gross output of sector *i* in region *R*

X_i^P is the gross output of sector *i* in the province *P*

E_i^R is the place-of-work employment in sector *i* for region *R*

E_i^P is the total provincial employment in sector *i*

The major regional data required, in order to determine regional output, was employment by place of work. However, these data were not available. Instead, the available data were for employment by-place-of-residence reported in Census 1991 (Statistics Canada, 1993). Although, employment level in an industry is a good indicator of economic activity, employment by place-of-residence is inappropriate in this respect. This is due to the fact that employment by place-of-residence is for all residents in a given community. These residents can be employed either in their place of residence (non-commuters) or in place different from their place of residence (commuters). Thus, appropriate measure is employment by place-of-work. Employment by place-of-residence is made up of two types of employed workers residing in a community (or region), namely (1) non-commuters (2) out-commuters. On the other hand, employment by place-of work is made up of two types of workers - non-commuters and in-commuters. Estimates of sectoral employment by place-of-work were derived by netting out commuting flows from employment by place-of-residence. Details on derivation of these estimates are presented in Appendix D.

The available regional employment data used to estimate the regional sectoral output had one limitation. It assumes that the product composition of output from each sector is identical in all regions to that of the province. Such an assumption may not be realistic. However, in the absence of primary data, these estimates were used to provide a measure of the regional sectoral output.The estimated regional sectoral output contained some peculiarities. First, the estimates indicated that various industries present in the higher-order regions (PWR, SWR, CSC and PSC) are also present in the lower-order regions (FCC, MCC, and ROS) of the province. Second, the production of primary goods, which takes place in the hinterland (ROS), was also present in the PWR, SWR, CSC, PSC, FCC, and MCC. Experts, however, suggest that there is little to almost negligible primary economic activity in the regions below the Partial Shopping level. To reflect reality, one modification using the judgmental method was made to the sectoral output in the primary sectors (namely CPS Wheat, Cattle, Other Agriculture, Forestry and Fishing, and Mining). This involved removing the production of these sectors out of the PWR, SWR, CSC, PSC, FCC, and MCC into the hinterland (ROS). The final estimates of sectoral output for each of the seven regions are presented in Table 5.2.

Table 5.2. Estimates of Sectoral Output in Each of the Seven Regions (Million dollars)

	Functional Level of the Region							
Sector	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Total
1.Ethanol-Cattle	0	0	0	0	0	0	0	0
2. CSP Wheat	0	0	0	0	0	0	46.5	45.5
3. Cattle	0	0	0	0	0	0	833.4	833.4
4.Other Agric.	0	0	0	0	0	0	3,249	3,249
5.Fish. & Forest.	0	0	0	0	0	0	95.2	95.2
6. Mining	0	0	0	0	0	0	3,550	3,550
7.Manufacturing	2118.9	704.5	125.9	349.3	123.5	91.4	238.6	3,752
8. Construction	1,432.1	593.6	143.5	340.4	180.6	102.4	267.3	3,060
9. Transport	1,094.1	473.1	90.5	348.7	132.8	96.0	227.2	2,462.4
10.Communic.	1,520.1	338.0	0	0	0	0	0	1,858.1
11. Wholesale	552.3	162.4	44.2	108.7	48.3	26.5	59.1	1,001.6
12. Retail	832.0	378.6	81.4	204.5	88.7	42.9	113.1	1,741.5
13. F.I.R.E*	2,653.3	784.8	161.7	433.7	196.8	96.7	280.2	4,607.3
14. Services	2,167.0	782.3	152.6	415.3	198.6	106.3	330.9	4,153.1
TOTAL	12,369.8	4,217.3	799.8	2,200.6	969.3	562.2	9,290.5	30,409.1

* FIRE is the abbreviation for Financial, Insurance and Real Estate sector.

It was, however recognized that some workers who reside in higher-level regions were employed in the primary sectors. Thus a further adjustment was made to treat these workers as in-commuters into the ROS region. This allowed some outflow of labor income from the primary industries located in the ROS region to higher-level regions.

5.5.2 Determination of Regional Consumption

Economic theory suggests that family consumption expenditure is a function of family size and income, and is usually expressed using the Engle curve. The estimation of the Engle curves requires detailed cross-section or time series data on family income and consumption expenditure by commodity. These data are usually obtained through primary household expenditure surveys or reports of such surveys. For the present study, detailed data on family income or distribution of income groups and their consumption expenditure were not available, and collecting such data was considered beyond the scope of the study. For making the model operational, it was assumed that households in the seven regions have homogenous consumption patterns, which are represented by the provincial pattern.

The total personal consumption expenditure for the province in 1992 was $13 billion dollars (Saskatchewan Bureau of Statistics, 1993). These total consumption expenditures for the province were divided among the seven regions in fixed proportion to each region's share of the place-of-residence employment in the province. Employment was preferred to population in allocation of regional consumption expenditure, because employment is assumed to be a major determinant of household income, which in turn determines consumption expenditures. This disaggregation provided the exogenous estimates of regional personal consumption expenditures. Assuming that personal consumption patterns across the seven regions are identical to those for the province, a breakdown of total personal expenditures by sector in each region was obtained through multiplying the provincial personal expenditure coefficients by the total regional personal expenditure. The consumption expenditure coefficients were obtained from the updated 1992 Input-Output Table for Saskatchewan.

Adjustment for Outshopping Expenditures: Underlying the estimate of personal consumption expenditures for each region is the assumption that residents in each region make all their personal consumption expenditures within their home-communities. The reality, however, is that people living at different levels of communities in Saskatchewan are involved in outshopping (Stabler and Olfert, 1992). Outshopping is an important aspect of regional consumption expenditures within the Saskatchewan central place hierarchy. There is a tendency for outshopping to increase as one moves from the higher-level centres (PWR) to the lower level-centres. All centres below the PWR level are involved in outshopping at the higher-level centers notably, the PWR centres, because of price competition and the availability of a greater variety of goods and services at the PWR level, compared to those available locally.

In order to take outshopping into consideration, the total regional consumption expenditure must be expressed as a sum of the home-community purchases and outshopping purchases as shown below:

$$C_i^R = \pi_1 C_i^R + \pi_2 C_i^R \tag{5.2}$$

where

$C_i^R =$ Total personal consumption expenditure on commodity i by residents of region R

$\pi_1 =$ Share of home-community purchases in total personal expenditures on commodity i by residents of region R

$\pi_2 =$ Share of outshopping purchases in personal consumption expenditures on commodity i for residents of region R

The sum of $\pi_1 + \pi_2 = 1$. The first term on the right side of equation (5.2) is the expenditure on commodity i made in the home-community, and the last term is the outshopping expenditures on commodity i by residents of region R, and is part of the interregional shipments.

This distribution of regional consumption expenditures into local and outshopping purchases has important implications for modeling regional impacts. In this respect, to attribute all personal consumption expenditures to the home-community, when outshopping expenditures are large, would bias the contributions made by the household sector to the regional economy. For this reason, in this study the personal consumption expenditures for various regions were adjusted for leakages due to outshopping expenditures. The procedures followed are presented in the next sub-section.

Determination of Home-Community Personal Expenditures: In order to adjust personal expenditures for outshopping leakages, data on the proportion of purchases made in the home-community out of the total personal expenditures by type of commodity and by region were required. This study obtained these data for rural residents in home-communities from a study by Olfert and Stabler (1994). In the study by Olfert et al. (1994) these estimates were derived by applying the consumer price index (CPI) weights by expenditure item for Canada (Statistics Canada, 1986) to the shopping patterns data from the earlier study of Stabler and Olfert (1992). The result was CPI weighted expenditures by rural residents made in home-communities. These estimates were adopted in this study as the best available set of data on shopping expenditures for the different levels of communities in Saskatchewan. These data, as shown in Table 5.3, however, are given in terms of consumer prices. Thus, before these can be used to adjust the personal consumption expenditures in the input-output format, their conversion into producer prices was necessary. The conversion from purchaser prices to producer prices was obtained by netting out various margins from the total purchases. This procedure involved a number of steps:

(1) Correspondence between the various shopping items listed in Table 5.3 with the 100 input-output commodities was established. For most items a one-to-one correspondence was present. For groceries, because of the wide range of items under this category, establishing correspondence with I-O commodities was difficult. To overcome this problem, the personal expenditures on commodities in the food and beverage category contained in the final demand matrix of the 1991 input-output structure for the Canadian economy (Statistics Canada, 1991, Table 9) were identified as the best proxy for expenditures on groceries. Using these data, grocery expenditures were sub-divided into various I-O commodities.

(2) The proportions of commodity margins and producer share by I-O commodity (see Appendix E) for 1991 were calculated using data on margins reported by Statistics Canada (1991, Table 8). These margins were used to distribute the CPI weights into margins and producer shares.

Table 5.3. Consumer Price Index Weights for Expenditures Made by Residents in the Home-Communities.

TYPE OF PURCHASE	Functional Level of Community						
	PWR	SWR	CSC	PSC	FCC	MCC	ROS
1. Groceries	13.70	13.70	13.43	10.69	8.36	3.56	0
2. Beer	3.67	3.67	3.64	3.27	2.39	0.70	0.70
3. Clothing	8.95	8.52	5.89	3.38	0.72	0.38	0
4. Furniture	4.35	4.15	2.83	1.32	0.25	0.22	0
5. Automobile	13.84	13.84	13.01	9.09	6.16	14.49	0
6. Housing	17.61	17.61	17.61	16.97	16.1	14.49	14.49
7. Insurance	3.35	3.35	3.35	2.91	2.71	1.11	0
8.Accounting & Legal	0.17	0.17	0.16	0.11	0.04	0.01	0
9. Recreation. & Education	8.71	8.31	7.51	6.51	5.53	3.12	0
10.Health/ Personal Care	5.72	5.54	5.15	4.20	2.51	0.58	0
11.Restaurant	5.08	4.83	4.11	2.79	1.57	0.51	0.51
12.Household Operation	5.53	5.42	4.94	3.91	2.41	1.0	1.0
13.Communication. & Utilities.	5.39	5.39	0	0	0	0	0
14.Others*	4.47	4.47	0	0	0	0	0
TOTAL	100.8	99.21	81.66	65.15	46.75	28.29	16.70

** Others = Nonprincipal Accommodation + Public Transportation + Post Secondary Courses + Travel Tours*

SOURCE: Olfert and Stabler (1994).

(3) Once CPI weighted expenditures were assigned to the commodity group and margins using the proportions above, an aggregation scheme was followed which grouped I-O commodities according to the sectors defined in this study. This aggregation produced CPI weighted expenditures by sector for each region.

(4) The proportion of home-made expenditures were estimated at sector level for the various regions, taking the CPI weighted expenditures for residents at the Primary Wholesale-Retail (PWR) centre as the base.

(5) Since it is known that production in the primary sectors (namely, agricultural sectors, forest and fishing sector, mining and related sectors) takes place only in the hinterland [rest of Saskatchewan (ROS)], some modifications were made to estimate home-community expenditures and this involved setting home-made purchases at zero for the PWR, SWR, CSC, PSC, FCC, and MCC. The final estimates of percentages for expenditures by residents made within the home communities are given in Table 5.4.

As can be seen in this Table, various regions exhibit a hierarchical pattern in terms of percentages of home-made purchases from the non-primary sectors (manufacturing down to services). The highest-level region purchases a larger percentage of consumer goods and services within the home region. The percentage of purchases made within the home-communities tends to decline as one moves down the hierarchy from PWR to ROS, with the MCC and ROS making the smallest percent of consumption purchases within the home-community. Conversely, the percentage of outshopping expenditures tends to increase as one moves down the hierarchy from higher to lower-level centres.

Table 5.4. Estimated Percentages of Home-Community Purchases in the Total Consumption Expenditures by Sectors and Regions

SECTOR	Functional Level of Community						
	PWR	SWR	CSC	PSC	FCC	MC C	ROS
1. Ethanol-Feedlot	0	0	0	0	0	0	0
2. CPS Wheat	0	0	0	0	0	0	0
3. Cattle	0	0	0	0	0	0	0
4. Other Agriculture	0	0	0	0	0	0	0
5. Forestry & Fishing	0	0	0	0	0	0	0
6. Mining	0	0	0	0	0	0	0
7. Manufacturing	100	99	90.4	65.9	45.0	18.9	1.10
8. Construction	0	0	0	0	0	0	0
9. Transport	100	99.5	34.4	23.9	15.4	6.65	0.20
10. Communication.	100	100	0	0	0	0	0
11. Wholesale	100	99.1	89.3	62.3	40.7	17.5	0.22
12. Retail	100	97.5	80.8	54.8	30.9	13.3	0.88
13. F.I.R.E	100	100	100	94.8	89.7	74.4	69.2
14. Services	100	96.5	79.0	63.5	44.0	19.2	5.32

Adjusting Regional Consumption Expenditures for Outshopping Purchases: Once the shopping patterns data presented in Table 5.4 were prepared, the next step in estimating the regional personal expenditures involved the adjustment of regional personal consumption expenditures, as estimated previously, for outshopping leakages. The vector of regional expenditures by sector was split into two parts, namely, the local purchases and outside purchases. This required the following two steps: (1) Local purchases were introduced into the total requirements table for the region, and (2) Outshopping expenditures were assigned to direct regional imports. This adjustment was made to regional data prior to implementing the Supply-Demand Pool estimation technique.

5.5.3 Total Regional Other Final Demand

The total other final demand (OFD) for the province was obtained from the updated 1992 Saskatchewan Transactions Table. This total OFD was the sum of private investment and government expenditures. The total other final demand for each of the seven study regions was determined by allocating the provincial total private investment and government expenditure among the seven regions. The basis for this allocation was each region's share of place-of-work employment in the province.

The government capital expenditures for the province were allocated to the seven regions in two steps. (1) the portion of total provincial government expenditure was assigned to the ROS region on the basis of the region's share in the total provincial employment in the government sector. (2) the estimated government expenditure for the ROS region was subtracted from the provincial total, and the difference became the total government expenditure for the other six regions (PWR, SWR, CSC, PSC, FCC, and MCC). This was divided among the six regions using average capital expenditure patterns, as reported in a study by Stabler and Olfert (1992, p.80). These average expenditures were based on combined provincial and Saskatchewan Wheat Pool infrastructure investment during the decade of the 1980s. The spatial pattern of infrastructure expenditure conforms to the six-tier hierarchy of regions. Finally, the aggregate value of the other final demand for each of the seven regions was found as a sum of the estimated regional private investment and regional government expenditure.

The sectoral distribution of total regional other final demand was determined by multiplying the total value and the provincial coefficients from the updated 1992 Saskatchewan input-output table.

5.5.4 Estimation of Out-of-Province Exports from Each Region

The exports to out-of-province from each sector were estimated as part of the updating of the Saskatchewan Transactions Table to 1992 situation. Total sectoral exports to out-of-province for each region were determined using a combination of a non-survey and judgment method. The procedure made possible an accurate reflection of the sectoral production and exports in the Saskatchewan economy. Letting the total exports (out-of-province and interregional) be determined on the basis of exportable surplus using the SDP method was rejected on the grounds that it generated somewhat unrealistic regional export levels.

According to expert opinion[9], various industries located at different levels in the Saskatchewan trade centre hierarchy export a certain percentage of their production to buyers located outside the province. These exports to out-of-province for each region were estimated using the following three steps: (1) The subjective proportions (PS^R_i) of production for export by sector *(i)* and for each region *(R)* were obtained using expert opinion[10]. (2) The initial estimates of exports to out-of-province by sector and region were determined by multiplying the subjective proportions with the respective regional output. (3) The final estimates of exports to out-of-province were derived by adjusting the subjective percentages under the constraint that total exports from the seven region were equal to that of the province. The estimated out-of-province exports by sector for each of the seven regions are given in Table 5.5. These estimates of exports were used as input in estimating the self-supply ratios (SSR) required in the Supply-Demand Pool (SDP) method.

[9] Based on personal communication with Professor J. C. Stabler.

[10] The estimates of the proportions of regional production for export to outside of the province were obtained though personal communication with Professor J.C Stabler. These proportions are shown in appendix F.

5.5.5 Application of SDP to Regional Input-Output Models

The regional input-output coefficients were estimated from the Saskatchewan provincial I-O coefficients using the supply-demand pool (SDP) technique (Schaffer and Chu, 1969). The salient regional data, assembled in sections 5.5.1 to 5.5.4, became input

Table 5.5. Estimates of Out-of-Province Exports by Sector From each Region (Million dollars)

Sector	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Total
1. Ethanol-Feedlot	0	0	0	0	0	0	0	0
2. CSP Wheat	0	0	0	0	0	0	42.2	42.2
3. Cattle	0	0	0	0	0	0	675.3	675.3
4. Other Agriculture	0	0	0	0	0	0	2,606.0	2,606.0
5.Fishing & Forestry	0	0	0	0	0	0	6.9	6.8
6. Mining	0	0	0	0	0	0	3,071.0	3,071.0
7. Manufacturing	847.6	422.7	107.0	314.4	122.3	90.5	236.0	2,135.0
8. Construction	2.8	0.6	0	0	0	0	0	3.4
9. Transport	765.8	378.5	72.4	280.3	119.6	86.4	205.0	1,908.0
10. Communication	146.3	0	0	0	0	0	0	146.4
11. Wholesale	267.8	81.2	22.1	65.2	28.9	18.6	41.4	525.3
12. Retail	74.8	20.8	0	0	0	0	0	94.8
13. F.I.R.E*	530.6	156.9	24.3	43.4	0	0	0	758.2
14. Services	325.0	86.0	16.7	41.5	19.8	10.6	29.8	529.4

* FIRE is the abbreviation for Financial, Insurance and Real Estate sector.

N.B: The SSR represents the percentage of local demand that is satisfied by supplies from local production. This is a local SSR which was derived after the Provincial SSR was applied to the Provincial I-O Table.

into the SDP technique. With this approach, the provincial I-O coefficients were taken as first approximations to regional coefficients. The provincial technology was applied to estimate regional requirements (G_i^R) by sector in the following manner: (1) Multiplying each of the provincial input-output coefficients (a_{ij}^P) by the appropriate regional output of that sector to yield intermediate demand, and (2) Multiplying the provincial final-demand input proportions (C_{if}^P) by appropriate regional final demands (Y_f^R), to yield regional final demand; and (3) Summing up all transactions including the exogenous non-Saskatchewan exports (F_i^R). The regional gross requirements for sector i of regional R was expressed as

$$G_i^R = \sum_j a_{ij}^P X_j^R + \sum_f c_{if}^P Y_f^R + F_i^R \qquad (5.3)$$

The sectoral output balance b_i^R was calculated for each sector as the difference between local demand and local production.

$$b_i^R = G_i^R - X_i^R \qquad (5.4)$$

When this balance is positive or zero, it implies that (1) the region is self-sufficient, (2) its exportable surplus ($Z_i^{RS} > 0$) is positive, and (3) it has no regional imports ($M_i^R = 0$). Thus, if using provincial coefficients as estimates of regional coefficients does not generate an overestimate of regional production, the regional technology is identical to that of the province. However, if the output balance (b_i^R) is negative, it implies that the region is a net importer, ($M_i^R > 0$), and this further implies that interregional exports should be set equal to zero. Thus, the provincial coefficients are "too large" in the sense that they generate unrealistically high regional outputs for the respective sector.

The regional coefficients in this study were obtained by adjusting provincial coefficients by the self-supply ratio.The self-supply ratio was estimated as

$$\Omega_i^R = (X_i^R - F_i^R) / (G_i^R - F_i^R) \qquad (5.5)$$

where $G_i^R = \sum_j a_{ij}^P X_j^R + C_i^R + FD_i^R + Z_i^{RS} + F_i^R$

The numerator in equation (5.5) represents the level of local production that is used locally. It was estimated by subtracting the estimated out-of-province exports from the total production. The denominator in equation (5.5) is the total regional demand. Note that out-of-province exports by sector from each region were discussed above in section 5.5.5. The estimated self-supply ratios for each sector in the seven regions are presented in Table 5.6. It is important to mention that, for the non-primary sectors in the lower-level regions (from CSC through to MCC and ROS), the reasonable values of SSR would be less than one. In particular the SSR presented above are too high for construction, FIRE, and services sectors. One explanation for these high SSR values for lower-level regions would be a sectoral aggregation bias. Since there are differences in the range of goods and services offered by the same sector at various levels of centres, caution should be applied in interpreting and applying SSR values for an aggregated sector.

When $\Omega \geq 1$, it implies that the region is a net exporter in sector i; thus, regional imports are equated to zero, and $Z_i^{RS} > 0$ and $F_i^R > 0$. When $\Omega < 1$, it implies that local net supply is less than regional demand; hence, regional imports are needed to satisfy the excess demand in region R. The exports were set equal to zero $Z_i^{RS} = 0$ and $F_i^R = 0$. Thus, interregional trade flows depend on whether the region has a regional trade

Table 5.6. Estimates of Self-Supply Ratios by Sector for the Seven Regions

Sector	PWR	SWR	CSC	PSC	FCC	MCC	ROS
1. Ethanol-Feedlot	0	0	0	0	0	0	1
2. CSP Wheat	0	0	0	0	0	0	1
3. Cattle	0	0	0	0	0	0	1
4. Other Agriculture	0	0	0	0	0	0	1
5. Fishing & Forestry	0	0	0	0	0	0	1
6. Mining	0	0	0	0	0	0	1
7. Manufacturing	1	1	0.421	0.319	0	0	0.008
8. Construction	0.870	1	1	1	1	1	0.534
9. Transport	1	1	1	1	0.627	0.697	0.307
10. Communication	1	1	0	0	0	0	0
11. Wholesale	1	1	1	1	1	1	0.224
12. Retail	1	1	1	1	1	1	1
13. F.I.R.E*	1	1	1	1	1	0.926	0.252
14. Services	1	1	1	1	1	1	0.444

* FIRE is the abbreviation for Financial, Insurance and Real Estate sector.

deficit or surplus. The value of the self-supply ratio works as an indicator of the direction of trade flows. When $\Omega < 1$, the regional imports were estimated as

$$M_i^R = (1 - \Omega_i^R)(\sum_j^n a_{ij}^P X_j^R + C_i^R + FD_i^R) \tag{5.6}$$

where,

M_i^R denotes the imports of the products of sector i by region R

The estimated Ω_i^R coefficients were used to compute the regional input-output models as follows:

$$X_i^R = \Omega_i^R(\sum_j a_{ij}^P X_j^R + \sum_f c_{if}^P Y_f^R) + F_i^R \tag{5.7}$$

The estimation of the seven regional I-O tables was a very repetitive task and thus it was automated using a MACRO program developed on a Quattro Pro spreadsheet. The program generated the gross requirements table, then divided that table into intraregional requirements table and the interregional imports table. In addition, the program generated the exportable surplus and gross regional imports.

5.6 Determination of Interregional Trade Flows

5.6.1 Hierarchical Interregional Trade Flows

Interregional trade flows were estimated through the extension of the SDP logic and assumptions of trade patterns within the central place hierarchy. The regional exportables and regional imports, calculated during the SDP estimation of the single region models, were collected and checked to ensure they balanced at the provincial level for each sector. These estimates were used to create the trade balance matrix for each sector. This was a (7 by 7) shipment matrix, with shipments from each region listed along the row and shipments received by each region given along the column. The row sum for each region gave the total exportable surplus, and the column sum gave the total regional imports. Since no cross-hauling is allowed, a given region is either an exporter or importer and not both. In total, 13 trade tables were created; these are presented in Appendix G.

To complete the trade matrix, data on interregional commodity shipments (Z_i^{RS}) are required. Such data, however, are non-existent in Saskatchewan, and collecting such data through surveys was beyond the scope and resources of this study. Thus, a nonsurvey approach developed by Robison and Miller (1991), along with some logical rules, were used to allocate the exportable surplus of each region among importing regions within Saskatchewan.

The logical trade rules are based on assumptions regarding trade in "specialized goods" (Parr, 1987). Trade flows in the provincial economy were determined using two trade assumptions:

(1) The Higher-level regions (PWR, SWR, CSC, PSC, FCC, and MCC) were assumed to dominate trade in goods of non-primary sectors (i.e. manufacturing, construction, transport and storage, communication and utilities, wholesale, retail, Financial Insurance and Real Estate (FIRE), and services). A strictly hierarchical one-way trade pattern was assumed for trade in the non-primary sectors. That is, higher-level regions are surplus regions in goods produced by non-primary sectors, and, hence, ship their excess supply to producers and final users in the dominated lower- level regions and to non-Saskatchewan markets.

(2) The hinterland sub-region (ROS) dominates trade in goods in the primary sectors.

The amount of exportable surplus shipped by a particular dominating subregion to an importing region was determined by the hierarchical dominance of the subregion. Thus, for trade in goods of primary sectors, the hierarchical dominance implies increasing dominance as one moves from higher to the lowest-level subregion. Trade in the non-primary sectors is depicted by decreasing dominance as one moves from top to lower-level subregions in the hierarchy. The dominant subregion had the priority to ship the exportable surplus to importing regions. Once the exportable surplus was exhausted, and there was still excess demand, then the next dominating subregion had the priority, and this was continued until all regional imports were satisfied by shipments from the appropriate dominating subregions.

The total interregional exports shipped from each region were obtained as a row sum in the trade matrix. The difference between total exportable surplus and total interregional exports was equated to non-Saskatchewan exports.

5.6.2 Estimation of Interregional Trade Flows

The estimated interregional exports or, equivalently, interregional imports were then used to calculate the interregional export shares (t_i^{RS}). Then these export shares were used to allocate the regional imports among exporting regions.

In the seven-region case, region S can import from sector i located in the other six regions subject to trade assumptions and the hierarchy of the region. Thus, the imports of goods i by region S were allocated among the six possible supplying regions according to the interregional export shares.

$$\sum_{R=1}^{6} Z_i^{RS} = \sum_{R=1}^{6} t_i^{RS} M_i^S \qquad (i = 1,..14;\ R,\ S = 1,..,6) \qquad (5.8)$$

For each of the seven regions, an intraregional I-O table and six interregional trade coefficient matrices were generated using a macro program written on a Quattro Pro spreadsheet. These tables for the seven regions were arranged to give a preliminary seven-region hierarchical I-O model of the Saskatchewan economy for 1992. At this stage the model contained 112 rows (= 98 sectors + 1 labor income + 1 Other Value added + 1 imports), and 107 columns (= 98 sectors + 7 households sectors + 1 other final demand + 1 Non-Sask. Exports).

A consistency check was done on the model to ensure it was balanced: row totals were equal to column totals. Then adjustments for income, commuting and regional consumption were performed; these are discussed in the next sections. The final table was obtained and this is given in Appendix H

5.6.3 Income and Commuting Adjustment

The estimated model above was checked and found balanced; i.e., the row totals were equal to the column totals. The single row of payments to labor in the model was adjusted to reflect that each place-of-work employed workers drawn from seven regions in the province. The adjustment involved dividing labor payment of each regional sector into 7 rows according to place-of-residence of workers based on commuting patterns data. In essence, seven rows of labor payments were created, where each represented the total labor income earned by residents of a given region from employment in seven regions of the model including their place-of-residence. The total labor income received by residents of each region was calculated as a row sum.

5.6.4 Adjusting Regional Consumption

For each region, estimates of the total consumption expenditure by residents in the region were checked against total labor income for that region (see section 5.6.3). This check is important because personal consumption should be a function of labor income which depends on the level of employment enjoyed by the residents in that region. Assuming labor income is the only source of income for residents, then it follows that the total personal consumption expenditures would equal the total labor income. For each region, an income adjustment factor was calculated as a ratio of the total regional labor income to total regional consumption expenditure. Then this was used to adjust the purchases for residents in the appropriate region, ensuring that their labor income matched their total consumption expenditure. Any excess expenditure above labor income was treated as exogenous, and was put in a column which was added for non-wage personal expenditure.

5.7 Impact Analysis

The study model constructed using the methods and procedures discussed in the preceding sections of this chapter was used to estimate the impacts of an integrated Ethanol-Cattle production complex for six regions in Saskatchewan during 1992. The impact analysis[11] was conducted for two phases of the project: (1) Construction phase and (2) the Operation phase. The process of impact analysis used to analyze the impacts under these two phases is briefly presented below..

5.7.1 Conceptual Impact Analysis

In order to demonstrate the role of the household sector within a regional economy, the regional input-output model was closed with respect to this sector. It is

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[11] Computer programming assistance for conducting impact analysis was provided by Allan Florizone.

known that inclusion of the household sector in a regional model leads to larger multipliers than those obtained when the household sector is missing. Batey and Weeks (1989) showed that induced effects are more important than indirect effects, which reinforces the general argument that more attention need be paid to specification of the household sector. Household income and consumption are important in determining the size of impacts that occur in I-O models. The results of an economic impact analysis are also likely to be influenced by the choice of the household disaggregation scheme (Batey and Weeks, 1989, p.119-124).

Beyers (1989, p.182) pointed out that although regional linkages to the income payments-income disposition sectors have been identified as a key source of 'power' in the regional I-O models, there are significant interregional linkages with these systems as well. In the interregional model, the household sector is responsible for the cross-boundary flows of income payments and expenditures. In modeling the household sector, one runs into the problem of accounting for these cross-boundary flows[12] or leakages. For example, income generated in a region may flow to commuting workers or absentee owners of land and capital, thus leaking out of the spending stream.

In this study, seven household sectors were considered. Each region had a single household sector representing the personal expenditures of employed households; thus, seven column vectors of personal expenditures and seven rows of labor income were needed to complete the closure. The households made personal purchases of goods and services from the region of residence as well as from other regions in the province. On the labor income side, the total labor income was made up of labor income received from sectors within the region of residence plus income received by workers commuting to other regions.

On the method used for closing regional I-O models, the recent literature suggests including only the" income that is generated in the region, received in the region and respent in the region" (see Rose and Stevens, 1991). The literature further points out that the regional I-O modeling of cross-boundary incomes, payments and personal expenditures is still unsatisfactory. Two methods have been used (see Rose and Steven, 1991, p.256): (1) The personal expenditures are set equal to the labor income and any excess in personal expenditures above labor income is treated as exogenous. (2) The

[12] See Rose and Beaumont (1988 and 1991) for a detailed discussion of cross-boundary income payments and expenditures.

personal expenditures are set equal to the labor income plus a fraction of the capital related income. The problem, however, is that the criteria needed to determine the distribution of capital income in each sector among investors, including households, requires a very data intensive task which is also difficult to implement for sub-regions.

In this study the approach taken was to set the personal expenditures equal to the labor income and any excess was regarded as non-wage based personal expenditures and treated as exogenous to the model,as explained above in section 5.6.4.

As mentioned above, the household sector contributed $13 billon in personal consumption expenditure to the economy during 1992. For impact analysis, it is crucial to include the household sector in the model; failure to do that would lead to underestimating of the role of household income and consumption, and could bias the results of an impact analysis exercise and the consequent policy implications of the results. When an input-output table which contains a household sector is used in impact analysis, it generates type II multipliers, and these multipliers have been found to be greater than those from tables in which data on the household sector is missing. For this study, the model is closed with respect to seven households, and accordingly the impact analysis for both construction and operation phases in this study will be based on type II multipliers .

5.7.2 Impact Analysis Procedure for the Construction Phase Scenarios

The construction scenarios included the direct impacts resulting from the cost of constructing a building for the ethanol plant with an annual production capacity of 10 million litres and of expanding an existing beef cattle feedlot to an annual handling capacity of 45,000 head per annum.

The construction of an Ethanol-Cattle production complex in each of the six regions represents a scenario. Since there were six alternative regions (namely, PWR, SWR, CSC, PSC, FCC, and MCC), this meant there were six construction scenarios. For each scenario, the total construction expenditures amounted to $14.58 million. Out of the total construction expenditures, almost $9.48 million was spent on construction materials imported from outside of Saskatchewan, and only $5.09 million was the direct contribution to the sectors into the provincial economy.

For the impact analysis the construction expenditures under each scenario were treated as the final demand investment change. It was assumed that during the construction phase, the structure of the economy remained unchanged. The gross output impacts of each construction scenario were determined by multiplying the multiplier matrix by the final demand changes. The multiplier matrix was generated from the base model using the computer program developed by Florizone. Thus, for each scenario, the sectoral outputs required from various regions to support this change in the final demand were estimated. Then the associated changes in labor income, other value added and non-Saskatchewan imports were estimated.

5.7.3 Impact Analysis Procedure for the Operations Phase Scenarios

Since the ethanol sector was not present in the base model (since it was represented by rows and columns of zeros), the implementation of the operation scenario started by inserting input requirements and sales for the integrated ethanol-cattle production complex in the appropriate region of the base model. The outputs of the new sector included ethanol, beef cattle and animal feeds (by-products). The sales of these products were as follows: About 90% of the ethanol output went to the PWR region and 10% was exported outside of Saskatchewan. About 70% of the total beef cattle output was exported and 30% went to PWR region. The by-products and animal feeds were sold to the other agricultural sectors in the ROS region.

Inserting the outputs for the new industry led to increases in the column totals for affected sectors. The input purchases from the new ethanol industry were balanced by reducing non-Saskatchewan imports. This adjustment allowed the total inputs for each sector to be kept at the same level as in the base model.

In essence, the procedure involved augmenting the base matrix with a row and column of vector of coefficients for the new sector. This procedure is explained by Miller and Blair (1985) and Freeman et al. (1991), as a partial impact method. This procedure makes possible to estimate the partial impact of a new industry. The procedure can also represent new technologies that are not yet in the region. Its disadvantage is that it does not estimate at the same time the substitution effect that might occur due to the introduction of a new industry. In applying this procedure to a regional economy, it is assumed that the coefficients are fixed, which implies the patterns of interindustry sales, purchases, market shares, and trade coefficients remain unchanged. Once the model was augmented, it was used to conduct an impact analysis through which the gross outputs required to support the new economy were estimated.

The scenario results represent the difference between the Base Case interregional transactions table (Z_0) and the Scenario interregional transactions table (Z_1). The Scenario transactions table was derived by forming a Leontief inverse of the estimated interregional I-O coefficient matrix in which the ethanol-cattle production complex was inserted in one of the regions. The so-formed Leontief inverse was post-multiplied by a vector of final demands. This generated the total transactions that are required to support the new economy in which the ethanol-cattle production complex was present. The differential impact of introducing an ethanol industry in a region was then found by subtracting the Base Case transactions from the Scenario transactions

$$[\text{Impact} = (Z_1) - (Z_0)].$$

5.8 Summary

The chapter presented the method used to construct the seven-region hierarchical interregional input-output model of Saskatchewan. The chapter outlined the preparation of the seven regional input-output tables and determination of the corresponding interregional trade matrices. In addition, it presented the preparation of the final model and its application in analyzing the impacts of an integrated ethanol-cattle production complex in six regions of Saskatchewan. The results obtained for various scenarios under the construction and operations phase are presented in the next chapter.

CHAPTER 6

SPATIAL ECONOMIC IMPACTS OF AN INTEGRATED ETHANOL-CATTLE PRODUCTION COMPLEX

Chapter 5 reported on the methodology used to construct the study model and the process for conducting an economic impact analysis of construction and operation phases of an integrated ethanol-cattle production complex in Saskatchewan. This chapter presents the outcomes resulting from the construction and operation phases of this complex in one of six alternative regions in Saskatchewan.

This chapter is divided into three sections. Section 6.1 deals with the economic impacts of the construction scenarios of the ethanol-cattle production complex, whereas Section 6.2 addresses the economic impacts resulting from its operation scenarios. These two sections have a similar format. Each section is divided into nine major sub-sections. In sub-section one, the direct impacts of the project are discussed. The spatial distribution of the direct impacts are given in sub-section two. The gross output impacts resulting from the six scenarios are presented in sub-section three. The spatial distribution of the aggregate gross output impacts is presented in sub-section four. Sub-section five focuses on the spatial distribution of aggregate labor income impacts. The estimated type II multipliers of output are presented in sub-section six and labor income (type II) multipliers in sub-section seven. The spillover coefficients of output and labor income are subjects of sub-sections eight and nine, respectively. Section 6.3, provides a discussion on the implications of the results for future ethanol development in Saskatchewan.

6.1 Construction Phase Economic Impacts

Based on the information provided by the Poundmaker-Agventures Ltd. (1996), the construction of an integrated Ethanol-Cattle production complex was estimated at $14.58 million during 1992. This cost included expenditures on materials to construct the ethanol production complex and to expand an existing beef cattle feedlot. These expenditures generate additional economic activity in the project-region and other regions of the province through backward linkages. The total impacts of the new sector were estimated as Type II impacts, which is the sum of the direct, indirect and induced impacts.

As noted in Chapter 5, six construction scenarios were formulated. Each scenario constituted the construction of the complex in one of six regions. The economic impacts of these scenarios are presented in terms of

(1) Gross output, which is the sum of value of goods and services produced by sectors in the study regions;
(2) Labor income generated, which includes wages and salaries, supplementary labor income, net income of farm operators, and net income of unincorporated non-farm business;
(3) Other value added, which is the total GDP at market prices less labor income above; and
(4) Imports and other leakages, which include imports from outside of Saskatchewan province.

6.1.1 Direct Impact of Integrated Ethanol-Cattle Production complex Construction

In 1992 dollars, it is estimated that the construction of an Integrated Ethanol-Cattle production complex in any one of the six regions would cost $14.58 million. This gross value of investment expenditure was shared among various input supplying sectors, payments to value added sectors, and imports, as shown in Table 6.1. The largest share (65% of the expenditure) went to various imports from outside of Saskatchewan. The remaining 35% or $5.09 million was the direct contribution to the sectors in the provincial economy. Thus, construction of such a complex involves a large proportion of its requirements to be met through imports, which affect other Canadian regions and the Rest-of-the-world more.

Table 6.1. Direct Impact of Integrated Ethanol-Cattle Production complex Construction, 1992.

Item	Amount ($ million)	% of Total
Intermediate Inputs	4.08	28.05
Value Added	1.01	6.92
Imports and Leakages	9.49	65.03
Total Value of Expenditures	14.58	100.00

The breakdown of inputs purchases during the construction phase by major commodities is presented in Table 6.2. The major items imported from outside of the province include the major plant processing equipment (distiller) worth $3.8 million, and payments for concept development, project management and design, worth $1.5 million. The total value of imports is made up of two parts. The first part includes the major plant processing equipment and project development and design; these are imports directly purchased by the Ethanol-Cattle production complex from outside of Saskatchewan, and are valued at $5.3 million. The second part reflects the import margins in the commodities purchased from the local firms. This is obtained by multiplying the value of the commodity purchases by the provincial self-sufficient ratios. The provincial self-sufficient ratios used in this study were obtained from a report by Kulshreshtha et al. (1991, p.126-131).

Table 6.2. Breakdown of Construction Phase Expenditures ($ Million)

No.	Commodity	Saskatchewan Supply	Imports
50	Boilers, Tanks	0.93	1.50
52	Pens	0.03	0.54
54	Feed & Grain Handling Equipment	0.08	1.09
70	Plant Security Fence	0.07	00
71	Non-Residential Building	1.54	0
79	Other Utilities	0.09	0.09
83	Finance, Insurance and Real Estate	1.35	0.77
84	Technical Services	0.07	0.18
95	Indirect Taxes (license, fees, contracts)	0.93	0
50	Major Process Equipment	0.00	3.81
84	Project Design and Management	0.00	1.51
	TOTAL	5.09	9.49

6.1.2 Spatial Distribution of Direct Impacts Under the Construction Scenarios

For each scenario, the direct impacts of the construction expenditures were distributed among the seven study regions of the province. The supplying regions of purchased inputs were determined according to the hierarchy of the region, and the availability of the particular product or service in a region. A region purchase coefficient (RPC) was assigned[1] per commodity for each region. An RPC = 1 meant that a region is self-sufficient and the supplier of that commodity to regions lower in the hierarchy. A value of RPC=0 meant that the region is an importer of that commodity. The value of each commodity in purchaser prices was converted into the equivalent producer share and margins for each region. For each scenario, the purchases by commodity from the seven regions were aggregated into purchases by sector. A vector of purchases from sectors in the project-region and other six regions plus Non-Saskatchewan imports was generated. The spatial distribution of these aggregate direct construction expenditures under the six scenarios are given in Table 6.3.

Table 6.3. Spatial Distribution of Aggregate Direct Construction Expenditures under Each Scenario ($ million)

	S1	S2	S3	S4	S5	S6
PWR	4.08	0.07	2.74	2.74	4.08	4.08
SWR	0	4.01	0.52	0.52	0	0
CSC	0	0	0.83	0.46	0	0
PSC	0	0	0	0.36	0	0
FCC	0	0	0	0	0	0
MCC	0	0	0	0	0	0
ROS	0	0	0	0	0	0
Labor Income	0	0	0	0	0	0
Other Value Added	1.01	1.01	1.01	1.01	1.01	1.01
Imports	9.49	9.49	9.49	9.49	9.49	9.49
TOTAL	14.58	14.58	14.58	14.58	14.58	14.58
Direct Impact in Project Region (%)	28.0	27.5	5.7	2.5	0	0

As shown in Table 6.3, about 28 percent of the construction expenditures under scenario one and scenario two were made within the project-region. This figure decreased to 5.7 percent under scenario three and to 2.5 percent under scenario four, and to almost zero under scenarios five and six. For scenario three, the major part of the expenditure occurred in the PWR region, and some smaller expenditure was shared by the project-region and SWR region. Under scenario four the expenditures occurred in the

[1] The RPC was assigned subjectively aided by information on availability of Producer Services at different levels of the Saskatchewan Trade Centres presented by Stabler and Olfert (1992, p.20).

project-region as well as in the three top level regions with the PWR being the major suppliers of goods required for the construction of the complex. For scenarios five and six, all the construction expenditures occurred in the PWR region, reflecting the dependency of lower order regions on the top level regions in the provision of input requirements during the construction phase.

6.1.3 Gross Output Impacts Resulting from the Construction Scenarios

The gross output is equal to the value of goods and services produced by various sectors in the seven regions of the province. The estimated output is a total of direct, indirect and induced impacts generated under each of the six construction scenarios. These are discussed for each of the six construction phase scenarios in the following sub-sections.

Gross Output Impacts Resulting from the Construction Scenario One: The gross output impacts resulting from the scenario one under the construction phase are given in Table 6.4. The impact on the provincial economy was to increase the total gross output by \$6.45 million. The largest impact by region was \$6.04 million which occurred in the project-region, PWR. The non-project-regions experienced minimal gross output impacts, except for the ROS region which experienced an increase of \$0.33 million in gross output. Generally speaking, for scenario one, the impacts were confined mostly to the project-region.

Gross Output Impacts Resulting from the Construction Scenario Two: The gross output impacts of construction Scenario Two are given in Table 6.5. The largest output impacts were \$5.68 million which occurred in the project-region, SWR. The other regions, CSC to MCC, experienced very little output impacts, but the output impact in the PWR region was about \$0.4 million and in the ROS region at \$0.34 million. The impact of Scenario Two on the provincial economy was to increase gross output by \$6.49 million. The largest impact occurred in the project-region; it was \$5.68 million.

Table 6.4. Spatial Distribution of Output Impacts of Construction Scenario One ($ Million)

SECTOR	Region of Impact PWR	SWR	CSC	PSC	FCC	MCC	ROS	Total Impacts
Ethanol Industry	-	-	-	-	-	-		-
CPS Wheat	-	-	-	-	-	-	0.001	0.001
Cattle	-	-	-	-	-	-	0.039	0.039
Other Agriculture	-	-	-	-	-	-	0.096	0.096
Fishing/Forestry	-	-	-	-	-	-	0.024	0.024
Mining	-	-	-	-	-	-	0.148	0.148
Manufacturing	1.134	0.003	-	-	-	-	-	1.137
Construction	1.628	0.012	0.003	0.001	0.001	0.001	0.002	1.647
Transport & Stor.	0.094	0.001	-	-	-	-	-	0.095
Communic & Util.	0.346	0.003	-	-	-	-	.001	0.348
Wholesale Trade	0.240	0.001	-	-	-	-	-	0.241
Retail Trade	0.213	0.007	0.001	0.004	0.002	0.001	0.001	0.228
FIRE	1.848	0.006	0.001	0.002	0.004	0.009	0.008	1.878
Services	0.538	0.010	0.001	0.001	0.001	0.002	0.009	0.561
Total Output	6.040	0.042	0.005	0.007	0.007	0.0132	0.329	6.446

Of the non-project regions, PWR experienced an increase of $0.40 million. This was followed by ROS region with an increase of $0.33 million, and about $0.03 million for the PSC region. The other regions had output impacts in the magnitude of $0.01 million. It can be said that the gross output impacts of Scenario Two are concentrated in the project region and the ROS region.

<u>Gross Output Impacts Resulting from the Construction Scenario Three</u>: The spatial distribution of the output impacts resulting from construction scenario Three are presented in Table 6.6. Total output impacts generated in the project-region were about $1.03 million of the total output in the province. The largest impact was $4.29 million, which occurred in PWR region, and was followed by $0.76 million in the SWR region. In addition, about $0.33 million of the total output impacts were realized in the ROS region. Again the regions below CSC, except ROS, experienced almost zero output impacts. Overall, the impact on the provincial economy was to increase gross output by $6.46 million.

Table 6.5. Spatial Distribution of Output Impacts of Construction Scenario Two ($ Million)

	Region of Impact							
SECTOR	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Total
Ethanol Industry	0	0	0	0	0	0	0	0
CPS Wheat	0	0	0	0	0	0	0.001	0
Cattle	0	0	0	0	0	0	0.039	0.04
Other Agriculture	0	0	0	0	0	0	0.097	0.10
Fishing/Forestry	0	0	0	0	0	0	0.024	0.02
Mining	0	0	0	0	0	0	0.148	0.15
Manufacturing	0.045	1.095	0	0.001	0	0	0	1.14
Construction	0.006	1.636	0	0.002	0.001	0.001	0.002	1.65
Transport & Stor.	0.010	0.085	0	0	0	0	0.001	0.10
Communic. & Util.	0.052	0.301	0	0	0	0	0	0.35
Wholesale Trade	0.011	0.231	0	0.001	0	0	0	0.24
Retail Trade	0.029	0.184	0.004	0.013	0.004	0.001	0.001	0.23
FIRE	0.100	1.753	0.001	0.010	0.005	0.008	0.015	1.89
Services	0.147	0.404	0.001	0.005	0.002	0.002	0.010	0.57
TOTAL Output	0.400	5.688	0.005	0.030	0.012	0.011	0.339	6.49

Table 6.6. Spatial Distribution of Output Impacts of Construction Scenario Three

($ Million)

SECTOR	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Total
Ethanol Industry	0	0	0	0	0	0	0	0
CPS Wheat	0	0	0	0	0	0	0.001	0.001
Cattle	0	0	0	0	0	0	0.039	0.039
Other Agriculture	0	0	0	0	0	0	0.096	0.096
Fishing/Forestry	0	0	0	0	0	0	0.024	0.024
Mining	0	0	0	0	0	0	0.148	0.148
Manufacturing	0.238	0.474	0.426	0	0	0	0	1.138
Construction	1.318	0.017	0.307	0.001	0.001	0.001	0.002	1.647
Transport & Stor.	0.038	0.025	0.031	0	0	0	0.001	0.095
Communic & Util.	0.319	0.031	0	0	0	0	0	0.350
Wholesale Trade	0.058	0.069	0.114	0	0	0	0	0.242
Retail Trade	0.159	0.031	0.029	0.007	0.003	0.001	0.001	0.230
FIRE	1.744	0.049	0.059	0.003	0.005	0.011	0.011	1.882
Services	0.415	0.065	0.069	0.002	0.002	0.002	0.009	0.564
TOTAL	4.289	0.761	1.035	0.013	0.011	0.015	0.333	6.458

Gross Output Impacts Resulting from the Construction Scenario Four: The spatial distribution of the output impacts resulting from the construction Scenario Four are presented in Table 6.7. It shows that about $0.46 million of total output impacts occurred in the project-region. The largest impacts was $4.03 million, which occurred in PWR. This was followed by $0.76 million in the SWR region, and $0.57 million in the CSC region. Furthermore, there was an output increase of $0.33 million in the ROS region. Scenario Four has a wider spread of output impacts compared to the first three scenarios above, but the share for the project-region has declined. These results indicate that the PSC region depends on the higher-order regions, but has greater dependency on the PWR region.

Table 6.7. Spatial Distribution of Output Impacts of Construction Scenario Four ($ Million)

	Region of Impact							
SECTOR	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Total
Ethanol Industry	0	0	0	0	0	0	0	0
CPS Wheat	0	0	0	0	0	0	0.001	0.001
Cattle	0	0	0	0	0	0	0.039	0.039
Other Agriculture	0	0	0	0	0	0	0.096	0.096
Fishing/Forestry	0	0	0	0	0	0	0.024	0.024
Mining	0	0	0	0	0	0	0.148	0.148
Manufacturing	0.241	0.474	0.397	0.026	0	0	0.000	1.138
Construction	1.318	0.017	0.007	0.302	0.001	0.001	0.002	1.647
Transport & Stor.	0.038	0.025	0.023	0.008	0	0	0.001	0.095
Communic & Util.	0.319	0.031	0	0	0	0	0	0.350
Wholesale Trade	0.058	0.069	0.065	0.048	0	0	0	0.242
Retail Trade	0.161	0.031	0.014	0.019	0.003	0.001	0.001	0.230
FIRE	1.749	0.049	0.030	0.028	0.005	0.010	0.012	1.882
Services	0.418	0.066	0.039	0.028	0.002	0.002	0.009	0.564
TOTAL	4.303	0.763	0.574	0.460	0.011	0.014	0.334	6.458

Gross Output Impacts Resulting from the Construction Scenario Five: The output impacts of construction Scenario Five are given in Table 6.8. The spatial distribution of these impacts across the seven regions is as follows: Almost $6.04 million of the total gross output occurred in PWR region, $0.42 million in the SWR region and $0.33 million in the ROS region. The impacts in the other regions were almost nil. The project-region did not experience any output impacts. Even though the project-region is FCC, the impacts of construction activity are concentrated in the PWR region. The results indicate that FCC region is highly dependent on the PWR region during the construction phase.

Table 6.8 Spatial Distribution of Output Impacts of Construction Scenario Five ($ Million)

SECTOR	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Total
Ethanol Industry	0	0	0	0	0	0	0	0
CPS Wheat	0	0	0	0	0	0	0	0
Cattle	0	0	0	0	0	0	0.04	0.04
Other Agriculture	0	0	0	0	0	0	0.10	0.10
Fishing/Forestry	0	0	0	0	0	0	0.02	0.02
Mining	0	0	0	0	0	0	0.15	0.15
Manufacturing	1.134	0.003	0	0	0	0	0	1.14
Construction	1.628	0.012	0.003	0.001	0.001	0	0	1.65
Transport & Stor.	0.094	0.001	0	0	0	0	0	0.10
Communic & Util.	0.346	0.003	0	0	0	0	0	0.35
Wholesale Trade	0.240	0.001	0	0	0	0	0	0.24
Retail Trade	0.213	0.007	0.001	0.004	0.002	0.001	0	0.23
FIRE	1.848	0.006	0.001	0.002	0.004	0.009	0.01	1.88
Services	0.538	0.010	0.001	0.001	0.001	0.002	0.01	0.56
TOTAL	6.040	0.042	0.005	0.008	0.007	0.013	0.33	6.45

Gross Output Impacts Resulting from the Construction Scenario Six: The output impacts in the project-region for Scenario Six of the construction phase are shown in Table 6.9. The impacts are spread across the regions as follows: $6.04 million of the total occurred in the PWR region, $0.33 million occurred in the ROS region, and only $0.01 million occurred in the project-region. It can be said that the project-region experienced almost no output impacts and that the majority of the impacts occurred in the PWR region. The results of this scenario are similar to those generated for Scenario Five.

6.1.4 Spatial Distribution of Aggregate Gross Output Impacts from the Construction Scenarios

In the preceding sections, the spatial distribution of output impacts for each scenario was discussed individually. For the purpose of comparing output impacts from the six scenarios, the aggregate output impacts by region and scenario are shown in

Table 6.10. For each scenario, the total gross output in the provincial economy is given as the column total. For Scenarios One, Three, Four, Five and Six, output increased by

Table 6.9 Spatial Distribution of Output Impacts of Construction Scenario Six ($ Million)

SECTOR	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Total
Ethanol Industry	0	0	0	0	0	0	0	0
CPS Wheat	0	0	0	0	0	0	0.001	0.001
Cattle	0	0	0	0	0	0	0.039	0.039
Other Agriculture	0	0	0	0	0	0	0.096	0.096
Fishing/Forestry	0	0	0	0	0	0	0.024	0.024
Mining	0	0	0	0	0	0	0.148	0.148
Manufacturing	1.134	0.003	0	0	0	0	0	1.137
Construction	1.628	0.012	0.003	0.001	0.001	0.001	0.002	1.647
Transport & Stor.	0.094	0.001	0	0	0	0	0.001	0.095
Communic & Util.	0.346	0.003	0	0	0	0	0	0.349
Wholesale Trade	0.240	0.001	0	0	0	0	0	0.242
Retail Trade	0.213	0.007	0.001	0.004	0.002	0.001	0.001	0.229
FIRE	1.848	0.006	0.001	0.002	0.004	0.009	0.009	1.878
Services	0.538	0.010	0.001	0.001	0.001	0.002	0.009	0.562
TOTAL	6.040	0.042	0.005	0.008	0.007	0.013	0.330	6.446

Table 6.10. Spread of Aggregate Output Impacts for Various Construction Scenarios ($ Million)

	Scenario					
Study Region	S1	S2	S3	S4	S5	S6
PWR	6.04	0.40	4.29	4.30	6.04	6.04
SWR	0.04	5.69	0.76	0.76	0.04	0.04
CSC	0.01	0.01	1.03	0.57	0.01	0.01
PSC	0.01	0.03	0.01	0.46	0.01	0.01
FCC	0.01	0.01	0.01	0.01	0.01	0.01
MCC	0.01	0.01	0.02	0.01	0.01	0.01
ROS	0.33	0.34	0.33	0.33	0.33	0.33
Total	6.45	6.49	6.46	6.46	6.45	6.45

almost $6.46 million. The largest impact is $6.49 million which was generated for Scenario Two. The elements along the main diagonal of Table 6.10 are the intraregional output impacts. The highest level of intraregional output impacts was $6.04 million which occurred under Scenario One. This was followed by $5.69 million generated for Scenario Two, and this decreased to $1.03 million for Scenario Three. The lowest intraregional output impacts were realized under Scenarios Five and Six, which were estimated at $0.01 million. The off-diagonal elements are the interregional output impacts; they range in value from $0.01 million to $6.04 million. The largest interregional impacts for all the scenarios occurred for Scenarios Five and Six. The interregional output impacts resulting from Scenarios One and Two were the lowest. For all the six scenarios, the interregional output impacts experienced by the ROS region were in the magnitude of about $0.33 million. In summary, the intraregional gross outputs seem to conform to the hierarchical levels of regions, decreasing in magnitude down the hierarchy from top to lower-order regions. These aggregate output impacts for the various scenarios are also shown below in Figure 6.1. in terms of project-region impacts and non-project-region impacts.

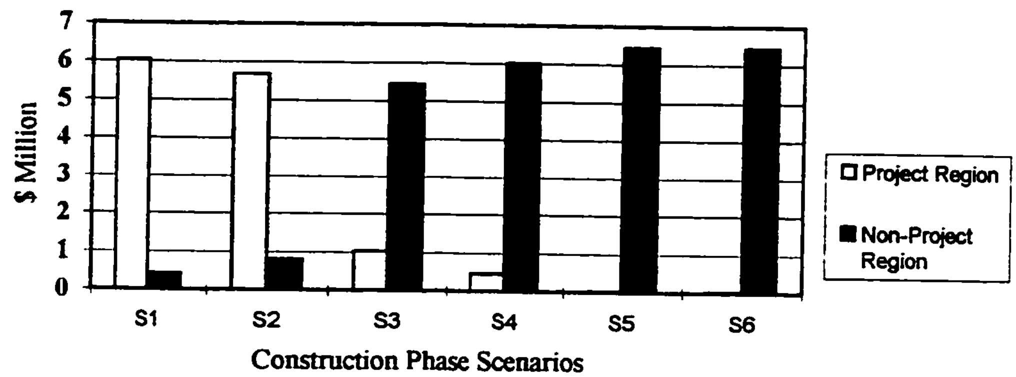

Figure 6.1. Spread of Aggregate Output Impacts for Various Construction Scenarios

As shown in Figure 6.1, for Scenarios One and Two, the major part of the aggregate gross output impacts occurred in the project-region. In the case of Scenarios Three and Four, most of the aggregate gross output impacts were experienced in the non-project-region. In contrast, for Scenarios Five and Six, the results show that all the aggregated output impacts occurred in the non-project region.

6.1.5. Spatial Distribution of Aggregate Labor Income Impacts from the Construction Scenarios

The impacts on labor income, other value added and imports into Saskatchewan resulting from the construction expenditures for the six scenarios are presented in Table 6.11. The total labor income impact on the provincial economy was $1.77 million, total value added was $2.66 million, and imports into Saskatchewan were valued at $11.11 million. The results for the construction scenarios indicated that a very large percentage of construction expenditures went to imports from out-of-province.

Table 6.11. Aggregated Labor Income Impacts for the Construction Scenarios ($ Million)

Item	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
PWR	1.57	0.12	1.13	1.13	1.57	1.57
SWR	0.02	1.28	0.17	0.17	0.02	0.02
CSC	0.00	0.00	0.21	0.10	0.00	0.00
PSC	0.01	0.04	0.01	0.11	0.01	0.01
FCC	0.02	0.03	0.03	0.03	0.02	0.02
MCC	0.06	0.05	0.07	0.07	0.06	0.06
ROS	0.08	0.26	0.16	0.17	0.08	0.08
Total Labor Income	1.77	1.79	1.78	1.78	1.77	1.77
Other Value Added	1.64	1.65	1.65	1.65	1.64	1.64
Total Value Added	2.66	2.67	2.66	2.66	2.66	2.66
Total Import)	11.11	11.11	11.11	11.11	11.11	11.11

The largest labor income impacts were $1.57 million which occurred in the PWR region, for Scenarios One, Five and Six. This was followed by $1.28 million in the SWR region under Scenario Two. From scenarios Three to Six, the project-region experienced less labor income impacts than the outside regions. The largest share of the interregional labor income impacts was captured by the PWR region. The results indicate that the MCC and FCC regions depend totally on the PWR region for the supply of inputs required to satisfy the construction activity. They also signal the weak interindustry structure that exists in the lower-level regions, and the inability to meet the final demand changes arising from the construction activity in the region.

6.1.6 Estimated Type II Output Multipliers for the Construction Scenarios

The aggregate impacts of output reported in section 6.5.7 were converted into Type II pseudo multipliers of output. The pseudo multiplier estimates the change in economic activity for one dollar of the direct value of goods and services produced by the sector. The pseudo output multiplier, as presented in Table 6.12, was estimated as the ratio of total output impacts (direct, indirect and induced) to the total construction expenditure. Furthermore, the intraregional output multiplier was defined as the ratio of the total output impacts captured by the project-region to the total construction expenditures. Similarly, the interregional output multiplier was defined as the ratio of total output impacts captured by the non-project region to the total construction expenditures.

Table 6.12. Total Output Multipliers for Construction Scenarios

Impact Region	Scenarios					
	S1	S2	S3	S4	S5	S6
PWR	0.414	0.027	0.294	0.295	0.414	0.414
SWR	0.003	0.390	0.052	0.052	0.003	0.003
CSC	0.000	0.000	0.071	0.039	0.000	0.000
PSC	0.001	0.002	0.001	0.032	0.001	0.001
FCC	0.001	0.001	0.001	0.001	0.001	0.001
MCC	0.001	0.001	0.001	0.001	0.001	0.001
ROS	0.023	0.023	0.023	0.023	0.023	0.023
Provincial Level Multiplier	0.442	0.445	0.443	0.443	0.442	0.442

As shown in Table 6.12, the highest intraregional multipliers occurred in the PWR region under Scenario One. The intraregional output multipliers decreased in magnitude down the hierarchy from top (PWR) to bottom (ROS) region. On the other hand, the interregional output multipliers tended to increase down the hierarchy from Scenario One to Scenario Six. Overall, the total output multipliers for the province under each construction scenario was around 0.442. This means that for every dollar of construction expenditure 44 cents was generated in the provincial economy.

6.1.7 Estimated Type II Labor Income Multipliers for the Construction Scenarios

The labor income multiplier was defined as a ratio of total labor income in a region to the total construction expenditures. The estimates of labor income multipliers for the construction scenarios are presented in Table 6.13. It is shown that for every dollar of construction expenditure incurred by the ethanol-cattle production complex under each scenario, $0.12 of labor income was generated in the provincial economy.

The intraregional labor income multipliers are the elements along the main diagonal of Table 6.13, while the interregional labor income multipliers are given by the off-diagonal elements. As shown in this table, under each scenario, the 12 cents is distributed among workers drawn from the seven study regions. The PWR region dominated other regions in terms of intraregional labor income multiplier; it captured almost 11 cents of this total of 12 cents income generated in the province for Scenario One. The intraregional labor income multipliers decreased from 9 cents for the SWR region, to about 1 cent in the CSC and PSC regions. For the FCC and MCC regions, the intraregional labor income multipliers were almost zero.

Table 6.13 Labour Income Type II Multipliers of the Construction Scenarios

Impact Region	Scenarios					
	S1	S2	S3	S4	S5	S6
PWR	0.108	0.008	0.077	0.077	0.108	0.108
SWR	0.002	0.088	0.012	0.012	0.002	0.002
CSC	0.000	0.000	0.014	0.007	0.000	0.000
PSC	0.001	0.003	0.001	0.007	0.001	0.001
FCC	0.001	0.002	0.002	0.002	0.001	0.001
MCC	0.004	0.004	0.005	0.004	0.004	0.004
ROS	0.006	0.018	0.011	0.012	0.006	0.006
Provincial Level Multiplier	0.122	0.122	0.122	0.122	0.122	0.122

In general, the results tended to conform to the hierarchical level of regions in the province. The lower-level regions, such as CSC, PSC, FCC and MCC, experienced smaller intraregional and interregional impacts. These lower-order regions experienced larger leakages of impacts and received little labor income leakages from other regions.

6.1.8 Spillover Coefficients of Output

The spillover coefficient was defined for each scenario as the ratio of the total interregional output impacts to the total output impact. The estimated output spillover coefficients for the six scenarios are presented in the bottom row of Table 6.14. Note that the elements along the main diagonal are the intraregional shares of total output and are subtracted from one to give an estimate of total spillover coefficients for each scenario.

Table 6.14. Spillover Coefficients of Total Output Impacts by Region for Each Scenario during the Construction Phase.

Impact Region	Scenarios					
	S1	S2	S3	S4	S5	S6
PWR	0.94	0.06	0.66	0.67	0.94	0.94
SWR	0.01	0.88	0.12	0.12	0.01	0.01
CSC	0.00	0.00	0.16	0.09	0.00	0.00
PSC	0.00	0.00	0.00	0.07	0.00	0.00
FCC	0.00	0.00	0.00	0.00	0.00	0.00
MCC	0.00	0.00	0.00	0.00	0.00	0.00
ROS	0.05	0.05	0.05	0.05	0.05	0.05
Provincial Level Multiplier	0.06	0.12	0.84	0.93	0.99	0.99

The spillover coefficient is a relative measure of interregional impacts (leakages) per dollar of total output impacts generated by the project for a given scenario. Scenario One generated the lowest spillover coefficient, about 0.06. The spillover coefficient increased drastically from 0.12 for Scenario Two to 0.84 for Scenario Three, and increased to 0.93 for Scenario Four and reached a maximum of 0.99 under scenarios Five and Six. Again, similar to other measures of impacts used above, the spillover coefficients tended to conform to the hierarchical level of regions in the provincial economy. The lower-level regions, such as CSC, PSC, FCC, and MCC, generated larger spillover coefficients than the higher-level regions (PWR and SWR) in the construction phase of the project.

6.1.9 Spillover Coefficients of Labor Income

The spillover coefficients for labor income were generated to demonstrate the spatial distribution of labor income across the study regions for each scenario, and was estimated in the same manner as for output. The estimated spillover coefficients are given in the bottom row of Table 6.15. As one moves from Scenario One to Scenario Six, the spillover coefficients increased in magnitude from a minimum of 0.11 to a maximum of almost 0.99. Similar to spillover coefficients of gross output, the spillover coefficients of labor income increased as one moves down the hierarchy from higher-level to lower-level regions in Saskatchewan.

Table 6.15 Estimated Spillover Coefficients for Aggregated Labor Income Impacts under the Construction Scenarios

Type of Impact	Scenarios					
	S1	S2	S3	S4	S5	S6
Intraregional	0.89	0.72	0.12	0.06	0.01	0.04
Interregional	0.11	0.28	0.88	0.94	0.99	0.96
Spillover Coefficient	0.11	0.28	0.88	0.94	0.99	0.96

6.2 Economic Impacts of Operation Phase

Similar to the analysis for construction phase, the six scenarios were analyzed for the operations phase of the ethanol-cattle production complex. Each scenario represented locating and operating the ethanol-cattle production complex in one of the six regions, namely, PWR, SWR, CSC, PSC, FCC and MCC. The production of ethanol and cattle from an integrated production complex for each scenario was estimated at $22.09 million during 1992. This activity generated additional economic activity in the project-region as well as in other regions of the province through purchases of inputs required for the production of ethanol and beef cattle. The impacts of the operation activity of this sector were calculated as type II, which included direct, indirect and induced impacts. The results are presented in terms of (1) Gross output, (2) Labor income, (3) Non-labor value added, (4) GDP (market prices)[2], and (5) Imports and leakages.

6.2.1 Direct Impacts of Integrated Ethanol-Cattle Production complex Operation

The operation of an integrated ethanol-cattle production complex in one of the six study regions created direct impacts on the provincial economy through the purchases of goods and services worth $22.08 million. The breakdown of the direct impact purchases for the operation phase is given in Table 6.17. Out of the $22.08 million, the total purchases made in Saskatchewan amounted to $19.08 million, while the value of imports margins amounted to $3.01 million. This value of imports is the estimated value of imports and import margins associated with the commodities purchased within the province. The import margins were estimated by multiplying the value of commodity purchases by the corresponding provincial import coefficient.

6.2.2 Spatial Distribution of Direct Impacts for the Operation Scenarios

The direct impacts of each operation scenario were distributed among supplying sectors located within the project-region and other regions. The spatial distribution of aggregate direct impacts for the six scenarios is given in Table 6.17. Each column shows the distribution of direct impacts for a given scenario in terms of intermediate purchases from the seven regions, labor income, other value added, and imports. For each of the six scenarios, intermediate purchases from the ROS region amounted to $10.33 million. These intermediate purchases included mostly the agricultural products such as Canadian

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[2] GDP =wages + salaries +supplementary labor income + corporation profits + net income of unincorporated business + inventory valuation + indirect taxes - subsidies + capital consumption allowance + miscellaneous valuation adjustment.
Or simply GDP = Labor income + Other Value Added

Prairie Spring wheat, barley (feed grains), feeder calves, and straw, hay and silage supplies.

Table 6.16 Direct Impact Purchases for the Operation of the Integrated Ethanol-Cattle Production complex. ($ Million)

No.	Commodity	Total Amount	Saskatchewan Purchases	Imports
1	Grains/ CPS Wheat	2.31	2.31	0.00
1	Grains / Barley	2.23	2.23	0.00
2	Live Animals	8.67	7.50	1.17
3	Hay + Straw + Silage	0.46	0.46	0.10
11	Natural Gas	0.20	0.06	0.13
18	Wet Distiller's Grain (Feed)	1.01	1.01	0.00
22	Yeast & Enzymes	0.47	0.06	0.41
62	Fuel & Oil	0.04	0.01	0.03
66	Veterinary Supplies	0.30	0.00	0.30
72	Repair & Maintenance	0.42	0.42	0.00
76	Telephone	0.02	0.02	0.00
78	Elec. Power	0.20	0.19	0.00
79	Water	0.21	0.11	0.11
82	Land Rent	0.01	0.01	0.00
83	Other Finance, Ins., Real Estate	1.91	1.21	0.70
84	Business Services	0.08	0.03	0.06
89	Other Personal & Misc. Services	0.01	0.00	0.00
91	Operating, Office, Lab. & Food	0.02	0.02	0.00
92	Advertising & Promotion Travel	0.01	0.01	0.00
95	Indirect Taxes	0.01	0.01	0.00
96	Subsidies	-2.42	-2.42	0.00
97	Wages & Salaries	1.41	1.41	0.00
100	Other Operating Surplus	4.43	4.43	0.00
	Total	21.99	19.08	3.01

For all scenarios, intermediate purchases from the ROS region were valued at $10.33 million, labor income was $1.41 million, other value added was $2.08 million and imports amounted to $3.01 million. A closer look at the spread of the aggregate intermediate purchases among the six regions, excluding ROS, revealed that (1) Under Scenarios One and Two, this portion of the direct impact went to the project-region. (2) For scenarios Three to Six, the aggregate intermediate impact was shared between PWR and the project-region. (3) Direct impact occurring in the project-region tended to decrease as one moves from the top two regions to the next two and then to the bottom two regions in the central place hierarchy. This reflects the increasing dependence on the PWR for the supply of inputs required to operate an integrated ethanol-cattle production complex. This information is also indicative of the location of the major impacts of the project.

Table 6.17. Spatial Distribution of Direct Impacts of Operation Scenarios ($ Million)

Impact Region	Scenarios					
	S7	S8	S9	S10	S11	S12
PWR	5.27	0	2.66	2.66	4.25	4.25
SWR	0	5.27	0	0	0	0
CSC	0	0	2.61	0	0	0
PSC	0	0	0	2.61	0	0
FCC	0	0	0	0	1.01	0
MCC	0	0	0	0	0	1.01
ROS	10.33	10.33	10.33	10.33	10.33	10.33
Labor Income	1.41	1.41	1.41	1.41	1.41	1.41
Other Value Added	2.08	2.08	2.08	2.08	2.08	2.08
Imports	3.01	3.01	3.01	3.01	3.01	3.01
TOTAL	22.09	22.09	22.09	22.09	22.09	22.09

6.2.3 Gross Output Impacts at the Provincial Level.

The total gross output impacts of the various operations phase scenarios were estimated as a sum of the direct, indirect and induced output impacts generated in the provincial economy. The total gross output impacts in the provincial economy during 1992 were estimated at $44.34 million. For each scenario this amount was distributed differently among project-region and other regions. The most affected sectors for the operation scenarios included Cattle, Other Agriculture, CPS Wheat, Manufacturing, Transportation and Storage , Services, and Finance, Insurance and Real Estate (FIRE), and Services. The impact on these sectors was that output increased by $7.33 million for Cattle, by $3.58 million in Other Agriculture, $3.18 million for FIRE, $1.95 million for

Services, $1.92 million for Transportation and Storage, and $1.47 million for CPS Wheat, and $1.08 million for Manufacturing, and Finance and Real Estate.

6.2.4 Gross Output Impacts for Various Scenarios

Since various primary sectors, namely; CPS Wheat, Cattle and Other Agriculture, Forestry and Fishing, and Mining are located in the ROS region, most of these impacts[3] would be realized in that region as well. It is observed that all the six operations phase scenarios had an equal output impact on these sectors. This is not surprising, given that the direct impact expenditure on the ROS region was the same for the six scenarios.

The gross output impact for each operation scenario on the ROS region was that the total output increased by $13.38 million. This output impact was distributed mostly among the primary sectors as mentioned above. Since the impact on the ROS region is the same for the six scenarios, the focus in this next section is on an examination of the differences in the gross output impacts in the six regions (excluding ROS). Furthermore, because the ROS region is the host to the primary sectors in the province, a discussion of non-primary sectors was preferred.

Gross Output Impacts Resulting from the Operation Scenario One: The gross output impact estimates resulting from Scenario One, when the project-region is PWR, are presented in Table 6.18. The impact of this scenario on the provincial economy was that total gross output increased by $43.35 million. Out of this, $32.83 million was an increase in total gross output impacts which occurred in the project-region, and $13.38 million was experienced in the ROS region. The other regions such as SWR, CSC, PSC, FCC and MCC, experienced minimal impacts. Thus, it can be said that the impacts were confined to the PWR and ROS regions. The ROS region served as the supplier of agricultural products to the ethanol-cattle production complex located in the PWR region, while the non-primary sectors located in the PWR region satisfied the inputs required from such sectors by the project.

Gross Output Impacts Resulting from the Operation Scenario Two: The gross output impacts resulting from Scenario Two during the operations phase are shown in Table

[3] Based on the assmptions made. It is possible some impacts would be felt in other regions.

6.19. The impact on the provincial economy was an increase in gross output by $46.39 million. As was the case in Scenario One, the ROS region realized an increase of $13.38 million in total gross output. The gross output for PWR was estimated at $3.85 million and at $28.87 million for the project-region (SWR). The gross output impacts on the other regions were almost zero.

Table 6.18. Spatial and Sectoral Distribution of Gross Output Impacts of Operations Phase Scenario One ($ Million)

	Region of Impact							
SECTOR	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Total
Ethanol Industry	22.09	0	0	0	0	0	0	22.09
CPS Wheat	0	0	0	0	0	0	1.47	1.47
Cattle	0	0	0	0	0	0	7.33	7.33
Other Agriculture	0	0	0	0	0	0	3.58	3.58
Fishing/Forestry	0	0	0	0	0	0	0.03	0.03
Mining	0	0	0	0	0	0	0.19	0.19
Manufacturing	1.04	0.03	0	0	0	0	0	1.08
Construction	0.62	0.04	0.01	0.03	0.01	0.01	0.06	0.78
Transport & Stor.	1.90	0.01	0	0	0	0	0.02	1.92
Communic & Util.	1.16	0.03	0	0	0	0	0	1.19
Wholesale	0.78	0.01	0	0	0	0	0.03	0.82
Retail Trade	0.46	0.10	0.03	0.07	0.02	0	0.07	0.75
FIRE	2.86	0.05	0.01	0.02	0.01	0.02	0.22	3.18
Services	1.32	0.23	0.00	0.01	0.01	0.00	0.38	1.95
TOTAL	32.23	0.48	0.04	0.13	0.05	0.03	13.38	46.35

Thus, operating an ethanol production complex in SWR region generates impacts which are spread across three regions, SWR, PWR and ROS. These gross output impacts, however, are concentrated mostly in the ROS region and the project-region.

Gross Output Impacts Resulting from the Operation Scenario Three: The gross output impacts of Scenario Three are shown in Table 6.20. This scenario caused gross output to increase by $46.36 million in the provincial economy. The level of gross output impacts experienced by CSC, the project-region, was $24.29 million, which was followed by

$13.38 million realized by the ROS region. The level of output impacts in the PWR region was around $7.97 million. The impacts on the SWR region were about $0.48 million. The other regions had very minimal impacts, close to zero.

Table 6.19. Spatial and Sectoral Distribution of Gross Output Impacts of Operations Phase Scenario Two ($ Million)

	Impact Region							
SECTOR	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Total
Ethanol Industry	0	22.09	0	0	0	0	0	22.09
CPS Wheat	0	0	0	0	0	0	1.47	1.47
Cattle	0	0	0	0	0	0	7.33	7.33
Other Agriculture	0	0	0	0	0	0	3.58	3.58
Fishing/Forestry	0	0	0	0	0	0	0.03	0.03
Mining	0	0	0	0	0	0	0.19	0.19
Manufacturing	0.82	0.25	0	0	0	0	0	1.08
Construction	0.07	0.59	0	0.03	0.01	0.01	0.06	0.78
Transport & Stor.	0.11	1.80	0	0	0	0	0.02	1.93
Communic & Util.	0.59	0.60	0	0	0	0	0	1.19
Wholesale Trade	0.16	0.63	0	0	0	0	0.03	0.82
Retail Trade	0.16	0.40	0.03	0.08	0.02	0	0.07	0.76
FIRE	1.14	1.76	0.01	0.03	0.01	0.02	0.23	3.19
Services	0.81	0.74	0	0.02	0.01	0	0.38	1.96
TOTAL	3.85	28.87	0.04	0.16	0.06	0.03	13.39	46.39
Regional Share	0.08	0.62	0	0	0	0	0.29	1.00

As before, sectors most affected in the ROS region are the primary sectors. The output increases in the PWR region were in Manufacturing, Communication, Wholesale, FIRE and Services sectors. In the project-region, besides operating the integrated ethanol-cattle production complex, some increased output occurred in Transport and Storage, Wholesale Trade, FIRE, Services, and Manufacturing sectors, but these increases were smaller compared to those experienced by the PWR region.

<u>Gross Output Impacts Resulting from the Operation Scenario Four</u>: The gross output impacts resulting from Scenario Four during the operation phase of the project are presented in Table 6.21. The spread of the gross impacts across the regions is as follows: $24.29 million of gross output impacts occurred in the project-region, $13.38 million in the ROS region, and $7.97 million of gross output increase occurred in the PWR region.

It is worth noting that the spatial distribution of output impacts under this scenario is similar to the results obtained for Scenario Three. The impacts are spread among three regions-- PWR, ROS and the project-region. Similar to operation Scenario Three, the gross output impacts of the operations phase in the other regions were almost zero.

Table 6.20. Spatial and Sectoral Distribution of Gross Output Impacts of Operation Phase Scenario Three ($ Million)

	Impact Region							
SECTOR	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Total
Ethanol Industry	0	0	22.09	0	0	0	0	22.09
CPS Wheat	0	0	0	0	0	0	1.47	1.47
Cattle	0	0	0	0	0	0	7.33	7.33
Other Agriculture	0	0	0	0	0	0	3.58	3.58
Fishing/Forestry	0	0	0	0	0	0	0.03	0.03
Mining	0	0	0	0	0	0	0.19	0.19
Manufacturing	1.02	0.03	0.03	0	0	0	0	1.08
Construction	0.57	0.03	0.06	0.03	0.01	0.01	0.06	0.78
Transport & Stor.	0.14	0.01	1.76	0	0	0	0.02	1.93
Communic & Util.	1.16	0.03	0	0	0	0	0	1.19
Wholesale Trade	0.76	0.01	0.02	0	0	0	0.03	0.82
Retail Trade	0.39	0.11	0.09	0.07	0.02	0	0.07	0.76
FIRE	2.73	0.05	0.12	0.02	0.02	0.02	0.23	3.18
Services	1.19	0.23	0.13	0.01	0.01	0	0.38	1.95
TOTAL	7.97	0.48	24.29	0.14	0.06	0.04	13.38	46.36
Regional Share	0.17	0.01	0.52	0	0	0	0.29	1.00

<u>Gross Output Impacts Resulting from the Operation Scenario Five</u>: The estimated gross output impacts resulting from Scenario Five during the operation phase are presented in Table 6.22. These impacts are concentrated in three regions-- PWR, ROS and the host-region. The level of impacts in the project region was about $22.15 million. The impacts experienced by the ROS region was around $13.38 million, and for the PWR region it was about $10.13 million of gross output. The impact on other regions was again very little. Compared to the level of impacts for Scenarios Three and Four, that in the PWR region for this scenario has increased slightly while gross impacts in the project-region have decreased. A closer look at the results shows that except for the operating of an

ethanol-cattle production complex, there are almost no output impacts from other sectors in the project-region.

Table 6.21. Spatial and Sectoral Distribution of Gross Output Impacts of Operation Phase Scenario Four ($ Million)

	Impact Region							
SECTOR	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Total
Ethanol Industry	0	0	0	22.09	0	0	0	22.09
CPS Wheat	0	0	0	0	0	0	1.47	1.47
Cattle	0	0	0	0	0	0	7.33	7.33
Other Agriculture	0	0	0	0	0	0	3.58	3.58
Fishing/Forestry	0	0	0	0	0	0	0.03	0.03
Mining	0	0	0	0	0	0	0.19	0.19
Manufacturing	1.02	0.03	0	0.02	0	0	0	1.08
Construction	0.57	0.03	0.01	0.09	0.01	0.01	0.06	0.78
Transport & Stor.	0.14	0.01	0	1.76	0	0	0.02	1.93
Communic & Util.	1.16	0.03	0	0	0	0	0.00	1.19
Wholesale Trade	0.76	0.01	0	0.02	0	0	0.03	0.82
Retail Trade	0.40	0.11	0.03	0.13	0.02	0	0.07	0.76
FIRE	2.74	0.05	0.01	0.13	0.01	0.02	0.23	3.18
Services	1.20	0.23	0	0.13	0.01	0	0.38	1.95
TOTAL	7.99	0.49	0.04	24.37	0.06	0.03	13.38	46.36
Regional Share	0.17	0.01	0	0.53	0	0	0.29	1.00

Gross Output Impacts Resulting from the Operation Scenario Six: The estimates of gross output impacts obtained for operation Scenario Six are shown in Table 6.23. The results are similar to those obtained in Scenario Five. The total impact on the provincial economy was that gross output increased by $46.35 million. The gross output impacts are spread among three regions-- PWR, ROS and the project-region (MCC). Again, the level of output increased by $22.13 million in the project-region, by $10.13 million in the PWR region, and the ROS region experienced an increase of $13.38 million in gross output. Similar to the results for Scenario Five, there is virtually no output impacts on other sectors in the project-region, other than through direct impacts of the production complex.

6.2.5 Spatial distribution of Gross Output Impacts from the Operation Scenarios

In the preceding sections, the spatial distribution of output impacts for each scenario was discussed individually. For the purpose of comparing output impacts from the six scenarios, the aggregate output impacts by region and scenario are shown in Table 6.24. For each scenario, the total gross output in the provincial

Table 6.22. Spatial and Sectoral Distribution of Gross Output Impacts of Operations Phase Scenario Five ($ Million)

	Impact Region							
SECTOR	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Total
Ethanol Industry	0	0	0	0	22.09	0	0	22.09
CPS Wheat	0	0	0	0	0	0	1.47	1.47
Cattle	0	0	0	0	0	0	7.33	7.33
Other Agriculture	0	0	0	0	0	0	3.58	3.58
Fishing/Forestry	0	0	0	0	0	0	0.03	0.03
Mining	0	0	0	0	0	0	0.19	0.19
Manufacturing	1.04	0.03	0	0	0	0	0	1.08
Construction	0.62	0.04	0.01	0.03	0.01	0.01	0.06	0.78
Transport & Stor.	1.90	0.01	0	0	0	0	0.02	1.92
Communic & Util.	1.16	0.03	0	0	0	0	0	1.19
Wholesale Trade	0.78	0.01	0	0	0	0	0.03	0.82
Retail Trade	0.46	0.10	0.03	0.07	0.02	0	0.07	0.75
FIRE	2.86	0.05	0.01	0.02	0.01	0.02	0.22	3.18
Services	1.32	0.23	0	0.01	0.01	0	0.38	1.95
TOTAL	10.13	0.48	0.04	0.13	22.15	0.03	13.38	46.35
Regional Share	0.22	0.01	0.00	0.00	0.48	0.00	0.29	1.00

economy is given as the column total. For Scenarios One, Three, Four, Five, and Six, gross output increased by about $46.36 million. The largest output was $36.39 million for Scenario Two. The higher output under Scenario Two can be attributed to the larger self-supply ratios (SSR) associated with the SWR region than for any other region during regionalization of the provincial technology. The elements along the main diagonal of Table 6.25 are the intraregional output impacts. The highest level of intraregional output impacts occurred in the PWR region at $32.23 million, followed by the SWR region at $28.87 million and then, in the CSC and PSC regions at about $24.3 million. The lowest intraregional output impact was realized for FCC and MCC regions at $22.15 million.

The aggregate impacts of the various operation scenarios are also shown in Figure 6.2 in terms of project-region impacts and non-project-region impacts. The figure shows that the project-region impacts were largest for Scenario One and decreased as one moves to Scenario Two, and further decreased under scenarios Three and Four. But between

Table 6.23. Spatial and Sectoral Distribution of Gross Output Impacts of Operation Phase Scenario Six ($ Million)

	Impact Region							
SECTOR	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Total
Ethanol Industry	0	0	0	0	0	22.09	0	22.09
CPS Wheat	0	0	0	0	0	0	1.47	1.47
Cattle	0	0	0	0	0	0	7.33	7.33
Other Agriculture	0	0	0	0	0	0	3.58	3.58
Fishing/Forestry	0	0	0	0	0	0	0.03	0.03
Mining	0	0	0	0	0	0	0.19	0.19
Manufacturing	1.04	0.03	0	0	0	0	0	1.08
Construction	0.62	0.04	0.01	0.03	0.01	0.01	0.06	0.78
Transport & Stor.	1.90	0.01	0	0	0	0	0.02	1.92
Communic & Util.	1.16	0.03	0	0	0	0	0.00	1.19
Wholesale Trade	0.78	0.01	0	0	0	0	0.03	0.82
Retail Trade	0.46	0.10	0.03	0.07	0.02	0	0.07	0.75
FIRE	2.86	0.05	0.01	0.02	0.01	0.02	0.22	3.18
Services	1.32	0.23	0	0.01	0.01	0	0.38	1.95
TOTAL	10.13	0.48	0.04	0.13	0.05	22.13	13.38	46.35
Regional Share	0.22	0.01	0	0	0	0.48	0.29	1.00

Scenario Three and Four, there is no change. For Scenario Five and Six the impacts decreased as well, but remained unchanged between the two scenarios. Generally speaking, as one moves along the hierarchy from the top region to the bottom regions, the project-region output impacts decrease from the $32 million in the PWR region to $28.87 million in the SWR region, to $24 million in the CSC and PSC regions, and to $22 million in FCC and MCC regions. Conversely, the non-project region output impacts increased as one moves from the top of the hierarchy to the bottom regions in the hierarchy. The bottom regions are more dependent on the higher-order region (PWR) for the supply of inputs required for operating an ethanol-cattle production complex.

Table 6.24. Aggregate Value of Regional Output Impacts for Various (Operations Phase) Scenarios ($ Million)

Impact Region	Scenarios					
	S1	S2	S3	S4	S5	S6
PWR	32.23	3.85	7.97	7.99	10.13	10.13
SWR	0.48	28.87	0.48	0.49	0.48	0.48
CSC	0.04	0.04	24.29	0.04	0.04	0.04
PSC	0.13	0.16	0.14	24.37	0.13	0.13
FCC	0.05	0.06	0.06	0.06	22.15	0.05
MCC	0.03	0.03	0.04	0.03	0.03	22.13
ROS	13.38	13.39	13.38	13.38	13.38	13.38
Total	46.35	46.39	46.36	46.36	46.35	46.35

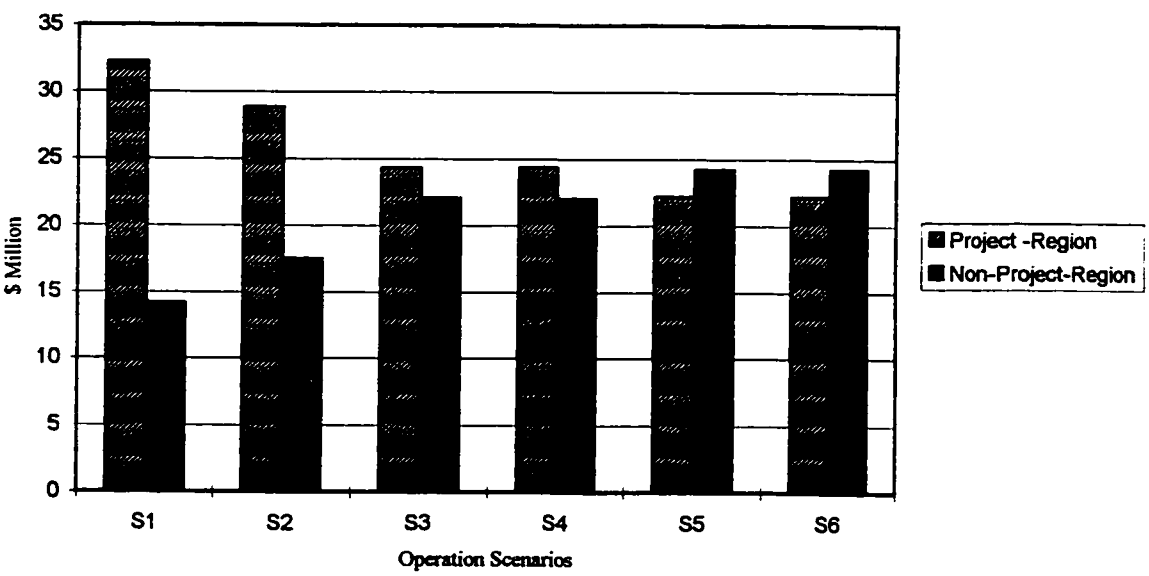

Figure 6.2. Spread of Aggregate Output Impacts for Various Operation Scenarios

6.2.6 Distribution of Labor Income, Other Value Added and Imports

The impacts on labor income, other value added and non-Saskatchewan imports resulting from the operation expenditures for the six scenarios are presented in Table 6.25. The impact of these scenarios was to increase total labor income by $6.31 million, and other value added by $8.34 million, and non-Saskatchewan imports by $4.83 million. These results indicate that the largest impact of the operation scenarios was on other value added. Furthermore, the results indicate that the labor income impacts generated by the six scenarios in a given region were not equal. The total GDP generated in the provincial economy by each operation scenario was about $14.65 million.

Table 6.25. Payments to Labor Income, Other Value Added and Imports Resulting from the Operation Scenarios ($ Million)

Impact Region	Scenarios					
	S1	S2	S3	S4	S5	S6
PWR	4.16	1.03	2.26	2.27	2.76	2.75
SWR	0.16	3.05	0.16	0.16	0.16	0.16
CSC	0.02	0.02	1.76	0.02	0.02	0.02
PSC	0.05	0.10	0.06	1.84	0.05	0.05
FCC	0.06	0.06	0.07	0.06	1.46	0.06
MCC	0.12	0.11	0.15	0.10	0.12	1.53
ROS	1.73	1.94	1.85	1.86	1.73	1.73
Total Labor Income	6.31	6.32	6.31	6.31	6.31	6.31
Other Value Added	8.34	8.36	8.35	8.35	8.34	8.34
GDP	14.65	14.65	14.65	14.65	14.65	14.65
Non-Sask. Imports	4.83	4.84	4.84	4.84	4.83	4.83

For PWR, the largest labor income impacts were $4.2 million under Scenario One. This decreased to $2.8 million under Scenario Five and Six. It further decreased to $2.3 for Scenario Three and Four, and to $1.0 million for Scenario Two. For the SWR, CSC, PSC, FCC and MCC regions, the largest labor income impact on these regions occurred for the scenario when these regions were project-host regions. In the case of the CSC to MCC regions, the intraregional labor income impacts were less than the interregional labor income ones. Most of the interregional labor income impacts for these scenarios went to the PWR and ROS regions.

6.2.7 Estimated Output Multipliers (Type II) for the Operation Phase Scenarios

The aggregate impacts of output reported in sub-Section 6.2.4 were converted into Type II pseudo multipliers. The pseudo multiplier estimates the change in economic activity for one dollar of the direct value of goods and services produced by the sector. The pseudo output multipliers, presented in Table 6.26, were estimated as the ratio of total output impacts (direct, indirect and induced) to the total operation expenditures. Within the provincial economy, the total value of the output multiplier generated for each operation scenario was 2.10.

Table 6.26. Estimated Type II Output Multipliers for the Operation Scenarios

Impact Region	Scenarios					
	S1	S2	S3	S4	S5	S6
PWR	1.46	0.17	0.36	0.36	0.46	0.46
SWR	0.02	1.31	0.02	0.02	0.02	0.02
CSC	0.00	0.00	1.10	0.00	0.00	0.00
PSC	0.01	0.01	0.01	1.10	0.01	0.01
FCC	0.00	0.00	0.00	0.00	1.00	0.00
MCC	0.00	0.00	0.00	0.00	0.00	1.00
ROS	0.61	0.61	0.61	0.61	0.61	0.61
Total	2.10	2.10	2.10	2.10	2.10	2.10

In terms of spatial distribution of the output multiplier, it was divided, similar to the construction phase, into the intraregional output multipliers and the intraregional output multipliers.. The highest intraregional multipliers occurred in the PWR region under scenario one. The intraregional output multipliers decreased in magnitude as one moves down the hierarchy from top to bottom region. In the case of scenarios 5 and 6, the intraregional output multiplier is 1.00, which implies that for the FCC and MCC regions there are no intraregional output impacts. On the other hand, the interregional output multipliers tended to increase down the hierarchy from scenario 1 to scenario 6. Overall, the total output multipliers for the province under each construction scenario was around 2.10. This means that for every dollar of operation expenditure, another $1.10 of economic activity is generated in the provincial economy.

6.2.8 Estimated Labor Income and Other Value Added, Imports Multipliers

The estimates of labor income multipliers for the operation phase scenarios are presented in Table 6.27. For every dollar of operation phase expenditures incurred by the ethanol-feedlot production complex under each scenario, $0.29 of labor income was generated in the provincial economy. The intraregional labor income multiplier was $0.19 for the PWR region. This decreased to $0.14 for the SWR region, and further decreased to about $0.08 for the CSC and PSC regions and to $0.07 for the FCC and MCC regions. The multiplier of other value added was estimated to be around $0.38 under each of the six operation scenarios. In addition, each dollar of operation expenditure, $0.22 of imports came into Saskatchewan. In terms of GDP, for every dollar of operation expenditure generated, a total of $0.67 of GDP in the provincial economy.

Table 6.27. Multipliers of Labor Income, Other Value Added and Imports Generated for the Operation Phase Scenarios

Impact Region	Scenarios					
	S1	S2	S3	S4	S5	S6
PWR	0.19	0.05	0.10	0.10	0.13	0.13
SWR	0.01	0.14	0.01	0.01	0.01	0.01
CSC	0.00	0.00	0.08	0.00	0.00	0.00
PSC	0.00	0.01	0.00	0.08	0.00	0.00
FCC	0.00	0.00	0.00	0.00	0.07	0.00
MCC	0.01	0.01	0.01	0.01	0.01	0.07
ROS	0.08	0.09	0.08	0.08	0.08	0.08
Total Labor Income	0.29	0.29	0.29	0.29	0.29	0.29
Other Value Added	0.38	0.38	0.38	0.38	0.38	0.38
Non-Sask. Imports	0.22	0.22	0.22	0.22	0.22	0.22

6.2.9 Spillover Coefficients of Output

The spillover coefficient was defined in a similar manner as for the construction phase. The estimated output spillover coefficients for the six scenarios are presented in the bottom row of Table 6.28.

Table 6.28. Spillover Coefficients of Output for Various Operation Scenarios

Type of Impact	Scenarios					
	S1	S2	S3	S4	S5	S6
Intraregional	0.70	0.62	0.52	0.53	0.48	0.48
Interregional	0.30	0.38	0.48	0.47	0.52	0.52
Spillover Coefficient	0.30	0.38	0.48	0.47	0.52	0.52

All the scenarios experienced some spillover of output impacts. The lowest spillover coefficient was 0.30 generated for Scenario One per dollar of total gross output in the provincial economy. Moving to Scenario Two, the spillover coefficient increased to 0.38. It further increased to reach a level of about 0.47 for both Scenarios Three and Four. The largest spillover coefficient was 0.52 observed under both Scenarios Five and Six. Again, similar to other measures of impacts used above, the spillover coefficients tended to conform to the hierarchical level of regions in the provincial economy. The lower-level regions were associated with larger spillover coefficients than the higher-level regions in the operation phase of the project.

6.2.10 <u>Spillover Coefficients of Labor Income</u>

Similar to the spillover coefficients of output for the operation scenarios, these coefficients were estimated for labor income in order to demonstrate the spatial spread across the study regions of each dollar of labor income generated in the provincial economy. These are shown in Table 6.29.

Table 6.29. Spillover Coefficients of Labor Income for the Operation Scenarios

Measure	Scenarios					
	S1	S2	S3	S4	S5	S6
Intraregional	0.66	0.48	0.28	0.29	0.23	0.24
Interregional	0.34	0.52	0.72	0.71	0.77	0.76
Spillover Coefficient	0.34	0.52	0.72	0.71	0.77	0.76

The largest spillover coefficients of labor income was 0.77 which occurred in both Scenarios Five and Six. This decreased to about 0.72 for Scenarios Three and Four. It further decreased to 0.52 under Scenario Two, and to the lowest value of 0.34 under Scenario One. In essence, the spillover coefficients of labor income increased moving down that hierarchy from top to bottom regions.

6.3 Implications of Results for Future Ethanol Industry Development in Saskatchewan

The results obtained for the two phases of the project had a similar pattern of spatial distribution, even though they differed in terms of magnitude of various measures. In light of the very similar results of the construction and operation phases, implications of these results are treated together in this section. The impact on the provincial economy was that gross output increased by $6.5 million for each of the six construction scenarios and by about $46.4 million under the various operation scenarios. The differences, however are observed in the spatial distribution of those impacts of each scenario across the seven study regions under each phase. These differential impacts have important implications for future ethanol industry development in Saskatchewan. The following implications are worth noting:

(1) The largest output and labor income impacts occurred in the PWR and SWR regions. These two regions also exhibited the lowest spillover coefficients of both output and labor income. This implies that if the public goal is to increase output and labor income for the project-region, the development of an ethanol-cattle production complex should take place in the PWR and SWR regions.

(2) The lower-order regions (MCC and FCC) had the highest levels of spillover coefficients and the least output and labor income impacts. It can thus be said that locating ethanol production complexes in such communities would not improve their output or labor income (employment).

(3) The mid-level regions, such as CSC and PSC, experienced moderate levels of spillover coefficients of both labor income and output. The values were between those experienced by the higher-level regions and lower-level regions. Thus, the

CSC and PSC regions generated medium level impacts. This implies that locating an ethanol-cattle production complex at this level in the hierarchy would improve output or labor income more than lower-level regions but not more than the higher-level regions.

The results generated in this study have important implications for rural development policy. First, they provide an insight into why some regions may be favored over other regions as sites for locating ethanol production complexes. It is important to realize that although an ethanol-cattle production complex presents a new opportunity for economic development, not all regions will capture the benefits of such projects. The analysis of the impacts of construction and operation of an integrated ethanol-cattle production complex in six different sized regions indicated that the higher-level regions experienced larger output and labor income impacts, and had relatively smaller spillover coefficients compared to other regions. These higher-level regions have more diversified economies than lower-level regions. They have lower leakages of income and spending. On the other hand, lower-level regions experienced large income leakages through input purchases and consumer spending in neighbouring higher-level regions. The results indicate that lower-level places will not benefit more than higher-level places. Thus, if the goal of public funding of such projects is to maximize impacts in the project-region, then higher-level regions should be preferred to lower-level regions. This raises a concern that the opportunity of pursuing regional development through the creation of ethanol-cattle production complexes may not reach all those communities who need it the most, especially the smaller communities.

In general the above results indicated that establishing an ethanol-cattle production complex at any level in the hierarchy led to some positive impacts on the provincial economy. For policy-makers considering ethanol-cattle production complexes as a strategy for economic development, the focus should go beyond the positive impacts of the project to include the costs (or leakages) associated with the subsidies which are used to promote ethanol production in Saskatchewan. In short, the questions of how to achieve sustainable rural development through ethanol-cattle production complexes in the absence and presence of subsidies need to be addressed. However, this question is beyond the scope of this study.

CHAPTER 7

SUMMARY AND CONCLUSIONS

7.1 Summary

7.1.1 Need for the Study

Agriculture is an important sector in the Saskatchewan economy. Most rural communities in the province are largely dependent, either directly or indirectly on agricultural pursuits. In many such communities, economic performance and viability are largely determined by the level and stability of farm income. Through the intersectoral linkages between agriculture and non-agriculture sectors in the economy, the fortunes influencing the agriculture sector get transmitted to non-agricultural sectors, and through that to the region as a whole. Agriculture in Saskatchewan is dominated by the production of wheat and barley. In addition, Saskatchewan agriculture depends on world grain markets, where it exports 50-80 percent of annual wheat and barley production. During the 1980s and part of the 1990s, agriculture was adversely affected by low commodity prices and fluctuations in the prices, and this has caused instability and reduced farm income for agricultural producers and related sectors.

Apart from reduced farm incomes resulting from the adverse world market influences on agriculture, the performance of rural communities has been affected by consolidation both in agriculture and in the trade centre system. Consolidation in agriculture has resulted from the substitution of capital for labor, which has led to an increase in farm size, a decrease in labor requirements on farms and resulting in part, in outmigration of farm families from rural areas. This loss in rural population has led to a loss of economic activity and employment in small rural communities and has threatened their viability. Within agriculture, in addition to the surplus labor created by labor-saving technology, the problem of underemployment[4] also exists. This is caused by the seasonality of production, and immobility of farmers due to remoteness or lack of access to non-farm employment opportunities in major urban centres. Consolidation of the trade centre system has resulted from improvements in transportation and communication. Partially it is a response to changes in fiscal realities, leading to closures of many public and private services (elevators, schools, hospitals, post offices, among others) in smaller centres, while maintaining these services in larger centres. The net effect of adverse factors on agriculture and consolidation of farms and of the trade centre system, is unbalanced regional growth. The households in rural communities have lower incomes and high rates of unemployment than their urban counterparts.

In an attempt to address the adverse situation threatening the viability of rural communities, Saskatchewan government has recognized the need to continually develop an economically and environmentally sustainable agriculture and food industry in the province. In this regard, diversification of agriculture and the food sector has been selected as a major strategy for rural community development in Saskatchewan. One avenue for diversification of agriculture, that has attracted public attention, is the production of ethanol using locally available grains. Diversification through ethanol production, along with its linkages with cattle feeding, has became an acceptable strategy that has received both provincial and federal government assistance. A number of communities in Saskatchewan seeking economic development have shown interest in establishing an ethanol-cattle production complex because of the perceived benefits a region can capture from such a project. Such a complex can create a stable market for grain producers, support local businesses through buying intermediate inputs from them, and create some jobs in the local community and thus boost the local economy and enhance the social-well being and viability of the community. In spite of this interest and the perceived benefits, communities lacked information on the types and magnitude of

[4] Underemployment means that a portion of the labor resource (person-years) can be diverted to non-farm uses without reducing farm income.

benefits the different sizes of communities could capture from such projects. This study was initiated to fill this information gap.

Study of effectiveness of ethanol production in terms of rural community development can be supported on several grounds. In the context of a comprehensive assessment of ethanol production, rural development benefits are one of the significant contributors to the total benefits. Knowledge of how ethanol production affects a given community can be very useful in addressing rural development issues surrounding such projects. Impacts of such projects on target groups versus leakages to other groups in the society would enhance the ability of policy-makers to design better economic development programs for rural areas. A case for ethanol production in rural areas can also be made on grounds that in many smaller communities new employment opportunities are relatively few. Yet, these communities are facing rapidly declining population, and high levels of underemployment, caused in part, by immobility of human resources. Knowledge of what type of economic impacts are created by ethanol production on different sized communities will be useful in this regard.

7.1.2 Problematic Situation

The problem addressed by this study concerns the investigation of potential impacts of an integrated ethanol-cattle production complex for six different sized regions within Saskatchewan. This is important because ethanol production complexes will generate different impacts and benefits in the project-region and neighboring regions. The magnitude of impacts in the regions will depend on the economic base of the regions and the actions and reactions of economic agents in them. In addition, based on the expected benefits of an ethanol project, governments have provided subsidies for such projects as a means to strengthen rural communities. For assessment purposes, the effectiveness of such projects should be measured in terms of total impacts, which include both the direct and indirect impacts. Spillover effects should also be measured because the impacts are not confined only to the target region, but spill also into adjacent regions. For modeling this type of problem, the study used an interregional input-output framework. However, since a study by Stabler et al. (1992) has suggested that communities in Saskatchewan operate in a hierarchical manner and can be classified using the Central Place theory, the analytical framework adopted for this study involved both the Central Place theory and input-output analysis.

7.1.3 Objectives of the Study

The objectives of this study were (1) to develop a hierarchically-based interregional economic structure of the Saskatchewan province; (2) to simulate the direct and spillover impacts of integrated ethanol-cattle production complex across six hierarchical regions; (3) to measure the differences in spillover effects captured by various types of communities under alternative location decision for the complex; and (4) to draw policy implications for development of integrated ethanol-cattle production complexes in Saskatchewan.

7.1.4 Study Methodology

In order to achieve the stated objectives of this study, an open static interregional input-output model of Saskatchewan was developed for the year 1992. Within this model, the Saskatchewan economy was divided into seven hierarchically-based regions. The seven regions are referred to as (1) Primary Wholesale-Retail centre (PWR); (2) Secondary Wholesale-Retail centre (SWR); (3) Complete Shopping centre (CSC); (4) Partial Shopping centre (PSC); (5) Full Convenient centre (FCC); (6) Minimum Convenient centre (MCC); and (7) Rest of Saskatchewan (ROS). The model contained 14 aggregated producing sectors, and three final demand components (other final demand sector, household sector and exports). A smaller number of aggregated sectors were selected to make the model operational, even though this causes some aggregation bias in the model and model results. The seven regional input-output matrices were estimated using the Supply-Demand Pool (SDP) method which is a non-survey method. It estimates regional I-O coefficients by modifying national (or larger regional) coefficients. The SDP method is based on satisfying local requirements and final demand from regional sources. The method was used because it was less expensive than survey method, since it required less details on economic activities in various regions. The interregional trade flows were derived by using the regional imports and exports estimated from the SDP method in combination with logic based on some assumptions regarding trade patterns within the central place region.

The seven regions were linked through two patterns of trade. One, it was assumed that in the rest-of-Saskatchewan (ROS) region, industries earned their income by supplying goods from the natural-resource based sectors (agriculture, forestry & fishing and mining) to the higher-level regions and outside of the province. Two, it was assumed that higher-level regions earned their income by supplying manufactured goods and services to lower-level regions, the hinterland (called ROS) and outside of the province.

Within this model the labor income was paid by each producing sector to seven types of workers defined according to their place of residence. This was facilitated by using commuting data, which gave a break-down of total place-of-work employment into non-commuters and in-commuters. On the final demand side, the model included seven different household sectors.

To complete the closing of the model with respect to households, a total of seven columns of personal consumption expenditures were included. The total personal consumption expenditures made by residents of a given region were adjusted for outshopping expenditures (leakage), in order to avoid over-estimating the impact of the household sector on the project region. Furthermore, the cross-region payments of labor income were checked to ensure that they were in balance with cross-region receipts for each region. The endogenous consumption expenditure for each region was set to be equal to the total labor income received by residents in that region.

7.1.5 Impact Analysis

The estimated seven region I-O model, which was closed with respect to seven households, was used to assess the economic impacts resulting from the construction phase and operation phase of an integrated ethanol-cattle production complex. Six alternative scenarios were considered under each phase, where each scenario referred to locating the ethanol-cattle production complex in one of the six regions (PWR, SWR, CSC, PSC, FCC and MCC).

The construction phase analyzed the impact on the project-region and other regions resulting from expenditures on construction materials required for building an ethanol processing production complex and expanding the feedlot complex. Each construction scenario was implemented as a final demand change. The impacts were measured in terms of gross sectoral output, labor income, other value added, and imports. These were subsequently converted into output and income multipliers. Spillover coefficients of labor income and output were also calculated as summary measures for each scenario to demonstrate the spatial distribution of impacts (leakages).

The operations phase sought to evaluate the impacts of operating an integrated ethanol-cattle production complex in the same six alternative regions. The implementation of each scenario involved inserting the new industry in the economy, hence changing the economic structure partially. The base model was augmented with a column and row of coefficients for the integrated ethanol-cattle production complex in the appropriate region to produce the scenario impact model. The transactions required to support the new economy (scenario model) were also estimated. The difference in the total transactions between the base table and the scenario table was the impact of the new project. For each of the six scenarios, the impacts were estimated in terms of gross output, labor income, value added, and imports. Similar to the impacts of the construction scenarios, various multipliers and spillover coefficients were also calculated.

7.2 Highlights of Results

The impacts of construction scenarios on the provincial economy included an increase in total gross output by $6.44 million, and an increase in total labor income by $1.11 million. Total value added increased by $2.65 million and imports from outside of Saskatchewan increased by $11.1 million. In this scenario, the largest intraregional output impacts occurred in the PWR region, followed by the SWR region, and decreased down the hierarchical level of regions. As a measure of interconnectedness, the spillover coefficient showed that the output spillovers were lowest in the PWR and SWR regions, but increased to more than 0.80 down the hierarchy. The labor income spillover coefficients were 0.11 for Scenario One (production complex in PWR region) and increased to 0.28 for Scenario Two (production complex in SWR region), and to about 0.94 for Scenario Four (production complex in PSC region) to Six (production complex in MCC region).

The impacts of the operation scenarios on the provincial economy were an increased gross output by $44.34 million. Within the province, the operation scenarios resulted in payments of $6.3 million to labor income, $8.34 million to other value added, and $4.8 million for imports from outside of Saskatchewan. The intraregional impacts ranged from the largest value of $32.2 million for Scenario One (production complex in PWR region) to the lowest value of $22.1 million for Scenarios Five (production complex in FCC region) and Six (production complex in MCC region). In general, such output impacts decreased down the hierarchy. It was noted, however, that intraregional output impacts for Scenario Three (production complex in CSC region) and Four (production complex in PSC region) were almost the same, and that between Scenarios Five (production complex in FCC region) and Six (production complex in MCC region) the intraregional output impacts were similar. The impact of the operation scenario expressed in terms of spillover coefficients indicated a tendency of output spillover coefficients to increase down the hierarchy from a value of 0.58 for Scenario One (production complex in PWR region) to a value of 0.99 for Scenarios Five (production complex in FCC region) and Six (production complex in MCC region). The labor income spillover coefficients increased from 0.34 for Scenario One (production complex in PWR region) to about 0.70 from Scenario Three (production complex in CSC region) to Six (production complex in MCC region).

Overall the results showed that for both phases of the project the impacts occurring in the higher-level regions were larger than those in the lower-level regions. Also, the higher-level regions experienced larger interregional impacts and had spillover coefficients of smaller magnitude compared to the lower-level regions. The results confirm that the impacts of an ethanol production complex in various regions are not likely to be of the same magnitude. The impacts in a given region are likely to depend on the level of the region in the hierarchy. The higher the level the larger the impacts and vice versa.

These results are not surprising, particularly in light of the fact that the higher-order regions have a more diversified economic structure than lower-level regions. In the provincial economy, one finds a larger concentration of secondary and tertiary sectors in the higher-order regions. Such sectors supply most of the inputs and consumer goods and services to firms and households located in the lower-order regions. Thus, whenever a new economic activity, such as an integrated ethanol-cattle production complex, is introduced in the lower-level region, the economic stimulus is realized in the higher-level region. Given that the higher-level region is almost self-sufficient in most inputs, except for primary raw materials in agriculture, forestry and mining, it can be said that any spin-off from the direct impact expenditures is confined to this region and would not leak to other regions in the hierarchy. It follows, thus, that the higher-level regions are likely to generate intraregional impacts of larger magnitude than lower-level regions.

7.3 Major Conclusions

The results generated for both phases of the project indicated that the larger intraregional impacts occurred in the higher-level regions compared to those in the lower-level regions. These impacts tended to decrease as one moves down the hierarchy from top to bottom regions. The spillover coefficients were smaller in the top regions than in the lower-level regions. Overall the higher-level regions, in particular the PWR, captured the largest share of interregional impacts whenever a project was introduced in the lower-level region. The study showed that the impacts of an integrated ethanol-cattle production complex are determined by the functional level of the region within a larger region. These results have important implications for rural development in the context of evaluating regions as sites for ethanol-cattle production complexes.

If the objective of community development programs is to maximize the intra-regional output and labor income in the project-region, then the preference to locating ethanol-cattle production complexes will be stronger for higher-level regions and weaker for lower-level regions in the hierarchy. This implies that, the smaller communities in rural Saskatchewan, for example, FCC and MCC, which need integrated ethanol-cattle production complexes the most, may not get them because they generate smaller local impacts and huge spillover coefficients. On the other hand, if the major objective of rural development is to address unbalanced regional growth through subsidized ethanol-cattle production complexes, smaller communities can be targeted as sites based on high unemployment and lower income, among other location characteristics. Furthermore, locating an integrated ethanol-cattle production complex in targeted remote smaller communities is essential for maintaining the rural population base, and for economic linkages in the local area. Furthermore, such a complex may also act as a catalyst in the community to make it more attractive to other businesses.

7.4 Limitations of the Study

Apart from the goals of rural development, the choice of the location of an integrated ethanol-cattle production complex is influenced by local factors such as land costs, local taxes, local wage rates, availability of required skilled labor, entrepreneurs, availability of major raw materials in the area and the presence of certain linkages. However, the regions used in this study are not specific geographic points, as such the regional differences in the local factors were not considered. Therefore, one has to be cautious in interpreting the estimated impacts for various different sizes of communities. Alternatively, the model could have been constructed for a specific set of city, town, and rural communities and taking into account the access to sources of raw materials and other pertinent local factors. However, the latter approach would have suffered from regional bias.

It should be noted that these results were obtained without taking into consideration the costs associated with subsidies used to promote ethanol development. For policy makers considering ethanol-cattle production complexes, as a strategy for sustainable rural development, the issue of using tax-payers dollars to subsidize ethanol development is touchy. It is known that to provide subsidies, taxes (or leakages) are created which cause a reduction in household disposable income. This may in turn reduce the multiplier effect of induced consumer spending. Thus, multipliers calculated without taking into account the effect of subsidies may be biased, and one needs to be cautious in interpreting the results.

The model developed in this study is associated with a number of limitations which should be considered as one examines the results generated for the various scenarios in both the construction and operation phases of the ethanol-cattle production complex. The limitations are summarized below:

First, the study used an input-output methodology and for this reason it shares in the limitations associated with any I-O model. The model was static, and all commodity and factor prices were assumed to be fixed and trade patterns stable. The model is total demand driven.

The second limitation is that the model was estimated using non-survey methods, coupled with the judgmental method using expert opinions, where available. The results obtained may be biased by the methods and sources of data used to estimate the model. Most of the data were determined in a non-survey approach with the use of expert knowledge. Improvements can be made by providing regional data on sectoral output and trade flows collected through primary surveys.

Third, use of aggregated sectors and aggregated regions causes sectoral aggregation bias and spatial aggregation bias. This might lead to overestimation of sectoral impacts in the various levels of regions.

7.5 Areas for Further Research

In light of the above limitations of the study, several areas can be suggested for further studies. The first area for further studies could be to improve the accuracy of the model by using primary data collected for key sectors in each subregion. This could also include validating the trade patterns between the hierarchical regions using primary data on commodity shipments.

The second area for further research could be to incorporate regional differences in the consumption expenditures based on a survey of households in the seven regions. The links between outshopping patterns and commuting patterns for the different levels of communities should be investigated further.

Third area for further research could be to link the model with another model, in particular a demographic model, to study the impact of demographic changes on various regions in Saskatchewan.

The fourth area for further studies could investigate the effect of subsidy on other regions in terms of taxes or leakages of labor income and induced consumer expenditures. These issues could be investigated using a multi-region computable general equilibrium model (CGE) for the province, and/or for Canada.

A fifth area of study could be to provide a comprehensive cost-benefit assessment of ethanol production which could address the many issues including subsidies and environmental impacts.

In this study no attention was paid to geographic bias. In short, the study assumed that the location was proper. However, given that there are differences in location factors, further research could investigate the optimal locations for ethanol-cattle production complexes in various regions of the province.

Finally, it is important to recognize that ethanol-cattle production is one of the many means for addressing problems of lower income, declining rural population and underemployment in rural communities, and is not the panacea. Thus, other rural community development programs need to be investigated as effectiveness solutions to the problems inflicting smaller communities in Saskatchewan.

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APPENDIX A

List of Communities (CSD) by Functional Categories

In this study, Saskatchewan communities were grouped into seven functional levels, which are presented in Tables A.1 to A.15. Following Stabler et al. (1992), the seven functional levels are briefly described in this section in terms of the number of communities, average population size and the number of business outlets found in each centre. By focusing on these aspects the description indicates the role performed by each functional level within the Saskatchewan trade centre system.

(1) Primary-Wholesale Retail Centre (PWR): This group is made up of the two largest cities in Saskatchewan, Saskatoon and Regina. This level has the largest number of business outlets in the province. The average number of business outlets is 4,213 per city. The PWR level is home to most non-primary sectors and is a major supplier of various services which include health, financial, insurance and education. This level contains the major colleges and universities found in the province. The average population of each city is about 180,000.

(2) Secondary Wholesale Retail Centre (SWR): In this category there are 8 cities with an average population of 18,000. The average number of business outlets per city is 533. These centres provide a variety of goods and services similar to those found at the PWR level but only fewer in number. The SWR centres depend on the PWR for provision of certain specialized services found only at the PWR level.

(3) Complete Shopping Centre (CSC): This functional level is made up of 6 towns. The average population is 4,878 and the average number of business outlets is 196. These communities offer fewer goods and services compared to the SWR centres, and also depend on the PWR for higher-order goods and services.

(4) Partial Shopping Centre (PSC): This functional level is made up of about 50 towns with an average population of 1,759, and the average number of business outlets is 70. The PSC centres have fewer functions compared to the CSC level, but they still perform an important role in the Saskatchewan trade centre system.

Generally speaking, the communities in the top four functional classifications do offer most producer and consumer services. Multiple outlets are usually present and the majority of the province's producers are also located in the 62 places that are included in the top four categories (Stabler et al. 1992, p. 22).

(5) Full Convenience Centre (FCC): There are about 113 communities in this category. Each community has an average population of 575, and the average number of business outlets is 21. The FCC centres usually provide groceries, gasoline, lodging, meals and financial services to consumers. Farm equipment, bulk fuel and building materials, are also available to producers.

(6) Minimum Convenience Centre (MCC): This functional level contains about 306 communities. Each community has an average population of 141. The average number of business outlets is 4. The communities in the MCC category do not provide a significant trade-centre function. There is no single function that can be counted on to be present in these places.

(7) The Rest-of-Saskatchewan (ROS): This category is made up of 326 communities found in Division 18 plus all the census subdivisions (CSDs) not included in the top six functional levels listed above. The average population is less than that of the FCC centres but greater than that of the MCC centres. This level represents mostly the open areas or the hinterland, where primary sectors such as agriculture, mining, fishing and forestry are found. These communities depend on the higher-level centres for the provision of all the consumer and producer goods and services.

Various Saskatchewan communities were classified into one of these seven clusters. Symbols used in the designation column of Tales A.1 to A.15 are as follows:

Designation:

C = City
T = Town
VL = Village
NH = Northern Hamlet
R = Reserve
RV = Reserve Village
RM = Rural Municipality

Table A.1. Communities in PWR, SWR, CSC and PSC

Function Region	Community Name	Desig-nation	Function Region	Community Name	Desig-nation
1	Regina	C	3	Kindersley	T
1	Saskatoon	C	3	Meadow Lake	T
2	Estevan	C	3	Melfort	C
2	Lloydminister	C	3	Nipawin	T
2	Moose Jaw	C	3	Tisdale	T
2	North Battleford	C	4	Biggar	T
2	Prince Albert	C	4	Biggar	T
2	Swift Current	C	4	Canora	T
2	Weyburn	C	4	Carlyle	T
2	Yorkton	C	4	Davidson	T
3	Humboldt	T	4	Esterhazy	T

Table A.2. Communities in PSC and FCC.

Function Region	Community Name	Desig-nation	Function Region	Community Name	Desig-nation
4	Assiniboia	T	4	Eston	T
4	Battleford	T	4	Foam Lake	T
4	Gull Lake	T	4	Fort Qu'Appelle	T
4	Watson	T	4	Gravelbourg	T
4	Whitewood	T	4	Grenfell	T
4	Balcarres	T	4	Hudson Bay	T
4	Big River	T	4	Indian Head	T
4	Carnduff	T	4	Kamsack	T
4	Cudworth	T	4	Kelvington	T
4	Redvers	T	4	Langenburg	T
4	Spiritwood	T	4	Lanigan	T
4	St. Walburg	T	4	Kipling	T
4	Macklin	T	4	Maidstone	T
4	Maple Creek	T	4	Raymore	T
4	Martensville	C	4	Melville	T
4	Moosomin	T	4	Rosetown	T
4	Outlook	T	4	Rosthern	T
4	Oxbow	T	4	Seekaskootch	T
4	Pilot Butte	T	4	Shaunavon	T
4	Preeceville	T	4	Shellbrook	T
4	Unity	T	4	Watrous	T
4	Wadena	T	4	Wynyard	T
4	Warman	T	5	Cupar	T
5	Allan	T	5	CutKnife	VL
5	Arborfield	T	5	Dalmeny	T
5	Archerwill	VL	5	Debden	T
5	Avonlea	VL	5	Delisle	T
5	Beechy	VL	5	Dinsmore	VL
5	Bengough	T	5	Dodsland	T
5	Bethune	VL	5	Duck Lake	VL
5	Birch Hills	T	5	Bruno	VL
5	Blaine Lake	T	5	Craik	T
5	Borden	VL	5	Creelman	T
5	Bredenbury	T	5	Coronach	T
5	Broadview	T	5	Colonsay	T

Table A.3. List of Communities in FCC.

Function Region	Community Name	Desig-nation	Function Region	Community Name	Desig-nation
5	Dysar	VL	5	Standing Buffalo	R
5	Eastend	T	5	Muskowekwan	R
5	Eatonia	T	5	Clavet	VL
5	Edam	VL	5	Red Earth	R
5	Elrose	T	5	Beardy and Okemasis	R
5	Fillmore	VL	5	White City	VL
5	Fox Valley	VL		Caronport	VL
5	Frontier	VL	5	Little Pine and Lucky Man	R
5	Gainsborough	VL	5	Mistawasis	R
5	Glaslyn	VL	5	New Thunderchild	R
5	Hafford	T	5	Nut Lake	R
5	Hanley	T	5	Cote	R
5	Herbert	T	5	Kyle	T
5	Hodgeville	VL	5	Lafleche	T
5	Perdue	VL	5	Lampman	T
5	Pierceland	VL	5	Langham	T
5	Ponteix	T	5	Lashburn	T
5	Porcupine Plain	T	5	Leader	T
5	Punnichy	VL	5	Leask	VL
5	Rabbit Lake	VL	5	Leoville	VL
5	Radisson	T	5	Leroy	T
5	Radville	T	5	Imperial	T
5	Richmound	VL	5	Invermay	VL
5	Rocanville	T	5	Ituna	T
5	Rockglen	T	5	Kenaston	VL
5	Rose Valley	T	5	Kerrobert	T
5	Smeaton	VL	5	Stoughton	T
5	Southey	T	5	Strasbourg	T
5	Spalding	VL	5	Sturgis	T
5	St. Gregor	VL	5	Theodore	VL
5	Mossbank	T	5	Turtleford	T
	Naicam	T	5	Vanguard	VL
5	Neilburg	VL	5	Vonda	T
5	Mosquito	R	5	Wakaw	T
5	Cumberland	R	5	Waldheim	T
5	Dysart	VL	5	Standing Buffalo	R

Table A.4. List of Communities in FCC.

Function Region	Community Name	Desig-nation	Function Region	Community Name	Desig-nation
5	Eastend	T	5	Muskowekwan	R
5	Eatonia	T	5	Clavet	VL
5	Edam	VL	5	Red Earth 29	R
5	Elrose	T	5	Beardy 97 and kemasis 96	R
5	Fillmore	VL	5	White City	VL
5	Fox Valley	VL		Caronport	VL
5	Frontier	VL	5	Little Pine and Lucky Man 116	R
5	Gainsborough	VL	5	Mistawasis 103	R
5	Glaslyn	VL	5	New Thunderchild	R
5	Hafford	T	5	Nut Lake 90	R
5	Hanley	T	5	Cote 64	R
5	Herbert	T	5	Kyle	T
5	Hodgeville	VL	5	Lafleche	T
5	Perdue	VL	5	Lampman	T
5	Pierceland	VL	5	Langham	T
5	Ponteix	T	5	Lashburn	T
5	Porcupine Plain	T	5	Leader	T
5	Punnichy	VL	5	Leask	VL
5	Rabbit Lake	VL	5	Leoville	VL
5	Radisson	T	5	Leroy	T
5	Radville	T	5	Imperial	T
5	Richmound	VL	5	Invermay	VL
5	Rocanville	T	5	Ituna	T
5	Rockglen	T	5	Kenaston	VL
5	Rose Valley	T	5	Kerrobert	T
5	Smeaton	VL	5	Stoughton	T
5	Southey	T	5	Strasbourg	T
5	Spalding	VL	5	Sturgis	T
5	St. Gregor	VL	5	Theodore	VL
5	Mossbank	T	5	Turtleford	T
	Naicam	T	5	Vanguard	VL
5	Neilburg	VL	5	Vonda	T
5	Mosquito	R	5	Wakaw	T
5	Cumberland	V	5	Waldheim	T
5	Wapella	T	5	Hodgeville	VL
5	Wawota	T	5	Perdue	VL

Table A.5. List of Communities in FCC AND MCC.

Function Region	Community Name	Desig-nation	Function Region	Community Name	Desig-nation
5	Willow Bunch	T	5	Pierceland	VL
5	Wishart	VL	5	Ponteix	T
5	Wolseley	T	5	Porcupine Plain	T
5	Nokomis	T	5	Punnichy	VL
5	Norquay	T	5	Rabbit Lake	VL
5	Ogema	T	5	Radisson	T
5	Pangman	VL	5	Radville	T
	Paradise Hill	VL	5	Richmound	VL
5	Candle Lake	RV	5	Rocanville	T
5	Cowessess 73	R	5	Rockglen	T
5	Moosomin	R	5	Rose Valley	T
5	Muskoday	R	5	Smeaton	VL
5	James Smith	R	5	Southey	T
5	Saulteaux	R	5	Spalding	VL
5	Poor Man 88	R	5	St. Gregor	VL
5	Assiniboine	R	5	Mossbank	T
5	Gordon 86	R	5	Naicam	T
5	Osler	T	5	Neilburg	VL
5	Sturgeon Lake	R	5	Mosquito 109	R
5	Big River	R	5	Cumberland 100	R
5	Ahtahkakoop	R	5	Standing Buffalo	R
5	Dysart	VL	5	Muskowekwan	R
5	Eastend	T	5	Clavet	VL
5	Eatonia	T	5	Red Earth 29	R
5	Edam	VL	5	Beardy 97 and Okemasis 96	R
5	Elrose	T	5	White City	VL
5	Fillmore	VL	5	Caronport	VL
5	Fox Valley	VL	5	Little Pine and Lucky Man 116	R
5	Frontier	VL	5	Mistawasis 103,	R
5	Gainsborough	VL	5	New Thunderchild	R
	Glaslyn	VL	5	Nut Lake 90	R
5	Hafford	T	5	Cote 64	R
5	Hanley	T	6	Arcola	T
5	Herbert	T	6	Arran	VL
6	Abbey	VL	6	Asquith	T
6	Aberdeen	T	6	Abernethy	VL

Table A.6. List of Communities in MCC.

Function Region	Community Name	Desig-nation	Function Region	Community Name	Desig-nation
6	Alameda	T	6	Aylesbury	VL
6	Albertville	VL	6	Aylsham	VL
6	Alida	VL	6	B-Say-Tah	RV
6	Alsask	VL	6	B-Say-Tah	RV
6	Alvena	VL	6	Balgonie	T
6	Aneroid	VL	6	Bangor	VL
6	Annaheim	VL	6	Beatty	VL
6	Antler	VL	6	Belle Plaine	VL
6	Aquadeo	RV	6	Benson	VL
6	Aquadeo	RV	6	Bienfait	T
6	Bird's Point	RV	6	Chaplin	VL
6	Bird's Point	RV	6	Chitek Lake 191	R
6	Birsay	VL	6	Chitek Lake	RV
6	Bjorkdale	VL	6	Cochin	RV
6	Bladworth	VL	6	Coderre	VL
6	Bracken	VL	6	Codette	VL
6	Bradwell	VL	6	Colgate	VL
6	Briercrest	VL	6	Conquest	VL
6	Brock	VL	6	Consul	VL
6	Broderick	VL	6	Craven	VL
6	Brownlee	VL	6	Day Star 87	R
6	Buena Vista	VL	6	Day Star 87	R
6	Bulyea	VL	6	Denholm	VL
6	Cadillac	VL	6	Denzil	VL
6	Calder	VL	6	Dilke	VL
6	Cando	VL	6	Disley	VL
6	Carievale	VL	6	Domremy	VL
6	Carmichael	VL	6	Dorintosh	VL
6	Caron No. 162	RM	6	Drake	VL
6	Carragana	VL	6	Drinkwater	VL
6	Ceylon	RM	6	Dubuc	VL
6	Chamberlain	VL	6	Dundurn	T
6	Chaplin	VL	6	Duval	VL
6	Chitek Lake 191	VL	6	Earl Grey	VL
6	Elbow	VL	6	Ebenezer	VL
6	Elfros	R	6	Edenwold	VL
6	Endeavour	VL	6	Elfros	VL
6	Englefeld	VL	6	Elstow	VL
6	Ernfold	VL	6	Gladmar	VL

Table A.7. List of Communities in MCC.

Function Region	Community Name	Desig-nation	Function Region	Community Name	Desig-nation
6	Evesham	VL	6	Glen Ewen	VL
6	Eyebrow	VL	6	Glenavon	VL
6	Fairlight	VL	6	Glenside	VL
6	Fenwood	VL	6	Glentworth	VL
6	Findlater	VL	6	Glidden	VL
6	Fishing Lake	R	6	Golden Prairie	VL
6	Goodsoil	VL	6	Goodeve	VL
6	Flaxcombe,	V VL	6	Goodwater	VL
6	Fleming,	VL	6	Govan	T
6	Forget	VL	6	Grand Coulee	VL
6	Fort San	RV	6	Grayson	VL
6	Fosston	VL	6	Griffin No. 66	RM
6	Francis	T	6	Grizzly Bear's Head 110 and Lean Man 111	R
6	Frenchman Butte		6	Guernsey	VL
6	Frobisher	VL	6	Hague	VL
6	Gerald	VL	6	Halbrite	VL
6	Girvin	VL	6	Harris	VL
6	Hazlet	VL	6	Hawarden	VL
6	Hazenmore	VL	6	Hazel Dell No	RM
6	Hepburn	VL	6	Laird	VL
6	Herschel	VL	6	Lajord No. 128	RM
6	Holdfast	VL	6	Lake Alma	VL
6	Hubbard	VL	6	Lake Lenore	VL
6	Hyas	VL	6	Lancer	VL
6	Jansen	VL	6	Landis	VL
6	Kahkewistahaw	R	6	Lang	VL
6	Kannata Valley	RV	6	Lebret	VL
6	Katepwa Beach	RV	6	Lemberg	T
6	Keeseekoose 66	R	6	Leross	VL
6	Kelliher	VL	6	Leslie	VL
6	Kendal	VL	6	Lestock	VL
6	Kennedy	VL	6	Liberty	VL
6	Kenosee Lake	VL	6	Makwa Lake	R
6	Kincaid	VL	6	Makwa	VL
6	Kinistino 91	R	6	Manitou Beach	RV
6	Kinistino 91	R	6	Manor	VL

Table A.8. List of Communities in MCC.

Function Region	Community Name	Designation	Function Region	Community Name	Designation
6	Kisbey	VL	6	Marcelin	VL
6	Limerick	VL	6	Marengo	VL
6	Lintlaw	VL	6	Margo	VL
6	Lipton	VL	6	Markinch	VL
6	Little Black Bear	R	6	Marquis	VL
6	Little Red River	R	6	Marsden	VL
6	Loreburn	VL	6	Mendham	VL
6	Love	VL	6	Marshall	VL
6	MacNutt	VL	6	Maymont	VL
6	Macoun	VL	6	Mazenod	VL
6	McTaggart	VL	6	McLean	VL
6	Macrorie	VL	6	Meacham	VL
6	Major	VL	6	Meadow Lake	R
6	Makaoo (Part)	R	6	Medstead	VL
6	Meota	VL	6	Nekaneet 160A	R
6	Mervin	VL	6	Neudorf	VL
6	Middle Lake	VL	6	Neville	VL
6	Milden	VL	6	North Portal	VL
6	Ministikwan 161	R	6	Ochapowace 71	R
6	Minton		6	Odessa	VL
6	Mistatim	VL	6	Okanese 82	R
6	Montreal Lake	VL	6	One Arrow 95	R
6	Morse	R	6	Paddockwood	VL
6	Mortlach	T	6	Palmer,	VL
6	Muenster	VL	6	Parkside	VL
6	Muscowpetung 80	VL	6	Paynton	VL
6	Muskeg Lake 102	R	6	Peepeekisis 81	R
6	Pense	R	6	Pelly	VL
6	Penzance	VL	6	Pennant	VL
6	Piapot	VL	6	Piapot 75	R
6	Pilger	VL	6	Sedley	VL
6	Speers	VL	6	Semans	VL
6	Pleasantdale	VL	6	Senlac	VL
6	Plenty	VL	6	Shamrock No.134	RM
6	Plunkett	VL	6	Sheho	VL
6	Poundmaker 114	VL	6	Shell Lake	VL
6	Prelate	R	6	Shesheep 74A	R
6	Primate	VL	6	Shoal Lake 28A	R

Table A.9. List of Communities in MCC.

Function Region	Community Name	Desig-nation	Function Region	Community Name	Desig-nation
6	Prince Albert National Park	UNO	6	Silton	VL
6	Prud'Homme	VL	6	Simpson	VL
6	Qu'Appelle	T	6	Sintaluta	T
6	Quill Lake	VL	6	Smiley	VL
6	Quinton,		6	Sovereign	VL
6	Rama	VL	6	Springside	T
6	Red Pheasant 108	R	6	Spruce Lake	VL
6	Regina Beach	T	6	Spy Hill	VL
6	Rhein	VL	6	St. Benedict	VL
6	Ridgedale	VL	6	St. Brieux	VL
6	Riverhurst	VL	6	St. Louis	VL
6	Riverside	RM	6	Star Blanket 83	R
6	Roche Percee	VL	6	Star City	T
6	Rouleau	T	6	Stenen	VL
6	Rush Lake	VL	6	Stewart Valley	VL
6	Sakimay 74	R	6	Stockholm	VL
6	Saltcoats	T	6	Storthoaks	RM
6	Salvador	VL	6	Storthoaks	VL
6	Sandy Beach	RV	6	Strongfield	VL
6	Sceptre	VL	6	Sun Valley	RV
6	Scott	T	6	Sweet Grass 113	R
6	Sedley	VL	6	Tantallon	VL
6	Semans	VL	6	The Key 65	R
6	Senlac	VL	6	Thode	RV
6	Shamrock	RM	6	Togo	VL
6	Sheho	VL	6	Tompkins	VL
6	Shell Lake	VL	6	Torquay	VL
6	Shesheep 74A	R	6	Tramping Lake	VL
6	Shoal Lake	R	6	Tribune	VL
6	Silton	VL	6	Tugaske	VL
6	Simpson	VL	6	Tuxford	VL
6	Sintaluta	T	6	Val Marie	VL
6	Smiley	VL	6	Vanscoy	VL
6	Sovereign	VL	6	Vawn	VL
6	Speers	VL	6	Veregin	VL
6	Springside	T	6	Vibank	VL

Table A.10. List of Communities in MCC.

Function Region	Community Name	Desig-nation	Function Region	Community Name	Desig - nation
6	Spruce Lake	VL	6	Viceroy	VL
6	Spy Hill	VL	6	Viscount	VL
6	Waldeck	VL	6	Wa-Pii Moos-Toosis	R
6	Waldron	VL	6	Wahpaton 94A	R
6	Waseca	R	6	Wroxton	VL
6	Waterhen 130	VL	6	Yarbo	VL
6	Webb	VL	6	Yellow Creek	VL
6	Weekes	VL	6	Yellow Grass	T
6	Weirdale	VL	6	Young	VL
6	Weldon	VL	6	Zealandia	T
6	Welwyn	R	6	Zelma	VL
6	White Bear 70	R	6	Zenon Park	VL
6	White Cap 94		6	Willowbrook	VL
6	White Fox	VL	6	Windthorst	VL
6	Wilcox	VL	6	Wiseton	VL
6	Wilkie	T	6	Witchekan Lake	R
			6	Wood Mountain	VL
7	Air LaRonge	NV	7	Denare Beach	NV
7	Beauval, NV	NV	7	Lucky Lake	VL
7	Brabant Lake, S-E	NV	7	Lumsden	T
7	Canoe Lake	R	7	Luseland	T
7	Chicken 224,	R	7	Mankota	VL
7	Cole Bay	NH	7	Maryfield	VL
7	Creighton	T	7	Meath Park	VL
7	Cumberland	R	7	Midale	T
7	Killaly	VL	7	Milestone	T
7	Kinistino	T	7	Motmartre	VL
7	Cumberland 100	NV	7	Happy Valley No. 10	RM
7	Hillsborough	RM	7	Maple Bush No. 224	RM
7	Antelope Park	RM	7	Rosemount No. 378	RM
7	Glen McPherson	RM	7	Canaan No. 225	RM
7	Harris	RM	7	Rodgers No. 133	RM
7	Enterprise	RM	7	Chaplin No. 164	RM
7	Pinto Creek No. 75	RM	7	Lone Tree No. 18	RM

Table A.11. List of Communities in ROS.

Function Region	Community Name	Desig-nation	Function Region	Community Name	Desig-nation
7	Gull Lake No. 139	RM	7	Lake Johnston No.102	RM
7	Poplar Valley No. 12	RM	7	Milton No. 292	RM
7	King George No. 256	RM	7	Deer Forks No. 232	RM
7	Pittville No. 169	RM		Big Stick No. 141	RM
7	Wise Creek No. 77	RM	7	Lost River No. 313	RM
7	The Gap No. 39	RM	7	Wreford No. 280	RM
7	Milden No. 286	RM	7	Surprise Valley No.9	RM
7	Brock No. 64	RM	7	Wheatlands No. 163	RM
7	Big Arm No. 251	RM	7	Huron No. 223	RM
7	Arm River No. 252	RM	7	Colonsay No. 342	RM
7	Redburn No. 130	RM	7	Argyle No. 1	RM
7	Mariposa No. 350	RM	7	Senlac No. 411	RM
7	Frontier No. 19	RM	7	Prairiedale No. 321	RM
7	Scott No. 98	RM	7	Sarnia No. 221	RM
7	Lake Alma No. 8	RM	7	Newcombe No. 260	RM
7	Norton No. 69	RM	7	Tullymet No. 216	RM
7	Clinworth No. 230	RM	7	Eyebrow No. 193	RM
7	Brokenshell No. 68	RM	7	Terrell No. 101	RM
7	Arlington No. 79	RM	7	Tecumseh No. 65	RM
7	Paynton No. 470	RM	7	Sutton No. 103	RM
7	Oakdale No. 320	RM		Hart Butte No. 11,	RM
7	Tramping Lake No.380	RM	7	Martin No. 122	RM
7	Cambria No. 6	RM	7	Bratt's Lake No. 129	RM
7	Hazelwood No. 94	RM	7	Piapot No. 110	RM
7	Waverley No. 44	RM	7	Craik No. 222	RM
7	Reford No. 379	RM	7	Wood Creek No. 281	RM
7	Glen Bain No. 105	RM	7	Willner No. 253	RM
7	Fillmore No. 96	RM	7	Fox Valley No. 171	RM
7	Blaine Lake No. 434	RM	7	Kutawa No. 278	RM
7	Progress No. 351	RM	7	St. Philips No. 301	RM
7	Wellington No. 97	RM		Elmsthorpe No. 100,	RM
7	Glenside No. 377	RM	7	Turtle River No. 469	RM
7	Last Mountain Valley	RM	7	Heart's Hill No. 352	RM
7	Fish Creek No. 402	RM	7	Prairie Rose No. 309	RM

Table A.12. List of Communities in ROS.

Function Region	Community Name	Desig-nation	Function Region	Community Name	Desig-nation
7	Bone Creek No. 108	RM	7	Mountain View No.318	RM
7	Rudy No. 284	RM	7	Lake of the Rivers	RM
7	Lomond No. 37	RM	7	Loreburn	RM
7	Grassy Creek No. 78	RM	7	Marquis No. 191	RM
7	Enfield No. 194	RM	7	Whiska Creek	RM
7	Coalfields No. 4	RM	7	Perdue No. 346	RM
7	Webb No. 138	RM	7	Touchwood	RM
7	Souris Valley	RM	7	Indian Head	RM
7	Auvergne No. 76	RM	7	Mount Pleasant	RM
7	Winslow No. 319	RM		Wood River No. 74	RM
7	Happyland No. 231	RM	7	Maryfield No. 91	RM
7	Moose Creek	RM	7	Morris No. 312	RM
7	Round Hill	RM	7	Benson No. 35	RM
7	Caledonia No. 99	RM	7	Bengough No. 40	RM
7	Pleasant Valley	RM	7	Laurier No. 38	RM
7	Reciprocity No. 32	RM	7	Key West No. 70	RM
7	Willowdale No.153	RM	7	Abernethy No. 186	RM
7	Grandview No. 349	RM	7	Lac Pelletier	RM
7	Cut Knife No. 439	RM	7	Round Valley	RM
7	Saskatchewan Landing	RM	7	Buffalo No. 409	RM
7	McCraney No. 282	RM	7	Douglas No. 436	RM
7	Rosedale No. 283	RM	7	Moosomin No. 121	RM
7	Golden West No. 95	RM	7	Walpole No. 92	RM
7	Browning No. 34	RM	7	Mayfield No. 406	RM
7	Spy Hill No. 152	RM	7	Coteau No. 255	RM
7	Eagle Creek No. 376,	RM		Val Marie No. 17	RM
7	Morse No. 165	RM	7	Cymri No. 36	RM
7	Livingston No. 331	RM	7	Willow Bunch	RM
7	Carmichael No. 109	RM	7	Keys No. 303	RM
7	Mankota No. 45	RM	7	Enniskillen No. 3	RM

Table A.13. List of Communities in ROS.

Function Region	Community Name	Desig-nation	Function Region	Community Name	Desig-nation
7	Pense No. 160	RM	7	Great Bend	RM
7	Grass Lake No. 381	RM	7	Arborfield No. 456	RM
7	Dundurn No. 314	RM	7	Viscount No. 341	RM
7	McKillop No. 220	RM	7	Gravelbourg No. 104	RM
7	Victory No. 226	RM	7	Lawtonia No. 135	RM
7	Dufferin No. 190	RM		Kingsley No. 124	RM
7	Reno No. 51	RM	7	St. Andrews No. 287	RM
7	Wolseley No. 155	RM	7	Miry Creek No. 229	RM
7	Prairie No. 408	RM	7	Chester No. 125	RM
7	Lake Lenore No. 399	RM	7	Lakeland No. 521	RM
7	Moose Mountain	RM	7	Old Post No. 43	RM
7	Redberry No. 4	RM	7	Excel No. 71	RM
7	Marriott No. 317	RM	7	Manitou Lake	RM
7	Lakeside No. 338	RM	7	Ituna Bon Accord	RM
7	Lipton No. 217	RM	7	Insinger	RM
7	Hillsdale No. 440	RM	7	Calder No. 241	RM
7	Invermay No. 305	RM	7	Silverwood	RM
7	Usborne No. 310	RM	7	Wolverine	RM
7	Montmartre No. 126	RM	7	White Valley	RM
7	Antler No. 61	RM	7	Chest	RM
7	Fertile Valley	RM	7	Meeting Lake	RM
7	Stonehenge No. 73	RM	7	Bayne No. 371	RM
7	Cupar No. 218	RM	7	Hoodoo No. 401	RM
7	Coulee No. 136	RM	7	Mount Hope	RM
7	Monet No. 257	RM	7	Grant No. 372	RM
7	Buchanan No. 304	RM	7	Barrier Valley	RM
7	Baildon No. 131	RM	7	Garden River	RM
7	Rocanville No. 151	RM	7	Montrose	RM
7	Garry No. 245	RM	7	Kelvington	RM
7	Elfros No. 307	RM	7	Cote No. 271	RM
7	Snipe Lake No. 259	RM	7	Grayson No. 184	RM
7	Lakeview No. 337	RM	7	Wawken No. 93	RM
7	Medstead No. 497	RM	7	McLeod No. 185	RM
7	Aberdeen No. 373	RM	7	North Qu'Appelle	RM
7	Elcapo No. 154	RM	7	Eye Hill No. 382	RM
7	Good Lake No. 274	RM	7	Kellross No. 247	RM

Table A.14. List of Communities in ROS.

Function Region	Community Name	Desig- nation	Function Region	Community Name	Desig- nation
7	Leroy No. 339	RM	7	Three Lakes	RM
7	Paddockwood No. 520	RM	7	St. Peter No. 369	
7	Parkdale No. 498	RM	7	Biggar No. 347	RM
7	Spalding No. 368	RM	7	Fertile Belt , RM	RM
7	Emerald No. 277	RM	7	Sherwood	RM
7	Pleasantdale No.398	RM	7	Laird No. 404	RM
7	Stanley No. 215	RM	7	Beaver River	RM
7	Sliding Hills No.273	RM	7	South Qu'Appelle	RM
7	Meota No. 468	RM	7	Cana No. 214	RM
7	Francis No. 127	RM	7	Estevan No. 5	RM
7	Invergordon No. 430	RM	7	Tisdale No. 427	RM
7	Birch Hills No. 460	RM	7	Sasman No. 336	RM
7	Big Quill No. 308	RM	7	Maple Creek	RM
7	Big River No. 555	RM	7	Mervin No. 499	RM
7	Ponass Lake No. 367	RM	7	Blucher No. 343	RM
7	Langenburg No. 181	RM	7	Bjorkdale No. 426	RM
7	Connaught No. 457	RM	7	Lumsden No. 189	RM
7	Battle River No.438	RM	7	Foam Lake	RM
7	Eldon No. 471	RM	7	Kinistino No. 459	RM
7	Weyburn No. 67	RM	7	Saltcoats No. 213	RM
7	Lacadena No. 228	RM	7	Duck Lake	RM
7	Flett's Springs	RM	7	Willow Creek	RM
7	Leask No. 464	RM	7	Churchbridge	RM
7	Loon Lake No. 561	RM	7	Longlaketon	RM
7	Excelsior No. 166	RM	7	North Battleford	RM
7	Kindersley No. 290	RM	7	Clayton No. 333	RM
7	Humboldt No. 370	RM	7	Wallace No. 243	RM
7	Star City No. 428	RM	7	Canwood	RM
7	Preeceville No. 334	RM	7	Rosthern	RM
7	St. Louis No. 431	RM	7	Shellbrook	RM
7	Porcupine No. 395	RM	7	Hudson Bay	RM
	Britannia No. 502	RM	7	Orkney No. 244	RM
7	Nipawin No. 487	RM	7	Moose Jaw	RM
7	Moose Range	RM	7	Torch River	RM
7	Swift Current No.137	RM	7	Vanscoy No. 345	RM
7	Wilton No. 472	RM	7	Spiritwood No. 496	RM

Table A.15. List of Communities in ROS.

Function Region	Community Name	Desig-nation	Function Region	Community Name	Desig-nation
7	Prince Albert	RM	7	Edenwold	RM
7	Buckland No. 491	RM	7	Meadow Lake	RM
7	Corman Park	RM	7	Green Lake	NV
7	Air Ronge	NV	7	Jans Bay	NH
7	Beauval	NV	7	Kitsakie 156B	NV
7	Brabant Lake, S-E	R	7	La Loche 222	R
7	Buffalo Narrows	NV	7	La Loche	NV
7	La Ronge	R	7	La Plonge 192,	R
7	Canoe Lake 165	R	7	Lac La Hache 220	R
7	Chicken 224	R	7	Lac La Ronge 156	R
7	Cole Bay	NH	7	Michel Village	NH
7	Creighton	T	7	Pelican Narrow	NH
7	Cumberland 20	R	7	Peter Pond Lake 193	R
7	Cumberland House	NV	7	Pinehouse	NV
7	Denare Beach	NV	7	Sandy Bay	NV
7	Deschambault Lake	NH	7	Southend 200	R
7	Dor_ Lake	NH	7	Southend Reindeer	NH
7	Flin Flon (Part)	C	7	Stanley 157	R
7	Fond du Lac 227	R	7	Stanley Mission	NH
7	Grandmother's Bay 219	R	7	St.George's Hill	R
7	Missinipe	NH	7	Sucker River 156C	R
7	Montreal Lake 106	R	7	Timber Bay	R
7	Morin Lake 217,	R	7	Turnor Lake 193B,	R
7	Patuanak, NH	NH	7	Turnor Lake	NH
7	Pelican Narrows 184B	R	7	Wapachewunak 192D,	R
7	Le-la-Crosse	NV	7	Weyakwin	NH

APPENDIX B

Saskatchewan Gross Sectoral Output and Selected Final Payments, 1992.

Appendix B.1: Saskatchewan Gross Sectoral Output and Selected Final Payments, 1992 ($ Million)

1 Agriculture & Related	4129.5	32 Storage Warehouse	497.64
2 Fishing & Trapping	8.52	33 Communication Ind	872.36
3 Logging & Forestry	86.68	34 Other Utility Ind	985.71
4 Mining	1384.1	35 Wholesale Trade	1001.6
5 Crude Oil & Natural Gas	1755.8	36 Retail Trade	1741.5
6 Quarry & Sand Pit	17.84	37 Finance, Real Est	2167.0
7 Service Related Min Ext	392.61	38 Insurance Industry	535.47
8 Food Industry	964.00	39 Govt.Royalty Nat.	229.0
9 Beverage Industry	88.00	40 Owner Occup Dwell.	1675.9
10 Tobacco Products	0.00	41 Business Service	618.37
11 Rubber Products	0.00	42 Educate Service	54.40
12 Plastic Products Industry	26.00	43 Health Service Ind	446.48
13 Leather & Allied Products	8.00	44 Accom. Food Ser	863.64
14 Primary Textile & Prod	14.00	45 Amuse. Recreat.Ser	116.66
15 Clothing Industry	14.00	46 Personal Househld	148.48
16 Wood Industry	157.00	47 Other Service Ind	170.36
17 Furni. & Fixture Industry	5.00	48 Oper.,Off,Café, & Lab	1089.9
18 Paper & Allied Products	412.07	49 Travel,Ad., Promotion	644.75
19 Printing Publish & Allied	198.00	50 Transport Margins	619.35
20 Primary Metal Industry	290.77	51 Unalloc.Imp. & Export	324.6
21 Fabricat Metal Products	176.00	52 Indirect Taxes	3394.0
22 Machinery Industry	209.00	53 Subsidies	-1892
23 Transport Equip. Industry	76.00	54 Wages and Salaries	9054.4
24 Elec. & Electron Products	231.00	55 Suppl.Labor Income	895.5
25 NonMetal Mineral Products	76.00	56 Net Inc.of Uninc Bus	11132
26 Refined Oil & Coal Prod	495.60	57 Other Oper. Surplus	8199.0
27 Chemical & Prod Industry	278.00	58 Imports & Leakages	14190
28 Other Mfg. Industry	34.00		
29 Construction Industry	3060.0		
30 Transport Industry	1161.1		
31 Pipeline Transport Ind	184.30		

APPENDIX C

Disaggregation of the Agricultural Sector

The single agriculture sector contained in the 1984 transactions table for Saskatchewan was disaggregated into three sub-sectors; namely, CPS wheat, Cattle and Other Agricultural Products. These three sub-sectors were considered relevant sectors for analyzing the impact of an ethanol-cattle production complex on the region. The CPS wheat sub-sector represented the production of the Canadian Prairie Spring wheat on farms. The CPS wheat is a special type of wheat required as feedstock in the production of ethanol. The Cattle sub-sector represented all cattle enterprises excluding dairy farms, whereas the Other Agricultural Products sub-sector represented all farms except Cattle and CPS wheat..

The disaggregation of agriculture into the above three sub-sectors required the development of various sub-sectors' respective output and input matrices. The methods and data sources used to develop these matrices are explained in the following sections.

C. 1 Estimation of the Output Matrix

The starting point for the estimation of the output matrix was the calculation of total value of agriculture output for 1992. One source of such data was the Agricultural Statistics Report (Saskatchewan Agriculture and Food, 1993) on cash receipts from farming operations in 1992. However, because of the differences in the accounting methods between Agriculture Canada and Input-Output Division of Statistics Canada, some reconciliation was required. This involved assigning the farming receipts with corresponding input-output commodity categories. In addition, total value of output for the agriculture industry needed to be estimated, using the input-output methodology.

Following the methodology outlined in Kulshreshtha et al. (1991), the total value of agriculture output for 1992 was estimated at $ 4,129.5 million (see Table C.1).

C.1.1 Allocating the Farm Receipts to Commodities

The 1992 cash receipts from farming operations (see Table C.1) according to farm products were assigned to seven input-output commodity groups, namely, (1) Grains, (2) Live Animals, (3) Other Agricultural Products, (4) Forest Products, (5) Meat Products, (6) Manure and Compost, and (7) Other Financial services, including Insurance and Real Estate.

Table C.1 Value of Saskatchewan Agricultural Output for 1992 in terms of I-O Method.

ITEMS	($ million)
CROPS	
1. Cash Receipts from Crops	2,279.5
2. Deferred Grain Receipts	180.0
3. Liquidation of Deferments	-200.9
4. Value of Inventory Change	-98.4
5. Non-commercial transactions	408.2
6. Wheat Board Profits	410.9
LIVESTOCK	
7. Cash Receipts from Livestock	946.0
8. Value of Inventory Change	-8.6
9. Non-Commercial Transactions	128.8
10. Milk Levy	5.1
MISCELLANEOUS	
11. Income in Kind	17.8
12. Service Incidental to Agriculture	49.5
13. Difference in Subsidy	4.3
14. Other Rent	17.7
TOTAL	4129.5

Sources: (1) Canadian Wheat Board (1992).
(2) Saskatchewan Agriculture and Food (1992).

For some commodities, namely, Manure and Compost, Meat Products, Forest Products, and Other Financial and Real Estate, there were no data on actual value of output in 1992. These were estimated using commodity proportions in the value of the agriculture output estimated for 1988 by Kulshreshtha et al. (1991). The value of meat products in 1992 was estimated using the fixed proportions of meat products to the value of live animals in 1988 multiplied by the value of live animals in 1992, where the value of live animals was based on data on cash receipts in 1992. The calculation is summarized by the equation (C.1).

$$Q_i^{1992} = (Q_i^{1988} / Q^{1988}).Q^{1992} \qquad (C.1)$$

where

Q_i^{19xx} is the estimated value of commodity i in a given year (1992 or 1988).

Q_i^{xx} is the total value of agriculture output in a given year.

Using this relationship, the value of Manure and Compost, and Other Finance, Insurance and Real Estate were obtained[1].

Based on the actual receipts and estimated value of commodities, the total value of agriculture for 1992 was estimated at $3,622.27 Million. The proportion of the value of each commodity in the total was calculated. These proportions were then applied to the 1992 value of the agriculture output which was estimated using the I-O methodology (see Kulshreshtha et. al.1991), to produce the estimates of commodity values shown in Table C.2.

Table C.2. The 1992 I-O Agriculture Commodities, Corresponding Total Output Values and Allocation Proxies.

I-O COMMODITY	Proportions	($ million)
1. Grains	0.510	2,123.3
2. Live Animals	0.250	1,053.0
3. Other Agric. Products	0.170	728.4
4. Forest Products	0.002	7.8
5. Meat Products	0.008	36.2
6. Manure & Compost	0.041	169.7
7. Other Fin. Real Estate	0.003	10.9
TOTAL	1.000	4,129.5

C.1.2 Allocation of Value of Agricultural Output to Agricultural Sub-Sectors

Once the I-O based agriculture output value for 1992 was assigned to the seven commodities, the next task involved allocating them to eleven farm sectors. This was based on the use of proxies. According to the 1991 Census of Agriculture, eleven farm types are (1) Dairy, (2) Cattle, (3) Pigs, (4) Poultry, (5) Wheat, (6) Small Grains, (7) Field Crops, (8) Vegetables & Fruits, (9) Specialty Crops, (10) Livestock Combination, and (11) Other Combination. The allocation proxies included Land planted to grains, livestock population on farms, cattle on farms, unimproved land, farm capital, a proxy for value of other agricultural products (based on the 1981

[1] For manure the reference commodity was also the value of live animals. But for Other FIRE , the calculation was based on the value of total output in 1988.

census). The data on the allocation proxies were obtained from the 1991 Census of agriculture.

After the commodity output was assigned to the eleven farm types using the various proxies, the eleven farm types were re-arranged into three farm types that were relevant to this study, namely, CPS wheat, Cattle and Other agriculture. The CPS wheat enterprise was defined to be producing only CPS wheat. The Cattle sub-sector was defined as the producer of cattle and calves. The other agriculture sectors represent all farm types except CPS wheat and Cattle. In allocating these three categories of commodities to the three farm sectors, it was recognized that each commodity is a broad category consisting of many products. Following Statistics Canada commodity aggregation, the commodity composition is as below: (1) Grains- which include wheat, barley, oats, rye; (2) Live animals- which include cattle & calves, hogs, poultry, sheep and lambs, and other live animals; (3) Other agricultural products- which include hay, forage and straw, seeds, excluding oil and seed grades.

The total value of CPS wheat in 1992 was equal to the share of CPS wheat in total wheat acreage in Saskatchewan during 1992 (Canadian Wheat Board, 1992) multiplied by the estimated value of wheat in 1992. The assigned value to wheat farms in terms of grains was $1,321.2 million, and the share of CPS wheat in total wheat acreage was 3.52%. Thus, the value of CPS wheat = (0.0352) X ($1321.15 million) = $ 46.5 million.

The estimated final value of output for the three farm subsectors in this study is shown in Table C.3.

Table C.3. Estimated Value of Output for Agriculture Sub-Sectors, 1992

SECTOR	($ million)
1. CPS Wheat	46.5
2. Cattle	833.5
3. Other Agric. Products	3,249.5
TOTAL	4,129.5

A distribution matrix (Table C.4) was constructed to allocate output to each of the eleven agricultural subsectors and later aggregated into three subsectors. The elements of the distribution matrix were derived using the various proxies shown in Table C.5

C.2 Estimation of the Input Matrix

The estimation of the input matrix for the three agricultural sub-sectors can also be divided into several steps. These are described below:

(1) The 1992 input vector for the agriculture sector was obtained from the (1992) Saskatchewan transactions table. These data reflected purchases of a single agriculture sector from the 50 sectors in the economy.

(2) The farm expenses by commodity for Saskatchewan for the year 1988, as reported in Kulshresththa et al. (1991), were used to assign the 100 commodities into 50 sectors. The proportions of expenditure on a commodity basis for each corresponding sector were calculated. For sectors with more than one commodity category, the appropriate breakdown was used.

(3) For each commodity, an allocation proxy was selected. Data on the proxy were collected from the 1991 Census (see Table C.4). Expenditure value by farm type was estimated by multiplying the total expenditure in that sector by the value of proxy. The proxies used were : farm capital, other expenses, fertilizer, acreages, acreage seeded to grain, livestock population, output value of all farm types, market value of land, buildings, machinery and equipment and the number of weeks worked by hired labor throughout Saskatchewan.

(4) The values of all purchases for each farm type were added and entered into a sectoral matrix by farm type.

(5) Steps One to Four for each sector were repeated.

(6) Steps One to Five resulted in an input matrix, 100 commodities by 11 farm sectors, which is shown in Table C.6.

These 11 farm sectors were collapsed into 3 farm sectors (as noted above -- CPS wheat, Cattle, and Other Agricultural Products) of interest in this study. The CPS wheat sector was created by adjusting the expenditures of the census wheat farms, using percentages of total wheat acreage seeded to CPS wheat for Saskatchewan during 1992. Data on CPS wheat production was obtained from a Canadian Wheat Board (1992) report. The Other Agricultural Products sector was created by combining all

Table C.4. Allocation Proxies for Distribution Ratios

Allocation Proxy	Dairy	Cattle	Pigs	Poultry	Wheat	Small Grains	Field Crops	Fruits & Veg.	Spec. Crops	Lvstk. Comb.	Other Comb.	Total
Cattle & Calves Population	0.039	0.724	0.006	0.001	0.160	0.000	0.000	0.000	0.002	0.054	0.013	1.000
Farm Capital	0.015	0.161	0.017	0.003	0.495	0.259	0.006	0.000	0.007	0.029	0.007	1.000
Farm Expenses	0.027	0.173	0.031	0.011	0.421	0.280	0.007	0.001	0.010	0.031	0.008	1.000
Land Fertilized	0.008	0.081	0.014	0.001	0.468	0.394	0.004	0.000	0.001	0.023	0.006	1.000
Land Seeded to Grains	0.008	0.092	0.012	0.001	0.622	0.234	0.002	0.000	0.001	0.023	0.005	1.000
Livestock Population	0.024	0.450	0.162	0.000	0.112	0.145	0.000	0.000	0.007	0.089	0.011	1.000
Output Value of All Farms	0.028	0.167	0.032	0.011	0.431	0.274	0.007	0.001	0.010	0.032	0.008	1.000
Value of Land and Buildings	0.013	0.135	0.017	0.003	0.519	0.262	0.007	0.000	0.007	0.028	0.007	1.000
Value of Machinery and Equipment	0.014	0.123	0.012	0.002	0.534	0.279	0.007	0.000	0.005	0.023	0.000	1.000
Weeks Worked by Hired Labor	0.045	0.147	0.021	0.013	0.451	0.249	0.010	0.003	0.025	0.029	0.008	1.000

Table C.5 Allocation Proxies for the Total Agricultural Commodity Output

COMMODITY	Amount ($ Million)	Allocation Proxy
1. Grain	2,282.0	Land Planted Grains
2. Live Animals	649.9	Livestock Composite
3. Other Agric Prod.	1,054.0	Composite of Proxies
4. Forest Products	6.5	Unimproved Land
5. Meat Products	23.2	Livestock Population
6. Manure & Compost	104.7	Livestock on Farms
7.Other Fin., R.Estate	8.4	Farm Capital
TOTAL	4129.5	

other farm types excluding cattle and CPS wheat. The result was a 100 by 3 input matrix for the three farm sectors. The 100 by 3 matrix was aggregated into 13 by 3 matrix. The aggregation involved assigning the 100 commodities into the 50 sectors and then aggregating the 50 sectors into 13 sectors.

The above set of transactions for the three agricultural sub-sectors did not include inter-sectoral transactions. To estimate these, knowledge of the products used as inputs by each farm type was required in addition to knowing which farm type was to serve as a principal producer of the product. It was assumed that the principal producer sector of the product will supply its own needs as well as sell it to other farm subsectors. It was assumed that commercial seed is produced by specialized farms and hence by the CPS wheat and Other Agricultural Products sector. Similarly for the Cattle sector, it was that the sector contributes 69 percent to the value of total live animals. Hence, assuming a direct proportion between output and inputs, cattle will contribute 69 percent to livestock purchases.

Commodity balance sheets were developed for each of the three commodities. Along the rows the 3 farm types were listed as producers, while along the columns the 3 farm sectors stand as the purchasers of the commodity. Therefore, this process allowed the commodities to be converted into farm sector categories. Finally, the three commodity balance sheets were added to produce a 3 by 3 matrix of transactions between the three agricultural sectors. The total value of transactions between the

Table C.6. Allocation of Input Use by Commodity, for Saskatchewan Farm Subsectors, 1992

Commodity	1988 Expenses	Shares	1992 Expenses	Allocation Proxy	Dairy	Cattle	Pigs	Poultry
1. Commercial Seed	233.34	0.39	43.04	LPG	0.35	3.94	0.52	0.04
2. Live Animals	49.68	0.08	24.2	LVST	0.59	10.88	3.91	0.01
3. Other Ag. Prod.	317.28	0.53	252.74	LPG	2.04	23.13	3.08	0.23
4. Forest Products	0.3	1	0.22	FEX	0.01	0.04	0.01	0
9. Coal	0.89	1	11.28	FEX	0.3	1.96	0.35	0.12
11. Natural Gas	0.79	1	4.08	FEX	0.11	0.71	0.13	0.05
12. Non-Metal Minerals	3.66	1	0.58	FEX	0.02	0.1	0.02	0.01
14. Custom Work Meat & Food	1.88	0.02	0.31	FOV	0.01	0.05	0.01	0
18. Feeds	114.47	0.98	46.37	LVST	1.12	20.85	7.5	0.02
27. Tires and Tubes	12.61	1	0	MACH	0	0	0	0
29. Plastic fab. Prodcts	0.89	1	0.21	FEX	0.01	0.04	0.01	0
33. Other Textile Prodcts	3.26	1	0.2	FEX	0.01	0.03	0.01	0
36. Lumber & Timber	0.02	1	0.26	BUILD	0	0.04	0	0
38. Other Wood Fab. Materials	1.01	1	0		0	0	0	0
42. Paper Prdcts	0.99	1	0.17	FOV	0	0.03	0.01	0
57. Modifcations, Conver	0.69	1	0.89	MACH	0.01	0.11	0.01	0
52. Agric. Machinery	45.65	1	5.5	MACH	0.08	0.68	0.07	0.01
61. Insulators & Elect.Fittings.Porce	0.1	1	0.21	MACH	0	0.03	0	0
62. Gasoline and Fuel Oil	240.75	0.85	74.86	MACH	1.06	9.23	0.9	0.15
63. Butane, Propane &Other Liquid Pet.Gas	42.23	0.15	13.13	MACH	0.19	1.62	0.16	0.03
64. Indus Chemical	142.67	0.31	9.1	LFERT	0.07	0.74	0.13	0.01
65. Fertilizer	166.97	0.36	10.65	LFERT	0.09	0.86	0.15	0.01
66. Pharmaceuticals	1.5	0	0.1	LVST	0	0.04	0.02	0
67.Other Chemical Products	150.85	0.33	9.62	LPG	0.08	0.88	0.12	0.01
72.Repair Construction	41.65	1	36.41	BUILD	0.49	4.93	0.63	0.1
74.Transport & Storage	9.69	1	4.99	FCAP	0.08	0.8	0.08	0.01
73. Pipeline Transport	3.46	1	1.23	FCAP	0.02	0.2	0.02	0
76. Telephone & Telegraph	21.26	0.93	20	FEX	0.53	3.47	0.62	0.22
77. Postal Service	1.48	0.07	1.39	FEX	0.04	0.24	0.04	0.02
78. Electricity	48.61	0.97	57.27	FEX	1.52	9.93	1.77	0.63
79. Other Utilities	1.57	0.03	1.85	FEX	0.05	0.32	0.06	0.02

Continued

Table C.6 Contd.

Allocation of Input Use by Commodity, for Saskatchewan Farm Subsectors, 1992

Commodity	1988 Expenses	Shares	1992 Expenses	Allocation Proxy	Dairy	Cattle	Pigs	Poultry
80.Wholesale Margins	115.78	1	39.55	FEX	1.05	6.86	1.22	0.44
81. Retail Margins	13.45	1	20.69	FEX	0.55	3.59	0.64	0.23
83. Other FIRE	301.54	1	209.79	FCAP	3.24	33.81	3.56	0.58
84.Business Services	10.19	1	4.03	FCAP	0.06	0.65	0.07	0.01
89.Other Pers. & Misc.Serv	44.7	1	11.21	FOV	0.32	1.88	0.36	0.12
91. Suppliesfor Office,Lab,Cafe	203.2	1	254.69	FEX	6.77	44.15	7.88	2.81
92.Travel,Advertising, Promotion	0.2	1	0.22	FEX	0.01	0.04	0.01	0
90. Transport Margins	41.53	1	12.83	FOV	0.36	2.15	0.41	0.14
95.Indirect Taxes	259.69	1	269.16	BUILD	3.63	36.47	4.68	0.75
96.Subsidies	-1029.67	1	-505.01	LPG, LVS	-8.64	-84.68	-22.28	-0.4
97.Wages	190.38	1	227.98	HLABOR	10.16	33.42	4.68	2.97
99. Net Income, Uninc.Business	665.3	1	263.69		4.07	42.49	4.47	0.73
100. Other Operating Surplus	807.28	1	1358.06	FCAP	20.96	218.85	23.03	3.74
TOTAL	3283.75		2797.74		51.4	435.53	49.05	13.8

Continued

Table C.6 Contd.

Allocation of Input Use by Commodity, for Saskatchewan Farm Subsectors, 1992

Commodity	Wheat	Small Grains	Field Crops	Fruits	Speciality Crops	Livestock	Other Combn	Total
1. Commercial Seed	26.78	10.09	0.07	0	0.02	1.01	0.23	43.04
2. Live Animals	2.71	3.5	0.01	0	0.17	2.16	0.26	24.2
3. Other Ag. Prod.	157.26	59.24	0.39	0	0.13	5.9	1.35	252.74
4. Forest Products	0.09	0.06	0	0	0	0.01	0	0.22
9. Coal	4.75	3.16	0.08	0.01	0.11	0.35	0.09	11.28
11. Natural Gas	1.72	1.14	0.03	0	0.04	0.13	0.03	4.08
12. Non-Metal Minerals	0.24	0.16	0	0	0.01	0.02	0	0.58
14. Custom Work Meat & Food	0.13	0.08	0	0	0	0.01	0	0.31
18. Feeds	5.18	6.71	0.02	0	0.32	4.15	0.5	46.37
27. Tires and Tubes	0	0	0	0	0	0	0	0
29. Plastic fab. Prodcts	0.09	0.06	0	0	0	0.01	0	0.21
33. Other Textile Prodcts	0.08	0.06	0	0	0	0.01	0	0.2
36. Lumber & Timber	0.13	0.07	0	0	0	0.01	0	0.26
38. Other Wood Fab. Materials	0	0	0	0	0	0	0	0
42. Paper Prdcts	0.07	0.05	0	0	0	0.01	0	0.17
57. Modifcations, Conver	0.48	0.25	0.01	0	0	0.02	0	0.89
52. Agric. Machinery	2.94	1.54	0.04	0	0.03	0.13	0	5.5
61. Insulators & Elect.Fittings,Porce	0.11	0.06	0	0	0	0	0	0.21
62. Gasoline and Fuel Oil	40	20.92	0.49	0.02	0.38	1.72	0	74.86
63. Butane, Propane &Other Liquid Pet.Gas	7.02	3.67	0.09	0	0.07	0.3	0	13.13
64. Indus Chemical	4.26	3.59	0.03	0	0.01	0.21	0.06	9.1
65. Fertilizer	4.98	4.2	0.04	0	0.01	0.24	0.06	10.65
66. Pharmaceuticals	0.01	0.01	0	0	0	0.01	0	0.1
67.Other Chemical Products	5.99	2.26	0.01	0	0	0.22	0.05	9.62
72.Repair Construction	18.89	9.55	0.25	0.01	0.25	1.03	0.27	36.41
74.Transport & Storage	2.47	1.29	0.03	0	0.04	0.14	0.04	4.99
73. Pipeline Transport	0.61	0.32	0.01	0	0.01	0.04	0.01	1.23
76. Telephone & Telegraph	8.42	5.6	0.15	0.01	0.2	0.63	0.15	20
77. Postal Service	0.59	0.39	0.01	0	0.01	0.04	0.01	1.39
78. Electricity	24.12	16.03	0.42	0.03	0.57	1.8	0.44	57.27
79. Other Utilities	0.78	0.52	0.01	0	0.02	0.06	0.01	1.85

Continued

Table C.6 Concluded
Allocation of Input Use by Commodity, for Saskatchewan Farm Subsectors, 1992.

Commodity	Wheat	Small Grains	Field Crops	Fruits	Specialty Crops	Livestock	Other Combn	Total
80.Wholesale Margins	16.66	11.07	0.29	0.02	0.39	1.24	0.3	39.55
81. Retail Margins	8.71	5.79	0.15	0.01	0.21	0.65	0.16	20.69
83. Other FIRE	103.8	54.31	1.33	0.04	1.51	6.05	1.56	209.79
84.Business Services	1.99	1.04	0.03	0	0.03	0.12	0.03	4.03
89.Other Pers. & Misc.Serv	4.83	3.07	0.08	0.01	0.11	0.36	0.08	11.21
91. Suppliesfor Office,Lab,Cafe	107.26	71.29	1.87	0.15	2.53	8.01	1.96	254.69
92.Travel,Advertising, Promotion	0.09	0.06	0	0	0	0.01	0	0.22
90. Transport Margins	5.53	3.51	0.09	0.01	0.12	0.41	0.1	12.83
95.Indirect Taxes	139.66	70.62	1.85	0.09	1.86	7.6	1.96	269.16
96.Subsidies	-257.29	-107.99	-0.64	-0.01	-0.94	-18.87	-3.27	-505.01
97.Wages	102.87	56.79	2.36	0.62	5.7	6.56	1.84	227.98
99. Net Income, Uninc.Business	130.47	68.27	1.67	0.05	1.89	7.61	1.97	263.69
100. Other Operating Surplus	671.96	351.59	8.61	0.27	9.75	39.18	10.12	1358.06
TOTAL	1357.4	743.98	19.89	1.35	25.58	79.29	20.39	2797.74

Table C.7 Estimates of Intersectoral Transactions among the three Farm Sectors for 1992. ($ million)

	CPS wheat	Cattle	Other Agric.	Row Total
CPS Wheat	0.94	0	0	0.94
Cattle	0	10.80	6.03	16.83
Other Agric.	0	186.20	113.86	300.06
Column Total	0.94	197.00	119.89	317.83

Saskatchewan agricultural sectors were estimated at $ 317 million for 1992 (see Table C.7).

C.3 Determination of Sales from Agriculture to Non-agricultural sectors and Final Demand.

In order to complete the rows for the three agricultural sub-sectors, details on sales of products as intermediate demand and final demand needed to be estimated. This involved disaggregating the single row of sales by the single agriculture sector to other sectors and final demand contained in the estimated transactions table of Saskatchewan for 1992. These transactions were distributed among the three farm sectors, using the following procedure:

From the updated and aggregated transactions table the row of sales by the single agriculture sector to other sectors in the economy was obtained. The sales made by the single agriculture sector to a particular sector were converted into sales originating from the three farm sectors to that particular sector. This allocation was achieved using the share of each farm sector in the total agricultural sales made to a particular non-farm sector. The shares were generated using data contained in Kulshreshtha et al (1991), which provided information on sales by the 12 farm types to all other sectors in the economy for 1988. For this study, the 12 farm types were re-arranged into three farm types. At the same time the buying sectors were collapsed into 13 sectors corresponding to those in the estimated 1992 transaction table for Saskatchewan.

A table of sales from the three farm sectors to the non-farm sectors in the economy was obtained from the transaction table of 1988 reported by Florizone and Kulshreshtha (1991). From this table the share for each farm sector in the total sales from farm sectors to each non-farm sector was calculated. Assuming these proportions of sales to the non-agricultural sectors remain unchanged (i.e. technology remains unchanged), these shares were used to allocate the sales of the single agriculture sector to the non-farm sector across the three farm sectors.

A breakdown of sales by the three farm sectors (CPS wheat, Cattle and other agriculture) to the non-agricultural sectors and final demand was obtained by multiplying the agricultural sector's share in total sales of the farm sectors to the non-agricultural sector by the total sales to that sector made by the single agriculture sector.

The intermediate and final demand sales by each of the three agricultural sectors were checked to ensure they equaled the estimated production. Also the exports by each farm sector were checked and found to be within normal range of level of exports for Saskatchewan.

APPENDIX D

Place-of-Residence Employment Profiles by Hierarchical Study Regions.

Determination of place-of-residence employment was required to undertake estimation of employment by place-of-work. In this appendix, the procedure followed for this estimation is described.

D.1. Preparation of Regional Employment by Sector

To generate regional input-output tables, suitable data on employment by various sectors were required from all the seven regions. Employment data based on place-of-residence were obtained from the 1991 census (Statistics Canada). The data indicated place-of-residence employment by major industry category (small level industry aggregation) for all the census subdivisions in Saskatchewan. The data were collected and arranged into the seven study regions. Although employment level in an industry is a good indicator of economic activity, employment by place-of-residence is inappropriate in this respect. This is due to the fact that employment by place-of-residence is for all residents in a given community. These residents can either be employed in their place of residence (non-commuters) or can be employed in a place different from their place of residence (commuters).

D.2. Generation of Employment by Place of Work

The appropriate measure is employment by-place-of-work. Employment by place-of-residence is made up of two types of employed workers residing in a community (or region), namely, (1) non-commuters (2) out-commuters. On the other hand, employment by place-of work is made up of two types of workers - non-commuters and in-commuters. Estimates of sectoral employment by place-of-work were derived by netting out commuting flows from employment by place-of-residence. This was achieved through a number of steps and assumptions listed below:

Step 1: The commuting flows were assembled using raw data of 1991 commuter flows for various CSDs in Saskatchewan provided by Statistics Canada *(Special Tabulations)*. Estimation of the commuting flows among the seven regions involved taking commuting flows for a sample of about 50 CSDs representing a region, and making extrapolations to give the estimates for the whole region. For regions made up of fewer CSDs, for example, PWR, SWR, CSC, and PSC, estimates of inter-community commuting flows were based on the total number of CSDs. This led to a 7 X 7 matrix of commuting flows among the seven regions (refer to Table D.1). The row total of this matrix represents the total regional employment by-place-of-residence. While the column total, represents the total regional employment by-place-of-work.

Table D.1. Place-Of-Residence Employment* Profiles by Functional Areas

	PWR	SWR	CSC	PSC	FCC	MCC	ROS
SECTORS:							
1.Agriculture	3,315	2,635	980	4,115	4,740	4,710	70,280
2.Fishing & Trapping	20	30	10	0	10	0	180
3.Logging & Forestry	335	290	115	85	110	135	735
4.Mining,& Related	2,820	1,890	370	1,530	1,325	915	2,950
5. Manufacturing	14,265	4,190	620	1,735	1,045	1,025	3,995
6. Construction	10,765	3,930	855	1,955	1,800	1,550	4,685
7.Transport & Storage	8,155	3,090	460	2,270	1,320	1,625	3,885
8. Communic & Utilities	9,440	2,630	410	805	680	535	1,570
9. Wholesale	10,420	2,615	680	1,680	1,165	975	2,700
10.Retail Trade	25,935	10,950	2,155	5,500	3,600	2,530	8,230
11.Fin. & Insurance	8,470	2,215	430	1,315	1,000	665	2,175
12.RealEstate& Insur.	3,870	1,010	160	305	160	120	505
13.Business Services	10,830	2,015	300	580	425	395	1,565
14.Govt. Service	17,325	5,655	860	2,200	2,100	2,360	6,385
15.Education Service	17,050	4,885	905	2,910	2,930	2,105	6,580
16.Health Service	22,045	8,645	1,335	3,955	2,720	1,645	8,100
17.Accom.,Food,Bev.	14,920	5,310	875	2,665	1,665	1,495	4,340
18.Other Service	15,265	4,925	970	2,420	1,640	975	3,970
TOTAL	195,245	66,910	12,490	36,025	28,435	23,760	132,830

*Total both sexes

Source:Compiled using special tabulations data from Statistics Canada for the 1991 Census on employment by place-of-residence for Subdivisions (CSDs) for Saskatchewan.

Step 2: The commuting flows at the end of the above steps were an aggregate of commuters on the basis of origin and destination CSD. However, for adjusting employment by-place-of-residence into employment by-place-of-work, sector level commuting flows were needed. These estimates of commuting at sector level were derived using the following assumptions:

(a) Commuters from lower-order regions into higher-order regions are those employed in the non-primary industries; and,

(b) Commuters from higher-order regions into lower-order regions are those employed in the primary industries.

The primary industries include agriculture, fishing. logging, and mining, whereas, the non-primary industries include the remaining sectors. The aggregate net commuting flows for a given region were converted into commuting flows at the sectoral level. The estimation[2] involved allocating the aggregate commuter flows among the industries according to the distribution of employment by sector in each region.

Step 3: Since it is known that production in the primary industries takes place in the hinterland (ROS), and not in the cities or towns, it was assumed that those employed in the primary industries were commuting to work in the ROS region. Thus, the place-of-work employment in the primary industries for top six regions was set equal to zero.

Step 4: For the non-primary sectors, the commuting outflows and inflows estimated above were netted out from the regional employment by place-of-residence to produce estimates of regional employment by-place-of-work for each sector across the seven regions.

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[2] It was assumed that the ratio of commuters to non-commuters was the same for all primary or non-primary sectors.

Table D.2 Place-of Work Employment by Industry for the Seven Study Regions

Sector	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Total
1. Agriculture	2,030	2,787	1,037	4,696	3,953	5,208	7,1021	90,735
2. Fish.& Forestry	217	336	130	162	100	148	642	1,735
3. Mining	1,727	2,019	428	2,094	1,105	1,054	2,619	11,050
4. Manufact.	15,240	5,067	905	2,512	889	657	1,387	26,660
5. Constru.	12,062	5,000	1,208	2,867	1,521	863	1,546	25,070
6. Transport	9,356	4,046	773	2,982	1,136	821	1,272	20,390
7. Communic.	9,914	2,968	526	1,092	572	289	501	15,865
8. Wholesale	11,252	3,309	900	2,214	983	540	965	20,165
9. Retail	28,317	12,885	2,771	6,962	3,020	1,462	2,751	58,170
10. F.I.R.E	13,101	3,875	799	2,141	971	478	954	22,320
11. Services	105,469	38,072	7,428	20,214	9,669	5,171	9,690	195,715
TOTAL	208,688	80,369	16,908	47,940	23,923	16,695	93,349	487,875

Table D.3 Aggregated Cross-Region Commuting Flows for Saskatchewan, 1991

	Place-of-Work Employment By Type of Region							
Place-of-Residence	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Row Total
PWR	169,745	1,294	191	723	0	0	3,361	172,290
SWR	1185	55,040	72	628	0	0	264	58,090
CSC	180	28	10,540	94	0	0	48	10,891
PSC	659	1,741	48	27,872	0	0	223	30,544
FCC	1,967	936	492	824	23,558	650	375	28,804
MCC	7,249	2176	1,065	1,040	743	21,535	0	33,810
ROS	4,708	9,463	2,900	11,276	0	4,559	89,139	122,048
Column Total	185,695	71,580	15,310	42,459	24,302	26,746	90,378	456,480

APPENDIX E

Commodity Margins by Commodity for Canada 1991

Table E.1. Commodity Margins by Commodity for Canada 1991

No.	Commodity	Retail	Whole sale	Tax	Transp ort	Gas	Storage	Pipeline	Producer Share	Total
1	Grains	0.00	0.08	0.00	0.17	0.00	0.13	0.00	0.62	1.00
2	Live animals	0.00	0.02	0.00	0.02	0.00	0.00	0.00	0.96	1.00
3	Other agricultural products	0.13	0.09	0.02	0.05	0.00	0.01	0.00	0.71	1.00
4	Forestry products	0.00	0.01	0.01	0.04	0.00	0.00	0.00	0.94	1.00
5	Fish landings	0.02	0.07	0.00	0.02	0.00	0.00	0.00	0.89	1.00
6	Hunting & trapping products	0.00	0.15	0.00	0.16	0.00	0.00	0.00	0.69	1.00
7	Iron ores & concentrates	0.00	0.00	0.00	0.32	0.00	0.00	0.00	0.68	1.00
8	Other metal ores & concentrates	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.97	1.00
9	Coal	0.00	0.03	0.00	0.71	0.00	0.00	0.00	0.25	1.00
10	Crude mineral oils	0.00	0.00	0.00	0.01	0.00	0.00	0.07	0.92	1.00
11	Natural gas	0.00	0.00	0.05	0.00	0.41	0.00	0.51	0.03	1.00
12	Non-metallic minerals	0.01	0.04	0.02	0.38	0.00	0.00	0.00	0.55	1.00
13	Services incidental to mining	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00
14	Meat products	0.19	0.05	0.00	0.03	0.00	0.00	0.00	0.73	1.00
15	Dairy products	0.18	0.08	0.00	0.02	0.00	0.00	0.00	0.72	1.00
16	Fish products	0.13	0.13	0.00	0.02	0.00	0.00	0.00	0.71	1.00
17	Fruits & vegetables preparation	0.30	0.16	0.01	0.06	0.00	0.00	0.00	0.47	1.00
18	Feeds	0.07	0.09	0.03	0.05	0.00	0.00	0.00	0.76	1.00
19	Flour, wheat, meal & other cereals	0.11	0.14	0.00	0.10	0.00	0.00	0.00	0.64	1.00
20	Breakfast cereal & bakery products	0.35	0.07	0.02	0.05	0.00	0.00	0.00	0.51	1.00
21	Sugar	0.16	0.31	0.00	0.05	0.00	0.00	0.00	0.48	1.00
22	Misc. food products	0.25	0.18	0.07	0.06	0.00	0.00	0.00	0.45	1.00
23	Soft drinks	0.19	0.14	0.14	0.04	0.00	0.00	0.00	0.49	1.00
24	Alcoholic beverages	0.15	0.02	0.51	0.01	0.00	0.00	0.00	0.32	1.00
25	Tobacco processed unmanufactured	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.98	1.00
26	Cigarettes & tobacco mkg.	0.07	0.02	0.45	0.00	0.00	0.00	0.00	0.45	1.00
27	Tires & tubes	0.21	0.17	0.07	0.04	0.00	0.00	0.00	0.51	1.00
28	Other rubber products	0.04	0.07	0.03	0.02	0.00	0.00	0.00	0.84	1.00
29	Plastic fabricated products	0.03	0.08	0.05	0.04	0.00	0.00	0.00	0.79	1.00
30	Leather & leather products	0.42	0.07	0.14	0.02	0.00	0.00	0.00	0.36	1.00
31	Yarns & manmade fibres	0.04	0.10	0.01	0.02	0.00	0.00	0.00	0.83	1.00
32	Fabrics	0.11	0.15	0.04	0.02	0.00	0.00	0.00	0.68	1.00
33	Other textile products	0.26	0.16	0.15	0.04	0.00	0.00	0.00	0.38	1.00
34	Hosiery & knitted wear	0.48	0.05	0.14	0.01	0.00	0.00	0.00	0.31	1.00

Table E.1. Continued

No.	Commodity	Retail	Whole sale	Tax	Transp ort	Gas	Storage	Pipeline	Producer Share	Total
35	Clothing & accessories	0.51	0.07	0.15	0.02	0.00	0.00	0.00	0.25	1.00
36	Lumber & timber	0.00	0.20	0.03	0.14	0.00	0.00	0.00	0.63	1.00
37	Veneer & prlywood	0.05	0.30	0.07	0.09	0.00	0.00	0.00	0.48	1.00
38	Other wood fabricated material	0.00	0.15	0.05	0.09	0.00	0.00	0.00	0.71	1.00
39	Furniture & fixtures	0.31	0.10	0.17	0.04	0.00	0.00	0.00	0.37	1.00
40	Pulp	0.00	0.02	0.00	0.06	0.00	0.00	0.00	0.93	1.00
41	Newsprint & other paper stock	0.00	0.07	0.00	0.08	0.00	0.00	0.00	0.84	1.00
42	Paper products	0.11	0.17	0.08	0.05	0.00	0.00	0.00	0.59	1.00
43	Printing & publishing	0.07	0.06	0.09	0.02	0.00	0.00	0.00	0.77	1.00
44	Advertising, print media	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.99	1.00
45	Iron & stel products	0.00	0.08	0.01	0.05	0.00	0.00	0.00	0.85	1.00
46	Aluminum products	0.00	0.03	0.00	0.02	0.00	0.00	0.00	0.95	1.00
47	Copper & copper alloy products	0.00	0.02	0.00	0.03	0.00	0.00	0.00	0.95	1.00
48	Nickel products	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.98	1.00
49	Other non-ferrous metal products	0.00	0.31	0.00	0.09	0.00	0.00	0.00	0.60	1.00
50	Boiler, tanks & plates	0.00	0.12	0.05	0.03	0.00	0.00	0.00	0.80	1.00
51	Fabricated structural metal products	0.01	0.07	0.07	0.03	0.00	0.00	0.00	0.83	1.00
52	Other metal fabricated products	0.06	0.21	0.06	0.04	0.00	0.00	0.00	0.63	1.00
53	Agricultural machinery	0.14	0.47	0.04	0.08	0.00	0.00	0.00	0.26	1.00
54	Other industrial machinery	0.03	0.58	0.09	0.06	0.00	0.00	0.00	0.24	1.00
55	Motor vehicles	0.06	0.08	0.11	0.03	0.00	0.00	0.00	0.73	1.00
56	Motor vehicle parts	0.16	0.24	0.04	0.05	0.00	0.00	0.00	0.51	1.00
57	Other transport equipment	0.02	0.03	0.02	0.01	0.00	0.00	0.00	0.91	1.00
58	Appliances & receivers, hhold	0.30	0.18	0.15	0.02	0.00	0.00	0.00	0.36	1.00
59	Other electrical products	0.04	0.20	0.07	0.02	0.00	0.00	0.00	0.67	1.00
60	Cement & concrete products	0.00	0.05	0.07	0.09	0.00	0.00	0.00	0.79	1.00
61	Other non-netallic mineral products	0.17	0.22	0.11	0.13	0.00	0.00	0.00	0.37	1.00
62	Gasoline & fuel oil	0.06	0.27	0.49	0.03	0.00	0.00	0.01	0.15	1.00
63	Other petroleum & coal products	0.03	0.10	0.04	0.09	0.00	0.00	0.04	0.70	1.00
64	Industrial chemicals	0.00	0.08	0.01	0.09	0.00	0.00	0.00	0.83	1.00
65	Fertilizers	0.03	0.12	0.01	0.27	0.00	0.00	0.00	0.56	1.00
66	Pharmaceuticals	0.55	0.31	0.06	0.02	0.00	0.00	0.00	0.05	1.00
67	Other chemical products	0.30	0.19	0.13	0.06	0.00	0.00	0.00	0.32	1.00

Table E.1. Continued

No.	Commodity	Retail	Whole sale	Tax	Transp ort	Gas	Storage	Pipeline	Producer Share	Total
68	Scientific equipment	0.46	0.32	0.18	0.04	0.00	0.00	0.00	0.01	1.00
69	Other manufactured products	0.38	0.17	0.16	0.02	0.00	0.00	0.00	0.27	1.00
70	Residential construction	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.94	1.00
71	Non-residential construction	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.99	1.00
72	Repair construction	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.99	1.00
73	Pipeline transportation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00
74	Transportation & storage	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.98	1.00
75	Radio & television broadcasting	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.93	1.00
76	Telephone & telegraph	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.90	1.00
77	Postal services	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.98	1.00
78	Electric power	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.94	1.00
79	Other utilities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00
80	Wholesale margins	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00
81	Retail margins	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.99	1.00
82	Imputed rent owner occ. dwell.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00
83	Other finance, ins., real estate	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.99	1.00
84	Business services	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.98	1.00
85	Education services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00
86	Health services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00
87	Amusement & Recreation services	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.93	1.00
88	Accom & food services	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.90	1.00
89	Other personal & misc. Services	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.95	1.00
90	Transportation margins	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00
91	Oper., office, lab. & food	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00
92	Travel, advert. & promotion	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00
93	Non-competing imports	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00
94	Unalloc. Imports & exports	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00
95	Indirect taxes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00
96	Subsidies	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00
97	Wages & salaries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00
98	Supplementary labor income	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00
99	Net income, unincorporated business	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00
100	Other operating surplus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00

APPENDIX F

Subjective Percentages of Production for Export

Table F.1. Subjective Percentages of Regional Production for Exports by Sector and Functional Type of Region.

SECTOR	PWR	SWR	CSC	PSC	FCC	MCC	ROS
1.Ethanol	0.10	0.99	0.99	0.90	0.90	0.90	0.99
2. CPS Wheat	0	0	0	0	0	0	0.91
3. Cattle	0	0	0	0	0	0	0.91
4. Other Agric	0	0	0	0	0	0	0.91
5. Fish &Forest	0	0	0	0	0	0	0.91
6. Mining & Rel	0	0	0	0	0	0	0.91
7. Manufacturing	0.40	0.60	0.85	0.90	0.99	0.99	0.91
8. Construction	0	0	0	0	0	0	0.91
9. Transp & Stor	0.70	0.80	0.80	0.80	0.90	0.90	0.91
10.Communic.	0.10	0	0	0	0	0	0.91
11.Wholesale	0.49	0.50	0.50	0.60	0.60	0.70	0.91
12.Retail	0.09	0.06	0	0	0	0	0.91
13.FIRE	0.20	0.20	0.15	0.10	0	0	0.91
14.Services	0.15	0.11	0.11	0.10	0.10	0.10	0.91

Source: Personal Communications with Professor J.C Stabler.

APPENDIX G

Estimated Sectoral Trade Flows Between Seven Study Regions

Table G.1 Canadian Prairie Spring Wheat Trade Flows Between the Seven Regions ($ million)

	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Interregional Exports	Non-Sask Exports	Total
PWR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SWR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROS	1.73	0.57	0.11	0.29	0.13	0.10	0.00	2.93	42.23	45.15
Total Imports	1.73	0.57	0.11	0.29	0.13	0.10	0.00	2.93	42.23	45.15

Table G.2 Cattle Trade Flows Between the Seven Regions ($ million)

	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Interregional Exports	Non-Sask Exports	Total
PWR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SWR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROS	76.47	25.59	4.68	12.83	5.09	3.69	0.00	128.35	675.33	803.69
Total Imports	76.47	25.59	4.68	12.83	5.09	3.69	0.00	128.35	675.33	803.69

Table G.3 Other Agricultural Sector Trade Flows Between the Seven Regions ($ million)

	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Interregional Exports	Non-Sask Exports	Total
PWR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SWR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROS	177.38	58.92	10.88	29.82	13.61	10.09	0.00	300.69	2605.74	2906.43
Total Imports	177.38	58.92	10.88	29.82	13.61	10.09	0.00	300.69	2605.74	2906.43

Table G.4 Forestry and Fishing Trade Flows Between the Seven Regions ($ million)

	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Interregional Exports	Non-Sask Exports	Total
PWR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SWR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROS	41.42	13.82	2.50	6.94	2.83	2.13	0.00	69.63	6.88	76.51
Total Imports	41.42	13.82	2.50	6.94	2.83	2.13	0.00	69.63	6.88	76.51

Table G.5 Mining Trade Flows Between the Seven Regions ($ million)

	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Interregional Exports	Non-Sask Exports	Total
PWR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SWR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROS	222.15	73.13	13.13	32.27	16.74	10.10	0.00	367.51	3,071.4	3,438.9
Total Imports	222.15	73.13	13.13	32.27	16.74	10.10	0.00	367.51	3,071.4	3,438.9

Table G.6 Manufacturing Trade Flows Between the Seven Regions ($ million)

	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Interregional Exports	Non-Sask Exports	Total
PWR	0.00	0.74	27.31	88.64	71.13	48.99	431.93	668.73	788.39	1457.11
SWR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	475.89	475.89
CSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	107.03	107.03
PSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	314.42	314.42
FCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	122.32	122.32
MCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	90.51	90.51
ROS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	236.28	236.28
Total Imports	0.00	0.74	27.31	88.64	71.13	48.99	431.93	668.73	2134.86	2803.58

Table G.7 Construction Trade Flows Between the Seven Regions ($ million)

	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Interregional Exports	Non-Sask Exports	Total
PWR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.86	2.86
SWR	177.20	0.00	0.00	0.00	0.00	0.00	0.00	177.20	0.00	177.20
CSC	35.51	0.00	0.00	0.00	0.00	0.00	10.17	45.68	0.56	46.24
PSC	0.00	0.00	0.00	0.00	0.00	0.00	134.03	134.03	0.00	134.03
FCC	0.00	0.00	0.00	0.00	0.00	0.00	48.93	48.93	0.00	48.93
MCC	0.00	0.00	0.00	0.00	0.00	0.00	40.10	40.10	0.00	40.10
ROS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Imports	212.71	0.00	0.00	0.00	0.00	0.00	233.23	445.94	3.42	449.36

Table G.8 Transport and Storage Trade Flows Between the Seven Regions ($ million)

	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Interregional Exports	Non-Sask Exports	Total
PWR	0.00	0.08	1.84	6.15	13.31	9.15	81.82	112.34	741.72	854.06
SWR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	382.80	382.80
CSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	74.81	74.81
PSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	297.71	297.71
FCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	119.57	119.57
MCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	86.42	86.42
ROS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	204.46	204.46
Total Imports	0.00	0.08	1.84	6.15	13.31	9.15	81.82	112.34	1907.49	2019.83

Table G.9 Communication and Utilities Trade Flows Between the Seven Regions ($ million)

	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Interregional Exports	Non-Sask Exports	Total
PWR	0.00	0.00	46.66	127.29	76.55	53.63	433.92	738.04	49.45	787.49
SWR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	96.95	96.95
CSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Imports	0.00	0.00	46.66	127.29	76.55	53.63	433.92	738.04	146.40	884.45

Table G.10 Wholesale Trade Flows Between the Seven Regions ($ million)

	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Interregional Exports	Non-Sask Exports	Total
PWR	0.00	0.20	0.45	4.55	5.65	6.58	107.36	124.80	227.71	352.50
SWR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	96.34	96.34
CSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.04	31.04
PSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	77.74	77.74
FCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.49	32.49
MCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.59	18.59
ROS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.40	41.40
Total Imports	0.00	0.20	0.45	4.55	5.65	6.58	107.36	124.80	525.31	650.11

Table G.11 Retail Trade Flows Between the Seven Regions ($ million)

	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Interregional Exports	Non-Sask Exports	Total
PWR	0.00	4.53	6.46	44.00	53.19	55.73	0.08	163.99	0.00	163.99
SWR	0.00	0.00	0.00	0.00	0.00	0.00	158.69	158.69	0.00	158.69
CSC	0.00	0.00	0.00	0.00	0.00	0.00	44.76	44.76	0.00	44.76
PSC	0.00	0.00	0.00	0.00	0.00	0.00	128.30	128.30	0.00	128.30
FCC	0.00	0.00	0.00	0.00	0.00	0.00	39.05	39.05	13.69	52.74
MCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.00	28.00
ROS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	53.20	53.20
Total Imports	0.00	4.53	6.46	44.00	53.19	55.73	370.89	534.80	94.89	629.69

Table G.12 Financial, Insurance and Real Estate Trade Flows Between the Seven Regions ($ million)

	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Interregional Exports	Non-Sask Exports	Total
PWR	0.00	0.00	0.00	9.14	14.36	37.57	1037.97	1099.0	135.83	1234.87
SWR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	314.65	314.65
CSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	73.45	73.45
PSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	196.24	196.24
FCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.05	38.05
MCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Imports	0.00	0.00	0.00	9.14	14.36	37.57	1037.97	1099.0	758.23	1857.26

Table G.13 Services Trade Flows Between the Seven Regions ($ million)

	PWR	SWR	CSC	PSC	FCC	MCC	ROS	Interregional Exports	Non-Sask Exports	Total
PWR	0.00	5.93	6.80	34.18	41.40	49.91	514.31	652.55	5.08	657.63
SWR	0.00	0.00	0.00	0.00	0.00	0.00	200.02	200.02	104.05	304.07
CSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	61.76	61.76
PSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	193.96	193.96
FCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	83.89	83.89
MCC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.87	50.87
ROS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.78	29.78
Total Imports	0.00	5.93	6.80	34.18	41.40	49.91	714.33	852.57	529.39	1381.95

APPENDIX H

Hierarchical Seven-Region Input-Output Tables for Saskatchewan 1992

Hierarchical Seven-Region Input-Output Tables for Saskatchewan
1992

GLOSSARY:

Columns and Rows:

a1, a2,...,a14 = Sectors in region PWR
b1, b2,...,b14 = Sectors in region CSC
d1, d2,...,d14 = Sectors in region PSC
e1, e2,....,e14 = Sectors in region FCC
f1, f2,....,f14 = Sectors in region MCC
g1, g2,...,g14 = Sectors in region ROS

Columns:

pe1 = Personal consumption expenditure by residents of region one (PWR)
pe2 = Personal consumption expenditure by residents of region two (SWR)
pe3 = Personal consumption expenditure by residents of region three (CSC)
pe4 = Personal consumption expenditure by residents of region four (PSC)
pe5 = Personal consumption expenditure by residents of region five (FCC)
pe6 = Personal consumption expenditure by residents of region six (MCC)
pe7 = Personal consumption expenditure by residents of region seven (ROS)
Non-Wage PE* = Total Exogenous non-wage personal consumption expenditure
OFD = Other Final Demand
Out-of-Sk Exports = Out-of-Saskatchewan Exports

Rows:

Lab1 = Labor force of region 1 (PWR)
Lab2 = Labor force of region 2 (SWR)
Lab3 = Labor force of region 3 (CSC)
Lab4 = Labor force of region 4 (PSC)
Lab5 = Labor force of region 5 (FCC)
Lab6 = Labor force of region 6 (MCC)
Lab7 = Labor force of region 7 (ROS)
ovad = Other value added
Imports = Imports from Outside Saskatchewan

		PWR a1	a2	a3	a4	a5	a6	a7	a8	a9	a10	a11	a12	a13	a14
PWR	a1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a7	0.00	0.00	0.00	0.00	0.00	0.00	86.36	98.03	20.39	7.82	8.10	6.80	6.19	138.46
	a8	0.00	0.00	0.00	0.00	0.00	0.00	8.89	0.87	28.04	34.46	0.87	4.23	108.42	3.88
	a9	0.00	0.00	0.00	0.00	0.00	0.00	18.19	8.75	108.36	5.88	3.86	2.86	2.31	25.70
	a10	0.00	0.00	0.00	0.00	0.00	0.00	50.40	6.30	28.25	38.98	20.30	40.21	98.86	81.53
	a11	0.00	0.00	0.00	0.00	0.00	0.00	20.54	22.57	8.04	2.18	2.47	1.18	2.22	32.29
	a12	0.00	0.00	0.00	0.00	0.00	0.00	4.80	13.58	6.23	4.20	1.21	1.20	4.78	41.33
	a13	0.00	0.00	0.00	0.00	0.00	0.00	18.43	15.84	22.15	72.77	18.17	44.44	140.29	38.10
	a14	0.00	0.00	0.00	0.00	0.00	0.00	101.54	52.61	43.89	47.58	41.86	88.79	115.27	172.14
SWR	b1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b8	0.00	0.00	0.00	0.00	0.00	0.00	1.08	0.11	3.23	4.27	0.12	0.52	13.57	0.46
	b9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CSC	c1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c8	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.02	0.86	0.86	0.02	0.10	2.72	0.08
	c9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PSC	d1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FCC	e1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MCC	f1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROS	g1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g2	0.00	0.00	0.00	0.00	0.00	0.00	1.19	0.02	0.00	0.00	0.00	0.01	0.00	0.04
	g3	0.00	0.00	0.00	0.00	0.00	0.00	65.56	0.11	0.01	0.04	0.07	2.80	0.11	0.88
	g4	0.00	0.00	0.00	0.00	0.00	0.00	128.17	1.73	0.18	0.14	0.28	1.86	0.24	4.41
	g5	0.00	0.00	0.00	0.00	0.00	0.00	38.02	0.25	0.01	0.00	0.12	0.00	0.00	0.61
	g6	0.00	0.00	0.00	0.00	0.00	0.00	32.80	91.46	1.82	68.84	0.34	0.98	2.71	1.80
	g7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab1	0.00	0.00	0.00	0.00	0.00	0.00	405.58	386.24	228.86	477.88	287.18	389.81	588.89	631.88
	lab2	0.00	0.00	0.00	0.00	0.00	0.00	2.27	2.89	1.89	2.64	1.28	3.22	2.94	3.89
	lab3	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.80	0.21	0.34	0.29	0.54	0.46	0.86
	lab4	0.00	0.00	0.00	0.00	0.00	0.00	1.07	1.52	1.39	0.89	0.94	1.84	1.08	2.08
	lab5	0.00	0.00	0.00	0.00	0.00	0.00	2.84	5.72	3.29	3.08	2.86	4.93	4.83	6.81
	lab6	0.00	0.00	0.00	0.00	0.00	0.00	11.74	22.34	18.37	10.91	10.07	18.71	18.11	23.44
	lab7	0.00	0.00	0.00	0.00	0.00	0.00	9.74	13.67	8.83	6.28	6.11	10.47	11.28	18.62
	oved	0.00	0.00	0.00	0.00	0.00	0.00	86.07	208.05	170.12	603.46	104.20	145.67	1330.02	242.83
	imports	0.00	0.00	0.00	0.00	0.00	0.00	1028.56	486.42	383.20	132.13	62.86	88.04	200.30	888.24
TOTAL		0.00	0.00	0.00	0.00	0.00	0.00	2118.86	1432.07	1084.07	1520.07	562.32	832.03	2853.30	2167.03

[illegible]

		SWR b1	b2	b3	b4	b5	b6	b7	b8	b9	b10	b11	b12	b13	b14
PWR	a1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SWR	b1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b7	0.00	0.00	0.00	0.00	0.00	0.00	28.36	38.39	8.82	1.74	1.79	3.09	1.83	40.99
	b8	0.00	0.00	0.00	0.00	0.00	0.00	3.52	0.41	12.94	8.80	0.33	2.21	37.18	1.52
	b9	0.00	0.00	0.00	0.00	0.00	0.00	6.05	3.83	47.29	1.28	1.13	1.30	0.86	9.28
	b10	0.00	0.00	0.00	0.00	0.00	0.00	16.76	2.61	12.22	6.00	5.87	18.30	28.65	28.43
	b11	0.00	0.00	0.00	0.00	0.00	0.00	6.83	9.35	2.81	0.46	0.73	0.54	0.86	11.86
	b12	0.00	0.00	0.00	0.00	0.00	0.00	1.59	5.82	2.89	0.83	0.36	0.55	1.41	14.92
	b13	0.00	0.00	0.00	0.00	0.00	0.00	6.13	6.46	9.58	16.16	5.84	20.22	41.50	14.12
	b14	0.00	0.00	0.00	0.00	0.00	0.00	33.76	21.77	18.96	10.56	12.34	25.84	34.09	62.14
CSC	c1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PSC	d1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FCC	e1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MCC	f1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROS	g1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g2	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.01	0.00	0.00	0.00	0.01	0.00	0.02
	g3	0.00	0.00	0.00	0.00	0.00	0.00	21.80	0.04	0.01	0.01	0.02	1.14	0.03	0.31
	g4	0.00	0.00	0.00	0.00	0.00	0.00	42.82	0.72	0.07	0.03	0.08	0.89	0.07	1.59
	g5	0.00	0.00	0.00	0.00	0.00	0.00	11.97	0.10	0.01	0.00	0.05	0.00	0.00	0.18
	g6	0.00	0.00	0.00	0.00	0.00	0.00	10.91	37.91	0.70	14.82	0.10	0.45	0.80	0.58
	g7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab2	0.00	0.00	0.00	0.00	0.00	0.00	116.86	137.95	85.10	86.97	65.77	165.56	151.22	199.96
	lab3	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.08	0.03	0.04	0.04	0.09	0.07	0.09
	lab4	0.00	0.00	0.00	0.00	0.00	0.00	2.84	4.02	3.86	1.74	2.48	4.87	4.46	5.49
	lab5	0.00	0.00	0.00	0.00	0.00	0.00	1.25	2.71	1.56	1.08	1.28	2.34	2.33	3.13
	lab6	0.00	0.00	0.00	0.00	0.00	0.00	3.52	6.71	5.52	2.43	3.02	4.72	4.54	7.04
	lab7	0.00	0.00	0.00	0.00	0.00	0.00	19.57	27.47	17.74	9.34	12.28	21.05	22.63	31.19
	oved	0.00	0.00	0.00	0.00	0.00	0.00	28.62	85.41	73.57	134.18	30.64	68.28	393.40	87.59
	imports	0.00	0.00	0.00	0.00	0.00	0.00	341.32	201.21	170.04	28.38	18.42	38.15	59.25	252.05
TOTAL		0.00	0.00	0.00	0.00	0.00	0.00	704.54	583.62	473.14	338.00	162.43	378.61	784.81	782.27

A Hierarchic

		CSC c1	c2	c3	c4	c5	c6	c7	c8	c9	c10	c11	c12	c13	c14
PWR	a1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a7	0.00	0.00	0.00	0.00	0.00	0.00	2.94	5.51	0.98	0.00	0.28	0.38	0.22	5.64
	a8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a10	0.00	0.00	0.00	0.00	0.00	0.00	3.00	0.63	2.34	0.00	1.82	3.93	5.91	5.74
	a11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SWR	b1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CSC	c1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c7	0.00	0.00	0.00	0.00	0.00	0.00	2.14	4.01	0.71	0.00	0.21	0.28	0.16	4.11
	c8	0.00	0.00	0.00	0.00	0.00	0.00	0.59	0.10	2.47	0.00	0.09	0.48	7.88	0.30
	c9	0.00	0.00	0.00	0.00	0.00	0.00	1.08	0.88	8.05	0.00	0.31	0.28	0.14	1.81
	c10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c11	0.00	0.00	0.00	0.00	0.00	0.00	1.22	2.28	0.50	0.00	0.20	0.12	0.14	2.27
	c12	0.00	0.00	0.00	0.00	0.00	0.00	0.28	1.38	0.52	0.00	0.10	0.12	0.29	2.81
	c13	0.00	0.00	0.00	0.00	0.00	0.00	1.10	1.57	1.83	0.00	1.63	4.35	8.55	2.75
	c14	0.00	0.00	0.00	0.00	0.00	0.00	8.03	5.28	3.83	0.00	3.38	8.56	7.03	12.12
PSC	d1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FCC	e1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MCC	f1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROS	g1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g2	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g3	0.00	0.00	0.00	0.00	0.00	0.00	3.80	0.01	0.00	0.00	0.01	0.24	0.01	0.06
	g4	0.00	0.00	0.00	0.00	0.00	0.00	7.82	0.17	0.01	0.00	0.02	0.19	0.01	0.31
	g5	0.00	0.00	0.00	0.00	0.00	0.00	2.14	0.02	0.00	0.00	0.01	0.00	0.00	0.04
	g6	0.00	0.00	0.00	0.00	0.00	0.00	1.96	0.16	0.13	0.00	0.03	0.10	0.17	0.11
	g7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab3	0.00	0.00	0.00	0.00	0.00	0.00	17.29	30.02	12.67	0.00	17.11	32.59	27.67	33.37
	lab4	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.11	0.10	0.00	0.07	0.13	0.12	0.15
	lab5	0.00	0.00	0.00	0.00	0.00	0.00	0.66	1.43	0.82	0.00	0.66	1.23	1.23	1.85
	lab6	0.00	0.00	0.00	0.00	0.00	0.00	1.72	3.28	2.70	0.00	1.48	2.31	2.22	3.44
	lab7	0.00	0.00	0.00	0.00	0.00	0.00	6.00	8.42	5.44	0.00	3.78	6.45	6.93	8.56
	oved	0.00	0.00	0.00	0.00	0.00	0.00	5.11	20.65	14.07	0.00	8.33	14.25	81.07	17.09
	imports	0.00	0.00	0.00	0.00	0.00	0.00	61.01	48.64	32.52	0.00	5.01	8.42	12.21	40.18
TOTAL		0.00	0.00	0.00	0.00	0.00	0.00	125.92	143.49	90.49	0.00	44.18	81.41	161.74	152.63

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		PSC d1	d2	d3	d4	d5	d6	d7	d8	d9	d10	d11	d12	d13	d14
PWR	a1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a7	0.00	0.00	0.00	0.00	0.00	0.00	9.58	15.38	4.43	0.00	0.82	1.14	0.89	18.07
	a8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a10	0.00	0.00	0.00	0.00	0.00	0.00	8.31	1.50	8.00	0.00	4.00	9.89	15.84	15.63
	a11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SWR	b1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CSC	c1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PSC	d1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d7	0.00	0.00	0.00	0.00	0.00	0.00	4.49	7.21	2.07	0.00	0.38	0.53	0.32	8.47
	d8	0.00	0.00	0.00	0.00	0.00	0.00	1.85	0.24	9.54	0.00	0.22	1.19	20.55	0.81
	d9	0.00	0.00	0.00	0.00	0.00	0.00	3.00	2.08	34.86	0.00	0.78	0.70	0.38	4.83
	d10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d11	0.00	0.00	0.00	0.00	0.00	0.00	3.38	5.36	1.83	0.00	0.49	0.29	0.38	8.19
	d12	0.00	0.00	0.00	0.00	0.00	0.00	0.79	3.22	1.89	0.00	0.24	0.30	0.78	7.82
	d13	0.00	0.00	0.00	0.00	0.00	0.00	3.04	3.72	7.08	0.00	3.77	10.83	22.83	7.49
	d14	0.00	0.00	0.00	0.00	0.00	0.00	16.74	12.48	13.89	0.00	8.26	13.96	18.84	32.99
FCC	e1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MCC	f1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROS	g1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g2	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	g3	0.00	0.00	0.00	0.00	0.00	0.00	10.81	0.03	0.00	0.00	0.01	0.81	0.02	0.17
	g4	0.00	0.00	0.00	0.00	0.00	0.00	21.13	0.41	0.05	0.00	0.06	0.48	0.04	0.85
	g5	0.00	0.00	0.00	0.00	0.00	0.00	5.84	0.08	0.00	0.00	0.02	0.00	0.00	0.10
	g6	0.00	0.00	0.00	0.00	0.00	0.00	5.41	21.74	0.81	0.00	0.07	0.24	0.44	0.31
	g7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab4	0.00	0.00	0.00	0.00	0.00	0.00	45.34	64.31	58.58	0.00	38.60	77.93	71.18	87.80
	lab5	0.00	0.00	0.00	0.00	0.00	0.00	1.10	2.39	1.37	0.00	1.11	2.08	2.05	2.78
	lab6	0.00	0.00	0.00	0.00	0.00	0.00	1.68	3.21	2.64	0.00	1.45	2.25	2.17	3.36
	lab7	0.00	0.00	0.00	0.00	0.00	0.00	23.32	32.73	21.14	0.00	14.63	25.08	28.97	37.16
	oved	0.00	0.00	0.00	0.00	0.00	0.00	14.19	48.99	54.22	0.00	20.51	36.81	217.40	48.50
	imports	0.00	0.00	0.00	0.00	0.00	0.00	169.25	115.40	125.32	0.00	12.33	21.15	32.74	133.83
TOTAL		0.00	0.00	0.00	0.00	0.00	0.00	349.36	340.46	348.70	0.00	108.69	204.57	433.70	415.34

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		FCC													
		e1	e2	e3	e4	e5	e6	e7	e8	e9	e10	e11	e12	e13	e14
PWR	a1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a7	0.00	0.00	0.00	0.00	0.00	0.00	4.88	11.72	2.42	0.00	0.82	0.71	0.45	12.41
	a8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a9	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.41	4.86	0.00	0.13	0.11	0.06	0.88
	a10	0.00	0.00	0.00	0.00	0.00	0.00	2.94	0.80	3.43	0.00	1.78	4.29	7.19	7.47
	a11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SWR	b1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CSC	c1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PSC	d1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FCC	e1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e7	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.27	0.08	0.00	0.01	0.02	0.01	0.29
	e8	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.13	3.83	0.00	0.10	0.52	8.33	0.39
	e9	0.00	0.00	0.00	0.00	0.00	0.00	0.88	0.89	8.32	0.00	0.21	0.19	0.11	1.48
	e10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e11	0.00	0.00	0.00	0.00	0.00	0.00	1.20	2.86	0.73	0.00	0.22	0.13	0.16	2.98
	e12	0.00	0.00	0.00	0.00	0.00	0.00	0.28	1.71	0.78	0.00	0.11	0.13	0.35	3.79
	e13	0.00	0.00	0.00	0.00	0.00	0.00	1.07	1.87	2.89	0.00	1.88	4.74	10.41	3.58
	e14	0.00	0.00	0.00	0.00	0.00	0.00	5.82	6.63	5.33	0.00	3.87	8.06	8.55	15.78
MCC	f1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROS	g1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g2	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g3	0.00	0.00	0.00	0.00	0.00	0.00	3.82	0.01	0.00	0.00	0.01	0.27	0.01	0.08
	g4	0.00	0.00	0.00	0.00	0.00	0.00	7.47	0.22	0.02	0.00	0.02	0.21	0.02	0.40
	g5	0.00	0.00	0.00	0.00	0.00	0.00	2.10	0.03	0.00	0.00	0.01	0.00	0.00	0.05
	g6	0.00	0.00	0.00	0.00	0.00	0.00	1.91	11.54	0.20	0.00	0.03	0.11	0.20	0.15
	g7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab5	0.00	0.00	0.00	0.00	0.00	0.00	24.08	52.17	30.02	0.00	24.19	44.95	44.91	80.30
	lab6	0.00	0.00	0.00	0.00	0.00	0.00	1.20	2.29	1.89	0.00	1.03	1.61	1.55	2.41
	lab7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	ovad	0.00	0.00	0.00	0.00	0.00	0.00	5.02	28.00	20.86	0.00	9.11	15.54	98.67	22.24
	imports	0.00	0.00	0.00	0.00	0.00	0.00	58.86	61.24	47.75	0.00	5.48	9.18	14.86	64.01
TOTAL		0.00	0.00	0.00	0.00	0.00	0.00	123.56	180.88	132.86	0.00	48.29	88.74	198.84	198.86

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		MCC f1	f2	f3	f4	f5	f6	f7	f8	f9	f10	f11	f12	f13	f14
PWR	a1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a7	0.00	0.00	0.00	0.00	0.00	0.00	3.56	6.57	1.73	0.00	0.28	0.34	0.22	6.57
	a8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a9	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.19	2.91	0.00	0.08	0.04	0.03	0.36
	a10	0.00	0.00	0.00	0.00	0.00	0.00	2.17	0.45	2.48	0.00	0.98	2.08	3.53	4.00
	a11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a13	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.14	0.00	0.07	0.17	0.38	0.14
	a14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SWR	b1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CSC	c1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PSC	d1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FCC	e1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MCC	f1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f7	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.22	0.08	0.00	0.01	0.01	0.01	0.22
	f8	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.07	2.83	0.00	0.05	0.25	4.68	0.21
	f9	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.44	6.89	0.00	0.13	0.10	0.08	0.88
	f10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f11	0.00	0.00	0.00	0.00	0.00	0.00	0.89	1.61	0.53	0.00	0.12	0.08	0.08	1.58
	f12	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.87	0.85	0.00	0.08	0.08	0.17	2.03
	f13	0.00	0.00	0.00	0.00	0.00	0.00	0.74	1.04	1.80	0.00	0.85	2.13	4.74	1.78
	f14	0.00	0.00	0.00	0.00	0.00	0.00	4.38	3.78	3.86	0.00	2.02	2.93	4.20	8.44
ROS	g1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g2	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g3	0.00	0.00	0.00	0.00	0.00	0.00	2.83	0.01	0.00	0.00	0.00	0.13	0.00	0.04
	g4	0.00	0.00	0.00	0.00	0.00	0.00	5.63	0.12	0.01	0.00	0.01	0.10	0.01	0.22
	g5	0.00	0.00	0.00	0.00	0.00	0.00	1.96	0.02	0.00	0.00	0.01	0.00	0.00	0.02
	g6	0.00	0.00	0.00	0.00	0.00	0.00	1.42	6.64	0.14	0.00	0.02	0.05	0.10	0.08
	g7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab6	0.00	0.00	0.00	0.00	0.00	0.00	9.27	17.84	14.51	0.00	7.95	12.40	11.94	18.51
	lab7	0.00	0.00	0.00	0.00	0.00	0.00	9.43	13.23	8.65	0.00	5.82	10.14	10.90	15.03
	oved	0.00	0.00	0.00	0.00	0.00	0.00	3.71	14.74	14.83	0.00	5.01	7.52	48.50	11.90
	imports	0.00	0.00	0.00	0.00	0.00	0.00	44.29	34.72	34.51	0.00	3.01	4.44	7.30	34.24
TOTAL		0.00	0.00	0.00	0.00	0.00	0.00	91.43	102.42	98.02	0.00	28.55	42.97	98.76	106.26

A Hierarchic

		ROS g1	g2	g3	g4	g5	g6	g7	g8	g9	g10	g11	g12	g13	g14
PWR	a1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a7	0.00	2.33	35.42	134.24	3.24	25.06	9.63	17.58	4.20	0.00	0.85	0.92	0.65	20.96
	a8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a9	0.00	0.21	2.18	10.79	2.65	9.76	1.42	1.13	15.72	0.00	0.29	0.27	0.17	2.72
	a10	0.00	1.19	13.95	66.36	0.23	85.80	5.68	1.18	5.87	0.00	2.17	5.47	10.23	12.45
	a11	0.00	0.45	5.32	24.91	0.30	10.28	1.79	3.27	0.87	0.00	0.21	0.12	0.18	3.82
	a12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a13	0.00	2.73	25.28	128.84	1.46	276.23	1.55	2.18	3.44	0.00	1.53	4.52	11.08	4.46
	a14	0.00	1.81	18.70	87.82	2.72	79.07	4.58	3.92	3.85	0.00	1.80	3.09	4.87	10.52
SWR	b1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b14	0.00	0.63	7.27	34.15	1.08	30.75	1.78	1.53	1.42	0.00	0.70	1.20	1.90	4.09
CSC	c1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c8	0.00	0.01	0.10	0.63	0.03	0.79	0.02	0.00	0.13	0.00	0.00	0.01	0.27	0.01
	c9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PSC	d1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d8	0.00	0.18	1.32	8.25	0.39	10.37	0.30	0.05	1.88	0.00	0.03	0.18	3.56	0.17
	d9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FCC	e1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e8	0.00	0.07	0.48	3.01	0.14	3.79	0.11	0.02	0.61	0.00	0.01	0.06	1.30	0.06
	e9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MCC	f1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f8	0.00	0.05	0.40	2.47	0.12	3.10	0.09	0.01	0.60	0.00	0.01	0.05	1.08	0.05
	f9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROS	g1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g2	0.00	0.94	0.00	0.00	0.01	0.01	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	g3	0.00	0.00	10.88	6.20	0.80	0.17	7.38	0.02	0.00	0.00	0.01	0.34	0.01	0.13
	g4	0.00	0.00	188.61	115.13	0.47	0.74	14.44	0.32	0.03	0.00	0.03	0.27	0.02	0.67
	g5	0.00	0.00	0.04	0.18	11.21	0.02	4.06	0.06	0.00	0.00	0.01	0.00	0.00	0.06
	g6	0.00	0.24	2.76	12.94	0.03	62.68	3.89	17.07	0.34	0.00	0.04	0.14	0.29	0.24
	g7	0.00	0.02	0.31	1.16	0.03	0.22	0.06	0.15	0.04	0.00	0.01	0.01	0.01	0.18
	g8	0.00	0.38	2.83	18.45	0.78	20.66	0.60	0.10	3.32	0.00	0.08	0.35	7.09	0.34
	g9	0.00	0.09	0.87	4.80	1.18	4.34	0.83	0.50	[illegible]	0.00	0.13	0.12	0.08	1.21
	g10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g11	0.00	0.13	1.54	7.20	0.09	2.97	0.52	0.94	0.28	0.00	0.06	0.04	0.05	1.11
	g12	0.00	0.31	3.59	16.80	0.39	10.01	0.54	2.63	1.29	0.00	0.13	0.16	0.50	6.31
	g13	0.00	0.82	8.53	43.49	0.50	93.24	0.62	0.74	1.16	0.00	0.52	1.53	3.74	1.51
	g14	0.00	1.78	20.74	87.44	3.02	87.73	5.08	4.35	4.05	0.00	1.99	3.43	5.41	11.67
	lab1	0.00	0.02	0.18	0.99	6.28	67.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab2	0.00	0.02	0.14	0.77	4.93	52.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab3	0.00	0.00	0.03	0.15	0.10	1.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab4	0.00	0.02	0.17	0.92	0.00	1.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab5	0.00	0.03	0.31	1.65	0.21	3.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	lab7	0.00	8.12	75.08	403.06	18.76	247.88	48.81	80.56	54.55	0.00	30.89	59.37	66.15	104.44
	oved	0.00	19.51	170.63	932.06	14.70	1854.76	9.69	38.46	36.32	0.00	11.16	19.81	140.48	37.05
	Imports	0.00	4.52	237.72	1087.62	19.57	504.19	115.63	90.59	81.65	0.00	8.71	11.70	21.16	108.62
TOTAL		0.00	46.50	833.49	3249.51	95.20	3560.36	238.67	267.27	227.18	0.00	59.14	113.16	280.25	330.91

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		PWR pa1	SWR pa2	CSC pa3	PSC pa4	FCC pa5	MCC pa6	ROS pa7	Non-Wage PE	OFD	Out-of-Rk Exports	TOTAL
PWR	a1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	a7	224.21	0.68	7.74	25.02	22.53	17.09	103.10	82.89	107.98	788.39	2118.96
	a8	5.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1236.84	2.86	1432.07
	a9	43.82	0.07	1.60	4.71	4.02	3.20	20.15	15.91	24.10	741.72	1094.07
	a10	284.51	0.00	15.87	40.20	28.89	21.82	130.84	108.77	138.36	48.45	1520.07
	a11	65.57	0.18	0.39	3.49	3.94	4.15	30.15	21.14	54.48	227.71	562.32
	a12	528.59	4.05	5.63	33.69	37.09	35.12	0.05	48.37	62.14	0.00	832.03
	a13	981.67	0.00	0.00	7.00	10.01	22.87	385.00	211.80	102.74	135.83	2863.30
	a14	507.88	5.30	5.93	28.18	28.87	31.45	164.19	128.83	411.32	5.08	2167.03
SWR	b1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	b7	0.00	67.99	0.00	0.00	0.00	0.00	0.00	8.11	17.50	475.89	704.54
	b8	0.62	1.77	0.00	0.00	0.00	0.00	0.00	0.21	500.96	0.00	593.63
	b9	0.00	13.35	0.00	0.00	0.00	0.00	0.00	1.59	4.78	382.80	473.14
	b10	0.00	87.11	0.00	0.00	0.00	0.00	0.00	10.39	21.60	98.95	338.00
	b11	0.00	19.89	0.00	0.00	0.00	0.00	0.00	2.37	10.96	98.34	162.43
	b12	0.00	157.80	0.00	0.00	0.00	0.00	104.01	73.50	15.22	0.00	378.61
	b13	0.00	284.45	0.00	0.00	0.00	0.00	0.00	35.11	20.76	314.65	784.81
	b14	0.00	150.20	0.00	0.00	0.00	0.00	63.85	51.46	108.71	104.06	782.27
CSC	c1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c7	0.00	0.00	4.76	0.00	0.00	0.00	0.00	0.70	1.81	107.03	125.92
	c8	0.13	0.00	0.32	0.00	0.00	0.00	0.05	0.08	123.97	0.87	143.49
	c9	0.00	0.00	0.84	0.00	0.00	0.00	0.00	0.12	1.17	74.81	80.49
	c10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	c11	0.00	0.00	3.27	0.00	0.00	0.00	0.00	0.48	2.89	31.04	44.18
	c12	0.00	0.00	23.84	0.00	0.00	0.00	28.34	18.93	3.73	0.00	81.42
	c13	0.00	0.00	53.63	0.00	0.00	0.00	0.00	7.89	6.09	73.45	161.74
	c14	0.00	0.00	22.39	0.00	0.00	0.00	0.00	3.30	22.19	81.76	182.63
PSC	d1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d7	0.00	0.00	0.00	6.86	0.00	0.00	0.00	2.04	2.75	314.42	340.36
	d8	0.00	0.00	0.00	0.82	0.00	0.00	0.71	0.62	277.88	0.00	340.46
	d9	0.00	0.00	0.00	1.46	0.00	0.00	0.00	0.46	2.36	287.71	348.70
	d10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d11	0.00	0.00	0.00	5.78	0.00	0.00	0.00	1.77	5.40	77.74	108.69
	d12	0.00	0.00	0.00	40.99	0.00	0.00	84.09	56.75	7.49	0.00	204.57
	d13	0.00	0.00	0.00	128.87	0.00	0.00	0.00	38.43	10.22	188.24	493.70
	d14	0.00	0.00	0.00	46.58	0.00	0.00	0.00	13.96	44.89	183.96	418.34
FCC	e1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e7	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.10	0.13	122.32	123.56
	e8	0.00	0.00	0.00	0.00	0.59	0.00	0.28	0.39	186.11	0.00	180.68
	e9	0.00	0.00	0.00	0.00	0.43	0.00	0.00	0.19	1.00	118.57	132.88
	e10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	e11	0.00	0.00	0.00	0.00	2.72	0.00	0.00	1.18	3.88	32.49	48.29
	e12	0.00	0.00	0.00	0.00	16.58	0.00	25.59	20.98	5.09	13.89	88.74
	e13	0.00	0.00	0.00	0.00	87.64	0.00	0.00	38.08	6.94	38.05	196.84
	e14	0.00	0.00	0.00	0.00	22.70	0.00	0.00	9.86	30.28	83.89	196.66
MCC	f1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f7	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.08	0.09	88.51	91.43
	f8	0.00	0.00	0.00	0.00	0.00	0.44	0.21	0.37	86.25	0.00	102.42
	f9	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.09	0.51	88.42	98.02
	f10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	f11	0.00	0.00	0.00	0.00	0.00	0.88	0.00	0.52	1.88	18.89	28.55
	f12	0.00	0.00	0.00	0.00	0.00	6.42	0.00	3.18	2.34	28.00	42.97
	f13	0.00	0.00	0.00	0.00	0.00	80.67	0.00	28.88	2.86	0.00	88.76
	f14	0.00	0.00	0.00	0.00	0.00	7.80	0.00	4.40	13.81	80.87	108.28
ROS	g1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g2	0.29	0.09	0.02	0.04	0.03	0.02	0.13	0.12	0.31	42.23	48.60
	g3	4.81	1.47	0.27	0.68	0.49	0.37	2.21	2.01	4.38	675.33	833.49
	g4	30.49	8.34	1.70	4.31	3.10	2.34	14.02	12.77	17.81	2806.74	3249.51
	g5	4.22	1.29	0.24	0.60	0.43	0.32	1.94	1.77	0.83	6.88	98.20
	g6	10.11	3.10	0.56	1.43	1.03	0.78	4.66	4.23	25.33	3071.42	3860.36
	g7	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.17	238.28	238.67
	g8	0.00	0.00	0.00	0.00	0.00	0.00	1.42	0.75	212.33	0.00	287.27
	g9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.88	204.49	227.18
	g10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	g11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.81	41.40	98.14
	g12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.40	83.20	113.16
	g13	0.00	0.00	0.00	0.00	0.00	0.00	77.25	40.61	5.89	0.00	280.25
	g14	0.00	0.00	0.00	0.00	0.00	0.00	6.62	2.80	48.00	28.78	330.91
	lab1	233.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1539.70	0.00	5233.70
	lab2	0.00	71.34	0.00	0.00	0.00	0.00	0.00	8.61	377.10	0.00	1555.46
	lab3	0.00	0.00	12.99	0.00	0.00	0.00	0.00	1.91	92.39	0.00	283.29
	lab4	0.00	0.00	0.00	32.92	0.00	0.00	0.00	10.07	186.63	0.00	717.73
	lab5	0.00	0.00	0.00	0.00	23.66	0.00	0.00	10.27	128.06	0.00	515.84
	lab6	0.00	0.00	0.00	0.00	0.00	17.87	0.00	10.49	57.80	0.00	389.56
	lab7	0.00	0.00	0.00	0.00	0.00	0.00	107.15	58.33	431.21	0.00	2336.27
	oved	408.01	124.93	22.75	57.65	41.43	31.29	187.64	170.89	558.54	404.06	9880.46
	imports	1767 19	541 08	98.55	249.67	179.44	135.51	812.70	740.15	1888.57	0.00	14125.79
TOTAL		5080 14	1555.46	283.29	717.74	515.84	389.56	2336.27	2127.71	9228.47	12905.66	65549.73