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Trends and Patterns of Agricultural Structural Change:

A Canada / U.S. Comparison

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INTRODUCTION

The removal of trade barriers in North America suggests that mutual forces operating in Canada and the United States are likely to result in similar agricultural structural adjustments in both countries. A comparative analysis of changing patterns and trends in Canadian and U.S. farm structure will help to distinguish those fundamental features most likely to be affected by changing trade policies. This paper explores specific structural issues in Canadian and U.S. agriculture and provides information to facilitate coordinated consideration of structural adjustment in the future.

The farm sectors of the United States and Canada have become more integrated with domestic and global economies since the end of World War II, no longer operating in their own closed economies. The restructuring of world commodity and financial markets, compounded by international negotiations to restructure agricultural policies, are exerting fundamental pressures on the structure of the farm sector (Ehrensaft and Bollman, 1992). Agriculture has become more dependent on other sectors for inputs and financing and on export markets for the sale of products, although certain sectors in Canada have been export dependent. This interdependence stresses the need for an increased awareness of conditions in the agricultural sector as well as in the more general economy.

Farm structure refers to the ways in which farms of different sizes and types organize natural, financial, and human resources to produce food and fiber and the distribution of income and wealth that results from that activity (Carlin, 1990). This definition guides the exploration of key structural features of the U.S. and Canadian agricultural industry, including such topics as changes in the number, size, and organization of farms, degree of commodity specialization, patterns of labor use, and the financial status of farm households. The analysis focuses on national and regional trends with emphasis on structural change since the 1970's.

The Economic Context

An exploration of key trends in the agricultural sector of both countries provides a context for understanding farm structural change. The economic literature suggests that structural changes in agriculture are caused by the imposition of a new or changed set of external conditions with respect to technology, factor market developments affecting the price, mobility, and/or quality of inputs, and macroeconomic changes in public policies and programs, including Federal monetary and fiscal policy, international exchange rates, environmental policy, and tax policy (Brinkman and Warley, 1983; Carlin and Mazie, 1990; Kislev and Peterson, 1982; Schertz, 1979; U.S. Department of Agriculture, 1981). Also see Erhensaft and Harrington in this volume for a more complete discussion of forces affecting structural change.

Although we examine the basic trends that most analysts review in discussions of agricultural structural change, we do not impute equal causality to the factors. We suggest that technology (both technology developed exogenous ***and*** endogenous to agriculture sector prices) is a fundamental driving force in the change in the size distribution of agricultural business units. Technological advances have greatly enhanced labor productivity and encouraged farm expansion because larger operations are necessary to provide full-time employment for farm operators. An important component of this feature is the vintage of each generation of human capital, where 'vintage' includes abilities, expectations of long-run relative opportunity costs in other pursuits, ***and*** expectations of 'adequate' living standards. Farmers' desire to achieve income levels equivalent to those in the nonfarm sector has led to both growth at the high end of the farm size spectrum and reductions in farm size at the low end (Reimund and Brooks, 1990).

Another feature of the farm sector focuses on the flexibility of agricultural households, largely exhibited in the pluriactive allocation of household labor resources. Although part-time farming has always existed, the increasing share of farm household income from off-farm sources (regardless of the size of the associated farm unit) suggests that farm families are becoming less reliant on farming for their livelihoods (Fuller and Bollman, 1992; Hallberg et al., 1991). This trend mirrors the trend to dual-earner families in non-farm households. Thus, the topic of the structure of agriculture may be of lesser importance in discussions of family equity issues.

The increased global integration of agriculture in Canada and the United States suggests that the farm sector has become increasingly susceptible to changes in the economy at large (Kitchen et al. 1987; Freshwater, 1987). The financial condition of agriculture in both the United States and Canada has been dramatically similar during the last few decades.[1] The 1980s were turbulent for the farm sector in both countries. Following the agricultural boom of the 1970's, fueled largely by export expansion, the early to mid-1980's saw declining farm exports, dramatic declines in farm asset values, and falling farm incomes. Aggregate net farm income in each country doubled between 1972 and 1974, but fell to one-third of this peak by 1983 after adjusting for inflation (Figure 1). The debt load, carried into the 1980's with lower incomes to service the debt, did result in financial stress for some farmers and led to strong media attention alluding to the "*worst farm crisis since the 1930's.*" Anecdotal and journalistic analyses foretold a dramatic decline in the number of farms in both countries.

However, from another point of view, this 'farm crisis' has apparently been with us for a while, since aggregate net farm income in both Canada and the United States remained at the same level in 1991 as in 1961, after adjusting for inflation. Also, the "farm crisis" had less effect on farm numbers and farm structure than it did on farm finances (Carlin and Reimund, 1990). Although the number of farms continued its long-term decline, the rate of decline during the 1980's was considerably below that of the 1950's and 1960's.

Another more fundamental feature of farm sectoral change has been the substitution of capital for labor. T.W. Schultz observed that one of the constants of world economic history has been the relative increase in the price of human time relative to the price of capital (Schultz, 1972). Kislev and Peterson (1982) suggested that relative prices were the dominant, if not the sole, factor causing an increase in farm size per farmer. Certainly, there has been a continuing increase in the capital/labor ratio in agriculture, regardless of methods of untangling the quantity of capital from the price of capital and regardless of methods of adjusting for the change in the quality of human time.

Capital has substituted for labor on farms and increased labor productivity over time. But, faced with inelastic domestic markets and fluctuating export markets, this substitution has resulted in a major reduction in labor employed on farms.

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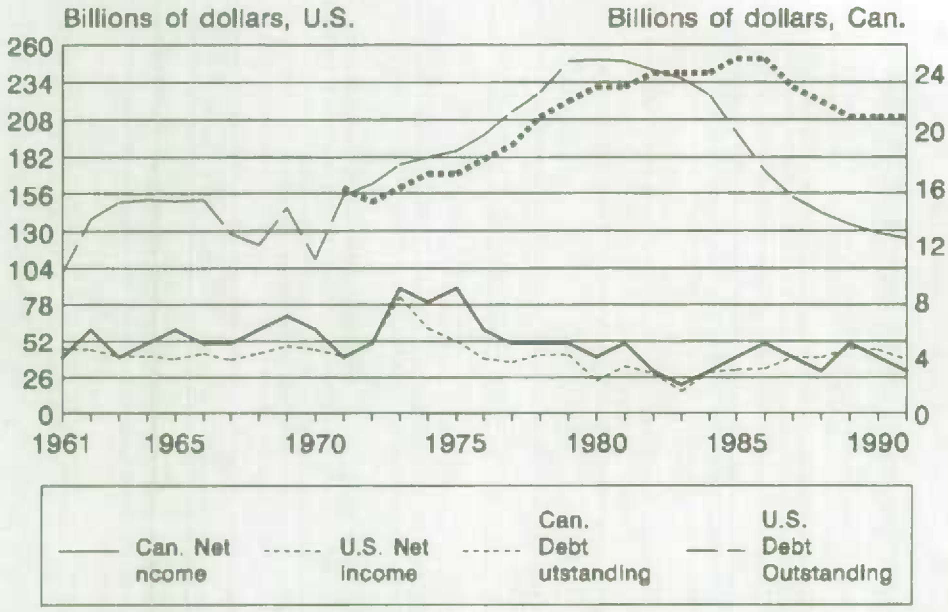
[1] See Barnard and Grimard in this volume for comparative financial characteristics of U.S. and Canadian farms.

Figure 1. Net Farm Income and Farm Business Debt, Canada/U.S., 1961-1991

Figures are in constant dollars (1987=100)



Source: Statistics Canada, Agriculture Economics Statistics (Cat. No. 21-603)
USDA, National Financial Summary

Capital/labor ratios have increased in both the Canadian and U.S. agricultural sectors (Figure 2)[2]. Interestingly, capital/labor ratios appear higher in Canada and the ratio has continued to increase. Numerous hypotheses might be offered but determining the exact reasons remains problematic. For example, an investment tax credit for machinery and equipment spurred machinery investment in Canada in the 1970s and early 1980s. Also, Canada is more intensive in the highly-mechanized (grain and oilseed) sectors relative to the United States.

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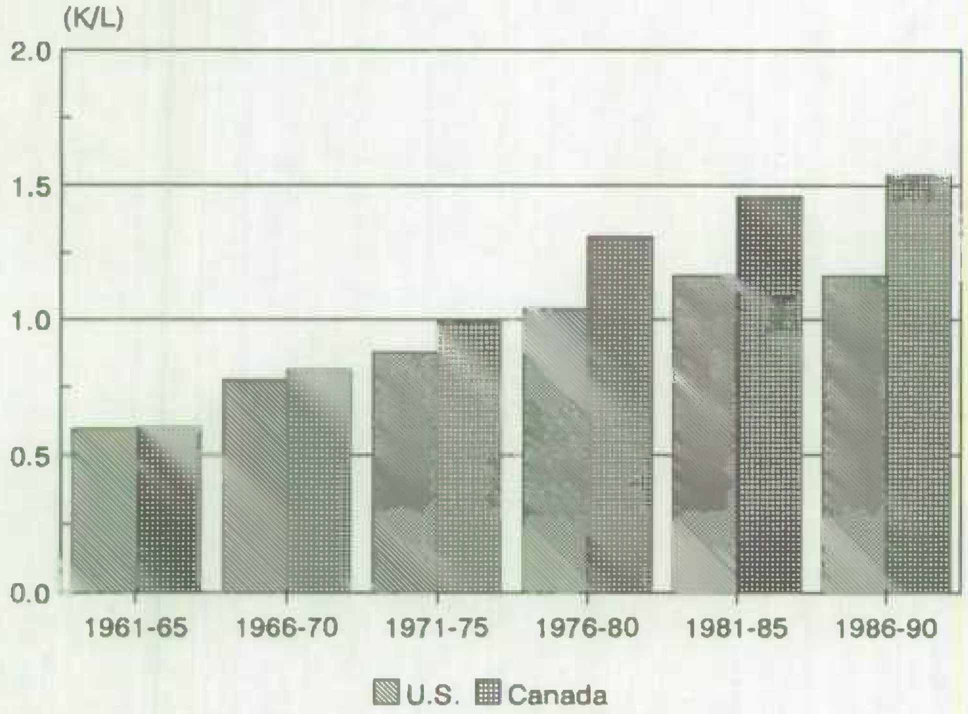
[2] We measure capital and labor in terms of 'flow of services', rather than as a stock. Labor is calculated by using an imputed constant dollar value of labor times the hours of labor input into agriculture. Capital is estimated by the imputed rental rate times the stock of land, buildings, machinery and livestock. Thus, the capital/labor ratio is the services of capital divided by the services of labor.

Figure 2. Capital Labour Ration (K/L), Canada/U.S., 1961-1990



Fundamental Features of the Structure of Agriculture: An Overview

This section explores some of the major changes in farm structure in the United States and Canada over the last several decades. These fundamental features include long-term trends in the number, size, and organization of farms, changes in the distribution of farms by major type of enterprise, trends in labor employed in agriculture, and changes in the economic status of farm households.

Long-term Trends in the Number of Farms

The Censuses of Agriculture in both the United States and Canada have enumerated fewer farms in each decade since World War II. In 1950, there were 5.4 million farms in the United States and 0.6 million census-farms in Canada (Figure 3)[3]. In the 1950's and the 1960's, the rate of decline in the number of farms was double the rate experienced in recent decades (over 2 percent per year compared to under 1 percent per year since the mid-1970's). One should note that the predictions of drastic declines in farm numbers during the *"worst farm crisis since the 1930's"* is not evident in the data.

We acknowledge that bankruptcies and foreclosures were at historic levels. Some farmers were forced off the land. The resulting number of farms did not change significantly. The farmers who left were replaced by other farmers. Some farms were amalgamated into larger units but the pace of change was not larger than previous decades. The pace of change in the size distribution of farms appears to have been influenced less by macro-economic conditions than by the underlying forces, such as technology and the demography of farming families.

Although the number of farms is declining in both countries, we do not infer that agriculture is a dying industry. Gross output and value-added indicators in the agricultural sector continue to increase with only temporary setbacks caused by the weather or government policy. In addition, as will be shown below, the number of larger commercial farms, which account for the major share of agricultural production and sales, has continued to increase in both countries. This pattern is similar to that in the manufacturing sector where output increases with no growth (and sometimes declines) in employment.

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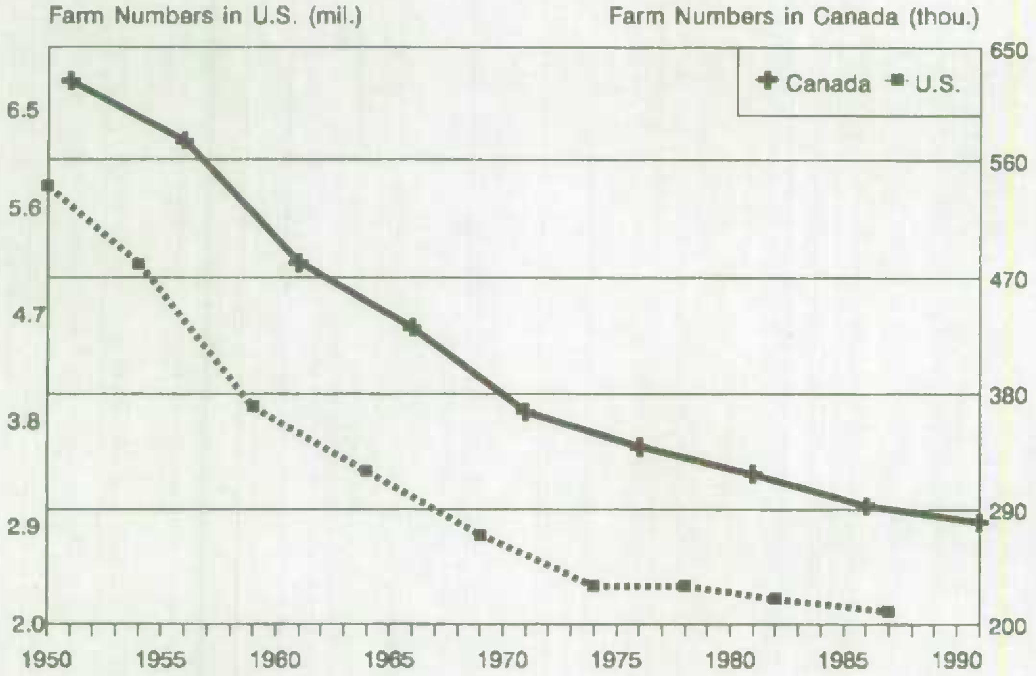
[3] In both Canada and the United States, all Censuses of Agriculture have enumerated essentially any holding with agricultural products for sale. The purpose is to obtain an inventory of all the resources in agricultural production and all the output of food and fiber products. However, as we shall see below, a high share of enumerated agricultural holdings in each country are very small and thus a small change in the lower threshold for defining a 'census-farm' in Canada or a farm in the United States may cause a significant change in the number farms, but no significant change in other variables, such as cash value of sales, amount of crop land, or production data.

Figure 3. Number of Farms, Canada/U.S., 1950-1991



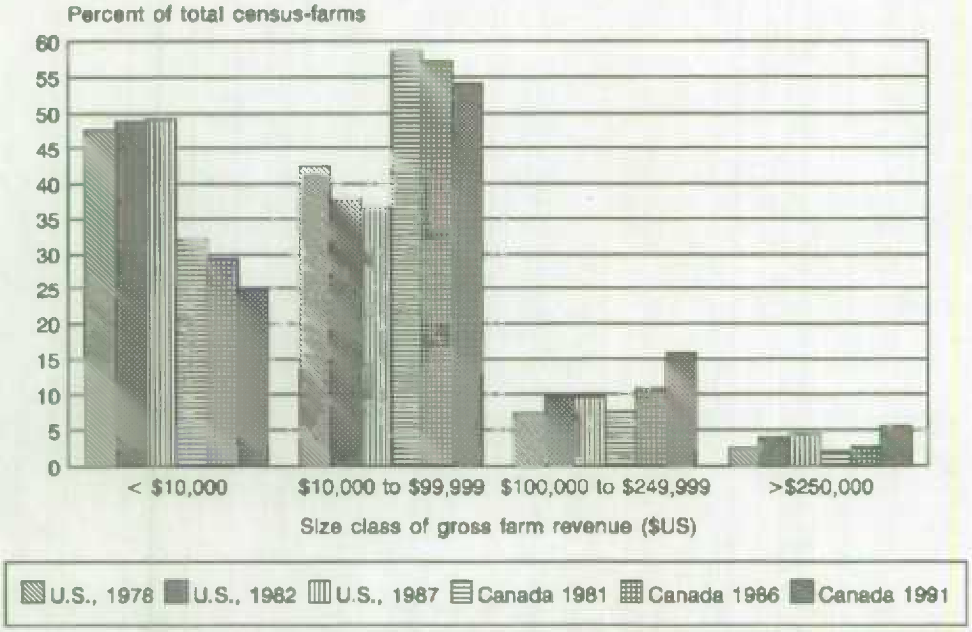
Source: Statistics Canada, Census of Agriculture, 1951-1991
U.S. Bureau of the Census, Censuses of Agriculture, 1950-1987

Changes in Farm Numbers by Size Class

The trend toward fewer agricultural holdings and larger farms continues in both the United States and Canada, but at a much slower rate than in the past. However, aggregate statistics mask divergent trends among farms of different sizes and in different regions of both countries. For example, in both Canada and the United States, the overall decline in farm numbers during the last decade was a result of decreases in the number of smaller farms offsetting the moderate increase in larger size farms. Decreases in the numbers of smaller farms have greater implications for the survival of rural communities while increases in the number of larger farms have greater significance in terms of the amount of sales affected and resources transferred.

Changes in the number and size of farms have led to concern that many mid-sized farms will disappear to be replaced by a relatively small number of large farms controlled by nonfamily corporations. Changes in the distribution of U.S. and Canadian farms over the last decade, measured by gross farm revenue in nominal dollars, show increases in the number and proportion of large farms with gross revenues of $100,000 or more.[4] The number and proportion of small farms with less than $10,000 in revenues decreased in Canada but remained relatively stable in the United States. Mid-sized farms with $10,000-99,999 in revenues declined in both countries (Figure 4).

Figure 4. Share of Farms by Size Class of Gross Farm Revenue, Canada/U.S., 1978-1991



Source: Statistics Canada, Censuses of Agriculture, 1981 to 1991
U.S. Bureau of the Census, Census of Agriculture, Unpublished Data

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[4] Measured by value of product sales in U.S. data. Gross farm revenue in Canadian data and value of product sales in the U.S. data are essentially the same. It includes the gross annual receipts from the sale of agricultural products plus government farm subsidies.

When the effects of inflation are taken into account, the real change that occurred during the last decade was less than that indicated by the nominal distributional change, but there was still a shift toward larger farms (Gale and Reimund, 1992; Statistics Canada, 1992). Similar patterns occurred when measuring farm size in terms of land acreage.

While there are many similarities in changing patterns of U.S. and Canadian agricultural holdings by size class, there are differences as well. Size class data indicate that the United States has a much larger proportion of small farms and a smaller proportion of mid-sized farms compared to Canada. For example, almost 50 percent of U.S. farms had gross farm revenues of less than $10,000 in 1987, compared with only 25 percent of Canadian farms in 1991. Some regional differences emerge as well. In general, the Eastern Canada-Northeastern U.S. and western Canada-Northwestern U.S. regions both show increases in the number of larger farms and decreases in the smaller and mid-sized farms (see appendix for definitions of regions). However, the eastern regions have a larger share of small farms with revenues less than $10,000 than the western regions. Although Eastern regions are generally less dependent on agriculture, this finding suggests that the continued decline in the numbers of small farms may have more serious implications for the survival of rural communities in the eastern regions.

Despite the increased industrialization of farming, most farms are still owned and operated by families; non-family corporations do not comprise a large share of farms in either country. Less than 2 percent of the farm businesses in Canada in 1991 and the United States in 1987 were organized as non-family corporations. Non-family corporations have increased only slightly in Canada and barely changed in the United States over the last decade (Statistics Canada, 1993; U.S. Department of Commerce, 1988).

This examination of changing farm numbers by size class raises an important consideration concerning the definition of a farm. Data sources in both the United States and Canada enumerate the smallest agricultural holding in order to obtain an inventory of all the agricultural resources and production in each country.[5] A 4-H project, for example, may produce sufficient sales to qualify as a farm. As a result, a large number of agricultural holdings are tabulated in

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[5] U.S. data sources define a farm as any unit which produced or expected to produce at least $1,000 worth of agricultural products in the census year; most Canadian data sources do not apply a sales criteria.

various agricultural data but do not represent farms to most data users nor to the respondents who complete the census or survey questionnaires. The result is that a high share of enumerated farms contribute a very small share of the aggregate output of the agricultural sector. Conversely, a small share of farms produce the bulk of the sector's output.

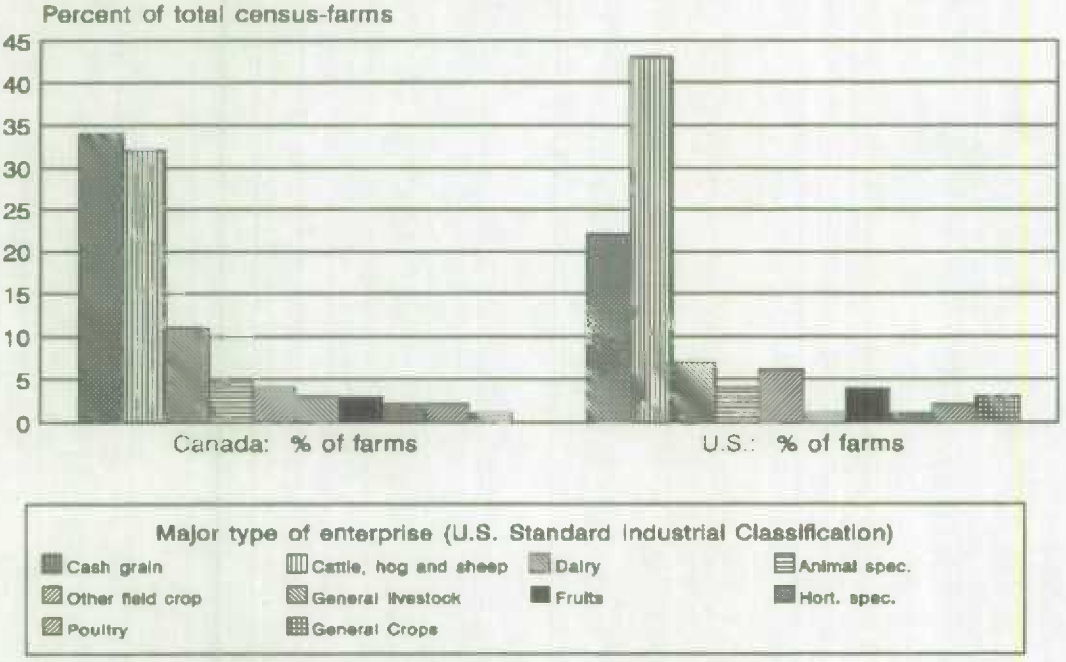
Distribution of Farms and Production by Type of Major Enterprise

Producers of commodities will be affected differently to the extent that market price trends and technological developments are specific to a commodity. This section presents an overview of the distribution of agricultural holdings by major enterprise group. Data from the Canadian Censuses of Agriculture have been tabulated according to the U.S. Standard Industrial Classification. To display similarities and differences, enterprise groups have been ranked according to their share of farms and their share of gross revenue in each country.

The first observation is that beef, hog, and sheep operations comprise a large share of farms and aggregate revenues in both countries. In the United States, this group ranks far above all other commodity sectors accounting for over 43 percent of the farms and 33 percent of the aggregate revenue (total sales) in 1987 (Figures 5 and 6). In Canada, cash grain enterprises rank first in number of farms, followed closely by beef, hog, and sheep operations, but the latter group ranks first in share of aggregate revenue. In 1991, beef, hog, and sheep farms accounted for 33 percent of both Canadian farms and aggregate revenue.

The second observation is that the agricultural economies of regions with similar geographies are similar. In both the northwestern United States and western Canada, for example, grain, and beef, hogs, and sheep comprise the largest share of farms. However, the Canadian west has a larger share of grain farms and a smaller share of beef, hogs and sheep enterprises compared to the northwestern United States. A comparison of the eastern regions of both countries show that grains, beef, hogs, and sheep, and dairy account for about 60 percent of the farms in eastern Canada and over 75 percent of the farms in the northeastern United States. In eastern Canada, dairy farms comprise a larger share while grain farms account for a smaller share compared to the northeastern United States.

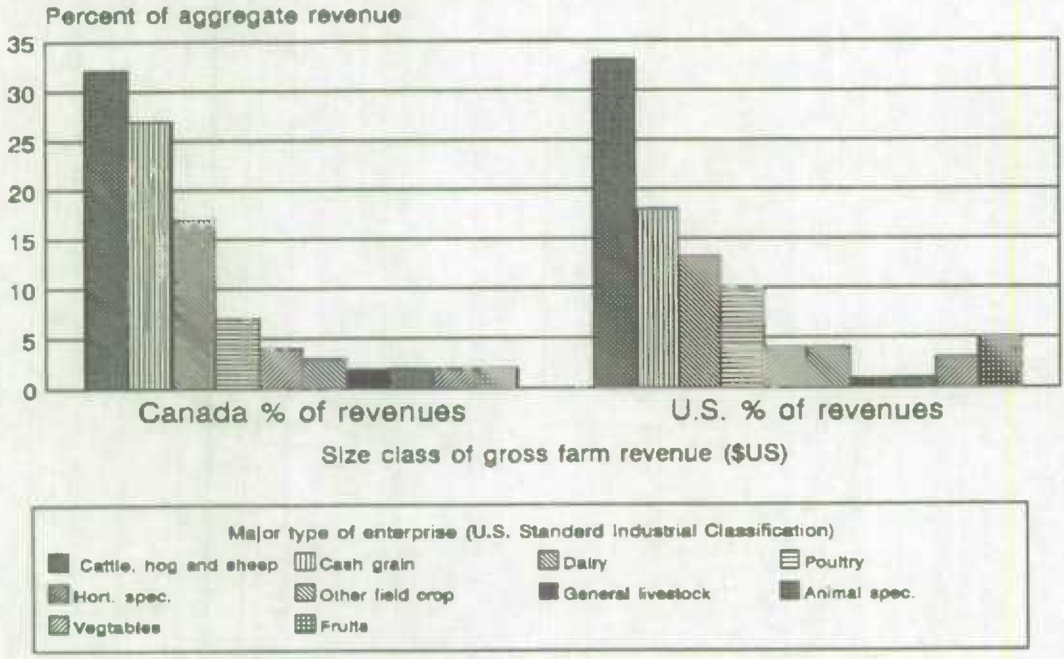
Figure 5. Share of Census-farms According to Canadian Rank Of Major Type of Enterprise, Canada, 1991/U.S., 1987



Source: Statistics Canada, Census of Agriculture, 1991
U.S. Bureau of the Census, Census of Agriculture, 1987

A final observation serves to document trends in commodity specialization in the United States and Canada. As the number of farms has decreased, farms have become more specialized along commodity lines, with distinct trends for different commodity subsectors. Because of the high degree of farm and regional specialization, the farm sector has now become many different industries, each with its own organizational characteristics. Specialization on farms has increased largely because of technological advancements such as chemical herbicides and single-function machinery, that changed the economics of farm production to favor a single-commodity type of agriculture. Regional specialization increased as a result of improved transportation, marketing, and storage technology that enhanced interregional trade, facilitating commodity concentration in areas of the greatest comparative advantage (Gale and Reimund, 1992).

Figure 6. Share of Aggregate Revenue According to Canadian Rank of Major Type of Enterprise, Canada, 1991 / U.S., 1987



Source: Statistics Canada, Census of Agriculture, 1991
U.S. Bureau of the Census, Census of Agriculture, 1987

Hog production in Canada offers a good example. Less than 30 years ago, only one-half of the Canadian hog herd was on hog-specialized farms; the other half were farms, largely grain producers, attempting to diversify production. Today, over 85 percent of all hogs are on hog-specialized farms. Several explanations for this increased specialization may be offered: grain farmers substituted crop insurance for hog enterprises in their diversification portfolios; the development of technology to raise hogs in barns lowered costs per unit of output making supplementary hog enterprises unprofitable; and/or the demand for standardized carcasses increased the pay-off to managerial attention in hog raising.

Poultry production offers a similar example in the United States. Before the 1950's, the poultry industry comprised a large number of small, geographically dispersed, autonomous producers selling through open markets. For many

producers, broiler and egg production were backyard activities. Technological advances during the 1940's and 1950's in poultry housing, processing, breeding, and disease control led to the transformation of the poultry industry. Today, poultry production is organized as a closely controlled, vertically integrated production-marketing system with regional concentration in the Atlantic Coast states. Poultry production in the United States now more closely resembles a manufacturing firm than what most would consider a farm firm (Gale and Reimund, 1992).

Trends in Labor Employed in Agriculture

Employment in agriculture in both countries has declined throughout the post-war period--a structural adjustment due largely to trends toward fewer agricultural holdings, larger farms, and increased mechanization. Annual average U.S. farm employment in 1990 was only slightly more than one-quarter the 1945 level in the United States; in Canada, average farm employment in 1992 was about 36 percent of the 1946 level (USDA, 1991; Statistics Canada, 1992). Beginning in the 1970's, a major structural shift also began to take shape within the workforce itself as the ratio of paid workers to family (self-employed and unpaid) workers began to increase (Figure 7). While both family and hired components of the work force have declined over time, family labor declined faster leading to a gradual substitution of hired for family labor on U.S. and Canadian farms.[6] Prior to 1970, the ratio had remained relatively constant. However, despite this substitution effect, family workers still account for the largest proportion of labor used in agriculture in both countries.

As hired workers provide more of the labor used on farms, farm operators will increasingly assume more labor-management responsibilities if they are to compete for workers in the farm labor market. The better managers will improve their personnel management skills in order to minimize hiring, turnover, and training costs. Both operators and workers will require a better understanding of National, State/provincial, and local employment, wage, safety and health regulations. Also, as farm operators increase their use of contract labor to meet some production and harvesting needs, operators will need to become increasingly knowledgeable on labor relations and labor contract negotiations procedures.

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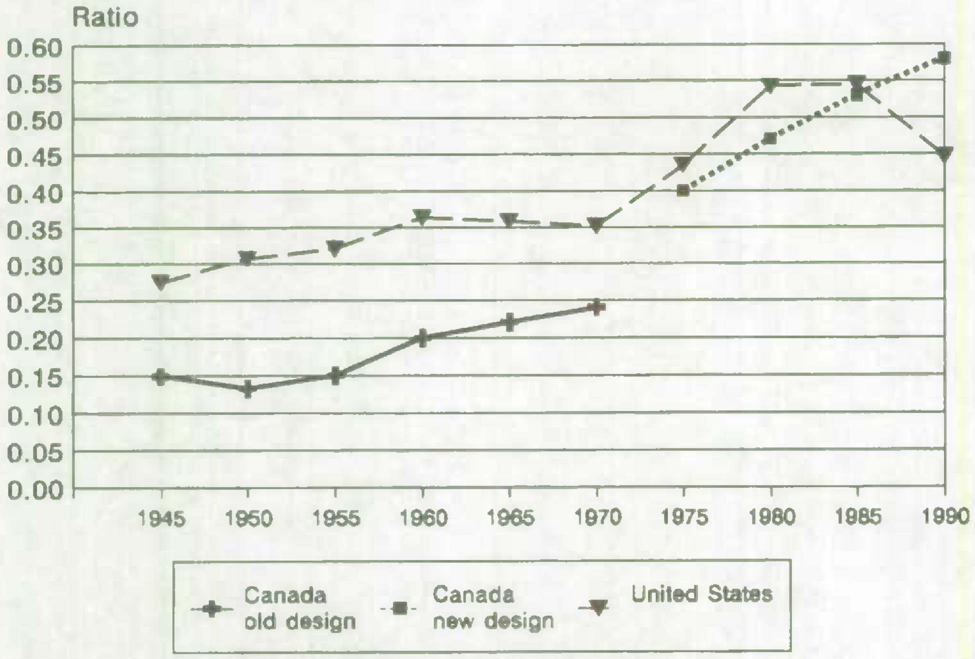
[6] Between 1985 and 1990, the ratio of paid to family in the United States began to decline slightly, although not to the levels seen prior to 1970. This may have represented a temporary adjustment to U.S. immigration reform legislation enacted in 1986 which made it illegal for agricultural employers to knowingly hire undocumented foreign workers.

Figure 7. Ratio of Paid Workers to Family Workers (self-employed + unpaid), Canada - United States, 1945-1990



Source: Statistics Canada, Labour Force Survey
U.S.D.A., NASS, Farm Labor Survey

The Economic Well-being of Farm Families

We have reviewed household-focused surveys, specifically, the Survey of Consumer Finances in Canada and the Current Population Survey in the United States, to compare trends in economic well-being of farm families in Canada and the United States. These surveys have obvious weaknesses for our purposes. The major weaknesses are that neither the survey frame nor the questionnaire contents are directly targeted at farm families. Farm families represent a small share of the overall sample. The advantage is that the same methodology is used to estimate the family incomes of farm **and** nonfarm families and the same general methodology is used in each country. We feel that the advantages in consistency outweigh the disadvantages of a survey that is not specifically designed for farming families.

Our income comparisons would provide stronger conclusions if we were able to control for family structure, age of income earners, educational background, and other relevant variables. Since this analysis would involve a major research undertaking, we offer a more simplistic picture which should not be accepted as definitive, but as indicative of general pattaerns and trends. Our data lead us to two conclusions. First, the incomes of farming families are no longer low relative to nonfarm families. Since the mid-1970's, the income of farming families has varied relative to nonfarm families in both Canada and the United States but farming families do not have incomes appreciably lower than nonfarm families and they are not losing (or gaining) relative to nonfarm families. The second general conclusion is that this result has been achieved by increasing the share of farm family income from off-farm sources. The share of family income from farming has not been above 50 percent in the last 15 years but is now closer to 30 percent in both countries.

Obviously, these general conclusions beg for an analysis of distribution and structure. The large number of families associated with small farms have little or no farm income and receive almost all of their income from nonfarm sources. At the other end of the spectrum, a smaller number of families associated with large "commercial" farms depend on farm earnings for most of their earned family income and produce the bulk of agricultural production.

The preambles to major pieces of farm legislation invariably state that improving the income of farm families is a primary objective of the proposed program. The U.S. and Canadian trends reported above suggest two insights about the relationship between farm policy and farm income in both countries. First, although improved farm family income is the *raison d'être* of most agricultural policy, the elasticity of response of farm family income to farm policy is not large. Second, although farm family income remains high relative to non-farm family income, at least in terms of historical relationships, much of this 'strength' results from off-farm employment by one or more family members. The growing importance of off-farm income to most farm households suggests that public policies that strengthen the rural nonfarm economy and improve employment and earnings opportunities may be more important to maintaining household income than farm commodity programs and policies.

Summary and Conclusions

This review of farm structural trends suggests more commonalities than disparities in economic conditions and structural trends between Canada and

the United States. Both countries experienced a "boom and bust" cycle during the 1970's and 1980's, resulting in lowered real farm incomes, increased debt, and economic stress for some farmers. The number of farms in both countries continued to decline over time while average farm size increased; despite farm enlargement, most farms are still owned and operated by families. Farm families in both countries have become increasingly reliant on off-farm income. In both countries, beef, hog, and sheep operations comprise a large share of farms and aggregate revenues, and in large part, the agricultural economies of U.S. and Canadian regions with like geographies are similar. Both countries are witnessing increased commodity specialization. Finally, U.S. and Canadian farm family income statistics no longer portray the farm population as a relatively disadvantaged group; by the end of the 1980's, farm family income had reached parity with that of respective nonfarm families in the United States and Canada.

Different parts of the farm industry structure are expected to be affected differently due to price movements and technological change in a freer trading environment. One challenge to analysts is to attempt to anticipate which part of the structure will be most affected and where public policy attention might be fruitfully focused. Some trends in farm structure are expected to continue:

1. *The number of smaller farms will continue to decline*

   We expect the number of small non-commercial farms to continue decreasing as they have done in the past. The decline of the small family farm continues to receive media attention in both countries. However, families on the smaller farms tend to have relatively high incomes with little dependence on farm income. In fact, they look like many other families, rural or urban, with one or two workers in the non-farm labor force. The 'fruitful' focus of public policy for this group is not obvious.

2. *The number of mid-sized farms will continue to decline and families on these farms will continue to receive lower incomes.*

   Generally, families on mid-sized farms have farms that are too small to provide high levels of net farm income while the time commitments often preclude full-time work off the farm. This has been a common feature of modern agricultural structures for decades. Historically, the adjustment among individual farming families has been to expand or to diminish the size of the farm operation. The constant dollar spread of the gross

revenue classes to cover these farms is increasing dramatically and there are increasingly fewer mid-sized farms. Public policy attention to facilitate the adjustment to larger farms through extension services or farm credit bureaus may be a useful approach. Public policy attention to facilitate farmers' adjustment to the non-farm workforce may need more attention, including training and local area job stimulation.

3. *Farms will continue to grow larger, but large corporations will not become predominant in operating farms.*

   The trend toward fewer, larger farms is continuing, but at a much slower pace than in the past. Also, non-family corporations do not comprise a large share of farms in either country. It is unlikely that corporate farms can exercise oligopolistic pricing practices because even the largest corporate farms are not able to control a high enough percentage of production to influence prices of commodities. Ease of entry for competing farmers and ease of substituting competing products in the diet prevent oligopolistic pricing even in limited markets for specialty commodities. It is highly unlikely that that corporate farms can exert control over consumer prices because of their oligopolistic practices and powers (Gale and Harrington, 1993).

4. *Trends toward commodity specialization will continue.*

   Farm enterprises are becoming more specialized at the same time that many policy analysts argue for diversification strategies. Within-farm diversification seems antiquated and the only farm diversification schemes likely to be encouraged are those arguing for each farmer to specialize in something different. A macro-diversity of micro-specialized production units could help provide a more diversified farm-based rural community.

5. *Vertical integration is likely to increase and could have mixed effects on producers.*

   Many farms, while maintaining family control over their operations, have become closely linked with downstream agribusinesses. Farmers who produce under contract reduce their risks associated with volatile and changing prices. Also, contract arrangements reduce barriers to farm entry for persons with low equity, although these farmers become less independent and experience other risks associated with contract renewal and negotiation (Gale and Harrington, 1993).

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Appendix

The following defines the regional aggregations used in this paper.

Eastern Canada: Includes the provinces of Newfoundland, Nova Scotia, Prince Edward Island, New Brunswick, Quebec, and Ontario

Western Canada: Includes the provinces of British Columbia, Alberta, Saskatchewan, and Manitoba

Northeastern United States: Includes Connecticut, Illinois, Indiana, Iowa, Kentucky, Maine, Massachusetts, Michigan, Minnesota, Missouri, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, West Virginia, and Wisconsin.

Northwestern United States: Includes Idaho, Montana, Nebraska, Oregon, North Dakota, South Dakota, Washington, and Wyoming.

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