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Recent Changes in Farm Structure: A Canada-U.S. Comparison

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The Issue

Following a series of bilateral and multilateral agreements, the past two decades have seen increased trade and investment liberalization between Canada and the United States in the agri-food sector. Changes in trade policy are one of several paths by which farm structure can change. This increased liberalization, together with the largest drop in Canadian farm numbers recorded by the Census of Agriculture in thirty years, has provided the impetus to review some aspects of farm structure. In particular, this article presents the latest Canadian and U.S. data on the number of farms by sales class, the concentration of sales and other production-related variables, and the distribution of income and receipts. We explore whether significant changes in the latter two elements of farm structure have occurred during this period of trade and investment liberalization.

Implications and Conclusions

The results suggest that farm income in Canada is becoming more unequally distributed among farm operations, although it remains more equally distributed than U.S. farm income. Non-supply-managed sectors, however, were the only Canadian farm sectors in which there was statistically significant increased inequality of the distribution of farm

cash receipts. The U.S. data show a greater stability in the distribution of farm income and receipts despite an overall higher level of inequality. While the article is not designed to rigorously separate trade influences from other factors that may be affecting the distribution of income, the results provide some tentative support for the view that some aspects of farm structure in the two nations are showing signs of convergence over the past 20 years, especially in trade-sensitive (non-supply-managed) sectors, and that the more significant changes are occurring in Canada – consistent with the view that such trade agreements would more greatly affect the smaller trading partner.

Both Canada's Agricultural Policy Framework (APF) and the United States's Farm Security and Rural Investment Act of 2002 recognize the need to consider the changing environment and structure of production agriculture. Therefore, the policies are more comprehensive than ever before, addressing issues of food safety and quality, environmental responsibility and concerns, globalization and increased trade, renewal, and science and innovation. Risk management is particularly important in creating an environment where entrepreneurial skill can yield reasonable returns to farm operators. The design of such programs requires detailed current information about the structure of this constantly changing sector in order to ensure an efficient use of public funds. In addition, the increased dependence of many farm families on non-farm income is another factor to be considered in measuring the overall well-being of those in the sector and the health of rural communities. If the trend to a more unequal distribution of farm income in Canada continues, one could expect that, similar to the United States, non-farm income will have a growing importance for those farm families who receive a smaller share of farm income.

Background

Much has been written about structural change in the agricultural sector on both sides of the border. Significant structural changes within the farm sectors of Canada and the United States, as well as macroeconomic and international forces outside the sector (Harrington and Reinsel, 1995; Bollman, Whitener and Tung, 1995; Oliveira, Whitener and Bollman, 1995), are changing the composition and distribution of farm and non-farm income and cash receipts and the concentration of farm production over time. Factors directly influencing the farm sector include changes in government farm policies (Huff, 1997; Gardner, 2002), technology, relative input and output prices, and the composition of demand for farm products (Boehlje, 1989; Harrington and Reinsel, 1995; Bollman, Whitener and Tung, 1995; Oliveria, Whitener and Bollman, 1995; Peterson, 1995; Gale and Pursey, 1995; Barnard and Grimard, 1995; Vogel and Johnson, 2000; Martin, 2000; Chavas, 2002). More indirect factors include macroeconomic policies and the international competitiveness of Canadian and U.S. agriculture vis-à-vis other nations. Boehlje notes that the most dramatic changes occurring in the agricultural industries may best be described in terms of changes in the ways of doing business. These include 1) the

United States
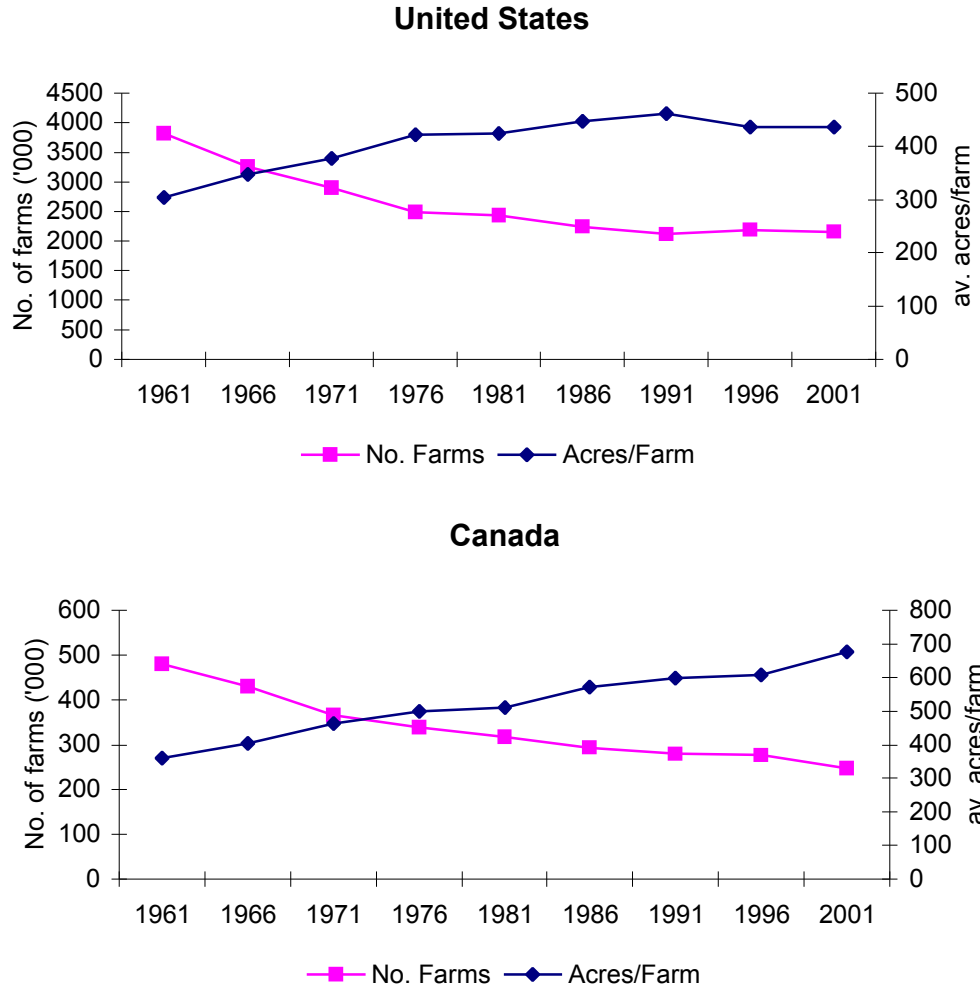
Canada

Figure 1 Farm numbers and average farm size.

Sources: United States Department of Agriculture; Census of Agriculture, Statistics Canada

development of food supply or value chains from genetics to end user/consumer and 2) the adoption of process control technology and a manufacturing mentality throughout the entire food chain but especially in production agriculture (Boehlje, 1999). To understand the forces underlying these changes, and thus to develop appropriate farm policies, it is important to develop appropriate measures of concentration of farm production (Gardner, 2002; Schmitz, Furtan and Baylis, 2003).

The Canadian and U.S. farm sectors have experienced considerable structural change in size and number of farms in each size class during the last century (figure 1). Despite the inclusion of small hobby farms in the estimates of farm numbers, the trend toward fewer operations overall but a greater number of larger farms continued in Canada during the past decade, while the loss in the number of farm operations has leveled off in the

Table 1 Detailed Distributions by Sales Class, Canada and United States, 2000, 2001

| Sales class ($US) | Percentage share of: | | | | | |
| | Farms | | Sales | | Net cash income* | |
	Canada	U.S.	Canada	U.S.	Canada	U.S.
< 20,000	39	58	2	5	-11	2
20,000 - 49,999	14	16	3	5	0	4
50,000 - 99,999	14	9	7	6	6	6
100,000 - 249,999	19	9	20	14	28	15
250,000 - 499,999	9	4	19	14	27	15
500,000 - 999,999	3	2	15	15	20	17
1,000,000 & over	2	1	34	42	31	43
All records	100	100	100	100	100	100

* Gross value added used for net cash income in the United States

Sources: 2001 Census of Agriculture, Statistics Canada; 2001 Agricultural Resource Management Survey, United States Department of Agriculture

United States. Indeed, in Canada the 2001 Census of Agriculture recorded the largest five-year drop – down 11 percent – in the total number of farms since the 1966-1971 period, while the United States showed a decrease of less than 2 percent during this period.

Various factors in Canada and the United States are driving these changes, including economies of scale and greater coordination between producers and processors. Horizontal integration through consolidation has occurred rapidly, as some producers leave the sector while others purchase these assets in an attempt to more fully exploit economies of scale. Vertical integration and more complex operating arrangements (including increased contracting) are connecting the retail sector back to the production sector, processing stages of the food system, and input suppliers (value chain). Other factors driving these structural changes include the relative profitability of farm vs. non-farm investments, government programs and farm programs, trade policies, economies of scope (reduced costs associated with the production of more than one output), and globalization. Some researchers have given the determining role for the increasing size of farms to the substitution of capital for labour as the price of labour – in this case the price of the time of farm operators – increases relative to the price of capital (Bollman, Whitener and Tung, 1995).

The distribution of farms across sales classes in 2001 shows some differences between the two nations (table 1). In particular, the greater proportion of small farms in the United States as well as the greater share of sales and income generated from the largest farms should be noted. In contrast, there are relatively more mid-sized operations

United States
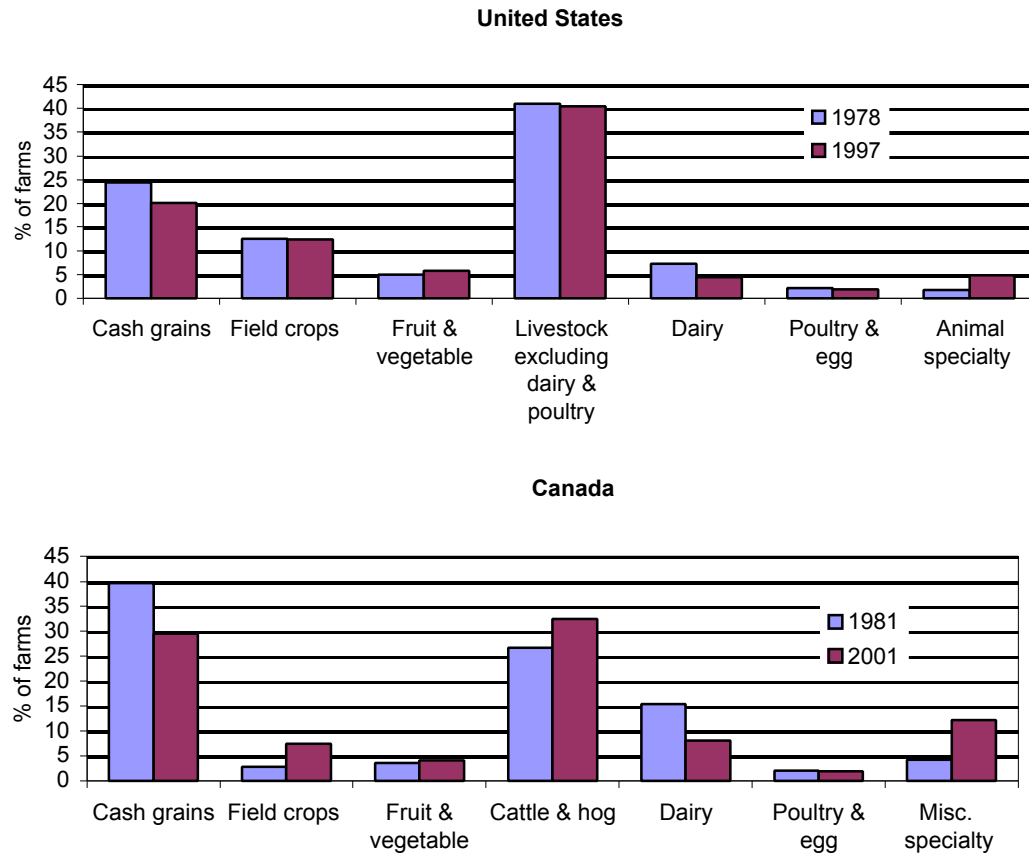
Canada

Figure 2 Percent of all farms, by farm type.

Sources: United States Department of Agriculture; Census of Agriculture, Statistics Canada

in Canada than in the United States. For example, operations in Canada with sales between $50,000 and $500,000 (US$) account for 42 percent of farms and 45 percent of sales while similarly sized operations in the United States make up only 22 percent of all agricultural operations, accounting for 35 percent of total receipts.

Many similarities have occurred in relative changes in farm types in Canada and the United States during the past 20 years (figure 2). Livestock farms continue to dominate in the United States and this is now true in Canada. However, this relative dominance of livestock farms can partly be attributed to the greater propensity of hobby farms being included in this farm type. Decreases in grain and dairy farms took place in both countries, although the drop was more pronounced in Canada. Animal and crop specialty farms have grown in relative importance in both countries. This is not surprising given the increased emphasis on exploiting niche markets through creating specific products for these markets.

Data and Methods

Data used for the Canadian analysis included the Census of Agriculture – a snapshot of the agricultural sector every five years, covering all farming operations with the potential to generate agricultural receipts – as well as Statistics Canada's Whole Farm Data Base. The latter is a comprehensive base of physical and farm financial data at the farm level. Among the data sources accessed from this base were the Farm Financial Survey (FFS), and the Taxation Data Program (TDP).

For the United States, data used included the U.S. Census of Agriculture, which also surveys the agricultural sector every five years and covers all farms with annual agricultural sales of at least $1,000. Also used extensively was the Agricultural Resource Management Survey (ARMS). ARMS is the USDA's primary source of information about the current status and trends in the financial condition, production practices, environmental impacts, and resource use of U.S. farmers and ranchers. ARMS provides the production expense and farm-related income data that underlie the USDA's annual estimates of net farm income.

The Gini Coefficient as a Measure of Inequality

The Gini coefficient is based on the Lorenz curve, a cumulative frequency curve that compares the distribution of a specific variable with the uniform distribution that represents equality. If, for example, net cash income were equally distributed across farms, the Gini would equal 0. If net cash income accrued to just one farm, then the Gini would equal 1 (perfect inequality) (Cowell, 1995).

A SAS@ matrix program was created to estimate the weighted Gini coefficients for Canada and the United States and to perform the hypothesis tests. Both stratified variances and jackknife variances were calculated where appropriate. The program also provides summary statistics and extensive error checking (Dubman, 2000). Zero responses were included in the Gini calculations for net cash income, as this is a legitimate although rare occurrence; however, for calculations involving receipts, zero values were excluded in order to better measure the equality of the distribution of receipts among active producers of the commodity in question.

In order to obtain Gini results based on a reasonably similar basket of agricultural products, observations from Alaska, Hawaii and states in the southern United States were excluded from the calculations. While ARMS data were used exclusively in these calculations, for Canada several data sources were used, including the FFS and TDP, in the estimation of the Gini coefficients. Because of its larger sample, the TDP estimates are used, although the general trends found in that data set were also evident in the FFS estimates. Farms with less than $10,000 in agricultural sales were excluded from the calculations in order to produce results from all data sources. However, producing Gini results including these smaller farms did not change the trends or the significance of the
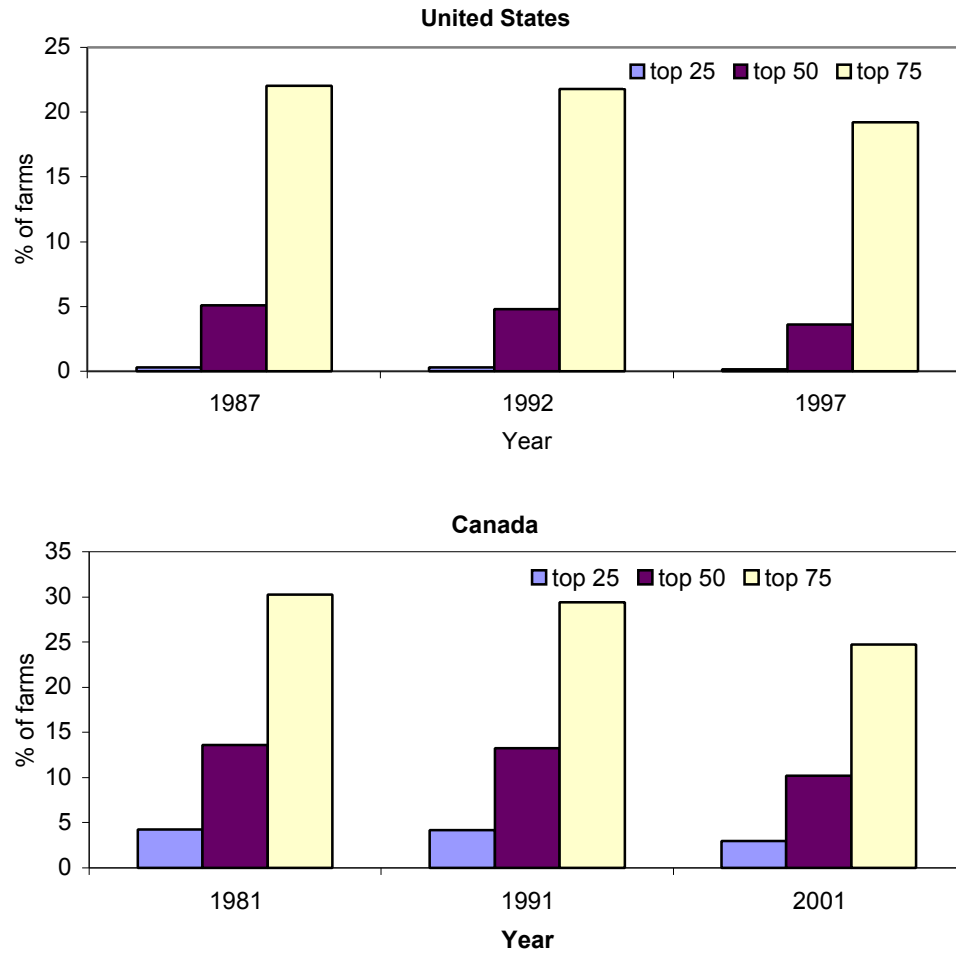
United States

Canada
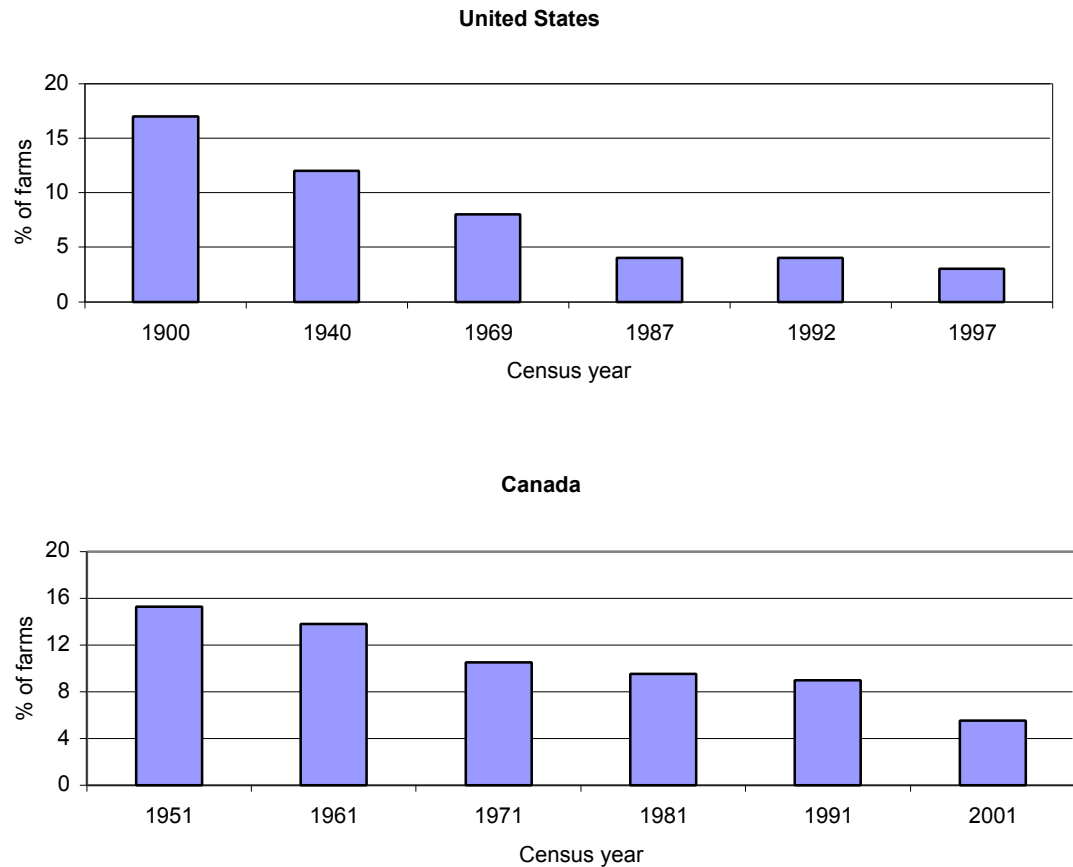
Figure 3 Smallest percentage of farms needed to account for half of agricultural sales.

Sources: U.S. Bureau of the Census, 1900-1992 Census of Agriculture; U.S. Department of Agriculture, National Agricultural Service, 1997; Census of Agriculture, Statistics Canada

coefficients shown in this article; only the levels were changed, by a relatively small amount.

Percentile data for showing concentration of sales and physical assets were based on tabulations obtained from the respective Canadian and U.S. Censuses of Agriculture, and used all census farms.

Concentration of Production and the Distribution of Net Cash Income and its Components

Concentration of production (as measured by the smallest percentage of farms needed to account for half of the value of agricultural sales) has been increasing, with sales becoming more concentrated in larger operations (figure 3). In the United States, this percentage fell from 3.6 percent in 1987 to 2.4 percent in 1997. In Canada, during a
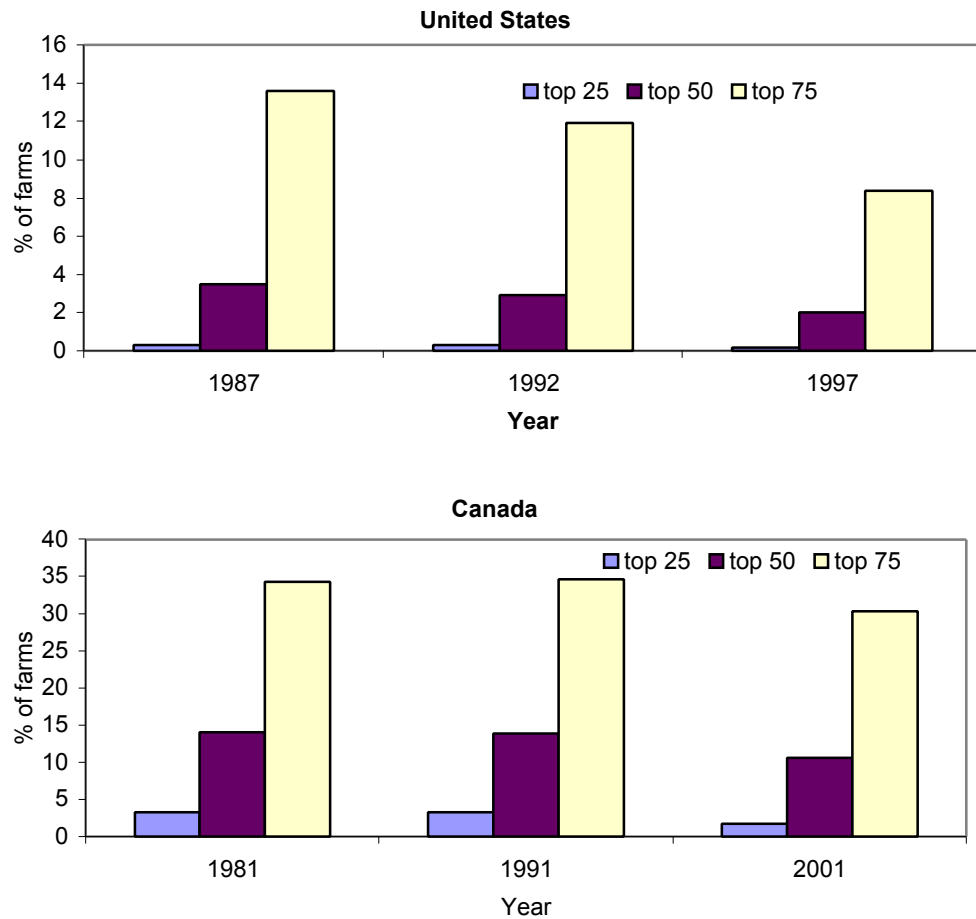
United States

Canada

Figure 4 Percentage of farms accounting for selected percentage of grain, oilseed and special crop salaes (United States) and area (Canada).

Sources: United States Department of Agriculture; Census of Agriculture, Statistics Canada

slightly later ten-year period (1991 to 2001), the number of farms accounting for 50 percent of sales fell from 9.0 percent to 5.5 percent. The data indicate that concentration of sales in larger units was occurring at a slightly faster pace in Canada than in the United States during much of the 1990s.

Using sales (United States) and area (Canada) we found that the grains and oilseeds sector showed signs of increased concentration in the 1990s (figure 4). From 1992 to 1997 the percentage of operations in the United States accounting for 50 percent of total grains and oilseed receipts fell from 4.8 percent to 3.6 percent. In Canada, the percentage of farms comprising 50 percent of the area seeded to grains and oilseeds dropped from 13.3 percent to 10.2 percent during the 1991 to 2001 period.

United States

Canada

Figure 5 Percentage of farms accounting for selected perecentage of total cattle sales (United States) and inventory (Canada).

Sources: United States Department of Agriculture; Census of Agriculture, Statistics Canada

There are similar trends in concentration in the United States and Canada in the cattle sector (figure 5), with 8.4 percent of U.S. cattle farms accounting for 75 percent of the value of sales – down from 13.6 in 1987 – while 30.3 percent of Canadian cattle farms account for 75 percent of cattle inventories – a modest drop from the 34.3 percent figure of 1981. Much of this increased concentration in Canada can be traced to the growth of feedlots in Alberta, which service the increased trade in beef and cattle to the United States. For example, the average herd size for the top decile of cattle and calf inventories in Western Canada has increased more than five-fold since 1991, reaching almost 15,000 in 2001.

Distribution of Net Cash Income: Canada and the United States
Net cash income (1990-2001), excluding operations with sales less than $10,000, is becoming more unequally distributed among farm operations in Canada but is not as

Table 2 Net Cash Income Gini Coefficients (excludes operations with sales < $10K)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Canada	0.81	0.80	0.79	0.79	0.82	0.81	0.84	0.84	0.85	0.88	0.87	0.86
U.S.	n/a	0.87	0.87	0.88	0.89	0.90	0.87	0.94	0.91	0.88	0.91	0.91

Note: U.S. includes only the Northeast, Lake States, Corn Belt, Northern Plains, and Pacific regions
Sources: United States Department of Agriculture; Census of Agriculture, Statistics Canada

Table 3 Gini Coefficients for Selected Receipts, Canada 1990-2001 (excludes operations with sales < $10K)

Receipt categories	1990	1992	1995	1998	2001
Significant upward Gini trends in:					
total receipts	0.58	0.60	0.64	0.67	0.71
grains and oilseeds	0.57	0.57	0.60	0.62	0.64
cattle	0.70	0.70	0.76	0.75	0.78
pigs	0.73	0.74	0.78	0.80	0.81
horticulture	0.74	0.75	0.77	0.79	0.82
Supply-managed sectors:					
poultry	0.79	0.80	0.83	0.77	0.77
dairy	0.45	0.43	0.43	0.43	0.45

Statistically significant upward trends were considered those series in which the Ginis in the 1998 to 2001 period were significantly greater than those of the 1990 to 1992 period (at 95 percent C.I.).
Source: Taxation Data Project, Statistics Canada

unequally distributed as it is in the United States (table 2). The Canadian estimates for 1990-1995 are statistically different from those for 1996-2001. The U.S. estimates do not show a similar trend towards greater inequality.

Distribution of Selected Cash Receipts:
Canada and the United States

For Canada, there is a statistically significant upward trend in Ginis in the non-supply-managed sectors (grains and oilseeds, cattle, pigs, and horticulture) (table 3). This suggests a greater inequality in the distribution of farm receipts during the 1990s. In the supply-managed sectors (poultry and dairy), the Gini remained stable and was considerably lower for the dairy sector than for the other sectors.

There is evidence of upward trends in the concentration of selected cash receipts in the United States (1995-2001) as well; however, with few exceptions, the Ginis across time are not statistically different (table 4).

Table 4 Gini Coefficients for Selected Receipts, United States, 1991-2001 (excludes operations with sales < $10K)

Receipt categories	1991	1993	1995	1998	2001
total receipts	0.64	0.64	0.66	0.69	0.71
grains & oilseeds	n/a	n/a	0.65	0.67	0.71
cattle	n/a	n/a	0.75	0.81	0.80
pigs	n/a	n/a	0.69	0.71	0.74
horticulture	n/a	n/a	0.79	0.84	0.85
poultry	0.87	0.84	0.88	0.84	0.75
dairy	0.53	0.55	0.60	0.62	0.64

Note: U.S. includes only the Northeast, Lake States, Corn Belt, Northern Plains, and Pacific regions
Source: Agricultural Resource Management Survey, United States Department of Agriculture

Between nations, the most notable difference is that the Gini coefficients for the U.S. dairy sector are significantly higher than those for the Canadian dairy sector. The more equal distribution of dairy receipts in Canada is likely in part related to the additional barriers to expansion faced by individual Canadian operations, which include the cost of purchasing quota as well as quota limits.

Summary and Areas for Further Research

The distribution of farm income and revenues has changed over space and time in Canada and the United States. These changes reflect the changing structure of production agriculture. Comparisons of Ginis suggest a somewhat greater inequality of the shares of net cash income in the United States than in Canada and a greater inequality in some farm receipts compared to others. Statistically significant increases in the Ginis occurred mostly in Canada.

Considerably more analysis is needed to better understand what is driving these changes. Areas for further research include the following questions: Are trade and investment liberalization likely to lead to convergence in rates of return in Canada and the United States? Is there likely to be a differential impact on trade-sensitive sectors? What would be the impact on the Gini results if higher revenue thresholds were used to minimize the influence of non–commercially viable operations? How has off-farm income affected the distribution of total farm household income in Canada and the United States? How has the growing proportion of off-farm income as a share of total household income affected the consumption and investment choices and decisions of farm households?

Explanations for cross-country, within-region, and between-region changes in the concentration of farm production and in the distribution of factor returns to rent, capital,

labour, and farm operators will have to include an expanded view of farm structure and performance in order to better measure, analyze, and interpret these changes. Such a view would synthesize and draw lessons from the economics of agricultural policy (Schmitz, Furtan and Baylis, 2003). Statistics Canada and the USDA-ERS will continue to work cooperatively in analysing issues related to farm structure and their implications for the well-being of farm families and the sector in general.

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