

RURAL ECONOMY

**Positioning for Trade Liberalization:
Structure of Earnings, Comparative and Competitive
Advantage of Agricultural Households in the
United States and Canada**

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and Blaine Calkins

PROJECT REPORT



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EXECUTIVE SUMMARY

Change in the earnings structure of agricultural households in North America is an important concern of policy makers in Canada and the United States. Earnings structure reveals the strengths and weaknesses of households in the climate of policy change, competition and predation associated with trade liberalization. Earnings structure can be broken down into source and composition structures. The source structure of earnings contains information about where household income is derived: market income, off-farm income, direct agricultural subsidies, social safety nets, and other income. The composition structure of earnings expresses returns in terms of wages, capital, and rents according to the form of property right underlying production.

Earnings structure is measured for each of six regions in North America: Western and Eastern Canada, Northwest and Northeast United States, and Southwest and Southeast United States. The regional comparisons are examined in a north-south direction on both the west and east sides of the continent. The earnings structure is measured for size classes of agricultural households for two periods, 1987-88 and 1990-91.

Two North/South patterns predominate in the source structure of earnings in both the East and West halves of the continent. The first is the greater volume of agricultural sales for comparable commercial agricultural households as one moves south. The second is that the proportion of agricultural households accounting for 75% of the output of agricultural commodities diminishes dramatically from North to South. The proportion in western Canada is 43% diminishing to 10% in the Southwest. In eastern Canada the proportion is 38% diminishing to 10% in the Southeast.

The pattern of the composition structure of earnings is similar in each of the six regions as household agricultural sales increase. The wage share of the earnings declines. The share of capital earnings is constant, while the share of economic rent increases.

The wage share of earnings is highest for western Canada compared to the western States. The proportion of earnings accounted for by the return to capital is highest in Canada apparently reflecting higher levels of capital, not including land, in the inputs structure. The proportions of rents are higher in the western U.S. regions than in western Canada.

The implications of the harmonization of trade rules is also analyzed. Comparative and competitive advantage analysis reveals the implications of integrating the Canadian and United States agricultural markets. Comparative advantage analysis provides clues as to which commodities realize advantages when fixed resources dedicated to the commodities incur the least opportunity cost relative to all other uses. Competitive advantage measures the outcome of all policies, business alliances, and market conditions, which enable a commodity landed in another trade jurisdiction to contribute to the economic rent in the place of origin. Comparative and competitive advantage analysis is used to measure and interpret trade advantages across North America.

Western Canada appears to hold the advantage for grain. The comparative advantage for western Canadian grain suggests that a level playing field would offer new opportunities. It is not clear what effect price pooling in Canada has on these measures of advantage. However, some kind of entitlement advantage appears to favour the inputs side of larger grain operations in Canada because competitive advantage increases with size while comparative advantage remains the same across farm sizes.

The majority of the size classes of beef producing households in western Canada appear to hold a competitive advantage over eastern Canada. The Northeast United States also seems to hold the competitive advantage in beef production over eastern Canada for the majority of households. The evidence is inconclusive for trade among the western regions.

Both the Northeast United States and Eastern Canada hold comparative advantages in grains. Eastern Canada holds a competitive advantage over the Northeast United States in grain production for the majority of households.

Source structures of earnings suggest that the east and west halves of the continent stand to be affected in opposite ways by subsidy roll-backs and redefinition of eligibility criteria for income support, that is, entitlements. The difference between eastern and western Canada is that the support programs in the East are both taxpayer and consumer financed within supply management programs. They are primarily taxpayer financed in the West. The degree of consumer financing shows up in the much larger share of market-based earnings in the East, attributable to supply management.

The differences for the east and west United States lie in the greater dependence of the West on taxpayer support. The Eastern agricultural households are largely self financing at all levels of importance to the National interest, measured in terms of commodity output.

This comparative study of earnings reveals that there are many national differences which interfere with the trade harmonization process. The vision of each country's agricultural

and rural systems must be looked at closely to understand how each country shares the costs of food, shares the cost of countryside amenities, deals with sustainability and plans on handling farm adjustment among agricultural households, taxpayers and consumers. Each National dynamic is viewed differently from each country. Regional differences seem to exist on property rights and entitlements. Evidence suggests the choice of policy measures to be harmonized retains strong roots in the fundamentally different regional rural worlds of the United States and Canada.

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INTRODUCTION AND PURPOSE

Earnings structures reveal the strategic weaknesses and strengths of households in the climate of policy change, competition and predation associated with trade liberalization. We view trade liberalization as a process of harmonizing the rules of entitlement across sovereign trading jurisdictions. Examples of entitlements are entry and exit, information, government income transfers, pollution and structural concentration of market power and property rights.

The distinctiveness of the United States and Canadian agricultural economies influences their competitive advantage in each others' markets. All features of the two economic systems facing trade liberalization are under pressure to harmonize over time. The process includes the form of forward and backward linkages between agricultural and nonagricultural subsystems and stakeholders in the national economies. Trade liberalization is much more than a simple matter of harmonizing border measures.

We argue that earnings reflect the positioning of households to take advantage of, resist, or succumb to this restructuring of entitlements. In general, reduced market segmentation and the harmonization of social, economic and technology policies between the two countries tend to shift economic entitlements away from agriculture. This shift takes place because technological change substitutes industrial inputs for land and on-farm labour, the main property entitlements in agriculture. Information inputs are substituted for decision-making ability, the main intellectual property entitlement.

Households earning economic rents, which are directly attributable to entitlements to transfers from government treasuries or legislated market power, are vulnerable to trade liberalization. Households with these attributes may be expected to seek to prevent harmonization, and most certainly may be expected to restructure or punt.

Competitive advantage is the ability to place a good or service into another trading jurisdiction at a net margin per unit of immovable assets higher than that of other competitors (Tweeten 1992). Competitive advantage takes into account resource endowments, intellectual property and all prevailing market imperfections contrived and otherwise. Competitive advantage is achieved typically through economic efficiency coupled to alliances with government(s).

Intellectual property is the expression of talent, skill, and knowledge owned by an individual or an institution such as a household. The term is more comprehensive than that of human capital and qualitatively distinct. Intellectual property is depleted by obsolescence, anxiety, discouragement, paranoia and depression. It is augmented through processes of accretion by learning and the release of human energy through motivated interest in work and risk taking. Its rewards are a flow of returns in proportion to the scarcity and uniqueness of the expression of these intellectual attributes, including an economic rent, social approbation and psychological satisfaction. Intellectual property is differentiated and protected by law, as is real property, in ways unique to each country.

Trade agreements, amplified by the tariffication outcome of the GATT agreement and the NAFTA provisions to reduce tariffs, promise a new tilt to the playing field on which business games with government are played (Freshwater, Apedaile and Ehrensaft 1992). The outcome of these games is revealed in revised agricultural terms of trade, and in technological, institutional, and structural change. These shifts lead to the redistribution of the economic value of productivity gains within agriculture, and among households and regions.

Specifically, the story in our analysis is that structural change is pervasive across all levels of importance of agricultural households to each economy. By and large, the earnings structures are changing in concert across North America. We see structural change as the movement of agricultural households towards the extreme ends away from mid-points on a scale of their importance to their national economies. Broad based restructuring of economic activities and employment in rural economies appears to be the most powerful force restructuring earnings of agricultural households. During the last three decades, pluriactivity of household labour has been hypothesized to be a transitory stage in a process of increasing concentration of households producing agricultural products. It is now increasingly recognized to be part of a global response to contradictions between feelings of impoverishment and the diminishing marginal utility of greater income needed to satisfy aspirations to higher standards of living.

Households with high economic rents and low shares of direct agricultural subsidies within

their earnings structures are likely to be most resilient to and best positioned to take advantage of rule changes. Generally these households are in the southwestern United States and have the highest volumes of sales of agricultural commodities per household. Households with the highest proportions of wages and of direct agricultural subsidies are most vulnerable to rule changes. Generally these households are found in western Canada and in mid-ranges of importance to their national economies.

The results reported here focus attention on three topics for U.S.-Canadian negotiations on harmonization. The first issue focuses on the ways that inputs, environmental and social costs of food security, agricultural export earnings, and countryside amenities are shared among consumers, taxpayers, agricultural households, and future generations. The second topic concerns the cultural and legal understandings of property rights and entitlements such as the right to farm, land tenure, pollution rights, tax concessions, and the exercise of uncompetitive market power. The third issue relates to the collective vision and purpose for agricultural households in the national economies. The wheat dispute of 1993-94 is part of the early stages of testing, sometimes called 'the dance', in the much larger process of negotiating around these topics.

This paper is modest relative to the scope of these structural and trade harmonization issues. The overall purpose is to use earnings structure to identify and define the positioning of agricultural households relative to opportunities and vulnerabilities of increasing cross-border trade in agricultural commodities, agricultural inputs, processed food products, and intellectual property.

METHOD AND DATA

Method of Structural Analysis

This study is comparative. The North American continent, less Mexico, is divided into east and west. Each side of the continent is then defined as three regions, Canada and northern and southern United States. The data resources in both countries are massaged to create a comparable base of evidence. We paid particular attention to north-south patterns of structural change in anticipation of technological and harmonization features of trade-induced adjustment processes.

We present two forms of earnings structure to carry our analysis beyond the usual models of structural change (Boehlje 1992). The approach is inspired in part by Nicolis and

Prigogine (1989) and Stokes (1992), and in part by Coasian and Ricardian ideas on property rights and rents (Coase 1937; Ricardo 1951). The focus is on the household to embrace all social definitions of family, to extend the concept of an operating decision unit beyond that of a farm, and explicitly to encompass non-agricultural activities (deLord and Lacombe 1990).

The source structure represents the earnings by type of profit-seeking activity engaged in by a household. The source structure is observed as shares of household earnings from market-derived net farm income; direct agricultural subsidies; off-farm income from wages and self employment; other nonfarm income comprised mainly of interest and investment income; and social safety net income from unemployment insurance, social security/assistance, and old age security.

The composition structure of earnings represents the outcome of institutional and rent-seeking behaviour for rewards to fixed factors. Composition structure is observed by measured shares of household earnings accruing to labour, capital, and property rights and entitlements.

Source structure of earnings is a more sensitive indication than is the composition structure, of the effects of changes in rules governing transactions and property rights. These rules are viewed here as the outcome of predator-prey relationships between agriculture and government much along the lines modelled by Rausser (1991) and de Gorter et al (1992).

The composition structure enables analysis of the resiliency and positioning of households relative to the closing and opening of opportunities in the process of trade. With new opportunities, households with a large share of earnings in the form of economic rents are best able to finance adjustments needed to position themselves for economic growth. As other opportunities for these same households disappear under freer trade, education and intellectual property replace real property as the basis for being swift-footed in adjustment (Schultz 1972). We suggest that substantial real property rents, as opposed to intellectual property rents, may become an impediment to adjustment.

Households having relatively low proportions of rent are vulnerable. Loss of entitlements for these households through policy harmonization, such as health care, would cut into standards of basic needs. Reallocation of household capital and mature labour to endeavours in new places would be more difficult when the proportion of economic rents in household earnings is low. Under these circumstances, household youth would move.

Comparability of Data

This paper reports an experimental technique to extract structural evidence in a comparable way from the Whole Farm Data Base in Canada and the Farm Costs and Returns Survey in the United States. Comparability of the data bases between the two countries is the greatest challenge facing this work.

Data for the United States are from the 1988 and 1991 Farm Costs and Returns Survey (FCRS). It is a complex multi-frame sample of farm operators, involving both list and area frames. The survey is intended for cost of production analysis and assessment of the general economic well-being of farm households (Ahearn, Perry and El-Osta 1993). Since the survey was not intended for structural analysis, its use here constitutes, in a sense, a test of its versatility.

The Canadian data are from the 1987 and 1990 Whole Farm Data Base (WFDB) (Foley and Spooner 1992), and the 1986 and 1991 Agriculture-Population Linkage data base. The WFDB is a fused data base of 60,000 observations comprising taxfiler data, Farm Credit Survey data, and the Farm Financial Survey. The taxfiler component alone is used here. Retabulation of this unpublished enumeration level data (microdata) enabled us to modify definitions of the variables to improve comparability between the two countries.

Multi-farm operators and multi-operator farms pose the first problem for comparability. They do not conform to the one-farm, one-household structure needed to analyze farm businesses and farm households simultaneously, because they involve multiple families and households. The result is discontinuities between counts of farms and households, and between financial analyses of farm businesses and farm households.

The U.S. FCRS tabulations exclude corporate farms and cooperatives, but include partnerships. The Canadian WFDB data also exclude corporate farms and individuals and households with more than one farm. However, since the classification criterion was the volume of gross farm sales, all households that could be 'associated' with a single farm such as a partnership farm, are included.

The household data provide the average off-farm income and the household's share of net farm income. Thus, households associated with a single unincorporated farm are included. The data for land area, capital and labour are for unincorporated census farms with gross revenue from agricultural sales greater than Cdn \$10,000. These data from the Canadian Agriculture-Population Linkage data base are classified into 20 equal-sized classes, called vingtiles, based on gross agricultural sales data from the WFDB. Vingtiles are defined

below.

Households with agricultural sales under Cdn \$10,000, correspond to 25 percent of all census farms in 1990 (Statistics Canada 1993). Those associated with larger corporate agricultural enterprises account for 32 percent of agricultural sales in 1990 (Statistics Canada, 1991a). The truncation of the lower end affects the structural characteristics of the first one or two vingtiles. The second truncation mainly affects the earnings structures of the upper 10 vingtiles, leading to under estimation of their per household market-based earnings and economic rents. This observation is based on the hypothesis of a higher level of profitability of agricultural activities by households operating incorporated farms.

We judge the short period of comparison to be adequate to indicate the direction of structural change. The length of period is irrelevant for purposes of prediction, however, because history of complex dynamical systems does not constitute a basis for predicting the future. The periods are 1987-1990 (Canada) and 1988-1991 (United States).

The definition of variables and assumptions leading to comparability are recorded in an Appendix to the larger project report on this work (Apedaile et al 1994).

Classification of Households

Households are classified in increasing order of their agricultural contribution to the national economy. Comparisons between regions and across time are therefore standardized by level of agricultural sales relative to the total contribution of agriculture within each jurisdiction being compared. For example, households accounting for 21-25 percent of aggregate sales in eastern Canada are compared to households in the northeast United States which also account for 21- 25 percent of agricultural sales.

The comparison is thus between households of equal rank in their contribution of agricultural products to their respective regional economies. This approach offers a solution to the problem of incomparability in time and across jurisdictions arising in the clash between historically dissimilar and arbitrary static reference bases for farm classifications, and the dynamics of technological change, farm consolidation, and economic restructuring.

This classification of agricultural households and the definition of sales class marks a significant departure from most structural work. Agricultural households are grouped here

according to their contribution to the national economy measured in terms of gross agricultural sales, not net farm income. Sales are the measure of the size of the farm component of household economic activities. We are looking for changes in the structure of agriculture based on what households do, not changes in number and distribution of households.

Twenty equal-sized gross sales classes, called vingtiles, are established. A vingtile is a group of households which accounts for 5 percent of aggregate agricultural sales. There are two advantages to the classification. First, the groups are comparable across years and regions. The relative contributory status of the group of households within a vingtile does not change over time and space, but the households themselves do. They restructure and/or attain a different contributory status, thus revealing the structural change of each vingtile. Problems with fixed sales classes are avoided. These problems stem from class obsolescence and changing relevance across time, commodity specializations, and regions. Second, the equality of class interval in proportional terms allows exploration of the possible forms of mathematical functions which may exist for characterizing structural change (Koutsouyanis 1981).

Vingtiles work well as long as the sample size for each vingtile is large enough. We do not know the definition of 'large enough' and so opt for small cutoffs to obtain as much continuity as possible of data across all twenty vingtiles. Vingtiles for Canadian data were not distinguished when sample size is 15 or less. The corresponding minimum sample size for the U.S. FCRS data is 30 or less. This higher cutoff should offset the lower sampling fraction and higher aggregation weights in the U.S. data to reduce some of the apparently erratic behaviour of the data across the U.S. vingtiles.

The use of vingtiles works well for the WFDB but not so well for the FCRS. The variability in the graphs contained in Figures 1 through 4 illustrates the problem. The use of vingtiles may have pushed the FCRS beyond its design capabilities because all variability of the sample observations for each vingtile turns up as design noise in the vingtile estimates. Outliers are not exempted. Compression of the vingtiles into deciles would contribute some smoothing, but at the expense of information. We judge that evidence of patterns is present despite the apparent noise. Predictions are not intended, nor should they be attempted.

Estimating Source and Composition Structure

The source structure of earnings is reported directly in the FCRS and the income tax

component of the WFDB. Net farm income in the WFDB is unincorporated net farm income after depreciation as claimed for tax purposes. Direct agricultural subsidies (DAS) in Canada may be under-reported, often being combined with commodity receipts. Unlike the U.S. subsidies, the Canadian DAS typically includes premiums paid by farmers in current and previous years (Bollman 1989). Income from pluriactivity is off-farm income from employment and self employment. The Canadian WFDB provides data for the income of the operator and the spouse and dependent children, if present. 'Other income' and 'off-farm income' as well as 'farm income' may be under reported according to the activity of the household in the underground economy.

The composition structure is derived. The wage share of earnings is income attributed to work effort, excluding the contribution of intellectual property. Thus the wage share could be viewed as the return to the 'right to farm'. It is estimated at the level of basic needs defined by the national standards of the day in each country. In the United States, the wage share of earnings is the income required at the poverty line for food, clothing and housing. The Canadian definition is the slightly more generous 'Low Income Cutoff (LICO)' defined by Statistics Canada.

Both 'wage' definitions reflect family size. The standards for a three- person household are US \$10,860 and Cdn \$16,472, respectively. The amounts are neither adjusted for purchasing power nor for the exchange rate differential. No attempt is made to compare earnings structures using the same wage definitions. The two definitions simply represent minimum standards set by two different societies. These standards affect the relative competitive positions of U.S. and Canadian agriculture in each others' markets.

Capital returns are defined as a real rate of return of 3 percent on reproducible capital excluding buildings. The capital stock used for the calculation is the market value of machinery, equipment and tools, breeding stock, and quota value. This standard is an arbitrary long-term opportunity cost to capital, taking into account the relative immobility of these types of capital.

Economic rent is the residual of household income less wages and the return to capital. In this work, profits are lumped with rents. Economic rent is the return to real property, including land, buildings and breeding stock, and to intellectual property including experience, skills, talent and education, after accounting for business expenses, and the long-run return assigned to capital and labour. Economic rent includes the return from entitlements to degrade the ecosphere, to preferred tax status, to trade protection, and to income transfers from government.

The structural patterns and tendencies reported in this paper must be interpreted carefully. Some change is not structural. Some non-change may mask structural change. Much of the change is a feature of changing terms of trade. The sample size for the United States regions is not large enough to allow the nature of change over the three-year period to be understood completely, given the variance of household characteristics, especially for specialized households.

SOURCE STRUCTURE OF EARNINGS IN 1990-91

Earnings Source Structure for all Western Households

(Appendix A: Figure 1, Tables 1, 2, and 3)

Relative importance of market-based agricultural earnings: Market-based earnings for western Canada in 1990 are positive from the 10th vingtile on (median sales of \$108,000). The proportion is highest for households in the 18th vingtile (median sales of \$441,000) at 35 percent of earnings. This proportion is about half as high as the 72 percent in the 13th vingtile in the southwest United States for 1991. About 30 percent of the value of agricultural output in 1990-91 in the western half of the continent is produced at a loss by about 60 percent of Canadian and 85-90 percent of U.S. farms.

Role of pluriactivity: Pluriactivity in 1990 accounts for more than 30 percent of earnings for the 81 percent of western Canadian households which produce the first half, 10 vingtiles, of the output of the agricultural sector. The proportions of off-farm income in the northwest and southwest United States are greater than the Canadian proportions in the early vingtiles but decline sooner to nominal values by the 6th or 7th vingtiles. However the 1st through 7th vingtiles in the northwest and southwest United States account for 88 and 94 percent of all agricultural households compared to only 67 percent in western Canada. Pluriactivity is a pronounced feature of the source structure of earnings in the western United States and appears to be becoming that way in western Canada, especially in the first two thirds of the vingtiles. Eastern Canada is notably less dependent on household pluriactivity than is western Canada.

Fuller and Bollman (1992) using similar data bases to those we used for the late 1980s concluded that pluriactivity within agricultural households was more prevalent in Canada than in the United States. By matching their evidence based on the participation rates of spouses and operators in off-farm activity, with ours on earnings structure, we conclude

that pluriactivity in the United States seems to be associated with higher quality rural jobs than in Canada. Further work would be needed to determine whether job quality differences could be attributed to education and skill levels, permanency, length of part-time employment, the mix of government (e.g. defense) and private sector jobs, performance of labour markets, and metro influence.

Incidence of direct agricultural subsidies: The role in 1990 for direct agricultural subsidies in western Canada is particularly important for mid-sized family farms between the 6th and 15th vingtiles grossing between Cdn \$65,000 and 210,000, respectively. The proportion of direct subsidies ranges from 25-41 percent of earnings. This pattern is similar in 1991, at 27-49 percent, for the northwest United States where the same vingtiles correspond to US \$135,000 and 631,000 (14th vingtile) in gross sales, respectively. Direct agricultural subsidies in the southwest, range widely from 8-73 percent for these same vingtiles, corresponding to aggregate sales volumes of US \$159,000 and 1,457,000, respectively.

Other earnings and social safety nets: Other sources of earnings with a few vingtile exceptions are structurally more important in western Canada than in the western United States, ranging downward in Canada from 36 percent in the lower vingtiles to 18 percent in the upper vingtiles in 1990. Social safety net income in Canada accounted for an additional 13-3 percent of earnings declining relatively in higher vingtiles. Other earnings are equally important in the two U.S. regions up to the 8th vingtile ranging downward in the southwest United States from there to 4 percent in the 15th vingtile. In the northwest United States, other earnings decline steadily across the vingtiles from a high of 31 percent in the 2nd vingtile to 5 percent in the 20th vingtile. In the U.S. data, social safety net income is not identified separately.

Earnings Source Structure for All Eastern Households

(Appendix A: Figure 11 , Tables 4, 5, and 6)

Relative importance of market-based agricultural earnings: Eastern Canadian agricultural operations are about 30 percent larger than they are in western Canadian household economies in most vingtiles, as measured by median sales of agricultural commodities. The reverse is true in the U.S. regions. Agricultural sales are between 40 and 100 percent larger in the northwest United States and 40-240 percent larger as vingtiles increase in the southwest United States. Typical median sales for the 5th and 15/16th vingtiles are contained in Tables 1, 2, 3 and 4 for all regions.

Eastern agricultural households rely increasingly on commodity markets and direct agricultural subsidies as they become individually more important to each of the two national economies. Market-derived shares of household earnings become important at the 7th vingtile in both eastern Canada and the northeast United States, and at the 5th vingtile in the southeast United States. The proportion from these vingtiles on, runs at 30-58 percent of earnings in Canada, 46-66 percent in the northeast United States and 29-55 percent in the southeast United States.

Role of pluriactivity: Off-farm income is more important to eastern households at most vingtiles as one moves south. In all three regions the households in the first 4 vingtiles accounting for 57, 77 and 87 percent of the agricultural households from north to south respectively are dependent on off-farm income. The proportion of off-farm income in household earnings declines in all regions to 8, 8 and 4 percent, respectively, by the 19th vingtile. However, the proportion starts out in early vingtiles a full 10 percent higher in the two U.S. regions than in Canada.

Incidence of direct subsidies: Direct agricultural subsidies, excluding the income effects of supply management, assume the significant level of 17 percent of total household earnings at the fourth vingtile in eastern Canada. This proportion increases to a constant 28-30 percent for each of the subsequent 14 vingtiles which together account for 28 percent of the farms and 65 percent of the region's output. The importance of direct agricultural subsidies is also constant across most of the vingtiles in the eastern United States but at about half the Canadian proportions for the northeast and a third in the southeast.

Other income and social safety net income: Other household income for the higher vingtiles, including social safety net income, declines proportionally to 10 percent in the two U.S. regions from about 24 percent in the northeast and 33 percent in the southeast in the first vingtile. A similar pattern holds for eastern Canada, but leveling off at the higher share of 21 percent, down from 34 percent, of which social safety net income is 3 and 10 percent, respectively. It was not possible to distinguish social safety net income from other household income in the U.S. data.

North-South Issues in Source Structure

The more important an eastern agricultural household is to its regional economy, the less pluriactive it is. The principal south/north pattern in the source structure of earnings is the growing part-time nature of commercial agricultural households as one moves south. This

pattern of increasing pluriactivity is in spite of the much higher concentration of output in the south. The 80 percent of output in the southeast United States in the top 16 vingtiles is produced by 13 percent of the households, compared to 23 percent of northeastern United States and 43 percent of eastern Canadian households.

Direct agricultural subsidies account for a greater proportion of earnings south to north. Several hypotheses, untested here, could explain this south-north pattern. The first is that technological change originates in the south and becomes less appropriate as it moves north. Second, regionally defined standards for earnings are higher in the north, particularly as one crosses the border into Canada. Third, northern farmers are better lobbyists or predators on the national treasury. Fourth, agricultural households produce more public goods and services as one moves north, or the production of public amenities, such as healthy communities and preservation of the countryside, receives greater public recognition in the northeast United States and in Canada. And, fifth, the ecosphere is less suitable to agriculture and less yielding to the substitution of capital for land in the northeast United States and eastern Canada, as was observed for Alberta by Packer and Apedaile (1985).

COMPOSITION STRUCTURE OF EARNINGS IN 1990

Western Composition Structure for All Households

(Appendix A: Figure 3, Tables 1, 2, and 3)

Across all vingtiles the regional wage share of earnings in 1990-91 is highest for western Canada by a wide margin followed by the northwest and then the southwest United States. The Canadian wage share holds constant at a little over 50 percent of earnings for the 6th through 13th vingtiles. The proportion of earnings accounted for by the return to capital is highest in Canada reflecting higher levels of nonland capital in the inputs structure.

The proportions of rents are higher in the U.S. regions. The proportions of rents in Canadian earnings for 1990 are lowest for households generating between Cdn \$75,000 and \$156,000 in the 7th through 13th vingtiles. The proportions in these vingtiles range between 19 and 36 percent. The U.S. proportions for the same vingtiles in 1991 with some irregularities in the data, are much higher at 69 to 87 percent of earnings for the southwest United States and 65 to 73 percent, except 20 percent in the 8th vingtile, for the northwest United States. The composition structures of earnings in all western regions are essentially unchanged between 1987/88 and 1990/91.

Composition Structure for All Eastern Households

(Appendix A: Figure 4, Tables 4, 5 and 6)

The patterns of shares for the three types of earnings are similar across the three eastern regions from the 1st to the 20th vingtile. The share of wages declines. The share of capital earnings is an almost constant share while the share of economic rent increases. As in the West, economic rents are higher in the U.S. regions for all farms and vingtiles. In the southeast United States, economic rents are generally in excess of 50 percent of earnings from the 5th vingtile (households grossing US \$89,000) and over 90 percent from the 13th vingtile grossing US \$436,000.

In eastern Canada, the rent share is greater than 50 percent in the first three vingtiles, declines slightly to the 9th vingtile with gross sales of Cdn \$142,000, then increasing to the range of 50-74 percent for the balance of the vingtiles. The pattern in the northeast United States is like that in Canada with the lowest proportion of rent in the 3rd through 11th vingtiles. The 11th represents median aggregate sales of US \$198,000. However proportions of rents exceed those in eastern Canada in the upper vingtiles by 10-15 percent.

DIRECTIONS OF STRUCTURAL CHANGE ON THE WESTERN HALF OF THE CONTINENT

Up to this point attention has been focused upon static inter-regional comparisons of the source and composition structures in 1990/91. This snapshot provides useful evidence for regional differences but not of the direction of change. Now we attempt to compare regional dynamics by comparing evidence for 1987/88 with 1990/91.

This three-year period is generally accepted as being too short to draw predictive conclusions about structural change. The changes in values of structural parameters cannot be attributed with confidence to structural change alone for reasons outlined earlier. The source structure is especially vulnerable to non-structural 'noise' in the rural economy, to commodity prices, and to treasury outlays. The composition structure, in contrast, changes in a relatively measured way, as noted already in several places. In both cases, the direction of change does constitute useful evidence of ongoing harmonization or divergence of earnings structures, as the case may be. We consider comparisons of the magnitude of the change in composition structures to be more indicative of real structural change than are the source structures.

Two vingtiles are selected for a detailed examination of structural change. They mark arbitrary breaks along the scale of importance of households to the national economy. We first select the fifth vingtile. Households in this vingtile have in common across time and regions their contribution of the 20 through 25th percentile of agricultural output. These households together with smaller contributors to agricultural output in vingtiles 1-4 account for 25 percent of the agricultural output of their country and 60-90 percent of the households. We also select the 15th vingtile which marks those households in the 70-75th percentiles of output.

The choice of these two vingtiles for comparisons over time achieves several purposes. First, they could be considered to represent small and large farms, where the definitions of small and large are determined by the times and regions involved. Second, they are internal to the continuum of economic importance, avoiding extreme situations which could exist at each end. Third, they represent approximately the median structures of each half of the continuum. The blending of the 15th and 16th vingtiles is necessary in some cases because of sampling.

Western Structural Change at the 5th Vingtile (Table 1)

Agricultural households within the first few vingtiles correspond to Perry and Ahearn's (1992) definition of limited resource farms. The fifth vingtile could be viewed as beyond the limited resource category, on the boundary between sub-commercial and commercial agriculture.

The evidence here is that structural change is pervasive and simultaneous among agricultural households at all levels of importance to their regional economies (Tables 1 and 2). The result was not anticipated without a much longer period for observation. Quite the contrary. We were looking for signals of future structural change at the lower end of the distribution based upon structural change among the most commercial and industrialized upper-end households.

The first five vingtiles account for the large majority of households, 57, 82 and 90 percent in western Canada, the northwest and southwest United States, respectively. The number of agricultural households in the 5th vingtile is increasing in the U.S. regions (Table 1). Median area per household in this vingtile is only increasing in the northwest United States, rising 31 percent over the three-year period. In 1990-91, the median area in the western United States regions for this vingtile is double that in western Canada.

Table 1. Structural change in the 5th vingtile of gross agricultural sales representing the lower end of the distribution of size of farm operation, western Canada, northwest and southwest United States, 1987-8 through 1990-1.

Structural attribute	West Canada		Northwest U.S.		Southwest U.S.	
	1990 level	Change 1990-87 percent	1991 level	Change 1991-88 percent	1991 level	Change 1991-88 percent
Median agricultural sales (\$1000)	55	-5.2	113	+18.9	121	+17.5
Total earnings per household	30.2	-10.5	36.3	-12.7	35.7	-11.9
Net farm income per household	4.7	-2.0	19.8	+4.0	6.9	+2.0
Number of agricultural	8190	-1	8617	+3	11301	+4
Percent of all households	7		4		3	
Cumulative % households	57		82		90	
Cumulative % sales	25		25		25	
Cumulative % subsidies	29		44		45	
Land per farm (acres)	906	-2.3	1804	+30.8	1899	0
Earnings: absolute change						
Source structure						
Net market income (%)	-5	+21	12	-14	-11	-4
Pluriactive income (%)	46	+23	31	-2	54	++
Direct agricultural	21	-51	43	-2	30	-8
Composition structure						
Economic rent (%)	34	+15	61	-1	59	-7

Source: Statistics Canada (1987 and 1990). Whole Farm Data Base (WFDB). Unpublished taxation data. Excludes corporate farms, cooperatives and households which operate more than one farm, but includes all unincorporated partners associated with a single farm with gross agricultural sales over Cdn \$10,000.

Source: Statistics Canada (1986 and 1991). Agriculture and Population Linkage data base. Unpublished data for unincorporated single-operator farms classified into vingtiles determined from the WFDB.

Source: U.S. Department of Agriculture (1988 and 1991). Farm Costs and Returns Survey. Excludes corporate and cooperative farms but includes partnerships.

The changes in the source structure for the lower vingtiles for the U.S. regions are much smaller than in Canada. Pluriactivity in the Canadian regions seems to be playing catch-up to this feature of the U.S. source structure for earnings, already prominent in 1988.

Pluriactivity beyond the 5th vingtile in all regions declines as the capacity to produce agricultural commodities increases. These agricultural opportunities seem to be less associated with land than with agriculturally specific intellectual property for which there is limited off-farm demand.

The composition structure at the fifth vingtile appears to be stabilizing in the western United States regions with around 60 percent of earnings in the form of economic rents. In western Canada, economic rents are increasing rapidly from a very low share of 19 percent to a still low 34 percent. Thus labour returns continue to be the dominant component of earnings in western Canada, while returns to entitlements dominate in the United States. The slight reductions in rent shares in the United States may signify a turn-around in the composition structure associated with declines in direct agricultural subsidies. In Canada, the increase in rent share is associated with a significant increase in pluriactivity and market-based income.

Western Structural Change at the 15th and 16th Vingtiles (Table 2)

The numbers of households in these two vingtiles are thinning out much more rapidly in the United States than in Canada, as output capacity concentrates in the higher vingtiles. The 15th and 16th vingtiles in 1991 in the northwest United States have only an estimated 1,839 households remaining, down 45 percent from 3,371 in 1988. In the southwest, the number of households in the same vingtiles is only 1,656 in 1991, down from 2,039. The numbers in western Canada are an estimated 4,625 down only 11 percent from 5,170 in 1987.

Evidence from the 15th and 16th vingtiles demonstrates that households holding the same relative position within their regional industries can have markedly different structural characteristics. Median household sales in 1990-91 are Cdn \$232,000 in Canada, US \$1,010,000 in the northwest United States and US \$1,762,000 in the southwest United States. Net farm earnings per household including wages paid to family members are also dramatically lower in Canada at Cdn \$26,000, compared to US \$136,000 and US \$279,000 respectively. Median area per household for each region respectively in 1990-91 is much larger in the United States at 4,401 and 5,131 acres in the northwest and southwest, respectively, compared to 1,820 acres in Canada.

Table 2. Structural change in the average of the 15th and 16th vingtiles of gross agricultural sales representing the upper end of the distribution of size of farm operation, western Canada, northwest and southwest United States, 1987-88 through 1990-91.

Structural attribute	West Canada		Northwest U.S.		Southwest U.S.	
	1990 level	change 1990-87 percent	1991 level	change 1991-88 percent	1991 level	change 1991-88 percent
structural change in the average of the 15th and 16th vingtile accounting for 5 percent of agricultural sales						
median agricultural sales (\$1000)	232	10	1010	78	1762	33
total earnings per hshld (\$1000)	43		168		268	
net farm income per hshld (\$1000)	26		136		279	
number of agr households	4625	-11	1839	-45	1656	-19
percent of all hshlds	4	0	1	0.5	<0.5	
cumulative % hshlds	98		99		100	
cumulative % sales	77		81		78	
cumulative % subsidies	88		96		98	
land per farm (acres)	1820	14	4401	-16	5131	-12
earnings; absolute change						
source structure						
net market income (%)	28	57	58	1	76	32
pluriactive income (%)	12	2	12	6	12	-8
direct agr subsidy (%)	35	-68	23	4	8	-15
composition structure						
economic rent (%)	46	4	84	-4	90	4

These vingtiles are used together because of some data gaps for the US regions. The numbers are medians for this decile.

Source: Author, 1987 and 1990. Whole Farm Data Base (WFDB), Statistics Canada. Unpublished taxation data. Excludes corporate farms, cooperatives and households which operate more than one farm, but includes all unincorporated partners associated with a single farm with gross agricultural sales over Cdn \$10,000.

Source: Author, 1986 and 1991. Agriculture and Population Linkage data base, Statistics Canada. Unpublished data for unincorporated single-operator farms classified into vingtiles determined from the WFDB.

Source: Author, 1988 and 1991. Farm cost and Returns Survey. United States Department of Agriculture, Washington. Excludes corporate and cooperative farms but includes partnerships.

The production shares classification seems to have produced evidence of an unusually rapid shift in the farm size distribution in the United States compared to Canada. Individual U.S. households in the 76 through 80 percentiles of sales have much higher sales capacity than just two years previously. For example in the northwest United States, median household sales were US \$1,010,000 in 1991 up from US \$567,000 in 1988. In western Canada, this concentration process is stagnant by comparison, with sales capacity up only \$21,000 to Cdn \$232,000 from 211,000 in 1987. These differences in the shifts may be interpreted as evidence of differential rates of concentration. We have not investigated ways in which the sampling structures of the two data bases may also be reflected in this result.

Pluriactivity in all three regions, in these vingtiles accounted for 12 percent of earnings in 1990-91, up in western Canada from 10 percent in 1988, up from 6 percent in the northwest United States, and down from 19 percent in the southwest. It would seem that pluriactivity in these vingtiles may be at an earlier stage of development in western Canada than in the United States.

In contrast to the rapid change in source structure, the composition structure at the 15th and 16th vingtiles remains relatively stable in the all western regions. Economic rents account for 90 percent of earnings in the southwest United States up slightly from 86 percent in 1988. Rents in the northwest declined slightly to 84 percent. These high proportions indicate heavy reliance upon property rights and entitlements. When changes in the source structure are considered, the evidence suggests that the mix of entitlements may be shifting to entitlements associated with stronger predatory power in markets, such as would be obtained through contractual alliances. Direct subsidies linked to real property seem relatively more important in Canada.

DIRECTIONS OF STRUCTURAL CHANGE FOR ALL EASTERN HOUSEHOLDS

Eastern Structural Change at the 5th Vingtile (Table 3)

The fifth vingtile of agricultural households in the eastern half of the continent represents the smaller commercial farms. They appear remarkably similar in all three regions. Median sales in 1990-91 are \$85,000 in Canada, \$82,000 in the northeast United States, and \$89,000 in the southeast. Median area per household for each region respectively in 1990-91 are also similar at 239, 362 and 338 acres. Total earnings per household are \$36,000, \$27,600 and \$39,000, respectively.

Table 3. Structural change in the 5th vingtile of gross agricultural sales representing the lower end of the distribution of size of farm operation, eastern Canada, northeast and southeast United States, 1987-88 through 1990-91.

Structural attribute	East Canada		Northeast U.S.		Southeast U.S.	
	1990 level	change 1990-87 percent	1991 level	change 1991-88 percent	1991 level	change 1991-88 percent
median agricultural sales (\$1000)	85		82		89	
total earnings per hshld (\$1000)	36		28		39	
net farm income per hshld (\$1000)	13		10		14	
number of agr households	3860	-20	27130	-4	9911	-13
percent of all hshlds	5		4		3	
cumulative % hshlds	62	-1	81	3	90	
cumulative % sales	23	-2	27	-1	28	
cumulative % subsidies	27	-4	40	9	26	11
land per farm (acres)	239	-11	362	3	338	-4
earnings; absolute change						
source structure						
net market income (%)	16	-8	26	18	31	1
pluriactive income (%)	34	12	51	7	49	-2
direct agr subsidy (%)	20	-13	9	-28	5	-2
composition structure						
economic rent (%)	46	28	52	3	67	11

Source: Author. 1987 and 1990. Whole Farm Data Base (WFDB), Statistics Canada. Unpublished taxation data. Excludes corporate farms, cooperatives and households which operate more than one farm, but includes all unincorporated partners associated with a single farm with gross agricultural sales over Cdn \$10,000.

Source: Author, 1986 and 1991. Agriculture and Population Linkage data base, Statistics Canada. Unpublished data for unincorporated single-operator farms classified into vingtiles determined from the WFDB.

Source: Author, 1988 and 1991. Farm cost and Returns Survey. United States Department of Agriculture, Washington. Excludes corporate and cooperative farms but includes partnerships.

Structural change in the sources of earnings is most active in the northeast United States. The share of direct agricultural subsidies is down 28 points to 9 percent approaching the 5 percent level of the southeast United States. In Canada, the share is down 13 points to 20 percent. The share of market derived income is up 18 points to 26 percent in the northeast United States, again approaching the level of 31 percent in the southeast, unchanged over the 1988-90 period. Income from pluriactivity passed the 50 percent mark in the northeast surpassing the 49 percent share in the southeast which experienced a reduction of 2 points over the three-year period. The share of off-farm income is 34 percent in Canada, up 12 points.

The composition structure follows the pattern of change in the west and in the higher eastern vingtiles. Economic rents in all regions are increasing even though they are 20-30 points lower as a share of earnings than for the 15th vingtile. The fastest rate of increase was 28 points to 46 percent in eastern Canada followed by the southeast United States, up 11 points to 67 percent. The rent share of earnings in the northeast United States was relatively unchanged between 1988 and 1991 at 49-52 percent.

These changes should be put into context. Agricultural activities account for less than a third of household earnings in this vingtile in all eastern regions. Nevertheless, these households account for nearly the same proportion of households, 3-4 percent, as they do of regional agricultural sales, south to north, respectively. The cumulative percentage of households up to and including the fifth vingtile are 90 percent, 81 percent and 62 percent south to north.

Eastern Structural Change at the 15th Vingtile (Table 4)

The higher vingtiles of the northeast United States are also undergoing a period of rapid restructuring of earnings. The change reflects the characteristics of the farms which occupy these vingtiles in the two periods. Farms which retained the same vingtile status have changed their operations during that period. The proportion of net farm income in household earnings is up to 43 percent from only 1 percent in 1988. This increase compares to a decrease of 9 percent in the southeast United States and an increase of 2 percent in eastern Canada. Pluriactivity in the northeast United States is up by 19 percentage points compared to 14 percent in the southeast and a decrease of 1 percent in Canada. Direct agricultural subsidies in the northeast have diminished markedly to 20 percent of earnings in 1991 from 77 percent in 1988. These numeric changes signal the presence of active structural change in the northeast United States, observed earlier for lower vingtiles. We caution again that the numbers do not enable prediction because past history of behaviour of complex systems, like these, does not determine the future.

Table 4. Structural change in the 15th vingtile of gross agricultural sales representing the upper end of the distribution of size of farm operation, eastern Canada, northeast and southeast United States, 1987-88 through 1990-91.

Structural attribute	East Canada		Northeast U.S.		Southeast U.S.	
	1990 level	change 1990-87 percent	1991 level	change 1991-88 percent	1991 level	change 1991-88 percent
median agricultural sales (\$1000)	267		379		545	
total earnings per hshld (\$1000)	54		66		122	
net farm income per hshld (\$1000)	36		42		85	
number of agr households	1420	-4	5930	-15	1620	-1.4
percent of all hshlds	2		1		<.05	
cumulative % hshlds	94		98		99	
cumulative % sales	71		78		80	
cumulative % subsidies	83		89		80	
land per farm (acres)	370	-6	1014	15	1635	27
earnings; absolute change						
source structure						
net market income (%)	39	2	43	42	50	-9
pluriactive income (%)	12	-1	30	19	24	14
direct agr subsidy (%)	28	-9	20	-57	19	-9
composition structure						
economic rent (%)	61	8	69	13	86	1

Source: Author. 1987 and 1990. Whole Farm Data Base (WFDB), Statistics Canada. Unpublished taxation data. Excludes corporate farms, cooperatives and households which operate more than one farm, but includes all unincorporated partners associated with a single farm with gross agricultural sales over Cdn \$10,000.

Source: Author, 1986 and 1991. Agriculture and Population Linkage data base, Statistics Canada. Unpublished data for unincorporated single-operator farms classified into vingtiles determined from the WFDB.

Source: Author, 1988 and 1991. Farm cost and Returns Survey. United States Department of Agriculture, Washington. Excludes corporate and cooperative farms but includes partnerships.

In contrast to the northeastern United States, eastern Canada is experiencing nearly no structural change in the source of earnings. We think this means that the composition of the farms in this vingtile is relatively unchanged compared to the northeast United States. However, there is evidence that the restructuring in Canada is taking place in the inputs as opposed to the earnings structure. All three regions experience a similar 30-percent decline in their debt/equity ratios at the 15th vingtile. This vingtile in Canada, with substantially higher capital labour and capital output ratios in 1987-88, records declines of 53 percent and nearly 42 percent in these ratios by 1990 respectively (Apedaile et al 1994). Eastern Canada also has the lowest proportion of market-based income and pluriactive income, and the highest proportion of direct agricultural subsidies in household earnings of all three eastern regions.

The pattern of change in the composition structure in the upper vingtiles appears to be stable in the east half of the continent. The proportions of economic rent in the composition structure are greater than 60 percent in all regions and are continuing to increase, especially in the northeast United States. The share of rents is highest in the southeast United States 86 percent in 1991. The rent share in the northeast increased the most to 69 percent, a level comparable to that in eastern Canada. Rents are highest and still increasing in the southern United States and wage shares are highest and decreasing the least in the north. This change pattern and its stability in the composition structure for the east is similar to the pattern in the west half of the continent.

HOUSEHOLDS SPECIALIZED IN GRAINS AND OILSEEDS

(Appendix A: Tables 7-12)

Overall grain perspective

Grain households in all three regions obtain a higher proportion of direct agricultural subsidies than the average share for all households. Both Canadian and Northwest households have higher than average shares of off-farm earnings. Grain specialized households in all regions have substantially lower proportions of economic rents than the all-household averages. Western Canadian and Northwest grain specialized households at the beginning of the fourth quartile of agricultural sales experience greater income problems than do agricultural households in general from that quartile onwards.

Source structure for grain households

Households specialized in grain enterprises are heavily reliant on non-farm sources of

income. In the East in 1990, market based income for all households becomes part of the source structure from the 7th vingtile on in the Northeast and the 14th in eastern Canada. The share of market-based income for grain households gradually becomes more prominent in higher vingtiles, attaining 69% in the 18th for the Northeast. In Canada, the shares are smaller clustering around 20%. These shares are all much lower than for all households in all regions of the eastern half of the continent. Evidence for the Southeast is too fragmented to reveal a pattern.

Grain specialized households are into more pluriactivity across all vingtiles than are all households in eastern Canada and the Northeast. In western Canada, pluriactivity is more important as a source of earnings as grain households increase their aggregate agricultural sales from the 4th vingtile on. The share of off-farm earnings for grain households is also higher than for all households in all vingtiles. In the Northwest, the patterns of shares for off-farm earnings are similar for grain and all households. Shares of pluriactive income are higher in the Southwest in the lower vingtiles for all households than for grain households. There are insufficient observations for the higher vingtiles.

Direct agricultural subsidies are more important for grain households than the average household in most vingtiles. The share of DAS peaks in the 12th vingtile (US \$198,000 sales volume) at 36% in Northeast grain households and in the 11th (also US \$198,000 of sales) at 26% for all households. In eastern Canada, DAS increases sharply to peak in the last two vingtiles at 61% compared to all households at 35%. In general the share of DAS is higher for grain specialized households than for all households from the 13th vingtile on in eastern Canada. In the Northeast, grain households are more heavily subsidized across all vingtiles than are all households. The subsidies complement the pluriactivity to subsidize grain production.

The evidence for grain households in the Southwest is sporadic but does also suggest higher shares of DAS than for all households. Grain households receive slightly higher DAS than do all households. The proportion of DAS in the Northwest reaches 71% by the 3rd vingtile (US \$66,000 of gross sales) and holds those levels through to the highest vingtile. The proportion for all households attains only 33% in this 3rd vingtile remaining in the 30s for the rest of the vingtiles.

Other income in the Northeast for grain households is generally less important than for all households in 1990, ranging downward to 2% in the last vingtile from 23% in the first. The pattern of decrease is much less marked in eastern Canada ranging down to 20% in the 19th vingtile from 26% in the 1st, hitting a high of 39% in the 8th. In Canada, social safety net income accounts for another 2 to 9% of total earnings in the lower vingtiles.

The share pattern for the other income is comparable to those for all households in each region.

Composition structure for grain households

One feature of the comparison of composition structure stands out. Western Canadian grain households have negligible economic rents, and much higher capital and labour shares in their earnings structures than for the US regions. These remarkable differences can be expected to contribute to trade stress and even interruption of harmonization processes in the future.

Economic rents for grain specialized households are near zero or negative in Western Canada over all vintiles. With these low rents, subsidy levels and design in Western Canada would not be expected to contribute to land values and may even be allowing devaluation. Recall that these subsidies account for between 20 and 47% of earnings in the upper fifteen vintiles in Canada.

In the United States, subsidies for Northwest households specialized in grain account for between 57 and 80% of earnings. The proportions for the Southwest are 43-83% for the same fifteen vintiles. These higher proportions correspond to rent shares in the Northwest of 48-80%, and in the Southwest, 45-87%.

Compared to all households, grain specialized households have lower proportions of economic rent. In Western Canada, the lower proportion is offset by shares of capital returns about four times those for all households. In the Northwest, the offset is higher wage shares, four times higher in the upper vintiles. Only in the Southwest are the composition structures for grain and all households virtually the same across all vintiles.

In the United States, proportions of economic rents are increasing while in western Canada, they are diminishing. Wage shares are diminishing in the United States regions and increasing in Canada. The changes are most pronounced in the lower vintiles of the Southwest and the highest vintiles of the Canadian west. The shares of capital returns increased dramatically in Canada while remaining the same in the US regions.

Driving forces on grains structure

The structural forces driving earnings structures for grain specialized households are reported for the three western regions. Those who wish to examine the structures of earnings for the eastern half of the continent may consult the spreadsheets contained in Appendix A: Tables 10, 11, & 12.

It appears that pluriactivity and direct subsidies play different roles in the earnings structures related to the inputs structures, especially in western Canada. The inputs structure for grain production in Canada suggests that the reason for near total dependence of grain farmers in Canada on off-farm work and direct subsidies for household income may lie with capital/labour/land substitution.

The capital output ratios of Cdn \$4.69-4.10 represented by the 10th and 15th vingtiles for grain specialized farming in western Canada are much higher than the corresponding ratios for grain households in the United States. These are respectively much lower being around US \$1.00 in the Northwest and still lower in the Southwest at \$1.00-0.87.

Western Canadian grain farmers appear to be using mechanical capital to substitute for shorter windows of opportunity for field work in the spring and fall and to release labour for off-farm work. Markedly higher capital/land, capital/labour and capital/output ratios in western Canada relative to all households in western Canada and to grain households in the two US regions match their northern geography, and higher shares of off-farm income in the source structure of earnings.

Subsidies in the US regions, especially the Southwest, cannot be disassociated from the high shares of rents in earnings of grain specialized households. Closer alignment of grain prices with world prices for US grain farmers would likely change their composition structure of earnings dramatically by reducing the rent share. In Canada, reduction of direct agricultural subsidies, other things equal, would disrupt debt servicing for capital equipment and reduce sales of machinery. Pluriactivity would become more essential to attain the LICO standard for the Canadian household incomes.

Harmonization issues for grain

The major question for harmonization raised by the earnings structure is how the nonagricultural rural economy would fare under freer trade. Pluriactivity is a major feature of income stabilization in the western regions. The second question is where to pinpoint

expected resistance to harmonization. We argue that households with earnings structures reliant on entitlements are most likely to oppose trade liberalization.

Western Canadian households in 1990 received more than 50% of their earnings from pluriactivity. Pluriactivity has been growing rapidly on the prairies. The agricultural household earning structure in the whole west half of the continent relies on off-farm jobs. Consequently the east west distribution of nonagricultural economic growth under liberalized trade, from the Atlantic to the Pacific coast, may be more important for western grain and oilseed specialized households than North South shifts in off-farm opportunities prompted by the NAFTA.

Disharmonies in the inputs structures across vingtiles are unlikely to be ironed out by trade protocols. The south to north gradient in agroclimatic conditions for grain production may be steep enough to explain the sharp differences in capital/labour and capital/land and capital/output ratios for all vingtiles between the Northwest and Western Canada. Frost free days are fewer and work windows shorter in the spring and fall from south to north. Similar structural effects of this gradient were discovered within Alberta for 1971 and 1981 (Packer and Apedaile, 1987).

However, differences in the design of farm support programs may also influence the process of substitution of capital for labour in each country. Border measures could be filtering and delaying access to capital saving technology, particularly in Canada from the United States. Disharmony of safety and health regulations, testing procedures, and property rights could introduce substantial lags in technologically-induced productivity by interfering with complementarities among biotechnology, information technology and mechanical technology in Canada.

The South to North pattern in input structure for grain households underlies the regional differences in the composition structure of earnings and therefore the ability to adjust to freer trade at the household level. The high proportions of economic rents for the composition structure of earnings for grain specialized households in the western US regions give these households an advantage under trade liberalization with Canada. Economic rents are the means of financing risk and surviving reductions in agricultural support programs.

On the basis of the differences in input structure, stand-alone grain farming in western Canada could not be sustained for most situations in any vingtile in the absence of subsidies with low market based margins and average rates of growth of the rural nonfarm

economy.

The US grain households face their own vulnerabilities from trade harmonization. Reductions in direct subsidies and other policy entitlements would immediately lower economic rents which are the most important feature in the composition of earnings of US grain households. Lower subsidies could not likely be offset by new opportunities for quality wage employment to maintain earnings. Thus substantial devaluation of assets such as land could accompany loss of entitlements to subsidies under harmonization.

The reactions in Canada and the United States to policy harmonization involving fewer privileged entitlements for grain could be quite different. Threats to the rent dominated earnings structure in the US could be expected to be met by militant political action of the type that curbed Canadian grain exports to the US in 1994. This action could slow or even derail harmonization processes.

In Canada, on the other hand, a threat to the wage dominated earnings structure for grain households could be expected to be met with divisive competition between labour and entrepreneur ideologies. The western Canadian earnings structure is supported by single desk selling, price pooling, ad hoc bailouts and export subsidies for transportation. The divisiveness would be most likely between groups of households in the upper and lower vingtiles and between eastern and western farmers. Conflicting signals to politicians from farmers have long been characteristic of the Canadian agricultural political scene, leading to protracted consensus-building processes unsuited to trade harmonization.

These observations on harmonization are intuitive. They are based on distinguishing between the political behaviour of systems with wage dominated and rent dominated earnings structures. The policies to be harmonized are in co-evolution with these earnings structures and the inputs structures which lie behind them. Research is needed to understand this process of co-evolution, to be able to determine a suitable pace and strategy for trade liberalization in grains and the grains related economy.

The reader is referred to the sections on comparative and competitive advantage to identify the kinds of grain households most likely to benefit or lose from harmonization.

HOUSEHOLDS SPECIALIZED IN BEEF

(Appendix A: Tables 13-18)

Overall beef perspective

Cow-calf specializations, hereafter called beef households, include all forms of beef operations, except specialized feedlots. Beef animals tend to be raised on land with low opportunity costs in terms of other agricultural use. Beef operations are found in all regions of North America. Cow-calf herds are often supplementary to other household activities under so-called marginal agricultural conditions, and often are used as tax loss offsets to other earnings. The earnings structure reported here is for agricultural households for which beef accounts for more than 50% of reported sales from agricultural activities.

Beef households in eastern and western North America account for similar proportions of all agricultural households. In Canada in 1990 beef households account for about a quarter of all households in the early vintiles diminishing to about a sixth in higher vintiles. The proportion is between a half and a third in the Northern United States and 60 to 70 percent in the South. Bear in mind that these proportions are approximate because of the data limitations described earlier in this report.

The specialized beef households in the West in 1990 have sales less than the all-household median across all vintiles. By the 11th vintile in the Southwest, beef households are up to half the sales volume of the all household average in that vintile. In the East, Canadian beef households have lower median sales in each vintile up to the 10th, when the volume of sales becomes larger than that for all households. This pattern is very different for the Northeast where beef households have about one third the sales of the average farm in each vintile, with the difference widening steadily to the 20th vintile. The pattern for the Southwest is much stronger still with beef households having a third to a sixth of the sales.

The same structural patterns for land holdings by specialized beef households applies on the eastern half of the continent. The exceptions, applying to all three eastern regions are that the beef operations use a half to one third the land used by average western specialized beef operations in all vintiles and the lower vintiles account for a larger proportion of all land used in beef production than in the west.

Source structure for beef households

The source structure in all regions of North America is marked by the lack of market based income in 1990. What market based earnings there are, show up in some of the higher vintiles in Eastern Canada mainly. Subsidies increase as a proportion of earnings in higher vintiles but at lower shares of earnings in 1990 especially in the East. In the West subsidies run at about half the proportion of direct subsidies in total household earnings for all households.

Pluriactivity is very much more associated with beef households than with all households, especially in the first vintiles in Canada. In 1990, for western Canada, off-farm earnings did not drop below 30% of beef household earnings until the 17th vintile for beef households compared to the 10th vintile for all households. The pluriactive distinctiveness of the pattern for beef households is even stronger in Eastern Canada. The comparable vintiles for the Northwest and Southwest are about the 5th for both beef and all households. Beef households are less pluriactive than all households for the Northeast and Southeast.

In Western Canada the proportion of other earnings for beef households is higher than for all households running at from 27% in the second vintile to 45% in the 18th. The corresponding proportions for all households are 32 and 29% respectively. The patterns for beef and all households in the Northwest decline to about 7% in higher vintiles from 30% in the second vintile. The proportion of other earnings declines faster for higher vintiles for beef households than for all households in the Southwest in 1990.

Composition structure for beef households

The three features of the composition structure which stand out are; 1) the relatively lower rents for Canadian beef households relative to all Canadian households East and West; 2) the substantially higher share for capital returns in Canada; and 3) the relatively much higher rents for United States beef households relative to Canadian beef households.

The share of earnings attributable to capital returns in Canada has more than doubled between 1987 and 1990, escalating particularly in higher vintiles. The shares have remained the same in the United States. Recall that absolute capital returns reflect directly the reported value of capital assets including breeding stock. An analysis of the breakdown of this capital to examine the importance of breeding stock could shed light on the possibility that the value of dairy herds in Eastern Canada, supported by supply management, has influenced eastern Canadian capital values. Part or all of the large

change could be due to technical aspects of splicing census and taxfiler data.

The main feature of the composition structure is the prominence of economic rents for US earnings for all vingtiles. For comparison's sake, note that the 1990 economic rents in beef specialized households in western Canada peak at 37% in the 3rd vingtile declining to negative proportions by the 15th. In eastern Canada they peak at 64% in the 2nd becoming negative in the 12th and 14th before increasing again to 57% by the 19th vingtile.

By contrast in the Southwest, 1990 proportions peak at 81% in the 4th vingtile and fluctuate to a low of 25%. The proportions in the Northwest range to 90% from 16%. The proportions of rents are all over 50% for the Southeast and for the first 6 vingtiles in the Northeast. The common feature of the pattern of rents in all regions is the relative weakness in the mid range of vingtiles.

The relatively high rents in the United States suggest that US beef households may be more successful predators than Canadian beef households. The difference may also be related to the relatively higher indebtedness of Canadian beef producers, tax policy, the tendency for Canadian beef and dairy policy to lead to capitalizing the value of stability into the price of breeding stock, the investment focus of beef farming in Canada, and the focus on the amenity value of cattle in the United States. There may also be a difference in the behaviour of cattle markets capitalizing expected rents into the value of breeding stock in Canada, while capturing rents for downstream food processors in the United States.

Driving structural forces for beef households

Evidence seems to indicate that larger beef operations are less industrialized, more extensive than smaller ones. The evidence could also be explained by different types of herds, more purebred cattle at the lower vingtiles and commercial crossbred herds in ranching formats at higher vingtiles. The cost structures for larger cow-calf enterprises suggest diminishing flexibility with size in their use of production capacity especially in western Canada.

In 1990 beef production is a constant cost industry. The structure remains constant cost in the Northwest and constant cost from about the fourth vingtile on in the Southwest. The cost structure in western Canada is almost in line with the US regions and technological change may be expected to make it more and more like a constant cost

industry. The consequence for market based income is increasing instability because of the vanishing supply curve.

Net margins are negative, with few exceptions, for all vingtiles in the Northwest and Southwest. Without direct agricultural subsidies they are even more negative. Note that net margins include depreciation. In western Canada, net margins are positive from the 6th vingtile onward in 1990. These higher margins in Canada do not translate into higher proportions of rent in the composition structure. Clearly, their incidence is elsewhere in the economy. A study of the upstream and downstream income flows and markets would be necessary to understand this apparent contradiction.

Harmonization issues

The north south patterns reveal a strong basis for protectionist behaviour for cow-calf enterprises in the south west US. The DAS accounts for over 50% of earnings from the 5th vingtile on. There appears to be no market basis for the beef specialized households in the Southwest US, with large negative net farm incomes for all except the 20th vingtile. The whole western beef industry from south to north in the west is reliant on off-farm and other nonfarm income. Problems with the reporting of income from cattle may help explain the apparant absence of market income. Predator prey relationships between cow-calf operation and feedlot and perhaps between processor and feedlot, may also be a factor.

Trade harmonization relative to cow-calf specialized households would seem to lie with downstream market structures and meat processing. On the upstream side, persistent low economic returns may be interfering with investment in beef production technology and ecosphere management technology. The low to negative returns make the earnings structure of beef specialized households particularly sensitive to land and water use regulation and water pollution legislation.

The contradiction between net margins and economic rents in the three regions raises interesting questions. Clearly the rents so prominent in the Southwest are not derived from negative net margins. Similarly the positive net margins for Canadian beef enterprises are not associated with their relatively weaker economic rents. It would appear rather that beef enterprises provide access to other property rights to which the rents are attached. These property rights cannot include access to direct agricultural subsidies because net margins are still negative after subsidies in the US. The answer must lie in the relationship of other income and pluriactivity, to subsidies, and tax priviledges. The performance of cattle markets as they attribute rents to assets ranging from beef cows to retail space in the

beef chain, could be also a part of the explanation.

The reader is referred to the sections on comparative and competitive advantage to identify the vintiles of cow-calf households most likely to benefit or lose from harmonization.

Integration of Canada/United States markets

Caveat

The following treatment of comparative and competitive advantage is an exploratory attempt to use earnings structure to learn about vulnerabilities and opportunities from harmonizing domestic policies to promote trade and economic efficiency. The measures used below are approximations at best. They do conform to fundamental neoclassical concepts. However, the price weights implicit in the agricultural sales data introduce the effects of price policies and market imperfections. The assumption of perfectly competitive markets does not hold.

The second caveat is the interpretation of transactions costs. They are far from zero. Therefore the net margins used to calculate competitive advantage cannot be considered to be landed margins. There is no way to tell in this analysis whether the calculated advantage is enough to cover transactions costs. The problem is somewhat addressed by assuming symmetrical transactions costs across regional boundaries. However the assumption does not solve the problem of whether the size of the costs would preclude trade for any given competitive advantage.

The following sections should be viewed as a trial effort to glean information about the likely effects of trade and domestic policy harmonization on regional and commodity interests. The results must be interpreted with care.

Comparative versus competitive advantage

The gains and losses from harmonizing trade rules are usually attributed to comparative advantage. The problem with comparative advantage is that it does not alone explain market shares, nor does it apply to strategic trade or in the presence of market imperfections, especially in markets for transactions services.

Competitive advantage on the other hand takes into account all market distortions, and

mercantilism in international relations. Competitive advantage directly affects market shares and therefore the volume of trade. One way to view competitive advantage is as contrived or 'managed' comparative advantage.

In this section of the paper, we elaborate on these two concepts and use structural variables to estimate measures. These estimates are applied to the trade of grain and cattle between the United States and Canada, and between eastern and western Canada.

Comparative advantage is the outcome of efficiency seeking behaviour. Comparative advantage for a particular commodity is realized when the fixed resources dedicated to that commodity incur the least opportunity cost relative to all other uses. Application of this principle by itself presumes symmetry of transactions costs in each trading jurisdiction. Transactions costs must be low enough to enable a positive net margin for the exporter.

In this study land is the fixed factor. The premise is that staying on the farm is a first choice for agricultural households and policy-makers.

Two aspects of comparative advantage affect predictions for the structural effects of market harmonization across national boundaries. The first is the current structure of comparative advantage across farm size. The second is comparative advantage conferred by earnings structures. The first provides insight to which agricultural households could be hurt most by liberalized trade and which are already positioned by virtue of a comparative advantage in agricultural activities to prosper as the border becomes less important. The second is more complex, suggesting that the structure of earnings of agricultural households specialized in a particular commodity influences the position of households for growth in output and sustaining market share for their specialized agricultural commodity in another jurisdiction.

Commodity-specific policies within jurisdictions, including those affecting transactions costs such as freight rates, influence comparative advantage more than do economy-wide macroeconomic policies such as monetary policy. Domestic agricultural policy targeted to earnings and inputs structures influence the impact of the freer play of comparative advantage as trade liberalizes. Differences in purchasing power of earnings within the two jurisdictions would not affect the estimate or operation of comparative advantage.

Comparative advantage is calculated for only two specializations, grain and cattle. The ratios of the output land ratios for each commodity are compared. The measure of

comparative advantage is approximate in that output includes sales of all commodities, not just the specialized commodity. Only the US regions adjacent to the international border are considered.

We anticipate that a region with the larger volume of agricultural sales generated by vingtiles holding a comparative advantage in a commodity is in a better position relative to the other region to expand output under freer trade. Similarly, vingtiles at a comparative disadvantage on either side of the border could be hurt and could be expected to lobby for protective or compensatory policies. These policies reduce the influence of comparative advantage, or pure efficiency, on the outcomes of playing field levelling agreements.

A comparative advantage or disadvantage may be overridden by policy entitlements or modifications of other property rights enabling households to ignore opportunity costs. Cross-subsidization within pluriactive agricultural households, as with the larger economy, may have the same effect. It is also possible for households to run a deficit on a specialized agricultural enterprise at the farm gate and still hold a comparative advantage in that commodity because of transactions costs, an historic justification for transportation subsidies. Alternatively, the social value of untraded and untradable public amenities such as food security or territorial management coincident with the output of commodities can lead to policies which over-ride the force of comparative advantage in expanding trade.

Competitive advantage

Competitive advantage/disadvantage is the outcome of policies, alliances and uncompetitive market behaviour leading to inefficiency or impure efficiency. Competitive advantage is the composite outcome of all policies, business alliances and market conditions, including transactions costs, which enable a commodity landed in another trade jurisdiction to contribute to economic rent in the place of origin.

Competitive advantage is particularly sensitive to strategic alliances built to enhance predatory gain through competitive win/lose behaviour. The idea is to reconfigure the nature and level of mutualism between domestic and foreign suppliers. This behaviour often heavily discounts future global interests in present trade outcomes. Competitive advantage may exist or be created in the short run when comparative advantage doesn't justify market penetration.

Competitive advantage is measured in this study as the ratio of the net margin per unit of

land in adjacent regions. A second measure is also calculated without the DAS to test the sensitivity of the competitive advantage to removal of direct subsidies. North/south comparisons are made for the two regions adjacent to the Canada US border, and east west within Canada. The ratios may be interpreted as reflecting landed costs by assuming symmetrical transactions costs. This measure of competitive advantage ignores exchange rates which enhance or reverse a competitive advantage, and the composite nature of the two commodity mixes in each country reflected in the measures of gross margin. Protective trade measures such as tariffs and NTBs are targeted to ward off competitive advantage held by trading partners, almost any part of which may be termed 'unfair'.

Structure of earnings has only an indirect effect on competitive advantage through the effect on the ability of agricultural households to learn about productive technology, have knowledge of where efficiency lies and to undertake the risks of market development in another foreign jurisdiction. More concentrated production structures and higher proportions of rents in the composition of earnings enable more aggressive alliance building and greater resistance to rivalry. Harmonization of earnings structures would tend to reduce the scope for, and size of competitive advantage over time.

Measuring and interpreting trade advantage

Comparative advantage is calculated as the opportunity cost of specializing in beef relative to grain. The opportunity cost of specializing in beef is the value of agricultural sales by grain specialized farms, less direct agricultural subsidies, foregone per dollar of agricultural sales less DAS earned by beef specialized farms. The measure is corrupted by the inclusion of non-grain and non-beef sales in the data. Cautious interpretation is also required in consideration that land and human skills cannot be switched or require significant cost to switch between grain and beef.

The comparative advantage is calculated within each potential trading region, then compared pairwise between regions for each vingtile. When the comparative advantage is in different specializations for each region, trade potential is indicated. When each region has a comparative advantage in the same specialization, then those vingtiles with the greatest advantage would be least vulnerable to harmonization and trade might take place depending on whether the competitive advantage reinforces the comparative advantage.

Recall that the main purpose of examining these approximations of comparative and competitive advantage is to determine which specializations, regions and vingtiles may be positioned to benefit or be harmed from trade liberalization. The interpretation thus

combines the two measures of advantage.

We conclude unambiguous strength for a specialization in a region when the two measures coincide in that the specialization holds a comparative advantage and the region holds a competitive advantage. The reverse holds. Vingtiles for specializations in a region with both comparative and competitive disadvantage face difficulty with policy harmonization.

Vingtiles with mixed signals of comparative disadvantage and competitive advantage are particularly vulnerable. Efficiency is probably being impeded by special entitlements granted by governments either by commission or omission.

Vingtiles with comparative advantage but competitive disadvantage could benefit from levelling the playing field. In this case the problem is a lack of appropriate entitlements or presence of barriers to trade. High transactions costs could be a problem.

Instances where ratios are near one or unstable around one from vingtile to vingtile, signify several things. First, the results are inconclusive. Second trade advantage is transitory, shifting from year to year. When conditions, such as phytosanitary regulations, environmental standards, interest rates, market structures, political parties change from those in 1990, trade advantage could be expected to change too. Third, trade potential is sensitive to exchange rates. Fourth, trade opportunities from harmonization could be sensitive to asymmetry of transactions costs.

The comparative advantage measures are reported in Appendix A:Table 20. Competitive advantages are reported in Appendix A: Tables 22, 23 and 24.

Western Canada and Northwest United States

Western Canada holds a modest comparative advantage in grain relative to beef and also a competitive advantage over the Northwest in grain from the third vingtile. The Northwest holds a comparative advantage in beef, for the few vingtiles for which measures could be calculated, matched by a competitive advantage in beef up to the fifth vingtile. The trends in ratios are stable from vingtile to vingtile and do not oscillate around one. For both grain and beef specialized households, the measures of competitive advantage involve negative net margins made even more negative by subtracting DAS.

The Canada/Northwest comparison suggests that trade policy harmonization should not be expected to change the specialization for all vingtiles in grains relative to beef for Western Canada. There is not enough evidence for the Northwest to enable such a conclusion. The prevalence of negative net margins suggest that little trade in beef would be expected under 1990 circumstances. The competitive advantage for Canada in grains without DAS indicates vulnerability to harmonizing non-subsidy policies such as for grain marketing institutions, inputs and taxation.

Northwest beef specialized households in the first five vingtiles, corresponding to median sales in the fifth vingtile of US\$ 98,000, have a competitive advantage over the same vingtiles, Cdn \$ 59,000, in Western Canada. They also hold a comparative advantage in the first two vingtiles. However, for the rest of the vingtiles Canada holds the advantage which strengthens in higher vingtiles and with the removal of DAS. Aggregation of the measure of comparative advantage for wheat across Alberta, Saskatchewan and Manitoba hides the advantage to beef along the Eastern slopes in Alberta and in the Parkland.

The main conclusion for beef is that harmonization of entitlements may be expected to be subject to considerable dispute from beef specialized households in the first five vingtiles in the Northwest. Specializations in both regions are sensitive to entitlements. Households producing the first 25% of the beef in the Northwest have a slim advantage, protected by or due to entitlements over beef from similar households in Western Canada and could be vulnerable to beef movements from the upper vingtiles in Canada.

The conclusion for grain is that Western Canada appears to be in a strong position too. The comparative advantage for all Canadian vingtiles, reinforced by a strengthening competitive advantage to higher vingtiles and with the removal of DAS, suggests that a level playing field would offer new opportunities. It is not clear what effect price pooling in Canada has on these measures of advantage. However, some entitlement advantages favour the inputs side of larger grain operations in Canada because competitive advantage increases with size while comparative advantage remains the same across all vingtiles.

Western Canada compared to Eastern Canada

The first ten vingtiles in Western Canada and the last ten in Eastern Canada hold the competitive advantage relative to each other in beef production in 1990. The same pattern holds for grain except that the advantage for Western Canadian specialized households is confined to the first three vingtiles. Both Eastern and Western Canada have comparative advantages in grain over all vingtiles except the last three in Eastern Canada. The ratios

are consistently stable across vingtiles, do not oscillate around 1.0 and are markedly different from 1.0. When you consider the number of households which the lower vingtiles represent in the East-West comparison it would appear that the majority of beef households in western Canada hold a competitive advantage over eastern Canada. The same conclusion could be applied to grains.

These results are counter-intuitive for beef. We expected the competitive and comparative advantages for the lower vingtiles of beef specialized households to rest in Eastern Canada. Being at a comparative disadvantage in beef and yet enjoying a competitive advantage for over half the mass of beef produced, Eastern beef households clearly benefit from special entitlements or circumstances. One of these could be the supply of culls and male dairy animals as a dairy industry by-product.

The Eastern Canadian advantage in grain no doubt reflects the higher yields of white wheats relative to hard red spring wheats in the West, and the advances in maize and soybean technology. Canola and barley advances on the prairies have been more than offset by the performance of canola and maize in the East. Few breakthroughs in red spring wheat technology to improve yields and grades have occurred, for both institutional and agroclimatic reasons.

The main difference in grain related policy between the two regions lies with grain transportation and the jurisdiction of the Canadian Wheat Board in the West. It appears clear that without these two policies, Western Canada would be at a stronger competitive disadvantage relative to Eastern Canada. The Western Canadian advantage relative to the Northwest could also be weakened or could be reversed for some vingtiles.

Eastern Canada compared with the Northeast

Both the Northeast, in vingtiles with available data, and Eastern Canada hold comparative advantages in grains except for the last vingtiles. The advantage for Eastern Canada is stronger with higher ratios. This stronger advantage is matched by a competitive advantage in grain across all vingtiles but the first. However, beef specialized households in the Northeast have a competitive advantage in beef in the first eight vingtiles associated with larger negative net margins in Eastern Canada. Eastern Canada holds a competitive advantage over the Northeast United States in grain production for the majority of households. The United States on the other hand seems to hold the competitive advantage in beef production in the east for the majority of households.

Policy harmonization on DAS is not expected to change the situation for grains. Other policies appear to give Canada the competitive edge, given that both regions hold a comparative advantage in grains. Flows of United States grain into Eastern Canada likely relates to comparative advantages in specialty crops in Eastern Canada.

Limitations

The results for comparative and competitive advantage reveal some of the problems with using these measures. The first problem, which affects the theory of comparative advantage in general, is that they are pairwise comparisons. The pairs, beef and grains in this case, may not be relevant to the issue at hand. The comparisons are not transitive from pair to pair. Second, both categories of production and the regions are aggregates of many species, varieties and agroclimatic conditions. Third the policy complex makes it impossible to isolate the entitlements which may account for advantages or disadvantages. Much more study is required to sort out technological issues from endowments and entitlements.

Discussion

This work is exploratory. We propose that two aspects of earnings structure, namely, source structure and composition structure, have something to say about the behaviour of agricultural households under trade liberalization. This work is also experimental. Structural analysis hasn't been done this way before. It involves novel retabulations for major Canadian and United States agricultural household data bases for which structural analysis was not anticipated. The results are evidence of both the versatility and limits of these two sets of sample data.

The method involves tabulations in vintiles designed to shed light on how complex systems change structurally. It is useful to recall that agricultural households are parts of complex human systems behaving in dynamic and nonlinear fashions. The main feature of the design is that households may move across class boundaries over time as their economic status changes. Classification criteria from one region are not imposed on another. The relative status of households according to individual contribution to their national economies is the constant in comparisons.

We must emphasize again that the inherent nature of dynamical systems is that nonlinear phenomena prevent linear prediction of structural change, because it is associated with

bifurcation behaviour (Apedaile et al, 1994). Structural predictions have always been quicksand for agricultural economists. Major exogenous impulses, like new trade rules, can change the proportionality of parameters such as terms of trade and relative productivities to strengthen or weaken the governing influence of strange attractors, upon which implications rest (Solomonovich et al, 1994). Nevertheless, we feel that the evidence reported here does enable anticipation of the nature of structural adjustments which may accompany freer trade and a changing policy environment.

Structural tendencies in both countries suggest that the source structures of earnings are moving in concert. This is not surprising. Changes in the source structure during the 1987/88-1990/91 study period are influenced mainly by market opportunities and treasury disbursements. We observe a tendency in the data over this short period for market based earnings to improve, especially in the United States. As direct subsidies are withdrawn or restructured, both their proportions and identification change in the earnings of farm households.

The consequent restructuring of entitlements to households changes both the composition structure of rents and wages in earnings, and what is observed. For example, today the growing EEP in the United States does not show up as a distinct payment to agricultural households and so does not appear as a direct subsidy. In contrast, GRIP payouts in western Canada, not only are counted as direct subsidies but overstate the subsidy by the amount of the insurance premium paid by the farmer. Changes in entitlement or in method of accounting can change the form as much as the substance of earnings.

High proportions of rents coupled with low proportions of direct subsidies in earnings structures generally signify resiliency to increased international competition, particularly where intellectual property rents are involved. A problem arises when harmonization processes attenuate real property rights and politically gained entitlements, or make intellectual property obsolete. Then the same rents which position households for resiliency to competitive forces are likely to diminish under rule changes. In particular, when rents are associated with significant proportions of direct subsidies in the source structure, the wellbeing of those households is particularly sensitive to changes in definitions of eligibility for subsidies.

Source structures of earnings suggest that the east and west halves of the continent stand to be affected in opposite ways by subsidy roll-backs and redefinition of eligibility criteria for income support, that is to say, entitlements. The difference between eastern and western Canada is that the support programs in the East are both taxpayer and consumer financed, while in the West they are only taxpayer financed. The degree of consumer

financing shows up in the much larger share of market-based earnings in the East, attributed to supply management. The differences enable east and west in Canada to be played off against each other as the combined provisions of the GATT and NAFTA are tested by strategic trade moves to improve market shares, as evidenced by the Canada/United States durum wheat dispute in 1994.

The differences for the east and west United States lie in the greater dependence of the West on taxpayer support. The Eastern agricultural households are largely self financing at all levels of importance to the National interest.

Households in the fifth through tenth vingtiles appear to be most exposed to changing rules on entitlements in all regions but the Northwest where the vulnerability occurs in even lower vingtiles. Relatively high proportions of wage earnings in the composition structure, much of which come from off-farm sources, limit their economic resiliency. High proportions of direct subsidies in the western source structures make them doubly vulnerable. These households may be expected to slip into lower vingtiles. They are likely to disengage from their already modest agricultural contribution to the national economy irrespective of agricultural trade liberalization. Rural development in tradeables other than agricultural commodities at the level of community economies is the main alternative to rural outmigration for these households.

Western Canadian agricultural households in the middle ten vingtiles appear to be the most precariously positioned of all agricultural households in the six regions. They have a relatively high wage share in the composition structure, giving a clear signal of the future farm consolidation and decline in farm numbers in store for the Canadian prairies. They are the yet-to-disappear middle. This situation is associated with 'right to farm' entitlements. It may also be evidence that the wage necessary to keep people from leaving the farm is less than the LICO.

Households at the high end of the range of shares of production in Canadian regions generally exhibit high rent and high direct subsidies. These households are most dependent of all on politically derived entitlements, benefitting from the political power of the middle. They have and use influence to maintain and enhance these entitlements. If these were to be reduced by trade liberalization their ability to finance adjustment, attributed to healthy rents, may be impaired. Reduction of rents reduces cash flow and the market value of real property.

To this point the discussion focuses on general principles and emphasizes sensitivity to

rule changes. This emphasis is in keeping with the protective nature of most agricultural policies. Harmonization means making protective measures in both countries more the same. It is already in progress with improvements in transparency and accessibility to dispute resolution provided by the CUSTA.

The potential structural effects of a continental agricultural policy, with no restrictive trade measures between the two countries, are evident in the comparisons at the fifth and fifteenth vingtiles. The earnings structures at the fifth vingtile in the eastern half of the continent are quite similar across the three regions. Trade liberalization might change the pace but not the differential pattern of structural change: Not so at the fifteenth in the east, nor for both vingtiles in all western regions. Consider the cases one by one.

If legislated supply management in Canada were to be replaced by contractual supply management by processors, harmonization of agricultural policies would reduce the number of Canadian households in the higher vingtiles. Farm numbers in the 15th, for example, are proportionally only one quarter as prevalent in the eastern United States as in eastern Canada. Some Canadian households would be expected to move to higher vingtiles and most to lower vingtiles. With harmonization extended to the whole economy, the actual shifts across vingtiles would depend on the sequencing of policy change. Some examples of policies relevant to sequencing are licencing of intellectual property, highway running rights, truck, rail and ship policies, fuel taxes, port operations, collective bargaining, and environmental policies.

The major impacts of harmonization for North America revealed by our analysis, where supply management is not explicit, are reserved for the western half of the continent where traded commodities are relatively more important. This interpretation is based on the observation that the greatest differences in earnings and size structure of agricultural operations on the continent are at the higher vingtiles in the west. These differences also show up in smaller scale at the fifth vingtile. Consider the fifteenth/sixteenth vingtile. Median agricultural sales in the Northwest are more than four times those in western Canada. In the Southwest, they are more than eight times. Correspondingly, the proportion of the number of farms in these US regions, in these two vingtiles are a quarter and an eighth respectively of the proportion in western Canada.

Harmonization for western North America is not related to open borders as much as it is to harmonization of direct support from taxpayers. The impact of policy harmonization in the direction of the current United States model on numbers of farms in western Canada would be so great that a rapid change is politically and socially inconceivable. This earnings structure is valued in Canada and the affected households are still numerous

enough to mount effective political resistance.

The main focus of policy harmonization in the west would be the relationship of households to commodity buyers at the first transaction. Given that some farms are more effective users of scarce resource entitlements than others, some analysts would argue that the US model of an oligopoly for private grain trade and direct farm/agribusiness contracts favour efficiency. Growing awareness that not all the social, and especially the environmental costs, are reflected in these farm gate transactions with highly concentrated inputs suppliers and commodity buyers, makes this conclusion less obvious. As these costs become better understood and pricing institutions emerge to capture them, harmonization could test severely the fundamental philosophies of the two countries about the role of the State in the private economic affairs of its rural citizens.

Harmonization at the farm gate involves reconciling two radically different approaches in the two countries to attuning the collective concerns with individual pursuit of market imperfection. The Canadian 'countervailing market power' model of the Canadian Wheat Board for export grain and supply management for feathers and milk contrasts sharply with the United States model of a 'treasury floor' under agricultural terms of trade for cereals and oilseeds and unrestrained contract farming for the industrializing livestock sector.

The data lead us to believe that the Canadian model appears to slow technological change. Whether or not this rate is more in line with the pace of learning about its long run implications is unclear, despite delayed adoption in Canada of US inspired chemical and biotechnology by means of supplementary government testing and regulation. Neither is it clear that such learning would be put to advantage anyway, either in perfectly competitive markets or by other politically driven allocative and distributive economic processes.

These observations have implications for steering the pace and sequencing of harmonization, and the process of structural change. Harmonization at the pace implied by the tariffication and tariff reduction schedules in the GATT and the NAFTA are likely to have little effect on the regional earnings structures at the fifth and lower vingtiles. The proportions of households in these vingtiles are likely to continue to grow. Numbers, however, should continue to decline, but at a slower rate as households slip down into lower vingtiles. There may be a need for a small farm policy to continue the delivery of countryside amenities, including environmental restoration, in some parts of regions of the two countries.

The policy implications for households at higher vintiles are more complex. In eastern regions, attrition of household numbers in the form of early retirements, out-migration of youth, pluriactivity and professionalization has been in progress for some time. The comparisons of 1987-88 and 1990-91 indicate that the dynamics of this process, observed through earnings structures, are very active, especially in the Northeast. The time line on tariffication of supply managed commodities and their derivatives is an important element in an orderly adjustment in Canada of private wealth in the form of quota entitlements and real property rights. Timing is perhaps even more important for community wealth and amenities as the spatial distribution of cows and agricultural households per acre concentrates without supply management.

The harmonization challenge is evident in the approach and results of our structural analysis. The shift of humans, households and communities down the vintiles and out of commercial agriculture for export and food security is the main problem of structural change. Humans and their social institutions are, relative to financial services, industrial inputs and processes, and commodities, less and less mobile across national boundaries as trade liberalization proceeds. Therefore these less mobile factors take the brunt of the economic costs of structural change. In particular, changes in earnings structure and in the engagement of households in agriculture in western Canada, in harmonization to the US model, could be as large, though not necessarily the same, as for the Canadian East Coast fisheries and West Coast logging.

Some of the evidence of relatively high wage shares in Canadian earnings structures leading to these interpretations may be attributed to the higher LICO in Canada. Other differences may be attributed to higher yields and rates of livestock gain in the United States, and to greater involvement in pluriactivity by US household members, especially for farms selling up to US \$140,000 of farm commodities accounting for 30% of US farm output. Stronger commodity prices in the US and lower US input prices, taking into account direct input subsidies, particularly affect net farm income. Lower direct agricultural subsidies across all US vintiles offset these circumstances, except for households below the sixth vintile in the West. This complexity requires more research to determine exactly why the proportion of rents is so much higher in the US regions.

Most profoundly, the definition of real property rights and rights of privileged access to home markets underlie most rules of transaction, and therefore the political process of harmonization to reduce trade distortions. Effects of the interaction of agricultural technologies with agroclimatic conditions and local ecospheres in each country are also emerging into the policy domain. However, so far these environmental implications appear to be viewed in the context of maintaining competitive advantage rather than of

harmonization of rules leading to freer trade.

This comparative study of earnings structures reveals the main national differences facing harmonization associated with freer trade. First, the vision and purpose in each country for its rural and agricultural systems must be reconciled for successful harmonization. Second the way costs are shared for food, country-side amenities, sustainability and farm adjustment among agricultural households, taxpayers and consumers are viewed differently in each country. Third, regional differences seem to exist on property rights and entitlements. Examples are; the right to farm, land ownership, intellectual property, tax exemption, conditions of employment, entitlements to uncompetitive business practices and market power, and rights to pollute or degrade land, water and scenery.

Global technological change and economic restructuring have a prevailing effect on earnings regardless of these differences. Policy measures internal to each country are increasingly endogenous to the global process of coevolution of these two agricultural economies. Harmonization of tariffs and non-tariff border measures by both countries should enhance the effects of global technology and structural change. However, the evidence is that policy measures retain strong roots in the fundamentally different rural world views between the United States and Canada, even on a regional basis. Therefore the pace, sequencing and form of harmonization of domestic regional agricultural policies in these two North American countries are less than obvious.

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APPENDIX A