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What Affects Farmers' Ability to Adjust: Evidence from the United States and Canada

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Despite the incredible changes that have occurred in agriculture during the last century, family-owned firms continue to account for over 97 percent of the farms in both the United States and Canada. While this basic ownership structure has remained intact, modern farms are characterized by a complex array of business arrangements that have affected both how management decisions are made as well as how production occurs. The complexity of farms and farm households has increased, as production has become more concentrated. Over the last 50 years, farm numbers have decreased 60 percent in the U.S. and 61 percent in Canada. Agriculture provides a unique decision-making environment. In addition to the commingling of ownership, management, labor and personal assets, commodity production depends on physical and biological processes and the primary resource (land) is in relatively fixed supply.

We define adjustment to mean the reallocation of household resources in adaptation to change. Broadly, adjustment could be a response to any type of change, including change in government programs or policies that affect agriculture. An examination of policy adjustment might start with those who are directly participating in traditional commodity farm programs. In the U.S., only one-third of farms participate in commodity programs as measured by receipts of various program payments. Considering a broader range of policies that includes conservation programs increases the pool of participants to more than 40 percent of farms. For Canada, 69 percent of farms participated in either crop insurance or NISA, and 59 percent of Canadian farms reported receiving government program payments. The entirety of impacts from government programs is not observed by the outcomes on participants, however, when incentives to produce certain crops over others are modified, or when rates of sector entry and exit are affected. Peripheral effects can be large when markets are adjusting to reform where relative prices effects and barriers to entry and exit exist as a result of farm policy.

When examining the interaction between farming and agricultural policy, both market-level and farm-level analyses of supply and demand are inadequate in fully measuring the success of farm policies in terms of maintaining or improving the well-being of farm families (Offutt). A farm household perspective is also important to understand the effects of subsidies on markets in the context of international trade liberalization. Farm household decisions, like decisions made by other households that are also self-employed, reflect both consumption and production. The farm household structure is a complex system of inter-relationships between and amongst a variety of endogenous and exogenous variables. It is a resource-allocating unit, where decisions are made on how scarce household resources are to be distributed among various needs to attain household goals. Often, decisions on resource allocation affect the welfare of the entire household as well as the welfare of individual members of the household. The importance of the farm as an activity included in household portfolios will vary among households. Demographic, social, and economic characteristics of households, as well as personal goals held by household members, may affect what adjustments households make in their farm operations in response to changes in farm policy.

It is difficult to find many examples where a single farm operator makes all production and marketing decisions employing only their own assets, and where the income derived from the farm constitutes the entire earnings of the household. Rather, agricultural production on contemporary farms takes place in partnership with asset owners, service providers, agribusiness firms, and both governmental and non-governmental agencies. Some of these partnerships are

long-standing, such as the landlord-operator relationship, while others such as custom-hire agricultural production, production and marketing contracts, and the production of environmental amenities through the Conservation Reserve Program and farmland easements, are newer vintage opportunities for entrepreneurial-minded producers. Because these production-based partnerships extend across many entities, adjustment is likely to be felt across these same partners. Understanding the diversity that exists in the agriculture sector even among sole-proprietorships is the first step in determining the willingness and the ability of farmers to adjust to changes in farm policy.

Farm and Farm Household Diversity

Both Canadian and U.S. data show that a wide range of livelihood strategies is currently in use on farm households. Farm typologies are constructed using common definitions for farms in each country (Appendix Table 1). To demonstrate the range of outcomes and inputs across all farms, a comparison using common definitions is included (Appendix Table 2) that focuses on key characteristics that are likely to play important roles in farm household adjustment. These characteristics or indicators include the level of financial well-being, the quantity of land and other asset ownership, and the goals that farm operators pursue within their farm businesses. Also, the extent to which farm and household financial well-being is derived from direct payments from government price and income support programs will help in understanding who will be most affected by future policy reform.

After adjusting for comparable farm definitions (farms with gross sales of \$10,000 Canadian or more), most U.S. farm are considered small. Even though most farms are small, agricultural production is concentrated in large and very large family farms. Together, these groups represented about one-third of farms and contributed 83 percent of the total value of agricultural production (Appendix table 2). Large and very large farms also received 87 percent of direct government payments. Two other prominent typology groups based on their share of farm numbers were retirement and lifestyle farms accounting for 23 and 22 percent of U.S. farms, respectively. The remaining three groups (low-income, small and medium business-focused farms) represented 21 percent of farms and less than 8 percent of the total value of agricultural production. Similarly in Canada, the large and very large farms account for 45 percent of farms and for 84 percent of production, while receiving 79 percent of the program payments. In Canada 17 percent of farms are classified as retirement and another 7.5 percent fell into the lifestyle category. Canada has a higher percentage of low-income farms at 13.5 percent compared to 6 percent in the United States. In the United States 15 percent of farms fall into the small and medium business focused groups compared to 17 percent in Canada.

Examining payment dependency ratios calculated for farms in Canada and the U.S. results in two primary observations. First, Canada has a much smaller set of non-participants, defined as farms that did not receive a government payment, compared to the U.S. (Appendix Chart 1). This could arise from the nature of the programs operated in the respective countries. In the U.S., payments are either linked to ownership or control of a production base or to current production of payment eligible commodities. Payment mechanisms that focus on selected commodities would also tend to limit farm coverage.

The second major difference is that Canada has a much more participation of farms at a low level of payment dependence than the U.S. Nearly half of Canadian farms report earning some, but less than 10 percent overall, of their gross farm income from payments. Fewer than 30 percent of U.S. farms report this amount of payments. For all farms, the U.S. has a slightly larger share of farms with 20 to 30 percent of gross income from payments while Canada has a larger share with over 30 percent. Other interesting differences exist as well when participation is viewed within a typology (bottom rows, Appendix Table 3, Panels A and B). In Canada, a larger share of lifestyle, low-income, and small business focused farms report earning 20 percent or more of their gross farm income from payments than in the U.S. Large and very large farms in the U.S. are more likely than Canadian large and very large farms to earn 20 percent or more of their gross farm income from payments.

The value of agricultural land depends largely on its expected future earning potential. Because government payments contribute to farm income, they indirectly support farmland values. Thus, any policy reform which contributes to adjustment, must also consider the longer-term implications for assets values, wealth and the distribution of land ownership in conjunction with the more direct effects realized through changes in farm productivity and business and household incomes.

Farm and Farm Household Adjustment

Adjustment is defined for this paper as the reallocation of household resources in adaptation to change. With economic, environmental, and social change occurring constantly, it is no wonder that those who participate in the economy are to varying extents motivated to adjust to these changes, oftentimes referred to as “shocks”. Of course, farm households are susceptible to shocks in the same way, and as entrepreneurs they may be even more susceptible. Households frequently use the resources at their disposal to adjust to shocks resulting from changes in demand, changes in technology, and changes in government policies. As noted earlier, the range of government policies that can affect farm households is considerably broader than commodity policies, and can include environmental, food safety, tax, and trade policies among others.

In discussing how households adjust to shocks, economists typically consider a rather brief list of key resources that households have at their disposal. The list of resources will typically include both physical capital – such as land and machinery – as well as more liquid capital, labor resources, and management (Figure 1). Adjustment, then, is the act of reallocating these resources so that they can be used to greater advantage in response to a shock. Adjustment may also be a change in how household resources are deployed within agriculture such as among different cropping enterprises or between crop and livestock production. Adjustment may also be observed as a change in how the household resources are allocated between farm and non-farm pursuits.

In order to explain this further, consider a shock such as an increase in the price of one agricultural commodity relative to the rest. While temporary shocks may warrant only temporary adjustments, if the shock is expected to be long-term some households may perceive an opportunity to take advantage of the change in relative prices. For example, some households may find it beneficial to change their current outputs to produce more of the commodity with the higher price. The transition will likely involve a reallocation of the current allocation of physical

capital, financial capital, labor, and management. The adjustment by the household could include a change in production practices, such as the purchase or the modification of machinery and equipment, the acquisition of new land or changing the crop rotations on existing land. If the opportunity is great enough, a household may decide to shift labor currently allocated to off-farm work to the farm or to hire additional labor for the farm. Conceivably, management skills may be required to bring about these and other changes associated with the new crop.

Constraints to Farm and Farm Household Adjustment

In thinking of adjustment processes, it is important to consider what the costs associated with the adjustment might be. In our example above, it is possible that for some households the costs of adjustment are greater than potential benefits. Presumably, households with the lowest transition costs will undertake the adjustment because it is more profitable to do so and the adjustment will occur successively until further adjustments are no longer profitable. For some farms, costs may be prohibitive due to physical or economic constraints, and adjustment may not occur at all (Figure 2).

Isolating factors that hasten or hinder adjustment is one way to begin to understand which households are most likely to be affected by a shock. These factors may be associated with the quality of the resources or how easily resources can be substituted among farm opportunities or between farm and non farm opportunities. We refer to this as “adjustment capacity”, and we consider physical and financial capital as well as labor and management to have an “adjustment capacity” that will govern the household’s ability to respond to shocks.

Take, for example, the adjustment capacity of agricultural land. Adjustment capacity may include the adaptability of land to different enterprises. Soil resource, climate, and proximity to markets are ways in which adjustment capacity is likely to vary. In the U.S., we might use a proxy for the adjustment capacity of land resources by looking at how suitable land is for a few enterprises or for many enterprises. One way to look at suitability is to measure the level of diversity in production that occurs among neighboring farms with similar climates and soil types. The U.S. National Resource Inventory estimates acreage allocations among 28 different agricultural enterprises (including six types of horticulture, nine types of row crops, five close-grown crops, and six other agricultural land uses). The diversity index mapped across the U.S. shows the degree to which production mix varies within a county (Figure 3). Greater variability (shown by darker green counties) in land uses is seen in the Upper Midwest, the Eastern Coastal Plain, and some western states, indicating that producers in these areas are engaged in a greater number of enterprises than producers in the counties mapped with a lighter color

Drivers of Adjustment on Farms and Farm Households

The reallocation of resources on farms and farm households can be driven by economic as well as non-economic factors. Given the diversity of farm households, how farms reallocate resource will depend on the driver of adjustment and the farm typology group. While the previous section’s example of an increase in the level of demand for an agricultural commodity may bring positive repercussions to some farm households, we would be remiss if we didn’t turn the discussion to how farm households can adjust to shocks with negative repercussions. As it turns out, the same four resources come into play whether it is a positive shock or a negative shock.

Both economic and non-economic factors influence the type of shocks that can occur in North American agriculture.

Economic Drivers of Adjustment

Canadian and U.S. farm operators face a number of economic factors that influence adjustment for the farm business as well as for the farm household. These economic factors can either be gradual pressures, which farm operators and farm households must respond to over time or “shocks” which result in an immediate change to the economic environment in which the farm operates.

The gradual decline in agricultural commodity prices has been one of the major drivers of adjustment in agriculture over time. As illustrated in Figure 4, the real price of wheat over the last 50 years has declined by more than 50 percent. Improvements in technology and productivity have allowed many farms to substitute factors of production and extract economies of scale, which subsequently results in declining commodity prices for agricultural outputs. (Figure 5).

Over the past fifty years, a number of technological developments have occurred to increase productivity or to reduce costs. The period of the 1950's was characterized by mechanical improvements with larger machines and tractors. In the period that followed in the 1960's and 70's chemical and plant breeding technologies were drivers which resulted in lower costs in real terms by increases in productivity.

Rapid increases in the rate of adoption of new technology have resulted in a decline in the costs of production and lowered costs to consumers of agricultural commodities. For example, more recently, technological advances related to biotechnology and increased information have driven agricultural production. Biotechnology has significantly influenced corn, soybean and canola production in North America.

Farm operators and households have also adjusted as non farm opportunities have pulled farm operators off the farm. In Canada, 49 percent of farm families report wages and salaries from off the farm (Farm Financial Survey, 2002). The option of combining farm and non-farm work has become the preferred option for many farm households. The increasing education levels of farm operators and farm families has also meant that off farm employment opportunities are often high paying jobs which provide challenging careers. Many farms are therefore organized to recognize the labor constraints associated with off farm employment.

Domestic economic policies in both Canada and the United States have also influenced structural change. These policies include price and income support programs for farm operators as well as domestic non agricultural policies such as availability of capital, interest rates, income tax rules and labor regulations. These policies can both encourage and discourage structural change.

Trade policies are another major driver of structural change in Canada and the US. In North America the introduction in 1988 of the Canada/US Trade Agreement and the subsequent extension to the North American Free Trade Agreement has been a significant driver for

structural change. With the introduction of the free trade agreements, agricultural trade in North America has increased considerably. A reduction of trade barriers has increased Canadian shipments of agricultural and agri-food products to the U.S., from \$3.3 billion in 1988 to \$15.5 billion in 2003. During the same time period shipments of agricultural and agri-food products from the U.S. to Canada increased from \$4.0 billion to \$12.5 billion (Agriculture and Agri-Food Canada).

The reduction of agricultural trade barriers has also meant that North American farm operators must adjust to new competitors. The cost of production for many agricultural commodities is lower in many countries than in North America. A recent report by the International Farm Costs Network illustrated that US beef producers have significantly higher costs compared to their South American competitors (Deblitz et al., 2003). Existing market participants must either adjust their practices to match the efficiency of the new entrants or exit the sector.

Non Economic Drivers of Adjustment

Natural events can also be drivers for adjustment. Droughts in North America can result in a change in crop mix and in some cases the conversion of land into pasture. The recent BSE outbreak in Canada and the United States will also result in changes in the North American cattle market.

Household goals and objectives are a critical factor in the structure of many Canadian and US farms. Goals related to quality of life and providing a farm environment for their children are as important as economic goals for many farm households. The possible intra-generational transfer of the farm within a household is also a driver of structural change for many farm households. About one-fourth of operators indicated their intent to retire from farm work within five years. Important to the farm adjustment question, however, is that the percent indicating a planned retirement differed greatly among sizes and groups of farms, and that intended uses of the property after retirement varied widely. Nationally, about 19 percent of operators reported the intent to rent, 16 percent to sell, 25 percent to turn over management, and 41 percent to make some other arrangement for their business. A larger share of operators of large and very large farms indicated they would give up management. Regardless of size, however, a very large percentage of households reported their intent to use their business assets to generate cash in retirement whether through selling, renting or operating the farm as an intact business.

Food safety concerns and regulation are playing an increasing role in the North American farming sector as a driver of adjustment. Recent events in North America related to BSE and Avian Flu have increased consumers awareness of food safety issues. Food safety concerns raise the issue of the necessity and feasibility of implementing traceability systems for agricultural products. Food safety concerns are also changing how North American products are marketed as consumers and processors are demanding products that meet higher food safety standards. Food safety issues are also creating opportunities related to organic production. This production can require significant adjustments in a farm operation.

Environmental concerns and regulation are also major drivers of adjustment in North American agriculture. In the 1970's and 80's issues related to soil erosion and land use were drivers for

change. During this period, conservation tillage usage increased significantly in North America. In more recent years, environmental issues have expanded to include water quality and availability, odor issues and noise issues. These environmental issues are increasingly affecting farm production decisions.

Evidence of U.S and Canadian Farm and Farm Household Adjustment

We include two examples of farm and farm household adjustment; one for Canada and one for the U.S. The examples draw on the concepts introduced earlier on resource allocation in response to an exogenous force. Data gathered at the farm and farm household level are used to demonstrate the diversity in response to shocks, and provide background for understanding the components of aggregate-level phenomena.

Case Study: Canadian Farm Adjustment to Changes in Policy

One of the more significant policy reforms in Canadian agriculture in the last 20 years has been the elimination of transportation subsidies for grain from western Canada in 1995. Prior to 1995, the Government of Canada was providing about \$560 million annually to the railways under the Western Grain Transportation Act to reduce the transportation costs of grain and oilseeds. The transportation subsidy was replaced with a one-time \$1.6 billion payment to landowners in the Prairie Provinces.

Table 1. Number of pigs by prairie and non-prairie regions.

| | 1971 | 1981 | 1991 | 1996 | 2001 |
|--|-----------|-----------|-----------|-----------|-----------|
| <u>Number of Pigs</u> | | | | | |
| Prairie Provinces | 4,031,082 | 2,648,726 | 3,826,034 | 4,264,189 | 5,677,550 |
| Rest of Canada | 4,075,539 | 7,226,339 | 6,390,049 | 6,776,273 | 8,281,222 |
| <u>Growth between Censuses</u> (percent) | | | | | |
| Prairie Provinces | | -34.3 | 44.4 | 11.5 | 33.1 |
| Rest of Canada | | 77.3 | -11.6 | 6.0 | 22.2 |
| Percentage on Prairies | 49.7 | 26.8 | 37.5 | 38.6 | 40.7 |

Source: Statistics Canada, Census of Agriculture, 1971, 1981, 1991, 1996, 2001.

This policy reform was intended to move western agriculture from a reliance on shipping bulk grains and oilseeds to agriculture based on value added production and higher value crops. The value added production included an anticipated increase in livestock numbers including hog production. As the cost of shipping grain and oilseeds increased, it was anticipated that more grain and oilseeds would be consumed locally. The transportation reform increased most significantly the shipping costs from Manitoba and Saskatchewan.

As illustrated in Table 1, the production of hogs did increase significantly during the 1996 to 2001 time period. During this time period, the production of hogs increased by 33 percent for the

prairie region compared to 22 percent for non-prairie regions. While it would appear that this policy reform had a positive impact on hog production in western Canada, the extent that the policy reform is responsible for the increase in hog production is debatable. In addition to the policy reform of grain transportation rates, a number of the economic and non-economic drivers of adjustment were also influencing the structure of Canadian hog production. These drivers included the North American Free Trade Agreement, which provided better access to US markets, changes in environmental regulations and structural changes at the processing level.

The aggregate data regarding the increases in western Canadian hog production do not give any indication of how individual farms and households adjusted to the policy reform. Policy developers not only want to know the aggregate impact of policy reform on the sector, but also the effect on individual farms and farm households. In order to examine the impact of the policy reform on individual farms and households, longitudinal data of the 1996 and 2001 Censuses of Agriculture were examined for hog farms. The longitudinal data identify those hog farms that exited farming between 1996 and 2001, those that stayed in farming, and the new entrants into hog farming (Table 2). The prairie region had 770 hog farms exit farming whereas the non prairie region had 1,250 exit farming. In both these regions, the farmers exiting were generally small farms and marginally profitable.

Table 2. Number of hogs farms by stayers, exiters and entrants.

| | | Census year | Number of farms | Average total gross farm receipts | Average total farm operating expenses | Average net operating income |
|---------------------------|-----------------|----------------|-----------------------|---|---|---------------------------------------|
| <u>Non-prairie</u> | | | | | | |
| Exiters | Hog farms, 1996 | 1996 | 1,250 | 225,939 | 204,597 | 21,342 |
| Stayers | Hog farms, 1996 | 1996 | 4,345 | 328,465 | 287,520 | 40,945 |
| Stayers | Hog farms, 1996 | 2001 | 4,345 | 436,696 | 374,593 | 62,103 |
| Entrants | Hog farms, 2001 | 2001 | 960 | 312,521 | 269,573 | 42,948 |
| <u>Prairies</u> | | | | | | |
| Exiters | Hog farms, 1996 | 1996 | 770 | 216,763 | 189,371 | 27,392 |
| Stayers | Hog farms, 1996 | 1996 | 1,885 | 404,247 | 333,934 | 70,313 |
| Stayers | Hog farms, 1996 | 2001 | 1,885 | 545,614 | 456,111 | 89,503 |
| Entrants | Hog farms, 2001 | 2001 | 535 | 848,250 | 703,103 | 145,147 |

Source: Statistics Canada, Census of Agriculture, 1996 - 2001 Longitudinal Linkage .

Note: Net operating income does not include depreciation.

Hog farms in 1996 that stayed in farming had some growth between 1996 and 2001, although this growth was not dramatic. Revenues of prairie hog farms increased by \$141,000, compared to \$108,000 in the rest of Canada. The policy reform does not appear to have a major impact on the existing hog farms. The trends in the prairie and non-prairie region are relatively similar with small hog farms exiting and modest expansion among the medium-sized farms.

The major difference between the prairie region and the non-prairie regions is the large size of operation of the new entrants on the prairies. New hogs farms on the prairies, had average total revenues of \$848,000 compared to only \$312,500 for the non-prairie region. Farm operators and investors that are making the largest investment in hog production were generally choosing the prairie region. Policy reform is therefore one key factor influencing the location of hog farms in Canada. It is unlikely that if the transportation policies still existed, which encouraged the export of grain and oilseeds rather than livestock production, the prairie region and most notably Manitoba, would have had the same level of investment in new hog operations during the 1996 to 2001 time period.

In contrast to hog production, where the removal of transportation subsidies was intended to encourage production, the removal of the transportation subsidies was to discourage spring wheat production, which is grown mainly for export markets. Producer cost for transportation particularly in Saskatchewan increased significantly. At the aggregate level, production of spring wheat declined 17 percent from 1996 to 2001 on the Canadian prairies. The longitudinal 1996-2001 Census data however illustrate that the policy adjustments of wheat farms varied significantly.

The 1996 Census of Agriculture reported 29,350 wheat farms (operations with 50 percent or more of their farm revenues from wheat production). This farm type would be significantly affected by higher transportation costs without major adjustments. Of the 29,350 wheat farms in 1996, 9,650 or 33 percent exited farming from 1996 to 2001. These exiting farms contributed to the 16.4 percent decline in Saskatchewan wheat area between 1996 and 2001. Over eighty percent of the exiting farms had revenues of less than \$100,000. These farms generally rely on off farm income and in many instances did not want to make the investments to adapt to a new farm type. Of the 19,700 wheat farms that remained in farming, over 40 percent remained as wheat farms. A number of reasons limited the adjustment of these farms. The majority of the farms (62 percent) had revenues of less than \$100,000 in sales. With the reliance on off farm income, many of these farms did not want to make the investment to change production types. Bradshaw concludes that crop diversification did not occur between 1994 to 2000 for many small grain farms. On the larger farms moisture limitations constrained the adjustment to other enterprises, and as a result they stayed in wheat production.

Over 45 percent of the wheat farms that remained in farming changed from wheat farms in 1996 to become grain and oilseed farms in the 2001 Census. This shift in farm type contributed to an increase in higher value crops. For example dry field peas and lentils doubled in area in Saskatchewan between 1996 and 2001. These farms adjusted by shifting from wheat to higher value specialty crops and oilseeds. In many instances, the adjustment costs were relatively low since they were made with marginal investment in machinery and changes in production practices. A relatively small share (13 percent) of farms made more substantive adjustments to other commodities. These farms either significantly expanded an existing non-grain enterprise or started a new enterprise.

Case Study: U.S. Farm Household Adjustment to Income Shocks

Farm households, like most households, must make decisions in an environment of economic uncertainty. Farm household income varies more from year to year than non-farm household income (Figure 6). Farm households are engaged in non-farm economic activities as well as farm activities and as a result are subject to a wide range of potential shocks. These might include, but are not limited to:

- shocks to farm income through yield and price variability;
- shocks to non farm income through changes in the employment status of the operator, the spouse or the retained earnings of their business; and
- household shocks such as illness, legal expenses, or divorce.

Farm businesses have many tools at their disposal to deal with production related risk, including many different types of insurance products. Businesses can also use market mechanisms to minimize risk from volatile output prices and increased input costs by contracting, forward pricing, or by using other market-based tools. Analogous mechanisms exist for managing off-farm risk, such as unemployment, health, and liability insurance.

When farm operators were asked about household outcomes in 2000 and 2001, approximately 18 percent replied that their total household income was lower than the previous year. The most common reason for lower household incomes was low farm earnings from poor crop conditions or low commodity prices. Lower off-farm incomes, from the operator or spouse were cited by 5 percent of farm households, while six percent cited lower incomes for some other reason (including, presumably, that their previous year's income was unusually high compared to the current year).

While few households are likely to be able to predict with certainty their level of well-being, it is often the case that larger differences between expected well-being and actual well-being are more problematic for the household than are smaller differences. While the amount that income fell below the previous year was a relatively small 3 percent when averaged over all households, the average decline in household earnings was 17 percent for those households that received a shock.

Not all households that earned less than they had the previous year can be characterized as having limited resources. Although farm households reporting lower income than the previous year had average incomes below the average for all farm households, they also reported that their actual incomes were more than enough to meet their actual household expenses, and greater than the level of income necessary to meet their basic needs.

There are a number of mechanisms that farm operators and their families use to compensate for a loss in income, and to smooth over the shock. For those farms that had lower incomes than the previous year, the most common strategy (46 percent) was to decrease their level of spending. However, there are some indications that households respond with different strategies to an income shock, depending on the source of the shock. For example, for those households indicating that their farming operation was the source of the decline in earning, households typically borrowed or consumed out of personal savings to compensate for the lower income.

Households that had low incomes due to a decline in off-farm earnings or for some other reason also consumed from savings, but were less likely to make up the difference by borrowing money.

Several studies have examined the relationship between farm business success and farm characteristics (Mishra and Morehart; Mishra, El-Osta, and Johnson; Purdy, Langemeier, and Featherstone; Zech and Pederson). Many of these used logistic regressions to determine which factors contribute most to the likelihood of success. We applied a similar approach in order to identify determinants of farm operator household adjustment to a shock, defined as lower levels of household income. Because of the high degree of participation in off-farm labor markets by farm operators and their spouses, there should be a different dynamic than just measuring the success of the farm. For many farm households, economic success is not solely contingent on farm business success. Understanding the determinants of farm household success in adjusting to an income reduction provides some indication of adjustment capability.

In the Agricultural Resource Management Survey, farm operators identified the amount of income, before taxes, that was necessary to meet family living expenses (MINFL). A comparison of household income with MINFL gives a measure of economic attainment for the farm household based on their own indication of basic needs. In both 2000 and 2001, about one-third of farm operators had household income below MINFL. The average reported MINFL was \$33,000 in 2000 and just over \$35,000 for 2001. In both years, farm households that met or exceeded MINFL had much lower average MINFL than those that did not. These two groups, (those that met or exceeded MINFL and those that did not) form the binary dependent variable for the logit model applied to the 2000 ARMS data.

Farm households that are experiencing an unanticipated decline in income would be expected to have more difficulty meeting their basic needs. As discussed above, farm operator households with current household income below the previous year reported information on the occurrence of a negative household income “shock”, its origin, and their response. Three dummy variables represent the primary reason for lower household income, farm business, off-farm earnings, and other unanticipated events such as illness or divorce. The intercept term captures the omitted group, which had household income equal to or higher than the previous year. Farm, household, and operator characteristics hypothesized to affect the economic performance of farm households were drawn from variables found to be important in prior studies. Attributes of farm operator human capital such as education, age or experience have been shown to influence economic outcomes. Farm operators with a college degree or advanced degrees are expected to command higher compensation, while those with more years of experience are likely better farm managers. Farm size, measured by the total dollar value of agricultural production, is expected to be positively associated with the likelihood of farm household income meeting basic needs, since the farm’s contribution to household income is positively correlated with the size of the business. Farm diversification, which was estimated using an entropy index, is expected to reduce farm business income risk and variability. Commitment to off-farm work by both the operator and spouse was measured as the proportion of annual work hours devoted to off-farm employment. Time allocation decisions of the operator and spouse influence the composition and magnitude of household income. Household size, which is represented by the number of persons living in the farm operator’s households, is expected to positively influence the amount of income necessary for family living expenses. Combined farm business and household assets and debt measure the

solvency position of the household. Farm operator households with higher debt-to-asset ratios are more constrained in their ability to manage income shortfalls.

Farmers responded to more than twenty different questions about actions taken in the management of the farm business. Factor analysis was used as a variable reduction technique to prevent potential statistical issues associated with including all the management action variables in a single specification. One problem is that some management variables are likely to be highly correlated. Intercorrelation among explanatory variables would result in an upward bias of the variance estimates and thus unreliable tests of their statistical significance. The effect of measurement error associated with the management action variables may also be reduced by using factor analysis for variable reduction (Scott). Estimated factor scores suggest three different types of management strategies: aggressive marketing, business cost control, and reliance on advisory services. To determine if these farm management activities have a different influence for those reporting a farm-related household income shock, three interactive variables were included in the model specification.

Results of the logistic regression for 2000 are reported in Table 3. The global null hypothesis that all regressions coefficients are zero was rejected at p-value 0.0001. The signs of parameters correspond with expectations with the exception of cost reduction management activities (factor 2). Other types of farm management activities (marketing and advisory services) were not significant in terms of the probability of households meeting their basic needs. Cost reduction activities had a negative relationship with the probability of meeting household needs suggesting that for some farm households the idea of reducing farm costs was a reaction to a troublesome situation rather than an ongoing practice. Interestingly, for farms that had lower income than the prior year because of the farm business, cost reduction measures did not have a statistically significant influence of the likelihood of meeting basic needs.

Not all income shocks were detrimental to the household meeting basic needs. Although similar in magnitude and sign to other sources of income shock, the probability of meeting basic needs was not significantly different if household income was lower than the previous year because of off-farm employment than when there was no income shock. The source of the shock did negatively affect the probability of meeting basic needs if it originated from the farm business or for other reasons (illness, divorce, etc...). Lower household income attributed to the farm had a larger reduction in the probability of meeting basic needs (-0.19) than did having lower household income for other reasons (-0.14).

Education level of the operator had a positive and statistically significant impact on the probability of the household meeting their basic needs. Operators with a college degree or graduate studies were more likely to earn household income that was higher than the minimum necessary for family living in 2000. Experience of the operator in running a farm business was not significant. Farm households associated with larger or more diverse farm businesses had a higher probability of meeting basic needs. A one-percentage point increase in combined operator and spouse hours devoted to off-farm work increased the probability of meeting basic needs by 0.20, holding all else constant. Household size and the solvency position of the household were both significant and had a negative relationship with the probability of meeting basic needs. The solvency position of the household, however, had a much large impact on the

likelihood of meeting basic needs. Holding all else constant, a one percent increase in the combined farm and household debt/asset ratio reduced the probability of meeting basic needs by 0.24.

Table 3. Logistic regression results for probability of a farm operator household income being higher than income necessary to meet family living expenses

| Variable name | Estimated coefficient | 2000 ARMS results | | | Means |
|--|-----------------------|-------------------|---------|------------------|--------|
| | | Standard error | T-ratio | Marginal effects | |
| Intercept | 0.5663 ** | 0.1533 | 3.694 | 0.13 | |
| Dummy variable, =1 if "farm" was source of lower household income | -0.8544 ** | 0.1241 | -6.883 | -0.19 | 0.094 |
| Dummy variable, =1 if "off-farm" was source of lower household income | -0.5616 | 0.3400 | -1.652 | -0.12 | 0.047 |
| Dummy variable, =1 if "other" was source of lower household income | -0.6135 ** | 0.2131 | -2.878 | -0.14 | 0.045 |
| Dummy variable, =1 if operation completed college or graduate studies | 0.3838 ** | 0.1424 | 2.696 | 0.09 | 0.191 |
| Amount of govt. payments received by the farm operation (\$1,000) | 0.0038 | 0.0021 | 1.751 | 0.00 | 7.294 |
| Total value of farm production (\$1,000) | 0.0004 * | 0.0002 | 1.924 | 0.00 | 70.035 |
| Total value of farm production squared (\$1,000) | 0.0000 | 0.0000 | -0.337 | 0.00 | 344967 |
| Entropy diversification index | 0.5367 * | 0.2961 | 1.813 | 0.12 | 0.085 |
| Years of operator experience managing the farm | 0.0047 | 0.0028 | 1.650 | 0.00 | 24.169 |
| Proportion of operator and spouse hours devoted to off-farm employment | 0.9143 ** | 0.1083 | 8.444 | 0.20 | 0.445 |
| Number of persons residing in the operator's residence | -0.0847 ** | 0.0309 | -2.744 | -0.02 | 2.736 |
| Ratio of farm and non-farm debt to farm and non-farm assets | -1.1036 ** | 0.3120 | -3.537 | -0.24 | 0.145 |
| Forward pricing marketing strategy used | -0.3608 | 1.0145 | -0.356 | -0.08 | 0.000 |
| Implemented farm business cost reduction measures | -3.4616 * | 1.9314 | -1.792 | -0.77 | 0.000 |
| Used advisory services | 1.6037 | 2.0019 | 0.801 | 0.36 | 0.000 |
| Interaction between farm loss and factor 1 | 0.1846 | 1.8614 | 0.099 | 0.04 | 0.002 |
| Interaction between farm loss and factor 2 | 7.2290 | 4.1747 | 1.732 | 1.60 | 0.002 |
| Interaction between farm loss and factor 3 | -2.35945 | 3.90292 | -0.605 | -0.52 | 0.002 |

* denotes significance at the approximate 10% critical value, while ** denotes significance at the 5% critical value for the one-sided t-test.

Statistical goodness of the model:

-2 LOG L (degrees of freedom) 2563015.9 (14) (p=0.0001)

McFadden's R²

0.05

Mean of dependent variable (prop. of farms with total household income above basic needs)

0.33

8. Conclusions

It is difficult to predict how individual farmers will adjust to any shock, let alone a policy shock. We have identified farms and farm households that have successfully responded to past policy shocks, and found that constraints are likely to bind the decisions of some but not others. Predicting where constraints will be binding decisions becomes difficult because they are driven by a number of variables that are not identically distributed. Some farmers are unwilling to make changes in their farm operation, perhaps because they are risk averse or because their goals are not consistent with yet another round of "reinventing" their business. Some farmers may be quite willing and prepared to make the adjustment, but do not have the required management expertise to make the necessary switches. In still other cases, farm households may be willing to change and possess the human capital but are limited by lack of water and climate or the soil is simply not suited. As seen in the case of Canadian policy reform, much of the overall sectoral adjustment is achieved through exit and entry within the sector.

Aside from mobilizing labor resources to alternative uses, those that must adjust to agricultural policy reform may be less likely to have much in common with those that adjust to a loss in non-farm income, however. For one, a farming business consists of real, physical capital in addition

to labor and human capital, and adjustment could involve a different deployment of existing physical capital such as machinery, equipment, and land to some alternative use. Alternative uses for machinery and equipment might be found outside of agriculture or deployed in some other enterprise within agriculture. Substitution possibilities within agriculture are likely to vary by region, because crops produced tend to vary with soils and climate. Better alternative uses of agricultural physical capital will support their market values, and the viability of farm businesses as they adjust to new economic conditions. Adjustment capacity is likely to be greater where existing diversity is greater.

Research in the U.S. and Canada on farm and farm household adjustment indicate that one of the greatest impacts of existing agricultural policies is that the benefits of these are capitalized into the market values of owned factors of production. Accordingly, one of the effects of removing existing agricultural policies is that market values of owned factors of production are likely to drop. Naturally, asset deflation hurts owners of assets, but may help those who lease or would like to own assets. Adjustment to asset deflation may be especially difficult for those who have financed their purchase of that asset, meaning that adjustment pressures will affect the borrower as well as the lender.

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Appendix: Comparing U.S. and Canadian farm households

The first step in understanding farm and operator household diversity is to identify and group those with similar attributes. Differences in data systems and approaches to policy have lead to different farm typology classification criteria being applied in the two countries. To facilitate these comparisons, the Canadian typology was applied to the U.S. data system.

Appendix Table 1. Common U.S. and Canadian Farm Typology

Retirement farms – Operator 62 years and older receiving pension income
Lifestyle farms – Sales below \$50,000 and off-farm income greater then \$50,000
Low-income farms – Sales below \$100,000 and income less than \$23,000
Small business-focused farms – Sales below \$50,000
Medium business-focused farms – Sales between \$50,000 and \$100,000
Large business-focused farms – Sales between \$100,000 and \$500,000
Very large business-focused farms – Sales greater than \$500,000

Note: Canadian dollar amounts. The Canadian version of the typology was used, the USDA/ERS farm typology can be found at <http://www.ers.usda.gov/publications/AIB759/>

Canadian farm data are mostly from the Farm Financial Surveys (FFS). This is an annual survey conducted jointly by Statistics Canada and Agriculture and Agri-Food Canada (AAFC). The U.S. farm-level data are from the Agricultural Resource Management Survey (ARMS), which is conducted jointly by the ERS and USDA's National Agricultural Statistics Service (NASS). The ARMS is an annual survey that collects detailed structural and financial characteristics for U.S. farms and farm households. For comparison purposes, ARMS data were converted to Canadian dollars using the 2001 Exchange Rate³.

Farm and household sources of income and wealth

Aside from noticeable differences in farm size, each of the typology groups had a relatively balanced contribution to income from both crop and livestock commodities. The main exceptions were lifestyle and small business-focused farms where livestock sales were the dominant source of commodity income. The same was also true for these farm types in Canada. Large and very large, businesses-focused farms were the only typology groups in the U.S. that had average net cash income from the farm businesses of more than C\$20,000. A similar pattern was also evident in Canada.

In the United States, one-third of farms reported negative net cash income in 2001 compared to only 20 percent in Canada. On average, farm business net cash income was negative for lifestyle and low-income farms, which was also true for Canada. These were also the only two groups where more than 50 percent of farms had negative net cash income. In Canada 42 percent of lifestyle farms and 38 percent of low-income farms reported negative income. The next highest

³ The nominal exchange rate used is 1.551 Canadian dollars to each U.S. dollar. The 2001-2002 exchange rates were historically high, since then the U.S. dollar has fallen to 90 percent of its 2001 value. The principal impact of choosing a comparison year when the U.S. dollar is strong relative to the Canadian dollar will shift some U.S. farms into a higher sales class. The source used for exchange rates is <http://www.ers.usda.gov/Data/exchangerates/>

shares of farms with negative business income in the U.S. were small businesses-focused and retirement with about 30 percent. Only 12 percent of very large, business-focused farms had negative net cash income compared to 11 percent in Canada.

Average off-farm income ranged from just over C\$11,000 for low-income farm households to more than C\$130,000 for lifestyle farm households. The same was true for Canada, albeit with a smaller range of C\$11,000 for the low-income group to a high of C\$94,000 for the lifestyle group. Compared with other typology groups, low-income households had the smallest share of farms reporting off-farm income at 59 percent. In Canada 68 percent of the low-income group reported some off farm income, which was slightly higher than the large farms where 64 percent reported some off farm income. Nearly 90 percent of all farm households reported off-farm income, with 100 percent of retirement and lifestyle farms earning income from off-farm sources in the U.S. In Canada 77 percent of all farms reported off farm income and almost 100 percent of retirement farms reported off farm income. Wages and salary income was not a dominant source of off-farm earnings for retirement farms where only 22 percent reported such income. Low-income farms also had a relatively small percentage of farms (45 percent) reporting income from off-farm employment by a household member. In Canada, the figure was almost identical at 44 percent. Extending entrepreneurial skills to off-farm business ventures was more common for lifestyle farms where 22 percent reported income from another business. In Canada, 20 percent of lifestyle farms reported income from other business, which was somewhat comparable with other typologies.

USDA's ARMS survey showed that farm households had, on average, nearly \$528,000 (\$U.S.) of net worth from all sources, farm and non-farm at the end of the 2001 calendar year. For comparison purposes, data from the Federal Reserve Bank's Survey of Consumer Finance (SCF) showed that non-farm self-employed households had an average net worth of \$1,245,741 and other non-farm households, those households excluding the self-employed, had an average net worth of \$281,125 at the end of the 2000 calendar year. Two groups of farm households, those operating large and very large farm businesses, have average levels of net worth approaching or exceeding net worth reported by non-farm self-employed households. These farms generate over two-thirds of farm value of production, and account for over half of the nation's wheat and soybean production, three-fifths of corn production, and four-fifths of cotton production. Most wealth regardless of group is derived from the value of business assets, and by far the most important asset for farm businesses and the households that operate them is land. Thus, land ownership, land value, and household wealth are closely tied for U.S. farm households.

In Canada, the Survey of Financial Security collected information on the wealth of Canadian households for 1999 (Statistics Canada, 1999). This survey found that farm households, based on all farm sizes, had an average net worth of \$568,000 per farm household. This compares to an average net worth of all Canadian households of \$199,000. Canadian farm families are, however, much more dependent than non farm families on accumulated wealth in retirement since being self employed, many farm households will not receive a pension in retirement from employment. In fact, with a median farm household wealth of \$363,000 it would appear that many farm households will be dependent on government pensions in retirement. With significant off farm income, lifestyle farms will have a higher percent of households with pensions from employment and large and very large farms will have significant farm wealth in

retirement. Farm households, however, with low income and small and medium farms, will on average be more dependent on government pensions when they retire.

Land ownership

With the exception of retirement farms, average acres operated increased with farm size across the typology groups ranging from 217 acres for lifestyle farms to more than 2,600 acres for very large, business-focused farms. In Canada, the average acres farmed increased by typology except for retirement farms and low-income farms. It ranged from a low of 288 acres for the lifestyle to a high of 1,868 acres for very large farms. In the U.S., both retirement and lifestyle farms in the U.S. owned more than 70 percent of acres operated compared to more than 80 percent in Canada. The proportion of land owned for the other typology groups in the U.S. ranged between 45 percent and 56 percent. In Canada, the percentage owned generally decreased across typology from a high of 86 percent for the retirement to a low of 59 percent for the very large.

The use of both cash and share rental arrangements increased in proportion to the size of farm operation in the U.S. Only 30 percent of small business-focused farms in the U.S. cash rented land compare with 77 percent of very large, business-focused operations. As with production, acres operated and cropland was concentrated with the large and very large business-focused typology groups. Nonetheless, retirement and lifestyle farms together accounted for 25 percent of total acres operated and 20 percent of the cropland. In Canada, the retirement and the lifestyle groups accounted for a much smaller percentage, accounting for only 15 percent of acres farmed and 13 percent of the cropland.

The importance of land ownership for retirement farms was also revealed by average farm net worth of more than \$1 million. This was the third highest among the typology groups. Small business-focused farm households had the lowest average net worth for farms and for households. This group had average acres owned that was similar too lifestyle farms at around 150 acres.

Farm Operator Goals

Farm operators reported in the 2000 ARMS how important various goals were in regards to the agricultural operation. Farm operators tended to weight one or a few goals most heavily, while discounting the rest as essentially unimportant. The goals considered most important to individual operators varied, however. The share of farms that identified certain goals as unimportant or very unimportant demonstrates some of the variation across farm typology groups. For example, more than half of the retirement farms indicated that goals associated with businesses expansion were unimportant. Two groups that also did not view expansion as important were small business-focused farms and low-income farms (28 percent). Lifestyle and small businesses-focused farms had the highest share of operators that indicated the goal of providing an adequate income to the household without having to work off the farm was unimportant. The commitment to off-farm work by farmers in these two groups was also consistent with the amount of off-farm hours and the share of operators working for wages and

salaries off the farm. For lifestyle farms, 93 percent of the operators worked off farm - averaging more than 1,900 hours a year.

Importance of government payments

One measure of the importance of government payments to farm households is the amount of payments relative to all sources of gross cash farm income. Appendix Table 3 shows farm and household characteristics for different levels of government payments (excluding conservation programs) divided by gross cash income. The group with the highest degree of dependence on payments as a source of income (30 percent or more) accounted for 7 percent of farms and 4 percent of production. These farms had the lowest average farm and operator household incomes when compared with participants who were less dependent on payments as a source of income and non-participants. The next highest dependency level (20 to 30 percent) represented 11 percent of farms and about 10 percent of the total value of production. Compared with participants that were less dependent on government payments as a source of income, these farms had lower average farm business net income, but comparable levels of average farm operator household income. Twenty percent of farms and nearly one-third of production fell into the group of farm program participants that were least dependent on payments as a source of income. Among participants, this group had the highest levels of farm and operator household income.

In the United States, the distribution of payments tends to mirror the distribution of value of production for payment eligible commodities. This yields the distribution of 7.3 percent of farms with sales over \$250,000, or farms that fall into the large, very large or non-family groups of farms as measured by the ERS typology, earning over 46 percent of payments (Appendix Table 2). These farms produce a roughly similar amount of output and two-thirds are specialized producers of grains and oilseeds, cotton, or general crops where no particular commodity forms over half of a farm's value of production. Though distributions of payments and production among farms by type and size have been widely reported, they provide little information about the relative importance of payments as a source of revenue to farms or income to households. To provide more evidence of relative dependency on payments as a source of income, a ratio of payments to gross cash sources of income was computed.

Results from derivation of the ratio confirm that a large share of farms, totaling nearly half of farms in the U.S. do not receive a commodity-focused government payment. Any payment that the smallest farms receive often comes from conservation-type programs. But even here the average level of payment reported is small. The most-dependent group of farms earning over 30 percent of gross income from commodity program payments, amount to 7.3 percent of farms and in 2001 generated about 4 percent of farm value of production (Appendix Table 3, Panel B). Aggregating across farms that earned 20 to 30 percent of gross income from payments along with the most dependent group, we account for about a fifth of farms and one-seventh of value of production. These 214,000 farms that received a large majority of their payments either as direct payments or commodity loan payments, had, on average, payment levels that were nearly as large, or even larger, than net cash income in 2001. A striking finding is that even for this group of farms highly dependent on government payments, incomes of farm households that operate them consist predominately from off-farm sources. Fewer than 10 percent of households that

operate high payment dependency farms earned over 75 percent of household income from their farm businesses. Nearly three-fourths earned less than 25 percent.


In order to compare the Canadian numbers with the U.S. numbers in terms of program participation we have segregated crop insurance payments from other direct program payments. We have excluded participation in the Canadian crop insurance program because crop insurance in the U.S. is delivered by the private sector.

For the NISA program we have only included withdrawals from the Government's portion (Fund II) and have excluded Fund I withdrawals because the latter is the farmer's share which is being withdrawn. It should be noted that NISA is now being phased out over a five year period starting in 2004.

In Canada, 24 percent of farms did not participate in NISA or other government programs excluding crop insurance (Appendix Table 3, Panel B). In the U.S. almost twice the Canadian percentage (47 percent) did not participate in Government programs. In general Canada has a much higher participation rate in Government programs. For example 55 percent of farms participate in NISA and 50 percent of farms reported participating in crop insurance.

In Canada, half the farmers reported program payments accounting for 10 percent of their revenue or less. These farms accounted for almost two-thirds of the production while receiving only one-third of program payments. Those farms who reported program payments which were more than 10 percent of revenue accounted for 17 percent of farms and received 50 percent of direct program payments and two-thirds of NISA withdrawals.

Appendix Table 2, Panel A. Selected characteristics of U.S. farms, 2001, expressed in Canadian dollars

| Item | Comparable Farm typology  | | | | | | | U.S. total |
|---------------------------------------|--|-------------------|------------|----------------------------|----------------------------|----------------------------|--------------------------------|------------|
| | Retirement | Lifestyle | Low-income | Small business- focused | Medium business-focused | Large business- focused | Very large business-focused | |
| Number of farms | 266,583 | 259,768 | 71,192 | 46,299 | 123,553 | 310,421 | 82,814 | 1,160,630 |
| Percent of farms | 23.0 | 22.4 | 6.1 | 4.0 | 10.6 | 26.7 | 7.1 | 100.0 |
| Percent of value of production | 8.7 | 2.2 | 1.2 | 0.4 | 4.3 | 35.2 | 48.0 | 100.0 |
| Percent of direct payments | 12.3 | 3.4 | 1.5 | 0.7 | 5.2 | 37.9 | 39.0 | 100.0 |
| Percent of payments excl conservation | 10.0 | 2.4 | 1.5 | 0.3 | 4.2 | 39.5 | 42.0 | 100.0 |
| <i>Canadian dollars per farm</i> | | | | | | | | |
| Gross cash income | 85,852 | 22,918 | 39,560 | 25,043 | 72,577 | 231,030 | 1,483,191 | 203,621 |
| Livestock income | 31,200 | 11,353 | 15,093 | 13,454 | 24,071 | 78,633 | 564,666 | 75,054 |
| Crop sales (incl. net CCC loans) | 31,286 | 5,792 | 13,496 | 5,619 | 22,971 | 88,993 | 644,287 | 81,753 |
| Government payments | 10,618 | 3,018 | 4,957 | *3,617 | 9,685 | 28,060 | 108,301 | 19,826 |
| Other farm-related income | 12,748 | 2,755 | 6,014 | 2,353 | 15,850 | 35,344 | 165,937 | 26,988 |
| Cash expenses | 67,689 | 29,110 | 50,079 | 18,516 | 57,415 | 176,404 | 1,100,878 | 157,716 |
| Variable | 53,221 | 19,503 | 36,095 | 12,983 | 39,169 | 129,357 | 886,681 | 121,356 |
| Fixed | 14,468 | 9,607 | 13,984 | 5,532 | 18,246 | 47,047 | 214,197 | 36,361 |
| Net cash farm income | 18,163 | -6,191 | -10,520 | 6,527 | 15,162 | 54,626 | 382,313 | 45,905 |
| Median net cash farm income | 7,536 | -2,375 | *-4,673 | *7,667 | 19,519 | 54,184 | 237,522 | 10,128 |
| Share with negative income | 29.4 | 56.5 | 60.7 | 30.8 | 24.7 | 16.7 | 12.3 | 32.3 |
| Net farm income | 16,582 | ^a -774 | *-5,517 | *10,198 | *12,017 | 40,797 | 293,976 | 36,871 |
| Household earnings from farming | *6,210 | -11,837 | -18,633 | #3,132 | ^a 871 | 26,969 | 243,376 | 22,430 |
| Household earnings from off-farm | 71,795 | 131,501 | 11,052 | 32,085 | 108,089 | 53,569 | 49,058 | 77,215 |
| Share from wages and salaries | 13.4 | 66.0 | 68.2 | 67.5 | 68.4 | 54.2 | 39.6 | 51.1 |
| Share from off-farm business | 5.4 | 18.4 | *4.3 | *6.2 | *13.3 | *21.1 | *10.2 | 14.4 |
| Share from interest dividends | 18.7 | 5.9 | *10.1 | #13.7 | *6.5 | 8.9 | 22.4 | 10.3 |
| Share from social security | 46.0 | 2.7 | *11.4 | *7.9 | #3.3 | 2.1 | 1.3 | 13.1 |
| Share from other passive sources | 11.2 | 2.9 | #1.9 | *3.8 | 3.8 | *6.7 | 9.9 | 5.9 |
| Share with off-farm income | 100.0 | 100.0 | 58.8 | 96.7 | 92.8 | 80.9 | 70.0 | 89.3 |
| Share with off-farm wage income | 22.4 | 91.0 | 45.3 | 70.5 | 83.3 | 70.3 | 57.4 | 62.9 |
| Share with off-farm business | 6.4 | 21.9 | *4.8 | 10.4 | 13.5 | 9.2 | 5.6 | 11.4 |
| Farm operator household income | 78,005 | 119,664 | *-7,581 | 35,218 | 108,960 | 80,538 | 292,434 | 99,645 |
| Farm assets | 1,086,263 | 635,430 | 845,817 | 397,826 | 813,294 | 1,351,286 | 3,964,212 | 1,190,321 |
| Real estate | 852,230 | 473,339 | 634,391 | 307,153 | 611,404 | 909,364 | 2,400,235 | 832,421 |
| Farm liabilities | 41,036 | 45,757 | 64,923 | *26,521 | 92,774 | 200,484 | 721,970 | 139,719 |
| Farm equity | 1,045,227 | 589,673 | 780,894 | 371,304 | 720,520 | 1,150,802 | 3,242,241 | 1,050,603 |
| Non-farm assets | 254,129 | 290,413 | 87,323 | 87,485 | 204,256 | 146,503 | 216,480 | 208,589 |
| Non-farm debt | 17,061 | 51,070 | *23,073 | *8,434 | *55,943 | 33,261 | 50,001 | 35,520 |
| Non-farm net worth | 237,068 | 239,343 | *64,249 | 79,051 | 148,313 | 113,242 | 166,479 | 173,070 |

| | | | | | | | | |
|--|-----------|---------|---------|---------|---------|-----------|-----------|-----------|
| Household net worth | 1,243,138 | 821,847 | 808,416 | 446,762 | 836,025 | 1,190,418 | 2,949,515 | 1,154,728 |
| Average acres operated | 573 | 217 | 311 | 270 | 514 | 909 | 2,608 | 694 |
| Average acres owned | 406 | 158 | 174 | 147 | 229 | 416 | 1,234 | 369 |
| Average cropland acres | 210 | 79 | 148 | *95 | 190 | 481 | 1,385 | 326 |
| Percent of acres operated | 19.0 | 7.0 | 2.8 | 1.5 | 7.9 | 35.0 | 26.8 | 100.0 |
| Percent of cropland | 14.8 | 5.4 | 2.8 | 1.2 | 6.2 | 39.4 | 30.3 | 100.0 |
| Percent of households cash-renting land | 25.3 | 32.8 | 40.2 | 30.1 | 47.6 | 64.8 | 77.4 | 44.8 |
| Percent of households share-renting land | 10.2 | 9.2 | 17.1 | *6.8 | 24.3 | 28.5 | 34.0 | 18.4 |
| Average number of commodity groups | 2.8 | 2.8 | 3.4 | 2.9 | 3.1 | 3.9 | 4.0 | 3.2 |
| Average age of senior operator | 72 | 49 | 53 | 52 | 48 | 49 | 49 | 55 |
| Number of household members | 2.0 | 3.0 | 2.7 | 2.4 | 2.9 | 3.1 | 3.4 | 2.7 |

Source: 2001 USDA Agricultural Resource Management Survey.

Based on 6,287 observations.(6,287 Households). Expansion factor=vallwt0. Versions=1 and 2.

All 48 contiguous States were included in the sample. Alaska, Hawaii, and US territories are excluded from the surveys.

 indicates reliability concern,  indicates legal disclosure, **na** indicates missing estimate.

Coefficient of Variation = (Standard Error/Estimate)*100. * indicates that CV is greater than 25 and less than or equal to 50. # indicates that CV is greater than 50 and less than or equal to 75. **a** indicates that CV is above 75.

a indicates that CV is 188.62 , 303.76

Rounded percents may not add precisely to 100.

Appendix Table 2, Panel B, **Selected characteristics of Canadian farms, 2001, expressed in Canadian dollars,**

| Typology | Business Focused | | | | | | | All Farms |
|---------------------------|------------------|-----------|------------|---------|---------|-----------|------------|-----------|
| | Retirement | Lifestyle | Low-Income | Small | Medium | Large | Very Large | |
| Number of Farms | 26,596 | 11,557 | 20,876 | 8,846 | 16,949 | 58,368 | 12,250 | 155,442 |
| Percent of Farms | 17.1% | 7.4% | 13.4% | 5.7% | 10.9% | 37.5% | 7.9% | 100.0% |
| Percent of Production | 7.4% | 0.9% | 2.8% | 0.8% | 3.7% | 40.3% | 44.1% | 100.0% |
| Percent of Payments | 9.0% | 1.3% | 4.5% | 1.1% | 5.6% | 51.0% | 27.6% | 100.0% |
| Income | | | | | | | | |
| Gross Revenue | 91,600 | 25,115 | 44,570 | 29,326 | 72,527 | 227,990 | 1,190,743 | 212,552 |
| Livestock Sales | 35,361 | 8,663 | 16,705 | 11,000 | 28,138 | 103,038 | 619,236 | 100,123 |
| Crop Sales | 37,751 | 8,416 | 15,778 | 8,750 | 26,990 | 83,928 | 417,756 | 77,082 |
| Government Payments | 7,584 | 2,465 | 4,818 | 2,706 | 7,456 | 19,648 | 50,557 | 14,457 |
| Other Revenue | 10,905 | 5,570 | 7,269 | 6,871 | 9,943 | 21,376 | 103,195 | 20,890 |
| Cash Expenses | 72,023 | 27,883 | 45,411 | 20,211 | 53,969 | 178,985 | 1,000,945 | 173,620 |
| Net Cash Farm Income | 19,577 | (2,769) | (841) | 9,115 | 18,558 | 49,004 | 189,798 | 38,932 |
| Median Net Cash Income | | | | | | | | |
| Share of Negative Income | | | | | | | | |
| Household Income | | | | | | | | |
| Earnings - Farm | 22,852 | (1,858) | 324 | 10,745 | 21,437 | 61,182 | 233,493 | 35,338 |
| Earnings - Nonfarm | 27,095 | 93,594 | 10,626 | 32,100 | 49,604 | 23,382 | 22,549 | 30,814 |
| Nonfarm Wages & Salaries | 5,527 | 78,007 | 6,956 | 25,560 | 39,131 | 15,265 | 10,711 | 19,977 |
| Nonfarm Business | 2,121 | 8,014 | 1,636 | 1,962 | 5,319 | 5,070 | 8,365 | 4,433 |
| Nonfarm Interest | 3,877 | 3,559 | 642 | 1,334 | 2,662 | 1,716 | 2,259 | 2,203 |
| Nonfarm pension | 15,570 | 4,013 | 1,393 | 3,244 | 2,493 | 1,331 | 1,214 | 4,202 |
| Share of nonfarm income | 15.0% | 22.6% | 4.6% | 5.9% | 17.6% | 28.5% | 5.8% | 100.0% |
| Share of nonfarm wages | 4.7% | 29.0% | 4.7% | 7.3% | 21.4% | 28.7% | 4.2% | 100.0% |
| Share of nonfarm business | 16.5% | 27.0% | 10.0% | 5.1% | 26.3% | 86.4% | 29.9% | 201.2% |
| Total Household Income | 49,947 | 91,736 | 10,950 | 42,845 | 71,041 | 84,564 | 256,042 | 66,152 |
| Balance Sheet | | | | | | | | |
| Farm Assets | 631,294 | 422,354 | 434,430 | 342,747 | 587,585 | 1,249,994 | 3,267,552 | 1,008,212 |
| Real Estate | 400,445 | 306,937 | 276,773 | 240,637 | 361,033 | 610,393 | 1,497,380 | 528,774 |
| Farm Liabilities | 37,043 | 57,214 | 49,299 | 30,658 | 81,732 | 236,438 | 926,059 | 189,631 |
| Farm Equity | 94.1% | 86.5% | 88.7% | 91.1% | 86.1% | 81.1% | 71.7% | 81.2% |
| Production | | | | | | | | |
| Average Acres Farmed | 665 | 288 | 584 | 346 | 833 | 1,155 | 1,868 | 905 |
| Average Acres Owned | 572 | 244 | 429 | 270 | 508 | 745 | 1,094 | 610 |
| Acres Cropland | 306 | 127 | 272 | 152 | 344 | 662 | 1,094 | 479 |
| Percent of Acres Farmed | 46.0% | 44.1% | 46.6% | 43.9% | 41.3% | 57.3% | 58.6% | 337.8% |
| Percent of Cropland | 10.9% | 2.0% | 7.6% | 1.8% | 7.8% | 51.9% | 18.0% | 100.1% |
| Percent of Acres Rented | 5.4% | 1.1% | 7.1% | 1.5% | 12.0% | 52.2% | 20.7% | 99.9% |

Appendix Table 3, Panel A. Dependence on government payments of U.S. farms, 2001, expressed in Canadian dollars

| Item | Payments relative to IGCFI | | | | | | U.S. total |
|-------------------------------------|----------------------------|-----------------|--------------------|------------------|-------------------|----------------------|------------|
| | | Non-participant | 10 percent or less | 10 to 20 percent | 20 to 30 percent | More than 30 percent | |
| Number of farms | 542,863 | 227,119 | 176,491 | 129,717 | 84,441 | 1,160,630 | |
| Share of farms | 46.8 | 19.6 | 15.2 | 11.2 | 7.3 | 100.0 | |
| Share of value of production | 38.7 | 32.0 | 15.7 | 9.6 | 4.0 | 100.0 | |
| Average government payment | 1,178 | 9,258 | 25,939 | 33,561 | 37,454 | 12,783 | |
| Share conservation programs | 100.0 | 14.6 | 5.0 | 3.0 | 3.9 | 9.6 | |
| Share direct payments | 0.0 | 28.4 | 32.0 | 30.0 | 28.8 | 28.9 | |
| Share commodity loan programs | 0.0 | 24.9 | 35.4 | 40.0 | 36.5 | 34.0 | |
| Share other programs | 0.0 | 32.1 | 27.6 | 26.9 | 30.8 | 27.6 | |
| Net cash farm income | 38,152 | 71,240 | 55,593 | 40,358 | *15,874 | 45,905 | |
| Net farm income | 33,180 | *55,348 | 35,945 | 31,201 | *21,544 | 36,871 | |
| Household earnings from farming | 13,471 | *24,570 | 15,335 | *9,640 | ^a -770 | 14,462 | |
| Household earnings from off-farm | 88,550 | 67,146 | 65,416 | 75,563 | 58,624 | 77,215 | |
| Farm operator household income | 109,443 | 105,254 | 89,200 | 90,515 | 57,429 | 99,645 | |
| Average household expenditures | 40,004 | 39,574 | 44,634 | 42,918 | 41,497 | 41,058 | |
| Median operator household income | 67,048 | 69,632 | 67,999 | 75,765 | 47,748 | 67,715 | |
| Share with HHINC below state median | 46.8 | 46.2 | 48.2 | 42.8 | 58.7 | 47.3 | |
| Farm operator household net worth | 1,117,555 | 1,277,369 | 1,260,596 | 1,078,133 | 960,230 | 1,154,728 | |
| Typology of Farms: | | | | | | | |
| Retirement | 55.0 | 18.3 | 10.4 | 9.1 | 7.3 | 100.0 | |
| Lifestyle | 62.9 | 9.8 | 11.9 | 9.8 | 5.6 | 100.0 | |
| Low-income | 60.9 | 10.2 | 10.5 | 6.9 | 11.5 | 100.0 | |
| Small business-focused | 73.4 | 10.0 | 5.8 | 4.9 | 5.9 | 100.0 | |
| Medium business-focused | 42.2 | 21.2 | 15.6 | 11.4 | 9.7 | 100.0 | |
| Large business-focused | 27.7 | 27.9 | 22.1 | 14.9 | 7.5 | 100.0 | |
| Very large business-focused | 21.4 | 34.2 | 23.9 | 15.4 | 5.2 | 100.0 | |

Source: 2001 USDA Agricultural Resource Management Survey.

Based on 6,287 observations.(6,287 Households). Expansion factor=vallwt0. Versions=1 and 2.

All 48 contiguous States were included in the sample. Alaska, Hawaii, and US territories are excluded from the surveys.

indicates reliability concern, indicates legal disclosure, na indicates missing estimate.

Coefficient of Variation = (Standard Error/Estimate)*100. * indicates that CV is greater than 25 and less than or equal to 50. a indicates that CV is above 75.

a indicates that CV is 611.48

Rounded percents may not add precisely to 100.

Appendix Table 3, Panel B. **Dependence on government payments of Canadian farms, 2001, expressed in Canadian dollars**

| | Non- participants | 10% or Less | 10% to 20% | 20% to 30% | More Than 30% | All Farms |
|-----------------------------------|------------------------------|------------------------|-----------------------|-----------------------|--------------------------|----------------------|
| Number of Farms | 30,276 | 73,874 | 24,896 | 13,072 | 13,324 | 155,442 |
| Percent of Farms | 19.5% | 47.5% | 16.0% | 8.4% | 8.6% | 100.0% |
| Percent of Production | 14.3% | 60.9% | 14.1% | 6.0% | 4.7% | 100.0% |
| Programs | | | | | | |
| Average Payments | 0 | 7,403 | 24,891 | 34,050 | 47,697 | 14,457 |
| NISA Fund II Withdrawal | 0 | 661 | 2,071 | 3,784 | 2,925 | 1,215 |
| Share of Direct Payments | 0% | 24.3% | 27.6% | 19.8% | 28.3% | 100.0% |
| Share of Crop Insurance | 0% | 18.3% | 25.1% | 21.8% | 34.5% | 100.0% |
| Share of NISA | 0% | 25.9% | 27.3% | 26.2% | 20.6% | 100.0% |
| Balance Sheet & Income | | | | | | |
| Net Cash Farm Income | 28,102 | 50,137 | 36,410 | 23,464 | 21,300 | 38,932 |
| Farm Net Worth | 658,516 | 938,526 | 798,896 | 728,689 | 642,235 | 818,580 |
| Household Net Worth | na | na | na | na | na | na |
| Household Income | | | | | | |
| Earnings - Farm | 24,342 | 45,818 | 32,706 | 22,683 | 19,549 | 35,338 |
| Earnings - Nonfarm | 38,641 | 26,688 | 26,882 | 35,279 | 38,870 | 30,814 |
| Total Household Income | 62,983 | 72,506 | 59,588 | 57,962 | 58,419 | 66,152 |
| Typology of Farms | | | | | | |
| Retirement | 24.4% | 39.3% | 15.8% | 10.1% | 10.4% | 100.0% |
| Lifestyle | 36.4% | 33.0% | 11.0% | 6.9% | 12.7% | 100.0% |
| Low-Income | 26.1% | 38.9% | 15.1% | 7.9% | 12.0% | 100.0% |
| Small | 34.8% | 33.8% | 10.2% | 11.4% | 9.8% | 100.0% |
| Medium | 18.9% | 45.3% | 15.0% | 12.8% | 8.0% | 100.0% |
| Large | 10.2% | 56.7% | 19.2% | 7.0% | 6.9% | 100.0% |
| Very Large | 15.4% | 63.2% | 13.2% | 5.3% | 2.9% | 100.0% |

Note: NISA refers to the Net Income Stabilization Account

Figure 1. Farm and farm household adjustment

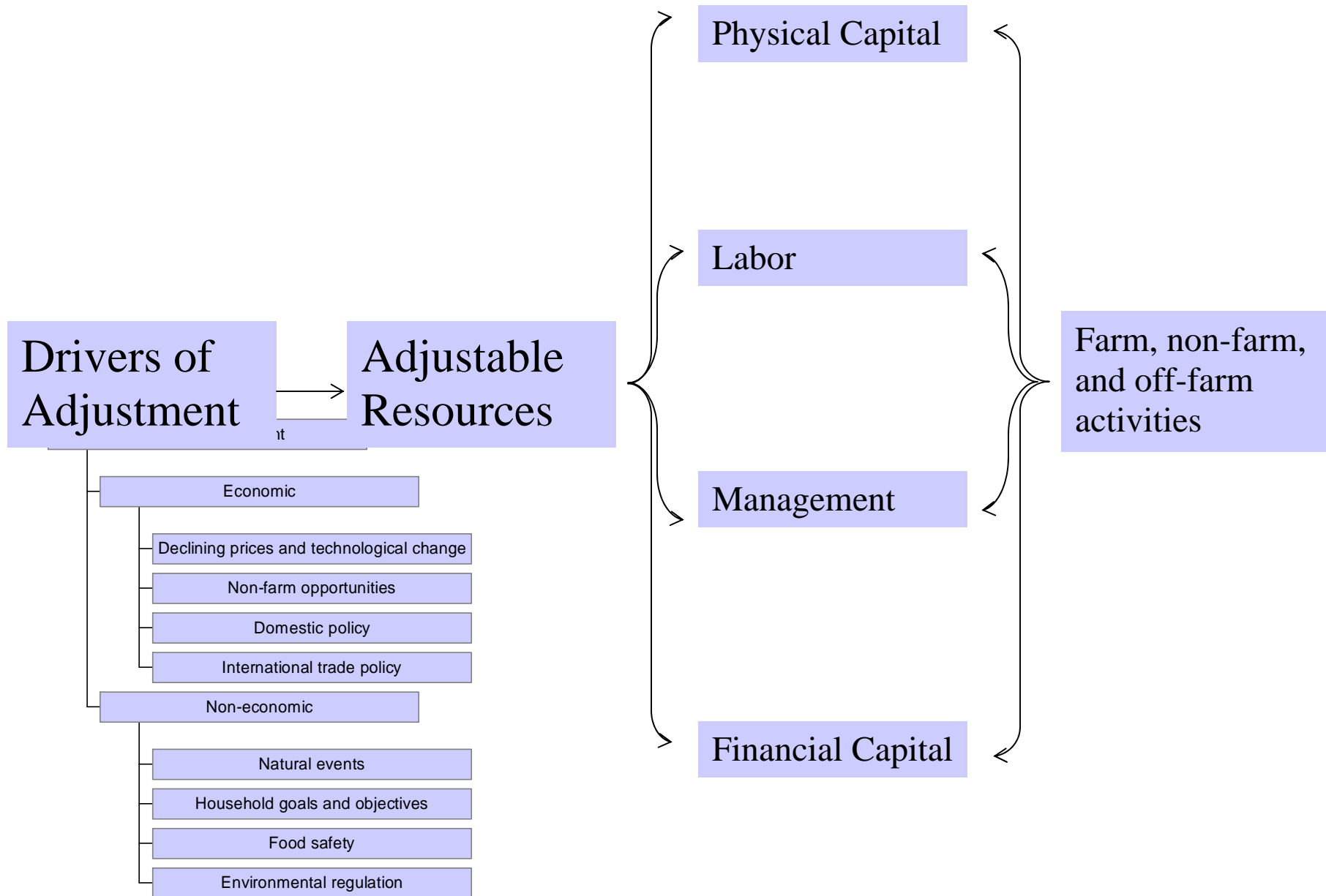


Figure 2. Constraints to household adjustment

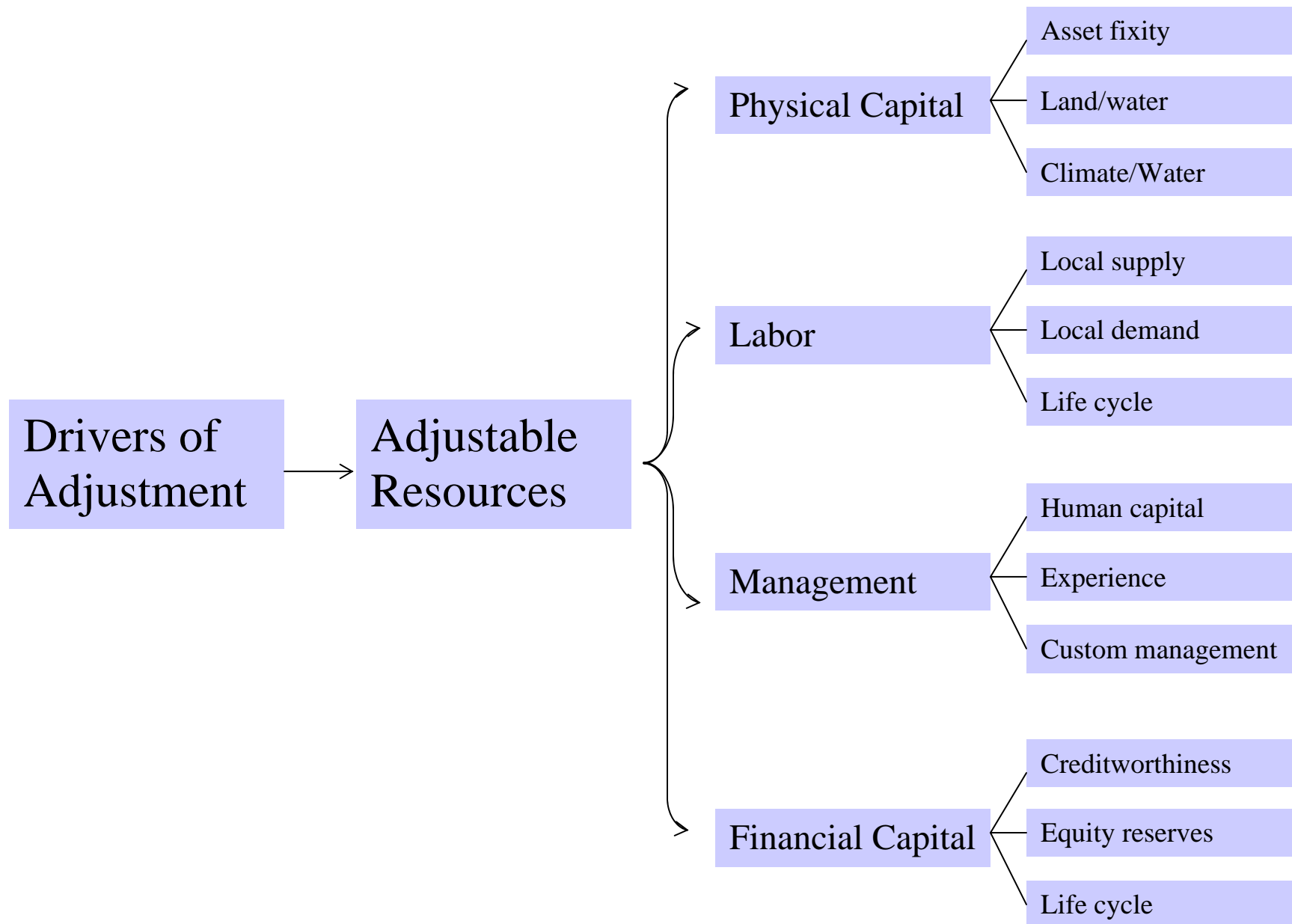
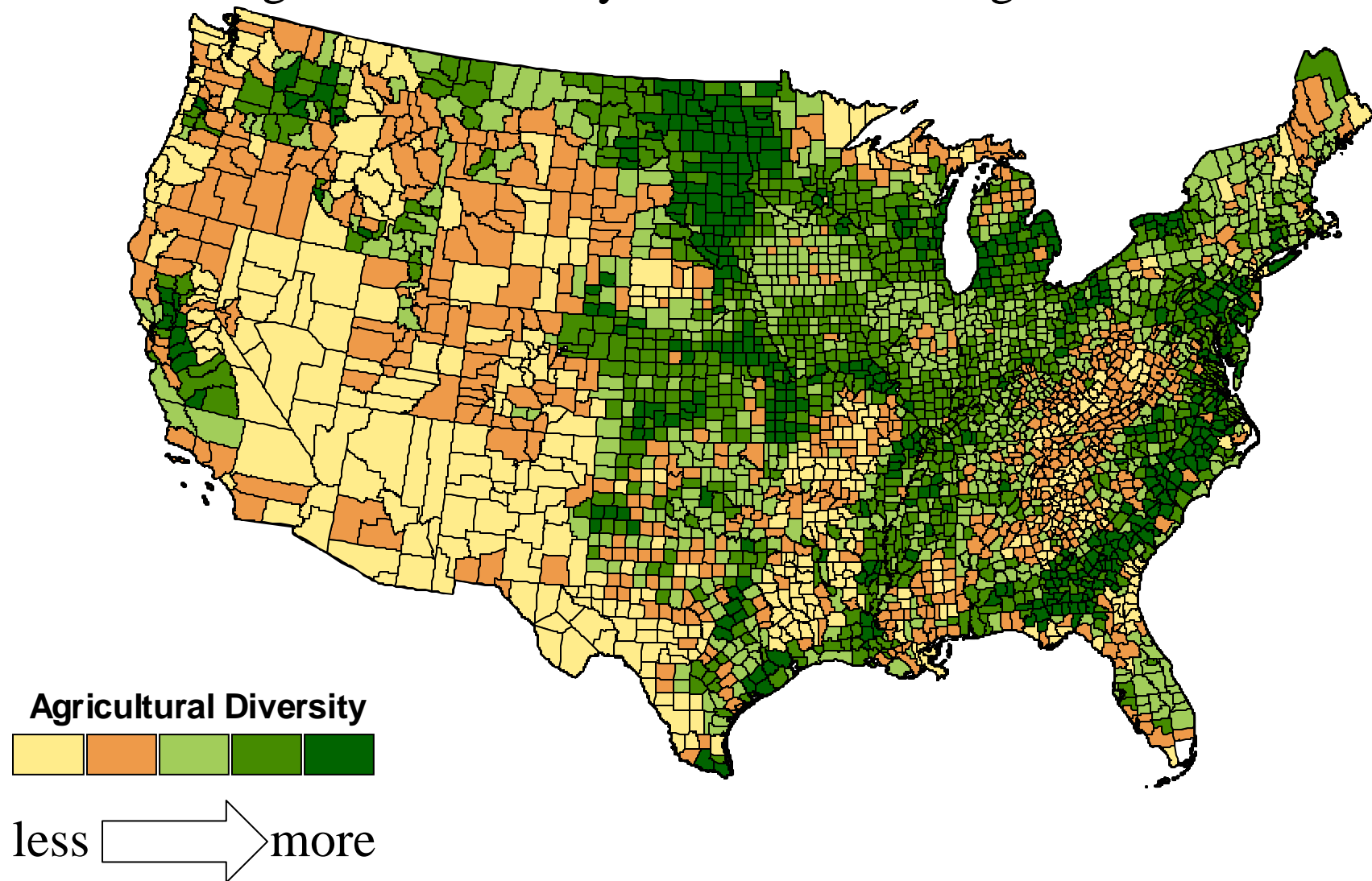
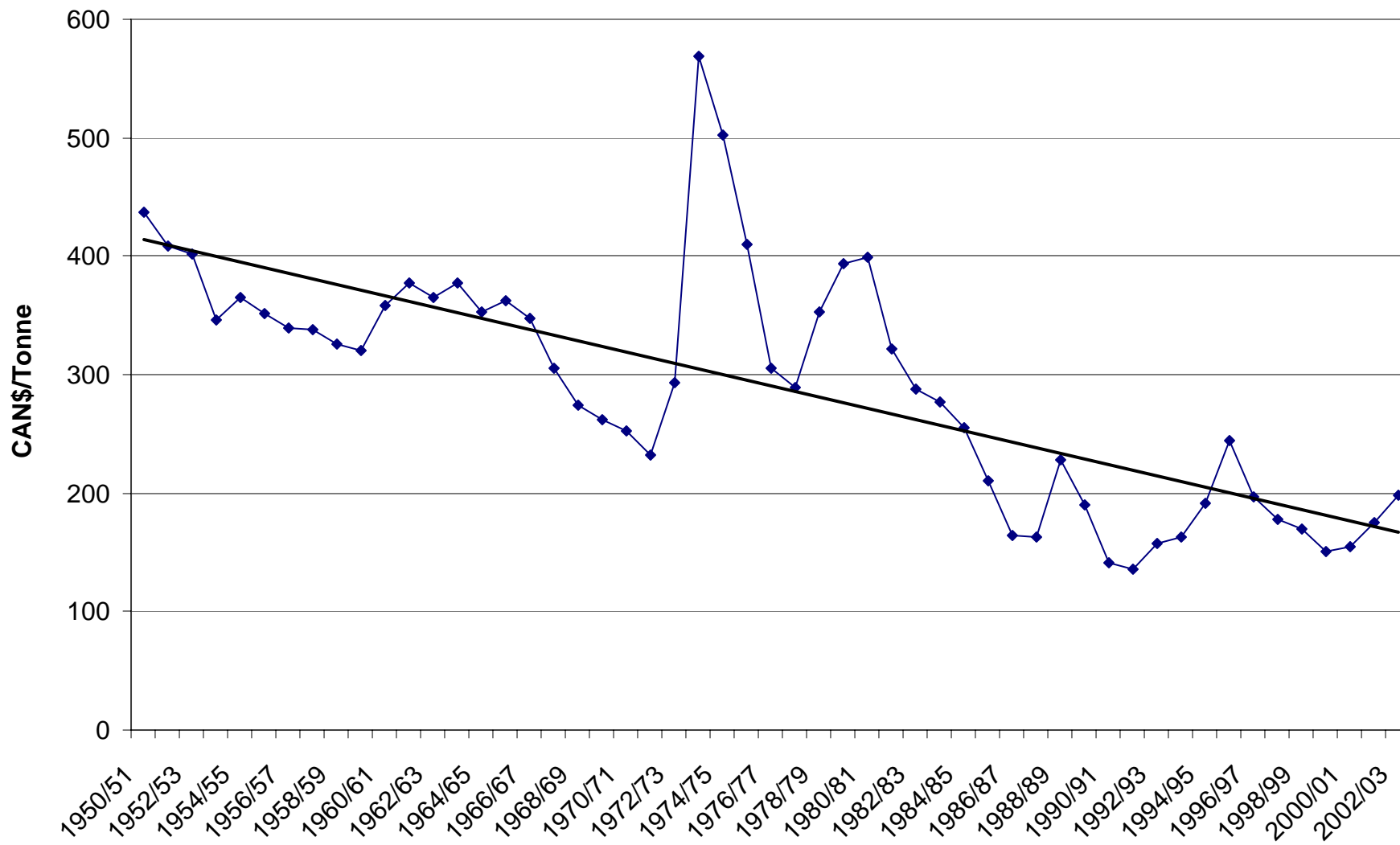


Figure 3. Diversity of land use among commodities



Data: National Resource Inventory,

Figure 4. Real price of wheat (1992/93 Canadian Dollars)



Source: Statistics Canada, data deflated using CPI

Figure 5. Price Index Ratio: Received to Paid: 1910 to 2003

