



**IS GOVERNMENT INTERVENTION IN
AGRICULTURE STILL RELEVANT
IN THE 21ST CENTURY?**

PRESENTED TO
UNION DES PRODUCTEURS AGRICOLES

FINAL REPORT

OCTOBER 2015

REPORT PRESENTED TO

Union des producteurs agricoles

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SUMMARY

Over 75 years after the *farm problem* was coined, agriculture in developing countries has undergone profound structural, social and technological changes that have led some agricultural economists to question whether the farm problem still exists. The farm problem scenario is one in which the supply and demand of agricultural products prevent the sector from maintain an equilibrium. The constant unbalance leads to price volatility and the recurrent incapacity to provide stable and sufficient remuneration for production resources over the long term. In the 20th century, governments adopted intervention measures in the agricultural sector, including agricultural credit programs, agricultural insurance, input subsidies, border protection measures, agricultural surplus management, export support, price and revenue support, supply management, agricultural product marketing measures, etc. More or less articulated from one country to the next, the programs especially aimed to provide agricultural producers with a safety net and create a more stable and more predictable sector that fostered investment and production development.

In questioning the relevance of government interventions in agriculture, this study seeks to revisit the key drivers of these interventions in light of the criticisms in economic literature, the current agricultural context and the new risks to the sector.

A literature review on the topic suggests that the characteristics that are specific to agriculture and which are at the root of the farm problem are still present today. None of the publications that were consulted revealed any significant changes to the supply (production cycles, product perishability, impacts of climate conditions and pests, asset fixity and specificity and the rapid pace of technological innovation) and demand (price and revenue inelasticity, competitive products structure and more concentrated buyers) of agricultural products. Even Gardner (1992), whose work is considered the keystone of farm problem critique, affirmed that “Econometric findings helped buttress the case for the existence, and more importantly for the inevitability of a farm income problem” (p. 97). The main point of contention is that the inequity between farm and non-farm household incomes no longer exists. In fact, in several developed countries, agricultural household incomes are equivalent and sometimes higher than those of non-agricultural families. But is this ground enough to conclude that the farm problem has disappeared? By definition, farm income analyses include the impact of agricultural support measures and tend to demonstrate that intervention serves to offset the effects of agricultural characteristics, at least in part. However, the findings do not make it possible to conclude that the market provides adequate remuneration for sector resources. Furthermore, the high proportion of off-farm income in agricultural households running an unincorporated operation makes it difficult to assess farm and non-farm income parity. When considering total farming incomes excluding subsidies, the figures are often negative and highly variable. Recognizing the progress made in terms of income parity should not occult the increased volatility of a significant number of agricultural markets. This instability, which can causes prices to soar or plummet, disrupts and breaks down the agricultural sector as well as the other links in the agri-food chain. The 2008 food crisis also proved that this volatility could impact consumers—specifically those for whom the purchase of food staples represents a substantial portion of the family income. Still today, the agricultural markets are precarious.

Several examples demonstrate that the volatility of agricultural markets has increased since the early 2000s due to factors that are beyond the control of individual operations and which cannot be foreseen, prevented or mitigated.

- Market globalization causes an upsurge in price volatility and exposes producers to additional risks that they cannot control (e.g. exchange rate changes).
- Climate change increases the frequency and intensity of extreme climate events that can lead to significant financial losses for the agricultural sector and contribute to price volatility.
- There is growing importance placed on biosecurity considerations by consumers and agricultural product purchasers (i.e. food safety) and by producers (i.e. reduced risk of the spread of disease to livestock and crops). Also, the sector is exposed to the risks associated with border and market closings and outbreaks of disease.

There is an international trend towards government disengagement from risk management and a greater reliance on private risk management tools such as futures markets and contracts. While these means may help manage business risks, the market is not able to provide a suite of producer tools to counter the agricultural sector's many risks, specifically the systemic and long-term threats. As it does in other economic sectors that are impacted by market failures, government must continue to play a role in agriculture.

From the perspective of having to feed nine billion people in 2050 in conditions that ensure the sustainability of agricultural resources, government intervention remains relevant in the 21st century. These actions must be renewed to introduce the new social expectations of agriculture as well as the new constraints brought about by resource scarcity and new risks. Intervention must also integrate private risk management options and account for their limitations. Governments will be faced with the crucial issue of creating conditions to foster investment and production development and government actions could mitigate income instability and compensate producers for responsibilities that are insufficiently remunerated by the market (or not remunerated at all). Intervention will therefore support the sector's development at a crucial period when the increase in agricultural product demand may surpass supply for the very first time.

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1. INTRODUCTION

In Quebec and around the world, agriculture is among the rare economic sectors to have its own government department and income security programs. Since the late 1970s, government intervention in agriculture has periodically been challenged, especially in times of budget restraints or agricultural sector booms. Quebec did not escape the trend. In the early 1990s, debates raged over the public finances crisis and the opening up of the markets. In the past few years, stakeholders questioned the significant deficit of the Financière agricole du Québec after a long period of low commodity prices. Whenever the issue is raised, governments seek reflections on the role of income security programs, their objectives and their terms (Saint-Pierre report, *Livre vert pour une politique bioalimentaire*, Groupe de travail sur la sécurité du revenu en agriculture au Québec). More recently, the Commission de révision permanente des programmes (Robillard commission) considered the relevance of provincial government support for agriculture and questioned the level of support allocated to producers as compared to the subsidies provided in other nations and in light of what the commission referred to as the *relatively advantageous economic situation of farm businesses*.

In fact, these reflections on the support for agriculture were formulated without references or an analysis of the reasons for government intervention in agriculture. These fundamental reasons, which were first described and theorized in 1938 by Galbraith and Black, constitute a series of agricultural sector characteristics that make up what has become known as the *farm problem*—the agricultural sector's incapacity to maintain an equilibrium leading to significant price instability and the recurrent failure to provide stable and sufficient remuneration for production resources over the long term. These reasons prompted states to adopt intervention measures in the agricultural sector throughout the 20th century.

Studies have been widely used around the world to justify the implementation of government measures to support agriculture and triggered the development of a series of actions, including agricultural credit programs, agricultural insurance, input subsidies, border protection measures, agricultural surplus management, export support, price and revenue support, supply management, agricultural product marketing measures, etc. More or less articulated from one country to the next, the programs especially aimed to provide agricultural producers with a safety net and create a more stable and more predictable sector that fostered investment and production development.

Over 75 years after the farm problem was coined, agriculture in developing countries has undergone profound structural, social and technological changes that have led some agricultural economists to question whether the farm problem truly exists. In questioning the relevance of government interventions in agriculture, this study seeks to revisit the key drivers of these interventions in light of the criticisms in economic literature, the current agricultural context and the new risks to the sector.

First, section 2 re-examines the farm problem, as it was set out at the turn of the 20th century. It includes a discussion on the characteristics of the supply and demand of

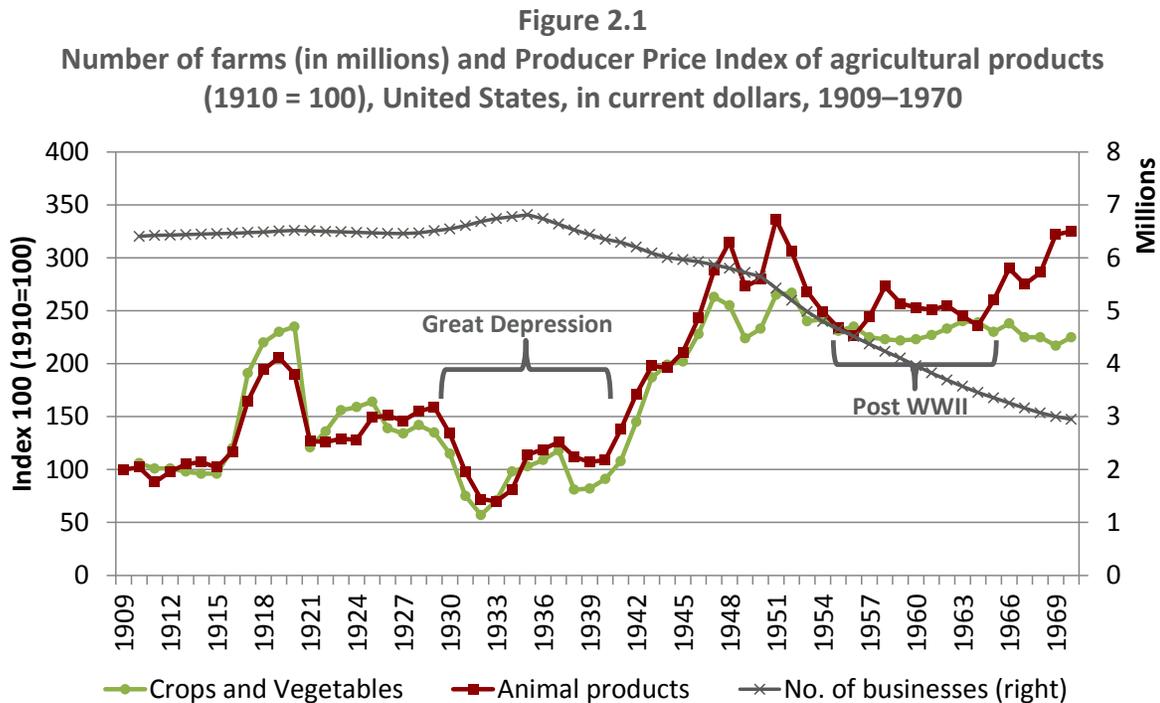
Is government intervention in agriculture still relevant in the 21st century?

agricultural products that make up the farm problem. Section 3 is focused on the new risks in the agricultural sector and their impacts on producers. Section 4 explores the reasons that justify government intervention in the 21st century in the context of modern agriculture and the new risks to which agricultural producers are exposed.

2. RE-EXAMINING THE FARM PROBLEM

2.1 FORMULATING THE FARM PROBLEM

During the Great Depression and in the aftermath of World War II, government intervention in the agricultural sector became generalized. In both periods, commodity prices remained low for extended times (see Figure 2.1), making it difficult to remunerate work and assets. But during the Great Depression, the number of farm businesses in the United States rose constantly, reaching a peak of 6.8 million agricultural enterprises in 1935 (NASS, 2015). The increase, which occurred in spite of the difficult market conditions, led economists to consider this particular situation.



Sources: NASS, *Quick Stats*, 2015; Bureau of Labor Statistics, *Consumer Price Index*, 2015; Author calculations

Galbraith and Black in 1938 and others¹ including Cochrane in 1958 developed a theory to explain why agricultural producers maintained production levels despite difficult market conditions rather than leave the sector, as would be expected in other economic sectors: the farm problem (Bonnen and Schweikhardt, 1998). The farm problem described a series of characteristics that, when combined, lead to persistently low agricultural income, inadequate agricultural asset return and price and income variability or instability. In the course of the 20th century, intervention mechanisms were progressively implemented to mitigate these impacts.

¹ Schultz (1945) and D. Gale Johnson (1947), then Cochrane (1958), G. L. Johnson (1958) and Hathaway (1966).

Since the mid-1900s, there has been considerable development in the sector. Farm businesses are definitely turned towards the markets (commercial farming) and have progressively specialized in one or two crops. The number of operations fell despite an increase in production yields. This consolidation of the agricultural sector combined with the adoption of new production techniques led certain economists, including Cochrane, to affirm that the farm problem was not what it had been in the 1930s². Some economists considered that the farm problem needed to be challenged in light of business expansion and new relations between the links in the sector chain, which were considered to be signs that agriculture had become a profitable economic sector like all the rest. But had it really? And are the characteristics and impacts of the farm problem still present today?

2.2 CHARACTERISTICS OF AGRICULTURAL PRODUCT DEMAND

A certain number of factors that characterize the demand for agricultural products directly impact the volatility of agricultural product prices and income (Gouin, 2004; Hathaway, 1966):

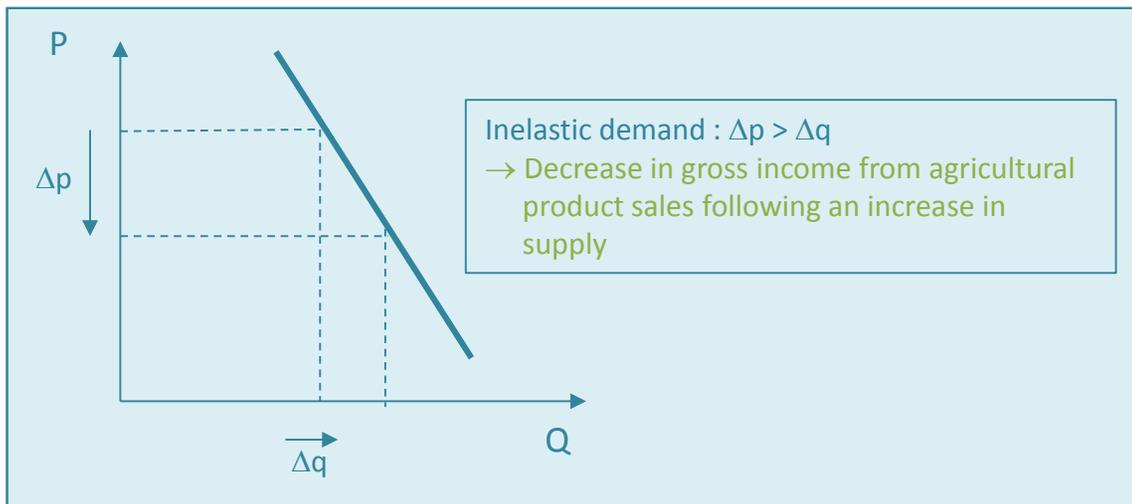
- price inelasticity of demand
- small size of agricultural producers as compared to their market
- income inelasticity of demand
- buyer concentration

PRICE INELASTICITY OF DEMAND LEADING TO SIGNIFICANT INCOME SHORTFALLS FOR PRODUCERS AS PRODUCTION INCREASES

Because food demand levels are limited by the amount of food that an individual can consume in a given period, agricultural product price variations do not usually lead to a proportional variation in demand (Cochrane, 1958). This link between price and quantity is known as the price inelasticity of demand: if there is an overall decline in agricultural product prices, consumers will increase their demand in a percentage less than the price reduction. The demand is therefore price inelastic. This characteristic is not without consequence since it entails a net decrease in the gross income of the agricultural sector (price multiplied by quantity) following an increase in production (Figure 2.2). Producers especially bear the impact of the price inelasticity of demand in good production years, when prices plummet because of ample supply. Price inelasticity of demand creates market instability since slight fluctuations in supply bring about significant variations in price.

² Vocal critics of the existence of the farm problem include Bonnen, Schweikhardt, Gardner, Offut, Hopkins and Tweeten.

Figure 2.2
Inelastic demand for agricultural products



Some authors (Bonnen and Schweikhardt, 1998; Tweeten, 1989) have affirmed that, in the long term, a decrease in prices would lead to a proportional increase in demand and that the sustainable increase in quantity (better yields or acreage increases) should not have a negative impact on sector revenues³. However, using a good or bad annual harvest as an example, price variability caused by the price inelasticity of demand remains a reality in the short term (see also Boussard, 2007). This short-term instability, which is still observed today, is precisely what price and income stabilization programs seek to offset.

The recent evolution in the number of pigs slaughtered in the United States and the price of live swine illustrates this point. Variations in volumes led to greater than proportional increases in prices (Figure 2.3), especially in 2014 when slaughter volumes were affected by mortality caused by porcine epidemic diarrhea (PED). The same analysis applies to grain prices. This volatility can lead to downward and upward adjustments in income.

³ The authors calculated the long-term elasticity of -1.0 for agricultural products: a decrease (increase) in supply leads to an exactly proportional increase (decrease) in price and therefore a neutral effect on gross income.

Figure 2.3
Monthly hogs slaughter and hogs price, US, January 2012 to February 2015
 (index 100 = January 2012)



Source: USDA, NASS, 2015

SMALL SIZE OF AGRICULTURAL PRODUCERS AS COMPARED TO THEIR MARKET

While the aggregate demand (total consumption) is inelastic, individual producers face perfectly elastic demand since each one will be paid the same price for each product unit delivered to a buyer, regardless of the volume he/she puts on the market (Gouin, 2004). In fact, the volume brought to market by one producer is generally minimal in relation to the total volume and the increase in the amounts produced will not impact the market results. Agricultural producers then find themselves in a situation in which they are price takers. The impact of these circumstances is significant since each producer perceives that an increase in production will lead to a corresponding increase in gross income because one person does not tangibly influence the market (no impact on prices). However, if all producers have the same perception for the same production in the same year, there will be a significant increase in supply and a decline in gross income in the sector because of the price inelasticity of demand. There is therefore a contradiction between a producer's perception of the market and the overall result of the sum of the individual actions, which are entirely rational. Despite the increase in the size of farm operations since the 1950s, the authors consulted as part of this report did not question this characteristic of agriculture. The production sector remains an atomistic one of price takers.

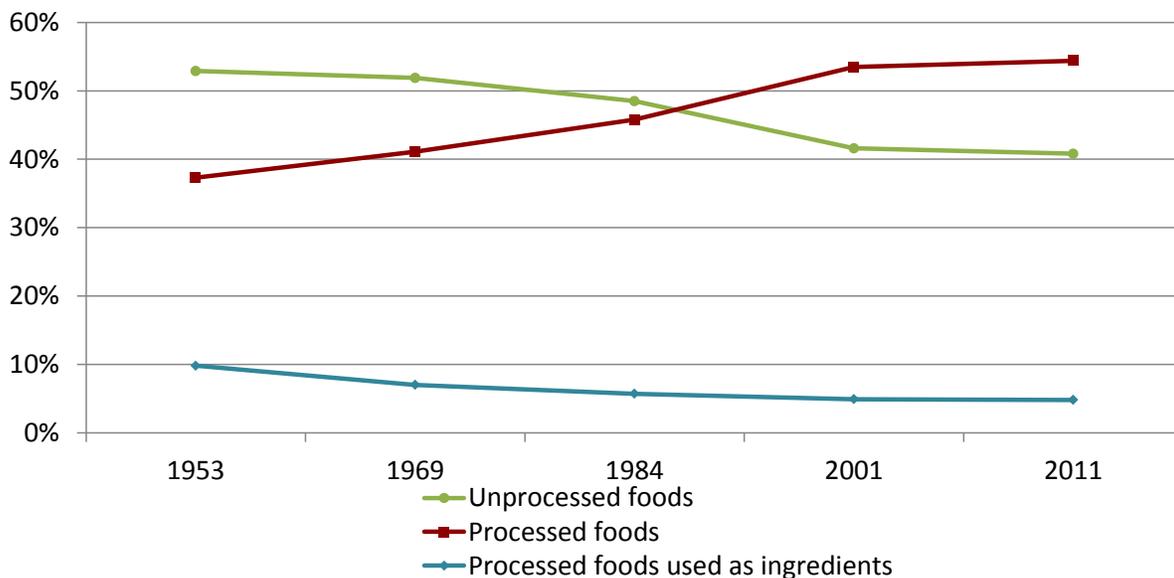
INCOME INELASTICITY OF DEMAND

In developed countries, an increase in consumer incomes will lead to a lesser increase in food consumption. However, a consumer whose income doubles will not consume double the amount of food. In economic terms, the link between a consumer's income and his/her demand for a given product is income elasticity. In general, in developed countries, the income elasticity of agricultural products is less than one and therefore inelastic. A consumer whose income increases will spend more on food but will not consume more food products. Rather, these consumers will tend to change their eating habits, consume a higher number of processed foods and eat outside the home. This increase in food spending has no effects on

the total demand of agricultural products: consumers do not eat more but will eat differently. As observed by Klatzmann in 1972, food spending increases but the processing sector is the one that profits.

Figure 2.4 illustrates the evolution of the profile of food consumption by Canadian consumers. Since 2001, spending on consumed processed products (cheese, ham, jam, bread, cake, etc.) surpasses spending on unprocessed products (produce, milk, etc.). The same type of profile has been observed in all developed nations. In general, producers do not earn more for agricultural products used to manufacture processed foods and will therefore not benefit from the added value of the processed product. The authors consulted as part of this report did not questioned this characteristic of agriculture.

Figure 2.4
Proportion of the food budget of Canadian households spent in food stores according to the level of processing of food products, 1953–2011



Note: Based on a classification of spending by Canadian households in food stores from five household spending surveys according to the level of processing of products. The data for 1953 and 1969 are from studies conducted in major urban centres.

Source: Moubarac et al., 2014

The consequence of the characteristic is that food demand in developed nations increases at a slower pace than agricultural product supply, which follows the pace of productivity gains, therefore **keeping agricultural product prices low in real terms**, all other things being equal.

BUYER CONCENTRATION: STRONGER BARGAINING POWER THAN AN AGRICULTURAL PRODUCER

The final characteristic of agricultural product demand that makes up the farm problem is the concentration of agricultural product buyers. In 1938, Galbraith and Black were the first to describe the impacts of the concentration: unequal power relations between producers and buyers and, as a result, the limited bargaining power of agricultural producers. Galbraith and

Black affirmed that producers are relatively small as compared to the original buyer of their products. Since they are so few, buyers can impose conditions that are unfavourable to producers when no regulations are in place. Producers, who are often scattered across the territory, sometimes have limited options when they refuse a buyer's offer.

Despite the structural evolution in the agricultural sector and the decrease in the number of farm operations, Doyon and Sanchez (2007, p. 17) stated that many studies show the exercise of market power with regards to agricultural producers by processors and distributors. By comparing agriculture in Quebec in 1956 and 2006, Doyon and Sanchez determined that, in 2006, without regulations, agricultural product buyers still exercise market power over producers and can impose conditions of sale.

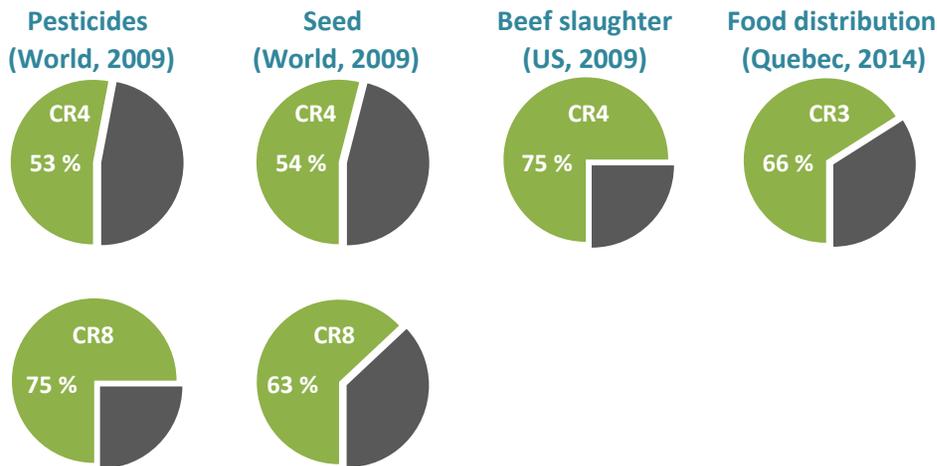
The degree of inequality in the balance of power varies from sector to sector. For example, grain farmers in Montérégie have several options to market grain since there are many competing buyers. Producers also have the option to store grain and sell it at a more favourable time. However, pork, cattle and lamb producers often only have one or two options (depending on the number of slaughterhouses nearby) and very little latitude to sell the products at another time. This is also the case for highly perishable products such as berries and lettuce, for example. This characteristic drove producers to join forces as cooperatives, marketing boards (and Quebec's *plans conjoints*) and farmer unions. Laws and regulations to govern transactions and contracts between producers and buyers have also been implemented around the world to counterbalance the situation. In Quebec, the *Act respecting the marketing of agricultural, food and fish products* aims to grant agricultural producers the power to negotiate and determine the marketing terms and conditions for their products.

Though the main authors who have discussed the topic (Cochrane, 1985; Gardner, 1992) highlight the increase in the size of farm operations, they conclude that producers still face unfavourable conditions imposed by buyers.

On the contrary, the speed at which operations upstream and downstream of production were consolidated was much faster than that of agricultural production. In major western countries, the sectors that provide inputs for agricultural production (animal feed, machinery and equipment, seed, fertilizers and pesticides), primary processing (slaughter, grain processing), distribution and retail are increasingly concentrated and integrated, heightening their oligopolistic nature. Internationally, the four key stakeholders in the pesticides industry generated over half (53%) of the total sales in 2009, and the eight major players were responsible for 75%. In the seed sector, the concentration ratios are similar: 54% for the four largest companies and 63% for the eight largest⁴.

⁴ FUGLIE, K. O. et al., *Research Investments and Market Structure in the Food Processing, Agricultural Input, and Biofuel Industries Worldwide*, ERR-130, U.S. Dept. of Agriculture, Econ. Res. Serv., December 2011.

Figure 2.5
Concentration indicators in the agri-food sector, 2009 and 2014, various regions



Sources: USDA-ERS, *Feedstuffs*, December 2011; MAPAQ, *Bottin statistique de l'alimentation*, 2015

US BEEF SLAUGHTER SECTOR

In the US, the four largest slaughterhouses—Tyson, Cargill, JBS and National Beef Packing—process 75% of the beef that is slaughtered. In addition to carrying out activities around the world, the corporations occupy predominant positions in the slaughter of several species (JBS is the second largest pork and poultry slaughterhouse in the US and the largest beef slaughtering company in the world) and in other links in the agri-food chain, including the marketing and processing of grain (Cargill is the world’s largest flour producer and a major player in corn and soy processing and chocolate manufacturing)⁵.

The businesses upstream and downstream of production are therefore converging, either through direct ownership or strategic partnerships.

The small number of buyers also constitutes a risk for agricultural producers from the perspective of their market outlets. The 2014 closing of a Heinz ketchup plant in Leamington, Ontario illustrates the vulnerability of producers operating in a sector with few buyers. Heinz alone purchased 40% of Ontario’s tomato production, which was only a very small portion of the multinational’s total supply but moved its processing activities to other plants across America. The closing of the plant caused market losses for the producers that supplied the plant and led to a dramatic decline in specialized assets (i.e. those that could only be used in tomato production) and significant conversion costs.

⁵ 2009 data: High Country News based on *Feedstuffs data*, Reference Issue and Buyers Guide, 2011; Center on Globalization Governance and Competitiveness, *A Value Chain Analysis of the U.S. Beef and Dairy Industries*, Duke University, 2009; and USDA. Available online: <https://www.hcn.org/issues/43.5/cattlemen-struggle-against-giant-meatpackers-and-economic-squeezes/the-big-four-meatpackers-1>

Key points

- Agricultural product prices are highly reactive to variations in quantity brought about by the price inelasticity of demand. An increase in supply may therefore lead to a major drop in prices.
- The demand for agricultural products does not increase as household incomes in developed countries rise. The productivity gains are often greater than the increase in demand, leading to lower prices in real terms.
- There is an interest for individual agricultural producers to increase their production to boost their income. However, collectively, if each individual business increases its offer at the same time, gross incomes will decline.
- Individual agricultural producers have little bargaining power, which oftentimes makes them vulnerable in relation to more concentrated buyers and their suppliers and explains the development of cooperatives, marketing boards and unions.

2.3 SPECIFIC CHARACTERISTICS OF AGRICULTURAL PRODUCT SUPPLY

Like the demand for agricultural products, supply involves a series of characteristics that impact sector variability and income levels and, by the same token, sector businesses. The characteristics of agricultural product supply limit the capacity of the production sector to quickly adjust to changes in market signals.

The characteristics of supply that contribute to the farm problem are (Gouin, 2004; Hathaway, 1966):

- production cycles leading to supply and demand imbalance and short-term price inelasticity of supply
- the perishability of agricultural products
- the impacts of climate conditions and the incidence of pests
- asset fixity and specificity
- the rapid pace of technological innovation

SUPPLY AND DEMAND IMBALANCE OR THE COBWEB THEOREM: WHEN PRODUCERS CANNOT INSTANTLY ADJUST THE SUPPLY

Several combined factors create a constant supply and demand imbalance. First, **production cycles caused by the biological nature of agriculture** can sometimes lead to significant lag times between the moment when a producer makes production decisions and the time when the production is brought to market. Production decisions are therefore seldom based on market conditions at the time the product is sold but rather on conditions at the start of the production process (Ezekiel, 1938; Hathaway, 1966). This is the case, for example, of field crop producers who must make decisions in spring (or earlier) on what they will plant and harvest in the fall. It is also the case for producers who choose to increase the size of their breeder flocks. This constant gap between market conditions and the quantities produced

creates an imbalance between market supply and demand and price fluctuations. This is what Ezekiel (1938) referred to as the *cobweb theorem*.

SHORT-TERM PRICE INELASTICITY OF SUPPLY (HATHAWAY, 1966)

Agricultural production cycles occur because agricultural production is a relatively slow process that is difficult to interrupt. For example, an apple tree will take three to five years before it becomes productive and a cow must be approximately 30 months old to produce milk. The consequence of these biological realities is that it can be difficult and even impossible for agricultural producers to quickly adjust supply in response to price terms. This characteristic is known as the price inelasticity of supply and illustrates how a variation in agricultural product price will lead to a less than proportional variation in product supply. It was described by Galbraith and Black in 1938 and several others, including Boussard (2007) who stated that agricultural economists still unanimously agree on the issue.

The example of the American beef sector from 1986 to 1993, when beef prices rose and remained relatively high, serves to illustrate the imbalance created by the gap between production decisions and product marketing (Figure 2.6). In response to the high prices, producers maintained their breeding herd at high levels and cull cow slaughter fell by approximately 35% in the period. However, beginning in 1993, prices dropped with the increased supply of beef available because of the large breeding herds. The decline in price led to an increase in cull cow slaughter—a sign that market conditions were less favourable and that herd numbers would drop. Smaller herds curbed beef supply in the longer term.

As the offer decreased, prices rose again a few years later. Again, there was an incentive for farmers to expand their herds and slow the slaughter of cull cows. Producers in this situation were forced to make decisions based on market conditions that were sure to evolve by the time the product was brought to market. The long production cycles in beef production (three years to raise a heifer and market its calf) made the adjustment all the more difficult.

Figure 2.6
Cull cow slaughter (millions of head) and beef prices in USD (100 lb. carcass weight), 1986–2013



Note: Prices for 1986 to 1996 are average monthly prices

Sources: USDA, NASS, 2015 and author calculations

Improved transmission of information to producers through the development of new means of communication should facilitate adjustments to future market conditions. Still, as stated by Gouin (2004), the significance of uncontrollable factors (e.g. climate conditions) makes decisions based on market forecasts risky. Producers make rational decisions but market conditions can change at any time due to factors that are beyond their control, creating market instability. In fact, even the development of futures markets for farm commodities meant to accelerate and democratize information sharing on markets did not stabilize market conditions. Successive spikes in cereal prices in 2008 and 2012 and the collapse of dairy product prices on the international market in 2009 and 2015 illustrate the phenomenon.

PRODUCT PERISHABILITY: THE IMPOSSIBILITY OF POSTPONING SALES UNTIL CONDITIONS ARE MORE FAVOURABLE

The fact that agricultural products are perishable is an additional challenge to supply-demand adjustments. If products could be stored when prices were low to take advantage of more favourable market conditions, it would be possible to adjust the sales volumes based on demand to ensure price stability, as is done for metals or computer parts, for example. But few agricultural products can be stored over long periods (vegetables, berries, etc.) and the animals meant for slaughter cannot be kept at the farm beyond their optimal selling weight without producers incurring higher costs (feed, space that cannot be used for another animal, target selling weights, etc.). While substantial improvements to means of transportation and the cold chain have made it possible to preserve agricultural products for

longer periods, no expert has questioned the perishable nature of agricultural products and the impacts on producers.

EXAMPLE OF PIGS AWAITING SLAUGHTER

The repeated episodes of pigs awaiting slaughter in Quebec illustrate the situation. Should there be a labour dispute or a seasonal variation in production, there may be excess supply in relation to a region's slaughter capacity. The surplus will stall pig delivery and the animals will be forced to spend more time at the farms and possibly exceed their optimal slaughter weight and yield a lower price for the producer per kilo⁶. Slaughterhouse swamping has occurred often in Quebec. The most recent episode was in August 2015. Without the terms set out in the sale agreement between the producers and the slaughterhouse, the producers who were directly affected would have experienced a significant loss of income.

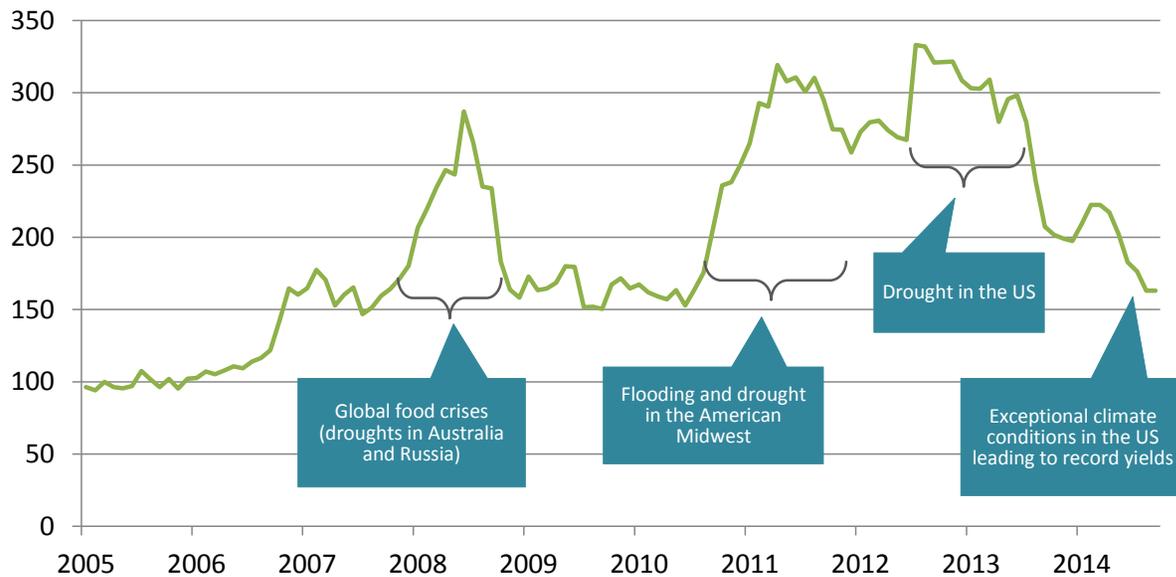
CLIMATE CONDITIONS AND PESTS: UNPREDICTABLE, UNCONTROLLABLE RISK FACTORS

Climate conditions and other production factors that are difficult to control (disease, pests, etc.) are also characteristics of agriculture that lead to market instability (Galbraith and Black, 1938). Even if producer decisions were made based on knowledge of future markets, bad or exceptional climate conditions and outbreaks of diseases and pests can lead to overproduction or underproduction that will cause major fluctuations in prices and market instability. For example, poor weather conditions in Australia and Russia in 2008 and in the US in 2010 and 2013 led to (or contributed to) skyrocketing prices for corn and other cereals and oilseeds (see Figure 2.7)⁷. Producers therefore face production risks that are entirely out of their control. Conversely, exceptional weather in the US in 2014 led to record yields and prices plummeted by 50% in less than 12 months.

⁶ In Québec and around the world, slaughter animals are generally valued according to a target weight grid with higher prices per kg for the target weight sought by the buyer and lower prices for animals over or under the target weight.

⁷ The example of 2014 PED epidemic in the US mentioned previously (see Figure 2.3) also serves to illustrate the phenomenon.

Figure 2.7
Monthly evolution of the world price for maize from January 2005 to September 2014



Source: World Bank, 2015

Only Boussard and Sassi (2001) questioned whether the issue was specific to the agricultural sector. In their 2001 publication, they stated that these considerations also applied to other sectors (tourism, specifically) and that climate disasters are never extensive enough to impact markets. When food prices spiked in 2008, 2011 and 2012 (see Figure 2.7) after challenging weather episodes, the authors eventually changed their opinion. It can therefore be argued that modern modes of transport may have fostered regional specialization and a greater dependence on the international market. Schweikhardt (2000) affirmed that unfavourable climate conditions in a prominent producing area could shock international markets and, by the same token, impact local markets that are more significantly integrated into the international ones. The 2008 food crisis and the California drought in 2014-2015 corroborate this theory.

ASSET FIXITY AND SPECIFICITY: ASSETS TEND TO REMAIN IN AGRICULTURE EVEN IN CHALLENGING PERIODS

Other than the factors described above (production cycles, product perishability, climate conditions and disease), certain characteristics of the assets used in agricultural production also contribute to instability. These characteristics are asset fixity and specificity, which lead to the **immobility of agricultural resources** (Gouin, 2004).

Economic theory asserts that when market conditions in an economic sector temporarily become less advantageous, businesses should curb their production or leave the sector to allocate their resources to more profitable sectors by selling part or all of the business' assets. The metaphor of the *invisible hand* described by Adam Smith in conventional economic theory depicts the approach. However, the phenomenon is not observed in agriculture.

Johnson (1958) was the first to highlight the impact of the **specificity of agricultural assets**⁸ as hindering adjustment. Because agricultural assets are production-specific (milking machines in dairy production, hog houses in swine production and harvesting equipment for field crops), their value varies significantly based on market conditions in the sector to which they belong. When prices are low, producers tend to keep their depreciated assets to reduce the downward adjustment of production. But maintaining the amounts produced will keep prices low.

The new trends in agri-food to develop value chains and differentiate agricultural products intensify the phenomenon of asset specificity since marketing differentiated agricultural products generally requires the adaptation of production methods and sites (free-range chickens, organic production, enriched cages, etc.), which involve specific investments (Schweikhardt, 2000). The specificity of the assets is therefore augmented by the drive to differentiate production and adds to the challenge of production adjustment when prices are low.

Several agricultural sectors are also characterized by **significant fixed costs** in proportion to the variable costs of production. This characteristic compels producers to continue to produce even when prices are low. According to economic theory, an operation will remain in production in the short term as long as it is able to cover its variable costs, even if it cannot cover its fixed costs. The phenomenon is an intuitive one: as long as income covers direct production expenses, a business will continue to produce if it anticipates that market conditions will improve (and be profitable) and that it can ensure the returns of its fixed costs (which is generally the case if the operation is not experiencing financial difficulties). An industry such as agriculture in which fixed costs are proportionally high as compared to total production costs may therefore experience a more significant reduction in price as compared to other sectors without producers abandoning production.

AGRICULTURAL WORK: A FIXED ASSET AND LIFESTYLE

In the economy in general, labour costs are considered variable and may be adjusted based on production. In agriculture, or at least in the sectors characterized by family-run operations as is the case of most farms, remuneration for work carried out may be likened to a fixed cost since the farmer and his/her family often do not have many working alternatives outside agriculture and especially because a career change for a producer generally involves significant adjustments including family relocation and the end of the farm lifestyle, often irreversibly (Cochrane, 1958). Producers' attachment to the agricultural lifestyle, agricultural skills that are difficult to transfer and the few jobs available near farm operations (Tweeten, 1989) are all factors that compel farmers to accept low incomes for long periods before resigning themselves to abandoning agriculture. In sum, unlike other activity sectors, work mobility in agriculture is low and cannot be considered as a short-term adjustment since it involves a definitive, consequential change. Haagsma and Koning (2005) even mentioned that the phenomenon also occurs with the children of producers, who will accept lower incomes in order to ensure the continuity of a family business. This fixity of agricultural work adds to the immobility of farm assets and the maintenance of agricultural supply even when prices are low.

⁸ For example, there are few use options for a milking robot outside dairy farming.

That said, Haagsma and Koning (2005) also affirmed that the rise in individualistic values and the increasing contribution of non-farm revenue to agricultural household incomes diminish the attachment that the children of producers may have to the agricultural lifestyle. The authors believe that these changes curb the specificity and fixity of agricultural work. While the argument that an increase in non-agricultural revenue can reduce the fixity, a lesser attachment to the agricultural lifestyle does not resolve the issue of tolerance in periods of low prices once an individual has made the decision to operate a farm, which remains a long-term commitment. Regardless whether the permanent nature of agricultural work is considered justified or not (not the topic of interest here), the phenomenon remains an observable reality that impacts the rigidity of agricultural product supply, the possibility of adjusting production based on market conditions and price volatility, as a result.

RAPID PACE OF TECHNOLOGICAL INNOVATION

The final distinctive characteristic of the agricultural sector is the rapid pace of technological innovation. Cochrane (1958) developed the *agricultural treadmill* model to explain the impact of technological innovation on agricultural price and income levels. An innovative producer who is the first to adopt a new technology to reduce production costs will gain a competitive edge. In agriculture more so than in other economic sectors, technological innovations generally aim to increase production rather than rationalize costs, especially since land availability is limited (doing more with the same rather than doing the same with less). Innovative producers will therefore have lower production costs and sell their products at the same price as competitors (as a price taker), gaining an additional economic profit on each unit brought to market. The other producers will then tend to adopt the new technology, which will reduce their production costs and increase their production. As producers implement the new technology, the amounts produced will increase. And because demand is inelastic to price (see section 2.2), a rise in the amounts produced will lead to a greater than proportional drop in price and therefore lower gross income in the sector (Klatzmann, 1972). The development of new grain crops in the 1970s and until the 1990s in developing nations illustrates this situation⁹. The new varieties led to substantial increases in yield but not to a proportional increase in demand. The result was a decrease in prices, which weakened businesses that had not planted the new varieties and which, for the most part, were smaller producers (IFPRI, 2002). Due to the immobility of labour in agriculture, producers with lower yields that do not adopt new technologies will tend to stay in business until retirement, thus maintaining agricultural product supply.

As stated earlier, Bonnen and Schweikhardt (1998) and Schweikhardt (2000) affirmed that, in the long term, demand would not be inelastic and that the increase in quantity brought about by innovation should lead to a reduction that is at least equal or less than proportional than price and therefore maintain gross income in the sector. Bonnen and Schweikhardt (1998) note that the adoption of a new technology could prove profitable for innovative producers but that the widespread adoption of the new technology would not have a negative impact on gross revenue in the long term.

⁹ Rice and wheat yields doubled in the period (IFPRI, 2002).

Key points

- These characteristics of agricultural product supply hinder the sector's capacity to quickly adjust to new market signals.
- Production cycles create a persistent lag between market conditions and the amounts produced since producers cannot immediately adjust their production to market signals, bringing about a constant market imbalance and significant price variability.
- The perishability of agricultural products makes it impossible to delay their sale. Producers therefore cannot wait for more favourable prices to sell their production.
- Variable climate conditions and episodes of disease can lead to significant variations in market prices and expose producers to risks that are unpredictable and uncontrollable.
- Agricultural assets (equipment, machinery and buildings) and labour are very specific. This specificity limits the sector's capacity to adjust to market conditions: assets and labour cannot be easily migrated to another economic sector when conditions are no longer favourable and delay the return to more favourable conditions.
- The rapid pace of technological innovation contributes to the increase in the expansion of the entire offer of agricultural products, which, faced with inelastic demand, tends to keep prices low. Only innovative producers (early adopters) gain additional profit.

In the past 20 or 30 years, several authors have doubted certain factors in the farm problem and even questioned its very existence¹⁰. However, after analyzing the critiques, it seems that the demonstration has yet to be fully made. In fact, most of the intrinsic characteristics of agriculture remain, making it difficult to adapt the supply to the demand. Specifically, agricultural products are not any less perishable. Their production cycles cannot be stopped and their distribution channels are still highly concentrated. Even considering new market structure approaches (opening up of markets, larger operations), the agricultural sector still carries the basic characteristics of the farm problem. In addition, new characteristics leading to risks and instability have emerged in recent decades. The next section focuses on these new features and their impacts.

¹⁰ Annex 1 includes a summary table of farm problem characteristics and the components that experts have questioned.

3. NEW SOURCES OF RISK IN AGRICULTURE

While several authors question some of the factors that characterize agriculture, they do not conclude that there should be no government intervention in the sector. In fact, experts note the emergence of new characteristics for which government intervention is required: these new sources of risk create volatility and costs for the production sector and include:

- market opening and globalization
- climate change impacts
- biosecurity considerations
- biodiversity loss
- increasing importance of environmental considerations

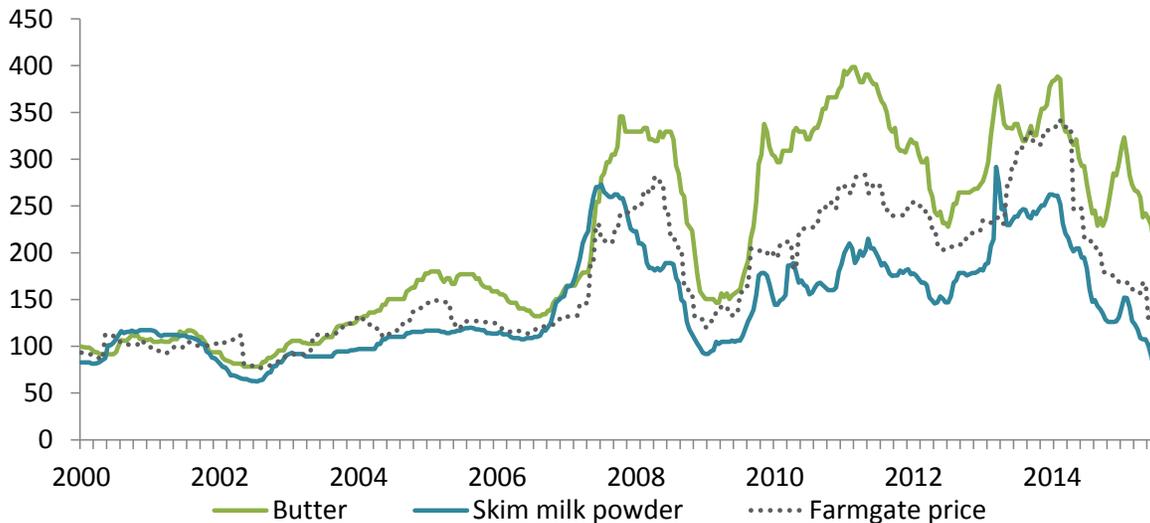
3.1 MARKET OPENING AND GLOBALIZATION

Schweikhardt (2000) and Boussard (2007) affirm that more open markets can exacerbate market imbalance and price condition variability. Boussard (2007) states that in an international market created through the partial merger of two local markets with the same market conditions, price uncertainty and production levels will intensify price volatility. When this type of situation occurs, the producers in the two countries will react to the same incentives, thus increasing the supply-demand imbalance. According to Boussard (2007), this scenario and other possible international market shockwaves require specific government intervention. Schweikhardt asserted that, in certain circumstances, market openness can lead to greater market sensitivity to climate conditions. Government intervention must therefore be re-examined based on the new challenges faced by agricultural producers (Schweikhardt, 2000).

The situation in the dairy sector illustrates this reality. Since the early 2000s, dairy prices on the international market have become increasingly volatile (Figure 3.1) due to several factors: droughts in Australia and exceptional production conditions and economic slowdown in China. For a country like New Zealand, which exports 95% of its dairy production, fluctuations on the international market directly impact production prices. While the country produced only approximately 3% of the global dairy production, it is responsible for some 30% of international dairy exports¹¹. New Zealand's significant dependence on the international market means that producer incomes will fluctuate considerably, much more so than in the past.

¹¹ Excluding trade within the European Union. According to FAO, approximately 13% of dairy production is exported internationally as compared to some 8% in the early 1980s. See <http://www.fao.org/docrep/015/an450e/an450e00.pdf>.

Figure 3.1
Price of butter and skim milk powder in Oceania
and farmgate price of milk in New Zealand (USD, index 100 = 2000)



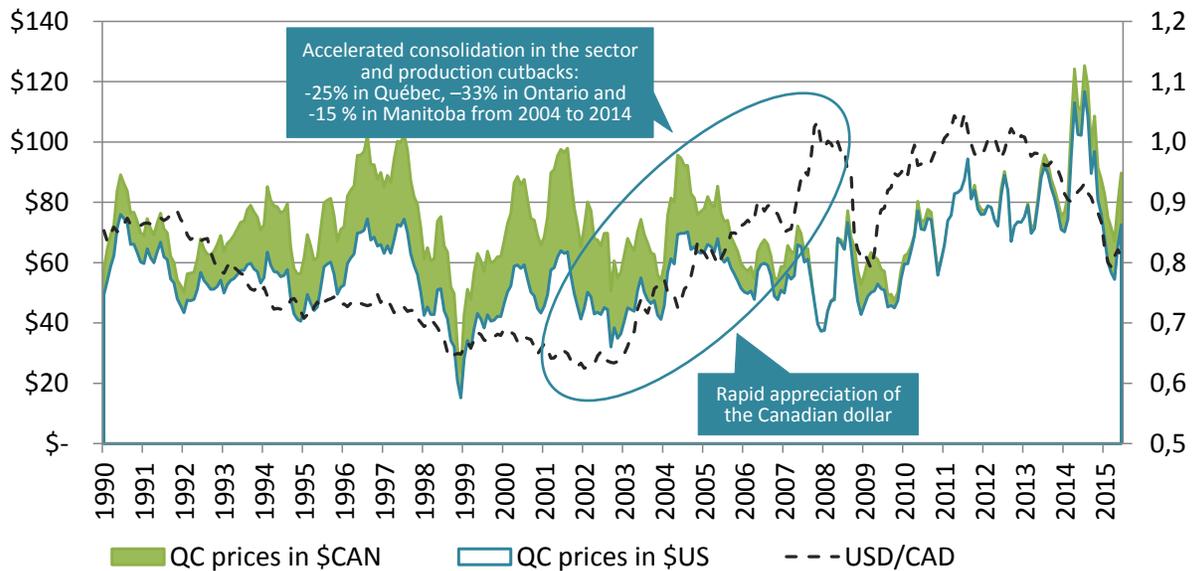
Sources: Agricultural Marketing Service, 2015; Statistics New Zealand, 2015; Ministry of Agriculture and Forestry of New Zealand, 2015; CLAL, 2015, from UK–Milk Development Council

In addition, in an open market, producers face other sources of instability including variations in exchange rates and other corollaries of monetary policies (Schweikhardt, 2000). The price of a product sold on an open market will fluctuate as exchange rates evolve. Agricultural producers must then cope with new characteristics over which they have little control and which are not linked to supply-demand conditions in the sector.

For example, in the hog market in Quebec, a strong Canadian dollar decreases the price received by producers because the hog market is open and prices are usually set in US dollars (Figure 3.2). From 2004 to 2008, the price received by Quebec pork producers fell by over 50%, especially because of the appreciation of the Canadian dollar as compared to the American dollar: the Canadian dollar rose by just over 40% from US\$0.70/CAN\$1 to parity. But the price of pork in US dollars did not fall, and the strength of the Canadian dollar prevented producers in Quebec and across Canada from benefitting from better price conditions on the international market, in which prices are in American dollars, and significantly curbed their competitiveness. The fast pace and extent of the evolution in exchange rates led to the loss of many operations that could not withstand the unfavourable price conditions over such a long period. These factors also led to national production cutbacks in Canada that were aggravated by the adoption of the US country-of-origin labelling regulations. From 2002 to 2014, the number of hog farms fell by 32% in Quebec, 48% in Ontario and 66% in Manitoba. At the same time, after hitting a peak in 2004, the number of sows had dropped by 25% in Quebec, 33% in Ontario and 15% in Manitoba in 2014¹².

¹² Statistics Canada, tables 003-0089 and 003-0004

Figure 3.2
Hogs prices in Quebec in Canadian and US dollars and exchange rates (USD/CAD), 1990 to 2015



Sources: Statistics Canada, *Table 002-0043*; Bank of Canada

Market globalization also makes the agricultural sector vulnerable to geopolitical risks. The recent Russian embargo on food imports from certain western countries including EU nations, the US and Canada, illustrates the risk. Declared in August 2014 and still in effect, the embargo was in reaction to the economic sanctions imposed on Russia by the west after military action in Ukraine. The European Union was especially impacted by the embargo since Russia is a major trade partner for several agricultural products such as butter (28%), cheese (33%), fruits and vegetables (29%), pork (20%) and beef (25%). For these product categories, Russia represented 20 to 33% of non-EU exports in 2013. From August 2014 to July 2015, the EU's agri-food exports to Russia fell by 43%, from 11B euros to 6.3B euros¹³. The European Commission estimated that the trade restrictions cut the incomes of 9.5 million individuals working in the most affected operations¹⁴. While some volumes were redirected towards other destinations, the impact on the prices of certain EU agricultural products was significant.

3.2 CLIMATE CHANGE IMPACTS

Much research has focused on the impacts of climate change on agriculture. While estimations of the extent of the impacts vary, experts agree that climate change is a reality that leads to positive and negative impacts on agriculture (Table 3.1).

¹³ European Commission, Agriculture and Rural Development, *Russian Import Embargo: EU Export Development Until July 2015*, 2015. http://ec.europa.eu/agriculture/russian-import-ban/pdf/2015-09-22-russian-import-ban_en.pdf

¹⁴ European Commission, Agriculture and Rural Development, *Information Note on the Russian Ban on Agri-food Products from the EU*, 2014. http://ec.europa.eu/agriculture/russian-import-ban/pdf/info-note-03-09_en.pdf

Table 3.1
Main climate change impacts on agriculture in Canada

| Positive impacts | Negative impacts |
|--|---|
| <ul style="list-style-type: none"> • Increased productivity as temperatures and atmospheric CO₂ rise | <ul style="list-style-type: none"> • Planning challenges due to unreliable forecasting |
| <ul style="list-style-type: none"> • Introduction of new crops | <ul style="list-style-type: none"> • Damages to crops caused by extreme heat |
| <ul style="list-style-type: none"> • Longer growing seasons | <ul style="list-style-type: none"> • Higher number of insect infestations |
| <ul style="list-style-type: none"> • Acceleration of maturity rates | <ul style="list-style-type: none"> • Increased erosion |
| <ul style="list-style-type: none"> • Decreased water stress | <ul style="list-style-type: none"> • More weeds and disease outbreaks |
| | <ul style="list-style-type: none"> • Reduced efficiency of pesticides and herbicides |
| | <ul style="list-style-type: none"> • Increased water stress and droughts |

Source: Adapted from Climate Change Impacts and Adaption, Government of Canada, 2004

The common thread running through these positive and negative impacts is their unpredictability. Climate change therefore constitutes a new risk, a new source of agricultural supply volatility that producers must mitigate. The recent droughts in California and Australia are excellent examples of the new reality of climate change and its potentially significant impacts on agricultural production, producers and the entire agri-food chain.

California has been experiencing unprecedented droughts since 2011. It is estimated that loss will reach 10.7 billion cubic metres of rainfall for state agriculture in 2015. The deficit is even greater than the one that occurred in 2014, which had been the worst year since data collection began. In 2015, water consumption by California agriculture will therefore be 33% less than in a normal year. The costs for producers in 2014–2015 are estimated at over \$US3.3B, including \$US1B in additional pumping costs and \$US2.3B in income losses for crops and livestock, and are expected to generate a gross agricultural income loss in California of 6% in addition to the impacts on employment, which are worsened by the expansion of the areas set aside (+33% as compared to 2014)¹⁵.

Considering the weight of agriculture in the economy, the drought will cost Californians between \$US2.2 and \$US2.7B/year, cut GDP by \$US1.3B and has led to the loss of 18 600 jobs, including 8 560 in agriculture (4.3% of jobs)¹⁶.

In the 2000s, historical droughts plagued Australia. According to *Dairy Australia*, the droughts caused 15% of producers to leave the sector in 2007–2008 to 2010–2011 and curbed dairy production by 17% in 2001 and 2008¹⁷. The uncertainty that was brought about decreased incentives for investment in agriculture, compromising the production sector's capacity to

¹⁵ Howitt et al., *Preliminary Analysis: 2015 Drought Economic Impact Study*, 2015; Howitt et al., *Economic Analysis of the 2014 Drought for California Agriculture*, 2014

¹⁶ Idem.

¹⁷ Dairy Australia, *Australian Dairy Industries in Focus*, 2014; Australian Dairy Industry, *Response to the Agricultural Competitiveness Issues Paper*, 2014

adapt to new conditions (Kingwell, 2006; Weitzman, 2009). There is strong scientific consensus that the frequency and intensity of extreme climate events will rise, and the direct consequence for agriculture will be increased fluctuations in yields and, by the same token, in prices and income.

3.3 BIOSECURITY

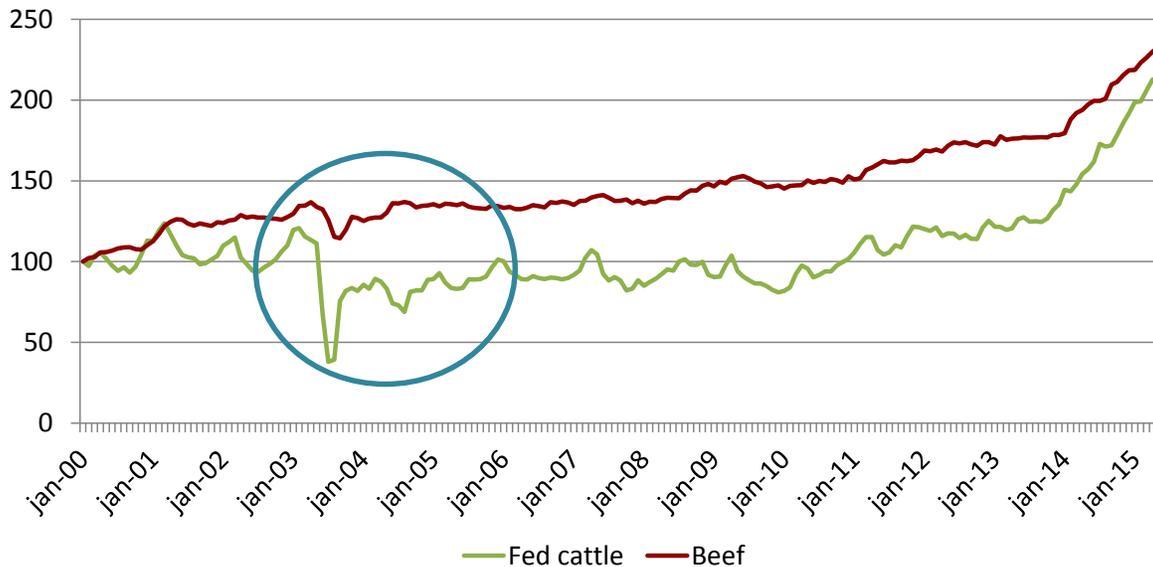
With the globalization of the economy and agricultural exchanges, biosecurity has become a key issue in agriculture and the agri-food sector. It is also a health and safety concern for consumers and an animal health concern shared by producers and industry.

There are several types of risks associated with biosecurity. Disease outbreaks can lead to significant production losses in terms of mortality and lower yields and to massive slaughter to stop propagation. Outbreaks may also cause the sudden loss of income when importing countries close their borders or consumers lose confidence in the safety of the products.

The outbreak of bovine spongiform encephalopathy (BSE) illustrates the extent of the consequences of consumers' new biosecurity concerns on the agricultural sector. A single case of the disease in Alberta in May 2003 caused the US and several other importing nations to close their borders to Canadian beef, and farmgate prices plummeted. In two months, the price of fed cattle in Alberta fell by 66%. While the retail price of beef decreased by 16% during the crisis and returned to its pre-crisis level a few months later, production prices only returned to their pre-crisis levels three years later and major restrictions were only lifted four years later, in 2007. The impacts on the Canadian beef industry were still felt years later as producers were forced to recreate their export networks and regain the markets lost to competitors. In 2005, Statistics Canada estimated that the direct losses of the BSE crisis totalled \$2.5B in exports, \$2B in GDP, \$5.2B in agricultural revenue, \$1B in employment income and 75 000 jobs lost¹⁸.

¹⁸ Parliament of Canada, *Mad Cow Disease in Canada, An Economic Overview*, July 5, 2005
<http://www.parl.gc.ca/Content/LOP/ResearchPublications/tips/tip116-e.htm>

Figure 3.3
Indexed fed cattle prices in Alberta and consumer beef prices in Canada from January 2000 to May 2015 (January 2000 = 100 index)



Source: Statistics Canada, tables 002-0043 and 326-0020

There are several recent examples that illustrate the impacts of disease outbreaks in the agricultural sector and the implementation of biosecurity objectives.

- An outbreak of PED in the US in 2014–2015 affected some 2 000 hog herds. It led to the death of 80 to 100% of pre-weaning piglets, reduced growth rates in older piglets and a loss of prolificity in sows. There was a total estimated drop of 3 to 6% in slaughter. While the contraction of the supply translated to an overall increase in production prices and a net increase in hog sales for all producers, those that were affected still lost everything. The epidemic did not occur in Quebec but the Centre de développement du Porc du Québec estimated average losses of \$94 000 or \$288/sow¹⁹ for a farrow operation impacted by PED.
- An avian flu outbreak in the northeastern US in December 2014 led to massive poultry culling (some 50 million birds), and egg prices soared to an all-time high. The impact was even felt in Canada when processors that depended on American eggs lost their supply.
- In February 2014, the discovery of two cases of African swine fever in Lithuania prompted Russia to close its borders to European Union pork imports. The hotly contested decision sunk pork price in the EU since Russia was the largest market. The embargo came on the heels of border closings to pork from hogs treated with ractopamine²⁰ to slow the influx of North American imports.

¹⁹ Michel Morin, *La DEP : Des pertes importantes*, Porc Québec, April 2014, p. 20-22.

<http://www.agrireseau.qc.ca/porc/documents/PQ%20avril%202014-DEP%20des%20pertes%20importantes.pdf>

²⁰ Ractopamine is a drug used as a hog feed additive to enhance breeding performance.

Biosecurity concerns can therefore lead to the adoption of laws to ensure better food safety, as was the case in the US with the implementation of COOL, whose effects were described earlier. The issues may also prompt private buyers to adopt purchasing criteria. Whether they are implemented for biosecurity or protectionist reasons, laws and criteria can have the same effects as an outbreak and suddenly deprive a nation or group of producers of market outlets for their products.

3.4 BIODIVERSITY LOSS

The vulnerability of crops and livestock to disease is compounded by biodiversity loss in agricultural systems and agricultural products. At the global scale, only 30 plant species and 14 animal species provide 90% of the calories consumed by humans. Agroecosystem biodiversity and genetic diversity within species are in accelerated decline stemming from intensive production modes (monoculture, livestock specialization) and human selection to obtain crops and animal species that meet the many requirements of modern agriculture, including productivity, resistance to stress (illness, drought, insects, etc.), taste, appearance and uniformity. This selection led to the progressive disappearance of several plant and animal species and varieties. The uniformity of their characteristics and the proximity of production sites foster the spread of disease and infestations and, by the same token, increase the risks for farmers.

BANANAS

The case of the banana, the world's eighth most important food crop, is an extreme example of the risk of genetic diversity loss in agriculture. In the early 20th century, the main commercial variety of bananas was the Gros Michel, which was decimated by Panama disease (*Fusarium wilt*)—a fungus that attacks the roots of banana trees and leads to plant death. The fungus spread around the world, ending the production of the Gros Michel and threatening the entire banana industry with losses estimated at \$2.3B according to FAO. When a banana field is contaminated, the disease persists in the area for 30 years.

In response to the illness, a new *Fusarium*-resistant variety—the Cavendish banana—was developed. In the 1990s, the fungus mutated and began to attack the Cavendish. It spread across plantations and threatened global production once again. While certain areas in North Africa and South America were unaffected, the spread stopped exports by two key producers: Indonesia and Malaysia. And the global production is still under threat since no other commercial variety resists the disease.

3.5 INCREASING IMPORTANCE OF ENVIRONMENTAL CONSIDERATIONS

The rationale for government intervention in agriculture for environmental reasons was developed in the US in the 1980s, when issues surrounding soil erosion and water availability in terms of quantity and quality were at the forefront (Cochrane, 1985). In fact, Schweikhardt

(2000) predicted that the increasing importance of environmental concerns would lead to more regulatory frameworks and higher costs for producers that would be difficult to pass on to consumers²¹. In Quebec, for example, agroenvironmental measures (phosphorus balances, buffer strips) were voluntarily introduced through incentive grants. Since then, the measures have become mandatory. The cost of certain initiatives must be entirely absorbed by producers or passed on to consumers. But in an open market in which local producers are in competition with operations around the world, the capacity to pass the costs on to consumers is very limited without international regulations. Without reciprocity rules, all else being equal, products from countries that have not implemented standards will have a competitive edge over local products. For this reason, the costs of these types of measures to meet social expectations and which cannot be reflected in consumer prices are sometimes incurred by the taxpayers through government support measures. This is the case in the European Union and Switzerland, which have set out stringent environmental regulations.

Environmental concerns will continue to grow in importance. More and more, agricultural producers will be called upon to comply with regulations (environmental standards, laws and regulations) to make positive environmental contributions through the provision of ecosystemic services. Because these services are non-market services (i.e. not compensated by the market), they must be remunerated through other channels or they will not be rendered at all.

The agricultural sector and agricultural producers generate negative and positive environmental impacts and are also affected by the environmental impacts generated by society (e.g. climate change, biodiversity loss, water availability, etc.). Environmental considerations are therefore a new, uncontrollable systemic risk to which agriculture is exposed. Experience has demonstrated that the risk can lead to significant economic loss and especially to volatility and instability that hinder investment and the development of agricultural activities.

Key points

Since the farm problem was formalized, the agricultural sector has evolved based on environmental and economic conditions (climate change, biodiversity loss, upstream and downstream concentration) and social demands (market openness, biosecurity, environmental issues). These developments have given way to new risks in agriculture.

- Market globalization increases price volatility and exposes producers to additional sources of risk over which they have little or no control (e.g. changes in exchange rates).
- Climate change increases the frequency and intensity of extreme weather events that can lead to significant financial losses in the sector and destabilize the international market.
- Biosecurity considerations are increasingly important to consumers and purchasers (in terms of food safety) and to producers (in terms of limiting the risk of spreading disease).

²¹ Schweikhardt (2000) foresees this evolution because income elasticity of environmental products is superior than income elasticity of food products.

Is government intervention in agriculture still relevant in the 21st century?

to herds and crops). The sector is exposed to the risks of the closing of borders and outlets and of disease outbreaks.

- Biodiversity loss increases the vulnerability of the agricultural sector as well as the risk of disease spread and the intensity of losses when they occur.
- Citizens' increasing concern for environmental considerations has led to new requirements for agricultural producers, which, in turn, have brought about costs that are not easily passed on to consumers.

These new characteristics heighten the volatility and risks to which the agricultural sector is exposed. Throughout the 20th century, countries implemented intervention mechanisms to offset the impacts of these risks.

4. REASONS FOR GOVERNMENT INTERVENTION IN AGRICULTURE

In response to the farm problem, developed nations implemented a series of intervention measures in agriculture in an effort to mitigate specific impacts on the agricultural sector: agricultural income inequality, inadequate returns on agricultural assets and significant price, revenue and asset income variability (Gardner, 1992; Gouin, 2004; Hopkins and Taylor, 2001; Tweeten, 1971).

Intervention measures to stabilize and even regulate agricultural product supply and stabilize and support agricultural producer incomes were therefore implemented. Crop and farm income stabilization, insurance programs and supply management are just three examples of a series of initiatives in Canada and Quebec. Certain intervention measures also aimed to restore the balance of power between producers and buyers to offset the concentration of agricultural product purchasers. Market information services, marketing boards and Quebec's *Act respecting the marketing of agricultural, food and fish products* were created with this goal in mind.

Table 4.1 is a partial list of the major government interventions in agriculture in response to the farm problem.

Table 4.1
Government interventions in response to the characteristics and impacts of the farm problem

| Characteristics | Description | Impacts | Examples of interventions |
|---------------------------|---|--|--|
| Price-inelastic demand | Lower prices do not lead to a proportional increase in demand | <ul style="list-style-type: none"> • Greater supply/demand imbalance and price volatility • Low prices for producers | <ul style="list-style-type: none"> • Quotas • Purchase of surpluses • Compensatory payments |
| Income-inelastic demand | A rise in income does not lead to a proportional increase in demand | <ul style="list-style-type: none"> • The increased demand for agricultural products is lower than supply growth | |
| Small producer operations | The individual supplies of agricultural producers do not influence the price they receive | <ul style="list-style-type: none"> • Agricultural producers are price takers | <ul style="list-style-type: none"> • Competition laws • Collective marketing |

Is government intervention in agriculture still relevant in the 21st century?

| Characteristics | Description | Impacts | Examples of interventions |
|--------------------------------------|---|---|---|
| Buyer concentration | The low number of buyers weakens the negotiation power of agricultural producers | <ul style="list-style-type: none"> Producers assume price fluctuations in the short term Asymmetry in price transmission | |
| Asset fixity and specificity | Asset specificity and the fixity of agricultural work weakens the capacity to adjust production | <ul style="list-style-type: none"> Greater supply/demand imbalance | |
| Supply/demand imbalance | Production decisions are based on current market conditions that may not apply at the time of sale | <ul style="list-style-type: none"> Greater supply/demand imbalance Producers always reacting | <ul style="list-style-type: none"> Income stabilization programs Information services developed for producers Funding for storage facilities |
| Product perishability | Incapacity to store products to sell when prices are higher | <ul style="list-style-type: none"> Need to sell production quickly Incapacity to quickly curb the offer to keep prices high | <ul style="list-style-type: none"> Regulations based on storable amounts of products |
| Climate conditions and other factors | Several uncontrollable factors impact production levels | <ul style="list-style-type: none"> Unpredictability of supply Greater supply/demand imbalance Increased price volatility | <ul style="list-style-type: none"> Crop insurance and disaster assistance Marketing opening Public storage |
| Rapid technological innovation | Early adopters will benefit from lower production costs and increased production but the advantage diminishes as the innovation becomes more widespread | <ul style="list-style-type: none"> Faster increase in supply than demand Higher amounts produced leading to lower prices | <ul style="list-style-type: none"> Innovation support programs Farm credit |

In questioning the relevance of government intervention in agriculture in the 21st century, it is important to determine whether the impacts that justified the action taken in the last century still occur today.

4.1 INCOME AND AGRICULTURAL ASSET RETURN LEVELS

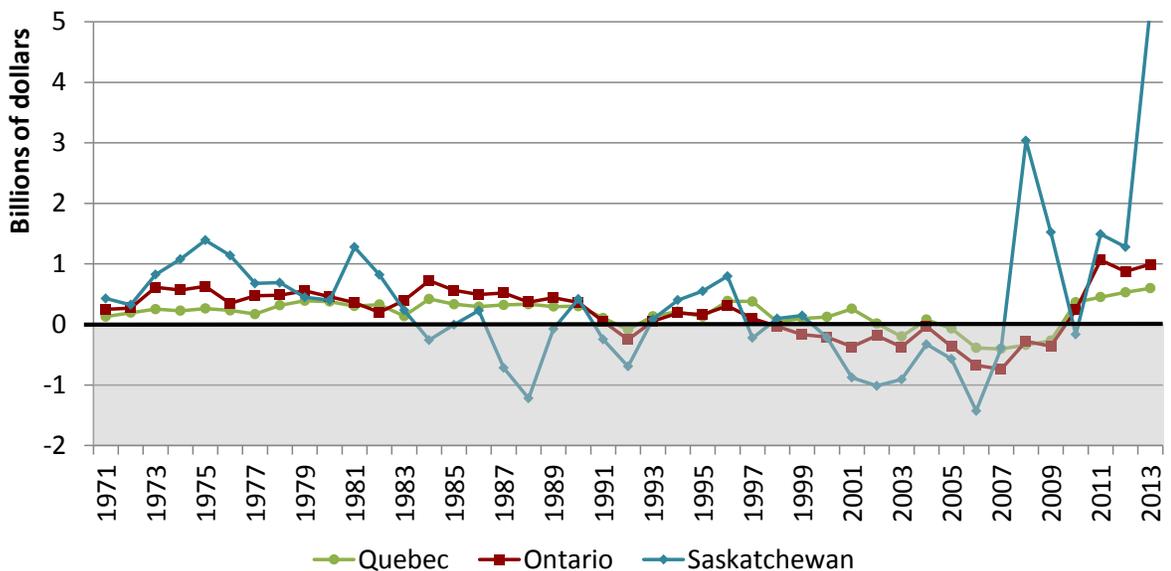
SECTOR INCOME IN AGRICULTURE

One of the first impacts of the characteristics of agricultural product supply and demand is the fact that they lead to the general fragility of farm incomes. Galbraith and Black (1938) and Cochrane (1958) highlighted the imbalance between agricultural and non-agricultural

family incomes. While the data does not date back to the time at which the farm problem was formalized, the figures for the past 40 years in Canada clearly illustrate how agriculture has always struggled to generate positive net returns.

Figure 4.2 describes the evolution of aggregate net farm income in the agricultural sector without direct payments for Quebec, Ontario and Saskatchewan from 1971 to 2013. Pre-payment net income varies from one year to the next and is also negative during prolonged recurrent periods. The situation in Saskatchewan is especially telling with regards to income variation in the agricultural sector: in the past ten years, the income rate experienced annual variations of \$3B on two occasions. Also during the 2000-2007 period, the net sector income without government intervention remained below zero. In Ontario from 1998 to 2009, net market income was negative each year. This was also the case in Quebec from 2005 to 2009.

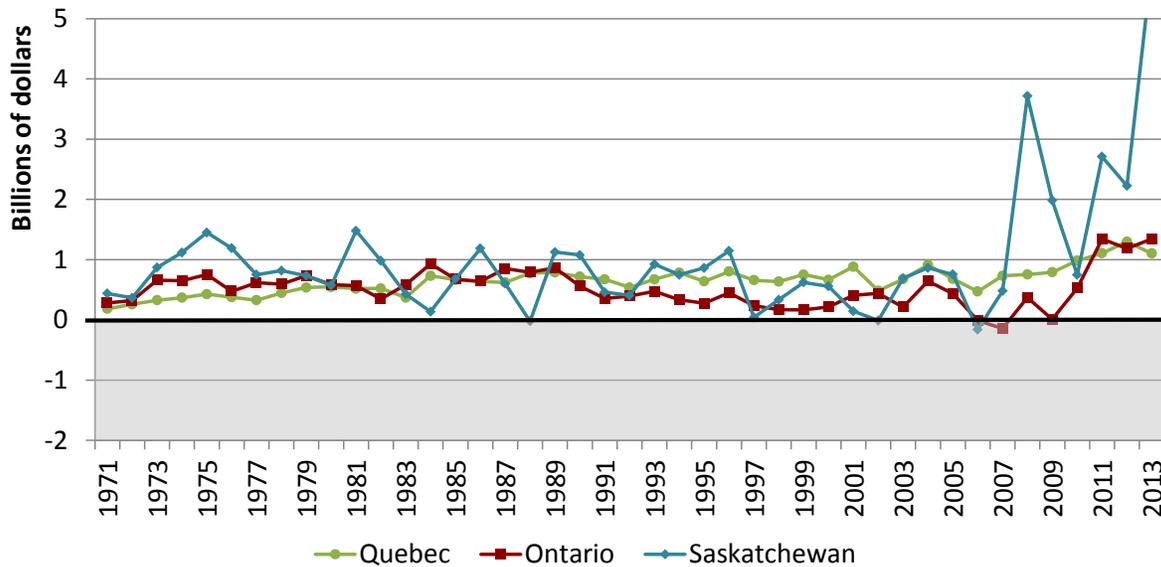
Figure 4.1
Net farm income without direct payments for certain Canadian provinces in current dollars, 1971–2013



Sources: Statistics Canada, tables 002-0001 and 002-0009, 2015a, 2015b; Author calculations

The changes in pre-payment net farm income in Quebec and Ontario indicate that low net incomes continue to plummet as variability increases. In most years since the 1990s, direct payments enabled the agricultural sectors in Quebec and Ontario to remain positive (Figure 4.2). In Saskatchewan, this has been the case since the early 1980s. Despite significant direct payments in 2002 and 2006, the province’s net farm income was negative. The aggregate farm income indicates the persistence of insufficient market income.

Figure 4.2
Total net farm income including direct payments for certain Canadian provinces in current dollars, 1971–2013



Sources: Statistics Canada, tables 002-0001 and 002-0009, 2015a, 2015b; Author calculations

AGRICULTURAL AND NON-AGRICULTURAL INCOME PARITY

In the mid 20th century, low sector income led to inadequate agricultural household incomes at the individual level, creating an imbalance between farm and non-farm incomes. Government interventions aimed to correct the situation and ensure parity. At the time, while most agricultural household incomes were from agriculture, there was a marked difference between the two groups. The evolution in agricultural household income in the past 20 or 30 years indicates that parity has been attained and even exceeded (Dumais, 2010; Gardner, 1992; Hopkins and Taylor, 2001).

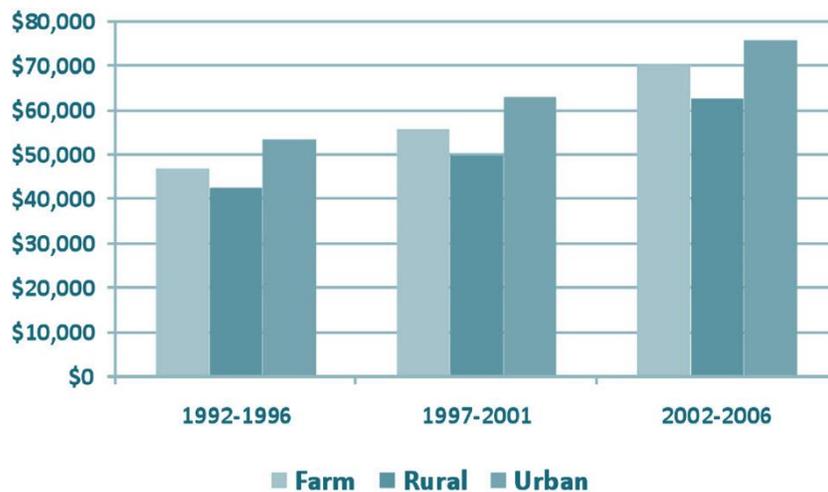
According to data from the *2011 Census of Agriculture* and using a methodology comparable to the one used by Dumais (2010)²², Canadian agricultural household income was 25% higher than the average Canadian household income: \$93 426 on average for agricultural households as compared to \$75 000 on average for Canadian households (Statistics Canada, 2015d; Statistics Canada, 2015g; author calculations). However, the aggregated data does not consider the increase in the portion of agricultural household income from non-agricultural sources (Gardner, 1992). The rise in non-farm revenue is stabilizing agricultural household income (Freshwater, 2007). In fact, the increase is so significant that in the US in the early 2000s, most agricultural households received most of their income from non-farm sources (Offut, 2002). In Canada, the situation is much the same: 69.5% of the household income of farm families operating unincorporated businesses was from non-agricultural sources in 1997. The figure increased to 75.6% in 2011 (Statistics Canada, 2015c). In Quebec the situation is similar but less pronounced: non-agricultural income made up only 63.2% of

²² Comparison based on total average income of all Quebec households (Statistics Canada, 2015g) and total average income of farm families adjusted for cost allowance for unincorporated businesses (Statistics Canada, 2015d).

total farm family income in 2011 (Statistics Canada, 2015c). Unincorporated farms make up 67% of the businesses in Quebec and 80% in Canada.

Other studies yield the same findings. Stiefelmeyer (2011a) showed that agricultural households receive, on average, an income that is higher than that of non-agricultural rural households but lower than that of urban households (Figure 4.3). It was also found that non-farm income was higher in smaller operations and that the non-farm income was applied against debt, invested in assets renewal or allocated to family expenses (Stiefelmeyer, 2011b).

Figure 4.3
Average Canadian household income by type (agricultural, rural non-agricultural and urban non-agricultural), 1992–2006



Note: Income data are five-year average to avoid the significant annual variations in agricultural household income. The data is from a special request carried out by Agriculture and Agri-Food Canada based on a series of longitudinal data

Source: Stiefelmeyer, 2011a.

Furthermore, the average net worth (assets minus liabilities) of agricultural households is much higher than that of average non-agricultural households (Bonnen and Schweikhardt, 1998; Martin, 2011a; Offut, 2002; Wise, 2005). In Canada in 2007, the net worth of agricultural households was approximately three times higher than that of average households (\$416 000 on average for Canadian households versus \$1 191 830 for agricultural households) (Stiefelmeyer, 2011a).

The statistical data for Canada and the US therefore indicate that there is no longer an income imbalance between agricultural and non-agricultural households when considering the agricultural household average. However, two elements limit the scope of the analysis. First, the statistics on farm household income include a high number of part-time farmer (i.e. farmers for whom agriculture is not their main source of income and never will be). On average in Canada, 76% of the income of households operating unincorporated farm businesses is from non-agricultural sources. Second, farm family income data implicitly includes the government's contribution to support agriculture. To determine whether the

income imbalance still prevails, the same analysis must be carried out excluding the support for agricultural incomes but available data does not enable this calculation. Aggregate net income data for the sector reveal that agricultural income from the market is very instable over time and often negative. Therefore, the conclusion that agricultural household income is equivalent to the income of non-agricultural households does not imply that the farm problem has disappeared. At best, the finding demonstrates a change in lifestyle and the effectiveness of support programs.

RETURN ON AGRICULTURAL ASSETS

Besides the issue of the inadequacy of incomes from agricultural activities, the farm problem highlights the low return on agricultural assets. In the 1930s and 1950s, agricultural assets did not require returns. But the issue became more and more significant, especially with the widespread reliance on bank loans. Since debt comes with interest, incomes must be high enough to enable those who borrow to fulfill their obligations. And what about the returns on agricultural assets today?

Studies have compared the profitability of agricultural and non-agricultural businesses (Erickson et al., 2001 and 2004; Hopkins and Morehart, 2000; Martin, 2011b). The results indicate that farm operations are generally less profitable than non-farm businesses but that profitability varied less from one business to the next, especially based on size (Hopkins and Morehart, 2000)^{23,24}. However, when considering taxation, the gap narrows and even disappears in certain periods since the taxation structure for farm operators is more favourable (Erickson et al., 2001). This finding illustrates an example in which government intervention— namely, a taxation policy that supports agriculture—offsets the income imbalance. As is the case for agricultural income, available data does not enable an analysis of the profitability of the agricultural sector without considering financial support. The few studies that explored the topic therefore implicitly considered the impacts of intervention. However, the observations on net agricultural income provide a good indication of the variability and level of profitability of assets.

Also, the agricultural sector is known to experience fewer cases of bankruptcy than other economic sectors (American Bankers Association, 2000; Goodwin, 2000; US Small Business Administration, 2000 [cited in Hopkins and Taylor, 2001]). Certain experts (including Hopkins and Taylor, 2001) attribute the lower bankruptcy rates to the less significant variability of agricultural income as compared to income generated by non-agricultural businesses. This rationale is questionable in light of the nature of agricultural assets. In agriculture, lenders have significant guarantees to liquidate assets (land, quotas) without the operations having to resort to bankruptcy.

²³ Hopkins and Morehart analyzed the dispersion of businesses according to returns on assets. For example, at the median, agricultural operations had a -0.02% return on assets versus 2.90% for non-agricultural operations. Large-scale farms posted a 6.90% return on assets at the median.

²⁴ Bousard and Sassi (2001) explained the greater consistency in farm profits by the lack of economies of scale and therefore the inability to increase profit margins as businesses grew.

4.2 PRICE, INCOME AND ASSET RETURN VARIABILITY

The last impact of the specific characteristics of agriculture is the significant variability in agriculture sector prices and incomes. This volatility, more so than price and income levels in absolute figures, is detrimental to businesses and to the development of the sector. Instability in agriculture chiefly stems from the price inelasticity of demand (see section 2.2). According to economic theory, price plays a role in transmitting information between consumer demands (their willingness to pay) and producer business choices (Boussard, 2007). Producers must therefore adjust their practices (increase or decrease production levels) to ensure that their marginal cost (cost of the last unit produced) is equivalent to the price. But when prices fluctuate considerably in a short period of time, producers cannot adjust to each market signal. An analysis of the prices of the main agricultural products traded worldwide between 1900 and 1987 revealed recurring **annual variation coefficients of 30%** (Deaton and Larocque, 1990 [cited in Boussard, 2007]). It goes without saying that, in these conditions, producers cannot adapt to market conditions (Boussard, 2007).

Several examples of price and income volatility were described earlier: grain, dairy, pork and beef prices and sectoral income. These cases show that the volatility of agricultural markets has increased since the early 2000s, especially due to market globalization, climate change impacts and biosecurity issues. Individual businesses cannot control, anticipate, prevent or offset any of these three factors.

Similarly, recent analyses revealed that agricultural household income varied more than non-agriculture household income, highlighting the role of non-farm revenue in stabilizing agricultural income (Frewshwater, 2007; Hopkins and Morehart, 2000; Hopkins and Taylor, 2001; Offut, 2002; Peake and Marshall, 2009²⁵). At a time in which agriculture constitutes a complex profession requiring a range of specialized technical and business management skills, it seems contradictory to base farm operation risk management on non-farm income.

²⁵ Citing Ahearn, 1986; Gunter and McNamara, 1990; Halberg et al., 1991; Mishra and Goodwin, 1997; Mishra and Sandretto, 2002; Perry and Hoppe, 1993; Sumner, 1982.

5. CONCLUSION

The aim of this report was to revisit the farm problem through the lens of 21st-century agriculture by providing an overview of recent work on the topic and setting out the new characteristics of agriculture and their impacts on the agricultural production sector. In a period in which many social stakeholders are questioning the relevance of government intervention in agriculture, it seemed appropriate to assess whether the farm problem that led western nations to implement measures to stabilize and support agricultural prices and incomes is ongoing.

In the past 20 or 30 years, researchers have sought to determine the persistence of certain characteristics of the farm problem and their impacts on prices and incomes in the agricultural sector. None of the studies in the literature review revealed any significant changes to the characteristics of agricultural production supply (production cycle, product perishability, impacts of climate change and pests, asset fixity and specificity and rapid technological innovation) and demand (price inelasticity, income inelasticity, competitive structure of production and concentrated buyers). The key issue that brought the farm problem into question was the gap between agricultural and non-agricultural household incomes. In many developed nations, current incomes of agricultural households are equivalent and even higher in certain cases than those of non-agricultural households. But does this finding necessarily mean that the farm problem no longer exists? Because farm income analyses include the effect of agricultural support measures, the studies rather demonstrate that intervention can offset the impacts of specific characteristics of agriculture but do not indicate that the market provides adequate income for farm families. Furthermore, the significant amount of non-farm income earned by families that operate unincorporated farm businesses makes it difficult to assess agricultural/non-agricultural income parity. In addition, when government support is subtracted, net farm income is often negative and highly variable. Even recognizing the progress made in terms of income parity, it is important not to overlook the volatility of many agricultural markets. These fluctuations, which cause prices to rise or fall significantly, destabilize and undermine the structure of the agricultural sector and of other links in the agri-food chain. The 2008 food crisis also showed that volatility could impact consumers, specifically households for which the purchase of food staples represents a significant amount of the family income.

Agricultural markets therefore remain highly unstable today. The literature review demonstrates that the specific characteristics of agriculture that drive the farm problem are still very relevant today. Even Gardner (1992), whose work is considered to be the cornerstone of the critique of the farm problem, stated that “Econometric findings helped buttress the case for the existence, and more importantly for the inevitability of a farm income problem” (p. 97).

In fact, certain phenomena intensify the risks in the agricultural sector. Open markets can lead to greater price volatility, exposing producers to the effects of variations in exchange rates that can have a quick and significant impact on competition, as was the case for the

Canadian pork industry in the 2000s. Climate change leads to a rise in the frequency and intensity of changes in supply, and biosecurity requirements increase the risk of sudden border closing in outbreaks. The case of the Canadian beef sector, which underwent a major crisis after the discovery of a single case of BSE in 2003, serves to illustrate this situation. The increasing importance of environmental issues and other social expectations with regards to agriculture also bring about additional production costs that are not easily passed on to the consumer in an open market.

There is an international trend towards government withdrawal from risk management and the increased use of private risk management tools such as futures markets and contract agreements. While these options support farm operations in their risk management, the market is still far from being able to provide a suite of tools for producers against agricultural risks and specifically the more systemic and long-term ones. As it does in other economic sectors impacted by market failures, the government must continue to play a role in agriculture.

With the perspective of feeding 9 billion people in 2015 in conditions that ensure resource sustainability, government intervention remains relevant in the 21st century. It must be renewed to account for new social expectations towards agricultural and new constraints brought about by resource scarcity and new risk factors. It must also be adjusted to integrate private risk management tools while accounting for their limitations. Governments face the crucial issue of creating conditions that foster investment and development in agriculture. Interventions will address income instability and remunerate producers for carrying out functions that the market does not or only partially compensates them for. They will also ensure sector growth in a crucial period when, for the very first time, the increase in the demand for agricultural products could surpass the increase in supply, which must be provided in ways that preserve the capacity of future generations to feed themselves.

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ANNEX 1

SUMMARY TABLE OF THE ISSUES THAT CHALLENGE THE SPECIFICITY OF THE AGRICULTURAL SECTOR

SUMMARY TABLE OF THE ISSUES THAT CHALLENGE THE SPECIFICITY OF THE AGRICULTURAL SECTOR

| Characteristic | Description | Critique or challenge | Analysis |
|---|--|--|---|
| Characteristics of agricultural product demand | | | |
| Price inelastic demand | Lower prices do not lead to a proportional increase in demand | The demand is inelastic in the long term | <ul style="list-style-type: none"> Short-term inelasticity and its impacts persist |
| Income inelastic demand | Increased income does not lead to a proportional increase in demand | None for developed countries | <ul style="list-style-type: none"> Still relevant in developed countries |
| Characteristics of agricultural product supply | | | |
| Small size of farm operations | Individual supplies do not impact the prices paid to producers | Concentration of production as a result of the structural development of the sector | <ul style="list-style-type: none"> Supply remains atomistic in most sectors |
| Buyer concentration | The low number of buyers weakens the negotiation power of agricultural producers | None | <ul style="list-style-type: none"> Still relevant |
| Supply/demand imbalance caused by production cycles | Production decisions based on current market conditions that may not apply at the time of sale | There are risk management tools for producers (e.g. futures markets) | <ul style="list-style-type: none"> Tools offset the impacts but the imbalance still exists |
| Product perishability | Incapacity to store products for sale when market conditions improve | Technological innovations have enhanced the preservation of several products | <ul style="list-style-type: none"> During production, perishability remains a reality |
| Asset fixity and specificity | Resource immobility that curbs the sector's capacity to adjust when prices are low | <p>The demand for different products increases asset specificity</p> <p>Individualism should reduce the specificity and fixity of the work</p> | <ul style="list-style-type: none"> Agricultural way of life still exists Product differentiation exacerbates the problem Suburban agriculture tends to be closer to urban values, unlike rural agriculture |
| Climate conditions and other factors | Many factors that are beyond producers' control impact production | Globalization and transport development prevent market shocks when catastrophes occur | <ul style="list-style-type: none"> Climate shocks tend to impact all consumers and not only local |

Is government intervention in agriculture still relevant in the 21st century?

| Characteristic | Description | Critique or challenge | Analysis |
|--------------------------------|---|-----------------------|--|
| Rapid technological innovation | Early adopters will benefit from lower production costs and increased production but the advantage diminishes as the innovation becomes more widespread. The cost advantage is then transferred to the consumer | None | populations <ul style="list-style-type: none">• Long-term price inelastic demand should offset the impact |