We See Thee Rise: Quantifying Farm Size Expansion in Canada

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Abstract

Average land size of Canadian farms increased from 500 to 730 acres between 1976 and 2006. Productive resources were also increasingly concentrated in farms from the upper tail of the size distribution. This paper uses a two-sector equilibrium model to quantify the importance of technological change versus farm subsidy in explaining this episode of farm size expansion. Exogenous variations in TFP and factor endowment account for 60 percent of the observed increase in average acreage. When farm subsidy is added, the model replicates the entire trajectory of farm size. The model’s predictions of employment in agriculture, agricultural value added per worker, average farm capital, and land value also accord well with data.

JEL Codes: O11; O13; Q18

keywords: Farm Size; Canada; Farm Subsidy; TFP
1 Introduction

In 1976, an average Canadian farm operated with a 500-acre land. By 2006, the average land size has increased to 730 acres. This observed increase in production scale is unique to the farming sector in Canada. Manufacturing, for example, saw average establishment size decline from 47 to 36 employees between 1990 and 2003.\(^1\) The expansion of farm size in Canada has two important implications. First, it has been documented extensively that larger farms have higher value added per worker. Changes in the size composition of farms connect closely to overall productivity growth in agriculture. Second, owner-operator is the predominant form of organization in Canadian agriculture. Increasing dominance of large farms potentially translates to increased income inequality across farmers. Understanding the sources of changes in farm size is not only an interesting question in its own right, but also policy-relevant. It is the objective of this paper.

The increase in average acreage is entirely driven by the rise of very large farms. The number of farms above 1600 acres - about the size of 1200 standard Canadian football field - doubled between 1976 and 2006. In contrast, the number of farms below 180 acres reduced by 30 percent; farms between 180 and 1600 acres saw its number shrink by half. One interpretation is that surviving farms consolidated as farmers exit agriculture over time. That is, small farms grew into mid-size farms, and mid-size farms grew into large ones. And the latter occurred at a faster pace. The question is: What are the quantitatively important factors behind farm size growth during this period?

To guide the analysis, I construct a model with an agriculture sector and a nonagriculture sector. Individuals have different managerial skills for agricultural production, but are equally productive in nonagriculture. They can either operate a farm in agriculture or work for a wage in non-agriculture. A farm consists of one operator with a span of control over land and capital as in Lucas (1978), and the operator’s skills determine the optimal farm size. Given a distribution of managerial skills and aggregate endowment of factors, the model generates endogenously allocations of labor and capital between the two sectors, and a size distribution of farms. I calibrate the model to 1976

\(^1\)Source: author’s calculation. CANSIM Table 301-0003.
Canadian economy, matching both key aggregate moments in the data as well as the observed size distribution of farms.

I first assess whether exogenous growth in aggregate stock of capital, quantity of land and total factor productivity (TFP) could explain the expansion of farm size. In the model, these exogenous variations, in conjunction with a subsistence constraint in preferences, lead to reallocation of labor from agriculture to non-agriculture, which in turn generates growing farm size as land is distributed among fewer farm operators. To quantify these effects, I calculate the growth of TFP both for the aggregate Canadian economy and for the agriculture sector specifically. I construct the sequence of capital stock using investment series from Penn World Tables and approximate the stock of land by arable land per worker. With these exogenous processes, the model is able to account for about 60 percent of the observed increase in mean farm size.

Next I explore whether the observed farm size expansion could also be fueled by government subsidy. A distinct feature of farm subsidy in Canada during this period is that it takes the form of revenue subsidy, instead of price support like in the United States. That is, the government transfers payments to farmers whenever farm revenue (and income) falls below a certain threshold. Consistent with this feature, I introduce to the model a government that provides a proportional subsidy on farm output, financed by lump-sum taxes. I calculate the rate of subsidy in the data as the fraction of total farm cash receipts that are direct payments. The inferred subsidies are strongly countercyclical and average about 7.7 percent. When these subsidies are added into the model, while keeping the same exogenous variations in TFP and factor endowment as before, the model replicates the entire trajectory of farm size. These results suggest that farm subsidy is as important as TFP for the expansion of farm size in Canada.

Having established that exogenous variations in TFP, factor endowment and government subsidy are able to explain the expansion of farm size, I explore whether other predictions from the model are also consistent with data. I find that the model, despite its relatively simple structure, is able to predict very well changes in agricultural employment, agricultural value added per worker, average capital per farm, as well as land
value over the sample period.

This paper is the first general equilibrium analysis of farm size in Canadian agriculture. It complements previous research on the subject that is either qualitative, e.g., Shapiro et al. (1987); Spriggs and Kooten (1988); Cahill and Rich (2012); Veeman et al. (2009); Cahill and Rich (2012) or partial-equilibrium in nature (Darku et al., 2016).

This paper also complements several other papers that study farm size using equilibrium models. Adamopoulos and Restuccia (2014b) find that policies in developing countries that limit the growth of large farms could generate sizeable productivity losses both in agriculture and in the aggregate. Cai (2017), on the other hand, investigates sources of farm size growth in the U.S. over the 20th century. He finds that, contrary to “pro-small” distortions in developing countries, farm-size distortions are “pro-large” in the U.S. Two other papers that study misallocation across farms are Restuccia and Santaeulalia-Llopis (2014) and Adamopoulos and Restuccia (2014a). Like Adamopoulos and Restuccia (2014b), these papers focus on developing countries.

The rest of the paper is organized as follows. Section 2 presents the model, Section 3 the quantitative results. And Section 4 concludes.

2 Model

The economy is populated with a stand-in household that consists of a continuum of mass one members. The household maximizes utility given by the following function:

\[ \eta \log(c_a - \bar{a}) + (1 - \eta) \log(c_n), \]

where \(c_a\) and \(c_n\) are consumption goods produced in agriculture and non-agriculture, and \(\eta\) and \((1 - \eta)\) their respective weight. As standard in the literature on structural transformation, the preferences feature a minimum consumption of goods produced in agriculture, denoted by \(\bar{a} > 0\).
Technology. Output in non-agriculture is produced by a representative firm using the following technology:

\[ Y_n = AK_n^\alpha N_n^{1-\alpha} , \]

where \( Y_n \) is output, \( A \) is total factor productivity (TFP), \( K_n \) is capital, \( N_n \) is labor, and \( \alpha \) is the capital share.

The production unit in agriculture is a farm, which consists of one farm operator, who has managerial skills denoted by \( s \). Farm production combines managerial skills, capital \( k \) and land \( \ell \), according to the following CES function:

\[ y_a(s) = AK [\theta k^\rho + (1 - \theta)(s\ell)^\rho \gamma^\frac{1}{\rho}] . \]

The parameter \( \kappa \) represents the agriculture-specific efficiency. The parameter \( \theta \) captures the relative importance of land and capital in production. The parameter \( \gamma \in (0,1) \) governs the operator’s span of control over capital and land, with an elasticity of substitution \( \rho \).

The economy is endowed with capital stock \( K \) and land \( L \), all owned by the stand-in household. There are competitive markets for the rental of labor, capital, and land, as well as consumption goods.

Optimization. The stand-in household allocates members between working in agriculture and non-agriculture. Those who work in agriculture are farm operators, and those who work in nonagriculture supply labor inelastically for a wage \( w \). Once assigned to the agricultural sector, individuals draw a random realization of managerial skills from a distribution \( F(s) \), with support \( S \).

A farm operator with managerial skill \( s \) solves the following problem:

\[
\max_{\{k,\ell\}} p_a AK [\theta k^\rho + (1 - \theta)(s\ell)^\rho \gamma^\frac{1}{\rho}] - rk - q\ell
\]

\[
s.t.: \quad k \geq 0, \ell \geq 0,
\]
where \( p_a \) is the price of agricultural output, \( r \) is the rental price of capital, and \( q \) is the rental price of land. Throughout the paper, non-agricultural output is the numeraire. Let \( k(s) \) and \( \ell(s) \) denote the optimal demand functions for capital and land, respectively, and \( \pi(s) \) the associated maximized profit that accrues to the farm operator. Given the distribution of managerial skills, the model generates endogenously a distribution of optimal land size \( \ell(s) \) and, correspondingly, a distribution of capital \( k(s) \) and output \( y_a(s) \).

Let \( N_a \) denote the measure of farm operators, then the measure of workers in non-agriculture is \( 1 - N_a \). Income for the household consists of wage income, rental income from capital and land, and profits from farms. The household’s problem is to choose the allocation of labor \( N_a \) and consumption goods \( c_a, c_n \) to maximize utility, i.e.,

\[
\max_{\{N_a, c_a, c_n\}} \eta \log(c_a - \bar{a}) + (1 - \eta) \log(c_n),
\]

subject to:

\[
p_a c_a + c_n = w(1 - N_a) + N_a \int_S \pi(s)dF(s) + rK + qL,
\]

\[
c_a > \bar{a}, c_n \geq 0.
\]

The representative firm in non-agriculture chooses the amount of capital and labor to maximize profit, i.e.,

\[
\max_{\{K_n, N_n\}} AK_n^\alpha N_n^{1-\alpha} - rK_n - wN_n
\]

subject to:

\[
K_n \geq 0, N_n \geq 0.
\]

The factors market clearing conditions are

\[
K_n + N_a \int_S k(s)dF(s) = K,
\]

\[
N_a + N_n = 1,
\]

\[
N_a \int_S \ell(s)dF(s) = L.
\]
The goods market clearing conditions are

\[ c_a = N_a \int_S y_a(s)dF(s), \quad (7) \]
\[ c_n = AK_n^\alpha N_n^{1-\alpha}. \quad (8) \]

**Equilibrium** A competitive equilibrium is a collection of prices \( \{w, r, q, p_a\} \), allocation for farm operators \( \{k(s), \ell(s)\} \), allocation for the representative firm in non-agriculture \( \{K_n, N_n\} \), and allocation for the stand-in household \( \{N_a, c_a, c_n\} \) such that (i) given prices, \( \{k(s), \ell(s)\} \) solves farm operators’ problem in (1); \( \{N_a, c_a, c_n\} \) solves the household’s optimization in (2); and \( \{K_n, N_n\} \) solves the firm’s problem in (3); (ii) markets clear, i.e., equations (4) - (8) hold.

What determines farm size and its change over time in the model? Suppose that the distribution of managerial skills is fixed over time (as it is in the quantitative analysis that follows), I can restrict my attention to factors affecting the optimal land size for a given farm operator. The optimal farm size for an operator with managerial skill \( s \) is

\[ \ell(s) = (p_aA\kappa)^{\frac{1}{1-\gamma}} \left( \frac{\gamma(1-\theta)}{q} \right)^{\frac{1}{1-\gamma}} \Phi(s)^{\frac{\rho}{1-\gamma}}, \]

where

\[ \Phi(s) = \theta \left( \frac{\theta q}{(1-\theta)r} \right)^{\frac{\gamma}{1-\gamma}} + (1-\theta)s^{\frac{\rho}{1-\gamma}}. \]

Suppose that \( 0 < \rho < \gamma < 1 \). This restriction holds in the Canadian data. Obviously, optimal farm size is increasing in managerial skill \( s \). That is, a more-able farm operator commands a larger plot of land. In addition, farm size increases when there is technological progress, either in aggregate TFP \( A \) or in agricultural-specific efficiency \( \kappa \). Expansion in farm size could also be supported by falling rental prices of capital and land. Therefore, the accumulation of land and capital over time could also drive the growth in farm size. Therefore, a natural starting point is to assess whether the growth in TFP, agriculture-specific efficiency, and endowment of capital and land can generate farm size growth observed in the data. This is the objective of the next section.
3 Quantitative Analysis

3.1 Calibration

I calibrate the model to the 1976 Canadian economy. The primary source for farm size data is the census of agriculture, which is conducted every five years in Canada. Correspondingly, I set one model period to be 5 calendar years. The preferences parameter $\eta = 0.01$, which implies a long-run share of expenditure on agricultural consumption that is commonly assumed in the literature. See, for example, Gollin et al. (2007) and Restuccia et al. (2008). Aggregate TFP $A$ and relative efficiency $\kappa$ are both normalized to 1.

For non-agriculture technology, I set $\alpha = 1/3$, based on the capital income share reported in Valentinyi and Herrendorf (2008). For the agriculture technology, the parameter $\gamma$ captures the share of income accruing to capital and land. Correspondingly, $1 - \gamma$ is the labor income share. Using value added accounts, I calculate labor income as the sum of family wages, non-family wages and unincorporated operator returns. As a share of gross value added, labor income averages 43 percent from 1976 to 2006 (CANSIM, Table 002-0004). Correspondingly, I set $\gamma = 0.57$. Next I calculate the land share of income. A difficulty is that the majority of farm operators own the land in their production. To impute land income, I use data on itemized agriculture expenditures that reports land rental cost for farms who rent the land in production. Then I calculate land income share as average land rental cost times total farm land, divided by gross agriculture value added.² Between 1986 and 2006, land income share averages 19.37 percent. This is quite close to the 16% estimated by Echevarria (1998) using a three-factor production function. I set $(1 - \theta)\gamma = 0.1937$, which yields $\theta = 0.66$. Lastly, the parameter $\rho$ determines the elasticity of substitution between capital and land. Existing studies on Canadian agriculture generally find an elasticity that is not significantly different from zero, e.g., Lopez (1980) and Lopez (1984). In light of this evidence, I set $\rho = 0$.³

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³U.S. studies generally find a much larger elasticity of substitution. See, for example, Binswanger (1974) and Adamopoulos and Restuccia (2014b).
I assume that managerial skills follow a log-normal distribution with mean $\mu$ and variance $\sigma^2$. I approximate the continuous distribution on log-spaced grids over the interval $[\underline{s}, \bar{s}]$. The support is chosen such that $\underline{s}$ is arbitrarily close to zero, and $\bar{s}$ is sufficiently large to guarantee a non-zero mass of farms above 2240 acres. There remains five parameters whose values are to be determined jointly: the distributional parameters $(\mu, \sigma)$ and the subsistence consumption parameter $(\bar{a})$, the aggregate quantity of capital $K$, and the quantity of land $L$. I proceed as follows. I first guess values for $\mu$ and $\sigma$. Given the guess, I choose $(\bar{a}, K, L)$ to match the following moments in the data: (i) the share of labor in agriculture is 0.048; (ii) aggregate capital-output ratio is 3.03; (iii) average farm size is 500 acres. I then iterate over $(\mu, \sigma)$ until the model also matches the frequency of farms by land size. Table 1 summaries the parameter values. Figure 1 plots the calibrated size distribution of farms and the actual one.

Table 1: Calibrated parameter values

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Endowment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>Land per worker</td>
<td>23.76</td>
</tr>
<tr>
<td>K</td>
<td>Capital per worker</td>
<td>5.231</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$A$</td>
<td>TFP</td>
<td>1.00</td>
</tr>
<tr>
<td>$\kappa$</td>
<td>Agriculture-specific efficiency</td>
<td>1.00</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>Capital share, non-agriculture</td>
<td>0.33</td>
</tr>
<tr>
<td>$\theta$</td>
<td>Capital share, agriculture</td>
<td>0.667</td>
</tr>
<tr>
<td>$\rho$</td>
<td>Elasticity of substitution</td>
<td>0.577</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>Span-of-control</td>
<td></td>
</tr>
<tr>
<td><strong>Preferences</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\eta$</td>
<td>Consumption weights</td>
<td>0.01</td>
</tr>
<tr>
<td>$\bar{a}$</td>
<td>Minimum consumption</td>
<td>0.198</td>
</tr>
<tr>
<td><strong>Skill distribution</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\mu$</td>
<td>Mean</td>
<td>-4.181</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>Standard deviation</td>
<td>7.375</td>
</tr>
</tbody>
</table>

$^4$Total capital stock (at current prices) is the sum of residential (CANSIM, Table 031-008) and non-residential fixed capital (CANSIM, Table 031-007).
3.2 Quantitative Results

3.3 Baseline

The model has four exogenous processes: aggregate TFP, agriculture-specific efficiency, capital per worker, and land per worker. I approximate aggregate TFP using Multifactor Productivity series published by Statistics Canada (CANSIM, Table 383-0021). The same series also provide estimates of TFP for the agriculture sector. Between 1976 and 2006, TFP for the aggregate Canadian economy grew at merely 0.23 percent annually, compared to 1.82 percent for the agriculture sector. TFP growth for the agriculture sector was impressively high for this period. To ensure that it is not a result of mismeasurement, I compare the number to existing estimates. Sheng et al. (2015) find an annual growth rate of 1.72 percent between 1961 and 2006. For the period 1980-1999, Kooten (1988) estimate TFP growth to be 1.23 percent for crop production, and 1.59 percent for livestock. Therefore, the TFP series from Statistics Canada is in the ballpark of other independent estimates. These two TFP series also yield that the agriculture-specific efficiency in the model has an annual growth rate of 1.59 percent. Following standard practice in the
development accounting literature, I compute the series of capital stock per worker using the perpetual inventory method and investment series from Penn World Tables 6.3. For land per worker, I start with arable land per capita available from the World Development Indicators. I then divide arable land per capita by the labor force participation rate to arrive at arable land per worker. Over the sample period, aggregate capital per worker increased by a factor 1.6, while land per worker declined by about 30 percent.

Figure 2 plots average farm size in the model and in the data. The model predicts that mean farm size increases from 500 acres in 1976 to 650 acres in 2006. This is less than the actual increase of 230 acres in the data. That is, exogenous variations in TFP and factor endowment account for 64 percent of the increase in average acreage in the data.

Figure 2: Average farm size, baseline model and data

To explore the model’s implications further, Figure 3 plots the entire size distribution of farms for six census years: 1981, 1986, 1991, 1996, 2001 and 2006. An outstanding feature of the data is that the share of very large farms increased substantially over the period. Less than 5 percent of the all farms were larger than 1600 acres in 1976. By 2006, the number is 12 percent. The model is able to capture this trend, but predicts only a 3 percentage point increase, which is about half of the actual number. Another
The salient feature of the data is that the fraction of small farms did not decline over time. The model cannot capture this margin, and instead predicts a counterfactual decline in the share of small farms. This failure comes from the assumption in the model that the distribution of managerial skills is constant over time. Given technological progress and falling factor prices, all farm operators, regardless of managerial skills, will expand the optimal size of land in production. Therefore, the share of farms below a given size threshold will decline definitely.

Figure 3: Farm size distribution: baseline model and data
3.4 Subsidies

So far, I have focused on efficient allocations. Yet it is well-known that agriculture in Canada, as in other developed countries, is heavily subsidized. In this section, I explore if the increase in farm size could be explained by government subsidies. Direct payments to the farming sector was 516 million dollars in 1976. By 2006, the number has increased to 4.5 billion. Given that farm number has been declining over time, average direct payment per farm must have been rising even faster.

There were substantial changes to farm support policies over the 30 years since 1976. For an excellent review of these changes, see Hedley (2015). An important change to government support is the gradual switch from crop-specific support to revenue and income insurance. The differences in federal programs across geographic areas (i.e., western versus eastern Canada) were also greatly reduced. During this period, two major instruments that implemented government support to agriculture are the Gross Revenue Insurance Program (GRIP) and Net Income Stabilization Account (NISA), though the latter is much smaller relative to the former. Under GRIP, the government transfers payment to farmers when gross revenue for farmers falls below a certain percentage (usually 80 percent) of historical average. Relative to direct price support to commodities, GRIP allows farmers more freedom in choosing the composition of crops, as well as adjusting to changing marketing conditions.

Under GRIP, government support to agriculture takes a simple form of a proportional subsidy to farm output. The rate of subsidy could be approximated in the data by total direct payments as a share of total farm cash receipt. Figure 4 plots the calculated rate of subsidy for six census years. As expected, the rate of subsidy is highly counter-cyclical, ranging from as low as 4 percent in 1996 to as high as 13 percent in 1986 and 2006. Across all periods, the subsidy averages about 7.7 percent. Note, however, that direct payment does not capture other implicit subsidies directed to the farming sector. Therefore, the 7.7 percent subsidy rate should be interpreted as a lower bound of the magnitude of government support to agriculture.

In the model, there is a simple link between subsidy and farm size. A proportional
subsidy to farm output, other things equal, increases the optimal farm size for a given farm operator. Therefore, the observed increase in farm size in the data that cannot be accounted for by TFP and factor endowment, could potentially be driven by an increase in aggregate level of subsidy. To formalize and quantify this idea, I introduce a government into the model developed in section 2. The government subsidizes agricultural production at the rate $\tau > 0$. The subsidies are financed through lump-sum taxes, denoted by $TR$. For the time being, I assume that the rate of subsidy is uniform across farms. The optimization problem of a farm operator with managerial skill $s$ is as follows:

$$
\max_{\{k, \ell\}} \quad (1 + \tau)p_A \kappa \left[ \theta k^\rho + (1 - \theta)(s\ell)^\rho \right]^{\frac{\gamma}{\rho}} - rk - q\ell
$$

s.t.: $k \geq 0, \ell \geq 0,$
and the household’s optimization problem becomes

$$\max_{\{N_a, c_a, c_n\}} \eta \log(c_a - \bar{a}) + (1 - \eta) \log(c_n),$$

subject to:

$$p_a c_a + c_n = w(1 - N_a) + N_a \int_{S} \pi(s) dF(s) + rK + qL - TR,$$

$$c_a > \bar{a}, c_n \geq 0.$$ 

Otherwise, the economy is identical to the one described in section 2, except that balancing government budget in addition requires

$$TR = N_a \tau \int_{S} p_a y_a(s) dF(s).$$

I feed the sequence of subsidy rate in Figure 4 into the model, and explore the impact of subsidies on mean farm size. Figure 5 plots mean farm size in the data, along with that from the model with subsidy. It turns out that given subsidy rate inferred from the data, the model is able to account for all of the increase in mean farm size between 1976 and 2006. This improvement is mainly coming from the model’s ability now to capture the rise of very large farms. With subsidy, the predicted share of farms above 1600 acres increased to 11 percent by 2006, very close to the 12 percent number in the data.

### 3.5 Other Model Predictions

Having established that exogenous variations in TFP, factor endowment and government subsidy are able to explain the entire trajectory of farms size in Canada, the next questions is whether the model is consistent with other observable changes to Canadian agriculture. In this sub section, I explore other predictions of the model, and compare as many of them to their data counterparts as possible. I start with labor allocation between agriculture and nonagriculture. A stylized fact of economic development is that the share of labor in agriculture declines with income. In the case of Canada, this share shrinks from 5 percent in 976 to less than 2 percent in 2006. The model is able to replicate all of this decline, through a mechanism that is standard in the structural transfor-
Figure 5: Average farm size, model with subsidy and data

Figure 6 plots the share of labor in agriculture in the model (with subsidy) and in the data. Labor productivity increased enormously in agriculture to compensate for the loss of labor over time. Figure 7 plots agricultural value added per worker in the model and in the data. Between 1976 and 2006, Canadian agriculture displayed an impressive annual growth of 2.7 percent in value added per worker. And the model accounts for most of this growth.

With falling prices of capital, agricultural production in Canada has been increasingly capital intensive. Average farm capital doubled from 1976 to 2006. Figure 8 shows that the model is able to account for the capital-deepening in agriculture almost perfectly. Despite the declining importance of agriculture for the aggregate Canadian economy, land value nearly doubled over the three decades. Figure 9 plots the value of land in the data and in the model. I calculate land value in the model as rental price of land divided by the relative price of agricultural output. An interesting observation is that in

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5Capital is the value of farm machinery and equipments, and does not include structure. The value of land includes both land and buildings. Unfortunately, the census data does not allowing separating the two. Nominal values are deflated using CPI. Source: http://www.statcan.gc.ca/pub/95-632-x/2007000/t/4185576-eng.htm

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Figure 6: Share of labor in agriculture, model with subsidy and data

Figure 7: Agricultural value added per worker, model with subsidy and data
both the case of farm capital and land value, there is a large jump around 1980s. This is possibly related to expansion of credits to farm production and the subsequent credit crisis that followed suits in the 1980s.

Figure 8: Average farm capital, model with subsidy and data

4 Conclusion

Between 1976 and 2006, Canada saw its average farm size increase from 500 to 730 acres. The rise of large farms, on the one hand, is contributing to overall productivity growth in Canadian agriculture, and on the other hand, raises concerns about the livelihood of small, family farms and the role of government subsidies in fueling the dominance of large farms. This paper constructs and calibrates a parsimonious equilibrium model. The model generates predictions that are broadly consistent with observed changes to the Canadian economy and the agriculture sector. I then use the model to quantify the relative importance of technological change and government subsidies in explaining the expansion of farm size. I show that technological change and falling input prices alone could explain about 60 percent of the increase in average farm size, and government
subsidies are responsible for 40 percent of the increase.

There remains one aspect of the data that the model, even with subsidies, fails to explain. That is, why did the share of small farms increase over the same time when large farms became increasingly dominant? I discuss two possible explanations here. First, there might be new entries into agriculture. These new entries are mostly “retirement farms” or “hobby farms”, which are small-scale in nature. Second, subsidy might not be uniform across farms. As Cai (2017) argues for the case of the United States, farm subsidies are regressive in the sense that larger farms enjoy a larger rate of subsidy than small ones. Therefore, small farms might not expand over time despite technological progress and falling factor prices. Given that small farms represent only a small share of total farms, and a negligible share of total agricultural output in Canadian, getting the share of small farms right is second order for understanding mean farm size and labor productivity in agriculture. However, it might be important for understanding inequality within agriculture.
References


