Rural and Small Town Canada Analysis Bulletin **Catalogue no. 21-006-X**
Vol. 8, No. 1 (March 2009)

Off-Farm Work by Farmers: The Importance of Rural Labour Markets

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Highlights

- **The number of census farm operators in Canada fell approximately 16% between 1991 and 2006, while the number with off-farm work rose by 9%.**
- **In 2001, among operators of very small agricultural holdings, about 60% were working off their holding. Among operators of larger census farms, about 20% were working off their holding. In 2006, the share of operators of smaller census farms reporting off-farm has remained stable while that of operators of larger census farms has further increased.**
- **Both the human capital of the operator and the characteristics of the census farm are associated with the incidence of off-farm work for operators of both smaller and larger farms.**
- **Family, community and regional characteristics appear more relevant in determining the joint decision to work off-farm and to operate a smaller holding.**
- **Proximity to a larger urban centre does not increase the probability of the joint decision to participate in off-farm work and to operate a census farm. Hence, census farm operators are more likely to be affected by rural development initiatives that directly address the dynamics of labour markets in the community where the operator lives.**

Introduction

The number of Canadian census farm operators and those who report off-farm work are trending in opposite directions. Between 1991 and 2006 the number of census farm operators fell 16%, from 390,870 to 327,055. Over the same period, the number of operators reporting off-farm work rose approximately 9%, from 145,005 to 158,255 (Statistics Canada 2002a; Statistics Canada 2007b). Multiple job-holding by farm households has become a common pattern across rural Canada (Fuller and Bollman 1992), with the service sector being the main source of employment for rural residents (Bollman et al. 1992).

Rural and Small Town Canada Analysis Bulletin

ISSN 1481-0964
ISBN 978-1-100-11735-5

Editor: Ray D. Bollman
Associate Editor: Neil Rothwell

Published in collaboration with The Rural Secretariat, Agriculture and Agri-Food Canada. The ***Rural and Small Town Canada Analysis Bulletin*** is an occasional publication of the Agriculture Division of Statistics Canada. To obtain a single issue, visit our website at www.statcan.gc.ca and select "Publications."

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Special thanks to Véronique Julien and Josée Bourdeau for their contribution in the publication process.

Published by authority of the Minister responsible for Statistics Canada.

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Symbols

The following standard symbols are used in Statistics Canada publications:

.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0^s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
p	preliminary
r	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
E	use with caution
F	too unreliable to be published

The size of the farm business is likely to be a major variable in determining off-farm labour participation. Smaller census farms are less likely to provide sufficient and stable income for the household and are more likely to be associated with rural lifestyle choices in which farming becomes a secondary economic activity for the household. Indeed, national statistics from the Census of Agriculture show a striking difference in off-farm labour participation by size of farm business (Statistics Canada 2002a). In 2001 and 2006, over 60% of the individuals operating very small operations (gross revenues below $10,000) were employed off their holding (Figure 1).

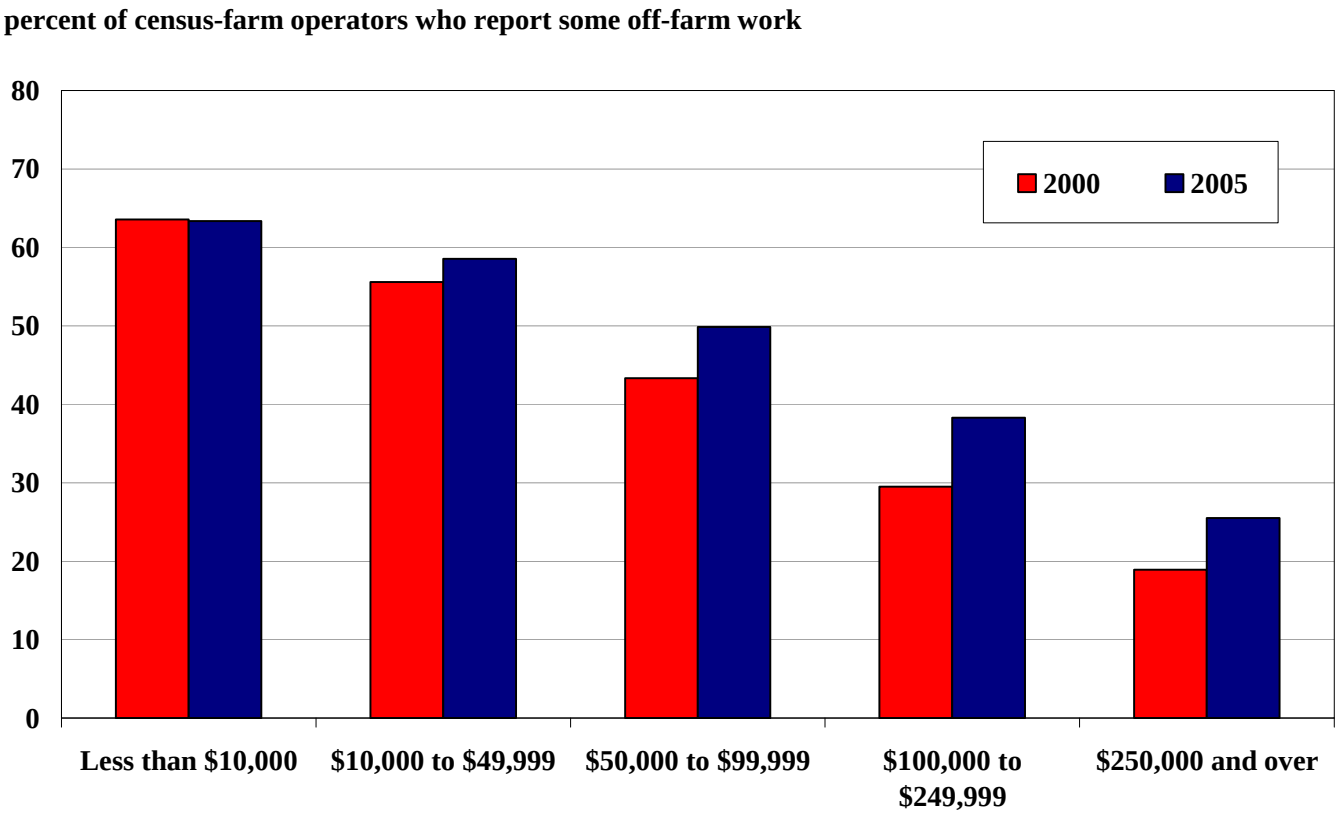
In practice, some operators of very small agricultural holdings run their farm as a hobby and as such might not claim to be "employed" on their holding. In this case, their so-called "off-farm" job would probably be their only employment. Note that for all individuals in Canada over 15 years of age, about two-thirds are employed. Thus, the share of operators of very small holdings who report (off-farm) employment is similar to the share of all Canadians with employment. In contrast, 25% of the operators of larger census farms, those with gross revenues over $250,000, were employed off-farm in 2006 (this was 19% in 2001).

Although farm size seems to be a major factor associated with the decision to work off-farm, other factors should also be considered. In this bulletin, the determinants of off-farm work decisions for Canadian census farm operators are assessed. To this end, micro-level data from the 2001 Census of Agriculture is combined with community level data from the 2001 Census of Population[1] (Box 2). Compared with previous research on off-farm employment, this study enhances the understanding of off-farm labour allocation by explicitly investigating the differential impacts of the various factors for households associated with a "smaller" and a "larger" census farm (Box 1). The regional dimension of the labour market is accounted for, and the influence of community, regional and urban factors in the decision to work off-farm are explored (Box 1 and Box 2).

This bulletin is a summary of a larger working paper which contains more details on the theoretical framework, data and variable selection, estimation procedure, probability estimates and some mapping and simulation analysis (Alasia et al. 2007).

1. The Agriculture-Population Linkage database for 2006 was released in December, 2008 and was not available for the analysis reported in this bulletin.

Figure 1 Operators associated with larger census farms are less likely to combine farm and off-farm work, Canada, 2000 and 2005



Source: Statistics Canada. Census of Agriculture, 2001, Catalogue No. 95F03555XIE and Census of Agriculture, 2006, unpublished tabulation.

Box 1 Key definitions

A census farm is defined as "a farm, ranch or other agricultural operation which produces at least one of the following products intended for sale: crops, livestock, poultry, animal products, greenhouse or nursery products, Christmas trees, mushrooms, sod, honey or bees, and maple syrup products." (Statistics Canada 2003b:6).

A smaller census farm is defined as an operation reporting total gross farm receipts of less than $250,000 for the census year. In 2001, there were 290,510 operators associated with a smaller census farm.

A larger census farm is defined as an operation reporting total gross farm receipts equal or greater than $250,000 for the census year. In 2001, there were 55,685 operators associated with a larger census farm.

Note that a typical farm has net cash revenue (before depreciation) that is about 15% of gross farm revenues (Statistics Canada 2000). Thus, a typical census farm with gross revenue of less than $250,000 would generate net revenue (before depreciation) of less than $37,500. Depreciation is typically one-half of net revenue before depreciation. Thus, after depreciation is taken into account, this income would be below the low income cut-off for a rural family of four ($23,713 in 2000). Thus, census farms with gross revenue less than $250,000 are designated as smaller census farms. We acknowledge there is a wide variability of net farm revenue as a percent of gross farm revenue when one compares farms specializing in different enterprises and, also, different operators have widely varying degrees of good luck and good management.

Farm operator "refers to those persons responsible for the day-to-day management decisions made in the operation of the census farm." (Statistics Canada 2003b:7).

Community: In this bulletin, "community" is defined as a Census Consolidated Subdivision (CCS). The two terms, community and CCS, are used synonymously. CCSs are defined according to the 1996 census geography. It should be mentioned that Statistics Canada does not provide a standard definition for the term community. The term is generically used to refer to administrative and statistical geographic units of smaller spatial areas and at an intermediate level between the provincial or regional level (economic regions, health region, Census agricultural regions, etc.) and the micro-geographic levels (Dissemination Areas, blocks or neighbourhoods).

A **Census Consolidated Subdivision** (CCS) is a grouping of two or more Census Subdivisions (CSDs), where a CSD is an incorporated town or municipality. For the detailed definition, see Statistics Canada (2003b). A typical case is where an incorporated town and the surrounding incorporated rural municipality have been consolidated as a CCS for statistical purposes.

Larger urban centre: This term is used to identify a Census Metropolitan Area (CMA) or Census Agglomeration (CA) of any size. In 2001, a CMA had an urban core of 100,000 or more and a CA has an urban core of 10,000 to 99,999. For the detailed definition, see Statistics Canada (2003b). It should be noted that the CMA and CA definitions were modified in 2006 to: a census metropolitan area must have a total population of at least 100,000 of which 50,000 or more live in the urban core. A census agglomeration must have an urban core population of at least 10,000 (Statistics Canada 2007a).

Region: Similar to the situation for "community", the term "region" also does not have a unique definition when used by Statistics Canada. For each community, we define its region, or regional milieu, as a set of communities within a certain distance of the given community. To measure the characteristics of this region, for a given variable, we use a spatially lagged variable computed from the community indicator. Specifically, a spatially lagged variable for each community is computed as the weighted average of the value of the indicator in the surrounding communities, where the weights are the inverse of the squared distance between community centroids (for details, see Alasia et al. 2007).

What is affecting off-farm labour decisions?

Previous research and theory suggest that the characteristics of the individual, the farm and the region in which the individual lives are all associated with the decision of a census farm operator to work off the holding (Alasia et al. 2007).

To disentangle the effect of these factors, a regression model (probit) was used. This type of model shows the relationship between the probability of a certain outcome (in our case off-farm work of a census farm operator) and a set of explanatory variables. The characteristics of the model are summarized in Box 3, while selected descriptive statistics and the definitions of the explanatory variables are reported in the Appendix Tables A.1 and A.2.

In the following sections we present the main results for each group of explanatory variables. The results highlight the influence of each variable when all other variables are held constant – hence showing the distinctive effect of each variable.

All the results are presented in terms of the *predicted probability of reporting off-farm work*. This is the computed probability associated with a specific set of characteristics of the operator. We compare the predicted probability with the benchmark probability of the *average operator of a census farm*, which is an operator with average values for all explanatory variables. Note that the probability of the average operator is computed for three models: the model that includes the entire sample (which provides the probability of the *average operator of a census farm*), the model for operators of smaller census farms (which provides the probability of the *average operator of a smaller census farm*), and the model for operators of larger census farms (which gives the probability of the *average operator of a larger census farm*) (Box 3). In other words, these are the computed probabilities for these three hypothetical operators that have average values for each of the explanatory variables used in the model – these hypothetical operators are only presented here for comparison purposes.

Box 2 Data source

This study used data from the 2006 Census of Agriculture to update the information on trends. The inter-relationships were estimated using data from the 2001 Agriculture-Population Linkage database combined with community-level data from the 2001 Census of Population. This database includes 70,851 census farm operators, of which we excluded 513 operators in collective dwellings (which would largely be residents in Hutterite Colonies). Community level data are obtained from the 2001 Census of Population, tabulated for constant 1996 census geography; this corresponds to 2,607 CCSs.

For the variables used in this research, data were available for 2,382 CCSs (1996 census geography) because community data could not be tabulated for CCSs with population less than 250 individuals for data quality and confidentiality reasons. The combination of the Agriculture-Population Linkage database and community level database yielded the data set used for estimation, which encompassed 69,797 farm operators and 1,746 CCSs out of 1,783 CCSs (2001 census geography) for which Census of Agriculture data was collected.

The Agriculture-Population Linkage database for 2006 was released in December, 2008 and was not available for the analysis reported in this bulletin.

Box 3 Methodology

The results presented in this bulletin are based on an econometric model (specifically a probit model) that is derived from a theoretical model of farm labour allocation decisions (farm household model). The econometric model that is estimated can be summarized as follows:

$$\Pr(M = 1 \mid \mathbf{x}) = \Phi(\beta_1 H + \beta_2 Z + \beta_3 K + \beta_4 R)$$

where the probability of observing off-farm work, *Pr(M=1)*, is a function of individual (*H*), family (*Z*), farm (*K*) and community and regional labour market characteristics (*R*), the β's represent the coefficients to be estimated, and Φ**(.)** denotes the cumulative normal distribution function. We use a total of 60 variables to capture these effects. A description of the variables used in the model is provided in Appendix Table A.2.

It should be emphasized that we identify two components of the regional milieu effect: **the community effect and the regional effect**. This distinction is introduced by means of CCS variables to capture the effect of community characteristics and their corresponding spatial lag to capture the regional effect. For each CCS and indicator of interest, the spatial lag is a distance weighted average of the neighbouring CCSs' values for that given indicator (see also the definition of geography in Box 1).

The probit model is estimated for the whole sample of operators and **two sub-samples**, corresponding to operators associated with smaller and larger census farms. We define operators of smaller census farms as those reporting total gross farm receipts of less than $250,000 for the census year. This sub-sample corresponds to 58,212 operators (83% of the total sample). Operators of larger census farms are defined as those with total gross farm receipts equal to or greater than $250,000 for the census year; this corresponds to 11,585 operators (17% of the total sample).

The results of these models are then used to compute the **predicted probabilities of off-farm work**, by using the estimated coefficients (β) and a specific set of values of the explanatory variables *H*, *Z*, *K*, and *R*. The specific set of values of the explanatory variables is intended to represent typical profiles of census farm operators. These predicted probabilities are often compared with the predicted probability of the *average operator of a census farm* (for three cases: whole sample, smaller and larger census farms). An average operator is an operator with sample average values for each of the explanatory variables used in the model. For instance we compare the predicted probability of the *average operator* with the probability of the *operator with a university degree*. Hence, we consider the case of an operator who has all the "average" characteristics (average value for his sample) and we compare it to the same operator whose only difference is to have a university degree.

We also compare the difference in the predicted probability of off-farm work for observations that differ by one standard deviation to get a feel for how off-farm work participation varies across the population of census farm operators. A standard deviation is a measure of spread of the data. Typically, 68% of the observations are within plus or minus one standard deviation of the average. For instance, with a 13 year standard deviation for the distribution of operators by age, we are saying that about 68% of the operators are within plus or minus 13 years of the age of the average operator.

For more details on the methodology see Alasia, Bollman, Weersink and Cranfield (2007).

Effect of individual characteristics

Age, gender and education have an important effect on the probability of being engaged in off-farm work, particularly for operators of smaller census farms. Compared to the average operator who had a predicted probability of off-farm work of 41%, the youngest operators were about 2 percentage points more likely to be engaged in off-farm work. The relationship between age and off-farm work, however, is not linear. With other variables being held at their average values, the probability of off-farm work peaked at approximately 35 years of age and was markedly lower for older operators.

For the average operator, a difference of 13 years (one standard deviation, Box 3), from about 43 to 56 years of age, was associated with an 18 percentage point lower probability of off-farm work. Most operators (over 80%) were associated with smaller holdings and thus the results for all operators were largely influenced by the pattern for operators of smaller holdings. Interestingly, for operators of larger farms, the age of the operator was not statistically significantly associated with the probability of off-farm work.

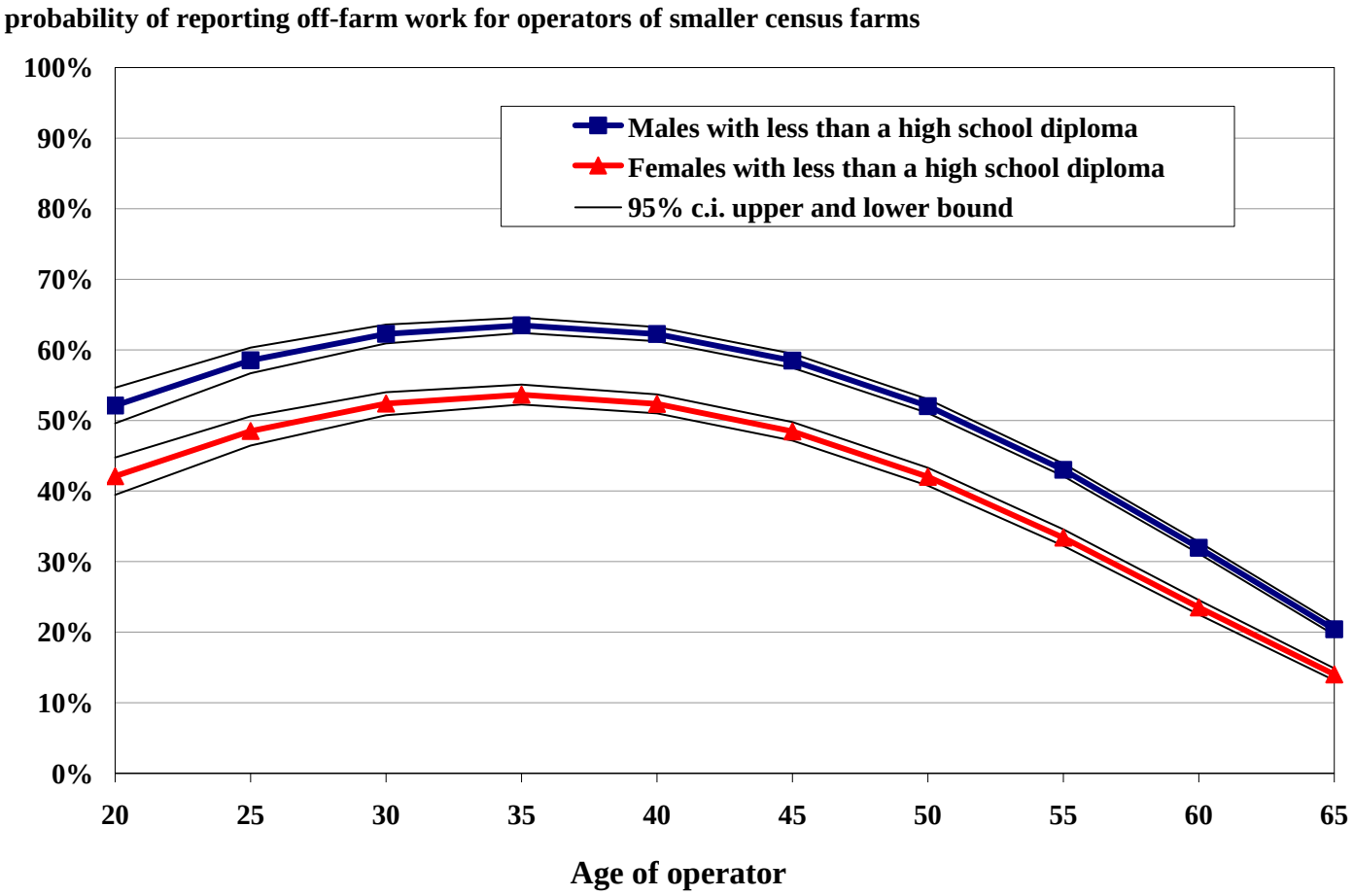
Compared to the average male operator, the average female operator was six percentage points less likely to be engaged in off-farm work. However, the gender differential was different for operators of smaller and larger census farms. Average female operators of smaller census farms had about a 10 percentage point lower probability of working off-farm compared to their male counterparts. In contrast, the average female operators of larger census farms were almost seven percentage points more likely to work off-farm compared to male operators of larger farms (Alasia et al. 2007).

The probability of a census farm operator working off-farm was particularly high for those with a university degree. Compared to the average for all operators, the typical operator with a university degree was almost 20 percentage points more likely to work off-farm. For operators of larger farms this probability differential fell to about nine percentage points.

However, regardless of whether we considered all operators together or if we considered operators of smaller or larger census farms separately, the attainment of more advanced education significantly raised the probability of off-farm work by operators. Each higher level of educational attainment was associated with a higher probability of participating in off-farm work.

Figure 2 and Figure 3 show the predicted probability of engaging in off-farm work for operators of smaller census farms, given different combinations of gender, educational attainment and age, and holding other variables at their mean. Figure 2 shows operators of smaller census farms that have less than a high school diploma while Figure 3 shows operators of smaller census farms that have a university degree. For instance, a 25 year old female operator with less than a high school diploma had a 48% probability of being engaged in off-farm work (Figure 2), compared to a 58% probability for a male operator of the same age and educational attainment and a 78% probability for a male operator of the same age with a university degree (Figure 3).

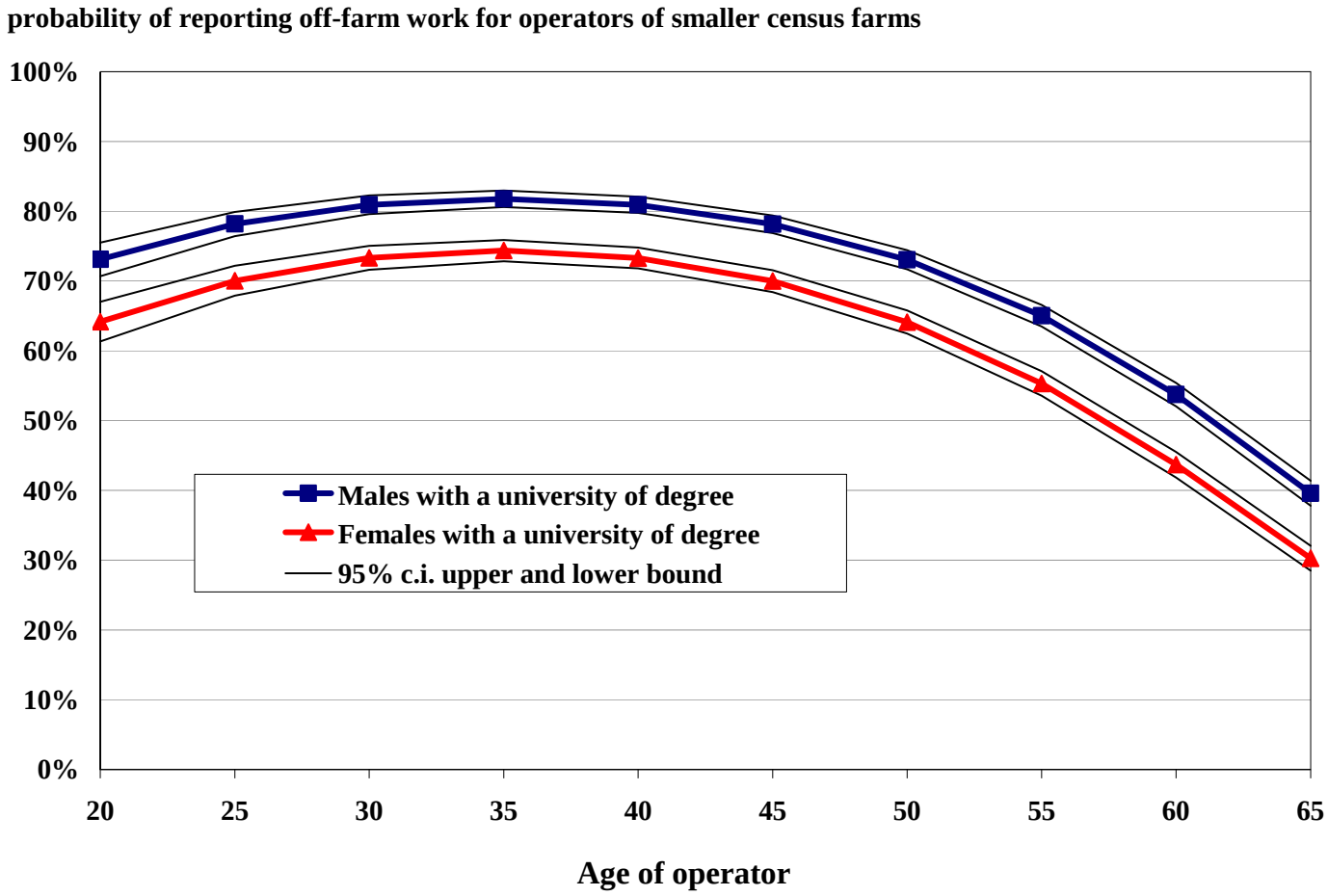
Figure 2 Probability of reporting off-farm work for operators with a less than a high school diploma, by age, showing the impact of operator's sex, Canada, 2000



Note: Probabilities are estimated holding the other explanatory variables at their mean value. The 95% confidence interval (c.i.) means that the true, but unknown, probability of reporting off-farm work has a 95% chance of lying between the lower and upper c.i. bound.

Source: Authors' estimation.

Figure 3 Probability of reporting off-farm work for operators with a university degree, by age, showing the impact of operator's sex, Canada, 2000



Note: Probabilities are estimated holding the other explanatory variables at their mean value. The 95% confidence interval (c.i.) means that the true, but unknown, probability of reporting off-farm work has a 95% chance of lying between the lower and upper c.i. bound.
Source: Authors' estimation.

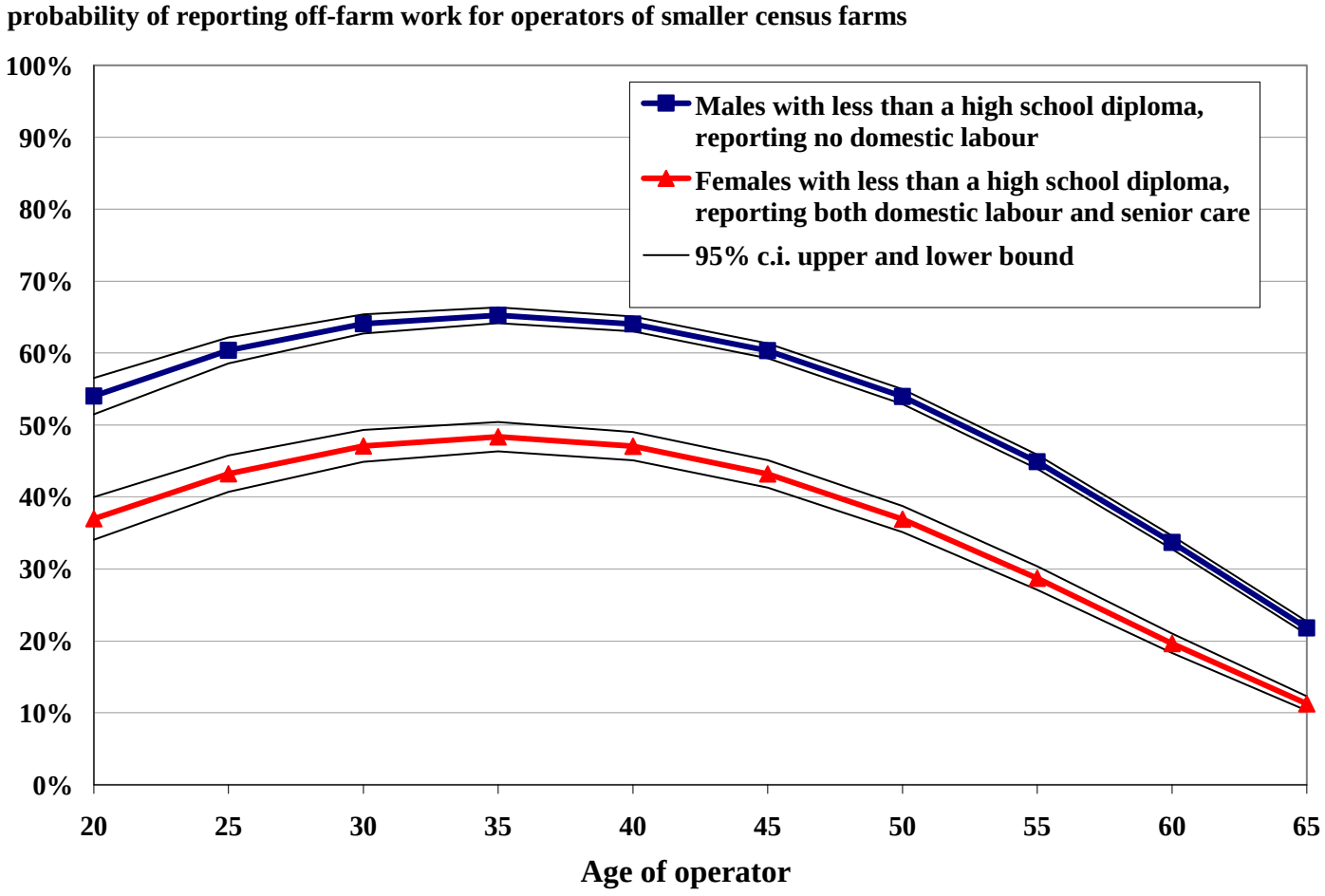
Effect of family characteristics

Family characteristics have a significant impact only for operators of smaller census farms. The typical operator of a smaller census farm who reports both unpaid domestic labour and senior care had a seven percentage point lower probability of working off the farm than a similar operator not reporting any unpaid domestic labour or senior care.

Figures 4 and 5 show the probability outcomes for operators of smaller census farms with different combinations of age, gender, education and domestic labour. Figure 4 shows operators of smaller census farms who have less than a high school diploma while Figure 5 shows operators of smaller census farms that have a university degree.

In particular, the female operator of Figure 4 and male operator of Figure 5 represent the lower and upper predicted probability boundaries for various combinations of these individual and family characteristics. Female operators of smaller census farms reporting domestic labour and less than high school education had less than a 50% probability of being engaged in off-farm work, regardless of their age cohort (Figure 4). This pattern contrasts with the results for male operators of smaller census farms with a university degree and no sizable engagement in domestic labour who had a probability of off-farm work greater than 70%, for any age cohort between 20 to 50 years of age (Figure 5).

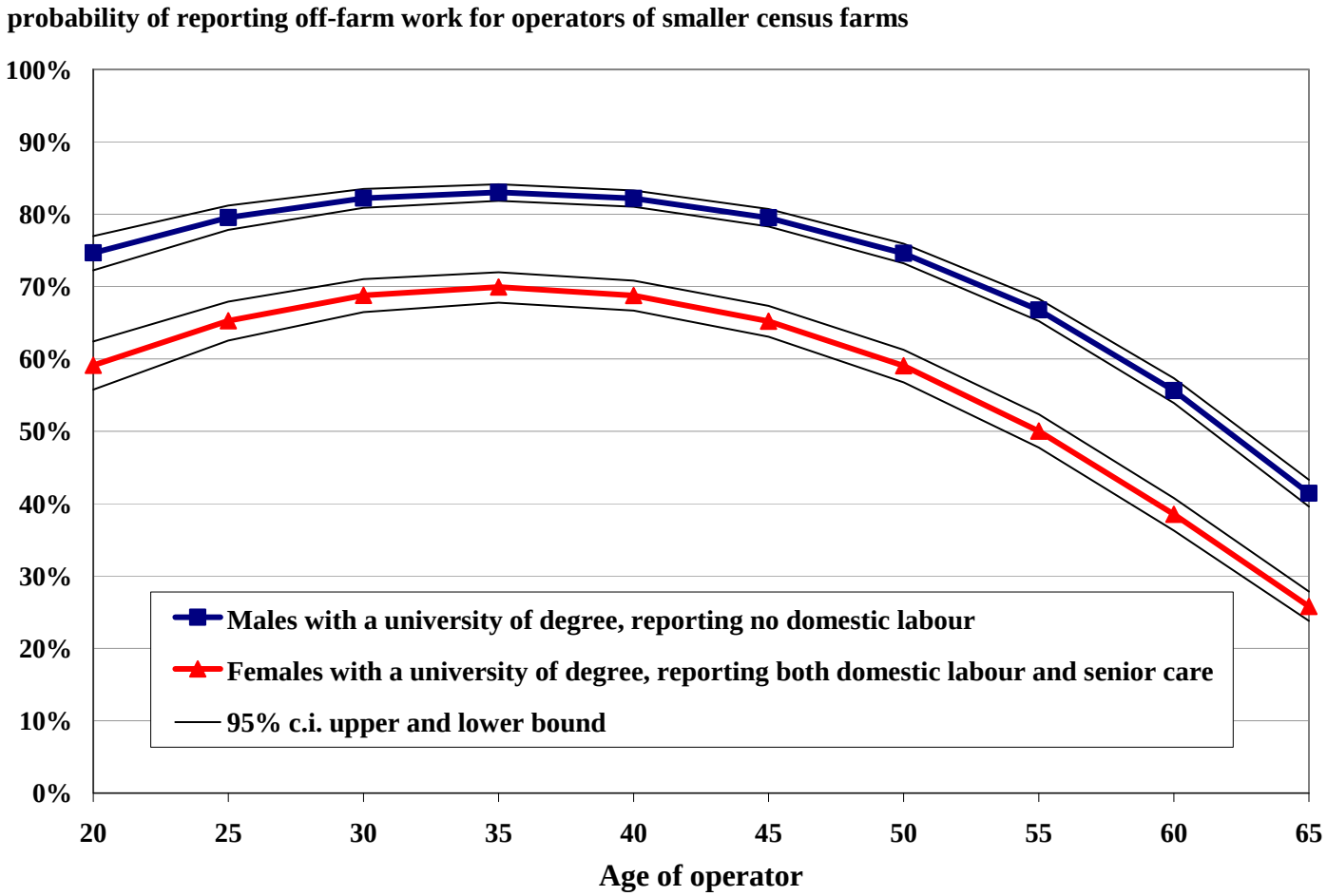
Figure 4 Probability of reporting off-farm work for operators with a less than a high school diploma, by age, showing the impact of participation in domestic labour, Canada, 2000



Note: Probabilities are estimated holding the other explanatory variables at their mean value. The 95% confidence interval (c.i.) means that the true, but unknown, probability of reporting off-farm work has a 95% chance of lying between the lower and upper c.i. bound.

Source: Authors' estimation.

Figure 5 Probability of reporting off-farm work for operators with a university degree, by age, showing the impact of participation in domestic work, Canada, 2000



Note: Probabilities are estimated holding the other explanatory variables at their mean value. The 95% confidence interval (c.i.) means that the true, but unknown, probability of reporting off-farm work has a 95% chance of lying between the lower and upper c.i. bound.
Source: Authors' estimation.

Effect of farm characteristics

The significance and direction of the effect of farm characteristics is remarkably consistent for operators of both smaller and larger census farms. The operator of a census farm with multiple-operators was three to four percentage points more likely to work off-farm as compared to his/her counterpart who was a single operator on the farm. Among operators of smaller census farms, the comparable difference was six to eight percentage points. In other words, an operator of a smaller census farm that had multiple-operators was about six to eight percentage points more likely to work off-farm than a single operator who had otherwise identical characteristics.

Business arrangements also affect the likelihood of off-farm work. The average operator of both a smaller and larger census farm was about three percentage points less likely to engage in off-farm activities if the farm was incorporated, compared to operators whose farm used partnerships or sole proprietorships as business arrangements. Recall

that these results on business arrangements were obtained while holding constant all other variables, including the size of gross farm revenue and the number of operators per holding.

Some of the largest differences in the probability of off-farm labour were observed for operators of different farm types. The average operator of a smaller vegetable farm had a probability of off-farm work that was 23 percentage points higher than the operator of a similar sized dairy farm (the reference group). Meanwhile, the average operator of a smaller grain and oilseed farm had a 37 percentage point higher probability of engaging in off-farm work than the operator of a similar size dairy farm.

For operators of larger census farms and again using dairy farm operators as the comparison group, the probability of working off-farm was 10 percentage points higher for operators of vegetable farms and 25 percentage points higher for operators of poultry and egg farms.

Figures 6 to 9 show different combinations of farm characteristics and farm size for dairy operators and for operators of all other farm types. In terms of the propensity of an operator to work off-farm, Figure 6 and Figure 7 show the difference between smaller farms that have one operator and smaller farms that have three operators. Figure 8 and Figure 9 show the same thing for larger farms. The impact on the probability of off-farm work of being a dairy operator is striking. Dairy operators were universally less likely to be working in an off-farm job.

The effect of a discrete difference in the size of the farm business is also revealing. Changes between minimum and maximum values of farm size generally had a large impact on the probability of working off the farm. However, for only one standard deviation change the effect on the probability was usually more contained. It should also be recalled that gross revenue was used as a classification criterion to split the sample into operators associated with smaller and larger holdings (Box 1).

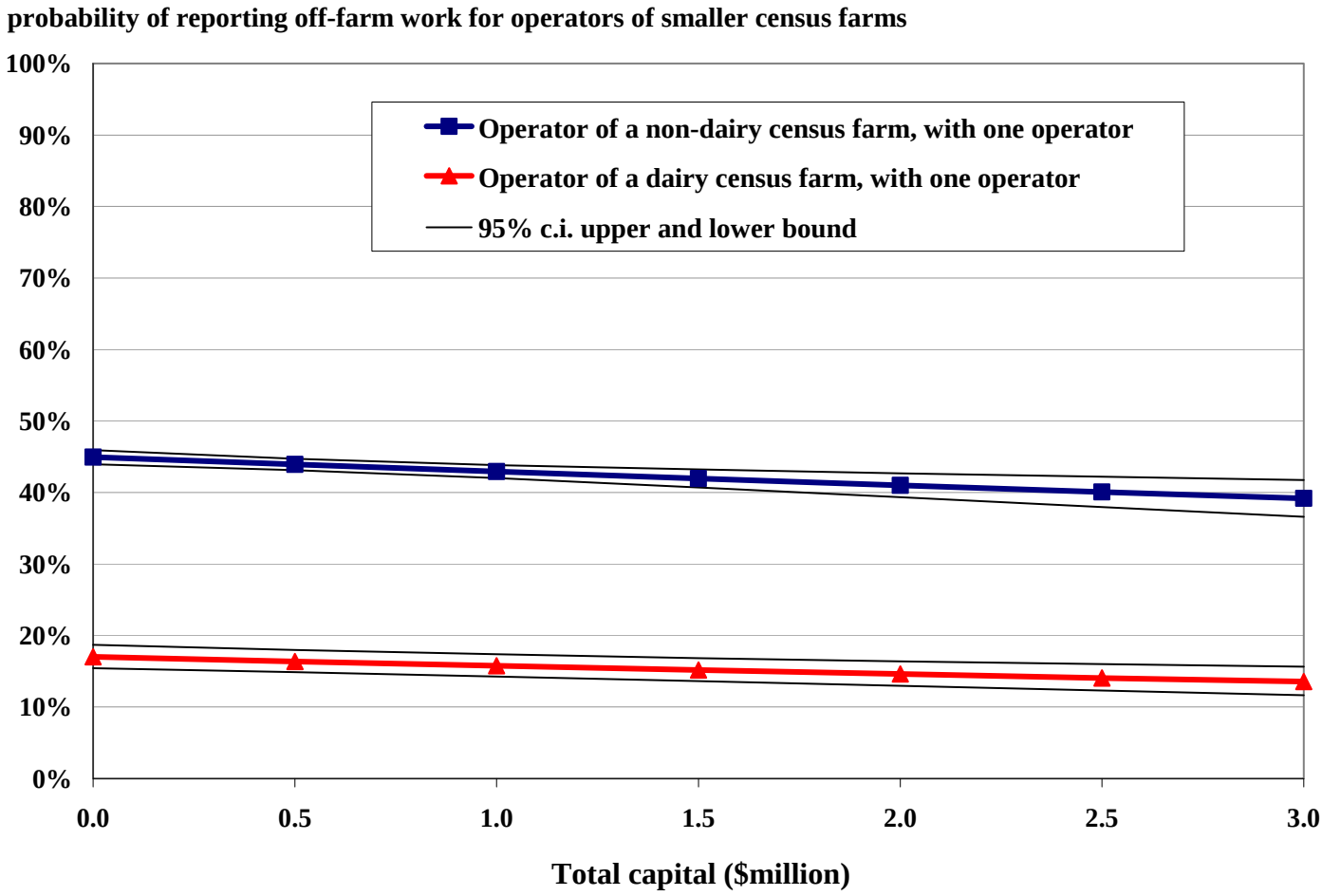
Note in Figure 1 that there is a marked gradient in the percent of operators reporting off-farm work from holdings with gross revenue below $10,000 to holdings with gross revenue of $100,000 to $249,999. These were smaller holdings in this study (Box 1). We would expect gross farm revenue to be statistically significantly associated with the probability of working off-farm for these operators. Among operators associated with larger holdings, only 19% reported some off-farm work, on average. Thus, the estimated relationship between gross farm revenue and off-farm work would be expected to be relatively insignificant for these operators. Hence, it was not surprising that the estimated difference in off-farm work for different gross revenue sizes differed for operators of smaller and larger holdings. The effect of different size classes of gross farm revenue was more important for operators of smaller census farms.

For the average operator of a smaller census farm, the gross revenue appeared to be a critical factor in determining off-farm labour decisions. For operators of farms with larger gross revenues, the predicted probability of engaging in off-farm work was considerably lower. The average operator of a smaller census farm, with gross sales of $59,000, had a 47% predicted probability of being involved in off-farm labour, while a comparable operator with gross sales of about $250,000 had a 26% probability, a 21 percentage point difference in the probability of engaging in off-farm work.

For operators of smaller and larger census farms, a one standard deviation larger capital size was associated with an approximately 2 percentage points lower probability of working off-farm. For hired labour, the same degree of difference was associated with approximately a 1 percentage point lower probability of off-farm work (Alasia et al. 2007).

Figures 6 to 9 show the predicted probability plots for plausible ranges of total farm capital, different types of farms (dairy and non-dairy), and number of operators (one and three). The figures show that operators of larger farms were much less likely to be working off-farm, whether they were involved in a dairy or a non-dairy operation. Among smaller census farms, operators of non-dairy farms were more likely to work off-farm and operators on farms with three operators were more likely to work off-farm.

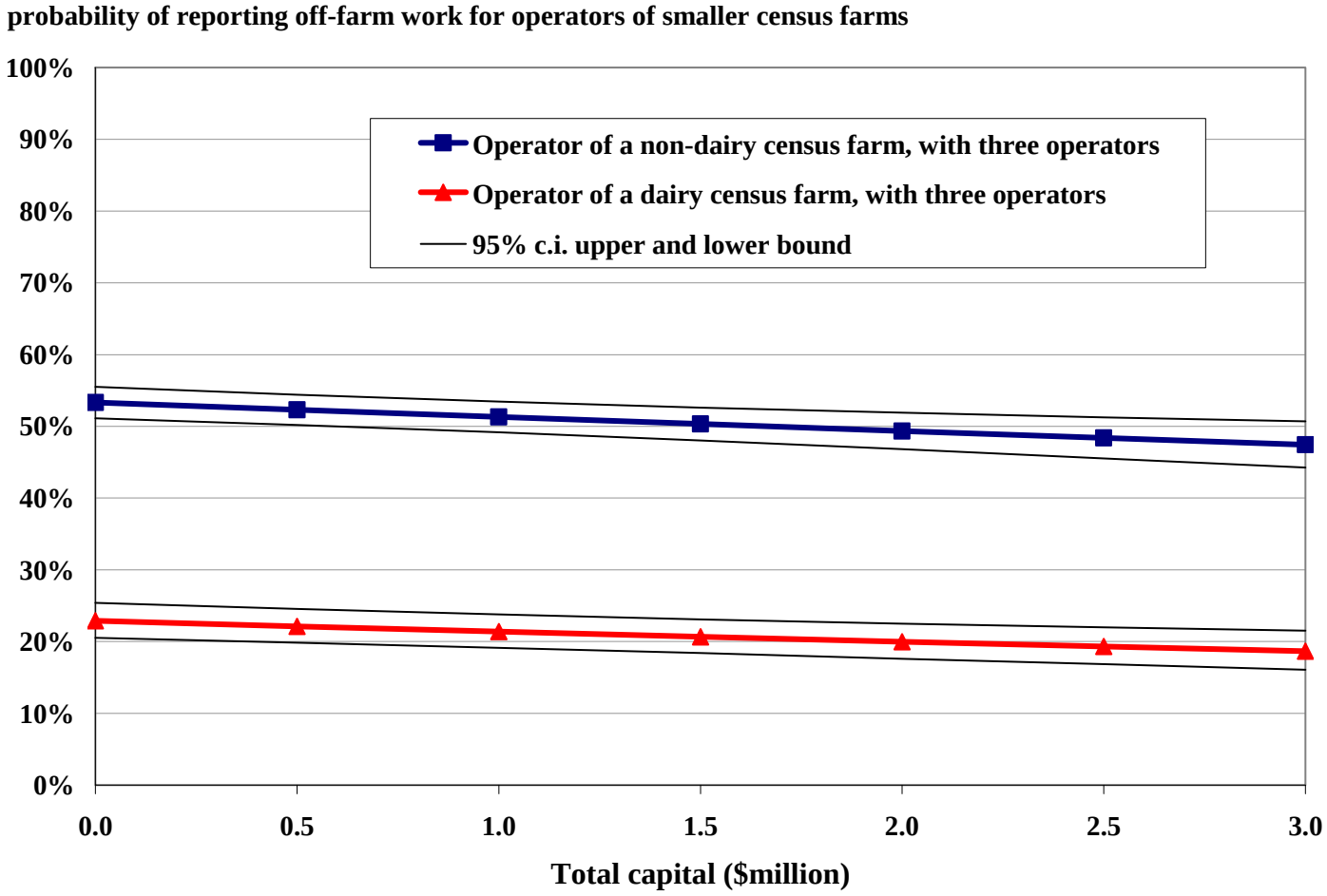
Figure 6 Probability of reporting off-farm work for operators of smaller census farms with one operator, by size of capital value of the operation, Canada, 2000



Note: Probabilities are estimated holding the other explanatory variables at their mean value. The 95% confidence interval (c.i.) means that the true, but unknown, probability of reporting off-farm work has a 95% chance of lying between the lower and upper c.i. bound.

Source: Authors' estimation.

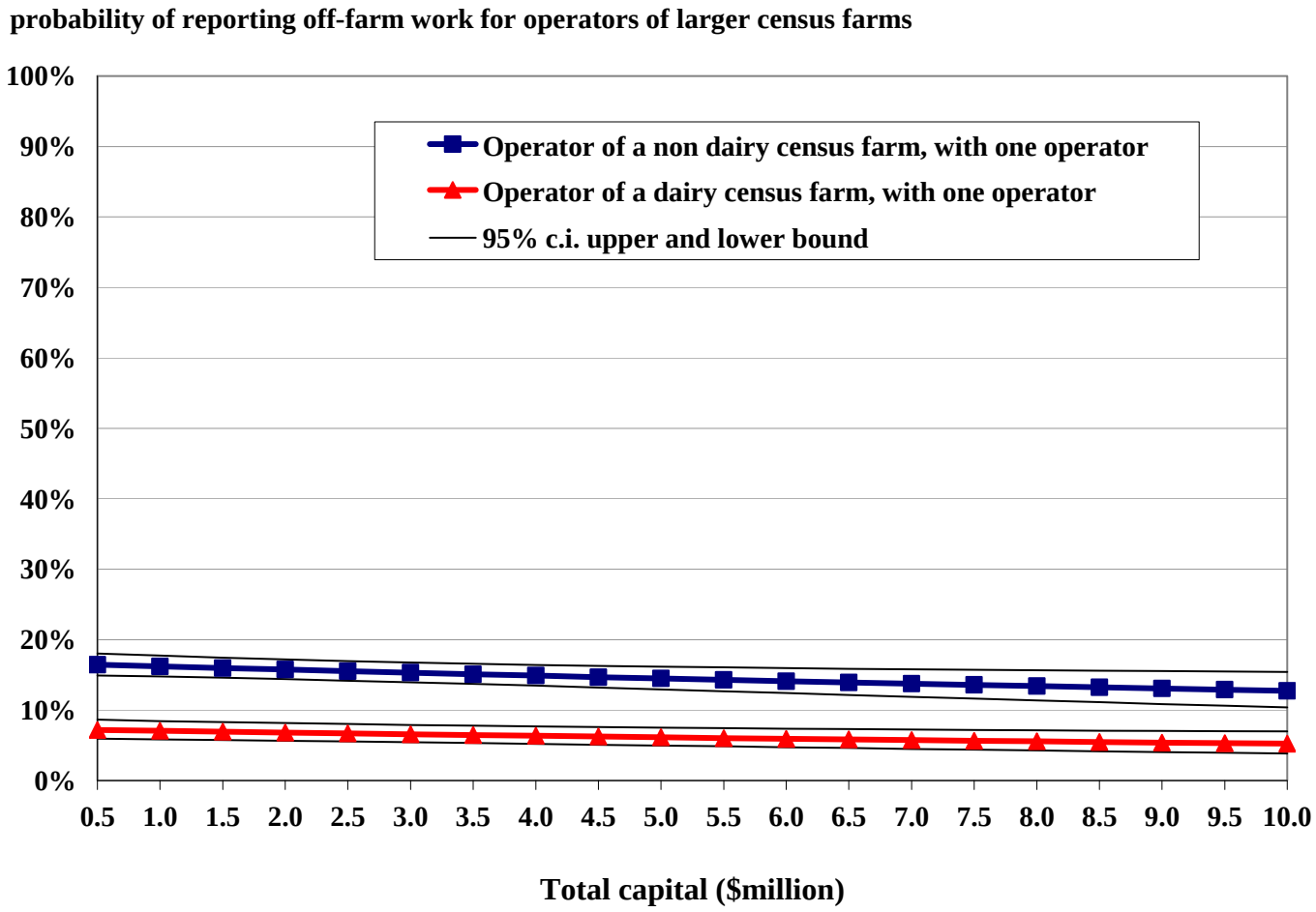
Figure 7 Probability of reporting off-farm work for operators of smaller census-farms with three operators, by size of capital value of the operation, Canada, 2000



Note: Probabilities are estimated holding the other explanatory variables at their mean value. The 95% confidence interval (c.i.) means that the true, but unknown, probability of reporting off-farm work has a 95% chance of lying between the lower and upper c.i. bound.

Source: Authors' estimation.

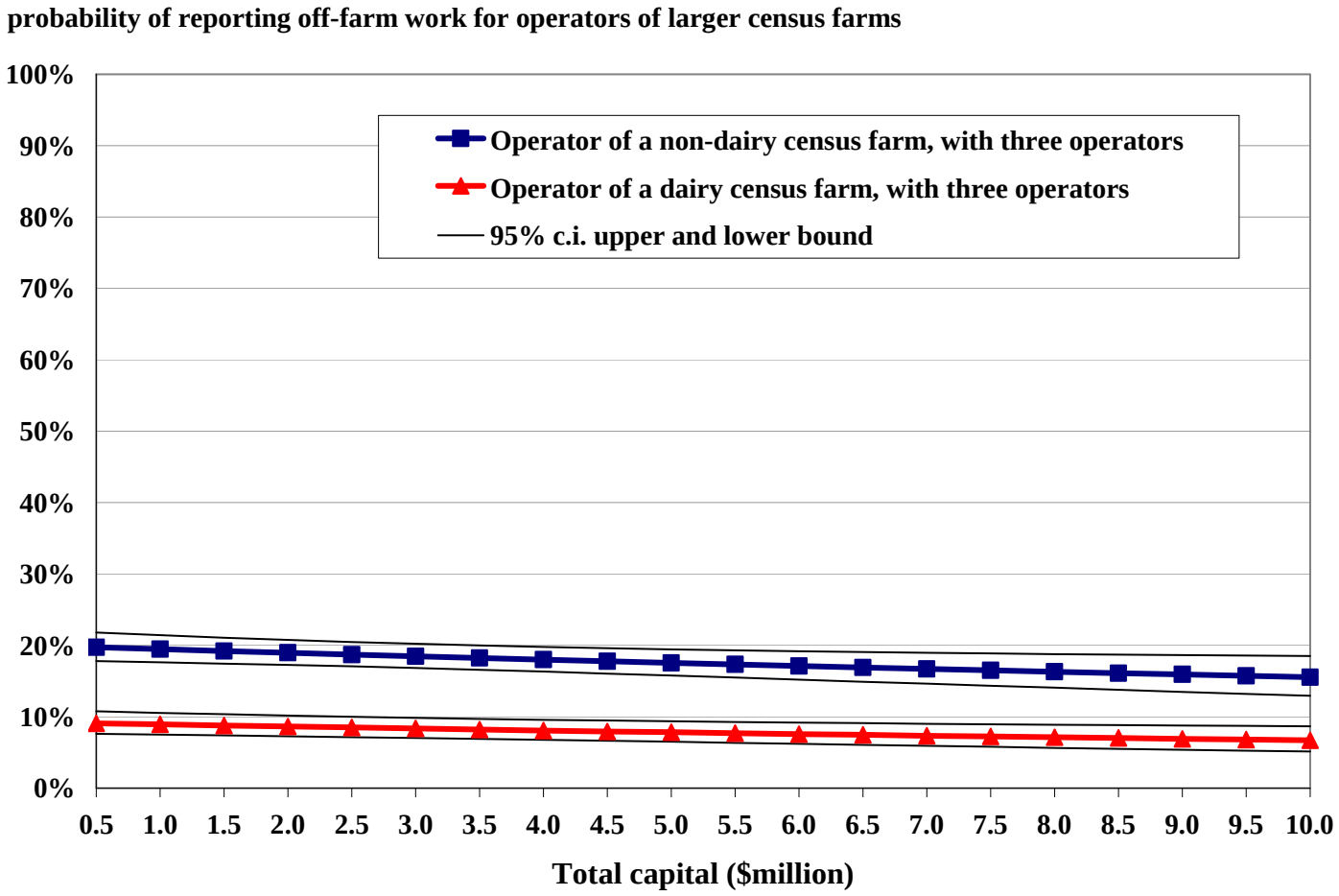
Figure 8 Probability of reporting off-farm work for operators of larger census farms with one operator, by size of capital value of the operation, Canada, 2000



Note: Probabilities are estimated holding the other explanatory variables at their mean value. The 95% confidence interval (c.i.) means that the true, but unknown, probability of reporting off-farm work has a 95% chance of lying between the lower and upper c.i. bound.

Source: Authors' estimation.

Figure 9 Probability of reporting off-farm work for operators of larger census farms with three operators, by size of capital value of the operation, Canada, 2000



Note: Probabilities are estimated holding the other explanatory variables at their mean value. The 95% confidence interval (c.i.) means that the true, but unknown, probability of reporting off-farm work has a 95% chance of lying between the lower and upper c.i. bound.
Source: Authors' estimation.

Effect of community and regional characteristics

Community and regional characteristics appear more relevant in determining the joint decision to work off-farm and to operate a smaller holding.

Operators who lived in communities that experienced rapid employment growth between 1991 and 2001 were more likely to be engaged in off-farm work. The average operator of a smaller census farm who lived in a community with the lowest employment growth was six percentage points less likely to work off-farm compared to a similar operator living in a community with the highest employment growth. The difference in the probability of engaging in off-farm work between a community with an 8% decline in employment from 1991 to 2001 compared to a community with

a 24% increase in employment[2] was less than one percentage point. The incremental effect of this explanatory variable was similar for operators of smaller and larger census farms as shown in Figure 10. Yet, for the average operator of a smaller census farm, the effect of changing regional economic specialization and unemployment rates were larger: about a two percentage point change in the probability of off-farm work for a one standard deviation change around the average regional specialization index (see Appendix Table A.2 for the definitions of the variables).

To gain a better understanding of the effect of changing overall labour market conditions on the probability of off-farm work, a continuum of "typical cases" was defined. Figure 11 shows the combined effect of various levels of community employment growth, regional unemployment levels and regional economic specialization on the probability of off-farm work. The values of the indicators resemble a continuum of conditions from a weak labour market to a strong labour market. While this continuum is clearly a simplification, it does represent plausible ranges of the variables and reflects the conditions observed in several communities across Canada. Holding other variables constant, there was a clear association between overall labour market conditions and the probability of off-farm employment. For the average operator located in a community with a weaker labour market (as shown on the left side of Figure 11 – an employment decline of 40% from 1991 to 2001, a high regional unemployment rate of 30%, and a relatively specialized economy shown by a Herfindahl Index (Appendix A.2 of 0.25) the probability of off-farm labour was about 30%. In contrast, the same average operator located in a community with a stronger labour market (as shown on the right side of Figure 11 – a high employment growth of 60% from 1991 to 2001, a low regional unemployment rate of 4.0%, and a relatively diversified economy shown by a Herfindahl Index of 0.14) had an approximately 54% probability of engaging in off-farm work.

The effect of community and regional employment variables is more complex (Alasia et al. 2007). The effect of community and regional employment in manufacturing act in opposite directions. For operators of smaller census farms, the probability of off-farm work was greater when the census farm is located within a community that had a higher share of the workforce employed in manufacturing. However, a higher share of manufacturing employment in the region was associated with a lower probability of off-farm employment. Hence, the impact of manufacturing employment in the community acted in a different direction than did manufacturing employment in the region. As a result, caution should be exercised when interpreting the results.

Similarly, a higher share of service sector employment in the community was associated with a somewhat higher probability of off-farm work for operators of smaller census farms (Figure 12). However, in contrast to manufacturing employment, the intensity of service sector employment in the region had a marginally positive impact on the probability of off-farm work.

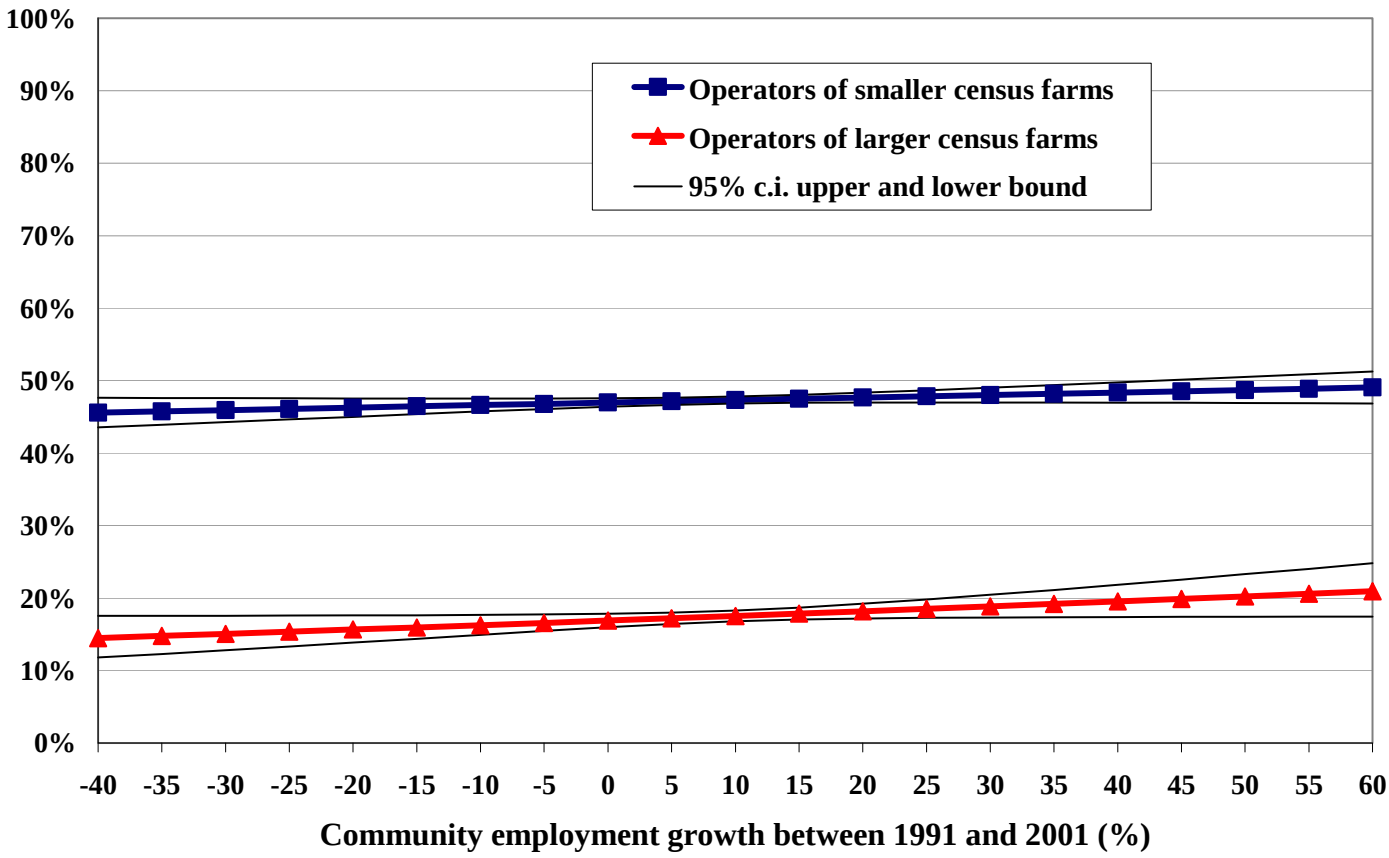
In summary, we found that community and regional characteristics had more influence in determining the decision to work off-farm for operators of smaller holdings than they had on operators of larger holdings. Rapid employment growth over the past decade, lower unemployment and a diversified economy at the community level were all associated with a higher probability of off-farm employment, particularly for operators of smaller census farms.

The impact of the economic structure of the community and region (as measured by employment shares in major sectors) is more complex. This is particularly so for manufacturing,

2. This is a one standard deviation difference in employment growth rates of communities (CCSs) over the 1991 to 2001 period.

where the intensity at the community level had the opposite effect on the probability of off-farm work than did the intensity at the regional level. However, we did not find a similar contradiction between community and region with service sector employment. Higher employment intensity in the service sector at both the community and the regional level was associated with a higher probability of off-farm work.

Figure 10 For operators of each of smaller and larger census farms, those residing in communities with greater employment growth in the previous decade[1] were more likely to be working off-farm in 2000, Canada

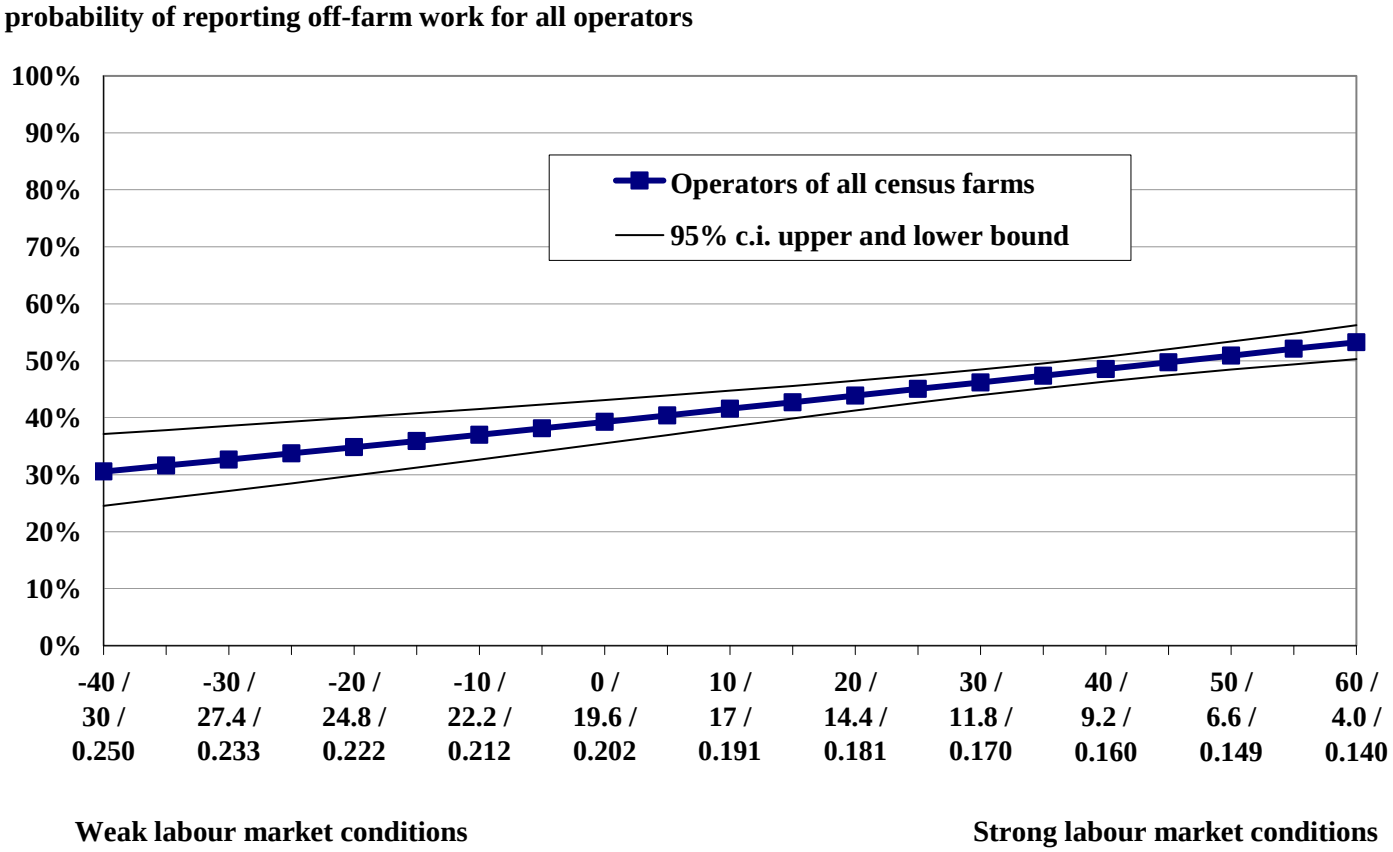


1. 1991 to 2001

Note: Probabilities are estimated holding the other explanatory variables at their mean value. The 95% confidence interval (c.i.) means that the true, but unknown, probability of reporting off-farm work has a 95% chance of lying between the lower and upper c.i. bound.

Source: Authors' estimation.

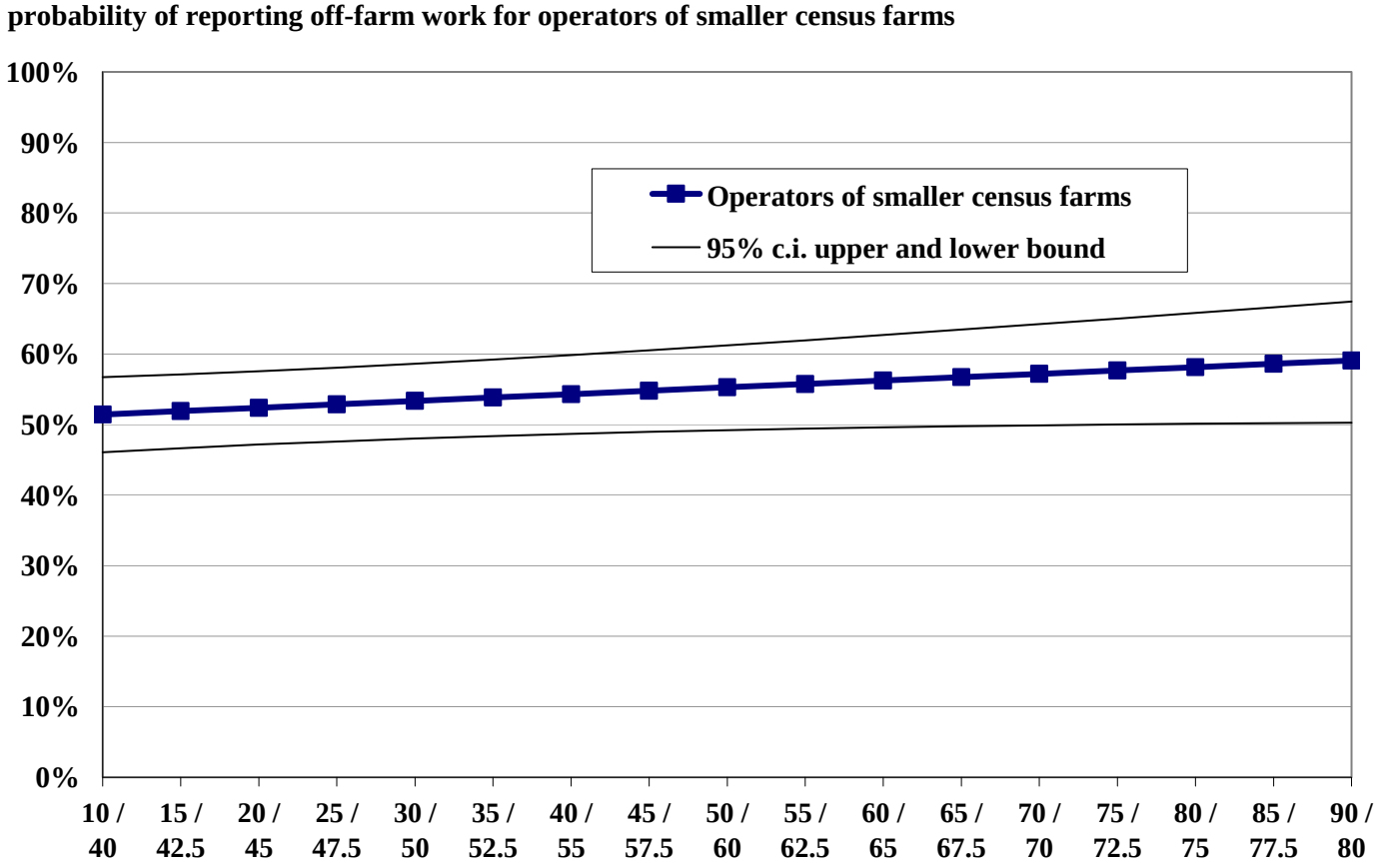
Figure 11 For operators of all census farms, operators residing in stronger labour markets were more likely to be working off-farm, Canada, 2000



Note: Probabilities are estimated holding the other explanatory variables at their mean value. The 95% confidence interval (c.i.) means that the true, but unknown, probability of reporting off-farm work has a 95% chance of lying between the lower and upper c.i. bound.

Source: Authors' estimation.

Figure 12 For operators of smaller census farms, participation in off-farm work is slightly higher for operators residing in labour markets with a higher share of employment in services, Canada, 2000



Note: Probabilities are estimated holding the other explanatory variables at their mean value. The 95% confidence interval (c.i.) means that the true, but unknown, probability of reporting off-farm work has a 95% chance of lying between the lower and upper c.i. bound.
Source: Authors' estimation.

Effect of urbanization factors

The effect of urbanization is particularly interesting and suggests that, once other factors are controlled for, the probability of an operator participating in off-farm work is not positively associated with the proximity or size of a nearby urban labour market.[3] On the contrary,

3. Throughout our discussion, we have presented the results in the context of the operator literally working "off" the holding. However, the exact wording on the Census of Agriculture questionnaire is "In 2000, did this operator receive a wage or salary from **another job** or **operate another business** not involved with this agricultural operation? (Do not include custom work done for others.)." Thus, it is possible that the operator was

participation in off-farm work appears to be more closely associated with rural labour markets. Moreover, similar to the other community and regional characteristics seen earlier, urbanization factors appear more relevant for operators of smaller holdings.

For the average operator of a farm located in the closest proximity of a larger urban centre (i.e. CMA or CA, as defined in Box 1), the probability of working off the farm was 39%, about two percentage points less than that of the average operator of a farm located 55 km away from a larger urban centre. Moving from 25 kilometres to 75 kilometres away from a larger urban centre (a one standard deviation difference) increased the predicted probability of engaging in off-farm work by two percentage points.

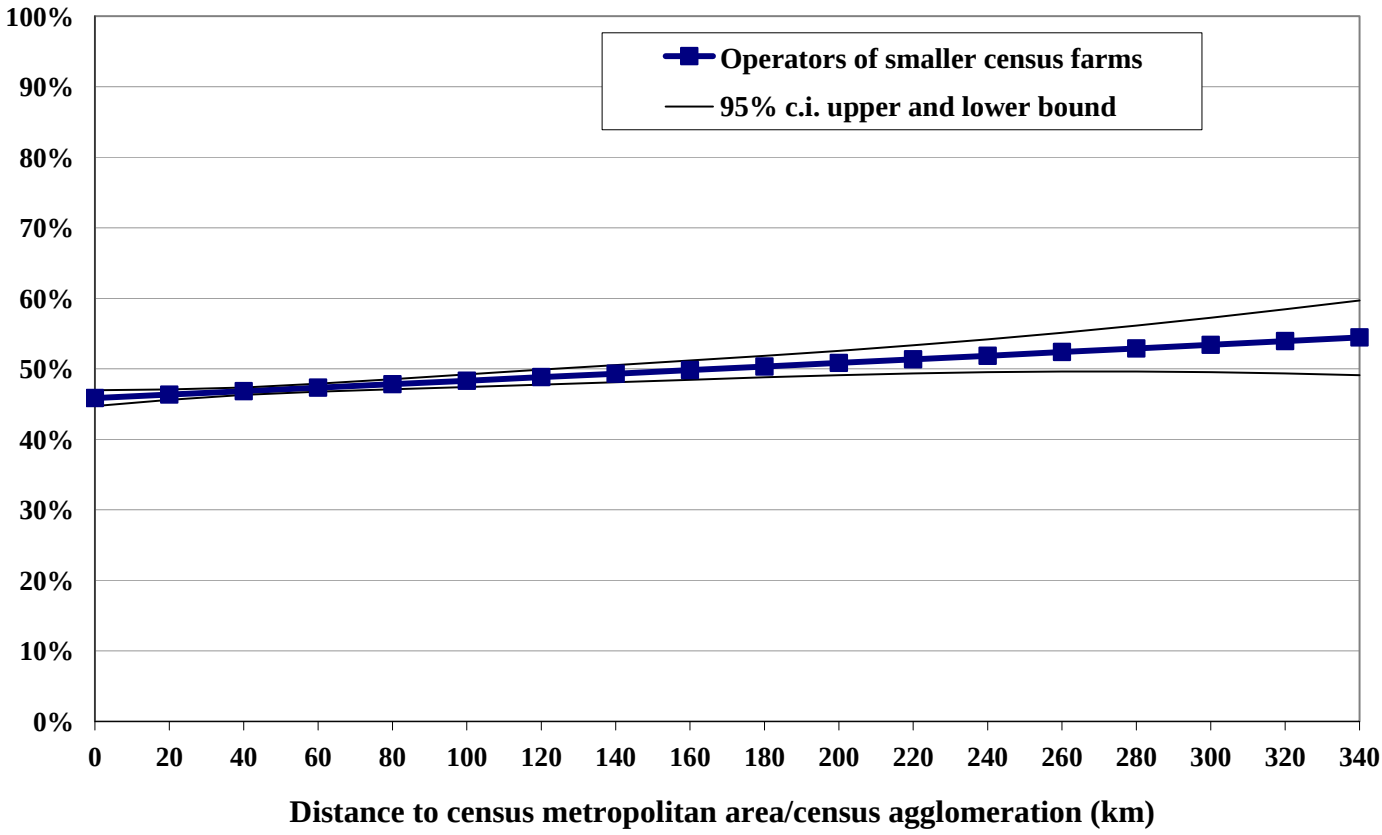
Moreover, an operator of a farm located in the most remote areas (about 340 kilometres from a larger urban centre) had a nine percentage point greater predicted probability of engaging in off-farm work compared to the average census farm operator. A similar pattern was observed for the average operator of a smaller census farm (Figure 13). There is clearly a higher probability of off-farm work for operators that are more distant from a larger urban centre.

When various measures of urbanization are combined (specifically, the distance to a larger urban centre, community population density and regional population density), the gradient between urban and rural types of labour markets become more evident. An average operator of a smaller census farm located close to a larger urban centre (20 kilometres) in a community and a region with a population density of 1,300 and 450 inhabitants per square kilometre respectively, had a predicted probability of off-farm work of about 40% (Figure 14). This contrasted with a predicted probability of over 50% for similar operators located 200 kilometres from a larger urban centre in a community and a region with low population density (1 and 10 inhabitants per square kilometre, respectively). It should be emphasized that Figure 14 is defined on an ideal continuum of distance and density that reflect plausible values for Canadian communities, but the scaling of this indicator is not linear in this figure. The two vertical lines separate ranges of combinations with more homogeneous scaling between the values of the urbanization indicators.

Overall, urbanization factors are negatively associated with the probability of off-farm employment of operators of smaller holdings. This may occur if the proximity to a city raises the value of agricultural work – which could reduce the likelihood of working off the farm for operators near cities. To the extent that the non-agricultural work is another business located on the farm, perhaps this enterprise was established to avoid a long drive to the city which emphasizes the local market as a source for non-farm work.

involved in non-farm work physically located on the holding. In 1996, about 15% of the operators of census-farms reported that they "operated another business (other than farming)." There was no indication whether the business was located on the holding or located elsewhere (Bollman, 1998, Table 4). Thus, not all operators with an "off-farm" job would be working off the holding. Also, not all operators live on their holding. In 2001, 15% of all operators never lived on their holding and others may have lived on their holding for only part of the year. However, our objective is to estimate the factors associated with having a job other than operating the holding. Thus, although the operator may live off the farm, our analysis of factors associated with holding an off-farm job would still apply.

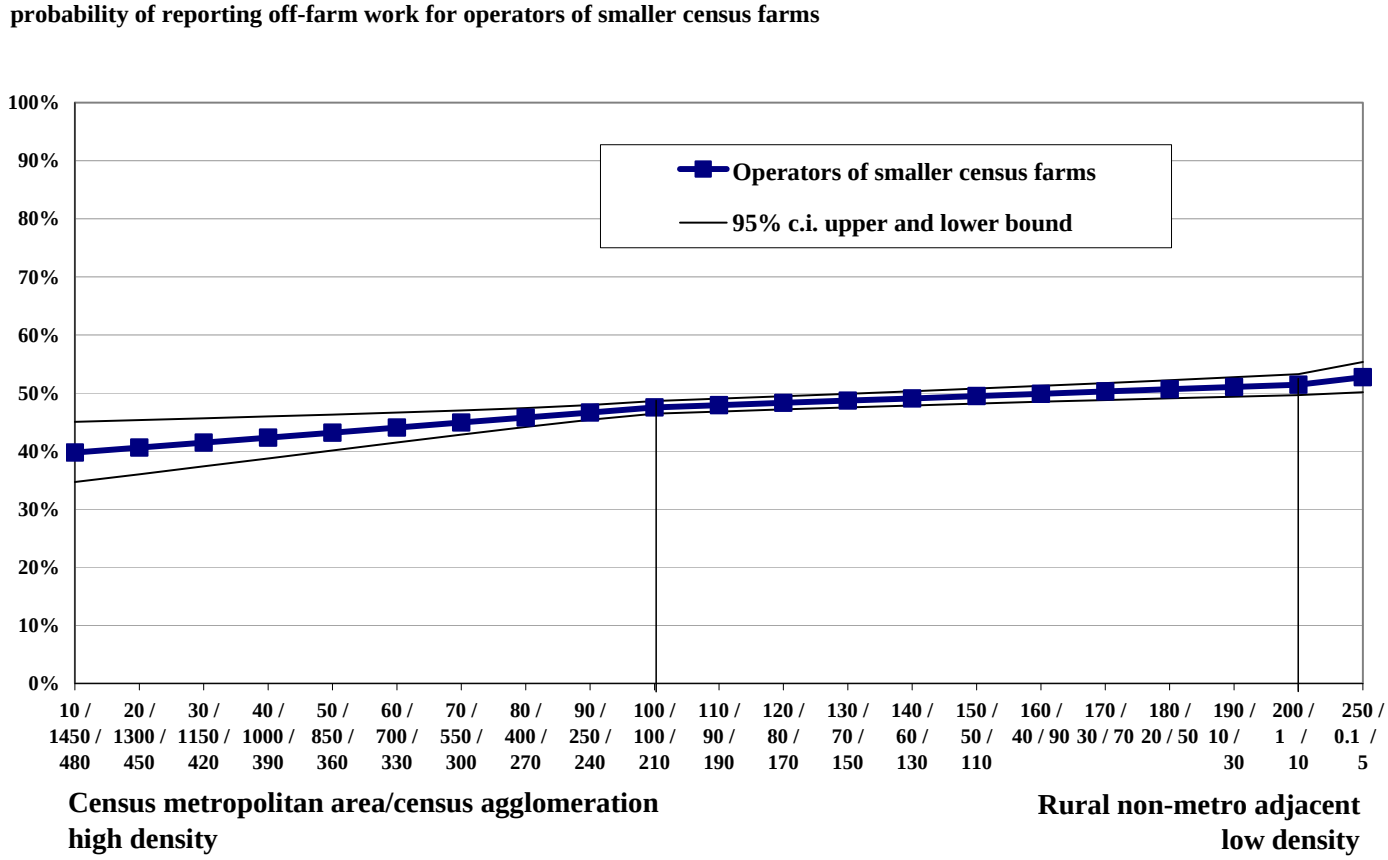
Figure 13 For operators of smaller census farms, the probability of off-farm work is higher for operators located further from a larger urban centre, Canada, 2000



Note: Probabilities are estimated holding the other explanatory variables at their mean value. The 95% confidence interval (c.i.) means that the true, but unknown, probability of reporting off-farm work has a 95% chance of lying between the lower and upper c.i. bound.

Source: Authors' estimation.

Figure 14 For operators of smaller census farms, the probability of off-farm work is higher for operators located in areas that are more rural[1], Canada, 2000



1. with lower population density and a greater distance to a larger urban centre

Note: Probabilities are estimated holding the other explanatory variables at their mean value. The vertical lines separate ranges that have a different scale. The 95% confidence interval (c.i.) means that the true, but unknown, probability of reporting off-farm work has a 95% chance of lying between the lower and upper c.i. bound.

Source: Authors' estimation.

Conclusions

This study has investigated the factors associated with off-farm work by operators associated with smaller and larger agricultural holdings (as measured by the size of gross revenue). The analysis accounted for the characteristics of the individual, the agricultural holding, the community and the region.

The results of this analysis, while confirming some findings of previous research regarding demographic and human capital indicators, provide further insights into the importance of different variables in determining the participation in off-farm labour markets by census farm operators.

Overall, it appears that human capital and farm characteristics are significant and have similar effects for operators of both smaller and larger census farms. Educational attainment is a major determinant of the ability to be an operator of a census farm and to participate in off-farm work. The type of farm must be amenable to off-farm work (i.e. dairy is not). At the same time, operators of holdings with more than one operator are more likely to work off-farm.[4] Operators of smaller farms are more likely to combine off-farm work and the operation of a census farm.

In contrast, family characteristics as well as community and regional characteristics appear significantly more important for operators of smaller census farms. Community labour market characteristics do affect the likelihood of off-farm employment, but much more so for operators of smaller, compared to larger, census farms. This finding does not appear to be at odds with the prevailing literature on smaller agricultural holdings, which emphasizes the combination of family, community and regional factors in determining family well-being. In particular, the importance of multiple jobholding by members of families associated with agricultural holdings has been shown to be relevant in Canada. In addition to the process of exit from the agricultural sector, a partial adjustment of agricultural labour, through participation in off-farm work has become a pervasive strategy of census farm operators and their families (Olfert and Stabler 1994).

These trends have brought recognition to the fact that, in many rural areas, multiple jobholding is likely to be an important strategy for maintaining livelihoods of farming families (OECD 1995). For operators of smaller holdings, the combination of family and local market conditions can play a critical role in determining the well-being of their family.

Another result that should be emphasized is the unexpected effect of proximity to urban areas. This result suggests that urban areas are not the core labour market for the operators who are involved in off-farm labour – rather urban areas appear to enhance the value of the operator's labour on the holding.[5] The result suggests some degree of disjunction between the off-farm labour supply of operators of agricultural holdings and the urban economy. This finding has relevant implications for rural development initiatives aiming to enhance the incomes of families associated with farming. There is evidence that a strong agricultural sector is neither necessary nor sufficient for high and growing household income in rural areas. Research findings from the US indicate that what matters is the linkage of farm factor markets, primarily labour, with the non-farm sector (Gardner 2005; Fuller and Bollman 1992). Hence, off-farm labour

4. Most census farms have one operator. The typical 2-operator census farm is a husband-wife operator team but father-child census farms are the second most numerous type. Among 3-operator farms, father-mother-child is the modal group.

5. We also acknowledge that the non-farm work could be the operation of a non-farm business located on the farm holding. This scenario also emphasizes the linkage to the local labour market for non-farm employment rather than the commuting to an off-farm job in the city.

represents one of the primary chains of transmission of wealth between the farm and non-farm sector. A specific attention to the functioning and performance of rural labour markets is one important way to improve the well-being of farming families.

With a growing share of employment opportunities concentrated in predominantly urbanised regions, the linkages between the urban labour market and the rural population remains vital for the economic sustainability of rural areas (Bollman and Biggs 1992; Schindegger and Krajasits 1997). This finding parallels some research on commuting flows, which indicates that commuting flows are not always unidirectional and not even exclusively dominated by in-commuting to major urban centres (Green and Meyer 1997). Research conducted in Southern Ontario, for instance, indicates a declining urban influence, as a pole of attraction, in face of an increasing rural self-sufficiency or a rural-to-rural pattern of interaction (Green and Meyer 1997). The nature of this rural-to-rural interaction should be further investigated with a specific focus on its relevance to off-farm labour opportunities for members of families associated with smaller agricultural holdings.

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Appendix table A.1 National statistics: selected variables for operators of census farms and their census farms, 2001

Variables	Total	Number of operators		Share of total operators		Share of variable total	
		No off-farm work	Some off-farm work	No off-farm work	Some off-farm work	No off-farm work	Some off-farm work
	units			percent			
Total number of operators							
Sex - Male	346,195	191,975	154,220	100.0	100.0	55.5	44.5
Sex - Female	91,180	4,565	41,615	25.8	27.0	54.4	45.6
Age - Under 35 years	39,915	17,610	22,310	9.2	14.5	44.1	55.9
Age - 35 to 54 years	185,575	86,145	99,430	44.9	64.5	46.4	53.6
Age - 55 years and over	120,705	88,225	32,485	46.0	21.1	73.1	26.9
Average age of operators	49.9	53.1	45.9	...	...	...	...
Major type of farm enterprise (NAICS classification)							
Cattle ranching and farming	125,795	76,265	49,530	39.7	32.1	60.6	39.4
Hog and pig farming	10,940	7,750	3,185	4.0	2.1	70.8	29.1
Poultry and egg production	7,240	4,255	2,980	2.2	1.9	58.8	41.2
Sheep and goat farming	6,235	2,395	3,840	1.2	2.5	38.4	61.6
Other animal production	33,665	13,340	20,325	6.9	13.2	39.6	60.4
Oilseed and grain farming	90,545	51,575	38,970	26.9	25.3	57.0	43.0
Vegetable and melon farming	7,315	4,745	2,575	2.5	1.7	64.9	35.2
Fruit and tree nut farming	11,050	5,610	5,445	2.9	3.5	50.8	49.3
Greenhouse, nursery and floriculture production	12,800	7,225	5,575	3.8	3.6	56.4	43.6
Other crop farming	40,605	18,825	21,785	9.8	14.1	46.4	53.7
Census farms reporting total gross farm receipts							
Under $10,000	72,960	26,580	46,380	13.8	30.1	36.4	63.6
$10,000 to $49,999	101,685	45,145	56,535	23.5	36.7	44.4	55.6
$50,000 to $99,999	47,660	27,010	20,655	14.1	13.4	56.7	43.3
$100,000 to $249,999	68,205	48,080	20,125	25.0	13.0	70.5	29.5
$250,000 and over	55,685	45,160	10,530	23.5	6.8	81.1	18.9
Census farms reporting total farm capital							
Under $100,000	15,680	6,270	9,410	3.3	6.1	40.0	60.0
$100,000 to $199,999	41,715	17,210	24,505	9.0	15.9	41.3	58.7
$200,000 to $499,999	119,055	54,545	64,510	28.4	41.8	45.8	54.2
$500,000 to $999,999	87,440	52,945	34,490	27.6	22.4	60.6	39.4
$1,000,000 and over	82,305	61,005	21,305	31.8	13.8	74.1	25.9
Census farms reporting total farm area							
Under 10 acres (under 4 hectares)	17,795	7,890	9,905	4.1	6.4	44.3	55.7
10 to 69 acres (4 to 28 hectares)	47,035	19,850	27,190	10.3	17.6	42.2	57.8
70 to 239 acres (28 to 96 hectares)	98,385	48,390	49,990	25.2	32.4	49.2	50.8
240 to 559 acres (96 to 224 hectares)	74,455	43,930	30,530	22.9	19.8	59.0	41.0
560 to 1,599 acres (224 to 640 hectares)	69,720	44,050	25,665	22.9	16.6	63.2	36.8
1,600 acres and over (640 hectares and over)	38,805	27,870	10,930	14.5	7.1	71.8	28.2

Source: Statistics Canada, Catalogue no. 95F0355X, and authors' calculation of these data.

Appendix table A.2 The variables used in this study

Dimension variable	Detailed description and computation
Off-farm work (dependent variable)	Dichotomous variable which takes value of 1 if the operator responded "yes" to the question on the Census of Agriculture questionnaire which asked "In 2000, did this operator receive a wage or salary from **another job** or **operate another business** not involved with this agricultural operation? (Do not include custom work done for others.)." Note that work in a non-agricultural business located on the holding would be classified as "off-farm work". We follow the protocol of many other studies by using the term "off-farm work" to refer to work physically performed off the holding plus non-agricultural work that takes place on the holding. In 1996, about 15% of the operators of census-farms reported that they "operated another business (other than farming)." There was no indication whether the business was located on the holding or located elsewhere (Bollman, 1998, Table 4). "Operators" were defined as those persons responsible for the day-to-day management decisions made in the operation of a census-farm or agricultural operation. Up to three operators could be reported per census-farm (Statistics Canada 2003b).
Individual characteristics	
Age	The age of the operator is entered as number of years (*Age*), as well as in its quadratic form as squared number of years of the operator (*Age*Age*) to allow for diminishing, or increasing, effects of an additional year of age.
Sex	*Sex* of the farm operator is entered as a dummy which takes the value of 1 if the operator is female, and 0 if male.
Education	A set of four dummy variables account for the effect of educational attainment: *Less than high school diploma* takes the value 1 if the operator has not completed high school, and 0 otherwise (omitted category); similarly for *High school diploma with or without some non-university post-secondary certificates; University non-degree certificate*; and *University degree*.
Family characteristics	
Children	Dummy variable that takes the value of 1 if the presence of one or more children less than 15 years of age is reported in the family of the operator, and 0 otherwise.
Mobility	Dummy variable that takes the value 1 if the operator has changed address (dwelling) over the past five years, and takes value 0 is the operator has not changed address.
Domestic work	Three independent dummy variables capture the extent to which the operator is involved in domestic work. *Unpaid housework* takes the value 1 if the operator does more than 15 hours/week of unpaid housework, and the value 0 otherwise; *Unpaid childcare* takes the value of 1 if the operator is involved in more than 5 hours/week of child caring, and 0 otherwise; *Unpaid senior care* takes the value 1 if the operator is involved in more than 5 hours a week of care to seniors.
Urbanization characteristics	
Distance to CMA/CA	This is the distance in kilometres between the CCS geographic centroid and the geographic centroid of the nearest Census Metropolitan Agglomeration (CMA) or Census Agglomeration (CA). The variable is used both in the linear and quadratic form.
Population density	Community population density is computed as total non-institutional population of a CCS in 2001 divided by the total land area of the CCS; Regional population density is the corresponding spatial lag.

Appendix table A.2 The variables used in this study (continued)

Dimension variable	Detailed description and computation
Farm characteristics	
Major type of farm enterprise	A set of twelve dummy variables describe the type of farming operation. This classification is generated by the Census of Agriculture (Statistics Canada 2002b). Each census farm is classified according to the predominant type of production. This is done by estimating the potential receipts from the inventories of crops and livestock reported on the census questionnaire and determining the product or group of products that make up the majority of the estimated receipts. The resulting twelve groups are the following (the dummy takes the value 1 if the farm belongs to the group and 0 otherwise): *Dairy* (omitted category); *Cattle (Beef); Hog*; *Poultry and egg; Wheat specialty; Grain and oilseed (except wheat specialty farms); Field crop (except grain and oilseed specialty farms); Fruit*; *Miscellaneous specialty; Livestock combination; Vegetable; and Other combination*.
Number of census farm operators	A set of three dummy variables indicates the number of operators involved in the census farm (1 if the operators belong to that group, and 0 otherwise); the dummies are: *Single operator* (omitted category); *Two operators; and Three operators*.
Business structure	Three types of farm legal organization are distinguished by using a set of dummy variables (1 if the operators belong to that group, and 0 otherwise): *Sole proprietorship* (omitted category); *Partnership* (with or without written agreement); and *Corporation* (including family and non-family).
Farm size	Three indicators of farm size are used both in the linear and quadratic form to allow for diminishing, or increasing, effects of farm size. *Area* is the total land area of the farm in thousand hectares; *Capital* is the total farm capital in million dollars; *Sales* is the total gross farm receipts (excluding forest products) in thousand dollars.
Hired workers	This variable, in linear and quadratic form, is the total number of weeks of hired work, from both part-time and seasonal workers, used on the census farm during the census year.
Community and regional characteristics	
Employment change	The *community employment change* is computed at the CCS level as percent change of total experienced labour force between 1991 and 2001. *Regional employment change* is the corresponding spatial lag.
Specialization	The *community specialization* of the economy is measured by the Herfindahl Index applied to experienced labour force data; the index is the sum of the squares of the industry employment shares in 2001 (experienced labour force). Eleven major industry groups are used in the computation: agriculture; other primary sectors; four types of manufacturing industries (natural resource related, labour intensive, scale based, and product differentiated and science based); construction; and four types of service industries (distributive, business, consumer, and public services). *Regional specialization* is the corresponding spatial lag.
Unemployment rate	The *community unemployment rate* of each CCS is computed as total unemployed individuals age 25 to 54 divided by unemployed and employed individuals age 25 to 54; *Regional unemployment rate* is the corresponding spatial lag.
Employment shares	Eight industry types are used, four for manufacturing and four for services. Industries are classified according to NAICS 2001. We use a classification of industries based on Statistics Canada and previous research of the authors (details are available from the authors upon request). Manufacturing is divided into natural resource related, labour intensive, scale based and product differentiated and science based; and service industries are divided into distributive, business, consumer and public services. Each indicator is used at the *community* and *regional* level (spatial lag).

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