Journal of Agricultural and Resource Economics 42(1):114–126 ISSN 1068-5502

2016 WAEA Winning Student Submission: The Effect of Saskatchewan's Ownership Restrictions on Farmland Values

Mandy L. Gabruch and Eric T. Micheels

Saskatchewan has a history of restricting farmland ownership, often for political reasons and having uncertain economic impacts. We build a model that includes fundamental and non-fundamental components of land valuation as well as indicator variables to capture the effects of ownership restrictions. Using Saskatchewan farmland value data from 1950–2014, we estimate the effect of Saskatchewan's farmland ownership restrictions on land values. The results suggest that ownership restrictions on residents of other Canadian provinces caused a 4.45% decline in the growth rate of land prices for years in which they were in effect.

Key words: Saskatchewan Farm Security Act, valuation

Introduction

Farmland constitutes 64% of all farm assets in Canada; fluctuations in its value can have substantial implications for farmers' financial well-being (Farm Credit Canada, 2015). Saskatchewan's farmland ownership restrictions, which were implemented to support rural communities and maintain opportunities for local farmers to own land, severely limited the amount of land all non-Saskatchewan entities were allowed to own in the province. In 2002, these limits were substantially reduced for the first time since their introduction in 1974 in order to allow Canadian residents and Canadian-owned corporations unlimited opportunity to purchase land for agricultural or value-added purposes (Government of Saskatchewan, 2015b). Although the restrictions have been reduced, the debate surrounding them has not, resulting in an announcement in late 2015 that ownership restrictions will once again be tightened. Pension plans, administrators of pension fund assets, and investment trusts will be excluded in response to public pressure (CBC News, 2015; Government of Saskatchewan, 2015a).

Opponents of Saskatchewan's ownership restrictions suggest that this policy has kept Saskatchewan land values artificially low, which is unfair to the current landowners and farmers whose assets are now undervalued, limiting the potential for debt-financed expansion and higher retirement savings (from the sale of farmland) upon exit. Proponents posit that allowing more outside investment, which could lead to higher land values, creates a barrier to entry for young local farmers and that outside ownership could have negative implications for rural communities. It is often suggested that this policy is what caused Saskatchewan's land values to fall below those of Alberta and Manitoba (see figure 1) (Pratt, 2015; The Globe and Mail, 2015). However, the

Mandy L. Gabruch is a MSc. candidate and Eric T. Micheels is an assistant professor in the Department of Agricultural and Resource Economics at the University of Saskatchewan
The authors would like to acknowledge the judges, organizers, and attendees of the WAEA student paper competition, as well as the reviewers, for their helpful comments. Also, a special thanks to Kelly Foley, Rob Roy, and Bill Brown for their inputs into the earliest drafts of this work.

Review coordinated by David K. Lambert.

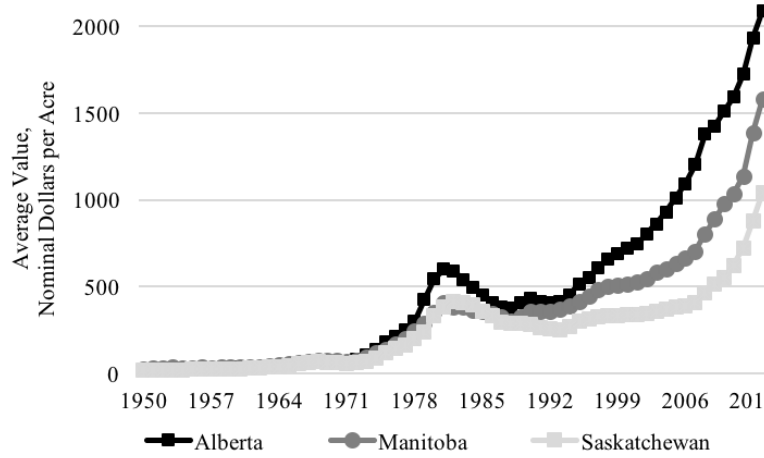

Figure 1. Prairie Provinces Farmland Values, 1965–2014

Source: Statistics Canada (2016c).

accuracy of these assertions is unclear. Additional factors besides policy could contribute to keeping Saskatchewan land values lower than those in neighboring prairie provinces.

A large body of literature suggests that government policies targeted at the agricultural sector can affect farmland values (e.g., Weersink et al., 1999; Barnard et al., 1997). In particular, the relationship between government payments to producers and farmland values has been extensively studied. In the context of both Canadian and U.S. agricultural programs, policies that extend payments to producers are associated with land value increases as a result of payments being capitalized into asset values (Goodwin, Mishra, and Ortalo-Magné, 2003; Shaik, Helmers, and Atwood, 2005; Shaik and Miljkovic, 2010; Veeman, Dong, and Veeman, 1993; Vyn et al., 2012).

Zoning regulations can affect land values if the development of agricultural lands for high density purposes, such as industrial or residential, is disallowed in certain areas to reduce urban sprawl. While these policies do not directly affect producers' income, they are often associated with a decline in land values (Deaton and Vyn, 2010; Lynch, Gray, and Geoghegan, 2007; Vaillancourt and Monty, 1985). These studies suggest that restrictions on farmland uses may have negative effects on its value, so restrictions on buyers may have similar outcomes.

Several studies have made contributions toward quantifying the effect of Saskatchewan's ownership restriction policy, but the results of these studies have not indicated a consistent direction of the effect. Carlberg (2002) showed that restricting the ability of non-Saskatchewan entities to own farmland did not have a significant effect on its value, while Ferguson, Furtan, and Carlberg (2006) found evidence of a negative impact on land values. Both studies used an adaptation of the Present Value (PV) model to estimate the relationship between the regulation and land values. This approach makes them distinct from more recent work by Bell (2012), who used exploratory data analysis rather than a PV model and concluded that the restrictions caused the absolute value of price changes in Saskatchewan to be lower than that in Alberta. As these findings are inconsistent, further research is needed to resolve the ambiguity about the effect of Saskatchewan's ownership restrictions on farmland values.

This paper estimates the impact of Saskatchewan's ownership restrictions on farmland values. Similar to Carlberg (2002) and Ferguson, Furtan, and Carlberg (2006), we incorporate drivers of farmland prices into a price model to estimate the effect this policy might have had on land values. However, the timing of this paper enables our model to use market information for the twelve years following the significant changes made in 2002, while Carlberg (2002) only used data to 1999 and Ferguson, Furtan, and Carlberg (2006) used data to 2002. Our dataset includes farmland market

responses following legislation changes allowing Canadians into the Saskatchewan farmland market. As the number of bidders (and in this case potential bidders) affects asset values (Larue, Pouliot, and Jeddy, 2016), we would expect that data that include the relaxation of restrictions would have a significant effect on Saskatchewan farmland values.

Theoretical Model

The price of farmland is influenced by both fundamental and non-fundamental factors (Falk and Lee, 1998; Power and Turvey, 2010). The fundamental component of farmland value lies in the rents that accrue to the owner, whereas the non-fundamental component involves drivers of land value unrelated to rents and reflects the speculative aspect of the market's valuation (Falk and Lee, 1998; Roche, 2001). The model for Saskatchewan farmland value determination developed here incorporates both components. We apply buyer exclusion to the model to test the hypothesis that Saskatchewan's farmland ownership restrictions have had a negative impact on values by reducing demand.

Fundamental Valuation

To include the effect of fundamental valuation on the price of farmland, we incorporate a PV model—which are commonly used to examine farmland valuation—into the general farmland pricing model. Burt (1986) showed that per acre returns are fundamental to the value of farmland. The PV model specifies the current value of an asset to be some function of future rent values to be earned over the course of its investment horizon. In some cases, these returns can be derived from development (Plantinga and Miller, 2001; Livanis et al., 2006) or from the use of easements to prohibit development (Nickerson and Lynch, 2001). In the Western Canadian farmland valuation literature, returns mostly consist of revenue generated by the production of commodities and income transfers from government payments. However, these revenue sources also have associated production costs, so these costs must also be accounted for to reflect the true return to ownership of the farmland asset. After production costs are removed from the revenues, what is left over are "rents," which accrue to the owner of the farmland. Some function of these discounted future rents influences the price for farmland that a potential buyer is currently willing to pay (Carlberg, 2002; Ferguson, Furtan, and Carlberg, 2006; Goodwin and Ortalo-Magné, 1992; Weerahewa et al., 2008; Weisensel, Schoney, and Kooten, 1988).

Non-Fundamental Valuation

Although the PV model is important to determining farmland prices, these values can diverge from what fundamental valuation would predict them to be, which suggests there is also a non-fundamental component to valuing this asset which needs to be considered (Falk and Lee, 1998; Roche, 2001; Tirole, 1982; Turvey, 2002; Wyman, Seldin, and Worzala, 2011). It is unwise to assume perfectly rational behavior with regard to asset valuation, as the influence of other buyers' valuations can play a role in this process (Shiller, 2006). Investors may not base their willingness to pay on expectations for future returns alone but also on observations of existing price trends and expectations of continuing upward movements in the asset's future value (Engsted, 1998; Featherstone and Baker, 1987; Tirole, 1982; Wyman, Seldin, and Worzala, 2011). Rising asset prices tend to induce higher expectations and willingness to pay, which keeps prices rising (or vice versa, where falling prices continue to fall). This behavior is driven by speculative forces rather than changes to fundamental valuations and has been found to have a role in diverting land values from their fundamental value, particularly over short horizons. It is therefore important to incorporate this behavior into the model (Falk and Lee, 1998; Power and Turvey, 2010; Roche, 2001).

Farmland Demand Model

The components that constitute the price an individual buyer is willing to pay for the farmland asset, P, are

$$P = \frac{R}{i} + S, \tag{1}$$

where P is decomposed into two parts. The first is the fundamental value, derived from future rents, R, to be generated. Because this investment takes place over an indefinite horizon and the discount rate, i, is assumed to be constant, this part converges to a simple capitalization model (Carlberg, 2002). Depending on their intended use for the farmland asset or the purchaser's confidence in his or her own ability to generate returns, R could vary among individual actors (Townsend, Busenitz, and Arthurs, 2010). Additionally, the applied discount rate would vary depending on a variety of factors such as the individual's level of risk aversion or the diversification of existing investments. If a subset of buyers intends to use the land differently or invest differently—for example, an institutional investor versus a farmer—this part of the equation could be affected by restricting participation in the market.

The second part is the non-fundamental component, S, which is driven by speculation about future appreciations in price rather than rational expectations for future rents. Both components of farmland values rely on buyers' expectations. However, all decision makers are faced with a lack of information about future outcomes, so these expectations for the future must be based on currently existing information. The model assumes the formation of heterogeneous expectations among buyers, even though they may have identical information available to them (Brown and Brown, 1984).

Saskatchewan Farmland Market Model

We consider the supply of farmland and the amount of farmland available for sale to be inelastic with respect to price. First, the actual quantity of farmland in Saskatchewan has remained steady since the 1960s, and more cannot be generated in response to price signals (Burt, 1986; Statistics Canada, 2016e). Second, farmland sales—which are mostly a result of exits from farming—tend to be negatively correlated with farm values, indicating that quantities of farmland sales tend to be insensitive to market price signals (Kimhi, 1999). The observed inelasticity of farmland sales may be a result of the nature of farmland investing, which is still undertaken primarily by farmers with the intention of long-term ownership rather than sale for capital gains. Many farmers continue to hold their land until they are no longer able to (Duffy, 2011). The remainder of this paper focuses on factors that influence demand, which is the main driver of value fluctuations when the market is faced with inelastic supply.

Figure 2 illustrates the model for Saskatchewan's farmland market, where price is affected by movements in the aggregate demand function for Saskatchewan farmland buyers. The demand function is assumed to be downward-sloping as a result of heterogeneity among buyers' expectations. The total demand for farmland, D_T, is an accumulation of demand from three groups: local Saskatchewan buyers, D_L; non-Saskatchewan Canadian buyers, D_C; and foreign buyers, D_F. Local demand is an accumulation of individual demand functions for those whose ability to purchase farmland is unaffected by ownership restrictions. In the case of Saskatchewan policy, this subset of potential buyers includes all Saskatchewan residents. Canadian and foreign demand comprise the individual demand functions for non-Saskatchewan residents forced out of the Saskatchewan land market following the implementation of ownership restrictions in 1974. Amendments made to this policy in 2002 allow most Canadians unrestricted access to the ownership of Saskatchewan farmland, so D_C would be added to D_L following the amendments.

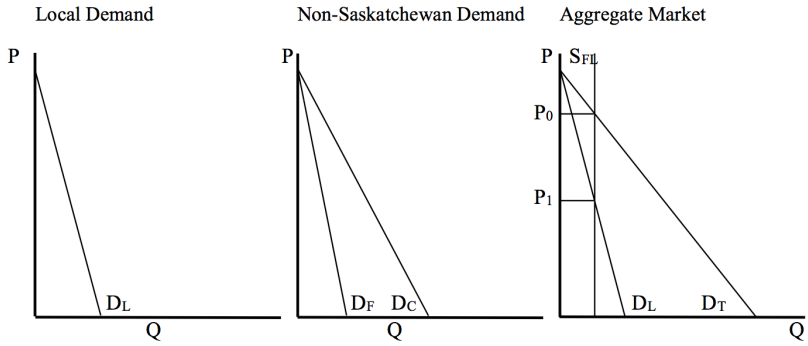

Figure 2. Market Model for Saskatchewan Farmland

Prior to the introduction of Saskatchewan's farmland ownership restrictions in 1974, the aggregate market includes all three demand curves. In this case, the market is cleared where the aggregate demand curve D_T equals the fixed supply curve S_{FL} at price P_0. This market price for Saskatchewan farmland is mainly affected by shocks to expectations and the number of buyers.

A change in the information available to potential buyers that influences their expectations will shift the demand curve. A positive shock to the fundamental price component could be an increase in long-run commodity prices or a decrease in expenses—potentially driven by technology—and would cause all potential farmland buyers to have higher expectations for the returns to be generated by that land than they did before (Brown and Brown, 1984). Alternatively, an increase in historical farmland prices could influence buyers to have higher expectations for future value, which also has a positive effect on their valuation of these assets (Shiller, 2006). Therefore, a positive shock to the information set would make every potential buyer willing to pay a higher price, shifting up the range of prices buyers are willing to pay in the aggregate market and, as a result, shifting the aggregate demand curve right and causing an upward movement in the market-clearing price.

The Saskatchewan Farmland Ownership Act of 1974, which later became a part of the Saskatchewan Farm Security Act,[1] restricted farmland ownership for all non-Saskatchewan residents and corporations to an aggregate assessed value of no more than CAD$15,000. This was amended in 1977 to allow non-Saskatchewan entities to own an aggregate holding of no more than 160 acres. Ownership became most circumscribed in 1980, when farmland ownership was limited to 10 acres for non-Saskatchewan entities. These restrictions remained in place until the act was amended in 2002 (Government of Saskatchewan, 1988).

In the theoretical model developed here, these ownership restrictions act as a barrier to entry for some potential buyers, which means that there are fewer individual demand curves included in the summation for total demand. Assuming no correlation between willingness to pay and the subset of buyers excluded, the result of restrictions would be a lower quantity of land demanded at each price level. The impact can be shown by inward rotation of the D_T curve—which includes all three demand curves—to D_L in the aggregate market and a downward movement in prices from P_0 to P_1. According to the theoretical model, the restriction of buyers in the market has a negative impact on prices. Having fewer participants in a market has also been shown by some contributions to the auction theory literature to reduce competition among buyers, which can have a negative impact on sellers' revenue, although this can vary based on the valuation of the buyers excluded (Brannman, Klein, and Weiss, 1987; Bulow and Klemperer, 1996; Goeree and Offerman, 2003; Compte and Jehiel, 2002; Larue, Pouliot, and Jeddy, 2016). The theoretical results of this conceptual framework motivate the hypothesis that the Saskatchewan Farm Security Act, in its restriction of ownership, resulted in lower farmland values.

[1] Chapter S17-1 of the Statutes of Saskatchewan.

Empirical Model

To measure the effect of these restrictions, we created an empirical model with two binary dummy variables. The first dummy variable is an annual that indicates the exclusion of Canadians who are not residents of Saskatchewan from the market; it equals 0 for years prior to 1974 and 1 for 1974–2002 to indicate the presence of ownership restrictions on all out-of-province entities. As of January 1, 2003, restrictions on all Canadian residents and corporations were removed, so this variable once again takes on a 0 value beginning in 2003. The second dummy variable is intended to capture the effect of excluding non-Canadian entities from the farmland market. These buyers were free to enter the market before 1974 but have been excluded since, so this variable equals 0 for all years preceding 1974 and 1 for all years that follow (Government of Saskatchewan, 2015b).

The fundamental component of valuation models farmland prices as a function of buyers' expectations for future rents to be generated and future price outcomes. However, no available data directly measure these expectations among buyers in the Saskatchewan farmland market. These expectations are therefore approximated using market information from the immediately previous period, which represents the information available to decision makers at the current time. This approach is similar to that taken by Ferguson, Furtan, and Carlberg (2006) and Carlberg (2002), as they also specified that expectations were formed in a previous period and incorporated lagged values into their models.

This market information includes revenue and expense information for the production and sale of Saskatchewan farm commodities. Cash receipts from crop and livestock receipts, as well as government payments, from the immediately previous period are included as a proxy for revenue information. To proxy expenses, information on fertilizer and fuel expenses is included, as these inputs represent approximately 18% of Canadian farm expenses for 2013. Therefore, prices for natural gas, which constitute 70–90% of fertilizer prices, and crude oil are incorporated into the model (Agriculture and Agri-Food Canada, 2013).

To control for the non-fundamental component of land prices, a lagged land price variable is included. This variable is intended to capture the speculative forces that drive the divergence of land prices from their fundamental values. Because these forces often arise from buyers' observations of recent trends and anticipation that these trends will continue into the future, recent farmland price information is included as a proxy for the information that drives speculative forces (Shiller, 2006).

Equation (2) summarizes the basic model used to estimate the effect of ownership restrictions on farmland values in Saskatchewan:

$$\begin{aligned} PL_t &= \beta_0 + \beta_1 Crop_{t-1} + \beta_2 Livestock_{t-1} + \beta_3 GovPmt_{t-1} + \beta_4 CrudeOil_{t-1} \\ &\quad + \beta_5 NaturalGas_{t-1} + \beta_6 PL_{t-1} + \beta_7 Canada + \beta_8 Foreign. \end{aligned} \tag{2}$$

The fundamental and non-fundamental aspects of the average Saskatchewan farmland price, *PL*, are held constant so that the impact of ownership restrictions on Canadian and foreign entities had on these prices can be estimated. Included are provincial annual cash receipts from the sale of crop and livestock commodities (*Crop* and *Livestock*), government payments (*GovPmt*), and *CrudeOil* and *NaturalGas* prices to proxy for information regarding rents. The *Canada* binary dummy variable, which represents the exclusion of Canadian entities residing outside Saskatchewan, and the *Foreign* binary dummy variable, which represents the exclusion of all non-Canadian entities, indicate the presence of ownership restrictions. This model, which has a single lag applied to the independent proxy variables, is referred to as Model A in the following discussion.

Although Model A calls for a single lag on the data, buyers could consider information from more than one previous period when making decisions, as year-to-year fluctuations can be severe in agricultural markets. To account for this, some series are also smoothed using a moving average so that information from several recent variations can be included (Bell, 2012). The purpose of applying a moving average is to capture longer-term dynamics in farmland prices. Falk and Lee (1998) found

that that the fundamental drivers of farmland prices tend to have long-term relationships with land values, whereas non-fundamental drivers tend to cause short-term deviations from fundamental values. Therefore, a second model, Model B, is also regressed, in which a simple three-period moving average is applied to each of the lagged fundamental variables to enable the model to capture some of these longer-term dynamics (Bell, 2012; Falk and Lee, 1998). In Model B, the period t land value is regressed on a simple average of the observations from $t-1$, $t-2$, and $t-3$ for the cash receipts, government payments, crude oil, and natural gas variables. The non-fundamental component does not have a moving average applied to it in this model, and the indicator variables also remain the same.

Data

Saskatchewan farmland value data were downloaded from the Statistics Canada CANSIM database, table 002–0003 (Statistics Canada, 2016c). This data series includes the average province-wide value per acre of farmland and buildings on July 1 of each year. Observations from 1950 to 2014 were used so that information before, during, and after the policy was in effect is included. Since the data span a period over sixty years, they had to be converted into real 2002 dollars to correct for inflation using the Bank of Canada's Consumer Price Index (Statistics Canada, 2016f). To approximate returns to land, data for income from crops, livestock and government payments were retrieved from the Statistics Canada CANSIM database. The observations in each of these farm income categories consist of the annual provincial total value of cash receipts. Observations for 1950–1970 were retrieved from table 002–0014, which was terminated in December 1970 (Statistics Canada, 2016d). The remainder of the returns to farmland data was retrieved from table 002–0001, which contains data for 1971–2014 (Statistics Canada, 2016b). These data were also converted into real 2002 dollars using the Consumer Price Index.

Crude oil prices were retrieved from the Federal Reserve Economic Database, which was sourced from Dow Jones & Company for 1950–1986 and the U.S. Energy Information Administration for 1986 onwards (Federal Reserve Bank of St. Louis and Dow Jones & Company, 2013; Federal Reserve Bank of St. Louis and U.S. Energy Information Administration, 2016). The West Texas Intermediate spot price is used, as it is the North American benchmark for oil markets (Canadian Chamber of Commerce, 2011). The natural gas price used is the U.S. Natural Gas Wellhead spot price series from the U.S. Energy Information Administration (EIA) for 1950–2012, after which the series was discontinued. For 2013 and 2014, the EIA's natural gas spot price from Henry Hub was used; this spot price is considered an appropriate approximation for the discontinued Wellhead price series (U.S. Energy Information Administration, 2012). Both crude oil prices and natural gas prices were converted to Canadian dollars using the CANSIM table 176–0064 data series for the U.S. dollar noon spot rate monthly average, which were averaged over the whole year so that annual price data could be converted (Statistics Canada, 2016a). These prices were also adjusted to real 2002 dollars.

Table 1summarizes the characteristics of the data series gathered for this analysis. The differing units of measurement for these variables resulted in large differences in magnitudes among these series. To ease interpretation of the results, these series were transformed by taking their logarithms so that the resulting regression estimates can be interpreted as elasticities.

Since this analysis employs time series data, non-stationarity is a potential problem, an issue that has been noted in previous literature using similar data to evaluate Saskatchewan farmland prices (Carlberg, 2002; Ferguson, Furtan, and Carlberg, 2006). Non-stationarity is a common problem with time series data that do not maintain consistent statistical properties over time. Dickey-Fuller test results on the logarithm-transformed variables used in this analysis are summarized in table 2 and reveal that the data are non-stationary when left in their level form. To correct these data for non-stationarity, the first difference of each series was taken. Doing so de-trends the data series, which is a common method for addressing non-stationarity. Taking the difference of a logarithm-transformed

Table 1. Descriptive Statistics

Variable	Measurement	Mean	Std Dev	Min	Max
PL	Real CAD$ per acre	373	173	138	833
Crop	Real CAD$ in thousands	4,185,761	1,460,209	2,077,610	7,908,581
Livestock	Real CAD$ in thousands	1,302,195	266,708	820,711	2,171,109
GovPmt	Real CAD$ in thousands	512,473	494,498	3,878	1,925,910
Crude	Real CAD$ per Barrel	39.58	23.34	16.10	99.32
NG	Real CAD$ per 1,000 Cubic Feet	2.86	2.07	0.53	8.30

Sources: Adapted from Statistics Canada (2016a,b,c,d,f), Federal Reserve Bank of St. Louis and Dow Jones & Company (2013), and Federal Reserve Bank of St. Louis and U.S. Energy Information Administration (2016).

Table 2. Dickey-Fuller Test Results for Non-Stationarity

	DF Test Statistics	
Variable (log)	Level	1st Difference
PL	−0.527	−3.040**
Crop	−2.160	−6.073***
Livestock	−1.648	−6.620***
GovPmt	−2.643	−10.873***
Crude	−1.085	−8.173***
NG	−1.445	−7.535***

Notes: Single, double and triple asterisks (*,**,***) indicate significance at 10%, 5% and 1% level, respectively.

variable is approximately equivalent to converting it to a growth rate (Wooldridge, 2013). After this transformation was performed, the Dickey-Fuller test was done again to confirm that the data was stationary following the transformation (see table 2).

Results

Table 3 summarizes the ordinary least squares regression results. The resulting coefficients are to be interpreted as the short-run elasticity of the growth rate of farmland values with respect to a 1% change in the growth rate of the independent variable in the previous period. The binary dummy variables need to be interpreted slightly differently, as they were not converted to logarithm form and differenced like the other variables. The coefficient on the *Foreign* or *Canada* variables can be multiplied by 100 to represent the estimated percentage change in the growth rate of the land values for a period in which ownership restrictions were in effect compared to a period in which they were not, *ceteris paribus*. A post-estimation serial correlation test, in which the estimated residuals were regressed on all independent variables and lags of themselves, was conducted for both models and included three error term lags. The results indicated that serial correlation is not an issue, as the coefficients on the lagged residuals were not found to be statistically different from zero (Wooldridge, 2013).

Both models have similar estimates of the effect that exclusion of non-Saskatchewan buyers had on provincial farmland values. When interpreted independently of the restrictions on foreign entities, Model A predicts that restricting Canadians' access to the Saskatchewan land market is correlated with a 3.75% decline in growth rates, while model B estimates a 4.45% decline in growth rates. Neither model predicts the exclusion of foreign buyers to have a significant effect on farmland values.

The effects of these restrictions were combined for the 1974–2002 period by re-running the models using only one dummy variable equal to 1 through this period only. The resulting coefficients' magnitudes decrease to −2.6% and −2.7%, with p-values increasing to 0.11 and 0.12 for the estimates in Models A and B, respectively. Although these estimates also suggest that restricting non-Saskatchewan access to the provincial land market is correlated with a decline in

Table 3. Estimation Results for Growth Rate of Saskatchewan Farmland (n=63)

Variable	Model A Coefficient	Variable	Model B Coefficient
Intercept	0.0134	*Intercept*	0.0147
	(0.0129)		(0.0127)
$\log PL_{(t-1)-(t-2)}$	0.6232***	$\log PL_{(t-1)-(t-2)}$	0.5447***
	(0.1059)		(0.1229)
$\log Crop_{(t-1)-(t-2)}$	0.0356	$\log Crop_{(t-1)-(t-2)MA(3)}$	0.1500
	(0.0470)		(0.0935)
$\log Livestock_{(t-1)-(t-2)}$	0.0646	$\log Livestock_{(t-1)-(t-2)MA(3)}$	0.1934
	(0.0719)		(0.1422)
$\log Gov_{(t-1)-(t-2)}$	0.0066	$\log Gov_{(t-1)-(t-2)MA(3)}$	0.0147
	(0.0084)		(0.0243)
$\log Oil_{(t-1)-(t-2)}$	0.0442	$\log Oil_{(t-1)-(t-2)MA(3)}$	−0.0279
	(0.0420)		(0.0857)
$\log NaturalGas_{(t-1)-(t-2)}$	0.0046	$\log NaturalGas_{(t-1)-(t-2)MA(3)}$	0.0782
	(0.0477)		(0.0956)
Canada	−0.0375*	*Canada*	−0.0445*
	(0.0218)		(0.0234)
Foreign	0.0169	*Foreign*	0.0257
	(0.0219)		(0.0233)
Adj. R-Square	0.50		0.52
F-Statistic	8.90		9.27

Notes: Single, double and triple asterisks (*,**,***) indicate significance at 10%, 5% and 1% level, respectively. Figures in parentheses are standard errors.

land value growth rates, the magnitude of this estimate is affected by the specification of restrictions on foreign entities.

Models A and B estimate that a 1% increase in the previous period's growth rate of land values is associated with an increase of 0.545%–0.623% in the current period's growth rate, holding changes in expected returns constant. In addition to its magnitude, the low level of error with which these coefficients are estimated suggests that past dynamics in land values have strong implications for current market outcomes. This result supports the idea of a momentum effect, in which rising asset prices tend to cause further price rises in the near future, and the idea that this effect plays an important role in Saskatchewan farmland valuation (Asness, Moskowitz, and Pedersen, 2013; Farm Credit Canada, 2015; Featherstone and Baker, 1987).

Limitations

The results presented must be interpreted with caution regarding the causality of the estimated effects. The data available were highly aggregated across the province, so some important factors that may also influence the value of a farmland parcel, such as productivity or proximity to a major urban center, could not be held constant. As a result, other variables not included in the model may explain the downward shift in land value growth rates during the span of the ownership restrictions. Therefore, the relationship between the policy and land values estimated may be a result of correlation rather than causality.

Additionally, this effect depends on whether the restrictions of Canadian and foreign entities are interpreted separately or combined. Although the results consistently indicate a negative correlation between ownership restrictions and growth rates in values, the magnitude of this relationship varies depending on how the restrictions are specified.

Conclusions

Using data on farmland values in Saskatchewan from 1950–2014, we find evidence of a negative relationship between increased ownership restrictions and farmland values, estimating the impact to be a 3.75%–4.45% decline in growth rates for years in which Canadians not residing in Saskatchewan were excluded from the market. Interestingly, the effect of excluding foreign buyers was not significant or in line with theoretical expectations (i.e., Larue, Pouliot, and Jeddy, 2016). This result may be related to the lack of foreign buyer presence in the Saskatchewan market prior to the implementation of restrictions (Government of Saskatchewan, 2015a). The most recent changes to ownership restrictions were not included because they were only announced in 2015, and the required data were only available to 2014. The effect of excluding pension plans, administrators of pension fund assets and trusts from purchasing Saskatchewan farmland could be an area of future inquiry, as this could affect the demographic of potential farmland buyers in the province.

Model B predicted that the exclusion of non-Saskatchewan-residing Canadians and corporations would have an economically significant impact on farmland values. Using this model's estimated results, which suggest the most severe impact, annual growth rates for 1974–2002 were increased by 4.45% to approximate estimated average growth rates in the absence of restrictions on Canadians. If ownership had not been restricted from 1974 to 2002, we estimate that the 2014 average value of farmland in Saskatchewan would be $1,147 nominal dollars per acre,[2] approximately $104 dollars higher than the actual 2014 price (Statistics Canada, 2016c). Considering that the average farm in Saskatchewan comprises 1,072 owned acres, this policy could be associated with an $111,488 difference in the farmland asset value for a typical farmer (Statistics Canada, 2016e). Even if a 2.6% impact is used in calculations, the difference in land values is $60 nominal dollars per acre, resulting in a $64,320 difference in asset values for the same farm size. Therefore, this analysis suggests that the price of farmland in Saskatchewan may be lower than would be the case if ownership restrictions had never existed, thus reducing financial barriers for entrant or expanding farmers. At the same time, this policy could also negatively affect the wealth of retiring farmers who intend to use the sale of their land to finance retirement. Either way, the magnitude of these estimates suggests that the effect of ownership restrictions could be economically significant, as there are clearly implications for the financial well-being of Saskatchewan's farmers.

Although we did not specifically investigate Saskatchewan land values in relation to those in neighboring prairie provinces, there are still questions to be answered regarding these observed differences. Even though the 2002 amendments brought Saskatchewan's farmland ownership policies into closer alignment with those of Alberta and Manitoba, farmland values still lag (Government of Saskatchewan, 2015b). We estimated Saskatchewan land values to be approximately $1,147/acre had restrictions on Canadians never existed; however, this value is still below Alberta's current average land value, at $2,092/acre, and Manitoba's, at $1,583/acre (Statistics Canada, 2016a). Studying the other potential factors influencing this price differential could shed light onto farmland market dynamics in Western Canada.

[Received July 2016; final revision received September 2016.]

[2] Calculated growth rates between 1974 and 2002 were each increased by 4.44% of their absolute value. These adjusted rates were then used to calculate the average annual farmland price for all years following 1974, allowing the effect to compound over time.

References

Agriculture and Agri-Food Canada. "Canadian Farm Fuel and Fertilizer: Prices and Expenses." Market Outlook Report 5(1), Agriculture and Agri-Food Canada, Winnipeg, Manitoba, 2013. Available online at http://www.agr.gc.ca/resources/prod/doc/misb/mag–gam/mor–rmar/pdf/ rmar_05_01_2013_eng.pdf.

Asness, C. S., T. J. Moskowitz, and L. H. Pedersen. "Value and Momentum Everywhere: Value and Momentum Everywhere." *Journal of Finance* 68(2013):929–985. doi: 10.1111/jofi.12021.

Barnard, C. H., G. Whittaker, D. Westenbarger, and M. Ahern. "Evidence of Capitalization of Direct Government Payments into U.S. Cropland Values." *American Journal of Agricultural Economics* 79(1997):1642–1650. doi: 10.2307/1244396.

Bell, P. N. "How Foreign Ownership Restrictions Affect Farmland Prices in Saskatchewan." Working paper, 2012. Available online at http://web.uvic.ca:8080/∼ uvecon/research/papers/pdfs/Bell.pdf.

Brannman, L., J. D. Klein, and L. W. Weiss. "The Price Effects of Increased Competition in Auction Markets." *Review of Economics and Statistics* 69(1987):24. doi: 10.2307/1937897.

Brown, K. C., and D. J. Brown. "Heterogenous Expectations and Farmland Prices." *American Journal of Agricultural Economics* 66(1984):164. doi: 10.2307/1241033.

Bulow, J., and P. Klemperer. "Auctions Versus Negotiations." *American Economic Review* 86(1996):180–194.

Burt, O. R. "Econometric Modeling of the Capitalization Formula for Farmland Prices." *American Journal of Agricultural Economics* 68(1986):10–26. doi: 10.2307/1241645.

Canadian Chamber of Commerce. "The Impact of Oil Prices on the Canadian Economy." Policy Brief: Economic Policy Series, Canadian Chamber of Commerce, 2011. Available online at http://businessinsurrey.com/wp-content/uploads/2016/03/110621_The_Impact_of_Oil_Prices_on_the_Canadian_Economy.pdf.

Carlberg, J. G. "Effects of Ownership Restrictions on Farmland Values in Saskatchewan." *Journal of Agricultural and Applied Economics* 34(2002):349–358. doi: 10.1017/S1074070800009111.

CBC News. "Debate Launched over Who Can Own Saskatchewan Farmland." 2015. Available online at http://www.cbc.ca/news/canada/saskatchewan/debate-launched-over-who-can-own-saskatchewan-farmland-1.3081341.

Compte, O., and P. Jehiel. "On the Value of Competition in Procurement Auctions." *Econometrica* 70(2002):343–355. doi: 10.1111/1468–0262.00278.

Deaton, J., and R. J. Vyn. "The Effect of Strict Agricultural Zoning on Agricultural Land Values: The Case of Ontario's Greenbelt." *American Journal of Agricultural Economics* 92(2010):941–955. doi: 10.1093/ajae/aap022.

Duffy, M. "The Current Situation on Farmland Values and Ownership." *Choices* 26(2011):1–6.

Engsted, T. "Do Farmland Prices Reflect Rationally Expected Future Rents?" *Applied Economics Letters* 5(1998):75–79. doi: 10.1080/758523507.

Falk, B., and B.-S. Lee. "Fads versus Fundamentals in Farmland Prices." *American Journal of Agricultural Economics* 80(1998):696–707. doi: 10.2307/1244057.

Farm Credit Canada. "Farmland Values Explained." FCC Ag Economics, Farm Credit Canada, Regina, Saskatchewan, 2015. Available online at https://www.fcc-fac.ca/fcc/about-fcc/corporate-profile/reports/ag-economist/ag-economics-farmland-values-explained-summer-2015.pdf.

Featherstone, A. M., and T. G. Baker. "An Examination of Farm Sector Real Asset Dynamics: 1910–85." *American Journal of Agricultural Economics* 69(1987):532–546. doi: 10.2307/1241689.

Federal Reserve Bank of St. Louis, and Dow Jones & Company. "Spot Oil Price: West Texas Intermediate (DISCONTINUED)." 2013. Available online at https://fred.stlouisfed.org/series/OILPRICE.

Federal Reserve Bank of St. Louis, and U.S. Energy Information Administration. "Crude Oil Prices: West Texas Intermediate (WTI) – Cushing, Oklahoma." 2016. Available online at https://fred.stlouisfed.org/series/MCOILWTICO.

Ferguson, S., H. Furtan, and J. Carlberg. "The Political Economy of Farmland Ownership Regulations and Land Prices." *Agricultural Economics* 35(2006):59–65. doi: 10.1111/j.1574–0862.2006.00139.x.

Goeree, J. K., and T. Offerman. "Competitive Bidding in Auctions with Private and Common Values." *Economic Journal* 113(2003):598–613. doi: 10.1111/1468–0297.t01–1–00142.

Goodwin, B. K., A. K. Mishra, and F. Ortalo-Magné. "What's Wrong with Our Models of Agricultural Land Values?" *American Journal of Agricultural Economics* 85(2003):744–752. doi: 10.1111/1467–8276.00479.

Goodwin, B. K., and F. Ortalo-Magné. "The Capitalization of Wheat Subsidies into Agricultural Land Values." *Canadian Journal of Agricultural Economics* 40(1992):37–54. doi: 10.1111/j.1744–7976.1992.tb03676.x.

Government of Saskatchewan. "S–17.1 – The Saskatchewan Farm Security." 1988. Available online at http://www.publications.gov.sk.ca/details.cfm?p=842.

———. "Legislation for Farmland Ownership to be Introduced." 2015a. Available online at https://www.saskatchewan.ca/government/news-and-media/2015/october/20/farmland-ownership-legislation.

———. "Saskatchewan Farmland Ownership." 2015b. Available online at https://www.saskatchewan.ca/∼/media/files/government/have

Kimhi, A. "Family Farm Dynamics in Canada and Israel: The Case of Farm Exits." *Agricultural Economics* 21(1999):69–79. doi: 10.1016/S0169–5150(99)00015–8.

Larue, B., S. Pouliot, and M. Jeddy. "On the Number and Heterogeneity of Bidders in Livestock Auctions." *Canadian Journal of Agricultural Economics* 64(2016):289–310. doi: 10.1111/cjag.12075.

Livanis, G., C. B. Moss, V. E. Breneman, and R. F. Nehring. "Urban Sprawl and Farmland Prices." *American Journal of Agricultural Economics* 88(2006):915–929. doi: 10.1111/j.1467–8276.2006.00906.x.

Lynch, L., W. Gray, and J. Geoghegan. "Are Farmland Preservation Program Easement Restrictions Capitalized into Farmland Prices? What Can a Propensity Score Matching Analysis Tell Us?" *Review of Agricultural Economics* 29(2007):502–509. doi: 10.1111/j.1467–9353.2007.00361.x.

Nickerson, C. J., and L. Lynch. "The Effect of Farmland Preservation Programs on Farmland Prices." *American Journal of Agricultural Economics* 83(2001):341–351. doi: 10.1111/0002–9092.00160.

Plantinga, A. J., and D. J. Miller. "Agricultural Land Values and the Value of Rights to Future Land Development." *Land Economics* 77(2001):56. doi: 10.2307/3146980.

Power, G. J., and C. G. Turvey. "US Rural Land Value Bubbles." *Applied Economics Letters* 17(2010):649–656. doi: 10.1080/13504850802297970.

Pratt, S. "Is It Time to Relax Ownership Restrictions?" *Western Producer* 93(2015):16. Available online at http://www.producer.com/2015/02/is-it-time-to-relax-land-ownership-restrictions/.

Roche, J. "Speculation, Fads, Bubbles, Irish Farmland Prices." *European Review of Agriculture Economics* 28(2001):95–115. doi: 10.1093/erae/28.2.95.

Shaik, S., G. A. Helmers, and J. A. Atwood. "The Evolution of Farm Programs and their Contribution to Agricultural Land Values." *American Journal of Agricultural Economics* 87(2005):1190–1197. doi: 10.1111/j.1467–8276.2005.00806.x.

Shaik, S., and D. Miljkovic. "Dynamic Relationships Between Farm Real Estate Values and Federal Farm Program Payments." *Journal of Agricultural and Resource Economics* 35(2010):153–165.

Shiller, R. J. *Irrational Exuberance*. Princeton, NJ: Princeton University Press, 2006, 2nd ed.

Statistics Canada. "2011 Census of Agriculture." 2016a. Available online at http://www.statcan.gc.ca/eng/ca2011/index.

———. "CANSIM – 002–0001 – Farm Cash Receipts." 2016b. Available online at http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=20001.

———. "CANSIM – 002–0003 – Value per Acre of Farm Land and Buildings, at July 1." 2016c. Available online at http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=20003.

———. "CANSIM – 002–0014 – Total Cash Receipts from Farming Operations." 2016d. Available online at http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=20014.

———. "CANSIM – 004–0002 – Census of Agriculture, Total Area of Farms and Use of Farm Land, Canada and Provinces." 2016e. Available online at http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=40002.

———. "CANSIM – 326–0021 – Consumer Price Index." 2016f. Available online at http://www5.statcan.gc.ca/cansim/pick-choisir?lang=eng&p2=33&id=3260021.

The Globe and Mail. "Globe Editorial: Saskatchewan's Farmland Ownership Rules Are Too Restrictive." *Globe and Mail* (2015). Available online at http://www.theglobeandmail.com/opinion/editorials/saskatchewans-farmland-ownership-rules-are-too-restrictive/article24066357/.

Tirole, J. "On the Possibility of Speculation under Rational Expectations." *Econometrica* 50(1982):1163. doi: 10.2307/1911868.

Townsend, D. M., L. W. Busenitz, and J. D. Arthurs. "To Start or Not to Start: Outcome and Ability Expectations in the Decision to Start a New Venture." *Journal of Business Venturing* 25(2010):192–202. doi: 10.1016/j.jbusvent.2008.05.003.

Turvey, C. G. "Can Hysteresis and Real Options Explain the Farmland Valuation Puzzle?" Working Paper 02/11, University of Guelph, Guelph, Ontario, 2002. Available online at http://purl.umn.edu/34131.

U.S. Energy Information Administration. "Notice of Change to the Publication of Natural Gas Wellhead Prices." *Federal Register* 77(2012):71,788–71,789. Available online at https://www.gpo.gov/fdsys/pkg/FR-2012-12-04/pdf/2012-29232.pdf.

Vaillancourt, F., and L. Monty. "The Effect of Agricultural Zoning on Land Prices, Quebec, 1975–1981." *Land Economics* 61(1985):36–42. doi: 10.2307/3146138.

Veeman, M. M., X. Y. Dong, and T. S. Veeman. "Price Behavior of Canadian Farmland." *Canadian Journal of Agricultural Economics* 41(1993):197–208. doi: 10.1111/j.1744–7976.1993.tb03743.x.

Vyn, R. J., Z. Haq, J. Weerahewa, and K. D. Meilke. "The Influence of Market Returns and Government Payments on Canadian Farmland Values." *Journal of Agricultural and Resource Economics* 37(2012):199–212.

Weerahewa, J., K. D. Meilke, R. J. Vyn, and Z. U. Haq. "The Determinants of Farmland Values in Canada." CATPRN Working Paper 2008–03, Canadian Agricultural Trade Policy Research Network, Guelph, Ontario, 2008. Available online at http://purl.umn.edu/43461.

Weersink, A., S. Clark, C. G. Turvey, and R. Sarker. "The Effect of Agricultural Policy on Farmland Values." *Land Economics* 75(1999):425–439. doi: 10.2307/3147188.

Weisensel, W. P., R. A. Schoney, and G. C. Kooten. "Where Are Saskatchewan Farmland Prices Headed?" *Canadian Journal of Agricultural Economics* 36(1988):37–50. doi: 10.1111/j.1744–7976.1988.tb03260.x.

Wooldridge, J. M. *Introductory Econometrics: A Modern Approach*. Mason, OH: South–Western, Cengage Learning, 2013, 5th ed.

Wyman, D., M. Seldin, and E. Worzala. "A New Paradigm for Real Estate Valuation?" *Journal of Property Investment & Finance* 29(2011):341–358. doi: 10.1108/14635781111150286.