Hobby Farms and Protection of Farmland in British Columbia

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Introduction

Protection of agricultural land, especially near urban areas, is an important public policy objective in many jurisdictions. Zoning is the most widely used instrument for protecting agricultural land, and it is used in British Columbia (BC), Canada, where most agricultural land is in the province's Agricultural Land Reserve (ALR). One of the downsides of zoning is that it creates an incentive for landowners to lobby for variances so they can transfer land from lower-valued agricultural uses to more valuable ones. In jurisdictions where the probability of being granted an exclusion is high enough, those wishing to develop the land or otherwise change its use have bid up the price of farmland beyond its agricultural value. In BC, the primary policy response to speculation has been to provide landowners with tax breaks (farmland is taxed at much lower rates than developed land) to encourage retention of lands in active agriculture. But this creates a whole other set of incentives, especially along the rural-urban interface, as illustrated in this paper.

© Canadian Journal of Regional Science/Revue canadienne des sciences régionales, XXXII: 3 (Autumn/automne 2009), 393-410.
ISSN: 0705-4580 Printed in Canada/Imprimé au Canada

The lower tax burden on farmland has been partially responsible for the growing number of hobby farms and large rural estates in the urban fringe. In some jurisdictions, the threshold for qualifying for preferential taxation rates is set deliberately low in order to make agriculture an attractive land use, although this has the unintended consequence of subsidizing sometimes wealthy landowners pursuing a rural lifestyle in proximity to the urban area (Cotteleer et al 2009). Given that property taxes account for about 40% of municipal revenues in BC, residents might not support tax regulations that favour hobby farmers. Nickerson and Lynch (2001) indicate that residents dislike the fact that tax dollars are spent on hobby farmers who might not use the land to grow crops (horse farms are common), introduce exotic animals such as lamas or ostriches (which sometimes result in externalities associated with smell), are deemed to contravene the spirit of the agricultural land protection regulation (food growing), or are perceived to be better off (even if they are not).

When surveyed, BC residents indicated strong support for agricultural land protection; for instance, in 1997, 90% said they favoured limits to urban development to protect farmland (Quayle 1998), in 2005, 94% of Central Saanich residents said they felt agriculture contributed greatly to the community (Walker 2005), and in 2008, 95% of BC residents said they support the ALR and the policy of preserving farmland (including 52% who said they "strongly support" this concept) (Ipsos Reid 2008).. However, researchers and policy-makers alike should question why so many people favour protection of agricultural land as a matter of principle. The growth in the number of hobby farms might be a positive development if the purpose of agricultural land protection is to slow development and retain open space and if hobby farming is not a first step towards the urbanization of agricultural land. If, on the other hand, the purpose of the ALR is to help support a viable farm economy, growth in hobby farming could be considered a step in the wrong direction as it could exert pressure on farmland values within the ALR, thereby making it difficult for conventional farmers to increase their land base and achieve economies of scale.

In this research, we investigate whether the establishment of hobby farms is detrimental to the goal of agricultural land preservation. We do so by focusing on the role of hobby farming within and in close proximity to the ALR. We test whether hobby farmers affect prices inside and outside the ALR, and identify what implications this has for the effectiveness of the ALR and other policy measures to protect agriculture in the urban shadow. We compare the results of two approaches for investigating the divergence between the price paid by conventional and hobby farmers in relation to the ALR. First, the hedonic pricing model employed by Cotteleer et al (2009) is extended to allow for divergence between the two farming types. Second, the propensity score method is used to control for a potential endogeneity bias with respect to hobby farms in the hedonic pricing model.

The outline of the remainder of the paper is as follows. In the next section, we consider why government intervention is needed to protect farmland and what form public policies might take. We then provide background information about agriculture in British Columbia and the Agricultural Land Reserve as an

instrument for protecting farmland. This is followed by a description of the methods we employ, and by a discussion of the data and variables used in the analysis. Finally, we provide estimation results followed by our conclusions and some policy implications.

Government Interference and Externalities at the Urban-Rural Fringe

Legislation, policies and other instruments to protect farmland are justified on the grounds that such protection is a public good, with farmland being under provided if left to markets and private individuals. The main output from farmland is marketable goods, but farmland also provides a variety of positive 'spillovers'. One might identify four types of value associated with agricultural land protection (Kline and Wichelns 1996): (i) agrarian values relate to food production and protection of the agricultural heritage and traditions of an area; (ii) environmental values concern protection of wildlife habitat, flood control and other environmental services that agriculture provides; (iii) aesthetic values focus on the preservation of open space; and (iv) anti-growth values see land protection as a safeguard against urban sprawl. Roe et al (2004), Irwin (2002), Curran (2001), and others have shown that citizens are willing to pay significant amounts to protect these amenities.

While positive externalities can be used to justify zoning and other legislation to protect farmland (such as beneficial tax regimes for agricultural producers), it is more difficult to justify protecting agricultural land because society needs to retain the ability to produce farm products in the future (though many make this argument). For example, Quayle (1998) concludes that agricultural land should be preserved at all costs, arguing that the importance of the province's agricultural sector for food production represents a sufficient reason to preserve all farmland. Yet, protection of agricultural land for the purpose of maintaining future agricultural production potential cannot be viewed as a public good, because, if declining global agricultural production or food scarcity is indeed a concern, the value of land in agriculture would rise relative to that in other uses in anticipation of rising future agricultural commodity prices, thereby causing more agricultural land to be protected privately. Although agricultural production is important in some jurisdictions, especially where food security is a concern, the impetus for protecting farmland in BC's urban fringe has more to do with a desire to protect a way of life, open space, access to farms for educational purposes, and other factors.

Multi-functionality is an increasingly common term (especially in Europe) to describe the various attributes of farmland and its contribution to a community. This includes not only food production and an economic source of wellbeing, but also ecological services, aesthetic properties and recreational value. Thus, governments at various levels recognize the public goods encapsulated by farmland and seek policies that enhance farmland protection and access (Brouwer and van der Heide 2009).

Agricultural Land Protection in British Columbia

British Columbia is Canada's westernmost province. It is characterized by rugged terrain, fertile valleys and, in some areas, the country's mildest climates. Its arable regions include part of Canada's grain belt (in the northeast), an intermountain region of livestock grazing and forage production, a Mediterranean inland lake region (the Okanagan Valley) noted for its orchards and vineyards, and wet mild areas in the southwest of the province. The latter consists primarily of the Fraser Valley on the mainland (near Vancouver) and the Saanich Peninsula (near Victoria) on southern Vancouver Island that offers a climate capable of growing the widest variety of crops in Canada.

Primary agriculture in BC generates approximately $2.2 billion in farm gate sales and more than 30,000 jobs (BC Ministry of Agriculture Food and Fisheries 2004; BC Ministry of Agriculture and Lands 2006). When food processing and other related industries are taken into account, the totals become even more significant for the provincial economy – some $21.9 billion and more than 280,000 jobs. Yet only 2.7% of the province is capable of growing a reasonable range of crops (Runka 2006), and much of this land lies near the rapidly developing urban areas of Victoria, Vancouver and Kelowna, and thus is under increasing development pressure.

The provincial government created the ALR in 1973 after it was estimated that 6,000 ha of farmland were being lost to development annually. Included in the ALR at inception was all farmland of two or more acres (0.81 ha or more) that was assessed as farmland for tax purposes, zoned as agricultural land by local governments, or rated in land classes one to four according to the Canada Land Inventory.[1] Though ALR lands remain in private hands, owners cannot subdivide them, build more than one dwelling or use them for non-agricultural purposes. The ALR is overseen by the Agricultural Land Commission (ALC) which adjudicates applications for exclusions, sub-divisions or non-farm uses. A map of BC's ALR is provided in Figure 1.

At the time it was formed, the ALR measured 4,715,897 ha, but it had grown to 4,759,219 ha by 2007, a net increase of 43,322 ha (Agricultural Land Commission 1974 to 2007). These figures belie the true state of agricultural protection, however, because most of the land excluded over time has come from the fertile south while most additions have come from the more arid northeast. According to Statistics Canada's (2006) Agricultural Census, the number of farms in BC has increased by 7.8% since 1971 – a trend opposite to that of the rest of Canada, although some turnaround in this trend was seen in the last agricultural

1. The Canadian Land Inventory rates land according to soil class on a seven-point scale, where class one land has the highest agricultural capability and class seven land no agricultural capability. Classes one to three constitute prime farmland (Runka 1973; van Kooten 1993: 271-274).

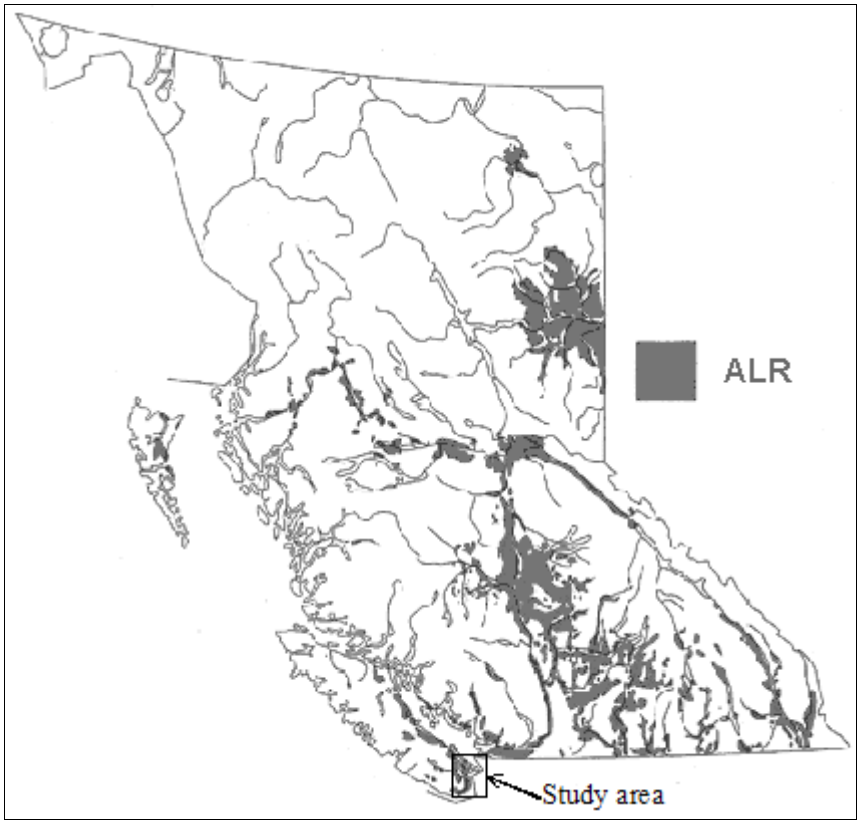

FIGURE 1 BC's ALR and the Study Area (Source: Smart Growth BC 2004, edited map)

census.[2] This suggests that new farms are being carved out of marginal land or, more likely, that some farms (including ones outside the ALR) are being subdivided and sold. Since the trend has been towards consolidation of farms into larger units, subdivision into smaller parcels requires an explanation that may be consistent with the observation that numbers of hobby farms near major urban areas have increased. As a result, the increase in farms is not necessarily an indication that the farm sector is thriving, but rather that it is dwindling, especially near urban centres.

Besides zoning policies to preserve farmland, BC also utilizes beneficial property tax regulations to reduce farmers' financial burdens. A farm property attains farm class status (and thus lower taxes) if it meets the restrictions described in Table 1. The gross agricultural income threshold is quite low and a property

2. The number of farms in BC declined by 2.2% between 2001 and 2006, while the number of farms in Canada declined by 7.2% during the same period, and by 37.3 per cent since 1971 (Statistics Canada 1971, 2001, 2006). So BC farms are being lost or amalgamated at a slower rate than the rest of the country.

TABLE 1 Thresholds for Properties to Qualify for Farm Class Status

Parcel size	Annual revenue threshold to be met once every two years
< 0.8 ha	Gross farm revenues ≥ $10 000
≥ 0.8 ha, < 4 ha	Gross farm revenues ≥ $2 500
≥ 4 ha	Gross farm revenues ≥ $2 500 plus 5% of land's assessed value

between 0.8 and 4.0 ha can meet it, for example, by harvesting and selling approximately 0.07 ha of Christmas trees, the eggs from approximately 70 chickens, alfalfa from about 1.2 ha, a few head of livestock (depending on quality and species), one horse or a combination of products.[3] It is also possible to attain farm status if the land is leased to another operator who meets the threshold, as long as the land makes a "reasonable contribution" to the overall farm operation (BC Assessment 2005).

Methodology

The current research employs two approaches to investigate whether demand for hobby farms drives up prices in the ALR. The first is a general OLS model that is used to estimate a hedonic price function. Hedonic price functions are used to parse out effects of covariates that determine the prices of farmland in order to derive shadow prices for property characteristics. In the model, we include a dummy variable indicating whether a farm parcel is inside the ALR and one indicating whether the farm parcel is operated by a conventional or a hobby farmer. We include both dummies in the hedonic pricing model to highlight price differences paid by disparate types of farm operators and landowners inside or outside the ALR. We also include an interaction term between the ALR and the hobby farm dummy variables to test whether the use of land for hobby purposes affects land prices differently within and outside the ALR.

If the farmland has development rights so that it could be converted to residential use at any time, there could be a problem with endogeneity in the hedonic price equation (Lynch et al 2007). That is, the distribution of land use for residential versus agricultural purposes might be an endogenous process. However, endogeneity with respect to the ALR variable is not considered a problem because of historical factors and the fact that the ALR is a zoning ordinance. As already noted, all land assessed as farmland, municipally zoned as agriculture or rated in Canada Land Inventory classes 1-4 was included in the ALR in 1973. Subsequently, in Saanich until 2006, there had been only 16 applications to the

3. This information comes from a 2007/2008 survey of twenty-five Saanich farmers and discussions with various provincial government staff. We discovered a certain laxity in the enforcement of farm status requirements. This may be to prevent developers from making a case before the ALC that some ALR lands should be excluded because they cannot meet minimal farm-status standards.

ALC to remove land from the ALR, constituting a total of 228 ha; while 13 were successful, total exclusions amounted to only 76 ha (as the ALC might not grant a request to remove the full amount in the application). Clearly, land cannot be easily converted to residential use nor has a large proportion of the ALR in the study area been removed for other purposes.

We also might worry about potential endogeneity with respect to the hobby farm variable. It is very likely that hobby farmers select to buy parcels based on unobserved characteristics that also affect the prices of those parcels directly. To address this potential problem, we employ a non-parametric approach known as Propensity Score Matching (PSM), which was first introduced by Rosenbaum and Rubin (1983). It was applied to farmland markets by Lynch et al (2007) to resolve endogeneity associated with an agricultural easement dummy variable. The PSM approach deals with treatment effects – the effects that a certain treatment has on a variable of interest. In our model, treatments occur when parcels are bought by hobby farmers, while the non-treatment or control group consists of parcels purchased by conventional farmers. The difference between the prices paid by the two groups of farmers can be viewed as the treatment effect.

The PSM method consists of two steps. In the first step, the propensity score for each farmland parcel is calculated (in the current research) using estimates from a probit model. Propensity scores indicate how likely it is that a farmland parcel with certain characteristics is bought for hobby versus conventional purposes. In the second step, treated parcels are matched with non-treated ones so that the parcel characteristics are as similar as possible. The propensity score is used to match the treated and control parcels. Propensity scores are not likely to be exactly the same because the propensity score is a continuous variable between zero and one. We pair treated and control units using the (1) stratification, (2) nearest-neighbour, (3) kernel and (4) radius-matching techniques (Becker and Ichino 2002). Since each measure has its advantages and disadvantages, we display the results of all four to indicate the robustness of the estimated treatment effects. After matching each treated unit to control units, average price differences between the two groups are calculated.

Data and Variables

Based on the actual use codes recorded by BC Assessment, there are a total of 1,017 parcels of agricultural land on the Saanich peninsula that are available for our analysis. Because we had to exclude parcels due to linking problems with information from other datasets or because the full set of explanatory variables was not available for each observation, we ended up with 323 observations of sales that took place in the period 1990-2005 for use in the hedonic pricing model, although 893 observations were available for use in the probit model. The numbers of observations differ because we were able to use information about all farmland parcels in the probit model, but we could only use observations on parcels that were sold in the relevant timeframe for the hedonic model. Of the 893 observations of farmland that were used in the probit model, 117 are categorized as hobby farms

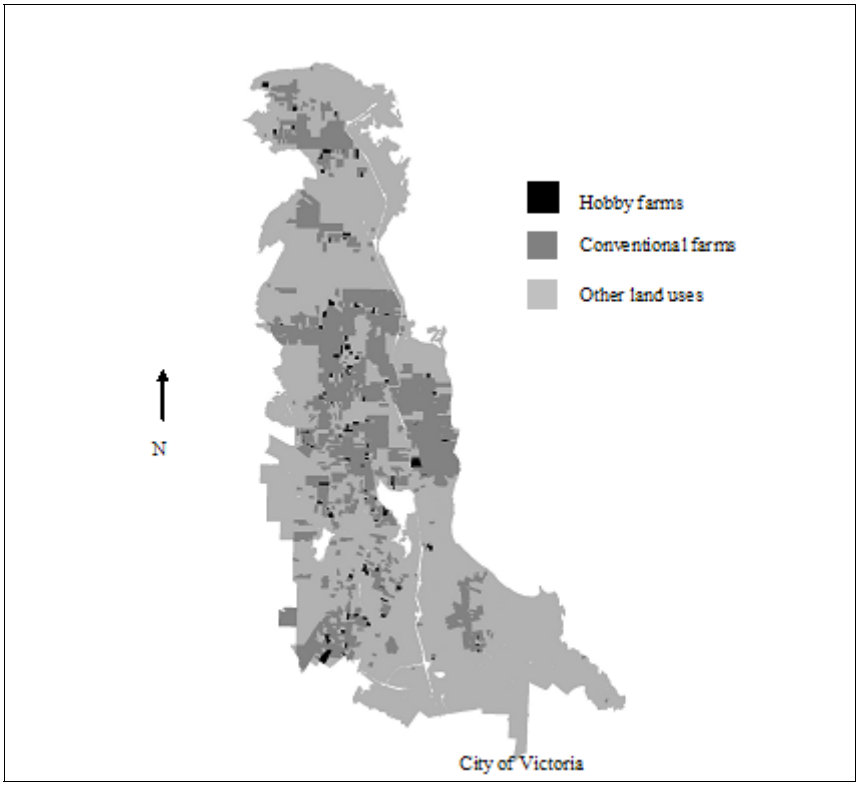

FIGURE 2 Distribution of Land Use on the Saanich Peninsula, Vancouver Island
Source: Ministry of Agriculture and Lands and the Capital Regional District, edited map

and the remainder are considered conventional farms.

In the hedonic price model and for the computation of the average treatment effects, we used sales transaction data for the period 1990-2005 but, if a parcel was sold more than once during this timeframe, only included data about the most recent transaction. In this way we ensure that the current owner is correctly classified as a hobby farmer or conventional farmer. In addition, sales of multiple parcels bundled together as a single unit were excluded because it was not clear how we could attribute the total price to the separate parcels in the bundle.

The Saanich Peninsula study area consists of 17,593 ha north of Victoria, the provincial capital, on southern Vancouver Island (Figure 1). It enjoys Canada's most temperate climate and contains some of the province's best farmland, growing a variety of crops such as fruits, vegetables and floriculture, as well as supporting livestock. In Figure 2, we provide a GIS map of the Saanich Peninsula that highlights land use and shows where hobby farmers are located. In addition, conventional farmland is distinguished from other uses, including residential, commercial and First Nations' lands (formerly known as Indian reservations).

A variety of GIS databases were used to develop the covariates of the

regression equations. Data were obtained from the BC Ministry of Agriculture and Lands, the BC Assessment Authority, other government agencies, the Capital Regional District (CRD), and private sources (such as LandCor). We use ArcGIS to link datasets, calculate distances, and analyze other spatial relations in the data. The dependent variable in the probit model and the explanatory variable of interest in the hedonic price model is a binary variable that takes on a value of one if the land parcel is used for hobby purposes and zero if it is used for conventional farming. Although there is no one universally-accepted definition of a hobby farm, Statistics Canada classifies a hobby farm as one in which the main operator reported 190 days or more of off-farm work and no other labour was employed year-round (Boyd 1998). In Canada, hobby farmers tend to cluster around certain crops and animals as evidenced by the fact that 35% of all horse operators were labeled as hobby farms in 1991, and more than 30% of all sheep and goat enterprises were hobby farms; among hobby farms, cattle rearing is most pronounced, accounting for 30.8% of hobby farmers, followed by wheat (12.2%) and horses (9.7%) (Boyd 1998). Other studies have used different definitions of what constitutes a hobby farmer, generally based on farm size or gross receipts. The 2006 Agricultural Census states that 9,466 of BC's 19,844 farms reported less than $10,000 in gross farm receipts and that 5,335 were less than four hectares in size (Statistics Canada 2006).

The 2004 Agricultural Land Use Inventory, compiled by the former BC Ministry of Agriculture, Food and Fisheries provides information about whether or not properties are hobby farms. Their description of a hobby farm is a property "with agricultural activity, but for amenity use only, i.e. no indication of farm products for sale (e.g. a residential property with one horse)." The distinction between hobby and conventional farms is determined somewhat arbitrarily, but, given no other information, we must rely on the government's own assessment.
The dependent variable in the hedonic price model is farmland price per ha adjusted for inflation using the Consumer Price Index with base year 2005. The hedonic price model also included dummy variables to capture price variation over time. The 2005 dummy was excluded, so 2005 is the base year. Explanatory variables in both models are roughly similar and include, among others, size of the farmland parcel, topographical features of the land, distance to Victoria, distance to the highway, and an ALR dummy variable. Also included in the model are dummy variables indicating the type of agricultural activity occurring on the parcel in 2004. The base case refers to parcels with grain, vegetables and mixed activities. We also included a fragmentation index, which is calculated as follows:
FI = proportion of perimeter bordering other farmland × size of total farm block of all adjacent farmland (including own parcel) measured in ha

Empirical Results

We start by discussing summary statistics that emerge from the data and then address some general empirical issues with respect to our model specifications. Then we provide estimates regarding the effect of hobby farms on prices within

TABLE 2 Summary Statistics for Farmland Parcel Sizes, Conventional and Hobby Farms in and Outside the ALR

	Number of observations	Mean	Standard Deviation	Minimum	Maximum
Hobby farms					
Within the ALR	27	1.7656	1.0165	0.2954	5.2609
Outside the ALR	90	2.0215	1.1507	0.3399	6.7178
Conventional farms					
Within the ALR	641	4.6511	5.3964	0.0486	40.4361
Outside the ALR	135	2.8900	6.8892	0.0850	76.7162

and outside the ALR, and finally compare the results of the hedonic price model with those of the propensity score method. We also discuss more general findings from the hedonic price and the binary choice (probit) models.

Summary statistics about the farm parcels in our sample are presented in Table 2. Hobby farms in the ALR are generally smaller than those outside it, although the differences in size are not statistically significant. The average size of conventional farm parcels in the ALR (4.65 ha) is larger than when they are located outside it (2.89 ha). Finally, for both hobby and conventional farm parcels outside the ALR, there is a tendency for size to fall in the range 0.8 to 4.0 ha, likely in response to tax incentives. There is also considerably more variation in parcel size for conventional than hobby farms with a standard deviation of 5.4 to 6.9 for the former and 1.0 to 1.1 for the latter.

Hobby farmers also differ from conventional farmers in other ways. For example, they are more often located outside the ALR than conventional ones. From Table 2, we see that 77% of all hobby farmers use non-ALR land compared to 17% of conventional farmers. This result provides an important clue to a question concerning the ALR: How are so many farms outside the ALR able to survive? The reason appears to be that many farms outside the ALR are not conventional enterprises but hobby farms.

A number of aspects arising from the empirical results are worth noting. First, about 42% of the total variation in farmland prices could be explained in the hedonic pricing model (Table 3). The explanatory variables included in the hedonic pricing model differ slightly from those included in the probit models (Table 4) used to estimate the likelihood that a farm parcel (within or outside the ALR) is owned by a hobby farmer versus a conventional one. The reason is that results from the probit models were used to estimate propensity scores for farm parcels and a necessary condition for PSM is that the propensity scores are balanced (Rosenbaum and Rubin 1983). If the balancing property is satisfied, the distribution of observable and unobservable characteristics is the same if propensity scores are similar, and this relationship is not affected by whether or

TABLE 3 Regression Results of the Hedonic Pricing Model, Saanich Peninsula (N = 323), with Robust Standard Errors

Dependent variable: Price per ha corrected for inflation (in 2005 Canadian $100,000s)	Parameter estimates	t-statistics
Hobby farm	-0.8231*	-1.86
ALR (= 1 if parcel located in the ALR, 0 otherwise)	-0.8467**	-2.22
Hobby farm × ALR	1.7247***	3.09
Distance to ALR boundary from outside (km)	1.7381*	1.70
Distance to ALR boundary from inside (km)	-0.1455	-0.37
Fragmentation index	0.0202	0.44
Distance to Victoria city centre (City Hall)	0.0174	0.90
Distance to highway	-0.1180	-1.58
Distance to recreational centers	-0.1696***	-3.14
Tree fruit (=1 if tree fruits are grown on the parcel, 0 otherwise)	-0.6184	-1.01
Small fruit (=1 if small fruits are grown on the parcel, 0 otherwise)	-0.1340	-0.32
Cows (=1 if farm is beef or dairy farm, 0 otherwise)	-0.4959*	-1.72
Poultry (=1 if farm is poultry farm, 0 otherwise)	-0.0369	-0.08
Parcel size (ha)	-0.1809***	-3.73
Vacant land (=1 if land is vacant, 0 otherwise)	-0.3285	-0.65
Maximum elevation level (meters)	-0.0026	-0.76
Difference in elevation level (meters)	-0.0069	-0.82
Year 1990	-1.3816***	-3.43
Year 1991	-0.7741**	-2.09
Year 1992	-0.5240	-1.11
Year 1993	-1.0078***	-3.16
Year 1994	0.4856	0.88
Year 1995	-0.1736	-0.42
Year 1996	-0.9541**	-2.52
Year 1997	-0.5580	-1.62
Year 1998	-1.3015***	-3.37
Year 1999	0.0237	0.04
Year 2000	-0.7246**	-2.06
Year 2001	-1.0951***	-3.34
Year 2002	-0.3569	-0.83
Year 2003	-0.1440	-0.42
Year 2004	0.3165	0.65
Constant	5.1300***	8.07
R^2	0.4153	

Note: 1. *** indicates significance at the 1%, ** at the 5%, and * at the 10% critical levels.

TABLE 4 Probit Regression Model Used to Estimate Propensity Scores within and Outside the ALR

Dependent variable: Hobby farm =1; conventional farm =0	ALR	Non-ALR
Distance to ALR boundary in km from inside the ALR, 0 otherwise	1.0840*** (3.22)	
Distance to ALR boundary in km from outside the ALR, 0 otherwise		3.6776** (2.09)
Squared distance to ALR boundary in km from outside the ALR, 0 otherwise		-5.3306** (-2.55)
Frag. index (proportion of perimeter bordering other farmland × size of total farm block of all adj. farmland in metres) / 10 000)	-0.0299 (-0.31)	0.0674 (0.69)
Distance to Victoria city centre (City Hall) in km	-0.0183 (-0.83)	-0.1003*** (-3.35)
Distance to highway in km	-1.0564*** (-3.45)	0.5425* (1.83)
Squared distance to highway in km	0.2321*** (3.32)	-0.0835 (-1.27)
Distance to recreational centres	-0.3059*** (-3.68)	-0.1736* (-1.71)
Parcel size (ha)	-0.2917** (-2.18)	-0.1653* (-1.85)
Vacant land (=1 if land is vacant, 0 otherwise)	--	-1.7858*** (-2.72)
Poultry (=1 if farm is a poultry farm, 0 otherwise)	--	-0.7903 (-1.52)
Maximum elevation level (meters)	-0.0025 (-0.56)	0.0061 (1.30)
Difference in elevation level (meters)	0.0215* (1.84)	-0.0087 (-0.80)
Constant	0.7097 (1.29)	0.7705 (1.27)
Number of observations	668	225
LR $\chi 2(16)$	48.46	104.30
Log likelihood	-88.846	-99.277
Pseudo R2	0.2143	0.3444

Note: 1. Parameter estimates are indicated with t-statistics in parentheses; *** indicates significance at the 1%, ** at the 5%, and * at the 10% critical levels.

not a property is in the treatment or control group. To meet this requirement, we had to include some squared terms in the probit models (e.g., distance to the highway). This was also the reason that the probit models for ALR and non-ALR parcels differ slightly. Other reasons for the slight divergence are that hobby farmers within the ALR never have poultry and never leave a property vacant.

TABLE 5 Average Treatment Effects of the Treated (ATT) for ALR and Non-ALR Parcels

Type of standard error (SE)	# of treated units	# of controls	ATT	t-statistic
ALR				
Kernel matching, bootstrapped SE	14	222	1.038***	2.772
Stratification method, bootstrapped SE	13	223	1.019*	1.794
Radius matching, analytical SE	13	222	1.622***	3.252
Nearest neighbour matching, analytical SE	14	12	0.617	0.98
Non ALR				
Kernel matching, bootstrapped SE	31	56	-0.843	-1.055
Stratification method, bootstrapped SE	23	64	-0.401	-0.684
Radius matching, analytical SE	31	50	-0.543	-1.067
Nearest neighbour matching, analytical SE	31	13	-1.241	-1.397

Note: 1. *** indicates significance at the 1%, ** at the 5%, and * at the 10% critical levels.

Therefore, these variables had to be excluded from the ALR probit model.

Another empirical issue concerns the potential for multicollinearity in our models. This problem might occur in our data because we analyze farmland prices on a small peninsula where different land use indicators are related. In our OLS specification, we tested for multicollinearity using Variance Inflation Factors (VIFs) (Hill and Adkins 2001). All VIFs were between 1.05 and 7.13, so that the highest VIF is still lower than the often-suggested critical value of 10. Therefore, we conclude that multicollinearity is not a problem in the hedonic pricing model. Since similar explanatory variables are used in the probit models, we argue that these findings also apply there.

Both the hedonic price model (Table 3) and the propensity score method (Tables 4 and 5) indicate that hobby farmers pay significantly more for ALR land than conventional farmers (see also Figure 3). Looking more closely at the results from the hedonic price model, we observe that the interaction term between the ALR and hobby farm variables is highly significant, indicating that hobby farmers have a different effect on farmland prices within and outside the ALR. We observe that conventional farm parcels inside the ALR are worth $84,670 less per ha than conventional farm parcels outside the ALR, while the opposite is true for hobby farms – they are worth $87,800 more per ha if located in the ALR than outside it. Outside the ALR, we find that hobby farms are worth $82,310 less per ha than conventional farms. Inside the ALR, however, hobby farms are worth more than conventional farm parcels by $90,160 per ha. It would appear from this that hobby farmers pay a premium for ALR land and, as a result, drive up prices inside the ALR. All prices are expressed in real 2005 Canadian dollars.

As indicated in previous section, the hedonic OLS results in Table 3 might be biased, because they fail to take into account the potential endogeneity of hobby

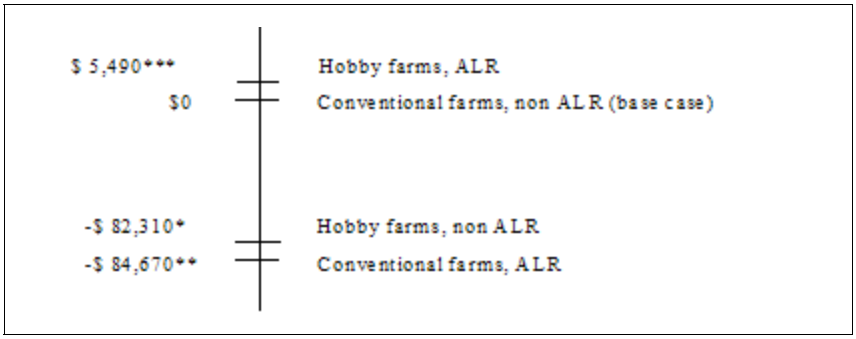

FIGURE 3 Price Differences per ha Paid by Hobby Farmers versus Conventional Farmers within and outside the ALR as Derived from the Hedonic Pricing Model

farms. However, the average treatment effects based on the propensity score measures (Tables 4 and 5) lead to similar findings. Again, there is a difference between the sales price per ha for hobby farm and conventional farm parcels within the ALR, similar to the results from the hedonic price model in Table 3. Depending on the matching method used, the prices vary between $61,700 and $162,200. (This brackets the effect of $90,160 found in the hedonic model.) Regardless of which PSM approach is used to analyze the data, the results indicate that people purchasing farmland for what can best be classified as hobby purposes drive up prices of such properties if land is located inside the ALR. (Three out of four of the estimates are statistically significant.) For properties outside the ALR, we again find similar results to those obtained from the hedonic price model – hobby farms are worth between $40,100 and $124,100 less per ha than conventional farms, although these differences are not statistically significant. Outcomes of the PSM approach are not very robust, because they tend to vary depending on the matching method used. This is very likely due to the small number of observations. Although we might not be able to put an exact number on hobby farm prices inside and outside the ALR, we can be confident that hobby farmers pay higher prices inside the ALR and lower prices outside the ALR compared to conventional farmers, since both the hedonic pricing method and PSM scores point in that direction.

From the probit model results provided in Table 4, we find that, when hobby farms are located inside the ALR, the land tends to be located farther from the ALR-boundary than for conventional farm parcels. This may indicate a preference on the part of hobby farmers for the open space and guarantee that surrounding land will not be developed that the ALR provides. The results also indicate that a farm is more likely to be a hobby farm the farther away it is from the ALR boundary when outside the land reserve. This seeming contradiction with the previous result can be explained by grouping hobby farmers according to those who wish to maintain easy access to urban amenities (reduced commuting time for work, public transit, recreation, etc.) and those who prefer a rural lifestyle to avoid the noise, congestion and other disamenities associated with being closer to

the city. This conjecture that there may be two types of hobby farm owners is supported by the findings on the distance variables. The distance to Victoria variable is significant for non-ALR land but not for properties located in the ALR. This could be because the 'commuting' hobby farmer seeks to minimize travel time and is more likely to live on land outside the ALR. This conclusion is supported by the estimated coefficients on both the linear and the quadratic distances to the highway.

Within the ALR, hobby farmers have a tendency to live either close to the highway or far away from it, while conventional farmers in the ALR tend to be located in between. Outside the ALR the distance to the highway only moderately affects the probability of being a hobby farmer. These findings support other findings that some hobby farmers wish to be near the highway (the more-likely-to-commute group), while others wish to be farther from it. Since hobby farms are more likely to include a residence, as indicated by the negative sign on the coefficient of the vacant land dummy variable, most owners of hobby farms are likely living on the farm and thus care about their location on the peninsula.

There are other factors that come into play and provide an explanation regarding commuters. The entire study area is within a 45-minute commute of downtown Victoria. Those located farthest from Victoria are within a five minute commute to the ferry terminal and airport, which is an advantage for those who commute to the Vancouver area for work. Unfortunately, our data do not enable us to investigate the extent to which people commute to the mainland, although observational evidence of people commuting from the Gulf Islands to Victoria and Vancouver suggests that it does occur.

Parcel size also seems to be an important factor. From the probit model, we see that as parcel size increases, the probability that the farm parcel is used for hobby purposes declines significantly regardless of location inside or outside the ALR. From the hedonic price model (Table 4), per ha value significantly decreases with parcel size. This makes sense given the institutional environment that hobby farmers live under in the province. Favourable tax rates are possible and easily achieved for farms of a certain size range. This finding indicates that hobby farmers have bid up the price of smaller agricultural parcels.

Discussion

To date there has been little research into hobby farming because its effect on the agricultural sector is generally considered positive at best and benign at worst. As a result, little is known about its impact on land prices. Given that the number of hobby farms near major urban areas is growing, there is a need to investigate this phenomenon further if agricultural policies to protect small farms and farmland more generally are to be effective. For example, our study indicates that incentives created by farm assessment and taxation policies may raise farmland prices, making it more difficult for conventional farmers to expand their operations to achieve economies of scale.

The findings from both the hedonic pricing model and the propensity score

matching method indicate that the existence of hobby farms drives up prices of ALR land. According to the PSM method, hobby farming can increase values by between $61,700 and $162,200 per ha, while the estimated impact from the hedonic pricing model is an increase of $90,160 per ha. Outside the ALR, hobby farms tend to be worth less per ha than conventional farms; although these findings are corroborated by PSM estimates, the difference in that model was statistically insignificant.

Hobby farms benefit from BC's favourable property tax treatment of agricultural land, which sets a low threshold for obtaining tax benefits. Indeed, it is clear that potential hobby farmers seek parcels that provide them the lowest threshold for qualifying for farm class status, avoiding parcels smaller than 0.8 ha that would place them into the category with the highest taxes as well as ones greater than 4.0 ha that would require them to become 'serious' farmers. Hobby farmers actively seek farm class status to reduce their property tax burden, even though they may view their property primarily as a residence. Hobby farm owners may be motivated by a desire to produce and sell agricultural commodities, but they might also simply want a rural lifestyle – a retreat – or want to avoid high residential prices in urban areas; or some combination of all these factors may be at work. In all cases, they seek farm class status for tax purposes.

BC residents clearly support protection of agricultural land, and would favour the protection offered by the ALR as well as taxes that favour farmers. However, the research reported here suggests that, in some cases, these policies could possibly have a deleterious effect on the survivability of farming in the longer term. This is especially true in how farm legislation treats hobby farmers. Our research suggests that current policies need to be modified if agricultural production is to be protected in the long run, especially in how it treats small, unprofitable farming operations that are classified as hobby farms but might well serve another purpose. Despite good intentions on the part of current policy and perhaps even hobby farm owners, hobby farming might simply be a means of converting agricultural land locked into a land reserve into residential properties, resulting in what we term 'rurban' development – sprawling large-lot residential developments.

Nonetheless, it is not entirely clear whether hobby farming is something to be encouraged because of the amenity benefits that it is still capable of providing (open space, views, wildlife habitat) and the fact that hobby farmers are often located outside the ALR, or whether it simply constitutes 'rurbanization' of the countryside (urban development of rural areas subject to minimum lot size constraints) with all pretence of farming disappearing as conventional farms rollover. Further research and monitoring of this phenomenon is certainly warranted.

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