The Effect of Agricultural Zoning on Land Prices, Quebec, 1975—1981

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At the end of 1978 a set of zoning restrictions was introduced by the government of the province of Quebec (Canada) to ensure the protection of agricultural land. This paper examines if that policy creates a price differential between restricted and unrestricted use land.[1] Since Quebec has one of the strongest agricultural land protection policies in North America, the results of such an examination can be useful in indicating to public policymakers the effects of such a policy.

The paper is divided into three parts. In the first, the institutional setting and the region examined are presented; in the second, the model and data used are discussed; and in the third, the results of a single equation model are discussed. They indicate that for an urban fringe area south-east of Montreal (the Carignan/Saint-Mathias area), the effect of agricultural zoning is to reduce the relative price of restricted use land ("green land") with respect to unrestricted use land ("white land").

1. THE INSTITUTIONAL SETTING AND THE CARIGNAN/SAINT-MATHIAS AREA

The Act to Preserve Agricultural Land, Bill 90, was presented by the Quebec Minister of Agriculture to the Quebec National Assembly on November 8, 1978; it became law on December 22, 1978. The law creates the "Commission de Protection du Territoire Agricole" and sets out the process to be used in determining the restricted use areas. That process is as follows:

(1) The Government sets, by decree, which parts of a region are temporarily designated as restricted use land and which are not. This technique was designed to allow the government to freeze development of land instantaneously while allowing it to do so at different dates in different parts of Quebec. In total, six decrees were used to cover the entire province. The first decree, passed November 9, 1978, covered the best agricultural land of Quebec and included the Carignan/Saint-Mathias area (hereafter CSM).

(2) Once a decree has been issued, municipalities covered by it enter in negotiations with the commission to determine the definitive boundaries of the restricted use (green) land and unrestricted use (white) areas.[2] These boundaries may differ from the temporary ones set by the decree. In case of disagreement the commission sets the boundary. This means that in between the issuance of a decree and the setting of

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[1]Article 1 of the law defines agriculture as the cultivation of the soil to grow vegetables or trees and the husbandry of animals. Buildings useful for agricultural purposes can be erected on restricted use land: personal residences are specifically excluded from that category of buildings. Article 26 of the law specifies that agricultural land in a restricted use area (green area) cannot be used for any other purpose than agriculture unless permission is obtained. Finally, article 70 of the law prohibits the removal for resale of topsoil.

[2]Municipal zoning bylaws remain applicable but are subordinate to the agricultural zoning law and cannot permit what that law prohibits in green areas. In white areas, municipal bylaws are fully applicable. However, building rights acquired in green areas before the zoning law was passed are protected.

> the definitive zoning boundaries, there is a period of uncertainty as to what land will be designated as green land: that period should usually not exceed six months. An important criterion used to determine if a parcel will be designated as green or white is its agricultural potential.[3]

As Raciti and Le May (1980) point out, the key features of Bill 90 is that "it amounts to the taking of property rights without reasonable compensation" (p. 51). As a result, it is important in assessing the effects of this law to examine the effects of restricted use zoning on the price of land.

The CSM area is made up of two contiguous municipalities, which have the Richelieu river as a common boundary. They were selected for this study because of our ease in obtaining the relevant data,[4] but the area is typical of urban fringe areas on the perimeter of Montreal in the second half of the seventies, with rapid population growth due to suburbanization.[5]

The CSM area measures 110.6 square kilometers and is part of the St. Lawrence river plain. The soil quality is the same throughout the area[6] and there are no special topographic features in this part of the plain. The only relevant CBD, Montreal, is located on average 25 kilometers away from the CSM area, using the main access route, the Eastern Township Expressway, to measure this distance.[7] There are no important regional towns in the area.

2. THE MODEL AND DATA

The theoretical underpinnings of the process that determines land values have been the object of study since the work of Von Thunen. More recently Alonso (1964) provided a more complete model of this process. In this study we accept that the price of land depends on its value in various alternative activities and use an empirical model based on the current literature as exemplified by the work of, among others, Brigham (1965), Adams et al. (1968), Hushak (1975), and Hushak and Sadr (1979). We draw particularly on the latter two papers since they include among their independent variables an agricultural zoning variable. We also make use of Grieson and White's (1981) analytical framework when examining the effect of agricultural zoning since it can be classified as an allowable use restriction.

The standard land price determination study uses a one-equation model, linking the price of a unit of land (square feet, acre, . . .) to the size of the lot, to its distance from the CBD and when appropriate, other cities, and to amenities. The type of functional relationship used (linear, semi logarithmic, . . .) varies from one study to the next. In this study we explain the value of the natural logarithm of the deflated price of an acre of land using the following independent variables: natural logarithm of lot size, linear distance to Montreal, and three sets of dummy variables (water/sewer services, neighborhood quality, and zoning).[8] We chose to use a transcendental function similar to the one used by Hushak and Sadr (1979) since we expect a nonlinear relationship between the price per unit of land and lot size, and since preliminary calculations indicate that this functional form yields the best fit.

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[3]Among other criteria one should note that the presence of water mains or sewers is considered and usually leads to land being zoned as unrestricted use land.

[4]L. Monty resides in the area; he personally assembled the data used here.

[5]From 1976 to 1981 its population grew by 35%, from 5,551 to 7,473 inhabitants: the population of the Montreal metropolitan area grew by 1% in the same period (1981 Census of Canada, *Population Geographic Distribution Quebec* (S-C 93-905) Ottawa: Statistics Canada, tables 5 and 6.

[6]Class-2 land (Canada Land Inventory classification scheme) with some excess humidity, slow drainage, and 2,500 thermal units per month.

[7]This expressway is used by an overwhelming majority of residents as their route to Montreal. The network of access road to it was not modified from 1975 to 1981.

[8]Taxes and municipal expenditures are similar in Carignan and Saint-Mathias, once differences in water and sewer services are controlled for. Hence, we did not include fiscal variables. One should note, however, that farmers defined as recognized agricultural producers (chapter P-28, Revised Statutes of Quebec 1983) will be reimbursed 40% of their property (municipal and school) taxes if their farm is located in a white area and 70% of these taxes if it is located in a green area (Municipal Finances Law, chapter F 2.1, Revised Statutes of Quebec 1983, article 215). The main criterion for being recognized as an agricultural producer is that a farmer produces goods for sale which have a value of at least $3,000 annually (P-28, R.S.Q., 1983, article 1.g). Taxes on farms located in a green area may not exceed 2% of

For our calculations we use only data from sales of vacant land, excluding land zoned at the municipal level for commercial or industrial purposes. As a result we need not take into account municipal zoning (commercial, industrial . . .) nor do we need to net out the effects of structures, often a difficult task.[9] We use data for the 1,284 normal sales that took place in the CSM area between January 1, 1975, and December 31, 1981. Normal sales are arm's length sales; excluded are sales such as those between parents or by auction for nonpayment of taxes. In total, excluded sales make up less than ten percent of all sales.

Information used to include or exclude sales as well as the data on price, lot size, and date of transaction were taken from the transaction report filed by municipalities with the Quebec Ministry of Municipal Affairs.[10] Data on the absence or presence of water mains and sewers, on the distance to Montreal and on being located in the white or green area were collected from various maps.

The dependent variable is the deflated price per acre: this deflation allows us to obtain the real increase in the price of land rather than the one incorporating inflation.[11] We use as a deflator the price index for durable goods rather than the Consumer Price Index as Adams et al. (1978) did.[12] We do this since we believe that individuals, when deciding if the (relative) price of land has gone up, will not do so by comparing it to a basket of all other goods and services but to goods which have at least some durability, as land does. Hence, land is much more comparable to durables such as cars than to nondurables such as food.[13]

We use the logarithm of lot size rather than its reciprocal to account for the nonlinear relationship that usually prevails between the size of lot and the per unit price of land because this is the relationship with the best statistical fit. We expect a negative relationship between the size of a lot and the price per acre of land since higher unit land prices tend to lead to a more intensive use of land and thus to smaller lots. This implies a simultaneous relationship between the per unit price of land and lot size which we neglect in our single equation model.

Our second independent variable is distance to Montreal. It enters in a linear fashion in our equation. We expect, as is usually the case in studies examining the determinants of land values, a negative relationship between the distance to the CBD and the per acre price of land in the CSM area. Since lots in Saint-Mathias are more often serviced (water/sewers) than those in Carignan and further away from Montreal on average, one could observe some correlation between these two variables.

Our third independent variable is the availability of services. Three levels are possible: no services, water main, water main and sewers. We expect a positive relationship between the level of services and the price per acre: we use two dummy variables to measure the level of service with "no services" the omitted category. We must note, however,

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the taxable value of the farm: the taxable value of an acre may not exceed $152. These restrictions do not apply to farms in white areas (F-2.1, R.S.Q., 1983, article 214). Municipalities are reimbursed by the Quebec government for the difference between the tax revenue they would have collected if these restrictions were not in force and the tax revenue effectively collected (F-2.1, R.S.Q. 1983, article 259). In 1981, tax reimbursements to farmers totalled $17,825,000 (Can.) paid out to 46,127 farmers (Rapport Annuel 1981/1982, Ministre de l'Agriculture des Pêcheries et de l'Alimentation, 63), while tax reimbursement to municipalities totalled $8,677,205 (Can.) paid out to 428 municipalities for the 1981 municipal taxation year (Rapport Annuel, 1981/1982, Ministère des Affaires Municipales, 28).

[9]There were no major changes in municipal zoning from 1975 to 1981 in the CSM area. While residential zoning could incompass multifamily dwellings, in practice it is single-family dwellings that are built in the CSM area.

[10]The "Rapport Analytique et Comparatif des Données du Marché Immobilier."

[11]Using the Consumer Price Index one finds that prices increased 71% in Canada from 1975 to 1981. Since agricultural zoning was implemented from 1979 onwards, the use of nondeflated prices would lead (as unreported estimates show) to measurement problems in sorting out the effects of the zoning measure and of inflation.

[12]When using the CPI one should remove from it the price index for land.

[13]We could possibly have used data for only one year, 1980 or 1981, to do away with, or at least minimize, the issues of deflation. However, we preferred using the highest possible number of transactions to minimize the impact that anomalous transactions could have on our results.

TABLE 1

MEAN VALUES AND DISTRIBUTION OF VARIABLES

	All lots	Restricted (Agricultural) Use lot (Green lots)[1]	Unrestricted Use lot (white lots)[1]
Deflated lot price ($)	28,405	13,294	34,569
Lot size (acres)	5.47	17.61	0.52
Deflated price per acre ($)	6610.82	3652.16	7817.64
Distance to Montreal (kms)	25.08	26.89	24.34
Water/Sewer services			
None (%)	71.0	93.9	61.6
Water (%)	9.7	1.3	13.2
Water and Sewer (%)	19.3	4.8	25.2
Quality of Neighborhood Index			
Level 1 (%)	20.4	69.4	0.4
Level 2 (%)	46.7	14.2	60.0
Level 3 (%)	22.6	12.1	26.9
Level 4 (%)	10.3	4.3	12.7
Number of lots	1284	372	912

Source: Monty (1983, 55).

Note: Before November 1978, there was no agricultural zoning. However, lots are classified according to the zoning boundary irrespective of when the recorded transaction took place in the 1975–1981 period. There were 366 transactions in the white area and 73 in the green area from November 1978 to 1981.

that the availability of services is linked to both lot size and the zoning variable. It is linked to lot size since municipal zoning requires that unserviced lots be larger so as to permit the installation of a septic tank and, in some cases, a well.[14] It is linked to the zoning variable since serviced lots will usually be zoned for nonagricultural use.

Our fourth variable is a four-level neighborhood quality index calculated using data collected by municipal assessors. We expect a positive effect of the neighborhood quality on the price of land: we use three dichotomous variables with the lowest quality level being the excluded category. We must note that assessors not only use variables such as the socioeconomic status of residents, the age of houses in the area, and the proximity to wooded areas or to the Richelieu river to determine the quality of a neighborhood but also the price of past transactions and the use of land for agricultural or residential purposes. In the case of prices there is a positive link between past prices of transactions in the area and the level of the quality index, but no formal link between the price of the actual transaction and the quality index. In the case of land use, areas with a high percentage of their land used for agricultural level have a lower quality index. Since these areas are more likely to be zoned for agricultural use, there is a link between this independent variable and the zoning variable.

Our last independent variable is our zoning variable. It is a dichotomous variable taking the value 0 for unrestricted use zoning (white land) and 1 for agricultural use zoning (green land).

Table 1 presents the mean values or percentage breakdown of our various variables for all lots, green and white. Not surprisingly one finds that agricultural lots have a lower per acre price, are larger, and are further away from Montreal than nonagricultural lots. Furthermore, given the links between zoning, on the one hand, and services and the

[14]In Saint-Mathias and Carignan, throughout the period, lots had to have a minimum size of 20,000 square feet if unserviced and 15,000 if serviced by a water main. Fully serviced lots (found only in Saint-Mathias) had to measure at least 6,500 square feet.

quality index, on the other, it is not surprising to find a higher percentage of agricultural lots than of unrestricted use lots in the unserviced and level-1 quality index categories.

3. THE RESULTS

Given the link between the zoning, services, and neighborhood quality index variables, we examine the effects of agricultural zoning (Table 2), first using the full set of independent variables (equation [1]) and then removing either the services (equation [3]) or neighborhood quality (equation [4]) variables or both (equation [5]). We also add to the full set of independent variables a set of six temporal dichotomous variables (equation [2]: 1976 to 1981 inclusively; 1975 is omitted). We do this because the zoning variable takes the value 1 only for transactions carried out in 1979, 1980, and 1981. As a result, it could be correlated with a time-related determinant of land prices that is not among the set of independent variables (for example, the economic cycle). In that case its coefficient would capture the effects of that variable and thus not give us a correct estimate of the impact of agricultural zoning. We expect that, because of its inelastic supply, the real price of land will increase through time.

Our first independent variable, ln (lot size) has the expected negative sign and is significant (at the 95% level) in all five equations.[15] Its absolute value, which varies from .252 to .392, falls in between the values reported for Columbus by Hushak and Sadr (1979) for residential (.638) and agricultural (.176) land parcel. Its absolute value increases as either or both of the services and neighborhood quality variables are omitted. When services are omitted, the effect of an increasing minimum lot size when the level of services declines (because of well and septic tank requirements) is captured by the lot size coefficient. Unserviced lots must be larger than serviced lots but the value of that extra space is lower than that of the basic building lot. When the Neighborhood Quality variables are omitted, the fact that level-1 land is often agricultural-type land is captured by the lot size variable since these lots are usually bigger than the others.

Our second independent variable, distance to Montreal, has the expected negative sign and is significant at the 95% level in four ([1] [2] [4] [5]) equations and significant at the 90% level in the other ([3]). In the first four cases, prices decline from 2% to 6% for each additional kilometer from Montreal, with 4% the result obtained in our full equation ([1]). Hushak and Sadr report for Columbus and Dayton that "land prices decline by about 4% for each additional mile from the urban center" (1979, 701). Using a different specification, Hushak reports that "if the property is residential or agricultural, each additional mile from Columbus reduces prices per acre by an estimated $509" (1975, 117). Using the mean for agricultural and residential sales (calculated from Table 1, Hushak 1975), one finds that this is equal to 3.6%. Why is the distance coefficient then not as high (in absolute value) or as significant in equation [3]? One possible explanation is that there is a greater proportion of serviced lots in Saint-Mathias than in Carignan, while Saint-Mathias is further away from Montreal than Carignan. Hence, when the services variable is omitted, the positive effect of services on the price of land is reflected in part in the distant coefficient, as shown in equation [3] and, less strongly, in equation [5], thus reducing its negative impact.[16]

Both the Services and the Neighborhood Quality variables have the expected positive signs, are significant, and are of the expected relative magnitude.[17] Only Adams et al. (1968) report using a sewer variable. They found that the presence of a sewer increased the logarithm of the deflated price per acre of residential land in Northeast Philadelphia from .55 to .91, depending on the equation used. We find three comparable values, .685, .723, and .967. When either the Services or Neighborhood Quality set of variables is

[15]We use one-tailed t-test level of significance since we have specific expectations as to the sign of each variable.

[16]In the same vein, one must note that better quality neighborhoods are closer to Montreal as indicated by comparing the results of equations [1] and [4].

[17]That is Water and Sewer > Water, and Level 4 > Level 3 > Level 2.

TABLE 2

REGRESSION RESULTS, EFFECT OF AGRICULTURAL ZONING ON PRICE PER ACRE, C.S.M. AREA, 1975–1981, 5 EQUATIONS

Variables	All Variables (1)	All Variables +6 Dummies (2)	Services Variables omitted (3)	Neighborhood Quality Variables omitted (4)	Serv. and Neighborhood Quality Variables omitted (5)
Constant	8,733	8,661	7,776	9,782	8,811
	(66.04)	(64.17)	(80.74)	(94.97)	(104.43)
ln (Lot size) (acres)	−0.256	−0.252	−0.277	−0.306	−0.392
	(−19.76)	(−19.73)	(−20.95)	(−25.09)	(−34.52)
Distance to Montreal (Kms)	−0.040	−0.042	−0.004	−0.067	−0.021
	(−8.84)	(−9.38)	(−1.46)	(−15.36)	(−6.51)
Restricted use (agricultural)	−0.159	−0.274	−0.143	−0.291	−0.364
	(−2.24)	(−3.60)	(−1.93)	(−3.80)	(−4.41)
Water/Sewer services (none omitted)					
Water	0.255	0.301	—	0.393	—
	(4.27)	(5.06)		(6.20)	
Water and Sewer	0.685	0.723	—	0.967	)
	(10.19)	(10.91)		(14.48)	
Neighborhood Quality (level 1 omitted)					
Level 2	0.410	0.349	0.658	—	—
	(6.57)	(5.55)	(11.05)		
Level 3	0.656	0.589	0.947	—	—
	(9.51)	(8.55)	(14.58)		
Level 4	1.121	1.02	1.371	—	—
	(14.81)	(13.41)	(18.45)		
$\bar{R}^2$	0.671	0.683	0.645	0.604	0.539
F	328.66	198.58	389.83	392.07	501.74

t-statistics appear in brackets below the coefficient.
The number of observations is 1284 in all five cases.
There are six temporal dummies in equation 2: 1975 is the omitted year.
The values of the coefficients (t-statistics) are:

1976:	.093	1979:	.336
	(1.76)		(5.06)
1977:	.132	1980:	.276
	(2.55)		(4.60)
1978:	.324	1981:	.184
	(5.99)		(3.06)

omitted, one finds that the value of the coefficients of the other increases. This is plausible since better quality neighborhoods hold a greater proportion of serviced lots thus making for a positive correlation between the two variables.

Finally, the temporal dichotomous variables (eq. [2]) indicate that real land prices increased from 1975 to 1979 and then declined in 1980 and 1981. The inclusion of that variable significantly affects only the zoning coefficient: it increases in absolute value when compared to the coefficient of equation [1].

To summarize, the results for our indepen-

dent variables other than the zoning variable are in agreement with our expectations and with results extent in the literature, indicating that we have a plausible model of the land price determination process.[18] Our zoning variable also yields the expected sign (negative[19]) and is significant. It indicates that green land is worth between 14.7% and 30.5% less than white land.[20] The lower impact is obtained using the full model and the highest impact when excluding both the Services and, more importantly, the Neighborhood Quality variables. Hence, the fact that serviced lots and lots in better quality neighborhoods are more often zoned for unrestricted than for agricultural use has an impact on the measurement of the effects of the zoning restriction. However, it is important to note that in all five equations the effect of agricultural zoning is unequivocally negative.[21]

CONCLUSION

Using a standard land price determination equation, we examined the effect of agricultural zoning in Quebec on urban fringe lots in the Montreal area. We found that restrictive use zoning reduced the price per acre of land, otherwise similar to unrestricted land.

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[18]As our $\bar{R}^2$ and F-statistics also indicate.

[19]In the absence of externalities we expect that land in a restricted use zone will have a lower price than land in an unrestricted use zone (Grieson and White 1981).

[20]We transform the coefficient in $a\%$ using the e^B-1 formula.

[21]If one performs a Chow test, as suggested by the referee, for all parameters including the constant (equation [1] with the zoning variable omitted) by subdividing the sample into two sets, one for the 845 transactions that took place before the zoning change (January 1975–October 1978) and one for the 439 transactions that took place after (November 1978–December 1981), one finds that there was a change in the structural relationship. A closer examination reveals that the lot size and services coefficients are not very different across both periods. The main differences are in the constant and in the neighborhood quality variables. This is not surprising since the excluded category for the neighborhood quality variable (level 1) is strongly associated with land used for agricultural purposes. Hence our use of a single equation for the entire period with a dummy variable to account for the effects of zoning is acceptable.