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CAPITALIZATION OF FARMLAND PROPERTY TAX - AN ALTERNATE VIEW

by

Maninder J. S. Bhatia

A thesis
presented to the University of Manitoba
in partial fulfillment of the
requirements for the degree of
Masters of Science
in
Agricultural Economics

Winnipeg, Manitoba, 1982

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THE UNIVERSITY OF MANITOBA
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The undersigned certify that they have read, and recommend to
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.....Alternate View.....
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ABSTRACT

This study investigates whether land taxes are capitalized into the farmland prices of rural municipalities in Manitoba, Saskatchewan and Alberta.

The Old or Traditional View, the New View and the Tiebout Hypothesis were the theories reviewed which explain the phenomenon of capitalization of property taxes. The Tiebout hypothesis is most suitable for the analysis because, it accounts for local government expenditures and requires less information to verify the relationships. It is especially applicable to the case of local public goods where markets fail due to free ridership.

The literature review showed that previous studies reach conflicting conclusions about the relationship between property taxes and real estate prices. The reason stems from inconsistent analysis due to variable definition and model specification.

It was argued the likelihood that property taxes and government expenditures are capitalized is very low for farmland. This is based on the assumption that price of farmland reflects the expected crop revenues from land. Local government districts which contain higher quality soils in terms of agricultural crops will have high priced land and are po-

tentially wealthier land owners. This localized wealth affects the demand for public as well as private goods and services. Assuming public services are normal goods, a higher level of wealth should result in greater expenditures on government services and larger taxes to finance these purchases.

A simultaneous equation model was specified for a study of tax capitalization. Because theoretical discussion suggested that property taxes are not capitalized in case of farmland, this model was simplified into three single equation submodels.

Many studies have used effective tax rate as a variable for testing the capitalization hypothesis. It was argued that effective tax rate has a built-in negative bias because it is derived by weighting tax per acre by weights which are inversely correlated with the price per acre.

Results of this study suggest low property taxes do not get capitalized into farmland prices in Manitoba, Saskatchewan and Alberta. The estimates indicate low taxes are associated with local governments financing local public services in regions where residents are wealthier. Public expenditures and farmland taxes are higher for local government jurisdictions that have more valuable farmland but the neither the estimated elasticities for expenditures or taxes with respect to wealth exceed one. Therefore, the tax rates

on farmland fall if jurisdiction contained higher valued farmland than a neighbouring local government. Thus lower land prices are associated with higher tax rates not because of capitalization but the expenditure decisions of local government.

It was seen that inclusion of tax per acre in the price equation inflated the coefficients of the other independent variables. Replacement of tax per acre by effective tax rate revealed that due to presence of built-in negative weights, the affect of tax per acre was partially neutralized with exception of certain variables where effective tax rate either reversed the direction of bias or added to the bias that was introduced by tax per acre.

It was further hypothesized that on farmland, value of land could be used as a proxy to net woth of the community. Prosperous communities are expected to have greater demand for services therefore taxes and expenditures are expected to be higher in these communities. It was seen that elasticity of demand with respect to wealth was far below 1. This led to the conclusion that local public goods and services are inferior goods. It was also observed that in wealthy agricultural communities increases in farmland taxes due to wealth are higher than the increases in expenditures due to larger wealth.

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I take sole responsibility of any error committed in this thesis.

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Chapter I

INTRODUCTION

1.1 GENERAL TRENDS

Local government raises revenue through property taxes, natural resource revenues, privileges, licences and permits, sales of goods and services, contribution of employees, postal revenues and fines. Out of all these sources, real estate taxes are the major contributors. In 1976, out of a Canadian consolidated revenue of \$76 million; 79.79% came from taxes; 4.02% from the natural resource revenues; 1.54% from privileges, licences and permits; 4.24% from the sales of goods and services; 8.18% from the returns on investments; and 2.54% from their own resources [72, P 1].

During the 1970's, the property tax was fourth largest tax source, following personal income taxes, sales taxes and the corporate income taxes. The percentage contribution of major taxes to the total tax revenue for 1976 has been provided in the Table 1 .

Real and personal property tax constitutes about 10% of the total tax revenues of Canada, 37.7% of total tax revenue raised by the local government and 35% of the total local government expenditures (not shown in table) [71,p23]. The basic function of property tax is to fund local public goods

TABLE 1	
Different taxes as a percent of total tax revenue	
Types of Taxes	Percent of Total Tax Revenue
1. Personal Income Taxes	36.86
2. General Sales Taxes	14.07
3. Corporate Income Taxes	12.51
4. Real and Personal Property Taxes	9.92
5. Social Insurance Levies	6.06
6. Universal Pension Plan Levies	3.61
7. Motive Fuel Taxes	3.60
8. Custom Duties	3.47
9. Tobacco Taxes	1.88
10. Hospital and Medical Insurance Premiums	1.66
11. Other Taxes	6.36

Source: [74].

and services¹ like education, healthcare, road maintenance, fire protection, police protection, and water and sewage.

Another major source of funding local public goods and services in Canada is provincial transfer payments. The percent share of these two sources varies from province to province. Table 2, shows the proportion of local government expenditure that came from the farmland property tax in rural municipalities of the provinces of Manitoba, Saskatchewan and Alberta for years 1967 to 1976.

¹ Local public goods are the ones whose benefits accrue only to the people located "near" them.

TABLE 2			
Contribution of farmland tax to rural municipal expenditure			
Year	Manitoba	Saskatchewan	Alberta
1967	86.19	85.10	44.06
1968	89.30	86.53	43.38
1969	78.80	87.73	42.91
1970	80.16	85.01	40.59
1971	76.69	78.97	38.07
1972	76.18	78.85	41.49
1973	73.82	80.20	41.40
1974	70.20	73.93	50.18
1975	75.42	72.27	N.A.
1976	74.54	75.76	34.21

Where: N.A. implies not available.

Source: Based on [66], [72] and [73].

The Table 2 indicates that the contribution of property tax is falling over time in the three provinces. It also shows that the percent contribution of property tax to total expenditures is almost twice as large in Manitoba and Saskatchewan as in Alberta.

The farming communities of Manitoba, Saskatchewan and Alberta have additional real estate in terms of mines, oil fields, oil refineries, food and beverage processing facilities. These non-farm lands contribute between 15% to 61% to the total property tax. The proportion of property tax that is contributed by non-farm real estate in the rural municipalities of Manitoba, Saskatchewan and Alberta has been summarized in the Table 3 for the years 1967 to 1976.

TABLE 3			
Non-farmland tax as percent of total property tax			
Year	Manitoba	Saskatchewan	Alberta
1967	33.79	15.04	42.80
1968	32.32	16.28	43.73
1969	19.07	17.76	47.07
1970	19.73	18.45	46.79
1971	20.28	18.45	49.23
1972	19.19	18.88	50.60
1973	19.69	20.79	52.86
1974	22.14	21.25	54.76
1975	23.22	20.55	56.25
1976	23.90	20.91	60.51

Source: Calculated from the data of [66], [72] and [73].

In general, Table 3 shows that percent contribution of non-farmland towards the total property taxes of Manitoba, Saskatchewan and Alberta has an increasing trend (with the exception of years 1967 and 1968 in Manitoba). It also shows that in Manitoba and Saskatchewan, the non-farmland property tax is about one-fifth of the total property tax while in Alberta it is more than half of the total property tax.

Out of all the local public goods and services, the largest amount was spent on education and public works. The share of spending on these services as compared to total local government expenditures in three provinces for the years 1967-76 can be seen in Table A3 .

TABLE 4						
The proportionate spending on education and public works						
Year	Education			Public Works		
	Man.	Sask.	Alta.	Man.	Sask.	Alta.
1967	42.66	41.04	55.22	26.01	38.66	43.92
1968	45.40	42.88	58.62	17.14	35.86	20.16
1969	46.08	45.09	64.84	25.98	33.58	15.65
1970	47.53	44.49	58.26	25.20	34.43	21.46
1971	44.40	49.34	56.40	26.88	37.43	18.52
1972	44.52	49.18	59.00	24.92	36.84	20.38
1973	41.20	49.66	57.47	26.01	34.80	20.83
1974	41.99	45.63	66.28	25.48	38.62	31.65
1975	48.11	41.59	N.A.	23.59	41.77	N.A.
1976	48.34	43.28	66.25	23.15	39.73	25.21

Where: N.A. implies not available.

Source: Calculated from the data of [66], [72] and [76].

Table 4 shows the percentage expenditure on education is higher in Alberta as compared to other two provinces. The percent spending on public works is highest in Saskatchewan while lowest in Alberta for most of the years considered. Percent of expenditure on education has been increasing in all the three provinces. Percent expenditure on public works has fallen in Alberta during 1967-76 while it has not changed much in Manitoba and Saskatchewan during the same period.

1.2 CHARACTERISTICS OF THE PROPERTY TAX

There are a number of features which make a tax desirable and undesirable. One of these is its variation in relation to the rate of inflation. Cost of provision of public goods may rise due to inflation. A good tax should adjust itself to compensate sufficiently for this increase in the cost. Because there was not any suitable index available that could provide information about the cost of provision of public goods and services, comparison of property tax with the rate of inflation could not be made. However, a comparison of property tax and government expenditure with the average farm income from the farm operation was performed. In order to do so, respective indices with 1967 as base year were calculated. These are presented in Table 5. Table shows that land tax and expenditure are continuously increasing over time. Income from farm operation continued to fall between 1967 and 1970. It increases thereafter to a highest level in 1974 and 1975 before falling again.

Figures of Table 5 show that there is little relationship between farm land taxes and average farm incomes. Because land tax does not seem to adjust with farm incomes, the burden of property tax on farmers is heavier when incomes are lower whereas, it is lower when incomes are higher. If administrative costs are not too high, it will be desirable to adjust the property tax according to the fluctuations in incomes.

TABLE 5										
Expenditure (Exp.), farmland property tax (L.T.) and average farm income (AFI)										
Year	Manitoba			Saskatchewan			Alberta			
	L.T.	Exp.	AFI	L.T.	Exp.	AFI	L.T.	Exp.	AFI	
1967	100	100	100	100	100	100	100	100	100	100
1908	115	80	79	105	105	78	106	109	92	92
1969	103	93	60	109	109	38	110	122	55	55
1970	114	101	39	106	111	34	113	132	42	42
1971	111	104	49	106	119	61	116	152	58	58
1972	119	111	94	108	122	98	124	152	73	73
1973	119	115	199	109	124	179	127	164	148	148
1974	148	154	257	119	147	245	148	165	214	214
1975	188	185	241	132	166	295	145	N.A.	214	214
1976	213	214	189	153	185	234	156	291	163	163

Where:

N.A. = Not applicable.

Source: Calculated from the data of [66], [72], [73], [74] and [75].

It is also important to know whether property tax is progressive, regressive or neutral. If it is a progressive tax than it may be a good tax from the equity point of view. If it is a regressive tax than it may be contradicting the income tax. This information about incidence of property tax may be quite useful for over all planning of tax structure.

It is further desirable to know whether the property tax is capitalized or shifted. If most of the farmland property

tax is shifted to the consumer of the farm products, then the property tax could be taken as a good tax because the services financed through this tax are mainly meant for the production and delivery of the farm products. Therefore, the costs ought to be shared among farmers and consumers in proportion to the benefits derived from this. On the other hand, if it is shifted on all forms of capital, then it will increase the burden of corporate income tax and may add to misallocation of resources.

The property tax is a unique tax in that the functions involved in its collection are carried out by different agencies. For example the taxable property is assessed by one agency, the rates are established by another one and the actual collections are carried out by third one. This could result in the higher administration costs. The property tax could be termed as a bad tax if cost of collection per dollar of tax is higher in comparison to the other alternatives available. It is also quite possible that disaggregation of the functions among various agencies may make tax system more efficient due to increased specialization. In such a situation, this tax will be termed as a "good" tax.

Consideration of the political feasibility of the tax is of some importance as well. If the tax is most feasible from the economic point of view, it may not be feasible from the political point of view. For example, although the lump-sum tax is considered non-distorting in nature, it may not be

politically feasible because it will fall more heavily on the low and the middle income groups which have the largest number of votes.

1.3 PROVINCIAL ASSESSMENT PRACTICES

The assessment of the taxable property is not carried out every year. Sometimes in some of the provinces the gap between the two assessments could extend to 10 years or more.

Generally, the base of the property tax in Canada is real property values.² The property tax revenue normally is produced by multiplying the assessed value of the taxable property by a tax rate expressed in terms of mills. The assessment, in addition, is often used as a basis of sharing the costs of inter-municipal services, to determine the appropriate grants-in-lieu to be paid on government owned and the other taxable property, and also as a basis for payment of equalization grants to less wealthy municipalities and school-boards. To ensure that each taxpayer pays his or her fair share of property taxes, to provide a proper basis for grants-in-lieu, an assessment system must be comprehensive, uniform and open. For this to occur: (1) all the property must be assessed whether taxable or not, (2) all real property must be assessed at current market value, (3) assessment should be made by trained experienced personnel working for a central agency which has direct and complete responsibili-

² The real property is the one which is non-mobile due to its attachment with the land.

ty for all assessment within a province, (4) the assessment function must be organized in such a way that assessors become very familiar with the local real estate markets, (5) property owners must be given ready access to pertinent assessment information and appeal bodies [13, P 349].

The assessment of the real property in Canada is usually carried out by the provinces. In Manitoba, the municipal tax rates are uniform for both residential and non-residential properties but the education tax rates for non-residential properties are considerably higher than the residential properties. Taxes are levied on the annual rental values of business property. The real property defined in the Municipal Assessment Act does not include machinery and equipments. Some property defined as personal property (principally gas distribution systems) is also assessed. Mobile homes are either assessed or licenced by municipalities. The real property exempt from taxation is also assessed. The province pays grants-in-lieu of equivalent to full property taxes on real property it owns. Land is assessed at two-thirds of its 'value', where value is the market value. Agricultural land is assessed according to a method which considers the relationship between the agricultural land value and the productive capability of soil in a base year. Farmland adjacent to an urban area may be assessed above its value as farmland if this is supported by market evidence. Legally, real property is supposed to be assessed at least

every seven years while in practice, areas having active real estate markets are assessed more frequently. Assessment notices are mailed to property owners only if assessed values change. Complaints about inequality can be made informally to assessor or formally to the annual court of revision in the municipality.

In Saskatchewan, taxes are levied on the assessed value of real property and on business assessment. The business assessment is calculated by applying a factor per square foot area used by businesses, except in Saskatoon where values are based on annual gross rentals. The assessable real property includes lands and buildings. Machinery and equipments are assessed only for mines and oil refineries. Mobile homes in built up areas are assessed. Exempt properties are assessed. The province pays grants-in-lieu of taxes on provincially owned properties which are used for commercial purposes like liquor stores. Assessable land and buildings are assessed at fair value. Fair value is the market value for urban lands but for agricultural lands it is determined largely according to productivity of soil. Fair value for buildings is based on depreciated replacement costs in a base period. Legally, cities and towns are required to be assessed every 8 years while other municipalities are to be assessed at least every twelve years. In practice the periods have been even larger in certain areas. The assessment of farmland is based on the average relationship between

market value and the soil productivity. Urban land is assessed at 100 percent of market value. The buildings are assessed at 50 percent of their replacement value in terms of average costs.

In Alberta, municipal real property tax rates could be lower for single-family housing than other properties. Education property taxes are higher on non-residential properties (as in Manitoba). Manufacturing and processing equipments and machineries are also assessed along with other property. Mobile homes are assessed only if the owner owns the land on which house is located. The province pays grants-in-lieu of its properties but not on educational institutions or hospitals. The assessed values are related to productivity of farmland, average construction costs for buildings and market values for urban lands. Generally, the re-assessments are conducted on a 7 year cycle but extensions could be granted by municipalities on a request basis. Assessment is under provincial control but power is delegated to municipalities who could use their own assessors or hire private assessors. The appeal procedures are similar to Manitoba and Saskatchewan.

1.4 OBJECTIVES OF THE STUDY

A detailed investigation of a number of tax issues could be initiated. These include: its correspondence with the rate of inflation, regressiveness or progressiveness of property tax, capitalization of property tax, administration and collection costs per dollar of tax collected and fairness of assessment practices. This study will investigate the capitalization of property tax in rural municipalities of Manitoba, Saskatchewan and Alberta. Following are the objectives of this study:

1. To study different theories of capitalization of property tax and local government spendings on the property values.
2. To review the previous studies of capitalization of property taxes and local government expenditures into the property values.
3. To build a model and to test the hypothesis of capitalization of farmland property taxes in the lower farmland values.

1.5 ORGANIZATION OF THE THESIS

Different hypothesis of the capitalization of property tax are discussed in the chapter 2. The literature review along with its critique has been presented in the Chapter 3. An alternative hypothesis for farmland has also been developed in the same chapter. In order to test the hypothesis devel-

oped in the Chapter 3, a model is developed in the chapter 4. In the same chapter, data used in the study is also discussed. Chapter 5 discusses the results and provides the conclusions.

Chapter II

THEORIES OF CAPITALIZATION OF PROPERTY TAX

Capitalization of the property tax is an old but controversial area of public finance. Many studies have investigated the issue of capitalization but their results are inconclusive and conflicting. Some confirm the hypothesis that higher taxes decrease the price of real estate. In order to perform a complete study of capitalization, a detailed knowledge of theory of capitalization of property tax is required. But there is not a single theory explaining this phenomena. There are at least three different theories namely: the Old View, the New View and the Tiebout Hypothesis. First two of these deal with incidence of property tax but neglect the government expenditures while the third one deals with both. Therefore, a detailed discussion of these theories will be undertaken under the two categories namely, the incidence of property tax, and the Tiebout hypothesis.

2.1 INCIDENCE OF PROPERTY TAX

The theories on the incidence of property tax aim at answering the question, who pays the property tax? The property owner may not bear the tax if it is shifted. Some owners may shift the tax forward by altering their receipts, for

example, by raising the rent or the price of the product produced on the land. Others shift it back by reducing the payment to other factors of production. The Old View and the New View are the two theories which attempt to answer to the above question.

The Old View does not distinguish between the change in property tax in a single locality; province or nation. The real property tax is treated as a tax on land and structures that increases the costs of goods and services produced from the tax base. The burden of the property tax on structures is believed to be borne in proportion to the consumption of such commodities. Assuming consumption per dollar of income is higher for low income families than compared to more well-to-do families, the burden of the property tax is comparatively high on the low income families.

The New View considers the property tax as a tax on capital. Since all capital goods are taxed, investors will shift resources from higher to lesser taxed areas. This shift of capital from the high tax area to the low tax area continues to take place until the after tax rates of returns are same throughout capital market therefore, all the owners of capital share the burden of property tax. As the ownership of capital is more concentrated among the high income families, the tax is progressive. A detailed discussion of these hypothesis follows:³

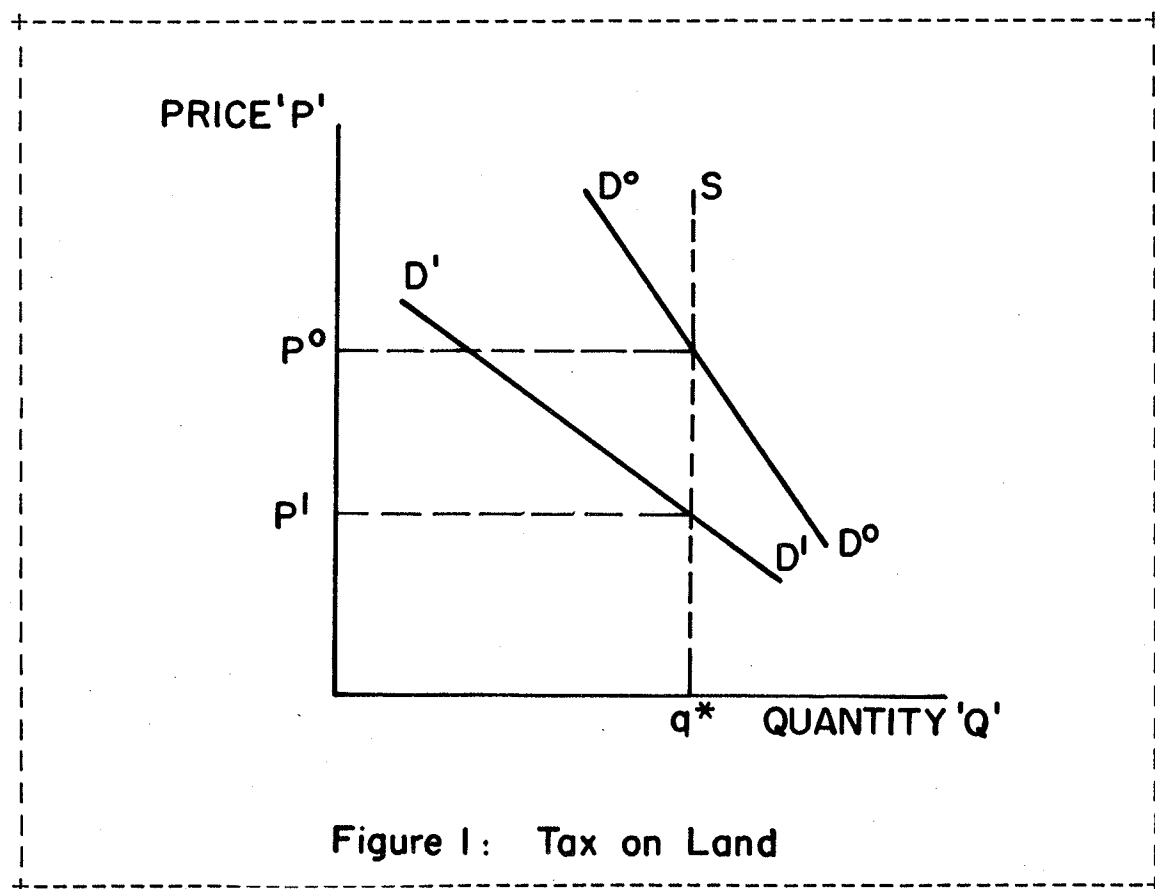
³ See also [1] and [5].

2.1.1 The Traditional or the Old View

This view is based on the partial equilibrium analysis and isolates two aspects, namely, a tax on land and a tax on structures.

2.1.1.1 Tax on Land

According to this view the supply of land is inelastic because the quantity of land can not be altered in response to change in return from land. Any tax levied on a commodity fixed in supply is borne by its owner. This is demonstrated in Figure 1.



In this figure, DD is the before tax demand curve and Sq^* is the inelastic supply curve, ' q^* ' is the equilibrium quantity of land demanded and supplied at the price P^0 . An ad valorem tax reduces the net proceeds accruing to the owners of land and could be considered as reduction in demand. The demand schedule will shift to a lower level because buyers account for the reduced after tax earnings. The supplier being unable to reduce the quantity of land receives only P' . The difference $P^0 - P'$ is the effect tax has upon the land price. Since the suppliers offer the same quantity q^* , regardless of price, they incur the entire tax burden. If the ownership of the taxed commodity is widely diffused, no owner will be able to successfully raise the price of land and hope to sell the property.⁴

2.1.1.2 Tax on Structures

The tax on land is analysed separately on the assumption that the supply of structures is not fixed. Any amount of capital for improvement in the real property is available at fixed cost and is determined by the productivity of capital in the other uses. The supply of structures is perfectly elastic in the long run and therefore the tax must eventually be borne by the users of structures. This has been shown in the figure 2.

⁴ The assumption here is that profit maximizing prices are not affected by tax. A proof could be seen in the Appendix A.

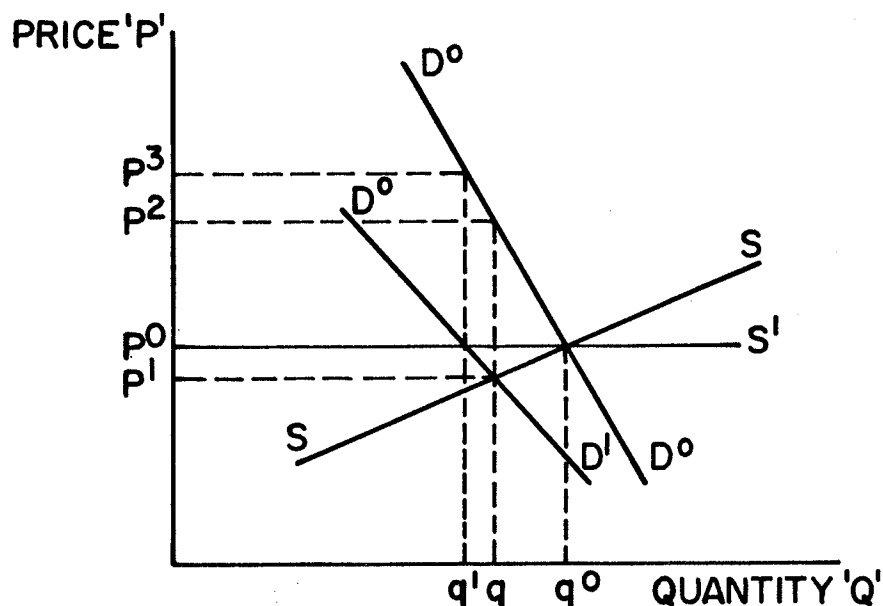


Figure 2: Tax on Structures

SS is the short-run supply curve of structures, D^0D^0 is before tax demand curve and D^1D^1 is after tax demand curve. Before tax, the equilibrium quantity and price are q^0 and p^0 . After the tax, the short run equilibrium quantity falls to q , the price paid by users rises to p^2 while the price received by the owners falls to p^1 . An amount equal to $p^2 - p^1$ goes to the tax, out of which, $p^2 - p^0$ is borne by users and $p^0 - p^1$ by the owners of the structures. The proportion of the share of the consumers and the owner of structures in the payment of property tax depends upon the elasticity of supply of structures. In the long run, the supply of struc-

tures is perfectly elastic and could be represented by the curve P^0S' . In long run, the equilibrium quantity further falls to q^3 where the whole of the tax is paid by the users of the structures.

2.1.1.3 Capitalization Hypothesis - Derivation

The study of incidence mainly aims at determining the effect of property tax on income levels. But the proposition that the return from the asset is related with the value of the asset and if the return from asset changes, the value of the asset also changes in the same direction, gives rise to the capitalization hypothesis. Because the property tax depresses the stream of the returns from land, the value of land is depressed by the amount of reduction in the stream of returns. Before tax present value⁵ is expressed in equation 2.1:

$$V^* = \sum_{i=1}^t (R + Ti)/(1 + r)^i \quad \dots (2.1)$$

Where,

R = Monetary return in constant dollar, net of all cash expenses including property taxes.

T = taxes per period i .

r = average cost of capital for farmland (%).

⁵ Only a simple method of estimating real estate value is being used here, because, the purpose is to demonstrate the derivation of capitalization and not to estimate real estate value from it. However, a more comprehensive formula for estimating real estate value could be seen in [34].

V^* = true present value of the future income stream from the property.

T^* = present value of the future stream of property tax payments on the farmland.

S = Sale price of the farmland.

The sale price would be present value net of taxes:

$$S = \sum_{i=1}^t R/(1+r)^i \quad \dots (2.2)$$

The difference between the sale price per acre and the present value per acre is the present value of the taxes per acre, if the tax is actually capitalized:

$$T^* = \sum_{i=1}^i T/(1+r)^i \quad \dots (2.3)$$

Over the life time of the land, the value of land will be depressed by the present discounted value of tax. In the case of less than perfectly elastic supply of land, a partial capitalization will be expected. Supply of land may be fixed on earth but the supply of land for a particular use could be altered. A parcel of land previously used for one purpose say farming could be used for residential or industrial purposes. An increase in the tax rate on farmland near the city may induce its conversion into urban land. Alternatively, a larger land tax in an urban area surrounded by underdeveloped farmland may reduce the supply of land brought into urban use, thus raising housing prices and affecting the wages, profits as well as the rents.

2.1.1.4 Criticism of the hypothesis

According to this hypothesis, because the supply of land is perfectly inelastic, all the land tax is borne by the land owner. In reality, at least for a particular use, the supply of land may not be perfectly inelastic. If land is perfectly elastic for some use, then, all of the tax on land may be shifted and not capitalized at all. Similarly, if the supply is partially elastic, only part of it will be borne by the land owner.

In addition, this theory is based on partial equilibrium analysis, where the land market does not interact with the rest of the capital market. If it is assumed that land investment is a particular form of capital, and if property tax is capitalized, then this will depress the rate of return on investment in land when compared to rest of the capital market. This will cause out mobility of investment from land to other sectors of capital market. The process will continue untill the rates of returns are equalized in whole of the capital market, and a new equilibrium is established. So, as a final equilibrium, property tax will be capitalized into land value to the extent it actually depresses the income from land.

This theory does not consider the local government expenditure. The property tax is raised to provide services like maintainence of roads, education, healthcare, police and fire protection along with water and sewage services. The

existence of these local public services is expected to appreciate the value of land and buildings. While the raising of property tax may have a negative effect, its use on the provision of local public goods and services may affect the values of land positively. The net effect whether negative or positive will be capitalized in the land values.

2.1.2 The New View

The New View is based on a general equilibrium approach. It holds that all owners of capital bear a tax on property. It has three stages of analysis. The first stage considers the distribution of burden from a "property" tax imposed uniformly on all property -- land and capital goods alike. The second stage considers the burdens arising from deviations in the tax rates around the average. The third stage considers the impact on the aggregate supply of land and capital of changes in the after tax rates and profits.

2.1.2.1 Stage 1 - Uniform tax

A uniform tax on all capital including the value of land would be borne in full by owners of the capital goods. It could not be shifted to untaxed sectors because all sectors are equally taxed, nor could it be shifted forward through higher prices because (assuming profit maximizing owners) the profit maximizing prices are not changed by a universal tax. The conclusion is based on the assumption that property

tax rates are uniform and that the aggregate supply of capital is fixed. This conclusion is consistent with the discussion related to figure 1. The uniform property taxes are capitalized into the net worth of capital due to reduction in after tax return.

2.1.2.2 Stage 2 - Deviation in rate around average

The property tax is not necessarily uniform. Some land and capital goods are taxed more heavily than others. In the short run the rates of returns are reduced on all capital goods in proportion to the tax rate. As a result of this some owners of assets of the heavily taxed sector may shift their assets to the lesser taxed sectors or uses. This could give rise to a number of occurrences:

If there are no taxes, then the capital market will be in equilibrium at a point where the rates of returns on capital in the whole capital market are same. Any imbalance due to imposed taxes will cause outmobility of capital from low return sector to the high return sector. This outmobility due to low return will raise the rates of return in this sector and in-mobility of capital in the high return sector will depress the rates of returns of the sector. As long as the rates of returns in the heavily taxed sector are lower than the lesser taxed sector, the mobility of capital from the former to the latter will take place. This mobility will continue until the rates are equalized in the two sectors.

In terms of land, if supply of land is fixed, then the New View, like the Old View holds that the imposition of a tax on land values reduces net income to landowners and increases availability of funds for public spending. This will be accompanied by change in economic behaviour of land-owners who will have less to spend. The assumption that the supply of land is fixed seems more appropriate for analyzing changes in land taxes imposed in cities surrounded by the other developed communities and not for the isolated towns surrounded by farms where the supply of land for urban use could be increased by conversion of farmland into urban land unless there are very strict zoning laws. The supply of farmland could also be altered through the landfill operations, soil reclamation, cutting of forests, terracing the hills, conversion of parks into farmlands and by technology providing similar inputs embodied in cropland.

As a result of movement of capital caused by variations in tax rates across jurisdictions and among industries, the payments to other factors of production will be affected. For example, in the high tax areas and uses, real wage rates will decline relatively, because workers will have fewer capital goods to work with and because owners of capital goods may try directly to reduce wages. Because labour is mobile, it will move out of low wage (high tax) area to the high wage (low tax) areas. This mobility will continue until the real wages are equalized in the economy. If labour is

fully mobile, any attempt to shift the tax on labour will result in supply of labour equal to zero in that area or use. So the shifting will not be possible.

If neither the land nor the wages directly absorb the above or below average tax rates, the relative prices of the products of the high tax region or industries will tend to rise and those of the low tax region and industry will fall. This situation will apply for goods which compete with each other only in the local markets and not the national markets.

There are difficulties in estimating the final affects of the tax induced shifts in the uses and locations of capital. These shifts are influenced by a number of factors like: extent of the substitutibility between capital, labour and land in the production of each commodity; shifts in demand for product with the change in price and the degree of competition between the product of high and low tax markets. It is clear that the burdens of a property tax will depress the average returns to the owners of land and the reproducible capital. In addition, variations in tax rates around the average will induce changes in land rents, wages and the commodity prices which will work to the disadvantage of the workers, landowners and consumers in the high-tax areas while to their advantage in the low tax areas. So two points become crucial in the calculation of the burden of property tax: (1) the determination of the size of the decline in

the rates of return on all capital and land due to the average rate of property taxation, and (2) the determination of the distribution of excise-tax effects among wages, rents and prices of final goods due to variations in the tax-rates among jurisdictions and uses.

A uniform tax on all assets will depress the rates of returns on all capital. Any difference in the tax of one sector will give rise to excise effect. The burden of tax on some sectors will be more than the others.

If the difference is in the tax rates within metropolitan areas, it will be capitalized primarily in the land values. This will happen because a well connected market exists for most of the goods and services. The burden therefore is unlikely to be shifted. If the market for housing or other goods are separated rigidly, chances exist that the burden will be shifted to the product prices.

The regional differences in property tax rates could be shifted to labour only if labour is immobile. Shifting on goods by raising prices is possible for the goods which are competitive only in the local markets. Such products are baked products, ice cream or goods sold by the small stores in the community.

To the extent that the capital goods used in the production of different commodities are taxed at different rates even within jurisdiction, for example, the residential property is taxed differently from the commercial or the farming

properties, the excise effect is generated and the rents on these properties could be different.

2.1.2.3 Stage 3 - The effect on supply of labour and capital

Analysis of Stage 1 and Stage 2 assumed the supply of capital is fixed. In reality, a fall in the rate of return on capital due to the increased property taxes may affect the proportion of income saved, therefore reducing the supply of investment which will reduce the overall capital stock. Theoretical analysis indicates that a tax on capital tends normally to shrink the capital stock, remuneration to labour and total production. The first effect comes about because of curtailment of saving, the second effect because of the reduction in productivity due to reduction in capital stock and the third because the other two effects may reduce the labour supply. As a result of this, real wages per worker will be smaller and rate of return on capital will be higher. The effect of property tax on capital, labour and their rates of returns will depend upon the sensitivity of savings to the rates of returns on saving and the speed of adjustment of capital stock to the changes in its rates of return caused by property tax. Theoretical analysis gives no indication whether these effects are larger or smaller or when will they occur. Empirical studies have not provided an adequate indication whether rates of return are positively or negatively correlated with the rates of saving. The rate of

return may not be an important factor determining the demand for capital in presence of macro-policies aimed at offsetting the deficit demand. These policies may simply shift investment demand from private to public sector or vice versa.

2.1.2.4 Criticism - New View

All the three stages assume the owners of real property are profit maximizers in the long run and no external constraint on their decisions exist. In the real world, the situation may be different; markets may be imperfect, monopoly profits may exist, non-internalized externalities may exist, government policies may affect the behaviour of investors and certain non-economic factors like political belief, social set-up, religion, norms, customs and ethenic origions may act as barrier to general equilibrium.

The application of the New View to the analysis of the property tax is restricted for a number of reasons: First of all, this view considers whole capital markets as one. In order to analyze the affect of the differential property tax on farmland of a region, one is required to consider capital, labour and the product market of whole world or at least that of U.S. and Canada. Such an analysis is restricted by larger data requirements.

A further problem with this theory is that it is not complete because it does not consider the affect of local government spending on the values of property.

It could be concluded from the theories of incidence of property tax that a more complete theory which analyzes the incidence of government expenditure on local goods and services along with the property tax is required. Along with this, better data and also some econometric tool which could make handling of large number of equations and variables easily is required.

2.2 TIEBOUT HYPOTHESIS

Tiebout [58] presented his theory of local government expenditures in 1956. This theory considers the effect of property tax along with the effect of expenditure on local public goods and services.

This hypothesis argues that there are efficiency generating processes at work, despite the publicness of the services. The assumption is that individuals are assigned the task of providing certain public goods and services, and individuals retain freedom of personal migration across jurisdictions.

Actually, the Tiebout model was a partial but positive response to the negative proposition advanced by Samuelson [49 and 50] that there exist no means of using market like decentralization to attain tolerably efficient results in the case of public goods. Samuelson showed that Pareto-efficient provision of public goods requires the satisfaction of condition:

$$\sum_{i=1}^N MRS_{gx} = MRT_{gx}$$

Or,

$$\sum_{i=1}^N MBg/Px = MCg/MCx$$

In perfect competition, price equals marginal cost. Therefore,

$$\sum_{i=1}^N MBg = MCg$$

Where,

g = Public good

x = Private good

i = individuals, 1 to N

MRS = Marginal Rate of Substitution

MRT = Marginal Rate of Transformation

MC = Marginal Cost

MB = Marginal Benifit

P = Price.

Above analysis suggests that an efficient provision of public goods is possible only if price of public good equals the sum of marginal benefits derived by all individuals from its consumption.⁶ The preference revelation is a problem in the provision of the public goods.⁷ By virtue of non-excludibility and non-rivalness, the exclusion is either not possible or at least it is not efficient. Everyone has an incentive to understate the amount of benefits which one has

⁶ For a detailed descussion on optimal provision of public goods, see [7], [39], [49] and [50].

⁷ There have been a number of attempts to develop better methods of preference revelation. See [22], [56], [59] and [63] for a detailed discussion of these methods. These methods have not yet been applied at more than the experimental levels.

derived from the consumption of a particular public good. Therefore, it is likely that the market system will fail in efficient allocation of resources and optimal provision of the public goods.⁸

The Tiebout model provided an opposite conclusion about the provision of public goods. He showed that for local public goods and services, an efficient provision is not only possible but it actually exists. In an economy consisting of many localities each of which provides a different mix of public goods and taxes, individuals will have incentive to migrate to those communities which offer the greatest difference between public benefits and public costs. This mobility of consumers, often referred as "voting with the feet", provides an alternative mechanism by which individuals may voluntarily reveal their preferences.

Tiebout argued in a world of perfect mobility between communities and where individual preference revelation functions perfectly, there will be an optimal distribution of population and optimal provision of public goods.

This model is abstracted from the real world as it is based on the assumption that an economy consists of a number of localities which satisfy the following properties [11]:

⁸ For detailed discussion on market failure, see [22] and [36].

1. Consumers have 'full knowledge' regarding revenue and expenditure patterns of various communities and are perfectly mobile among communities;
2. There exists a 'large amount of choice' between services (expenditures) and costs (taxes) in different communities;
3. All individuals live on dividend income. This provides a mean of virtually eliminating the locational fixity. If all income should be received from dividends, the individual's actual choice of location in space will be independent of the allocation of resources in the private sector of the economy;
4. There are 'no spillovers' between the communities;
5. There exists some 'optimal community size'. Communities below the optimal size seek to expand by attracting residents and vice versa.

In an economy satisfying above conditions, Tiebout argued that;

1. There would be a Pareto-optimal allocation of public goods within communities;
2. All communities will be of an optimal size;
3. Individuals with similar utility functions and income levels would congregate together to take the advantage of their complimentary tastes in public goods;

This hypothesis is based on somewhat unrealistic assumptions such as labour mobility does not affect the returns to lab-

our and there are no spillover effects between adjacent communities.

In each region, if public goods are not subject to congestion, net benefits per capita would be increased as more tax payers enter into the community and costs are spread over more people. This is just one side of the picture, however, because land is fixed factor in the community and when the number of labourers is increased beyond certain level, laws of diminishing return may start operating and marginal productivity of labour, income of community and therefore, income per capita may fall. The benefit of joint consumption will eventually be offset by a reduction in the wage rate. This may hinder inter-community mobility and Pareto-efficiency may not be attained.

Benefits due to more individuals in a community are also reduced by the impurity of public goods. When a worker moves to another region, not only does he reduces the tax bill of others in the region to which he is moving (and increase it in the region which he left), after a certain level of population in the municipality, he may also impose the congestion costs on the users of local public goods in his new region (and reduce them in the region he left). While deciding to move, one may not take into account the costs of congestion and Pareto-efficient allocation may not take place. Some communities may become over-populated while others remain under-populated. However, it is quite possible that

congestion costs may raise property taxes, therefore reversing the process back to the under-populated sector.

Flatters, F. et. al. [20] showed if compensated price elasticity of demand for the public goods is -1 , free migration of labour will generate a Pareto-optimal allocation. In other cases, resource allocation with free migration will be inefficient. In this case there will be need for some federation to be set up in order to induce workers to move from the over populated to the under populated areas.

Rufalo [48] argued that the studies which criticize the Tiebout model consider local public goods and services as separate from housing services. In fact, a renter views the two together and sees them as one package. He showed that under certain restrictions on the types of local public goods provided and the environment in which they are provided, the Tiebout hypothesis might be correct.

2.2.1 Tiebout-Oates Capitalization Model

Based on the model of Tiebout, Oates [40] developed the 'capitalization hypothesis'. The purpose was to assess empirically the validity of the Tiebout model of intercommunity mobility in response to different packages of local public goods and services and the taxes. He argued the quality of local public goods and services along with the level of property tax determined the residential choice for consumers, and local property values ought to be influenced by

them. Communities with high levels of local public services would tend to attract residents, all other things including the property tax being equal. The demand to locate there could drive up local property values since the quantity of property was presumably fixed. An equilibrium will be established, in which all or part of values of local public services were 'capitalized' into property values. The amount of capitalization would depend upon the mobility of consumers and the elasticity of supply of local property. On the other hand, local property taxes would have the opposite effect. If one community was identical to the other except for the level of property taxes, the mobility of the residents would cause property values to be lower in the high tax region. Among communities, local property values would differ due to variability of the level of public services and taxes.

Edel and Sclar [18] argued if Tiebout model is working then in real world no capitalization of taxes and expenditures could be expected. Like persons will congregate together. Their homogenous communities would differ from one another in taxes and expenditures, but not in property values as a result of capitalization. Therefore, occurrence of capitalization may show a disequilibrium situation which Tiebout model has not fully adjusted. They argued a more appropriate test of the Tiebout model could be to see if capitalization falls over time. They raised doubts about the soundness of Tiebout model by showing that despite the move-

ment of education service towards a Tiebout type equilibrium, the service market⁹ as a whole does not show the movement towards equilibrium. They used the data of Boston for years 1930, 1940, 1950, 1960 and 1970.

2.3 CHOICE OF THEORY

Previous discussion of this Chapter dealt with the three theories dealing with capitalization of property tax, namely: Traditional or Old View, the New view and the Tiebout Hypothesis. One of the major problems with the first two theories is that they do not consider the effect of local government expenditure along with the effect of the property tax on the property values.

The Old View is based on a partial equilibrium demand and supply analysis and does not completely trace the effect of property tax. The New View provides a general equilibrium framework but its applicability is restricted as analysis is too demanding in terms of data requirement, and model will be quite complex due to a large number of variables and equations involved. Furthermore, it neglects the imperfections in the market.

The Old and the New Views are both based on implicit assumption that price signals are sufficient for equilibration of the market. This as pointed out by Samuelson may not be true for public goods and market may fail.

⁹ Sum of all local services.

The Tiebout model seems to be more appropriate for the study of capitalization of property tax as it provides the theory of local government expenditure along with the property tax and also that it is not as complex as the New-View. It also provides an alternative mechanism for adjustment of market towards Pareto equilibrium.

Chapter III

LITERATURE REVIEW AND HYPOTHESIS

This Chapter has been divided into two sections. The first section reviews the literature and the second section develops the hypothesis.

3.1 LITERATURE REVIEW

This section has been divided into two parts. The first part reviews some studies and the second part provides the critique.

3.1.1 Part I - Summary of different studies

The possibility that property tax could be capitalized into property values has long been recognized. Reference to the phenomenon is available as early as 1733 [54, P 174-175]. In 1939, Shoupe [56, P 187-201] provided the summary of the theories of capitalization. A more recent summary was provided by Buchler [10] in 1950. Empirical investigation on the issue of the capitalization of the property tax began in early part of this century when Jensen [32] using data of 13 U.S. states for 1919-1924 showed the possibility of existence of capitalization of property tax into the farmland property values. He observed that after the taxes, the mar-

ket prices of farmland fell significantly during the period of analysis. Other factors were not isolated, yet it suggested the possibility of capitalization of property taxes.

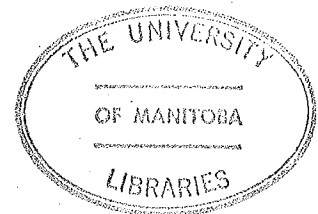
In a more recent study, Diacoff [17] using regression analysis and data of 20 townships and 3 cities of Michigan state for 1951 to 1957 found no evidence of capitalization. He argued that the government expenditures made possible by the tax revenues may add more to the property value than subtracted by the property taxes.

Woodard and Brady [64] performed a study of capitalization of property tax into the farmland property values using the data of 238 farms of varying sizes in Ohio and Indiana for which the actual sale took place during January 1, 1962 - July 1963. They found the present value of future income stream from farm property minus the present value of stream of tax payments on the farmland better explained the variance in the sale prices than the present value of future income stream by itself. Their model did not include the government expenditure and other variables which affect the price of farmland on the assumption that the other variables are constant in the short run. But, in a period of one and a half years, variables other than the property tax may not remain constant. Omission of these relationships may introduce a bias into the results. The direction of the bias could not be hypothesized because a number variables are missing. These missing variables could be local government

expenditure, variables expressing the demand and supply of land, location, technology, capital intensity and borrowing capability of farmer.

Wicks, Little and Beck [62] applied the same methodology to the study of capitalization using data of Missoula county, Montana for 1965-67. Their model had 64 observations which included the residential, business and rural properties. They evaluated the effect of reassessment which resulted in increase in the property tax. They found as the size of the tax rise increased, the expected sales price of the land decreased by larger amount. They also found the difference in price was greater for larger parcels of property. Their analysis is also subject to the same criticism as was that of Woodard and Brady [64].

Smith [55] performed a capitalization study for the San Francisco area. He used sales data from 1966 to 1968. During Nov. 1966, "residential property owners were faced with large increase in their tax bill". Based on the assumption that capitalization is dynamic phenomenon and the analysis of one period may not be sufficient, he performed his analysis in the three periods; the first is: the period when the property owners were unaware of major tax change, the second is: when they came to know about reassessment but they were unaware of the amount by which their tax will increase, and the third period: when exact size of tax change was known. The sample size for the period I was 80, for period II, 131,



and for period III, 90. He concluded that a negative capitalization exists and as the size of the tax increases, the fall in the values of the property also increases. In his model, the price equation has age of assets along with tax as an independent variable. But, because the other variables were missing, the results are expected to suffer from an omitted variable bias.

Oates [40], turned the studies of capitalization in a new direction. He attempted to test the Tiebout hypothesis using cross-section data of 53 municipalities of northeastern New Jersey for 1960. He used a multiple regression technique. He argued that people shop around among communities for the best tax-expenditure package and choose the one which suits them. As a result of their mobility in response to the different tax and expenditure packages, the property taxes get negatively capitalized while the local government expenditures get positively capitalized into the property values. In his price equation, he included a number of variables affecting the price of property. Tax and public school expenditures were two of them. He also used two stage least square (TSLS) method of estimation in order to remove the simultaneous equation bias. His results supported strong evidence of negative capitalization of the property tax and a positive capitalization of the government expenditures into the property values.

Pollakowski [47], while commenting on the Oates study, argued the use of education expenditure neglects the rest of the expenditure on local public services. As a result of this, an over-estimation of expenditure coefficient is possible. He further argued the use of median family income in the price equation is incorrect because it only reflects the demand for property by present owners that excludes the potential buyers. He mentioned there is no need to use TSLS method of estimation because a number of exogenous variables are correlated with the error term. For example, people with higher levels of educational attainment tend to locate in areas with low pollution levels since their higher incomes and wealth allows them to do so. Therefore, educational attainment can not be a predetermined variable. If most of the predetermined variables are added into model, the taxes and the expenditures on education per pupil will be quite close to the actual ones. Therefore, there is no point in using TSLS method of estimation. He also believed Oates results support the Tiebout hypothesis because of choice of very special data, and similar results may not be obtained in other regions. Using the Oates model with replacement of certain variables and the data of 19 cities of San Francisco-Oakland and San Jose urbanized areas for 1960-61 to 1962-63 he re-performed his analysis. He removed the median income, families with median income and log of distance and added houses with more than one bath as character of hous-

ing. He dropped the distance because his data had a number of employment centres as compared to the Oates study which had only one employment centre. He obtained statistically insignificant negative coefficient for tax and positive coefficient for expenditure.

In response to this, Oates [41] re-estimated his equations. This time he included other expenditures along with the public school expenditures. This variable gave a positive and significant coefficient. The magnitude of the tax variable rose, which showed the exclusion of other expenditures causes under-estimation of capitalization. He also argued the use of the median family income was not wrong but it was an incomplete variable. A complementary variable which could explain the potential demand is required to fulfill the deficiency. Oates did not add such variable in his equation. He accepted that Pollakowski's analysis the results are sensitive to the specification. He refuted Pollakowski's argument that there was no need to use the TSLS method of estimation on the grounds every thing in this world is interrelated and it is economist's job to separate the important relationships. Because taxes and expenditures are both dependent on values and values are inturn dependent upon taxes and expenditures, there is simultaniety involved and TSLS is necessary.

¹⁰ Usually effective tax rate or mill rate is tax per thousand dollar of assessed value of the taxable property.

King [32] argued effective tax rates¹⁰ do not show the tax burden on the property owner. He replaced the effective tax by total tax on property in the Oates model. Using the Oates data, he found that Oates overestimated the capitalization of property tax by at least 40%.

A recent study by Brueckner [9] using the Oates' data showed the provision of public goods was at an inefficient level. Unless it is assumed taxes and services were moving towards pareto efficiency, such a data contradicts the implication of Tiebout model there is optimal allocation of local public goods and services.

Even before the study of Oates, Orr [42] performed a capitalization study of property tax by a different method. He assumed either taxes or expenditures are capitalized into the land values or they are shifted in higher rents. In order to test this, he regressed the median gross rent per room for 31 communities of Boston area on average land values, a dummy variable indicating the private or public provision of water and sewage facilities, an index of accessibility to centre of employment, condition of housing units, differentials in annual expenditures per pupil in the public schools and in effective tax rates. He concluded a substantial portion of property taxes on the improvement component of urban residential housing is borne by property owners. His study gave rise to a chain of comments. Heinberg and Oates [24] in their comments pointed out that Orr's study

suffers from a number of problems like the existence of simultaneous equation bias as several of independent variables are determined at least partly by the dependent variable. Instead of using rent from tenent houses, Orr uses gross rent per room for all housing units. Orr included Boston in his observations while it was not comparable with any other observation in its size or other characteristics. After making a few other adjustments in the data, Heinberg and Oates re-estimated equation by TSLS and obtained a positive tax coefficient.

In response to these comments, Orr [43] presented the results of his TSLS estimate using his previous specifications. He showed that results do not change much. Because the TSLS method did not have much affect on the results, he chose to present the results of Ordinary Least Square (OLS) in his earlier study.

Black [6] changed Orr's data. He replaced the effective tax rate for all houses by effective tax rate of two family houses. Also data for five variables (land values, public services, accessibility, education expenditure and employment density) for Boston city was missing. He concluded that forward shifting of taxes is lesser than the estimates of Orr.

While commenting on the Orr's study, Coen and Powell [14] argued Orr's study suffered certain problems namely: non-consideration of cross-elasticity of demand among communi-

ties and absence of community effect i.e., effect of "lovely lakes, rolling hills or pleasant views" from the equation. He pointed out time series (TS) data will be better than the cross section (CS) data for separation of community effect. Consideration of cross-elasticity of demand is desired as the level of tax shifting may be influenced by it. The time series data is important as complete adjustment may not occur in one period. Absence of the community effect may bias the estimated tax coefficient towards zero.

Orr [44] replied by arguing that the consideration of the cross-elasticity may not be possible in the estimation of capitalization where the number of communities are large. He showed in larger community case, tax differentials will show as rent differentials even if inter community migration is taken into consideration. Therefore, use of the CS data is legitimate. However, Orr accepted his general approach to the measurement of tax shifting was biased downward as it neglected the price changes in other communities. But this bias will be very small in case of larger number of communities (as in his own data) because price changes in other communities will be very small.

Heinberg and Oates [25] supported the comments of Coen and Powel. In particular, they accepted that inclusion of time lag in full capitalization is desirable.

Hyman and Pasour [28] used cross-section (CS) data in a study of owner occupied houses of 106 towns of North Caroli-

na. As opposed to the Oates study, their region had many employment centres. Because the jobs are location specific, mobility across communities is not very high. They hypothesized the taxes are shifted. They used effective tax as tax variable, the total tax (which includes: licence fee, property taxes, beverage taxes, utility taxes and intangible taxes) as a measure of service level in the community. They concluded that capitalization of tax does not exist.

In another study, with the data from North Carolina, Hyman and Pasour [29] used the methodology of Orr for a capitalization study. They regressed rents on effective tax rates along with other variables. The purpose of this study was to support their previous analysis. Hyman and Pasour argued the supply of land and housing is quite elastic because of the underdeveloped land available and entry into construction industry is not restricted. They concluded tax on rental dwelling units is partially shifted forward. The data used in the above study involved 115 municipalities across North-Carolina with more than 2500 inhabitants including urban cores.

Cowing [15] pointed out Pasour model is incomplete and misspecified. He argued that demand and supply of land are both elastic. Due to this chances of capitalization may be greater than anticipated by Hyman and Pasour. Furthermore, the Tiebout model applies to a given urban market. In this analysis there are a number of employment centres that have

not been separated from each other -- which is a mis-specification. They further argued that data of Hyman and Pasour excluded 9 largest cities. As a result of this, their results could be biased towards zero.

In return, Hyman and Pasour [29] replied that the Tiebout model is not restricted by space. The choices among the communities are fewer and therefore, the demand is less elastic.

Pasour [45] performed a similar study of capitalization for farmland of North Carolina with 1969 data. His sample included 83 out of 100 counties. He regressed the average county farm real estate value on soil quality, local service level, location, distance to the urban centre, percent of farmland in crops, crop production value index, effective tax rate, percent change in population from 1969-70 and the population density. His conclusion was that capitalization does exist.

Following the conclusion of Pasour about negative capitalization of property taxes, Deaton and Mundy [16] pointed out an implication of differential farm and non-farm assessments in Tennessee where all properties were assessed at 40% of the fair market value before the amendment of 1972. After 1972, the assesement of commercial and industrial property remained unchanged while it was reduced to 25% for the farmland and it was raised for utility property to 55%. As a result of this, the effective land tax on rural lands would

fall. It would raise the rural land values. This rise may not be same for all counties. The counties which have larger non-farm land package will get more relief. With the rise in the values of land, tax base will increase and therefore, the tax will increase again. This increase will be in proportion to the increase in the land value. In other words it will be higher in the counties where the proportion of the farmland is greater.

Bevins [3] also supported the argument by pointing out that the tax break to the Tennessee farmland owners will disappear over time as the decreased taxes are bid back in the increased land values. But this may take several years.

Jose [31] studied capitalization of property tax on farm income using data of 1970-75 period for rural municipalities of Saskatchewan. He found the elasticity of tax levies with the farm real income varied between 0.7 and 0.8. He concluded that the property taxes are regressive. In his model he regressed property tax as dependent variable against the log of farm income. His model seems to suffer from the omitted variable bias and the problem of causality. From theory, property taxes are supposed to be capitalized into the property values. If one assumes the property values as a function of income (because the value of an asset is the present discounted value of future stream of income generated from the asset) then one can substitute the income at the place of the value of land. If this is the case than one should be

regressing the income on property tax and not the tax on income. Even this is not sufficient, other variable affecting the income and expenditure variables are required to be included in the equation(s).

McMillan and Carlson [37] analysed the effect of property tax and public services upon residential property values in small Wisconsin cities. Their data consisted of all incorporated Wisconsin cities which had a high school, the population between 2,500-25,000 and lying outside the SMSA's. They used both OLS and TSLS methods of estimation on all 65 observations. They used effective tax rates as tax variable, and school expenditure per pupil and non school expenditure per capita along with the other fiscal and non-fiscal variables for 1970. They found no capitalization and argued this is because of elastic supply of land.

A Canadian study dealing with the capitalization of property tax was performed by Wales and Weins [60] on the residential property values. This study questions the use of effective tax rate as a biased variable. A negative bias is introduced due to regression of property value against the property tax divided by property value (which is effective tax rate). If the tax is held constant, the change in value will be correlated with the effective tax rate because when the value will increase, the effective tax (tax/value) will fall. They attempted to remove this bias, but the method was unsatisfactory. This study used sales data of 1800 improved

residential properties in 1972 in the municipality of Surrey in Greater Vancouver. Explanatory power of their estimated equation was low. They concluded that both taxes and expenditures are not capitalized.

3.1.2 Part II - Critique

A critique of the above studies follows. The critique focuses upon four different aspects of the studies, namely, the model, the theory, the data and estimation, and the results and conclusions.

3.1.2.1 The Model

The choice of a model based on the economic theory is of great importance for a sound analysis. Furthermore, the model should be properly specified. The variables should be chosen with care as the results are susceptible to error if choice of the variables is inappropriate. This could be observed from exchange of comments between Orr [51] and Heinberg and Oates [24]. Heinberg and Oates refer in particular to the measurement problem of the variables. Using the Orr's model, they changed the "income and tax on all houses" by "income and tax on the rented houses" which changed the sign of tax coefficient from positive to negative.

Certain studies used incomplete models. For example, Jose [31] regressed tax by itself on income, Woodard and Brady [64] and Wicks, Little and Beck [62] used only the tax and

the value of land in their analysis. Because these studies had a number of variables missing, their results are expected to have the omitted variable bias. Some studies had problem of partially missing variable. For example, Oates [40] used the education expenditure as a service variable while he neglected the expenditure on other services from his model. Similarly, Hyman and Pasour [27] used total tax as their service variable, but it neglects the transfers received from higher levels of government. Furthermore, it is a misspecification because tax should be the tax variable and not the service variable unless transfers are zero. McMillan and Carlson [37] used expenditure per capita as the service variable. Oates in both of his studies [40] and [41] used the expenditure or the education expenditure on a per capita basis. The use of the service variable on a per capita basis does not seem to be appropriate proxy for the level of services in the community. A pure public good or service 'by nature' is such that its consumption by one does not affect the consumption or the level of satisfaction drawn by anybody else. In case of such goods, expenditure per capita does not make much sense unless there is some congestion cost involved. Take the example of two communities with everything alike but the population. Now all the services which are financed through the property tax are not purely public in character. Some could be more public while

¹¹ The publicness of a good can be judged from the coeffi-

the other may be less.¹¹ Consider education where much of the funding is provided through the transfer payments on per pupil basis so one should use the education expenditure per capita as the service variable. But this is not necessarily true. Education expenditures are such that while a lot of threshold spending is required, the expenditure for the students at the margin are almost zero. Even if the community with more population sends more students to the school of their community, cost differentials may not be that high. The community with more students will get larger grants which that community can spend on improvement of the quality of education. This quality difference will not be reflected in the per pupil variable, but total expenditure will reflect it. Similarly a large number of other transfer payments are determined on a per capita basis. A community with more grants and more population may have better overall service level which will again not be reflected in the expenditure per-capita.¹² The argument that voters authorize expenditure based on their share may not be sufficient to support the use of per capita expenditure in the case of public goods due to problem of free ridership. A rational person would not authorize expenditure on public services according to his/her demand unless some specialized demand

cient of publicness, for which see [8].

¹² The whole of the above example assumes that there are no congestion costs involved with more people using the same public service. But if there are some congestion costs, appropriate adjustment should be made.

revealing process is in operation. This kind of voting model will support use of expenditure on per capita basis only if it should be shown that people reveal their true preferences in absence of any demand revealing mechanism. In summation, use of expenditure per capita will underestimate the service level.

Some definition problems have also been noticed in most of the reviewed studies. Most of the studies have used the 'effective tax rate' as a tax variable. The problem with this is that the dependent variable itself gets used as denominator of one of the independent variable (Effective tax = Total tax/Assessed value where assessed value to a certain extent is based on market price). It is expected to create two problems. First of all, it will pick the effect of the missing variables¹³ and in that case the coefficient of the effective tax rate will be biased. Secondly, a negative bias will be introduced in the estimated coefficient because holding the tax constant, any increase in property value will reduce the effective tax and an implicit negative relationship will be built in. In such a situation, even if there is no correlation between the property value and the property tax, a negative coefficient showing the existence of negative capitalization will be obtained. King's study [32] showed that replacement of effective tax rate by the total tax in the Oates' [40, 41] model reduced the extent of -----

¹³ Which is expected to show up as higher R-square.

negative tax capitalization by 40%. An attempt was made by Wales and Weins to correct this bias, but the method was not very effective because if effective tax rate is used, their approach could only test whether there was tax capitalization or not but it could not separate the magnitude of capitalization.

It could also be argued that it is not the effective tax rate which is negatively biased, but it is the tax variable which suffers from a positive bias because it is a product of effective tax rate and value of property. But this is not true. If in certain sample, the effective tax rate is lower on high valued land and higher on low valued land, a regression of price against effective tax rate will give a negative coefficient. But such an analysis is not justified. Take the case of two communities with land values \$200/acre and \$250 per acre. The effective tax rate in the first community is tax per 5 ($1000/200$) acres of land and it is tax per 4 ($1000/250$) acres in the second community. If one regresses price measured in homogenous units (per acre basis) against the effective tax rate measured in non-homogenous units (per 'x' acre units where x is a variable that is inversely related with the land price per acre), the effective tax rate will over estimate the level of negative tax capitalization. This type of analysis will be justified if one is considering same parcel of land with different effective tax rates over time. It will also be justified if one ad-

justs dependent variable according to the variable units used to measure the effective tax rate or alternatively, the effective tax rate must be multiplied by the value of land to remove its negative bias, and this gives the tax per acre.

This problem of bias in effective tax rate could also be discussed econometrically. Suppose there is no correlation between price and effective tax rate. Also assume that communities have same target level of revenue to be collected from the property tax. In such a situation the municipalities that have above average land values will have below average effective tax rate. In municipalities where land values are below average, the effective tax rates will be above average. A regression of price against effective tax rate ideally should not show any relationship. But by nature of effective tax rate, the error term in municipalities with land of above average value will be below zero whereas it will be above zero in municipalities where the land values are above average. The least square method of estimation will attempt to minimize the sum of square of these errors and a negative relation will be obtained.

3.1.2.2 The Theory

Unless the model is based on the economic theory, the results of the analysis could not be taken as sound. Such problem seems to exist in the study by Jose [31]. He at-

tempted to check the effect of property tax on the income of the farmer but did not specify any theory or reason underlying the belief that there will be some direct effect of property tax on the income of the farmer. If it is assumed that present value of a property depends upon the income streams, then because of its positive correlation with property value can be used as its proxy. In such a situation, the income should be regressed on tax; while he regressed tax on income. Therefore, his study suffers from the problem of causality.

The problem of causality could be seen in most of other studies which attempt to estimate the level of capitalization. These studies overlook the possibilities that alternative explanations (see Table 7 and its discussion for alternative explanations) could be provided for the results that correspond with the capitalization hypothesis. In particular these studies do not consider the possibility that the value of land may reflect the wealth level and therefore may have some positive influence on the level of tax. This positive relationship of price with tax may not necessarily indicate the presence of assessment bias in the tax variable and there may not be any need to deflate it with price in order to remove this bias.

3.1.2.3 Data and Estimation

The dynamic aspect has not been considered very well in the capitalization studies. This may be because of inavailability of the suitable data.

A number of studies have used OLS while there is need to remove the simultaneous equation bias. An example could be the use of the tax and the expenditure variables in the same equation. The two may be inter dependent as a major portion of expenditure is determined by the amount of tax collected and vice versa (taxes are raised to meet the predetermined expenditures). A number of studies including Oates [40] and [41] have done so.

3.1.2.4 Results and Conclusion

All the previous studies are summarized in the Table 6

Some of the studies do not support capitalization of property tax while the others do. There could be a number of reasons for this diversity in the results. Results may vary because of use of different methods of estimation or different data sets, or it could be because of some error and omission like the incomplete or omitted variables, incorrectly specified model or improperly measured variables etc. It could also be possible that the chosen data came from such a region which did not satisfy the assumptions of the model. It also could be that in some areas unique features prevent capitalization.

TABLE 6			
Property tax capitalization studies			
Reference	Farm/ Non-Farm	Conclu- sion	Tax variable
Jensen [30]	F	C	N.A.
Woodard and Brady [64]	F	C	ET
Pasour [45]	F	C	ET
Schuh [51]	F	C	n.a.
Jose [31]	F	C	T
Diacoff [17]	NF	NC	N.A.
Moody [38]	N	C	n.a.
Orr [42],[43] and [44]	NF	C	ET
Oates [40] and [41]	NF	C	ET
Pollakowski [47]	NF	NC	n.a.
Edel and Sclar [18]	NF	C	ET
Hyman & Pasour [27] [28]	NF	NC	ET
Gustely [23]	NF	C	n.a.
Wicks, Little & Beck [62]	F/NF	C	T
Smith [55]	NF	C	T
King [32]	NF	C	T
Wales & Wiens [60]	NF	NC	ET
Church [12]	NF	C	n.a.
Black [6]	NF	C	ET
H and O [24] & [25]	NF	C	ET
M and C [37]	NF	NC	ET

Where,
 F = farmland study,
 NF = non-farm study,
 C = capitalized,
 NC = not capitalized,
 T = tax,
 ET = effective tax rate,
 N.A. = not applicable,
 n.a. = not available,

Note: Summary of some of the studies is taken from Bird [4].

What ever the case may be, it could be concluded that due

to the conflicting results, the question of tax capitalization requires further investigation.

3.2 CAPITALIZATION HYPOTHESIS

This section attempts to combine the findings of literature review with the theory of capitalization. As has been discussed in the chapter 2, capitalization of property tax could be expected in land values from the Old View because it assumes that the supply of land is inelastic. From the New View, capitalization could be expected because of excise effect. The capitalization could be expected from the Tiebout hypothesis, if his assumptions that a large number of tax-expenditure packages exist and people shop around for the best choice. In order to perform a study of capitalization of farmland property tax, a careful examination of above theories with a specific reference to their applicability to the farmland is required. This will be done below.

3.3 THE OLD VIEW

The capitalization model based on the 'Old View' could be developed if the supply of farmland is perfectly or nearly inelastic. But new crop land could be added and the supply could also be altered [46]. Agricultural productive supply can be expanded in a number of ways. It can be expanded through increased spending on drainage, irrigation, leveling

of uneven land, conversion of forests into the farmland, reclamation of saline, alkaline or acidic soils. Intensity of cropping is also an important factor. By adopting more intensive cultivation, by extensive use of fertilizer and pesticides and by using the high yielding varieties, more production could be obtained from the same parcel of land. More green houses could be built where the cultivation could continue throughout the year.

3.4 THE NEW VIEW

Even though, the possibility of capitalization exists from the New View (from the excise effect), testing of it is not easy because it requires considerable data and a complex model. First of all, it will require the estimation of the effect of property tax on saving rates and then the effect of saving rates on capital formation. The capital stock may change because the supply of investment will change due to change in rate of saving and demand of capital will change due to change in rate of return on capital. Estimation of effect of change in property tax on saving rates will be complicated in presence of macro-policies directed to correct demand deficits. Secondly, due to property tax on land, there will be out mobility of investment from agriculture sector. This will depress returns in whole capital market. Estimation of such effect will require data on all of the capital market. Furthermore, in all this process of capital-

ization, longer lags might be involved and this will further complicate the situation by demanding a long period data. Even if a suitable data set could be obtained, such a study is out of scope of present thesis due to time and labour demands. Therefore, it will not be attempted to test the capitalization hypothesis with the New View. Furthermore, the theories of incidence of property tax are not complete as they neglect the expenditure aspect. It is also important to note the New View is not suitable for analysis of public goods. In presence of distortions in the market primarily due to free rider problem in the case of public goods, market may fail. Any theory based upon price signals will not be sufficient for such an analysis.

3.5 THE TIEBOUT HYPOTHESIS

This hypothesis considers both taxes and expenditures, and is not as complex as the New View. This hypothesis has some applicability in urban areas where a number of localities with differing tax and expenditure packages are present. It assumes all the incomes are obtained from dividends. In large urban areas where there are a number of communities with different tax expenditure packages, individuals can move from one to another without facing significant change in their incomes. One could continue with the same job after moving.¹⁴

¹⁴ Some effect on income is possible due to change in the transportation costs.

For farmland, the situation might be quite different. A farmer has to choose between living in the community near the land or in a community farther from farm but possessing the desired tax and service package. This option obviously involves the cost and inconvenience of travel to the farm. Or alternatively, he could sell the land and buy another parcel near the community of his choice. A farmer could not live far away from the farm.¹⁵ The reason could be the less developed rural transport system. In rural areas, the transport system suits the needs of moving farm products, while in the urban areas, one major function of the transport system is the transportation of passengers.

In the urban areas, there exists inter-community bus transit, taxi-cabs, trams and subways. They often are subsidized to encourage the use of the bus to reduce traffic congestion in the city. This facility is also quite useful for the low income people who can not afford to have their own car. In absence of bus service, they work on jobs which are located near their places of residence. With a good transit system, these people have broader choices among the workplace and residence.

This kind of the transport system is not available in the rural areas. The geographic boundaries within which a farmer is mobile are greatly restricted. The number of the -----

¹⁵ An exception to this is absentee ownership which is very small. Usually absentee owners are not potential farmers and invest in farmland for the purposes like hedge against inflation or to save taxes on their incomes.

communities is also smaller. Choices of different tax and expenditure packages are also limited in rural areas. Besides this there is not always the option of buying land in a lower tax area or even leasing it.

A farmer growing crops in certain community may not plan to live in the community of his choice without suffering income loss (The Tiebout Hypothesis assumes that income is not location specific). His income could be affected due to a number of reasons:

1. Time which could be spent farming or on leisure will now be lost in going to and coming back from the farmland.
2. Cost of travel to and from the farm may be fairly high because of longer distances and higher vehicle maintenance costs because of rural roads.
3. Taxes may also rise as he, along with others with similar interests may demand a better maintained road network.

Similar situation could exist in small urban and metropolitan areas. The individual's place of residence is influenced by the location of the work-place; therefore, they are location specific. The choice among communities may be limited due to travel costs involved. In rural, metropolitan or small urban areas, individual's ability to express satisfaction with public sector or even to realize the range of alternatives available, is constrained. This lowers the lik-

likelihood that differentials in the quality of service will be reflected in the property values [37]. This suggests the possibility of capitalization is low in the case of the farmland.

3.5.0.5 Alternate Hypothesis for Farmland

The capitalization hypothesis suggests the value of land is negatively related to the taxes and positively related to the expenditures. Actually this relationship is not that simple. The expenditure may also be affected by the the value of farm land. If the price of farmland is relatively high in a community then the community because of its wealth is expected to have a higher demand for local public services.

The local public services required by farm businesses are basically related to the production of crops and the livestock. Transportation is the most important service of this type. Other services will also have some influence. For example, a prosperous community may like to spend more on the services like water and sewage, fire and police protection, recreation and education. These services will be demanded and supplied because for farm production, labour is essential. Labour will be attracted towards the places where these services are ample.¹⁶

¹⁶ Like in far North, the level of services is low. So fewer people prefer to work there. In order to send the labour to a place where the level of services is low, some extra benefits like higher wages or extra allowances are paid.

The value of farmland may be higher in a region if it has high agricultural productivity. In order to ship its produce to the market, the community will demand more transportation services per unit of land. The production per unit of land (an acre or hectare) will be higher. The roads will be used more than the community that has land of lower productivity. Greater expenditure will be required to maintain the roads as due to higher use.

Certain farming communities of Canada also have primary industries like coal-mines, potash mines, oil refineries and secondary industries such as distilleries, food processing factories. These communities will use relatively more of the transport facility but they may require a differently developed transport system.

Furthermore, in the communities where farm operation is larger, demand for labour may also be relatively higher. With increase in population base, the demand for services like water and sewage, police protection, fire protection and health care will expand.

The value of the land could be higher due to recreation activities. Cottages tend to raise the demand and therefore value (price) of the land. In order to attract the tourists, there will be need to develop a good road network. The maintenance of these roads will require extra expenditures.

Usually, the lands with recreation facilities or which produce the non farm products tend to have higher values.

Therefore, in general, it could be ascertained that the service level¹⁷ is influenced by the value of the land.

Now, in a situation where possibility of capitalization is low or does not exist, the value of the land may effect the expenditure level in the community. A rural community containing more agricultural land may be willing to pay more taxes for public services than the neighbouring community endowed with less productive agricultural land. What would happen in such a case if price is regressed as dependent variable against expenditure and tax along with other independent variables affecting the price? This question will be dealt in the following section.

3.5.0.6 Expected Relationships

First of all, assume a hypothesis relating the value of land to taxes, the mill rate and expenditures has not been developed. Also assume the populations in the serviced and the taxed regions are similar. Now if the relationships shown

¹⁷ Usually municipal expenditure is used as a proxy to the level of service in the community. This measure may be biased. Expenditure required to produce the same service in the two communities could be different. It may depend upon the characteristics of the community and the type of the service which is to be provided. For example, provision of health care may require higher expenditure in a community far north than the community which is near southern border of Canada. Northern community will require more expenditure because in order to attract the doctors and other related staff, they may have to pay more allowances. Another problem with use of expenditure is that it does not differentiate among the services provided at the same cost. Health care for \$X may not give same utility to the residents of the community as is given by the educational service of the same amount.

in equations 3.1 and 3.2 are estimated from a population of different local governmental regions.

$$\text{Price} = f(\text{Exp.}, \text{Tax and Other variables}) \quad \dots (3.1)$$

$$\text{Price} = f(\text{Exp.}, \text{Eff. Tax rate and other variables}) \quad \dots (3.2)$$

Then thirteen possible relationships could be hypothesized. Table 7 summerizes the expected signs of the estimated regression coefficients under different combinations of increasing land prices occuring with either larger, smaller or constant tax, expenditure and transfer payments. For example, Case 1 indicates expenditures are larger in municipality A, taxes smaller and transfer payments much greater than the revenues received by B. The estimated regression coefficients of the tax and effective tax variables will be negative and the expenditure will be positive. This relationship is expected from Tiebout-Oates model of capitalization. Further discussion follows:

Case 1 and Case 2

After estimating the above mentioned equations if the results match with case 1 of Table 7, then one could say that results support Tiebout model. But, this may not always be true. Another possibility is that with an increase in the value of land, the nature of demand for services changes. More explicitly, communities with higher valued land may have greater demand for public services which are funded through greater transfer payments from provincial govern-

TABLE 7

Price, Municipal expenditure Tax and Effective tax relationships

Case	Exp.	Tax	T.P.	Exp. Co-eff.	Tax Co-eff.	ET Co-eff.
1.	I	D	I L	+	-	-
2.	I	K	I	+	n	-
3.	I	I	K	+	+	?
4.	I L	I	I	+	+	?
5.	I	I L	D	+	+	?
6.	K	I	D	n	+	?
7.	K	K	K	n	n	-
8.	K	D	I	n	-	-
9.	D	D L	I	-	-	-
10.	D	K	D	-	n	-
11.	D	D	K	-	-	-
12.	D L	D	D	-	-	-
13.	D	I	D L	-	+	?

Where,

Exp. = municipal expenditures,

T.P. = provincial transfer payments,

K = constant,

I = increase,

I L = increases more than change in the
other two variables

D = decrease,

D L = decreases more than change in the
other two variables

+

= positive,

- = negative

n = no correlation,

? = +, - or n.

ET = effective tax rate,

Co-eff. = Coefficient.

ment. This raises the possibility that total taxes in the

community may fall while total expenditures may increase. For example, if education services receive 50:50 matching grants and the community spends \$1 on education then provincial government contributes a \$1. Now, suppose in a region with high valued land, the demand for education is higher by \$1 than in the areas with low valued land. This means that the community's tax level will increase by \$0.5 as the remainder will be contributed by the province. A positive coefficient will be obtained if price is regressed against the expenditure. At the same time, if the demand for services not funded through transfer payments falls by \$1 then tax will fall by \$1. Overall decrease in the tax will be \$0.5 ($\$1 - \0.5). Therefore, tax coefficient will be negative. A positive coefficient of expenditure and a negative coefficient of tax seems to support the Tiebout-Oates model. In this situation, a result compatible with the Tiebout hypothesis does not actually confirm the hypothesis.

A question arises why the demand for education will be greater in communities which have high valued land than the communities which have low valued land. One of the possible reason could be that after fulfilling the demand for services which are not given transfer payments, communities with high valued land (HVL) are left with more funds than communities with low valued land (LVL). HVL communities may use a part to increase education services and rest to reduce the property tax. In this case the expenditures will be rising

and tax rate will be falling when comparing municipalities with lower valued lands to the higher valued lands.

The value of land could be lower because of inherent productive characteristics. The lower wealth will limit local communities from increasing taxes above certain level. Lesser funds will be left with the communities after provision of police, fire and road maintenance services. These services are not usually given higher provincial transfer payments. Therefore, these communities will be able to spend relatively less funds on the services which are given transfer payments. Their total expenditures will be lower than the communities which have higher valued real estate. Expenditure will be greater in HVL communities because of receipt of higher transfers. A positive regression coefficient of expenditure could be obtained in the price equation. The sign of the tax coefficient will be negative if HVL municipalities use some of their extra funds on provision of services which receive transfers and rest on the reduction of taxes. If taxes are not reduced then the coefficient will be insignificant as in case 2 of Table 7. If along with HVLs, taxes and expenditures both rise, then a positive coefficient for the two will be obtained. Therefore, any occurrence from 1 to 5 of Table 7 is possible. Case 6 to 13 are not expected if we assume that with increase in value of land, the level of services in community increases too.

Case 3:

If in HVL municipalities the, demand for services which do not receive transfer payments, is higher than municipalities with LVL, then almost the whole of the difference in demand will be funded through the higher taxes on municipalities with land of higher value. In this case, both taxes and expenditures will be higher in the municipalities with HVL, and a positive regression coefficient will be obtained for the two. Results will tally with case 3 of Table 7

Case 4 - Case 5:

If the demand for services receiving matching grants is high in the HVL communities, then results will correspond with the case 4. Results of the type of case 5 will be obtained if demand for services in high valued land communities is higher in absolute terms and therefore, the expenditure is also higher, but the provincial government has a policy of providing lower transfers to the more prosperous municipalities.

Effective Tax Rate:

Last column of the Table 7 shows the possible signs of effective tax rate coefficient. A negative sign in Case 1 and 2 is expected but for cases 3 through 5, the sign can not be known a priori. The occurrence of case 2 and case 3 is most likely. Sign of coefficient of ET will be positive if land prices between municipalities increase at a rate slower than the tax, it will be negative if the price increases at a rate faster than the increase in tax. A zero or insignifi-

cant coefficient will be obtained if both price and tax increase at the same rate.

From a previous discussion it was concluded the chances of inter-municipality mobility are low as incomes of the farmers are location specific, the transportation system is less developed and there are fewer choices among tax-expenditure packages in the mobility horizon. An alternative hypothesis developed in this study suggests the value of land reflects the demand for services and will be one of the determinants of the expenditure level in the community. Results of price regressed against expenditure and tax along with other relevant variables will match with case 1 to case 5 of the table 7. In the case of farmland, even if the results are similar to case 1, Tiebout hypothesis will not necessarily be supported because the assumptions on which the model is based are not satisfied for farmland. Even if supporting results are obtained on farmland, a number of alternative explanations which are different from the Tiebout model are possible. One of the reasons for the negative sign for tax variable is use of effective tax rate. Tiebout type results could be obtained due to the difference in the nature of demand in the municipalities of different land values.

Chapter IV

MODEL SPECIFICATION AND DATA

A complete model is shown in Figure 3. This figure shows that municipal revenues consist of property taxes and transfer payments. The farmland property taxes and the transfer payments in a municipality are affected by the assessed value of non-agricultural land, transportation services, population and the price of farmland. The price of land in a municipality is affected by soil productivity, credit availability, managerial capability, government and absentee ownership, the location of land. All the above relationships are depicted by strong arrows. Even though it has been argued in the previous chapters that there is little possibility of capitalization of property tax and service level into the price of land, yet the possibility of a weak relationship (depicted by dotted arrows) should not be neglected.

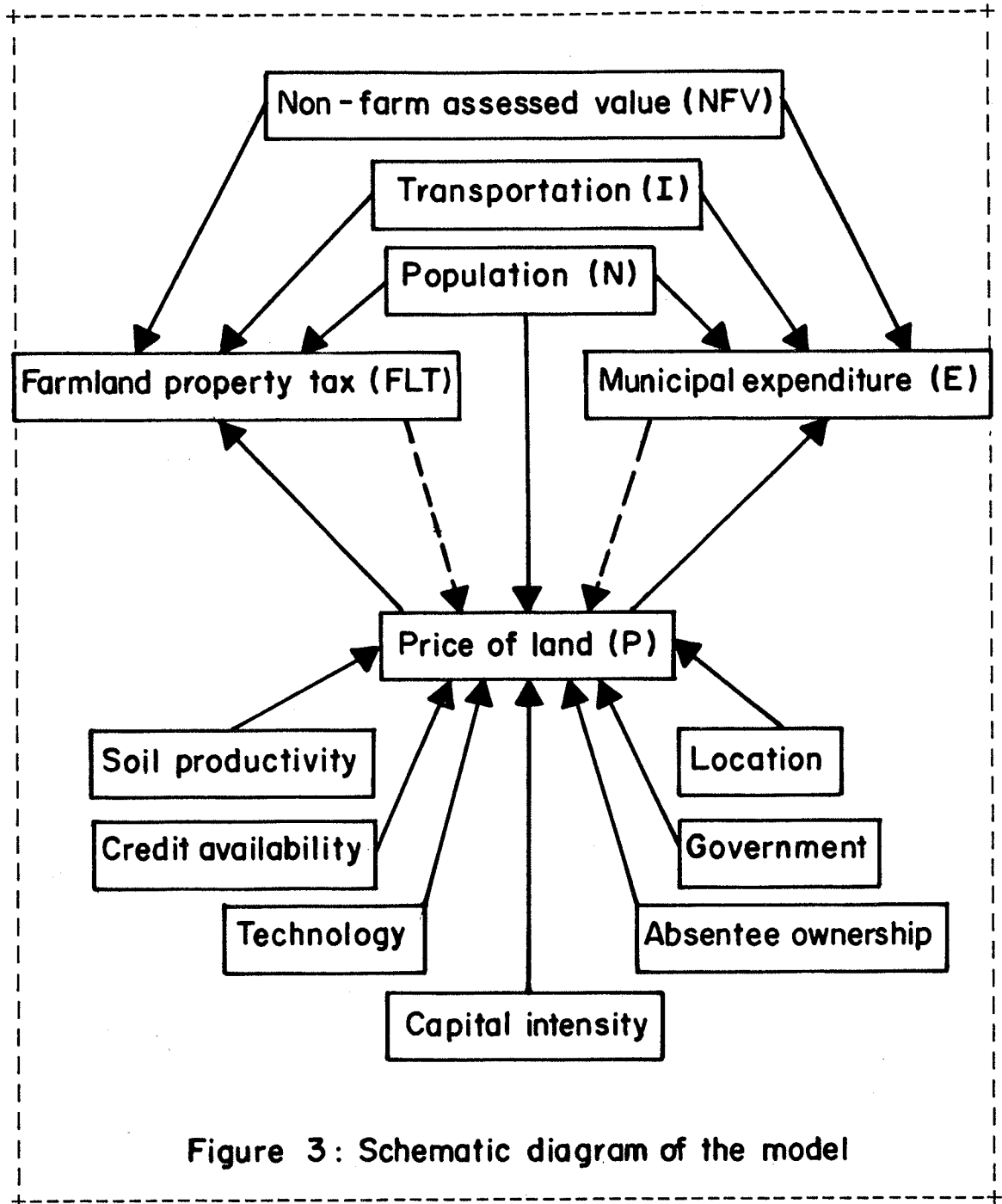
The model shown in Figure 3 could be expressed as:

$$FLT = f(NFV, I, N, P) \quad \dots(4.1)$$

$$E = f(NFV, I, N, P) \quad \dots(4.2)$$

$$P = f(E, FLT, N, \text{Other exogenous variables}) \quad \dots(4.3)$$

This system has 3 equations and 13 variables. Equation 4.1 shows farmland tax (FLT) and equation 4.2 shows Expenditure



(E) as function of non-farmland value (NFV), Improved land as proxy for transportation (I), population (N) and price of farmland (P). Equation 4.3 shows price as function of ex-

penditures, farmland taxes and other exogenous variables shown in Figure 3.

It was mentioned that on farmland people may not 'vote with their feet', therefore taxes and expenditures will not have any effect on price and could be dropped from the price equation 4.3. Price becomes exogenous to equations 4.1 and 4.2. All equations could be estimated without simultaneously estimating the other equations.

In the present study, the equations 4.1, 4.2 and 4.3 (without tax or expenditure variables) have been specified. The equation 4.3 with tax per acre has been specified to show that capitalization of property taxes into lower farmland values does not exist. If elasticity of price with respect to tax exceeds 1, then it will be concluded that a possibility of negative tax capitalization exists. A price equation with effective tax rate will be estimated to show that effective tax rate is a biased variable and can give a negative coefficient even if there is no tax capitalization.

The built-in negative bias in the effective tax rate could be demonstrated as follows:

$$\text{Tax/acre} = (\text{Effective tax})(\text{Assessed value/acre})/1000,$$

$$\text{or Effective tax} = (\text{Tax/acre})1000/(\text{Assessed value/acre}).$$

It could be seen that effective tax rate is derived by weighting the tax per acre by $1000/\text{assessed value}$. This weight is same as $1000/k(\text{price/acre})$, where 'k' is $(\text{Assessed value})/(\text{Price/acre})$ ratio. This weighting is inversely related to the price per acre. As a result of this a negative tax coefficient could be obtained even if there is no possibility of capitalization.

As discussed in Chapter 3, this negative bias could also be explained from the econometric point of view. The error term will be distributed in such a way that for above average land values it will be negative and for below average land values it will be positive. The ordinary least square method of estimation will give a negative relationship even in the case when there is no tax capitalization.

It was mentioned above that inclusion of tax/acre in the price equation will reduce the magnitudes of other coefficients. The effective tax rate will tend to reverse this bias. The reason is that effective tax rate is derived by weighting the tax per acre by a factor that is inversely related to the price per acre.

ECONOMETRIC MODEL:

The details of the econometric model, variables, expected signs and data are discussed below:

4.1 FARMLAND TAX EQUATIONS

Following farmland tax equation has been specified:

$$FLT = A^0 + A^1 W + A^2 PI + A^3 N + A^4 NFV + e^1 \dots (4.5)$$

4.1.1 Definition of the Variables

FLT = Total taxes collected from farmland (\$)

W = Total value of farmland in the municipality (\$)

PI = Total farmland improved for agricultural
crop production (acres)

NFV = Total assessed value of non-farm real estate in
the municipality (\$)

N = Number of residents living in a municipality

$A^1 - A^4$ = Coefficients to be estimated

e^1 = Error term

4.1.2 Description of the variables

Signs of various coefficients of independent variables are hypothesized below:

Value of Farmland: It is an indicator of the wealth of the rural community. Higher levels of wealth should be linked directly to the willingness to pay for the public services.

Improved: As the level of land improvement increases, more taxes should be required to expand the road network. This variable is a proxy for transportation services.

Population: Increase in the population is expected to have relationship with the demand for services. This increased demand could be wholly or partially funded through the increase in the taxes collected from the farmland. Therefore a positive sign is expected.

Non-Farmland value: As the non-farmland realestate tax base increases, the farmland taxes are expected to fall. This assumes non-agricultural industry requires an increase in services but contributes proportionately more revenues to the government than the added expenditures.

4.2 EXPENDITURE EQUATIONS

The following expenditure equation was specified:

$$E = B^0 + B^1 W + B^2 PI + B^3 N + B^4 NFV + e^2 \dots(4.6)$$

where the variables W, TI, N and NFV are defined previously. The dependent variable expenditures (E) equalled the municipal expenditure for services (\$). The expected sign showing the relationship between the independent variables and total municipal expenditure are: (+) - total farmland value, (+) - improved land, (+) - population and (+) - non farm capital.

4.3 PRICE EQUATIONS

In order to test the above hypothesis, separate price equations with effective tax rate and tax per acre were specified.¹⁸ These are:

$$P = C^0 + C^2 S^1 + C^3 S^2 + C^4 S^3 + C^5 S^4 \\ C^6 D + C^7 B + C^8 PD + C^9 FS + C^{10} FC + \\ C^{11} PF + C^{12} GF + e^3 \quad \dots \quad (4.7)$$

$$P = D^0 + D^1 FLT + D^2 S^1 + D^3 S^2 + D^4 S^3 + D^5 S^4 \\ D^6 D + D^7 B + D^8 PD + D^9 FS + D^{10} FC + \\ D^{11} PF + D^{12} GF + e^4 \quad \dots \quad (4.8)$$

$$P = E^0 + E^1 ET + E^2 S^1 + E^3 S^2 + E^4 S^3 + E^5 S^4 \\ E^6 D + E^7 B + E^8 PD + E^9 FS + E^{10} FC + \\ E^{11} PF + E^{12} GF + e^5 \quad \dots \quad (4.9)$$

4.3.1 Definition of the Variables

P = The average price of farmland and farm buildings per acre for a municipality (\$/acre).

$S^1 - S^4$ = The share of farmland in Canada land inventory Class I, II, III, IV (%) with each municipality.

D = Distance of major center from the municipality in (miles)

B = The assessed value of farm buildings per acre

¹⁸ See Appendix B for discussion on theory.

in 1971 (\$/acre)

PD = Population on farm or in unincorporated towns and villages per acre

FS = The percentage of farms below median farm size in a municipality (%)

PF = Percentage of land owned by absentee investors in the municipality (%)

GF = Percentage of land owned by Manitoba Agricultural Credit Corporation or the Saskatchewan Land Commission in 1976 (%)

fLT = Municipal Farmland tax per acre of land (\$/acre)

ET = Effective tax rate per thousand dollars of assessed value (\$/acre)

FC = Expenditures on fertilizer and pesticides (\$/acre)

$C^0 - C^{12}$, $D^0 - D^{12}$ and $E^0 - E^{12}$ = Regression co-effs.
 e^3 , e^4 and e^5 = Stochastic variables.

4.3.2 Description of the variables

The model described in equations 4.7 to 4.9 was developed by Magnuson [35]. Signs of various coefficients of independent variables are hypothesized below:

Tax: It is assumed to be correlated with price. The taxes reflect that portion of services which are funded through the property tax. The municipality with higher priced land may have a tendency to spend more on public services. Therefore a positive relationship is anticipated.

Effective Tax Rate: It has been assumed to be correlated with price. As discussed earlier, this variable is expected to suffer from a built in negative bias. Therefore a negative sign is hypothesized.

Soil Productivity: It is a factor that reflects the agricultural quality of land. A positive coefficient is expected as land with greater production capacity will have relatively higher value and therefore price.

Distance: Distance to the major centre is expected to show a negative correlation with the price of land. The variable is assumed to reflect the possibility of its conversion into urban land. Distance has been constrained up to about 50 miles range from major centre, namely Winnipeg in Manitoba, Saskatoon and Regina in Saskatchewan, and Edmonton and Calgary in Alberta.

It is also important to point out that the distance is an abstract variable. Purpose is not to estimate the effect of distance, but it is to estimate the ease of access to the major urban communities.

In this study, distance means $1/D$. Use of $1/D$ makes it non-linear. It was assumed that the effect of city decreases at decreasing rate as the distance from city increases.

Population Density: It has been included to reflect the potential residential demand for land. Greater population per

acre implies greater potential demand for land which would raise the price. A positive coefficient is expected.

Farm-Size: This variable reflects the borrowing capacity of farms within a municipality. A farm with more land has greater borrowing capacity as it provides more equity which could be pledged as collateral. In order to capture this effect, the percent of farms in a municipality below provincial median¹⁹ have been included in the study. A negative coefficient is expected.

Assessed Value of Buildings: It is included in the equation to account for the differential real estate prices between municipalities because more dairy cows, hogs and poultry require a higher investment in buildings.

Non-Residents: Under some circumstances non-residents are willing to pay higher prices than local residents [35]. The coefficient of this variable could be either positive or negative. It will be positive if foreigners buy the land at higher prices as demand is expected to increase by their participation. Coefficient could be negative if there are not enough buyers and foreign residents are attempting to dispose of the property.

¹⁹ The median value has been used because the distribution of the farms is skewed towards the small farms and the use of mean will over estimate the borrowing capacity of farmers.

The Fertilizers and Pesticides: It is assumed to reflect the influence of agricultural technology upon land prices. A positive coefficient is expected in this case as well.

Government Ownership: Purpose of the government ownership was to make the farm land available to the farmers to rent. Effect of this will be to increase the demand for land as people with low borrowing capabilities can also rent the land. Supply of land for sale will fall as government holds land to rent and not to sell. A positive relationship is hypothesized.

4.4 DATA

Annual cross-sectional data for farmland price were taken from the 1971 and 1976 Agricultural Census of Canada for the provinces of Manitoba, Saskatchewan and Alberta. Value of land and buildings is based on the average of estimates of each farm enumerated. It may be a biased estimate of the actual value. In real sense, it is the price that farmers expect for their land and therefore is an expected supply price of land determined independent of the demand forces. Market price is a better measure if sufficient sales occur. At the aggregate level basically this price shall be good proxy for market price as some farmers may have higher expectations while others may have lower. Chances of bias in the use of this measure do still exist if low and high expectations do not balance out. If expectations are based

upon past prices, then this data will underestimate the values of land and buildings as prices are rising over time due to inflation and the estimated coefficient will be of higher magnitude. Results will be biased if some municipalities underestimate the price while others do not or others overestimate it.²⁰

Data for tax revenue, assessed value of farm and non-farmland and buildings, total municipal expenditures, transfer payments and assessed acreage were derived from the annual reports prepared by the provincial Departments of Municipal Affairs [66], [72] and [73].

Effective tax used in the regression was directly available in the published form. Non-farm assessed value is the difference between total municipality assessed value minus assessed value of the agricultural land.

Four soil productivity variables are taken from a Canada Land Inventory tape which classifies all agricultural land into seven classes. Only the first four (out of 7) classes have been used as the rest are not suitable for crop production [35]. Out of chosen four classes, class 1 has no significant limitation for crop production, class 2 has moderate limitation, class 3 has moderately severe limitation while class 4 has severe limitations. Percent of land in the different classes in a municipality was derived by a computer.

²⁰ Available data also did not allow for the separation of the value of the buildings from the price of the land.

er program.²¹

Distance variable was determined by taking the linear distance of municipalities from the city on the map and then converted into miles according to the scale of the map.

Data for the value of buildings was derived by Magnuson [35].

The population density in 1971 and 1976 was total population of municipality divided by the area of the municipality in square miles.

Farm-size data is taken from the Agricultural Census of Canada for 1976. Same data was used for both the years as there has not been any major structural changes during these years.

Fertilizer plus Pesticide expenditures (FC) were derived from 1971 Agricultural Census of Canada. Same data was used for 1976 as well, as similar data was not available in 1976 Census. Results could be biased if any significant relative change has occurred between municipalities in these five years.

Percent foreign for Manitoba was derived by Magnuson [35].

Improved acres were taken from the Agricultural Census of Canada for 1971 and 1976.

²¹ Written by Raymond Chu.

Two different sets of models were estimated using 1971 and 1976 cross section data.

Chapter V

RESULTS

In this chapter, the results of the estimated equations are presented and discussed. First of all, a discussion on tax equations is performed, which is followed by the discussion on the expenditure equations. After comparing the two results, a discussion on the price equations without the tax variable, then with tax per acre and effective tax rate is performed. The main purpose of discussing the tax and the expenditure equations is to show the effect of municipal farmland value on demand for and level of services. The results of price equations without tax or effective tax variable have been included to show the actual relationship. The results of the price equations with tax per acre have been presented to show that negative capitalization of property tax does not appear to exist. The results of price equations with effective tax rate are presented to indicate the effective tax rate is a negatively biased variable and can lead to a conclusion that capitalization exists.

5.1 MUNICIPAL LAND TAX

In this section, a discussion of the results using statistics on municipal basis has been performed. The coefficients of value of farmland (municipal farmland value), value of non-agricultural property, population and improved land have been summarized in Tables 8 and 9. A more complete results could be seen in Tables 25 to 30 of Appendix²²C.

5.1.1 Statistical properties

After performing a t-test, it was found that all the variables but value of farmland in Manitoba in 1971, the value of non-farm real estate in Manitoba and Alberta in 1976 and population in Saskatchewan in both the years are significant at least at 5% level. All the equations are significant at least at 1% level through F-test with R-square varying between a low of 0.72 in Manitoba in 1971 and a high of 0.87 in Alberta in 1971.

In this study, the partial correlation coefficient above 0.7 was taken as an indicator of multicollinearity. It was observed that partial correlation coefficients between value of non-farmland and population in Manitoba and Alberta 1976 equations, and between farmland value improved acres in Saskatchewan in 1976 and in Alberta 1971 equations were above 0.7. An attempt to drop any one of these variables had an -----

²² These results are estimated using 106 observations in Manitoba, 291 observations in Saskatchewan and 54 observations in Alberta.

effect on R-square and coefficients of the other variables. In order to avoid omitted variable bias, none of these variables could be dropped.²³

5.1.2 Absolute statistical relationship

The partial regression estimates reported in Table 8 show in the municipalities with farmland assets increased by \$1000, the taxes collected from farmland were higher by \$3 in Manitoba in 1976 and in Saskatchewan in 1971 and 1976; and by \$5 in Alberta in 1971 falling to \$2 in 1976. Over the five year period, there is no effect on farmland taxes collected due to a change in the level of value of farmland in Saskatchewan. On the other hand, there is an increase of 50% in Manitoba and a drop of 60% in Alberta.

Wealth of a municipality could be higher because of two reasons: either the municipality has a larger farmland area and/or the average value of the farmland real estate is higher. In the first case, taxes would be higher because larger municipalities require more expenditures on services. In the second case, the taxes would be higher because a prosperous municipality demands higher level of services. The aggregate value of farmland variable does not actually

²³ A variable which does not improve R-square and does not affect the values of other coefficients to a considerable extent is superfluous and could be dropped. But a variable whose inclusion affects other coefficients and/or value of R-square should not be dropped unless its sign is unanticipated [33, P 231].

TABLE 8
Estimated total farmland tax equations (Model 1)

Variable	Unit	1971			1976		
		Manitoba	Sask.	Alberta	Manitoba	Sask.	Alberta
Wealth	\$	ns 0.002	** 0.003	** 0.005	** 0.003	** 0.003	** 0.002
Non-farm		**	**	**	ns	**	ns
Value	\$	-0.019	-0.006	-0.009	-0.007	-0.016	-0.004
Populatn	Ind.	** 38.881	ns 1.820	** 36.714	** 35.936	ns 1.535	** 31.118
Improved	Acre	** 1.392	** 0.791	** 0.627	** 2.651	** 1.018	** 0.733
Constant	\$	* -32756.000	** 15471.000	* -89509.000	* -55477.000	** 27282.000	ns -26240.000
R-square		** 0.719	** 0.737	** 0.870	** 0.819	** 0.725	** 0.867

ns = Non-significant
* = Significant at 5%
** = Significant at 1%
Ind. = Individual

seperate the two effects.

In the municipalities where the value of non-farm real estate is higher by \$1000 the property tax on the farmland in 1971 are lower in Manitoba by \$19, in Saskatchewan by \$6 and in Alberta by \$9. By 1976 non-farm real estate reduced taxes on farmland even further in Saskatchewan.

TABLE 9
Relative coefficients estimated for total farmland tax (Model 1)

Variable	Unit	1971			1976		
		Manitoba	Sask.	Alberta	Manitoba	Sask.	Alberta
Wealth	\$	ns	**	**	**	**	**
Non-farm		0.103	0.328	0.486	0.241	0.432	0.565
Value	\$	**	**	**	ns	**	**
		-0.164	-0.090	-0.289	-0.046	-0.198	-0.170
Populatn	Ind.	**	ns	**	**	ns	**
		0.370	0.013	0.434	0.207	0.007	0.392
Improved	Acre	**	**	**	**	**	**
		0.580	0.584	0.369	0.611	0.481	0.309

ns = Non-significant
 * = Significant at 5%
 ** = Significant at 1%
 Ind. = Individual

Again the value of non-farmland value could be higher either because the municipality has a larger proportion of land used for non-farm operations and/or because value of non-farmland is higher on per acre basis. In the first case, the taxes on non-farmland property would be lower because there will be lesser farmland in the municipality, while in the second case, there may or may not be any effect of taxes imposed on farmland. There will be no effect on the farm-land taxes, in the case when increase in the level of

services financed through taxes collected from non-farm property do not substitute for the service required by farmland. On the other hand, if some of the services funded through taxes collected from non-farm real estate substitute for some of the services required by the farmland, then it is possible taxes on farmland will decrease with increase in the assessed value of non-farm property.

Addition in the population of the municipality by one person led to higher taxes on farmland in municipalities of Manitoba by \$39 in 1971 falling to \$36 in 1976, and in Alberta by \$37 in 1971 falling to \$31 in 1976. The impact of population related demand on the taxes has fallen over the five year period by \$3 in Manitoba and \$6 in Alberta.

For every additional acre of improved land in a municipality, the municipal farmland taxes were higher by \$1.39 in Manitoba in 1971, \$0.79 in Saskatchewan and \$0.65 in Alberta. By 1976 these figures rose to \$2.65 in Manitoba, \$1.02 in Saskatchewan and \$0.73 in Alberta. Over the five year period, there is an increase of \$1.26 in Manitoba, 23 cents in Saskatchewan and 10 cents in Alberta. This shows that the effect on taxes from financing improved land is highest in Manitoba and lowest in Alberta. The rate of this cost increase is highest (91%) in Manitoba, lowest (16%) in Alberta, and Saskatchewan (29%) falls in the middle.

5.1.3 Relative importance

In order to show the relative importance of changes in the independent variables, the standard partial regression coefficients have been summarized in Table 9. In 1971, a one standard deviation increase in the value of farmland of the municipality raised total tax on farmland by 0.3 standard deviation in Saskatchewan. By 1976, a similar change raised the tax on the farmland by 0.4 standard deviation. A similar interpretation could be attached to rest of the variables. The magnitude of the standard coefficients indicates the relative ranking of these factors. With the exception of Alberta, the highest relative importance could be attached to total improved land. Wealth was the most important variable in Alberta and the second most important variable in the other provinces with exception of Manitoba in 1971. Except in Saskatchewan in 1976, population as third most important variable.

5.2 FARMLAND TAX PER ACRE

Discussion of this section is based on the results summarized in Tables 10, 11 and 12. These tables summarize the results of the farmland tax equations estimated on per acre basis (disaggregated model). Tables 31 to 36 of Appendix C provide detailed results along with correlation matrices.

5.2.1 Statistical properties

All the equations are significant at least at 1% level with independent variables explaining a minimum of 71% of variation in farmland tax per acre in Saskatchewan and a maximum of 89% of variation in Alberta 1976. Except for the equations of Alberta 1971 and Saskatchewan 1976, the R-square has increased in all other provinces above the estimates shown in Table 8. Among the variables that were insignificant in the aggregate (municipal) tax equations in Table 8, the value of farmland in Manitoba in 1971 and the non-farm real estate value in Manitoba in 1976 have become significant. At the same time, among the variables that were significant in the municipal tax equations, the non-farm value in Alberta in 1971 and in Manitoba in 1976, and population in Manitoba 1976 have become insignificant. A possible reason for change in levels of significance could be multicollinearity. The partial correlation coefficient between population and non-farm value is above 0.7. In the municipal tax equations, there was problem of multicollinearity between value of farmland and improved land.

5.2.2 Absolute statistical relationship

In 1971, a ten dollar difference in the average price of land between two municipalities showed the farmland tax per acre increased by 9 cents in Manitoba, 7 cents in Saskatchewan and 6 cents in Alberta. By 1976, a similar ten dollar

TABLE 10
Estimated per acre farmland tax equations (Model 2)

Variable	Unit	1971			1976		
		Manitoba	Sask.	Alberta	Manitoba	Sask.	Alberta
Price	\$	**	**	**	**	**	**
Non-farm		0.009	0.007	0.006	0.005	0.005	0.003
Value	\$	*	**	ns	**	**	ns
PopuDen	Ind.	-0.012	-0.005	-0.002	-0.017	-0.012	-0.007
Improved	Acre	**	ns	**	ns	ns	*
Constant	\$	0.042	0.010	0.022	-0.002	0.015	0.023
R-square		**	**	**	**	**	**
		1.357	0.764	0.796	2.850	1.070	0.785
		**	**	*	**	**	ns
		-0.545	-0.166	-0.216	-0.551	-0.195	-0.118
		**	**	**	**	**	**
		0.806	0.755	0.842	0.828	0.714	0.889

ns = Non-significant
 * = Significant at 5%
 ** = Significant at 1%
 Ind. = Individual

difference saw 5 cents in Manitoba and Saskatchewan and 3 cents in Alberta. Over the five year period, there has been a drop in this effect by 4 cents (44%) in Manitoba, 2 cents (28%) in Saskatchewan and 3 cents (50%) in Alberta.

As mentioned earlier, the effect of value of farmland due to the size of the municipality could not be seperated from

TABLE 11							
Relative coefficients estimated for per acre farmland tax (Model 2)							
Variable	Unit	1971			1976		
		Manitoba	Sask.	Alberta	Manitoba	Sask.	Alberta
Price	\$	** 0.391	** 0.468	** 0.616	** 0.386	** 0.484	** 0.623
Non-farm		*	**	ns	**	**	ns
Value	\$	-0.133	-0.090	-0.156	-0.179	-0.243	-0.043
PopuDen	Ind.	** 0.283	ns 0.041	** 0.365	ns -0.011	ns 0.042	* 0.373
Improved	Acre	** 0.464	** 0.464	* 0.309	** 0.562	** 0.420	** 0.180

ns = Non-significant
 * = Significant at 5%
 ** = Significant at 1%
 Ind. = Individual

the effect of value of farmland owing to higher value on per acre basis. Such a problem does not exist in present case, and price variable directly reflects the average wealth of a municipality in terms of farmland values.

The estimated coefficients of price per acre are generally larger than the value of farmland coefficients in tax equations. For a better comparison of the two, elasticity estimates at the mean have been summarized in Table 12. It could be seen the estimated elasticities are again larger in

TABLE 12
Elasticity estimates of tax model

Variable	Model	1971			1976		
		Man.	Sask.	Alta.	Man.	Sask.	Alta.
Wealth	1	ns	0.26	0.44	0.23	0.35	0.47
Price	2	0.56	0.55	0.54	0.41	0.55	0.57
Non-farm	1	-0.07	-0.02	-0.10	ns	-0.04	ns
Non-farm	2	-0.05	0.00	ns	-0.05	-0.03	ns
Populatn	1	0.36	ns	0.33	0.17	ns	0.22
PopuDen	2	0.24	ns	0.15	ns	ns	0.13
Improved	1	0.76	0.66	0.46	0.75	0.59	0.39
Improved	2	0.72	0.64	0.58	0.80	0.62	0.41

Model 1 = Aggregate or municipal model

Model 2 = Dissaggregate or per acre model

ns = Non-significant

the case of tax per acre equations. The elasticities for the aggregate model are composite estimates of the two factors as value of farmland of municipal farmland is a product of the average price and area in land. The percentage change in farm wealth measured by this variable is thus comparized of a change in area and average price. The elasticity estimates for the tax per acre specification account only for the difference in the average price of land between two municipalities. These latter estimates are very consistent among provinces and years. The elasticity estimates indicate that municipalities in Manitoba, Saskatchewan and Alberta pay

about half a percent increase in farmland taxes for a one percent increase in the price of farmland. This would indicate that the affluent municipalities are willing to accept higher taxes but the expenditures increasing only half the rate of the wealth. Public services financed by taxes would generally fall into the category of inferior goods. The aggregate wealth elasticity values are lower because taxes do not increase as much as growth in municipality's acreage. Wealth elasticities are probably under estimated by aggregate specification. It is also possible that there are economies of size.

If one moves to a municipality with non-farm real estate values higher by \$10 per acre, one finds taxes on farm real estate lower by \$.12 in Manitoba in 1971 and \$.05 in Saskatchewan in the same year. By 1976, there is an additional drop of 5 cents in Manitoba and 7 cents in Saskatchewan.

In aggregate tax model, non-farm variable reflected a combined effect constituted by two factors: effect due to larger area occupied by non-agricultural uses and the effect due to greater value of non-farmland on per acre basis. This problem continues to exist in the present model as well. An important difference between the two cases is: in aggregate estimation, the size of the municipality is not held constant while varying the other variables, whereas in the disaggregated model, size of the municipalities is standard-

ized. In particular, this variable does not differentiate the larger non-agricultural property of lower value from smaller but high valued property. The effect on demand for services may be quite different in two situations as the purchasing power of non-agricultural sector (on per acre basis) may be lower in the first case.

A comparasion of the two models reveals the elasticity estimates for non-farmland value are higher in the aggregated model. This means the elasticities of non-farm variable are over estimated if the size of the municipality is not standardized.

The non-farm real estate value which was significant in Manitoba in the aggregate estimation has turned out insignificant in present case. Same variable was significant for Alberta in 1976, but has become insignificant in the disaggregated model. A possible reason for this is high multicollinearity between population and non-farm real estate value.

An addition in the population per square mile by 10 individuals raised the farmland taxes per acre in 1971 by 42 cents in Manitoba and 22 cents in Alberta. By 1976, there was an increase of 1 cent in the population density coefficient in Alberta.

A comparasion of the elasticity estimates from the two models reveals estimated elasticities are smaller in disaggregated specification. It seems, there are some economies with denser population. For example, if municipality size is not held constant a one percent increase in the population raised farmland taxes by .36% in Manitoba in 1971. At the same time, if population per square mile increased by 1%, the taxes on farmland per acre would have risen only by .24%. This is probably because of the services whose requirement increases with area. This is because in the first case the population and the size were together increasing whereas in second case only population increases but area is constant.

A larger area under improved land by 1% in 1971, raised farmland taxes \$1.36 in Manitoba, \$0.76 in Saskatchewan and \$0.80 in Alberta. By 1976, there was an increase of \$1.49 in Manitoba, \$0.31 in Saskatchewan while a drop of one cent in Alberta. The level of improved land mainly reflects road facilities. It could be seen that the tax burden of services to farmland is highest in Manitoba. In Saskatchewan and Alberta, the tax burden is almost same in 1971. In 1976, while it has stayed almost unchanged in Alberta, it has increased in Saskatchewan.

The elasticity estimates from the two models are very close to each other. This implies that there are no econo-

mies or diseconomies involved with the size of the municipality in provision of road maintenance.

5.2.3 Relative importance

According to the partial correlation coefficients in Table 11, the most important variable in Saskatchewan and Alberta is price of land. In aggregate model, the most important variable in most equations was total improved land. In Manitoba, improved land per acre continues to be the most important variable, while price holds the second position. The second most important variable is improved land per acre in Saskatchewan and population density in Alberta. The third most important variable is population density in Manitoba in 1971 and non-farm value in 1976, improved land per acre in Alberta and non-farmland value in Saskatchewan.

5.3 MUNICIPAL EXPENDITURE

This section discusses the results of expenditure equations estimated from municipality data. The main purpose is to show the effect of wealth on municipal expenditure. Some important results about estimated coefficients and elasticities have been summarized in Tables 12, 13 and 14. Tables 37 to 42 of Appendix C show the detailed results along with the correlation matrices.

5.3.1 Statistical properties

With the exception of value of farmland in Manitoba and Alberta for 1971 and population in Alberta in 1976, all other variables are significant at least at 5% level. As compared to the aggregate tax equations, a number of variables -- population in Saskatchewan and non-farm value in Manitoba and Alberta in 1976 -- have become significant. In Alberta for 1976 municipal tax equations, the non-farm value was insignificant, but now it is population that has become insignificant. In the municipal tax equations, while value of farmland was insignificant only for Manitoba 1971, in municipal expenditure equations it has become insignificant for Alberta as well. All the equations are also significant atleast at 1% level with R-square varying between a low of 0.81 in Saskatchewan in 1976 and 0.94 in Alberta. The percent of variation explained by independent variables (as reflected by the value of R-square) is greater in aggregate expenditure model than compared to the aggregate land tax model. The correlation matrices are same as in the tax equations.

5.3.2 Absolute statistical relationship

If one moves to a municipality where value of farmland was higher by \$1000, the total expenditure will be higher by \$3 in Saskatchewan in 1971, in Manitoba and Saskatchewan in 1976; and by \$2 in Alberta in 1976.

TABLE 13
Estimated total expenditure equations (Model 3)

Variable	Unit	1971			1976		
		Manitoba	Sask.	Alberta	Manitoba	Sask.	Alberta
Wealth	\$	ns	**	ns	**	**	*
Non-farm		0.002	0.003	0.002	0.003	0.003	0.002
Value	\$	**	**	**	**	**	**
Populatn	Ind.	0.048	0.070	0.060	0.077	0.062	0.093
Improved	Acre	**	**	**	**	**	ns
Constant	\$	57.410	45.673	65.584	81.918	72.836	39.977
R-square		**	**	**	**	**	**
		1.250	0.854	1.470	2.470	1.019	2.132
		ns	**	ns	ns	**	ns
		-8922.800	-32919.000	-51728.000	-23038.000	86269.000	210920.000
		**	**	**	**	**	**
		0.840	0.862	0.937	0.851	0.808	0.940

ns = Non-significant
 * = Significant at 5%
 ** = Significant at 1%
 Ind. = Individual

As compared to the municipal tax equations, the value of farmland variable has become insignificant in Alberta in 1971. It could be seen that wealth elasticities are same in models 1 and 3. This means in wealthy farming municipalities (wealth not adjusted for size) higher expenditures are mainly funded through higher farmland taxes. The elasticity estimates shown in Tables 12 and 15 indicate the elasticities

TABLE 14							
Estimates of relative coefficients of total expenditure (Model 3)							
Variable	Unit	1971			1976		
		Manitoba	Sask.	Alberta	Manitoba	Sask.	Alberta
Wealth	\$	ns	**	ns	**	**	*
Non-farm		0.086	0.162	0.078	0.177	0.265	0.091
Value	\$	**	**	**	**	**	**
Population	Ind.	0.298	0.586	0.647	0.337	0.519	0.822
Improved	Acre	**	**	**	**	**	ns
		0.393	0.185	0.255	0.292	0.190	0.168
		**	**	**	**	**	**
		0.375	0.359	0.286	0.352	0.260	0.472

ns = Non-significant
 * = Significant at 5%
 ** = Significant at 1%
 Ind. = Individual

for wealth in aggregate equations (Model 1 and 3) are lower for municipal expenditure equations than the municipal tax equations. This means increase in expenditures due to larger value of farmland (land value) leads to increase in municipal taxes by a greater percentage. This seems to be consistent with estimates of absolute coefficients.

An increase in the value of non-farmland by \$1000 in 1971, raised municipal expenditure by \$48 in Manitoba, \$70 in Saskatchewan and \$60 in Alberta. By 1976, there was an

TABLE 15
Elasticity estimates of expenditure model

Variable	Model	1971			1976		
		Man.	Sask.	Alta.	Man.	Sask.	Alta.
Wealth	3	ns	0.15	ns	0.18	0.24	0.12
Price	4	0.35	0.25	0.21	0.35	0.27	ns
Non-farm	3	0.12	0.13	0.27	0.14	0.09	0.37
Non-farm	4	0.13	0.14	0.25	0.31	0.01	0.12
Populatn	3	0.36	0.15	0.24	0.25	0.13	ns
PopuDen	4	0.32	0.15	0.27	ns	0.11	0.56
Improved	3	0.46	0.46	0.44	0.46	0.35	0.36
Improved	4	0.44	0.39	0.24	0.52	0.37	ns

Model 3 = Aggregate or municipal model

Model 4 = Dissaggregate or per acre model

ns = Non-significant

additional effect of \$29 in Manitoba and \$33 in Alberta, while in Saskatchewan this effect fell by \$8.

In case of aggregate tax equations, the sign of the coefficient of non-farm value was negative as opposed to a positive one in present case. This implies, while an increase in the value of non-farmland in municipality increases expenditures, it reduces taxes on farmland.

Elasticities in Table 15 show that a one percent additional of non-farmland value leads to the higher municipal expenditure by certain percentage which is almost twice in

magnitude in Alberta as in the other two provinces. At the same time, there is a reduction in farmland taxes which in percent terms amounts to be largest in Alberta. This means, although the municipalities of all provinces are benefitted by larger value of non-farmland, the largest benefit is derived by Alberta farmland owners.

With the higher population of the municipality by one person in 1971, there is an addition in the municipal expenditure by \$57 in Manitoba, \$46 in Saskatchewan and \$66 in Alberta. The coefficients of aggregate expenditure model are greater than the aggregate tax coefficients implying an additional person in the municipality brings about increase in the municipal expenditures by an amount larger than the municipal farmland taxes. The difference between the two either comes from higher provincial transfers or higher taxes on non-farm property. By 1976 this addition in municipal expenditure due to population had risen by \$25 in Manitoba and \$27 in Saskatchewan. During the same period, there was a drop in the municipal tax coefficients. This means, while the tax burden due to population decreased on farmland, it increased either on non-farmland, or on provincial transfers.

From elasticity Tables 12 and 15, it seems, both municipal tax as well as municipal expenditure elasticities with respect to population are lower in 1976 than 1971. This

means, an extra percentage change in population changed municipal taxes and expenditures by an amount that was greater in 1971 than in 1976. It could further be noticed that these expenditure elasticities and tax elasticities vary between 0.13 and 0.36. In some cases, aggregated expenditure elasticities are larger than the aggregate farmland tax elasticities, while in other cases the situation is reverse. But in general, the two elasticities do not differ very much. This implies, in percentage terms, there exists some constant relationship of population with the municipal tax and expenditure.

On moving to a municipality which has larger improved land by 1 acre in 1971, raised municipal expenditure by \$1.25 in Manitoba, \$0.85 in Saskatchewan and by \$1.47 in Alberta. By 1976, this effect has increased by \$1.22 in Manitoba, \$0.17 in Saskatchewan and \$0.66 in Alberta. This increase is largest in Manitoba while smallest in Alberta. In the year 1971, an extra improved acre of land cost highest in Alberta, while in year 1976, this cost was highest in Manitoba. In Manitoba and Saskatchewan, while the cost of provision of additional improved acre falls on farmland through higher taxes, in Alberta, a major portion of this cost either comes from higher taxes on non-agricultural property or higher provincial transfers.

Expenditure elasticities show, with improved land of municipality larger by 1%, the municipal expenditure rose by 0.4%. On percent basis, there is not much difference in municipal expenditures due to improved acres among the three provinces. It is interesting to note while additional percent of improved land led to additional municipal expenditures only by 0.4% on average, it raised municipal farmland taxes by 0.4-0.8%. This means, if land tax increases more is spent on that extra improved land. In Manitoba and Saskatchewan, an additional percent of improved land in municipality raised farmland taxes by a greater percentage than the expenditure. This is consistent with the fact that major portion of funds in the two provinces comes from higher taxes on farmland. In Alberta, an additional percent of improved acre raised municipal taxes on farmland and municipal expenditures by same percentage. Because the municipal expenditures are greater than the municipal taxes only a portion of funds for financing improved land comes from taxes on farmland.

5.3.3 Relative importance

According to the standardized coefficients, the value of non-farmland is the most important variable explaining expenditure in Alberta and Saskatchewan. In Manitoba it is population in 1971 and improved in 1976. In aggregate farmland tax equations, the most important variables were value

of farmland and percent improved. In present case, value of farmland acquired the lowest position while improved acres maintained the second position.

5.4 EXPENDITURE PER ACRE

Tables 16 and 17 summarize the estimated partial absolute and partial relative coefficients for expenditure per acre equations. The detailed results could be seen in Tables 43 to 48 of Appendix C.

5.4.1 Statistical properties

All the variables but population density in Manitoba in 1976; and price and improved land per acre in Alberta in the same year are significant atleast at 5% level. As compared to the aggregate expenditure estimation, the price has become significant in Manitoba and Alberta in 1971, while it has become insignificant in Alberta in 1976. Furthermore, improved acres has become insignificant in Alberta 1976 and population has become significant in same province in same year.

As compared to the land tax per acre equations, the population has become significant in Manitoba in 1976 and in Saskatchewan in 1971 and 1976; in Alberta in 1976, it has become insignificant. In addition to this, in Alberta in 1976, the value of non-farmland has become significant whereas price of land has become insignificant.

In comparasion to the disaggregated tax model, the value of R-square has increased in all provinces. In comparasion to the aggregate expenditure estimation, the R-square has increased in Manitoba and Alberta and decreased in Saskatchewan. This means, disaggregate expenditure model gives better fit than the disaggregate tax model for all three provinces. In comparasion with the aggregate expenditure model, it gives a better fit in Manitoba and Saskatchewan. All equations are significant. The correlation matrices are same as the ones in the tax per acre equations.

5.4.2 Absolute statistical relationship

In 1974, in municipality with land price per acre higher by \$10, expenditure per acre rose by 8 cents in Manitoba, 5 cents in Saskatchewan and 6 cents in Alberta. By 1976, there was a drop of one cent in Manitoba to 7 cents in Saskatchewan to 9 cents by 1976.

The elasticity estimates show that the effect of value of farmland on expenditure is under estimated in the aggregate specification. This is because the effect of size has not been seperated from the effect of value per acre. The total expenditure is a variable that may not reflect the actual level of services in a municipality. For example, a municipality may have higher expenditure and larger size. Expenditure adjusted for size does not have such bias. In comparasion with the tax per acre elasticities, the expenditure per

TABLE 16
Estimated per acre expenditure equations (Model 4)

Variable	Unit	1971			1976		
		Manitoba	Sask.	Alberta	Manitoba	Sask.	Alberta
Price	\$	** 0.008	** 0.005	** 0.006	** 0.007	** 0.004	ns 0.003
Non-farm		**	**	**	**	**	**
Value	\$	** 0.049	** 0.074	** 0.050	ns 0.162	** 0.064	** 0.029
PopuDen	Ind.	** 0.082	** 0.075	** 0.103	ns -0.038	** 0.100	** 0.364
Improved	Acre	** 1.225	** 0.732	** 0.874	** 2.874	** 1.086	ns -0.603
Constant	\$	** -0.398	ns 0.078	ns 0.078	* -0.368	** 0.307	ns 0.171
R-square		** 0.874	** 0.832	** 0.981	** 0.936	** 0.726	** 0.965

ns = Non-significant
* = Significant at 5%
** = Significant at 1%
Ind. = Individual

acre elasticities are lower in magnitude. An increase in the price of land per acre by one percent may raise taxes on farmland per acre by 0.4% to 0.6%, while expenditure may only rise by 0.2% to 0.4%. Because elasticities are less than 1, the public services could be classified as inferior goods.

TABLE 17
Estimates of relative coefficients of per acre expenditure (Model 4)

Variable	Unit	1971			1976		
		Manitoba	Sask.	Alberta	Manitoba	Sask.	Alberta
Price	\$	** 0.229	** 0.179	** 0.115	** 0.246	** 0.202	ns 0.066
Non-farm		**	**	**	**	**	**
Value	\$	** 0.352	** 0.702	** 0.614	** 0.811	** 0.630	** 0.275
PopuDen	Ind.	** 0.358	** 0.171	** 0.316	ns -0.084	** 0.145	** 0.669
Improved	Acre	** 0.269	** 0.237	** 0.062	** 0.271	** 0.216	ns -0.016

ns = Non-significant
* = Significant at 5%
** = Significant at 1%
Ind. = Individual

In Manitoba 1971, Saskatchewan 1971 and 1976, estimated price coefficients were lower in disaggregate expenditure model than compared to the disaggregate tax model. The difference either reduced taxes on non-farm property or lowered transfer payments. In Alberta, any increase in demand due to higher price of farmland was funded through property taxes on farmland itself. On the other hand in Manitoba in 1976, additional demand for services on per acre basis in the municipality raised taxes by an amount which was lesser than

the cost of provision. The difference was either contributed by taxes from non agricultural property of transfer payments.

A higher value of non-farm real estate by \$10 per acre in 1971 raised expenditure per acre by 49 cents in Manitoba, by 74 cents in Saskatchewan and by 50 cents in Alberta. In 1976, while these figures rose by \$1.13 in Manitoba, it fell in Saskatchewan by 10 cents and in Alberta by 21 cents. This means that in Manitoba while additional non farm real estate value raised expenditure per acre in 1976 by an amount which was higher than the 1971 level, in Saskatchewan and in Alberta it raised expenditure by an amount which was lower in 1976 when compared to 1971. It is interesting to note, in the aggregate municipal expenditure equations (Model 3) for Alberta, an increase in the municipal expenditure was greater in 1976 compared to 1971. This contrary to the estimates in Model 4. This difference could either be due to the non-farm real estate value that has not been adjusted for the size of the municipality.

The elasticity estimates for non-farm real estate in Table 15 for the aggregate and disaggregate models (3 and 4) are very close to each other in 1971 while quite different in 1976. Therefore, the municipal expenditure estimates may not be good estimates for non-farmland value elasticities in 1976. It could also be seen, while higher non-farm real es-

tate value per acre leads to increase in expenditure, it also reduces taxes on farmland per acre. This means, a part of the services funded through taxes on non-agricultural property are substitutes for services required by agricultural property.

If a municipality's population increased by one person per square mile in 1971, then there would be an increase in municipal expenditure per acre by 8 cents in Manitoba and Saskatchewan and 10 cents in Alberta. By 1976, these figures rose by 25% in Saskatchewan and 360% in Alberta. This means an extra individual per unit of land in the municipalities led to an increase in expenditure per acre by an amount which was larger in 1976 in comparasion to the 1971 figures.

The population density elasticities from tax and expenditure equations show that an increase in population per square mile by 1% raised taxes on farmland per acre on an average by 0.2%, and it raised expenditure per acre on an average of 0.3%. This estimate could also be used as coefficient of congestion or coefficient of publicness. This also reflects economies with denser population.

With an increase in the concentration of improved land in a municipality by 1% in 1971, the expenditure per acre rose by \$1.23 in Manitoba, \$0.73 in Saskatchewan and \$0.87 in Alberta. This means a municipality in Manitoba with a 1% more

of its land base seeded to agricultural crops than the neighbouring municipalities will have a larger expenditure by \$1.23/acre in 1971. This expenditure estimates for Manitoba exceed both Alberta and Saskatchewan. This suggests that more expenditures are required to maintain the road network in Manitoba than Saskatchewan and Alberta. By 1976, these figures increased by \$1.64 (133%) in Manitoba and \$0.36 (49%) in Saskatchewan. In Manitoba and Saskatchewan in 1971, an additional percentage of improved land raised the tax per acre by an amount greater than the expenditure per acre implying that taxes on farmland rose by an amount greater than it actually was spent on improvement. The difference either led to lower transfers or lower taxes on non-farm property. The situation was reverse in Alberta where only a part of the funding for improvement of land came from the farmland taxes and the rest was either contributed by non-farm property or provincial transfers. In Manitoba and Saskatchewan in 1976, additional percentage of improved land was mainly financed by taxes on farmland.

While an increase in the improved land by 1% raised farmland tax per acre by 0.6% on an average, it raised expenditure per acre by 0.4% on an average. The farmland taxes and expenditures seem to be most elastic with respect to the level of improved land.

5.4.3 Relative importance

According to the relative partial regression coefficients of Model 4, the non-farm real estate value was the most important variable influencing municipal expenditures. The only exception occurred in the equations for Manitoba 1971 and Alberta 1976 where population density ranked first. The second most important position is shared by improved acres, population density and non-farm real estate value. In municipal expenditure (Model 3) equations the non-farmland value seems to be the most important variable but the second most important position is again shared by all the independent variables depending upon the equation. The price which seems to be the least important variable in expenditure per acre model is the most important variable in tax per acre model. These results are quite consistent. In Manitoba this situation is a little different as improved land proves to be the most important variable.

5.5 PRICE PER ACRE

In this section, the results of price per acre equations without inclusion of the tax variable will be discussed. A summary of results is shown in Tables 18 and 19 while detailed results along with the correlation matrices are presented in Tables 49 to 66 of Appendix C.

5.5.1 Statistical properties

All variables in the equation estimated for 1971 except the farm size in Manitoba, buildings and population density in Saskatchewan and soil productivity in Alberta were significant at 5% level. In the equations estimated for the land market in 1976, the fertilizer and pesticide in Saskatchewan and soil productivity in Alberta were insignificant at 5% level. All the equations were also significant atleast at 1% level. The partial correlation coefficient between soil productivity class 2 and class 3 was greater than 0.7 for Saskatchewan 1976. None of the two could be dropped as both added to R-square and also had effect on magnitudes and significance levels of other independent variables.

5.5.2 Absolute statistical relationship

5.5.2.1 Crop production

The production of crop depends upon soil productivity and application of fertilizer and pesticides:

a. Soil productivity 1971: In 1971, the average price of land was \$73.48 in Manitob, \$61.16 in Saskatchewan and \$80.75 in Alberta. By 1976 these prices increased by \$98.41 (134%) in Manitoba, \$84.99 (139%) in Saskatchewan and \$157.17 (195%) in Alberta.

Holding other variables constant, if one moved to a municipality which had larger proportion of land under soil

TABLE 18
Estimated absolute coefficients of price per acre (Model 5)

Variable	Unit	1971			1976		
		Manitoba	Sask.	Alberta	Manitoba	Sask.	Alberta
		**	**	ns	**	**	ns
SoilPrd1	X	1.176	0.868	0.363	3.099	1.850	-0.253
		**	**	**	**	**	ns
SoilPrd2	X	0.632	0.549	0.506	1.560	1.675	0.668
		**	**	ns	**	**	ns
SoilPrd3	X	0.402	0.346	0.199	0.959	1.032	0.276
			**			**	
SoilPrd4	X	-	0.134	-	-	0.642	-
		**	**	**	*	**	**
Distance	Mile	392.050	296.130	670.850	695.960	794.460	2078.200
		**	ns	**	**	**	**
Building	\$	0.823	0.524	2.082	2.005	1.923	10.338
		**	ns	**	**	**	**
PopuDen	Ind.	1.470	3.875	1.266	4.185	9.922	2.715
		ns	**	**	**	**	**
FarmSize	X	-0.135	-0.396	-0.521	-0.917	-1.050	-1.884
		**	**	**	**	ns	**
FertPest	\$	10.367	6.973	31.778	33.039	-0.586	117.140
					**	**	
%Foreign	X	-	-	-	1.700	2.871	-
						**	
GovtOwnd	X	-	-	-	-	-4.288	-
		**	**	ns	ns	**	**
Constant	\$	20.929	38.078	29.301	48.310	82.723	101.110
		**	**	**	**	**	**
R-square		0.868	0.807	0.935	0.881	0.741	0.922

ns = Non-significant
 * = Significant at 5%
 ** = Significant at 1%
 Ind. = Individual

productivity class 1 by 1% in Manitoba in 1971, one would

TABLE 19
Estimates of relative coefficients of price per acre (Model 6)

Variable	Unit	1971			1976		
		Manitoba	Sask.	Alberta	Manitoba	Sask.	Alberta
SoilPrd1	Z	0.168**	0.524**	0.068ns	0.157**	0.427**	-0.014ns
SoilPrd2	Z	0.428**	0.683**	0.163**	0.376**	0.792**	0.065ns
SoilPrd3	Z	0.205**	0.463**	0.044ns	0.174**	0.543**	0.018ns
SoilPrd4	Z	-	0.101**	-	-	0.183**	-
Distance	Mile	0.188**	0.216**	0.391**	0.119*	0.220**	0.364**
Building	\$	0.263**	0.068ns	0.291**	0.246**	0.067**	0.375**
PopuDen	Ind.	0.226**	0.265**	0.205**	0.259**	0.270**	0.208**
FarmSize	Z	-0.071ns	-0.388**	-0.216**	-0.171**	-0.391**	-0.236**
FertPest	\$	0.192**	0.096**	0.369**	0.218**	-0.003**	0.409**
XForeign	Z	-	-	-	0.191**	0.138**	-
GovtOwnd	Z	-	-	-	-	-0.146**	-

ns = Non-significant
 * = Significant at 5%
 ** = Significant at 1%
 Ind. = Individual

find that the price of land was higher by \$1.18. On the other hand, larger acreage under soil productivity of class 2

by same percentage raised price per acre by 63 cents whereas larger acreage under soil productivity of class 3 by 1% raised average land price by 40 cents. The effect of soil productivity of class 1 on average land price seems to be 1.9 times as higher as that of soil productivity of class 1 and 3 times as high as soil productivity of class 3.

In Saskatchewan in 1971, among all soil productivity variables class 1 was again the most influential in terms of its effect on the average price of land. As compared to the soil productivity of class 2, its impact was higher by 1.6 times. As compared to the effect of soil productivity of class 3, its effect on the average price was 2.5 times higher. The effect of soil productivity of class 1 was 6.5 times as high as that of soil productivity of class 4.

In Alberta soil productivity of class 2 is most important among the soil productivity variables. A comparison with the other classes is not possible because their coefficients are insignificant. The reason for the insignificant coefficients could be larger effect of fertilizer and pesticides on the price of land in Alberta. The estimated coefficients of fertilizer-pesticide of Alberta for 1971 is 1.9 times as high as that of Manitoba and 3.8 times as high as in Saskatchewan. It is possible that the proper use of fertilizer and pesticide in Alberta outweighs the differences in prices due to differences in the soil productivities among various

provinces. Alternatively, it is possible that non-productivity factors (e.g., urbanization, oil) affect values more.

b. Chemicals: In municipalities where the use of fertilizer and pesticide was higher by \$1 in 1971, the price of land was higher by \$10.37 in Manitoba, \$6.97 in Saskatchewan and \$31.78 in Alberta. During 1970's, the average mortgage rate in Manitoba was between 8% and 9%. This means, the return over the cost of fertilizer and pesticide in 1971 was \$0.88 ($0.085 \times \10.37).

The difference among the fertilizer and pesticide coefficient is probably reflection of a better management. A proper use of fertilizer and pesticide on deficient land at right time will raise the yield. But same fertilizer and pesticide used in other situations may not have any effect on the yield, as a matter of fact an excessive use may even harm the crop. It seems Alberta farmers manage the use of fertilizer and pesticide in a better manner. It is quite possible that Alberta farmers actually need lesser fertilizer per acre or they can get fertilizer and pesticide at comparatively cheaper rates.

c. Changes between 1971 and 1976: During this period in Manitoba, the effect of soil productivity of class 1 rose by \$1.92 (163%), the effect of soil productivity of class 2 rose by \$0.93 (154%) and the effect of soil productivity class 3 rose by \$0.56 (140%).

In Saskatchewan, the effect of soil productivity of class 1 has increased by \$0.98 (113%), the effect of soil productivity of class 2 has increased by \$1.13 (205%), the effect of soil productivity of class 3 has increased by \$0.68 (194%) and the effect of soil productivity of class 4 has increased by \$0.51 (392%).

In Alberta, the coefficient of soil productivity of class 2 has also become insignificant.

In general, the ranking of soil productivity variables in terms their affect on price of land has not changed.

Between 1971 and 1976 the price of wheat increased by 250% approximately. As a result of this income of land increased in proportion to its productivity. This effect appears to be capitalized in the average land prices and is reflected by the differences in 1971 and 1976 soil productivity coefficients.

The effect of fertilizer and pesticide has increased by \$22.67 (219%) in Manitoba and \$85.36 (269%) in Alberta. In Saskatchewan, the coefficient of fertilizer and pesticide has become insignificant.

5.5.2.2 Farm structure and ownership

Farm size: In a municipality of Saskatchewan, where the number of farms below provincial median (in terms of size) is

higher by 1%, the price of land is lower by 39 cents. The magnitude of this variable is assumed to reflect the borrowing capacity of farmer - lower the magnitude, higher the borrowing capacity. In Alberta, the effect of farm size on the average land price is lower than Saskatchewan. A 1% increase in the size of the farm reduces the land prices by 22 cents in this province.

b. Changes between 1971 and 1976: The coefficient of farm size which was insignificant in Manitoba in 1971 has become significant in 1976, but its effect is smaller than the other provinces. The effect of farm size on land price has increased by 1 cent in other two provinces.

c. Foreign ownership: If the proportion of farms owned by the foreigners was higher by 1% in 1976, the average price per acre was higher by \$1.70 in Manitoba and \$2.87 in Saskatchewan. This shows that foreign ownership of land pushes the land prices up. variation in Saskatchewan.

d. Government ownership: The government ownership had a negative impact of \$4.29 on Saskatchewan's average land price in 1976. The sign of the coefficient was opposite to the one that was hypothesized. This probably was because government supplied land at the rents lower than market rents. The government ownership explained about 2% of land price variation.

5.5.2.3 Farm buildings

a. Value 1971: The average price of farmland in 1971 was higher by 82 cents in Manitoba due to larger assessed value of buildings by \$1. This means that municipalities with larger investment in buildings which is assumed to reflect the level of animal husbandary and poultry production, have higher land prices.

In Alberta, the effect of animal and poultry production was larger by \$1.26 (154%) in the same year.

b. Changes between 1971 and 1976: In 1976, the coefficients of buildings rose by \$1.19 (145%) in Manitoba and \$8.26 (397%) in Alberta. In Saskatchewan, this coefficients was insignificant in 1971 but now it has become significant, at the same time its magnitude is smaller than the other provinces.

5.5.2.4 Population

a. Density: This variable reflects the potential demand for land. In Manitoba in 1971, the average land price was higher by \$1.47 due to an additional person per square mile. As compared to this, in Alberta the effect of same level of potential demand is lower by 20 cents.

b. Changes between 1971 and 1976: By 1976, the effect of one additional potential demanded per square mile has increased

by \$2.72 (185%) in Manitoba and \$1.45 (114%) in Alberta. In Saskatchewan, the coefficient of population density not only became significant but had the largest magnitude in comparison with other provinces.

5.5.2.5 Location

a. Distance 1971: The distance is a non-linear variable. The effect of equal change in distance on price will depend upon the initial distance. For example, as distance from a major metropolitan area increased from 10 to 20 miles, average land price in Manitoba in 1971 fell by \$19.60.

A similar change in distance reduced the average land price by \$14.60 in Saskatchewan and \$33.54 in Alberta. The effect of distance on price is highest in Alberta and smallest in Saskatchewan.

b. Changes between 1971 and 1976: By 1976, the effect of distance (10 to 20 miles) increased by \$15.20 (78%) in Manitoba, \$24.91 (168%) in Saskatchewan and \$70.37 (210%) in Alberta.

5.5.3 Relative importance

According to the relative partial coefficients, the most important variables are soil productivity in Manitoba and Saskatchewan and distance fertilizer, pesticides and farm size in Alberta. This means technology, borrowing capacity and

access to the major city centre are the most important factors determining the average price of land in Alberta. Furthermore, higher returns due to higher soil productivity do not get capitalized into the higher land values in Alberta (because estimated co-efficients are generally insignificant). Farm size appears to be quite important variable explaining land prices in Saskatchewan.

5.6 PRICE WITH TAX PER ACRE

This section mainly discusses the impact of inclusion of tax per acre in the price model. The results of the price equations with tax per acre have been summarized in Tables 20, 21 and 22 Detailed results along with the correlation matrices are given in Tables 55 to 60 of Appendix C.

5.6.1 Statistical properties

As shown in Table 20, all variables but farm size in Manitoba in 1971, Soil productivity class 1 to class 3 in Alberta in 1971; soil productivity class 1 to class 3 and population density in Alberta in 1976 are significant atleast at 5% level. All the equations are also significant at 1% level with R-square varying between a low of 0.78 in Saskatchewan in 1976 and 0.94 in Alberta in 1971. As compared to the price model without tax variable, the goodness of fit as explained by magnitude of R-square has increased. Among the variables that were significant in price model without tax

variable, the building and population density in Saskatchewan in 1971, fertilizer-pesticides in Saskatchewan in 1976 and population density in Alberta 1976 have become insignificant at 5% level. The level of significance of soil productivity class 2 fell from 1% to 5% in Alberta in 1971. The partial correlation coefficients between soil productivity classes 2 and 3 in Saskatchewan in 1971 and 1976 and between tax per acre and population density in Alberta in 1976 were above 0.7.

5.6.2 Absolute statistical relationship

5.6.2.1 Tax variable

In municipalities of Manitoba where tax per acre was higher by \$1 in 1971, the average land price was higher by \$11.80. In Alberta and in Saskatchewan the effect of tax per acre on average land price is approximately twice as large as in Manitoba.

By 1976, this effect has increased by \$7.82 (66%) in Manitoba, \$14.27 (65%) in Saskatchewan and \$72.10 (327%) in Alberta.

The coefficient of tax per acre has a positive sign implying larger the taxes on land, the higher will the price be. This contradicts the theory of capitalization. A positive coefficient could be obtained in this case because property tax is calculated based on the assessed value of

TABLE 20

Estimates of price equations with tax per acre (Model 6)

Variable	Unit	1971			1976		
		Manitoba	Sask.	Alberta	Manitoba	Sask.	Alberta
		**	**	*	**	**	**
Tax/acre	\$	11.800	21.840	22.079	19.622	36.106	94.175
		**	**	ns	**	**	ns
SoilPrd1	Z	0.771	0.510	-0.052	2.104	0.961	-1.615
		**	**	*	**	**	ns
SoilPrd2	Z	0.426	0.307	0.262	1.015	1.032	-0.382
		**	**	ns	**	**	ns
SoilPrd3	Z	0.325	0.216	0.018	0.669	0.721	-0.790
		**	*		**	**	**
SoilPrd4	Z	-	0.075	-	-	0.536	-
		**	**	**	*	**	**
Distance	Mile	355.790	260.990	681.600	508.250	703.810	1922.900
		**	*	**	**	*	**
Building	\$	0.790	0.719	1.563	2.112	1.842	7.196
		**	**	**	**	**	ns
PopuDen	Ind.	0.987	2.360	0.839	2.697	8.078	-0.052
		ns	**	**	**	**	**
FarmSize	Z	-0.072	-0.263	-0.466	-0.668	-0.662	-1.749
		**	**	**	**	*	**
FertPest	\$	8.192	13.301	29.958	27.174	12.814	93.117
		**	**	**	**	**	**
XForeign	Z	-	-	-	1.691	2.652	-
					**	**	
GovtOwnd	Z	-	-	-	-	-4.248	-
		**	**	**	*	**	**
Constant	\$	18.562	26.710	26.013	32.441	49.674	93.667
		**	**	**	**	**	**
R-square		0.883	0.843	0.941	0.894	0.781	0.940

ns = Non-significant

* = Significant at 5%

** = Significant at 1%

Ind. = Individual

TABLE 21							
Relative coefficients estimated for price equation with tax per acre (Model 6)							
Variable	Unit	1971			1976		
		Manitoba	Sask.	Alberta	Manitoba	Sask.	Alberta
Tax/acre	\$	0.267**	0.347**	0.214*	0.266**	0.342**	0.445*
SoilPrd1	X	0.110**	0.310**	-0.010ns	0.107**	0.222**	-0.090ns
SoilPrd2	X	0.288**	0.382**	0.084*	0.245**	0.488**	-0.036ns
SoilPrd3	X	0.166**	0.288**	0.004ns	0.122**	0.366**	-0.053ns
SoilPrd4	X	-	0.056**	-	-	0.153**	-
Distance	Mile	0.170**	0.190**	0.397**	0.087**	0.195**	0.336**
Building	\$	0.252**	0.093**	0.218**	0.259**	0.064**	0.261**
PopuDen	Ind.	0.144ns	0.152**	0.136**	0.167**	0.220**	-0.004ns
FarmSize	X	-0.038ns	-0.259**	-0.194**	-0.124**	-0.246**	-0.219**
FertFest	\$	0.152**	0.184**	0.348**	0.179**	0.067**	0.325**
XForeign	X	-	-	-	0.190**	0.127**	-
GovtOwnd	X	-	-	-	-	-0.144**	-

ns = Non-significant
 * = Significant at 5%
 ** = Significant at 1%
 Ind. = Individual

land. The assessed value of land is expected to have a close

TABLE 22

Elasticity estimates of price model

Variable	Model	1971			1976		
		Man.	Sask.	Alta.	Man.	Sask.	Alta.
---	5	-	-	-	-	-	-
Tax/acre	6	0.19	0.30	0.24	0.25	0.30	0.49
Eff. tax	7	-0.10	-0.19	-0.25	-0.28	-0.24	-0.29
SoilPrd1	5	0.02	0.06	0.02	0.03	0.05	-0.00
	6	0.02	0.03	ns	0.18	0.03	ns
	7	0.02	0.06	0.04	0.03	0.06	ns
SoilPrd2	5	0.26	0.18	0.12	0.27	0.23	0.05
	6	0.17	0.10	0.06	0.18	0.14	ns
	7	0.28	0.20	0.16	0.31	0.24	0.10
SoilPrd3	5	0.13	0.18	0.07	0.13	0.22	0.03
	6	0.11	0.11	ns	0.09	0.16	ns
	7	0.14	0.19	0.15	0.15	0.22	0.13
SoilPrd4	5	-	0.02	-	-	0.05	-
	6	-	0.01	-	-	0.04	-
	7	-	0.03	-	-	0.04	-
Distance	5	0.03	0.02	0.09	0.02	0.02	0.10
	6	0.02	0.02	0.09	0.01	0.02	0.09
	7	0.02	0.02	0.08	0.02	0.02	0.08
Building	5	0.10	0.02	0.17	0.09	0.02	0.22
	6	0.10	0.03	0.13	0.09	0.02	0.15
	7	0.10	ns	0.16	0.08	0.02	0.17
PopuDen	5	0.13	ns	0.10	0.16	0.16	0.08
	6	0.09	0.10	0.06	0.10	0.13	ns
	7	0.15	0.18	0.11	0.17	0.16	0.10
FarmSize	5	-0.10	-0.30	-0.32	-0.29	-0.33	-0.39
	6	-0.05	-0.20	-0.29	-0.21	-0.21	-0.37
	7	-0.13	-0.32	-0.25	-0.32	-0.36	-0.26
FertPest	5	0.15	0.03	0.40	0.20	0.00	0.50
	6	0.12	0.60	0.37	0.17	0.02	0.39
	7	0.15	0.01	0.31	0.17	ns	0.42
%Foreign	5	-	-	-	0.12	0.15	-
	6	-	-	-	0.12	0.05	-
	7	-	-	-	0.08	0.04	-
GovtOwnd	5	-	-	-	-	-0.03	-
	6	-	-	-	-	-0.03	-
	7	-	-	-	-	-0.03	-

Model 5 = Model without tax variable

Model 6 = Model with tax per acre

Model 7 = Model with effective tax rate

ns = non-significant

and direct relationship with the price of land. Average land price regressed against tax per acre will give a positive coefficient. If it could be assumed that estimates this study are unbiased then it could be concluded that farmland property taxes are not capitalized into lower farmland property values.

a. Effect on other variables: In case when there is no negative tax capitalization, inclusion of tax per acre in price equation will bias the coefficients of the rest of the independent variables. Tax per acre will reduce the magnitudes of the rest of the coefficients. The effect of tax per acre on various independent variables has been discussed below.

5.6.2.2 Crop production

a. Soil productivity: With inclusion of tax per acre in the price equation, the estimated co-efficients of the soil productivity variables were depressed however, the ranking remained unchanged. If it is assumed that tax is directly related to price because it varies in proportion to the variation in the assessed value of land and therefore the average land price; then inclusion of the tax per acre in the price equation is same as inclusion of price itself as an independent variable. Because price has a direct relationship with the soil productivity variables as well as with itself (that is, tax per acre), a part of the influence

of the soil productivity will be picked up by tax per acre and the estimated coefficient of the former will be depressed.

b. Fertilizer and pesticide: With exception of Saskatchewan in 1971, the estimated coefficient of this variable has been depressed in all the provinces. These depressed coefficients could be explained by the same argument used in the case of soil productivity, but the reason for increase in coefficient in Saskatchewan in 1971 is not clear.

5.6.2.3 Farm structure and ownership

The negative effect of the farm size has fallen in all provinces because of inclusion of the tax per acre. This could again be explained by the fact that a part of effect of this variable has been picked by tax per acre hence, reducing the magnitudes of co-efficients of farm size.

A same reasoning could provide an explanation for the depressed co-efficients of government and foreign ownership.

5.6.2.4 Farm buildings

The coefficient of buildings which was insignificant in the case of model 5 has become significant at 10% level. Therefore it is not possible to compare the coefficients in this particular case. In Manitoba in 1976, the estimated coefficient has increased by 0.01%. The reason is again unclear.

But in rest of the cases, the estimated coefficients have again been depressed.

5.6.2.5 Population

The coefficient of population density which was insignificant in model 5 in Saskatchewan in 1971 has become significant. The estimated coefficient of this variable has been depressed in all the other cases which again asks for same previous explanation.

5.6.2.6 Location

There is an increase of 0.02% in the estimated coefficient of distance in Alberta in 1971. The reason is again not clear. But in the rest of the provinces estimated coefficients have been depressed again.

5.6.3 Relative importance

By comparing the results of relative coefficients, it could be seen that tax per acre picks up most important position or second most important position. This is because this variable has picked part of the effect of rest of the independent variables and has become most important variable determining average price of land.

5.7 PRICE WITH EFFECTIVE TAX RATE

In order to show the effect of effective tax rate on the average price of land, notable results have been summarized in Tables 23 and \$sum14. Tables 61 to 66 show the detailed results along with the correlation matrices.

5.7.1 Statistical properties

With inclusion of effective tax rate, a number of variables that were insignificant at 5% level became significant at that level. Among these variables are soil productivity class 1 in Saskatchewan in 1971, Soil productivity class 2 in Alberta in 1976, Soil productivity class 3 in Alberta 1971 and 1976, population density in Saskatchewan in 1971 and fertilizer-pesticides in Saskatchewan 1976. Although fertilizer-chemical has become significant at 1% level in Saskatchewan, its sign does not correspond with the hypothesized sign. All the equations are significant atleast at 1% level with R-square varying between a low of 0.77 in Saskatchewan 1976 and a high of 0.94 in Alberta in 1971. As compared to the price equations without tax variables, the R-square has increased in all cases. Except in Alberta in 1976, the partial correlation coefficients are below 0.7. In Alberta in 1976, its value exceeds 0.7 for buildings and farm size.

5.7.2 Absolute statistical relationship

5.7.2.1 Effective tax rate

With the inclusion of the effective tax rate, the magnitudes of distance, assessed value of building and percent foreign have decreased. The coefficients of soil productivity, population density and farm size have mainly increased while that of fertilizer-pesticides have decreased in most of the cases.

As per the effective tax coefficients, an increase in the tax per thousand dollar of assessed value by \$1 in 1971 reduced the average price of land by \$466 in Manitoba, \$856 in Saskatchewan and \$1758 in Alberta in 1971. A similar increase in the effective tax rate in 1976 reduced price by \$3711 in Manitoba, \$4190 in Saskatchewan and \$12831 in Alberta. These figures seem to be unrealistic. For example, in Alberta in 1976, the average price of land was \$238 per acre. Therefore, approximately 4.2 acres could be purchased with \$1000. Therefore, an increase in tax per acre by 0.42 cents (i.e., $1/4.2$) in Alberta in 1976 reduced the average price per acre by \$128.31. If tax per acre is increased by 1 cent average price per acre will fall below zero. This means that such a significant effective tax coefficient may not necessarily imply a negative tax capitalization.

a. Effect on other variables:

TABLE 23

Estimates of price equations with effective tax rate (Model 7)

Variable	Unit	1971			1976		
		Manitoba	Sask.	Alberta	Manitoba	Sask.	Alberta
Eff. Tax	\$	-465.690	-856.480	-1757.900	-3710.700	-4190.000	-12831.000
SoilPrd1	%	1.231	0.926	0.671	3.327	2.074	0.702
SoilPrd2	%	0.684	0.593	-0.651	1.769	1.771	1.204
SoilPrd3	%	0.419	0.361	0.432	1.090	1.025	1.093
SoilPrd4	%	-	0.147	-	-	0.585	-
Distance	Mile	22.806	11.939	557.72	43.629	32.114	1747.400
Building	\$	0.810	0.354	1.951	1.754	1.758	8.293
PopuDen	Ind.	1.616	4.288	1.449	4.528	9.596	3.435
FarmSize	%	-0.179	-0.414	-0.407	-1.016	-1.123	-1.230
FertPest	\$	10.128	1.943	25.150	28.450	-11.900	98.342
XForeign	%	-	-	-	1.203	2.322	-
GovtOwnd	%	-	-	-	-	-3.277	-
Constant	\$	27.851	40.804	40.987	102.430	124.140	129.710
R-square		0.872	0.821	0.943	0.901	0.766	0.932

ns = Non-significant
 * = Significant at 5%
 ** = Significant at 1%
 Ind. = Individual

TABLE 24							
Relative coefficients estimated for price with effective tax rate (Model 7)							
Variable	Unit	1971			1976		
		Manitoba	Sask.	Alberta	Manitoba	Sask.	Alberta
Eff. Tax	\$	-0.082	-0.134	-0.126	-0.179	-0.174	-0.133
SoilPrd1	Z	0.175	0.563	1.125	0.164	0.479	0.039
SoilPrd2	Z	0.464	0.737	0.210	0.427	0.837	0.116
SoilPrd3	Z	0.214	0.482	0.096	0.198	0.520	0.073
SoilPrd4	Z	-	0.110	-	-	0.167	-
Distance	Mile	0.175	0.191	0.325	0.119	0.196	0.306
Building	\$	0.258	0.047	0.272	0.215	0.061	0.301
PopuDen	Ind.	0.248	0.294	0.234	0.281	0.261	0.263
FarmSize	Z	-0.093	-0.407	-0.169	-0.189	-0.419	-0.154
FertPest	\$	0.187	0.027	0.292	0.187	-0.062	0.343
%Foreign	Z	-	-	-	0.135	0.112	-
GovtOwnd	Z	-	-	-	-	-0.111	-

ns = Non-significant

* = Significant at 5%

** = Significant at 1%

Ind. = Individual

It was mentioned in Chapter 4 that effective tax rate con-

sists of tax per acre weighted inversely with land price. It was seen that inclusion of tax per acre in price equation deflated other coefficients due to its strong positive correlation with price. Inclusion of effective tax rate due to presence of weights that are negatively correlated with price of land, will affect the coefficients of rest of the variables in oppositediriction. The effect of effective tax rate on individual coefficients has been discussed below.

5.7.2.2 Crop production

a. Soil productivity: With the inclusion of effective tax rate in the price equation, the coefficients of soil productivity are slightly over estimated. Only cases of under estimation are soil productivity class 1 in Manitoba in 1971, soil productivity class 2 in Manitoba in 1976 and soil productivity class 3 and class 4 in Saskatchewan in 1976. The elasticity estimates have also been over estimated in most of the cases. For example, it was observed that inclusion of farmland tax per acre in the price equation depressed the magnitudes of coefficients of soil productivity variables. On the other hand, coefficients of soil productivity variables are over estimated when effective tax is introduced at the place of tax per acre. This means, due to domination of effect of negative weights, the estimated coefficients of soil productivity have increased in magnitude.

It was mentioned above that the coefficients of soil productivity were over estimated in some cases of model 7 in comparasion to model 5. Even in these cases, when compared to the model 6, the coefficients were smaller. This reflects the effect of negative weights is not sufficient to completely neutralize the effect of tax per acre.

Another effect of efective tax rate is: it has made significant the soil productivity 1 in Alberta in 1971; and soil productivity 1 and 2 in Alberta in 1971 and 1976. But the estimated coefficient of soil productivity 2 which was significant with correct sign in model 5 has become insignificant.

b. Fertilizer and pesticide: The estimated coefficient of this variable has mixed effect. First of all, its coefficient which was significant in price model without tax variable has become insignificant in present case. In the same province, in 1976, this coefficient was insignificant in model 5, but now it has become significant with a smaller magnitude.

In Manitoba and in Alberta, the estimated co-effecients of this variable have been depressed in comparasion to model 5 but increased in comparasion to model 6. This shows the weights have neutralized only a part of the effect of the tax per acre.

5.7.2.3 Farm structure and ownership

a. Farm size: This variable has a negative effect on the price, therefore its coefficients were increased in the model 6 with tax per acre. With the inclusion of the effective tax rate, most of the coefficients have become larger than the ones in models 5 and 6. Only exception to this is the case of Alberta in 1971 where coefficient is biggest in model 5. The reason for this is not clear, but in rest of the cases it could be assumed that the effect of the negative weights has dominated the effect of the tax per acre. Furthermore, the coefficient of farm-size was insignificant for Manitoba in 1971 in model 5 and model 6, but it has become significant at 5% level.

b. Foreign ownership: In model 6, the coefficients of foreign ownership were depressed. In present case these have increased but are still less than the ones in model 5. This means the effect of tax per acre has dominated over the effect of negative weights.

c. Government ownership: The negative coefficients of this variable which was depressed in model 6 have become even bigger than the ones in model 5. This implies the effect of $1/\text{price}$ has dominated in this case.

5.7.2.4 Farm buildings

The estimated coefficients of this variable have become insignificant in Saskatchewan in both the years. In Manitoba and in Saskatchewan, in comparison to the model 6, the coefficients are bigger but remain smaller than the ones in model 5. This means the effect of tax per acre dominates the effect of negative weights.

5.7.2.5 Population

The estimated coefficient of population density was insignificant for Alberta in 1971 in model 5, it became significant in model 6 and remained so in model 7 as well. Its magnitude fell in model 6, but now it is even larger than the one in model 5. This is reflection of domination of negative weights over tax per acre. In Alberta in 1976, it was insignificant in model 6 but now it has become significant. In Saskatchewan in 1971, the estimated coefficient was insignificant in model 5 but it became significant in models 6 and 7. In all cases except Saskatchewan in 1976, the coefficients were smaller in model 6, but now they are bigger than model 5. In Saskatchewan in 1976, the coefficient is bigger than the one in model 6 but remains smaller than the one in model 5. This means in Saskatchewan in 1976, the effect of tax per acre dominated the effect of negative weights.

5.7.2.6 Location

The estimated coefficients of distance variable fell in model 6. In model 7, it was expected that their magnitudes will increase again. But contrary to this expectation, a larger drop in their magnitudes was noticed. This requires further investigation.

The tax per acre is expected to fall as distance from the major centre increases. As a result of this, the distance variable ($1/\text{distance}$) had a positive relationship with the tax per acre. Therefore, tax per acre variable picked up part of the effect of distance variable in model 6, hence reducing its coefficient.

On the other hand, as actual distance increases i.e., distance variable falls, land price is expected to fall which in other words means, $1/\text{price}$ (proxy for $1/\text{assessed value}$) is expected to increase. When distance variable increases, both $1/\text{price}$ as well as tax per acre increase which makes effective tax rate which is product of tax per acre and $1/\text{price}$ to increase at even faster rate. As a result of this, a larger portion of the effect of distance variable is taken away by the effective tax rate, hence reducing its coefficient.

5.8 SUMMARY

In this chapter, results of tax and expenditure models have been presented and discussed both on municipal as well as on per acre basis. Following this the results of average price equations without tax variable, with tax per acre and with effective tax rate respectively were discussed. In this section, some important findings have been listed.

It was found that value of farmland (farmland price) if adjusted for size of the municipality, could reflect prosperity of community. Such an adjustment for size revealed value of farmland elasticity estimates are lower in the aggregate specification. It was seen public services are inferior good as value of farmland elasticity was far below 1. The value of farmland coefficients were higher for taxes than for expenditures reflecting wealthy agricultural communities pay relatively more taxes on farmland than actually spent on services. As a result of this, either the taxes on non-agricultural property or the transfer payments get smaller.

The effect of non-farm variable purely due to higher value could not be separated from the effect due to size. But under per acre specification, it became possible to standardize municipalities to same size. Such a standardization revealed the non-farm value elasticities are over-estimated by aggregate model. Non-farm property depresses taxes on

farmland while raises municipal expenditures. This means, a part of the services funded through the taxes collected from non-farm property are required by the farmland.

The population elasticities were lower in per acre specification. It implied there were some economies involved with denser population. It was observed that between 1971 and 1976, as a result of change in population density, the taxes fell while expenditures rose. This means, during this five year period, either the tax burden due to population on the non-farm property or in province increased.

The provision of transportation services did not show any economies due to size of the municipality. It seems consistent with the fact that larger communities require proportionately more roads. The burden of provision of improved land was highest on the Manitoba farmers. Furthermore, in Manitoba and Saskatchewan, the tax on farmland per acre exceeded the amount actually spent on improved land. On the other hand in Alberta, only a portion of cost of providing improved land came from taxes on farmland. A major portion of this cost was either provided by non-farm property taxes or provincial transfers.

In the price model, soil productivity was most influential variable. Among the soil productivity variables, class 1 ranks highest, class 2 was second whereas class 3 and 4 shares third and fourth position respectively. This is consistent with the fact more productive land has higher value.

The effect of distance to major city on price was highest in Alberta while lowest in Manitoba.

The effect of capital intensity reflected by buildings was highest in Alberta. It seems in Manitoba and Saskatchewan, the level of buildings reflect prosperity of farms while in Alberta it may reflect oil wells and refineries as well.

The impact of population density on average price of land is highest in Saskatchewan while lowest in Alberta.

Inclusion of tax per acre in price equation depressed the other coefficients. The tax per acre acquired the most important position among the independent variables. It gave a positive coefficient 1 reflecting non-existence of negative capitalization.

Inclusion of effective tax rate because of presence of negative weights neutralized some of the effect of tax per acre. It inflated the magnitudes of the coefficients of the rest of the variables. A negative effective tax rate coefficient was obtained, but its magnitude was so high that no faith could be placed upon it. This combined with the theoretical discussion provides a greater support to the hypotheses that farmland property taxes are not capitalized into lower farmland values in Manitoba, Saskatchewan and Alberta.

Chapter VI

SUMMARY AND CONCLUSION

About 80% of total government revenues in Canada are raised through taxation. Out of all the sources of tax revenue, the property tax ranked the fourth largest tax source in 1976. The property tax contributed 10% to total tax revenue, 38% to local government taxes and 35% to municipal expenditures. In farming communities, tax on farmland was a major contributor to municipal expenditure. In Manitoba and Saskatchewan 80% and in Alberta 45% of municipal expenditure came from the property tax. In Alberta, 50% of property tax was raised from non-agricultural property whereas in Manitoba it was 25% and in Alberta it was only 18%. About three quarters of local government spending is on provision of education and public works. Percent spending on education is highest in Alberta (60%). Percent spending on education in Manitoba and Saskatchewan is same (45%). Percent expenditure on public works is biggest in Saskatchewan (38%). Percent spending on public works is almost same in Manitoba and Alberta (25%).

It was observed that farmland property taxes and local government expenditures are not correlated with average farm income. This means the tax burden is higher when farm incomes are lower.

The collection of the property tax is performed by three different agencies operating together. One agency assesses the property, other sets the tax rates and a third performs actual collection. Many agencies may be bad if it raises cost of collection per dollar of property tax and it may be good if due to specialization efficiency increases. It was seen that non residential property was assessed at a higher rate. Farm property is assessed based on value and productivity of land. Provinces usually pay grants-in-lieu on its property. Usually legal assessment periods are 7 to 12 years but they are not strictly followed.

A major objective of this study was to test the hypothesis of negative capitalization of property tax into the lower farmland values. Out of the three theories namely: the Old View, the New View and the Tiebout-Oates model, which attempt to explain the phenomenon, the last one was found most suitable for study as it included theory about local government expenditures along with the taxes and also that its data requirements were quite manageable. The Old View assumes supply of land is perfectly elastic but this postulation of inelastic supply of land for farm production was rejected. Old View also does not trace the effect of property tax to final equilibrium because it is based on a partial equilibrium demand and supply analysis. New View requires larger data set and a complex model. It also neglects distortions in the market which could hinder the equilibra-

tion mechanism. Both Old and the New Views are based on the assumption that market works but they neglect the possibility of market failure in the case of public goods. Tiebout-Oates model of capitalization provides an alternative mechanism for equilibration of market and efficient provision of local public goods which are mainly financed through the property taxes. This model is quite manageable and requires lesser data.

The literature review revealed that previous studies of capitalization of property tax used either effective tax rate or some other inappropriate variable or model, and this persumably was, the cause of their conflicting results as some supported capitalization while others did not.

A complete simultaneous equation model was built for the study of capitalization. But in the case of farmland, the theory suggests that possibility of capitalization is remote. This is because: the supply of land for agricultural use is elastic and people do not 'vote with their feet'. As a result of this, the model was simplified into three single equation submodels.

It was argued that effetive tax rate is a variable which is derived by multiplication of tax per acre by weights which are inversely related to the price. This will introduce a negative bias and a negative coefficient will be obtained even if there is no negative tax capitalization.

An argument was raised that inclusion of tax per acre in the price equation will depress the coefficients of rest of variables. This is because price reflects demand for services and is expected to have a positive relationship with tax per acre. On the other hand the effective tax rate will inflate the coefficients due to presence of built-in negative weights.

Seven different equations were estimated using 1971 and 1976 cross-section data for provinces of Manitoba, Saskatchewan and Alberta. The dependent variables in the first four equations are: aggregate municipal tax, tax per acre, aggregate municipal expenditure and expenditure per acre respectively. In equations 5 to 7, the average farmland price per acre was dependent variable. The difference is that there was no tax variable in equation 5, tax per acre was introduced as an independent variable in equation 6 which was replaced by effective tax rate in equation 7.

The theory suggested that the farmland property taxes are not expected to be capitalized into the lower farmland values. An alternative hypothesis was raised in this study -- the property taxes and municipal expenditures are influenced by the wealth of the municipality. The value of land could be used as a proxy to the wealth of the municipality. If the value of the land is higher, the level of demand for services is also expected to be higher. Therefore the value

of the land is expected to have a positive effect on the taxes and expenditures. The elasticity of taxes with respect to the land values is assumed to reflect the willingness of the community to pay for larger services demanded due to the larger wealth. The elasticity of expenditure with respect to the wealth is assumed to reflect the increase in the amount of services required with larger wealth. In order to estimate these effects, the tax and the expenditure equations were estimated both on municipal as well as on per acre basis. There are at least two differences between the municipal and the per acre equations. First of all, the dependent variable has not been standardized in the municipal model. In case of expenditure, a larger municipality with the same expenditure level as a smaller municipality will have smaller expenditure on per acre bases. A smaller community will need lesser spending on roads and it will have larger funds left to be spent on other local public services. Therefore a smaller municipality with the same level of expenditure as a larger municipality is expected to have a better service level. Similarly, larger taxes in a larger municipality may actually be smaller on per acre basis as compared to another smaller municipality. This depends upon the difference in the sizes and the tax levels in the two municipalities. In such a situation, the willingness to pay and actual demand for services will be over estimated for the larger municipality. Secondly, the wealth variable (i.e., the value of

the land) increased for the municipality as a whole may be quite different from the one measured on per acre basis. The wealth could be larger if municipality has a larger size, or it could be larger if municipality has a land whose value is larger on per acre basis. In the municipality where wealth is larger due to larger acreage, an increase in taxes and expenditures will reflect need for larger expenditure due to larger area. On the other hand in cases of wealth per acre of higher value, the larger taxes and expenditures will reflect the increase in the demand for services due to higher purchasing power.

In a situation when property taxes are not expected to be capitalized in the property values, a tax variable should not be included in the price equation. In case if it is included, it will introduce bias in the results. The reason is: the tax is correlated with the price because of the demand effect and when it is included in the price equation, it picks part of the effect of the other independent variables hence deflating their magnitudes. A same situation was observed in this study. The estimated price equations without any tax variable had higher explanatory power. The variables were also significant at least at 5% level with anticipated signs. An inclusion of the tax per acre in the price equation the coefficients of the other variables in most cases. A positive coefficient of tax per acre was obtained. This suggested that there is no negative tax capi-

talization. But before coming to this conclusion, it will be desirable to do some further investigation.

It is usually argued that the tax per acre suffers from a positive assessment bias. But this does not seem to be true. This could be shown in two ways. First of all suppose there exists assessment bias. This means a positive relationship between the land values and the tax per acres (which exists due to assessment practices) leads to an under-estimation of the tax capitalization. But this would be a very naive view of the situation. The first question that arises is: why is the tax per acre higher for high valued lands. Assuming that the effective tax rate is same for all properties, the tax per acre will be higher for lands whose value is higher. But why the value of the land was higher at the first place. It could be due to any other variable say soil productivity in case farmland. So in the first period when there was no property tax, the value of the land depended upon the soil productivity. When the tax is imposed, it falls in larger amount on higher valued lands. In this situation, a regression of price of land against the tax and soil productivity will give a positive coefficient for the two. But the results will be biased because the tax per acre does not belong to the price equation as an independent variable as capitalization has not occurred yet. Once the capitalization has taken place, the value of land will fall where the tax was higher on per acre basis. Once

the effect of soil productivity is taken out of the price, a negative tax coefficient will be obtained.

Secondly, in case of the average municipality data, the possibility of bias is even lower. This is because each municipality is independent to decide how much to spend. In such situation, the effective tax rate will be different in the different municipalities. Because the effective tax rates are not determined simultaneously in all municipalities, the tax per acre of one municipality will have no correlation with the value of the the land of the other municipality. Therefore an assessment bias could not be expected at least in the present study.

The tax per acre could also have a positive bias due to demand effect. In the municipalities where the land values are higher, the demand for services and therefore the taxes per acre are also higher. It could be argued that the tax and the price equations should be estimated simultaneously in this case. But there is no reason to assume that there is simulataneous equation bias. If one is estimating a demand for services curve, then one would expect a simultaneous effect from the supply of services curve. The demand for services and the capitalization are not determined simultaneously. Again going back to the example where initial price of land was higher because the soil productivity was higher. Higher taxes were imposed on lands where the wealth (price)

was higher on per acre basis. Suppose that taxes get capitalized after one period. If the effect of soil productivity on land value was separated then the tax per acre will show a negative relationship with the price per acre. In case when there is no tax capitalization, an inclusion of tax per acre in the price equation will bias the coefficients of the rest of the variables (soil productivity in this case) due to problem of causality. But when there is capitalization, tax per acre will give a negative coefficient with the price of land. This is because the effect of the rest of the variables on price has been separated by other independent variables. Therefore a positive tax coefficient could be taken as sufficient indicator of no negative tax capitalization.

A same reason applies in the case of the effective tax rate. Theory suggests that taxes are not capitalized in the case of farmland. In such situation, the tax variable as such does not belong to the price equation no matter whether it is measured by total tax, the tax per acre or the effective tax rate. An inclusion of the tax per acre will bias the results. A same situation was observed in the present study. The elasticity of tax per acre with respect to the price per acre was below 1. This means the tax per acre moved in the direction of the price per acre but at a slower rate than the price. Because of this relationship the tax per acre gave a positive coefficient when included in the price per acre equation. Although the effective tax rate did

not belong to the price equation, when included gave a negative coefficient. This is a perfect result and could have been taken as a support to the hypothesis that taxes do get capitalized into lower farmland values, and therefore, theory developed in this study is wrong. But a further analysis of effective tax rate revealed that the effective tax rate itself is a biased variable and could give a negative coefficient even if there is no tax capitalization. In order to show this, the effective tax rate was broken into the product of the tax per acre and the number of acres that could be bought with \$1000 (which acts as a weight on the tax per acre). As price increases, the weights on tax per acre fall. In a situation when prices differ more than the taxes, the weights will increase at a rate which is faster than the fall in prices. So on low valued lands, the taxes are lower than the ones on the high valued lands. As a results of this built-in negative bias, a negative effective tax rate coefficient could not be interpreted as an indicator of negative tax capitalization.

6.1 IMPORTANT RESULTS OF THE STUDY

It was observed that in the municipalities that had larger amount of wealth due to larger acreage and/or larger values of land on per acre basis, taxes and expenditures were higher by certain amount. However, the municipalities that had higher values of farmland on per acre basis (reflecting

greater purchasing power) had even higher taxes and expenditures. This implies, if in a municipality, the demand and the level of services was higher because of larger size and/or because of higher purchasing power, this would be lesser than the case in which a municipality had greater demand and level of services just because of greater purchasing power. Furthermore, in the first case, higher level of services was financed through higher taxes on land. On the other hand, in the second case, increase in taxes sometimes, exceeded the cost of provision of those services. Elasticity of taxes and expenditures with respect to wealth were below 1 depicting the possibility that local public goods are inferior goods.

It was further observed that the service level was higher on municipal as well as on per acre basis, in the municipalities that had larger non-agricultural operations. At the same time, there was reduction in the farmland taxes in the whole municipality as well as on the per acre basis.

It was also seen that increase in population and population density led to increase in the level of services. More than half of the cost of provision of these extra services due to extra population was financed through higher farmland taxes, and the rest of fund either came from taxes on non-farmland or from transfer payments. The elasticities were lower in the disaggregate specifications reflecting the ex-

istence of economies of scale with respect to the population.

The municipalities which had larger improved land, had higher service level on municipality as well as on per acre basis. On municipal basis, major portion of this higher service level in Manitoba and Saskatchewan was financed through higher farmland taxes while the rest came from other sources. In Manitoba, municipal farmland taxes rose more than the cost of provision of those extra services. A similar conclusion could not be drawn for land taxes on per acre basis.

6.2 CONCLUSION

A test about capitalization of property tax was performed on the farmland data of Manitoba, Saskatchewan and Alberta for years 1971 and 1976. The results suggested the possibility that farmland taxes are not capitalized into lower farm real estate prices.

A second hypothesis that was tested in this study is that the effective tax rate is not suitable for the test of capitalization of property tax due to built-in negative bias that could lead to a conclusion supporting the negative capitalization even in the case when no such possibility exists. It was concluded the effective tax rate is not a suitable variable for the study of capitalization of property tax.

6.3 LIMITATIONS OF THE STUDY

This study pointed out that there is no simultaneous equation bias or assessment bias in the estimated equations or the tax coefficients. A causality problem was noticed in the price model when tax variable was introduced. It was concluded that there is no negative tax capitalization. There could be a number of reasons that could question this conclusion.

First of all, this study implicitly assumes that the price data is equilibrium data after capitalization has taken place. But it is quite possible that for some of the observations capitalization process has not been completed yet. A bias could be expected in the results in such a situation. The only situation when taxes do get capitalized but a positive sign is obtained for the tax per acre is when most of the observations are the ones before capitalization. In such a situation, a cross-section data is inadequate for complete analysis.

Secondly, this study has mainly relied on the Least Square method of estimation. For this method of estimation, the variables are not the variables but they are pure numbers. A problem may arise in a situation when taxes do get capitalized into the property values but the prices of the high tax lands do not fall to the extent that they go below the low tax lands. A regression of price per acre against

tax per acre will give a positive sign, if the other factors which actually cause higher land prices are not included in the price equation. But even if other factors determining land prices are included in the price equation, the true effect of the taxes on prices may still remain hidden. In order to understand clearly, suppose before tax prices differ because of soil productivity. If price is regressed against the soil productivity a positive coefficient will be obtained. Now suppose tax is imposed in a way that it falls more on the high valued lands. After capitalization prices of high taxed lands fall but not below the prices of the low valued lands. A regression of price per acre against soil productivity and tax per acre may give a positive coefficient for both independent variables. This is because, on high valued lands both taxes and the soil productivity are higher than the low valued lands. This is a typical situation of multicollinearity and the effect of the two independent variables on price could not be separated from each other. In such a situation, the magnitudes of the variables affecting the price per acre positively will get depressed whereas the magnitudes of the coefficients of the variables negatively affecting price per acre will get inflated. Such a situation has not been observed in present study.

A third possible source of bias could be the use of expected price at the place of market price. If due to some unknown reason, the farmers in the high tax regions expect

higher land prices, a positive relationship between the tax per acre and the expected land prices could be obtained even if actual land prices have fallen. Again there is no reason to presume any such pattern in the expectations of the farmers. But this could be tested if data for actual market prices could be obtained.

6.4 IMPLICATIONS

If the purpose of the policy is to give relief to the land owners by reducing rate of tax on land, then because, the land tax is not negatively capitalized into the farmland values, the problem that a tax cut will raise land values and net total tax burden of the farm owner may not fall to the extent the policy intends, does not arise.

Larger land holdings in general, are expected to yield higher returns to the owner. Because, the property tax is not capitalized in lower farmland values, or in other words, it does not depress the rates of return from these holdings, it is a non-progressive tax. It does not increase the progressiveness of income tax for the farmland holders as compared to the people who derive their income through other sources. Therefore, there is no need to reduce the progressivity of income tax for the farm owners.

6.5 SUGGESTIONS FOR FURTHER RESEARCH

It was concluded that possibility of capitalization of farmland property taxes is little. Most probably, most of the farmland property tax is shifted forward to the consumers of farm-products or backward to other factors of production, or may be, part of it is contributed by both channels. It would be worthwhile to know, where does it get shifted and by what proportion. Information will be useful for designing the over all tax structure.

This study ends but the question that who pays the farmland property tax remains unresolved.

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Appendix A

Let,

t = Property tax rate

P = Price of land

$q = f(P)$ = Quantity of land demanded

r = Total economic rent on all lands

$$r = p \cdot q - P \cdot q \cdot t$$

$$= P \cdot q (1-t)$$

$$= [P \cdot f(P)](1-t)$$

First order condition for profit maximization:

$$\partial r / \partial p = (1-t)[P f'(P) + f(P)] = 0$$

$$\text{Or, } P \cdot f'(P) + f(P) = 0$$

$$\text{Where, } f'(P) = \partial f(P) / \partial (P)$$

Therefore, the profit maximizing prices are unaffected by ad valorem property tax rate.

Appendix B

1. DEMAND FOR FARMLAND:

Investment Decisions: The investment in the farmland is similar to the investment in any other capital purchase. There are a number of methods by which the investments are renewed. These are: Present Value criteria, Benifit-Cost ratio, Internal Rate of Return criteria and Marginal Efficiency criteria.

The Present Value criteria is based upon the difference between the Present discounted value of aggregate of income stream of money Benifits (Bt) and Costs (Ct) accruing in various years. The Present Value of investment which will last in T years is

$$V = \sum_{t=0}^T (Bt - Ct) / (1+r)^t \dots \dots \dots (1)$$

Where,

V = Present Value

r = Annual rate of return

The investment with highest V are chosen.

The Benifit-Cost Ratio is ratio of stream of benifits derived from investment to the stream of cost. It could be shown as

$$B/C = \frac{\sum_{t=0}^T [Bt / (1+r)^t]}{\sum_{t=0}^T Ct / (1+r)^t} \dots \dots \dots (2)$$

The investment with the highest B/C is chosen.

The Internal rate of return is the rate of return at which the present value becomes zero. It could be shown as

$$0 = \sum_{t=0}^T (B_t - C_t) / (1+m)^t \quad \dots \dots \dots (3)$$

The investment with the highest m is chosen.

The Marginal Efficiency of investment criteria is based on the assumption that with the increase in the level of investment the internal rate of return falls while the rates at which the funds are available for investment increase. The optimum level of investment is the one where m equals r .

An investor will invest in farmland if the rate of return m exceeds the rate at which the funds are available to him. The amount invested also depends upon the access of the investor to the funds. More realistically, the farmers and the other investors in farmland have a debt-equity ratio with an upper limit imposed by the lending institutions or by the investor himself. The equity depends upon the land, buildings, machinery, livestock and personal savings. A farmer invests in all of those and therefore, the internal rate of return curve gives the demand for all types of farm investments including land. The demand for land is the sum of all investments of an individual in the land in the portfolio which have a greater internal rate of return than the market rate of interest.

The above mentioned formulae assumes that the investor is certain about income per year and this per year income does not even vary over time. Actually, every investor may ex-

pect different rates of returns from the different investment packages in the different years. Furthermore, the value of land may appreciate or depreciate due to the capital gain or loss.

The The Maximum Bid price a farmer will be ready to pay depends upon the lowest rate of return he will accept on any investment.

A part of the demand for farmland will be determined by consumer demand. Some of the purchasers of land may buy a parcel of farmland for recreation or for the personal satisfaction of owning the land. The utility derived from owning the land depends upon location, appearance, surrounding and the access to the city, hospitals and the recreation spots.

The Non-residents and foreigners may also have effect upon the demand for land in a region. If the foreigners or non-residents have access to the less costly loans or if their expectations for rates of return from the parcel of land are higher, then they may be willing to buy land in a region even at higher prices than the local demanders. This will shift the demand for land schedule away from the origin.

The Public Investments like the Saskatchewan Land Bank may also influence the demand for land in a province. Government has relatively lower constraints for obtaining the funds. It is a big buyer and can influence the prices upwards or downwards. Government also controls the authority

to regulate the industry. All of this may have some impact upon the demand for land.

2. SUPPLY OF FARMLAND:

The Supply of farmland also influences the price. The supply may come from the involuntary disinvestment like bankruptcy and voluntary determinants like higher opportunity cost of staying in agriculture as compared to the other business. One may voluntarily retire from the farming due to old age.

The Government Ownership will affect the supply if government decides not to sell or to pass such regulation.

The Non-residents may affect the supply if they hold the land as hedge against inflation and not sell it. This may reduce the long term supply of land.

PRICE DETERMINING RELATIONSHIPS:

Inter action of demand and Supply forces determines the price of farmland. The variables determining the price of land in rural municipalities have been discussed in Chapter 4.

Appendix C

TABLE 25
Total farm land tax
Manitoba 1971

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Wealth	\$	0.00165	1.18ns	0.10257	0.113
Non-farm	\$	-0.01921	-2.33**	-0.16412	-0.072
Populatn	Ind.	38.881	3.97**	0.36968	0.356
Improved	%	1.3921	8.27**	0.57988	0.759
Constant	\$	-32756	-1.94*		

R-square=0.72

F-ratio=64.72

Observations=107

CORRELATION MATRIX:

Wealth	1.00				
Non-farm	.15	1.00			
Populatn	-.55	-.60	1.00		
Improved	-.50	.05	-.06	1.00	
Constant	-.07	.05	-.15	-.50	1.00

'ns' = Non-significant,
'**' = Significant at 1% level
'*' = Significant at 5% level
Ind. = Individual

TABLE 26
Total farm land tax

Manitoba 1976

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Wealth	\$	.00283	3.54**	0.24138	0.234
Non-farm	\$	-0.00700	-0.69ns	-0.04690	-0.019
Populatn	Ind.	35.936	2.50**	0.20697	0.169
Improved	%	2.6506	10.58**	0.61075	0.752
Constant	\$	-55477	-2.27*	0.61075	

R-square=0.82

F-ratio=114.00

Observations=107

CORRELATION MATRIX:

Wealth	1.00				
Non-farm	.02	1.00			
Populatn	-.41	-.71	1.00		
Improved	-.51	.22	-.18	1.00	
Constant	-.05	.06	-.14	-.53	1.00

'ns' = Non-significant,
'**' = Significant at 1% level
'*' = Significant at 5% level
Ind. = Individual

TABLE 27

Total farm land tax

Saskatchewan 1971

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Wealth	\$	0.00345	6.06**	0.32764	0.261
Non-farm	\$	-0.00614	-2.87**	-0.08978	-0.018
Populatn	Ind.	1.82000	0.3ns	0.01293	0.009
Improved	%	0.79073	12.39**	0.58444	0.664
Constant	\$	15471.00000	2.23**		

R-square=0.74

F-ratio=200.22

Observations=291

CORRELATION MATRIX:

Wealth	1.00				
Non-farm	.1	1.00			
Populatn	-.50	-.18	1.00		
Improved	-.68	-.12	.04	1.00	
Constant	.18	.03	-.21	-.67	1.00

'ns' = Non-significant,

'**' = Significant at 1% level

'*' = Significant at 5% level

Ind. = Individual

TABLE 28

Total farm land tax

Saskatchewan 1976

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Wealth	\$	0.00283	6.92**	0.43215	0.347
Non-farm	\$	-0.01641	-5.95**	-0.19782	-0.039
Populatn	Ind.	1.5347	0.19ns	0.0074	0.005
Improved	%	1.0184	8.45**	0.48056	0.587
Constant	\$	27282	2.37**		

R-square=0.72

F-ratio=188.45

Observations=291

CORRELATION MATRIX:

Wealth	1.00				
Non-farm	-.13	1.00			
Populatn	-.36	-.22	1.00		
Improved	-.79	.07	.04	1.00	
Constant	.34	.00	-.19	-.74	1.00

'ns' = Non-significant,

'**' = Significant at 1% level

'*' = Significant at 5% level

Ind. = Individual

TABLE 29
Total farm land tax

Alberta 1971

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Wealth	\$	0.00478	5.16**	0.48562	0.444
Non-farm	\$	-0.00883	-3.24**	-0.28924	-0.097
Populatn	Ind.	36.714	4.72**	0.4335	0.334
Improved	%	0.62680	4.49**	0.36930	0.459
Constant	\$	-89509.00000	-1.79*		

R-square=0.87

F-ratio=82.21

Observations=54

CORRELATION MATRIX:

Wealth	1.00				
Non-farm	-.22	1.00			
Populatn	-.28	-.69	1.00		
Improved	-.75	.34	.02	1.00	
Constant	.23	.05	-.35	-.63	1.00

'ns' = Non-significant,
'**' = Significant at 1% level
'*' = Significant at 5% level
Ind. = Individual

TABLE 30
Total farm land tax

Alberta 1976

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Wealth	\$	0.00239	6.58**	0.56505	0.472
Non-farm	\$	-0.00400	-1.41ns	-0.16971	-0.220
Populatn	Ind.	31.11800	3.02**	0.39237	0.220
Improved	%	0.73281	4.20**	0.30948	0.386
Constant	\$	-26240.00000	-0.37ns		

R-square=0.87

F-ratio=79.99

Observations=54

CORRELATION MATRIX:

Wealth	1.00				
Non-farm	.08	1.00			
Populatn	-.39	-.86	1.00		
I/A	-.69	.09	.14	1.00	
Constant	.22	.17	-.35	-.71	1.00

'ns' = Non-significant,
'**' = Significant at 1% level
'*' = Significant at 5% level
Ind. = Individual

TABLE 31

Farm land tax per acre

Manitoba 1971

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Price	\$	0.00884	4.64**	0.39053	0.559
PopuDen	Ind.	0.04168	2.88**	0.28290	0.238
Non-farm	\$	-0.01176	-1.79*	-0.13304	-0.045
Improved	%	1.35650	7.74**	0.46428	0.717
Constant	\$	-0.54523	-6.08**		

R-square=0.81

F-ratio=104.98

Observations=107

CORRELATION MATRIX:

```

Price      1.00
PopuDen    -.68 1.00
Non-farm    .32 -.76 1.00
Improved   -.64 0.26 -.06 1.00
Constant   -.17 -.08 .05 -.46 1.00

```

'ns' = Non-significant,

'**' = Significant at 1% level

'*' = Significant at 5% level

Ind. = Individual

TABLE 32

Farm land tax per acre

Manitoba 1976

Variable Name	Unit	Co-eff.	T-ratio	Stnd. Co-eff.	Elast. at mean
PRICE	\$	0.00524	5.05**	0.38627	0.412
PopuDen	Ind.	-0.00243	-0.12ns	-0.01109	-0.007
Non-farm	\$	0.01714	2.47**	0.17883	0.051
Improved	%	2.84990	10.01**	0.56215	0.797
Constant	\$	-0.55147	-3.96**		

R-square=0.83

F-ratio=121.78

Observations=107

CORRELATION MATRIX:

Price	1.00				
PopuDen	-.58	1.00			
Non-farm	.14	-.74	1.00		
Improved	-.62	.14	.11	1.00	
Constant	-.01	-.12	.05	-.62	1.00

'ns' = Non-significant,
 '**' = Significant at 1% level
 '*' = Significant at 5% level
 Ind. = Individual

TABLE 33

Farm land tax per acre

Saskatchewan 1971

Variable Name	Unit	Co-eff.	T-ratio	Stnd. Co-eff.	Elast. at mean
Price	\$	0.00743	10.04**	0.46753	0.548
PopuDen	Ind.	0.00959	1.15ns	0.04134	0.030
Non-farm	\$	-0.00502	-3.02**	-0.08956	-0.015
Improved	%	0.76440	11.45**	0.46430	0.636
Constant	\$	-0.16582	-4.70**		

R-square=0.75

F-ratio=220.04

Observations=291

CORRELATION MATRIX:

```

Price      1.00
PopuDen    -.51 1.00
Non-farm    .01 -.08 1.00
Improved   -.64 .11 -.08 1.00
Constant   -.14 -.11 .03 .55 1.00

```

'ns' = Non-significant,
 '**' = Significant at 1% level
 '*' = Significant at 5% level
 Ind. = Individual

TABLE 34
Farm land tax per acre
Saskatchewan 1976

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
PRICE	\$	0.00458	9.89**	0.48403	0.550
PopuDen	Ind.	0.01459	1.20ns	0.04191	0.028
Non-farm	\$	-0.01241	-7.48**	-0.24271	-0.033
Improved	%	1.06990	9.18**	0.41983	0.615
Constant	\$	-0.19513	-3.31**		

R-square=0.71

F-ratio=178.80

Observations=291

CORRELATION MATRIX:

Price	1.00				
PopuDen	-.32	1.00			
Non-farm	-.14	-.08	1.00		
Improved	-.69	.04	.03	1.00	
Constant	-.02	-.17	.06	-.61	1.00

'ns' = Non-significant,
'**' = Significant at 1% level
'*' = Significant at 5% level
Ind. = Individual

TABLE 35
Farm land tax per acre

Alberta 1971

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Price	\$	0.00598	6.97**	0.61582	0.542
PopuDen	Ind.	0.02195	2.83**	0.36512	0.151
Non-farm	\$	-0.00233	-1.15ns	-0.15619	-0.031
Improved	%	0.79629	4.70**	-0.30896	0.580
Constant	\$	-0.21577	-2.17*		

R-square=0.84

F-ratio=65.22

Observations=54

CORRELATION MATRIX:

Price	1.00
PopuDen	-.13 1.00
Non-farm	-.34 -.79 1.00
Improved	-.46 -.13 .34 1.00
Constant	-.05 -.05 -.00 -.80 1.00

'ns' = Non-significant,
'**' = Significant at 1% level
'*' = Significant at 5% level
Ind. = Individual

TABLE 36						
Farm land tax per acre						
Alberta 1976						
Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean	
PRICE	\$	0.00294	8.77**	0.62273	0.568	
PopuDen	Ind.	0.02300	2.11*	0.37328	0.127	
Non-farm	\$	-0.00052	-0.25ns	-0.04287	-0.008	
Improved	%	0.78476	3.51**	0.18027	0.409	
Constant	\$	-0.11844	-0.86ns			

R-square=0.89

F-ratio=98.26

Observations=54

CORRELATION MATRIX:

```

Wealth      1.00
PopuDen     -.25 1.00
Non-farm     -.03 -.92 1.00
Improved     -.33 -.11 .20 1.00
Constant     -.10 -.02 .02 -.85 1.00

```

'ns' = Non-significant,
 '**' = Significant at 1% level
 '*' = Significant at 5% level
 Ind. = Individual

TABLE 37
Total expenditure
Manitoba 1971

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Wealth	\$	0.00193	1.31ns	0.08619	0.089
Non-farm	\$	0.04842	5.60**	0.29773	0.123
Populatn	Ind.	57.41000	5.60**	0.39297	0.356
Improved	%	1.24950	7.08**	0.37469	0.461
Constant	\$	-8922.80000	-0.50ns		

R-square=0.84

F-ratio=132.07

Observations=107

'ns' = Non-significant,
 '**' = Significant at 1% level
 '*' = Significant at 5% level
 Ind. = Individual

TABLE 38
Total expenditure

Manitoba 1976

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Wealth	\$	0.00336	2.86**	0.17721	0.183
Non-farm	\$	0.07698	5.43**	0.33692	0.143
Populatn	Ind.	81.91800	3.88**	0.29150	0.250
Improved	%	2.46970	6.71**	0.35161	0.459
Constant	\$	-23038.00000	-0.64ns		

R-square=0.85

F-ratio=143.80

Observations=107

'ns' = Non-significant,

'**' = Significant at 1% level

'*' = Significant at 5% level

Ind. = Individual

TABLE 39

Total expenditure

Saskatchewan 1971

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Wealth	\$	0.00299	4.14**	0.16177	0.146
Non-farm	\$	0.07036	25.90**	0.58606	0.130
Populatn	Ind.	45.67300	6.31**	0.18484	0.147
Improved	%	0.85353	10.53**	0.35944	0.463
Constant	\$	-32919.00	3.74**		

R-square=0.86

F-ratio= 447.90

Observations=291

'ns' = Non-significant,

'**' = Significant at 1% level

'*' = Significant at 5% level

Ind. = Individual

TABLE 40

Total expenditure

Saskatchewan 1976

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Wealth	\$	0.00321	5.10**	0.26546	0.235
Non-farm	\$	0.06161	19.35**	0.51927	0.093
Populatn	Ind.	72.83600	5.89**	0.19012	0.132
Improved	%	1.01920	5.48**	0.26016	0.350
Constant	\$	86269.00000	4.85**		

R-square=0.81

F-ratio=300.81

Observations=291

'ns' = Non-significant,

'**' = Significant at 1% level

'*' = Significant at 5% level

Ind. = Individual

TABLE 41
Total expenditure
Alberta 1971

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Wealth	\$	0.00232	1.19ns	0.07760	0.087
Non-farm	\$	0.05988	10.42**	0.64721	0.266
Populatn	Ind.	65.58400	4.00**	0.25549	0.242
Improved	%	1.46950	4.99**	0.28564	0.437
Constant	\$	-51728.00000	-0.49ns		

R-square=0.94

F-ratio=183.17

Observations=54

'ns' = Non-significant,

'**' = Significant at 1% level

'*' = Significant at 5% level

Ind. = Individual

TABLE 42
Total expenditure

Alberta 1976

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Wealth	\$	0.00188	1.58*	0.09112	0.117
Non-farm	\$	0.09330	10.10**	0.81278	0.365
Populatn	Ind.	39.97700	1.19ns	0.10361	0.090
Improved	%	2.13200	3.74**	0.18507	0.355
Constant	\$	210920.00000	0.91ns		

R-square=0.94

F-ratio=192.26

Observations=54

'ns' = Non-significant,
'**' = Significant at 1% level
'*' = Significant at 5% level
Ind. = Individual

TABLE 43
Expenditure per acre

Manitoba 1971

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Price	\$	0.00809	3.39**	0.22925	0.348
PopuDen	Ind.	0.08224	4.52**	0.35827	0.319
Non-farm	\$	0.04852	5.89**	0.35227	0.126
Improved	%	1.22460	5.57**	0.26904	0.440
Constant	\$	-0.39827	-3.54**		

R-square=0.87

F-ratio=175.74

Observations=107

'ns' = Non-significant,

'**' = Significant at 1% level

'*' = Significant at 5% level

Ind. = Individual

TABLE 44
Expenditure per acre

Manitoba 1976

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Price	\$	0.00698	5.25**	0.24627	0.354
PopuDen	Ind.	-0.03842	-1.51ns	-0.08400	-0.074
Non-farm	\$	0.16236	18.31**	0.81108	0.310
Improved	%	2.87380	7.88**	0.27142	0.519
Constant	\$	-0.36790	-2.06*		

R-square=0.94

F-ratio=366.10

Observations=107

'ns' = Non-significant,
'**' = Significant at 1% level
'*' = Significant at 5% level
Ind. = Individual

TABLE 45
Expenditure per acre

Saskatchewan 1971

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Price	\$	0.00535	4.65**	0.17925	0.254
PopuDen	Ind.	0.07450	5.73**	0.17102	0.152
Non-farm	\$	0.07387	28.64**	0.70232	0.141
Improved	%	0.73211	7.06**	0.23675	0.393
Constant	\$	0.07766	1.42ns		

R-square=0.83

F-ratio=354.72

Observations=291

'ns' = Non-significant,
'**' = Significant at 1% level
'*' = Significant at 5% level
Ind. = Individual

TABLE 46
Expenditure per acre
Saskatchewan 1976

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Price	\$	0.00378	4.22**	0.20232	0.269
PopuDen	Ind.	0.09959	4.22**	0.14479	0.113
Non-farm	\$	0.06365	19.83**	0.63013	0.010
Improved	%	1.08560	4.82**	0.21568	0.369
Constant	\$	0.30711	2.69**		

R-square=0.73

F-ratio=189.30

Observations=291

'ns' = Non-significant,
'**' = Significant at 1% level
'*' = Significant at 5% level
Ind. = Individual

TABLE 47
Expenditure per acre

Alberta 1971

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Price	\$	0.00619	3.82**	0.11640	0.212
PopuDen	Ind.	0.10319	7.04**	0.31579	0.268
Non-farm	\$	0.05017	13.07**	0.61353	0.247
Improved	%	0.87369	2.73**	0.06192	0.240
Constant	\$	0.07784	0.41ns		

R-square=0.98

F-ratio=636.98

Observations=54

'ns' = Non-significant,
'**' = Significant at 1% level
'*' = Significant at 5% level
Ind. = Individual

TABLE 48
Expenditure per acre

Alberta 1976

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Price	\$	0.00273	1.64ns	0.06553	0.145
PopuDen	Ind.	0.36388	6.71**	0.66903	0.555
Non-farm	\$	0.02935	2.85**	0.27485	0.124
Improved	%	-0.60301	-0.54ns	-0.01576	-0.087
Constant	\$	1.1714	1.71ns		

R-square=0.96

F-ratio=334.53

Observations=54

'ns' = Non-significant,

'**' = Significant at 1% level

'*' = Significant at 5% level

Ind. = Individual

TABLE 49
Average land price

Manitoba 1971

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
SoilPrd1	%	1.17560	3.75**	0.16756	0.023
SoilPrd2	%	0.63168	8.94**	0.42814	0.255
SoilPrd3	%	0.40168	4.82**	0.20493	0.131
Distance	Miles	392.05000	4.11**	0.18779	0.025
Building	\$	0.82331	5.06**	0.26256	0.101
PopuDen	Ind.	1.46980	4.15**	0.22589	0.133
FarmSize	%	-0.13501	-1.46ns	-0.07063	-0.101
FertChem	\$	10.36700	3.61**	0.19186	0.148
Constant	\$	20.92900	3.10**		

R-square=0.87

F-ratio=79.53

Observations=107

CORRELATION MATRIX:

SoilPrd1	1.00								
SoilPrd2	.03	1.00							
SoilPrd3	.08	.37	1.00						
Distance	.09	-.22	-.27	1.00					
Building	.22	.22	.20	-.20	1.00				
PopuDen	-.05	-.33	-.21	-.25	-.30	1.00			
FarmSize	-.08	.47	.22	-.06	-.21	-.34	1.00		
FertChem	-.53	-.16	-.21	.05	-.39	-.17	.16	1.00	
Constant	.16	-.62	-.45	.23	.09	.23	-.86	-.28	1.00

'ns' = Non-significant,
'**' = Significant at 1% level
'*' = Significant at 5% level
Ind. = Individual

TABLE 50
Average land price
Manitoba 1976

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
SoilPrd1	%	3.0985	3.67**	0.15718	0.026
SoilPrd2	%	1.55990	7.99**	0.37629	0.269
SoilPrd3	%	0.95930	4.26**	0.17419	0.134
Distance	Miles	695.96000	2.31*	0.11864	0.019
Building	\$	2.00530	4.66**	0.24562	0.087
PopuDen	Ind.	4.18460	4.47**	0.25933	0.160
FarmSize	%	-0.91665	-3.63**	-0.17069	-0.293
FertChem	\$	33.03900	4.33**	0.21763	0.202
%Foreign	%	1.69990	4.33**	0.19055	0.115
Constant	\$	48.31000	2.61ns		

R-square=0.88

F-ratio=78.79

Observations=107

CORRELATION MATRIX:

SoilPrd1	1.00									
SoilPrd2	.04	1.00								
SoilPrd3	.08	.39	1.00							
Distance	.03	-.28	-.29	1.00						
Building	.20	.25	.18	-.19	1.00					
PopuDen	-.02	.30	-.18	-.31	-.41	1.00				
FarmSize	-.09	.40	.20	.08	-.13	-.36	1.00			
FertChem	-.53	-.19	-.21	.15	-.32	-.19	.16	1.00		
%Foreign	.07	.23	.15	-.44	-.03	.09	-.20	-.14	1.00	
Constant	.15	-.63	-.46	.21	.08	.24	-.81	-.26	-.15	1.00

'ns' = Non-significant,

'**' = Significant at 1% level

'*' = Significant at 5% level

Ind. = Individual

TABLE 51

Average land price

Saskatchewan 1971

Variable Name	Unit	Co-eff.	T-ratio	Stnd. Co-eff.	Elast. at mean
SoilPrd1	%	0.86772	13.67**	0.52745	0.055
SoilPrd2	%	0.54935	14.82**	0.68343	0.180
SoilPrd3	%	0.34649	10.98**	0.46289	0.180
SoilPrd4	%	0.13413	2.61**	0.10080	0.023
Distance	Miles	296.13000	7.41**	0.21576	0.020
Building	\$	0.52396	1.44ns	0.06756	0.022
PopuDen	Ind.	3.87460	0.66ns	0.26543	0.167
FarmSize	%	-0.39573	-9.27**	-0.38837	-0.301
FertChem	\$	6.97290	2.65**	0.09640	0.032
Constant	\$	38.07800	13.19**		

R-square=0.81

F-ratio=130.89

Observations=291

CORRELATION MATRIX:

SoilPrd1	1.00									
SoilPrd2	.39	1.00								
SoilPrd3	.39	.69	1.00							
SoilPrd4	.26	.58	.57	1.00						
Distance	.05	-.12	-.11	-.14	1.00					
Building	-.08	-.07	-.07	-.11	-.34	1.00				
PopuDen	-.26	-.26	-.19	.03	.03	-.46	1.00			
FarmSize	.15	.17	.33	.28	.14	-.45	-.18	1.00		
FertChem	-.51	-.19	-.04	-.01	-.06	-.01	.00	-.12	1.00	
Constant	-.17	-.52	-.74	-.72	.01	.36	-.18	-.63	-.06	1.00

'ns' = Non-significant,

'**' = Significant at 1% level

'*' = Significant at 5% level

Ind. = Individual

TABLE 53
Average land price

Alberta 1971

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
SoilPrd1	%	0.36314	0.99ns	0.06754	0.019
SoilPrd2	%	0.50626	3.77**	0.16299	0.121
SoilPrd3	%	0.19910	1.08ns	0.04433	0.068
Distance	Miles	670.85000	6.07**	0.39062	0.092
Building	\$	2.08200	3.46**	0.29061	0.166
PopuDen	Ind.	1.26570	3.53**	0.20454	0.096
FarmSize	%	-0.52075	-3.26**	-0.21693	-0.320
FertChem	\$	31.77800	6.79**	0.36882	0.395
Constant	\$	29.30100	3.15**		

R-square=0.94

F-ratio=81.20

Observations=54

CORRELATION MATRIX:

SoilPrd1	1.00								
SoilPrd2	.27	1.00							
SoilPrd3	.07	.05	1.00						
Distance	-.52	.04	.00	1.00					
Building	-.35	-.34	-.29	-.06	1.00				
PopuDen	.05	.13	.25	-.23	-.50	1.00			
FarmSize	.38	.29	.28	-.08	-.69	0.15	1.00		
FertChem	-.43	-.39	-.01	-.06	.19	.03	-.41	1.00	
Constant	-.10	-.30	-.74	.12	.51	-.33	-.68	-.05	1.00

'ns' = Non-significant,

'**' = Significant at 1% level

'*' = Significant at 5% level

Ind. = Individual

TABLE 54
Average land price

Alberta 1971

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
SoilPrd1	%	-0.25267	-0.18ns	-0.01412	-0.004
SoilPrd2	%	0.66797	1.36ns	0.06462	0.054
SoilPrd3	%	0.27610	0.42ns	0.01847	0.032
Distance	Miles	2078.20000	4.98**	0.36360	0.097
Building	\$	10.33800	4.16**	0.37535	0.217
PopuDen	Ind.	2.71450	3.22**	0.20750	0.078
FarmSize	%	-1.88350	-3.38**	-0.23576	-0.393
FertChem	\$	117.14000	6.91**	0.40850	0.495
Constant	\$	101.11000	3.02**		

R-square=0.95

F-ratio=66.04

Observations=54

CORRELATION MATRIX:

SoilPrd1	1.00								
SoilPrd2	.29	1.00							
SoilPrd3	.08	.03	1.00						
Distance	-.54	.01	-.04	1.00					
Building	-.43	-.34	-.24	.04	1.00				
PopuDen	.13	.14	.23	-.35	-.50	1.00			
FarmSize	.41	.29	.25	-.15	-.67	.19	1.00		
FertChem	-.41	-.38	.01	-.05	.14	.04	-.38	1.00	
Constant	-.22	-.29	-.73	.17	.49	-.30	-.69	-.08	1.00

'ns' = Non-significant,
'**' = Significant at 1% level
'*' = Significant at 5% level
Ind. = Individual

TABLE 55

Price with land tax per acre

Manitoba 1971

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Tax/Acre	\$	11.80000	3.58**	0.26719	0.187
SoilPrd1	%	0.77073	2.43**	0.10985	0.015
SoilPrd2	%	0.42552	4.83**	0.28841	0.172
SoilPrd3	%	0.32547	3.99**	0.16605	0.106
Distance	Miles	355.79000	3.92**	0.17042	0.022
Building	\$	0.78960	5.13**	0.25181	0.097
PopuDen	Ind.	0.98711	2.56**	0.14402	0.085
FarmSize	%	-0.07171	-0.60ns	-0.03752	-0.054
FertChem	\$	8.19190	2.95**	0.15161	0.117
Constant	\$	18.56200	2.90**		

R-square=0.88

F-ratio=80.72

Observations=107

CORRELATION MATRIX:

Tax/acre	1.00									
SoilPrd1	-.36	1.00								
SoilPrd2	-.65	.25	1.00							
SoilPrd3	-.26	.16	.44	1.00						
Distance	-.11	.12	-.09	-.23	1.00					
Building	-.06	.23	.20	.21	-.19	1.00				
PopuDen	-.40	.10	.04	-.07	-.18	-.25	1.00			
FarmSize	.20	-.15	.22	.16	-.08	-.22	-.39	1.00		
FertChem	-.22	-.40	.02	-.14	.07	-.37	-.06	.10	1.00	
Constant	-.10	.19	-.40	-.40	.23	.10	.26	-.86	-.25	1.00

'ns' = Non-significant,
 '**' = Significant at 1% level
 '*' = Significant at 5% level
 Ind. = Individual

TABLE 56

Price with land tax per acre

Manitoba 1976

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Tax/Acre	\$	19.62200	3.49**	0.26629	0.250
SoilPrd1	%	2.10410	2.49**	0.10674	0.178
SoilPrd2	%	1.01470	4.19**	0.24476	0.175
SoilPrd3	%	0.66921	2.93**	0.12151	0.093
Distance	Miles	508.25000	1.75 *	0.08665	0.014
Building	\$	2.11190	5.17**	0.25867	0.092
PopuDen	Ind.	2.69700	2.74**	0.16714	0.103
FarmSize	%	-0.66836	-2.68**	-0.12445	-0.213
FertChem	\$	27.17400	3.67**	0.17900	0.167
%Foreign	%	1.69070	4.55**	0.19000	0.115
Constant	\$	32.441	1.79 *		

R-square=0.89

F-ratio=80.36

Observations=107

CORRELATION MATRIX:

Tax/acre	1.00									
SoilPrd1	-.34	1.00								
SoilPrd2	-.65	.24	1.00							
SoilPrd3	-.36	.19	.51	1.00						
Distance	-.19	.09	-.09	-.20	1.00					
Building	.07	.16	.14	.14	-.20	1.00				
PopuDen	-.43	.13	.07	.01	-.19	-.40	1.00			
FarmSize	.29	-.18	.11	.07	.02	-.10	-.43	1.00		
FertChem	-.23	-.41	.01	-.11	.18	-.32	-.07	.09	1.00	
%Foreign	-.01	.07	.18	.14	-.43	-.03	.08	-.19	-.13	1.00
Constant	-.25	.22	-.30	-.33	.25	.05	.32	-.83	-.11	-.15
Constant	1.00									

'ns' = Non-significant,

'**' = Significant at 1% level

'*' = Significant at 5% level

Ind. = Individual

TABLE 57

Price with land tax per acre

Saskatchewan 1971

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Tax/Acre	\$	21.84000	7.90**	0.34700	0.296
SoilPrd1	%	0.51046	6.92**	0.31028	0.032
SoilPrd2	%	0.30687	6.75**	0.38177	0.101
SoilPrd3	%	0.21577	6.53**	0.28826	0.112
SoilPrd4	%	0.07507	1.59 *	0.05642	0.013
Distance	Miles	260.99000	7.16**	0.19016	0.018
Building	\$	0.71870	2.17 *	0.09267	0.030
PopuDen	Ind.	2.35990	3.74**	0.15167	0.101
FarmSize	%	-0.26342	-6.25**	-0.25853	-0.200
FertChem	\$	13.30100	5.28**	0.18388	0.603
Constant	\$	26.71000	8.95**		

R-square=0.84

F-ratio=149.80

Observations=291

CORRELATION MATRIX:

Tax/acre	1.00									
SoilPrd1	-.62	1.00								
SoilPrd2	-.67	.64	1.00							
SoilPrd3	-.50	.57	.78	1.00						
SoilPrd4	-.16	.30	.53	.57	1.00					
Distance	-.12	.12	-.00	-.04	-.11	1.00				
Building	.07	-.11	-.10	-.10	-.12	-.34	1.00			
PopuDen	-.30	-.00	.02	-.00	.07	.07	-.46	1.00		
FarmSize	.40	-.13	-.15	.06	.19	.08	-.38	-.28	1.00	
FertChem	.32	-.58	-.35	-.20	-.06	-.02	.01	-.10	.02	1.00
Constant	-.48	.18	-.01	-.32	-.55	.07	.28	-.00	-.70	-.20
Constant	1.00									

'ns' = Non-significant,

'**' = Significant at 1% level

Ind. = Individual

'*' = Significant at 5% level

TABLE 58

Price with land tax per acre

Saskatchewan 1976

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Tax/Acre	\$	36.10600	7.09**	0.34180	0.301
SoilPrd1	%	0.96061	4.43**	0.22181	0.025
SoilPrd2	%	1.03190	7.33**	0.48766	0.142
SoilPrd3	%	0.72077	6.98**	0.36578	0.156
SoilPrd4	%	0.53640	3.41**	0.15313	0.039
Distance	Miles	703.81000	6.03**	0.19480	0.020
Building	\$	1.84190	1.52 *	0.06391	0.019
PopuDen	Ind.	8.07790	4.84**	0.21957	0.129
FarmSize	%	-0.66157	-4.73**	-0.24664	-0.211
FertChem	\$	12.81400	1.66 *	0.06729	0.024
%Foreign	%	2.65190	4.11**	0.12733	0.048
GovtOwnd	%	-4.24770	-4.27**	-0.14443	-0.034
Constant	\$	49.67400	5.23**		

R-square=0.78

F-ratio=82.54

Observations=291

CORRELATION MATRIX:

Tax/acre	1.00									
SoilPrd1	-.58	1.00								
SoilPrd2	-.64	.62	1.00							
SoilPrd3	-.42	.54	.76	1.00						
SoilPrd4	-.09	.31	.55	.61	1.00					
Distance	-.11	.07	-.05	-.09	-.17	1.00				
Building	-.01	-.03	-.04	-.06	-.10	-.31	1.00			
PopuDen	-.16	-.09	-.10	-.13	-.04	-.02	-.38	1.00		
FarmSize	.39	-.13	-.12	.14	.26	-.01	-.30	-.34	1.00	
FertChem	.24	-.56	-.31	-.16	-.06	.04	.01	-.07	-.01	1.00
%Foreign	-.05	-.10	-.16	-.18	-.30	.05	.02	.12	.00	.07
GovtOwnd	.01	-.11	-.17	-.24	-.23	.14	.08	.20	-.46	.02
Constant	-.49	.15	-.04	-.38	-.55	.13	.22	.06	-.73	-.16
%Foreign	1.00									
GovtOwnd	.00	1.00								
Constant	-.05	.26	1.00							

'ns' = Non-significant

'**' = Significant at 1% level

'*' = Significant at 5% level

Ind. = Individual

TABLE 59

Price with land tax per acre

Alberta 1971

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Tax/Acre	\$	22.07900	2.03 *	0.21446	0.244
SoilPrd1	%	-0.05185	-0.13ns	-0.00964	-0.003
SoilPrd2	%	0.26155	1.48 *	0.08420	0.062
SoilPrd3	%	0.0178	0.09ns	0.00396	0.006
Distance	Miles	681.6	6.37**	0.39688	0.094
Building	\$	1.5629	2.46**	0.21814	0.125
PopuDen	Ind.	0.83908	2.07**	0.1356	0.064
FarmSize	%	-0.46615	-2.96**	-0.19419	-0.286
FertChem	\$	29.958	6.50**	0.3477	0.373
Constant	\$	26.013	2.85**		

R-square=0.94

F-ratio=77.63

Observations=54

CORRELATION MATRIX:

Tax/acre	1.00									
SoilPrd1	-.50	1.00								
SoilPrd2	-.68	.51	1.00							
SoilPrd3	-.45	.28	.34	1.00						
Distance	.05	-.48	-.00	-.02	1.00					
Building	-.40	-.08	.05	-.06	-.08	1.00				
PopuDen	-.52	.30	.44	.43	-.22	-.18	1.00			
FarmSize	.17	.24	.09	.17	-.07	-.69	.04	1.00		
FertChem	-.19	-.27	-.15	.08	-.07	.25	.12	-.42	1.00	
Constant	-.18	-.07	-.09	-.57	.11	.53	-.18	-.69	-.01	1.00

'ns' = Non-significant,

'**' = Significant at 1% level

'*' = Significant at 5% level

Ind. = Individual

TABLE 61

Price with effective tax rate

Manitoba 1971

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Eff. Tax	\$	-465.69	-1.71 *	-0.08193	-0.096
SoilPrd1	%	1.2306	3.94**	0.17540	0.024
SoilPrd2	%	0.68412	8.95**	0.46368	0.276
SoilPrd3	%	0.41899	5.03**	0.21376	0.136
Distance	Miles	22.806	3.81**	0.17473	0.023
Building	\$	0.81035	5.02**	0.25843	0.1
PopuDen	Ind.	1.6158	4.48**	0.24832	0.146
FarmSize	%	-0.1785	-1.87 *	-0.09339	-0.133
FertChem	\$	10.128	3.56**	0.18745	0.145
Constant	\$	27.851	3.56**		

R-square=0.87

F-ratio=72.40

Observations=107

CORRELATION MATRIX:

Eff. Tax	1.00									
SoilPrd1	-.10	1.00								
SoilPrd2	-.40	.07	1.00							
SoilPrd3	-.12	.09	.39	1.00						
Distance	.17	.07	-.26	-.28	1.00					
Building	.05	.22	.18	.19	-.19	1.00				
PopuDen	-.24	-.02	-.20	-.17	-.28	-.30	1.00			
FarmSize	.27	-.11	.30	.18	-.01	-.19	-.38	1.00		
FertChem	.05	-.53	-.17	-.21	.06	-.39	-.18	.16	1.00	
Constant	-.52	.19	-.28	-.32	.11	.05	.32	-.85	-.26	1.00

'ns' = Non-significant,

'**' = Significant at 1% level

'*' = Significant at 5% level

Ind. = Individual

TABLE 62

Price with effective tax rate

Manitoba 1976

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Eff. Tax	\$	-3710.7	-4.45**	-0.17878	-0.280
SoilPrd1	%	3.327	4.32**	0.16877	0.028
SoilPrd2	%	1.7689	9.59**	0.42672	0.306
SoilPrd3	%	1.0903	5.25**	0.19798	0.152
Distance	Miles	43.629	2.53**	0.119	0.019
Building	\$	1.754	4.41**	0.21484	0.076
PopuDen	Ind.	4.5283	5.26**	0.28064	0.173
FarmSize	%	-1.0156	-4.38**	-0.18911	-0.324
FertChem	\$	28.45	4.04**	0.18740	0.174
%Foreign	%	1.2033	3.20**	0.13489	0.082
Constant	\$	102.43	4.92**		

R-square=0.90

F-ratio=86.79

Observations=107

CORRELATION MATRIX:

Eff. Tax	1.00									
SoilPrd1	-.07	1.00								
SoilPrd2	-.25	.05	1.00							
SoilPrd3	-.14	.09	.41	1.00						
Distance	-.00	.03	-.27	-.29	1.00					
Building	.14	.19	.20	.15	-.19	1.00				
PopuDen	-.09	-.02	-.27	-.16	-.31	-.42	1.00			
FarmSize	.10	-.10	.36	.18	.08	-.11	-.36	1.00		
FertChem	.15	-.53	-.22	-.23	.15	-.29	-.20	.17	1.00	
%Foreign	.30	.04	.13	.10	-.42	.01	.06	-.16	-.08	1.00
Constant	-.58	.16	-.34	-.29	.17	-.02	.25	-.71	-.29	-.29
Constant	1.00									

'ns' = Non-significant,

'**' = Significant at 1% level

'*' = Significant at 5% level

Ind. = Individual

TABLE 63

Price with effective tax rate

Saskatchewan 1971

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Eff. Tax	\$	-856.48	-4.6 **	-0.1344	-0.19
SoilPrd1	%	0.92579	14.79**	0.56275	0.058
SoilPrd2	%	0.59274	16.01**	0.73742	0.195
SoilPrd3	%	0.36091	11.78**	0.48216	0.187
SoilPrd4	%	0.14701	2.96**	0.11048	0.025
Distance	Miles	11.939	6.69**	0.19137	0.018
Building	\$	0.35406	1.00ns	0.04666	0.015
PopuDen	Ind.	4.2879	6.63**	0.29375	0.184
FarmSize	%	-0.41418	10.00**	-0.40710	-0.315
FertChem	\$	1.9433	0.70ns	0.02687	0.009
Constant	\$	40.804	13.19**		

R-square=0.82

F-ratio=128.38

Observations=291

CORRELATION MATRIX:

Eff. Tax	1.00									
SoilPrd1	-.20	1.00								
SoilPrd2	-.25	.43	1.00							
SoilPrd3	-.10	.40	.69	1.00						
SoilPrd4	-.06	.26	.58	.58	1.00					
Distance	.19	.01	-.16	-.13	-.14	1.00				
Building	.10	-.10	-.10	-.08	-.12	-.31	1.00			
PopuDen	-.14	-.22	-.22	-.17	.04	.01	-.47	1.00		
FarmSize	.10	.13	.14	.32	.27	.16	-.43	-.19	1.00	
FertChem	.39	-.54	-.27	-.08	-.03	.13	.03	-.06	-.07	1.00
Constant	-.67	.02	-.20	-.47	-.49	-.12	.19	-.04	-.53	-.30
Constant	1.00									

'ns' = Non-significant,

'**' = Significant at 1% level

'*' = Significant at 5% level

Ind. = Individual

TABLE 64

Price with effective tax rate

Saskatchewan 1976

Variable Name	Unit	Co-eff.	T-ratio	Stnd. Co-eff.	Elast. at mean
Eff. Tax	\$	-4190.00000	-5.37**	-0.17432	-0.241
SoilPrd1	%	2.07360	11.07**	0.47880	0.055
SoilPrd2	%	1.77120	15.72**	0.83704	0.243
SoilPrd3	%	1.02520	10.61**	0.52026	0.222
SoilPrd4	%	0.58543	3.61**	0.16712	0.042
Distance	Miles	32.11400	5.84**	0.19555	0.020
Building	\$	1.75750	1.40ns	0.06098	0.019
PopuDen	Ind.	9.59550	5.63**	0.26082	0.164
FarmSize	%	-1.12280	-8.40**	-0.41859	-0.357
FertChem	\$	-11.90000	-1.48ns	-0.06249	-0.023
%Foreign	%	2.32230	3.44**	0.11151	0.042
GovtOwnd	%	-3.27730	-3.13**	-0.11143	-0.026
Constant	\$	124.14000	10.78**		

R-square=0.77

F-ratio=75.65

Observations=291

CORRELATION MATRIX:

Eff. Tax	1.00										
SoilPrd1	-.22	1.00									
SoilPrd2	-.16	.41	1.00								
SoilPrd3	.01	.39	.70	1.00							
SoilPrd4	.06	.29	.62	.63	1.00						
Distance	.14	-.02	-.17	-.15	-.17	1.00					
Building	.02	-.05	-.06	-.07	-.10	-.31	1.00				
PopuDen	.04	-.23	-.27	-.22	-.06	-.03	-.38	1.00			
FarmSize	.10	.10	.17	.37	.33	.05	-.32	-.30	1.00		
FertChem	.26	-.55	-.24	-.06	-.02	.10	.02	-.02	-.09	1.00	
%Foreign	.15	-.18	-.26	-.22	-.29	.06	.02	.12	.04	.12	1.00
GovtOwnd	-.18	-.09	-.19	-.26	-.24	.12	.08	.19	-.51	-.02	-.02
Constant	-.67	.02	-.28	-.56	-.55	-.03	.17	-.04	-.56	-.21	-.21
%Foreign	1.00										
GovtOwnd	-.02	1.00									
Constant	-.17	.34	1.00								

'ns' = Non-significant,
 '**' = Significant at 1% level
 '*' = Significant at 5% level
 Ind. = Individual

TABLE 65

Price with effective tax rate

Alberta 1971

Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Eff. Tax	\$	1757.9	-2.43**	-0.12647	-0.25
SoilPrd1	%	0.67056	1.81 *	1.12472	0.035
SoilPrd2	%	0.65088	4.62**	0.20955	0.155
SoilPrd3	%	0.43234	2.16 *	0.09626	0.147
Distance	Miles	557.72	4.85**	0.32476	0.077
Building	\$	1.95130	3.40**	0.27237	0.156
PopuDen	Ind.	1.4493	4.15**	0.23421	0.110
FarmSize	%	0.40654	-2.56**	-0.16931	-0.25
FertChem	\$	25.15	4.82**	0.2919	0.313
Constant	\$	40.987	4.08**		

R-square=0.94

F-ratio=80.68

Observations=54

CORRELATION MATRIX:

Eff. Tax	1.00									
SoilPrd1	-.34	1.00								
SoilPrd2	-.42	.37	1.00							
SoilPrd3	-.48	.22	.24	1.00						
Distance	.41	-.59	-.14	-.20	1.00					
Building	.09	-.36	-.34	-.30	-.02	1.00				
PopuDen	-.22	.12	.21	.32	-.29	-.50	1.00			
FarmSize	-.30	.44	.38	.38	-.19	-.68	.20	1.00		
FertChem	.52	-.52	-.52	-.26	.16	.21	-.09	-.49	1.00	
Constant	-.48	.01	-.03	-.34	-.10	.40	-.18	-.43	-.29	1.00

'ns' = Non-significant,

'**' = Significant at 1% level

'*' = Significant at 5% level

Ind. = Individual

TABLE 66					
Price with effective tax rate					
Alberta 1976					
Variable Name	Unit	Co-eff.	T-ratio	Std. Co-eff.	Elast. at mean
Eff. Tax	\$	-12831.00	-2.53**	-0.13282	-0.294
SoilPrd1	%	0.70182	0.52ns	0.03922	0.012
SoilPrd2	%	1.2038	2.36**	0.11645	0.097
SoilPrd3	%	1.0932	1.55 *	0.07314	0.126
Distance	Miles	1747.4	4.21**	0.30574	0.082
Building	\$	8.2932	3.34**	0.30119	0.174
PopuDen	Ind.	3.4352	4.05**	0.26259	0.098
FarmSize	%	-1.2298	-2.09 *	-0.15394	-0.256
FertChem	\$	98.34200	5.57**	0.34296	0.415
Constant	\$	129.71000	3.86**		

R-square=0.93

F-ratio=66.46

Observations=54

CORRELATION MATRIX:

Eff. Tax	1.00									
SoilPrd1	-.28	1.00								
SoilPrd2	-.01	.37	1.00							
SoilPrd3	-.46	.19	.22	1.00						
Distance	.31	-.58	-.12	-.18	1.00					
Building	.33	-.48	-.43	-.35	.14	1.00				
PopuDen	-.34	.21	.26	.34	-.42	-.55	1.00			
FarmSize	-.04	.48	.42	.40	-.27	-.71	.31	1.00		
FertChem	-.42	-.47	-.48	-.18	.09	.26	-.11	-.49	1.00	
Constant	-.34	-.10	-.11	-.45	.05	.33	-.15	-.43	-.21	1.00

'ns' = Non-significant,

'**' = Significant at 1% level

'*' = Significant at 5% level

Ind. = Individual