"VACANT INDUSTRIAL LAND ANALYSIS IN THE CITY OF WINNIPEG: FISCAL IMPLICATIONS AND POLICY ALTERNATIVES"

BY

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1.0 **Introduction**

The determinants of industrial location decisions within a metropolitan area may have important policy implications for government at both the municipal and provincial levels. Therefore, an understanding of what underlies location decisions is essential for policy makers. In order to accomplish this goal, both demand and supply factors must be considered. Analysis of land price determinants combined with the annual absorption and existing supply of vacant industrial land will enable civic policy makers to determine how Winnipeg can effectively meet industry's present and future demands.

An adequate supply of vacant land which exists in appropriate locations is essential to promote industrial growth within any metropolitan centre. However, industry will not be enticed to develop in locations that are unable to provide the essential ingredients for sustained industrial growth. A thorough understanding of what these ingredients are, enables government to determine why industry chooses one specific site relative to another. Effective development policy goes well beyond land development, which is premised upon the supply side of the market and merely identifies the need to ensure a significant range of locational choice and potential for different intensities and standards of development as a means of encouraging industrial growth. Maintaining a significant inventory of industrial land in all sectors of the City is but part of the answer to resolving Winnipeg's plan for future industrial growth. Market segmentation is a key element in determining how government should promote an efficient use of public resources in the field of industrial development. If the existing supply does not match demand requirements regarding locational factors then aside from increasing the supply of available industrial land in appropriate locations, two avenues of fiscal management may be pursued in an attempt to re-distribute the demand for industrial land to areas which may presently contain an excess supply of appropriate sites. Land cost reductions and property tax incentives have both been effectively used in the past by governments in order to attract industry to specific locations within municipal boundaries.

Can such incentives be effectively used to re-distribute the demand for industrial land in Winnipeg? The model developed within this study analyzes price determinants of industrial land and clearly identifies the influence of property taxes and zoning on the demand for such land in this City.

Industry's profit maximization objective does not necessarily correspond to government's primary interest in maximizing the welfare of its residents. The total utility of a community's inhabitants is interdependent on the level of private goods, government goods and the living conditions within the community. "Well-being is maximized when the community chooses industry such that the marginal environmental damage from industry is equal to the additional compensation resulting from another unit of industry locating in the community."[1] In order to partially compensate the community for servicing costs and destruction imposed upon the local environment through industrial externalties such as air and water pollution, excessive noise and congestion, the municipality assesses local firms with a property tax.

Industry's optimum arrangement would ensure that firms situate themselves such that the total cost of locating in each neighbourhood is identical. In this instance, total cost includes rents, differential location factors and "net taxes" (property taxes minus services received). Although net taxes do not form a significant portion of total costs,

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[1]Fox, W.F., Fiscal Differentials and Industrial Location: Some Empirical Evidence, Urban Studies (1981), 18, p. 106.

their percentage of the firm's profit margin can be substantial. Therefore, this marginal expenditure is a factor to be concerned with, since the foundation to industry's primary objective of maximizing profits is based on cost minimization. The property tax leads to a more efficient use of resources, in that firms are forced to consider both the public and private costs (capital and labour) of their production. If more firms want to locate than are compatible with the community's welfare, then zoning authority must be exercised.

1.1 **Property Tax Incidence: Traditional versus New View**

In order to determine whether intrametropolitan property tax incentives may effectively be used to attract industrial development from specific locations within the City of Winnipeg, it becomes essential to identify who pays the property tax. Do property taxes change industry's behavior and, if so, to what extent does this occur?

Economic theory presently contains two views relating to property tax incidence. As distinct from the conventional view, which suggests that the incidence of property taxation on structures (except for owner-occupiers) rests on tenants and consumers of the services of these structures, the new view states that the burden falls on property owners. The difference is based on the way in which the tax is viewed. Whereas the traditional approach dealt with incidence in a specific municipality, the new view assesses incidence from a national perspective.

The traditional approach assumes that the tax is separable into two components: a tax on land and a tax on structures. Supporters of this view assume that land is fixed in supply and thus any tax must be borne by the owner. It cannot be shifted to others by changing the totally inelastic supply of land and, therefore, land taxes are fully capitalized into the price of land with the consequent effect that land prices will fall.

The supply of structures, on the other hand, may be altered via capital expansion projects, and consequently a tax on structures may be shifted forward to the consumers of the goods and services produced by the buildings. The supporters of this view assume that any quantity of structures will be provided at a specific rate of return (infinitely elastic supply curve) in the long run. Consequently, in the case of non-residential property, the entire amount of the tax on structures will be passed on to consumers of goods and services produced by commerce and industry. The conventional outlook, views the incidence of taxation on structures as regressive, in that it absorbs a greater percentage of the income of low income earners than of high income earners.

The new view states that the burden falls on the owners of capital, since this approach evaluates incidence over the entire nation, assuming a fixed supply of capital (land and structures).

The new view assumes that the total supply of labour and capital is fixed, product and factor markets are perfectly competitive with factors receiving the value of their marginal product, and capital is perfectly mobile between industries and regions.[2] The tax is "borne by the owners of these assets and since this ownership is assumed to be more concentrated among high income than low income earners, the incidence of the tax will be progressive."[3]

The new view does not alter the economist's perception of the potential efficiency involved with the use of tax incentives to redistribute the demand for industrial

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[2]Kitchen, H., "Local Government Finance in Canada," (1984), p. 202.

[3]*Ibid*.

development, since regardless of the view one adheres to, excise tax effects still exist.

Netzer in particular, identifies that excise tax effects exist, regardless of how one judges incidence, whether it be on income (rent from reproducible capital structures) or tangible property (land value), as long as the "effective rate" is calculated on taxable property alone. This fundamental view point is in opposition to the traditional view which indicates that the property tax is regressive in nature.

Netzer has calculated the effective tax rate (tax/market value) for the total tangible national wealth in the United States and compared this to the effective rate for just that component of the total wealth that is subject to property taxation. These two effective rates, total versus taxable, differ substantially. The rate applicable to taxable wealth was 1.73 in comparison to the average effective rate for total tangible wealth, which was equal to 1.02. The difference in the two rates, equal to .71, identifies that component of taxable wealth that is shifted forward to consumers and tenants.

1.2 Property Tax Capitalization

Tax capitalization is relevant to the question of whether or not fiscal incentives may be used to modify the demand for industrial location, as it supports the belief that excise effects have an impact on the price of industrial property.

The literature on property tax capitalization is concerned with the negative effect of this tax on the value of property. Analysis carried out to date has attempted to indicate the extent of tax capitalization based upon a combination of two fiscal variables: the effective tax rate and municipal expenditures related to education and non-educational public services. According to the Tiebout hypothesis, the utility maximizing consumer weighs benefits from the local public services against the cost of his tax liability, which is the price of consuming the local output of public goods, and chooses a location which provides him with the greatest surplus of benefits over costs. It is the present value of the future stream of benefits from the public services relative to the present value of future tax payments that is important.

Numerous authors have produced critiques on the inaugural exercise carried out by Oates (1969), in which he attempted to identify the extent of property tax capitalization. These studies attempt to identify the effect, on the value of residential property, of various supply side explanatory variables such as the property tax or effective tax rate, municipal expenditures relating to education as well as other "non-educational" local expenditures, various quantitative and qualitative neighbourhood characteristics, proximity to the downtown (locational variable), and various physical attributes of the property in question.

Oates (1969) developed a cross-sectional analysis designed to test the effects of local property taxes and local expenditure programs on residential property values. His regression equation indicates that local property values bear a "significant negative relationship to the effective tax rate and a significant positive relationship with expenditure per student in the public school system." Property tax capitalization depended upon whether or not there was a corresponding increase in local public spending.

Due to the wide variation in assessment ratios across the nation, Oates chose the effective property tax rate (tax divided by the market value) as opposed to the nominal tax rate for the sake of identifying the appropriate fiscal variable.

As a measure of local public services, he chose the annual expenditure per student in the public school system rather than per capita expenditure. The latter is considered a poor measure of the level or quality of output, whereas the quality of education in the local school systems should vary directly with expenditure per pupil for a group of communities within the same metropolitan area.

Two major areas of concern regarding Oates' original model expressed by a majority of authors involved mis-specified explanatory variables and structural problems related to the type of model in question. The criticism surrounding mis-specification is based upon certain "left out or inappropriate" explanatory variables in the model which result in inaccurate estimates of the independent variable coefficients.

1.3 Comparison of Research Methodologies: Strengths and Weaknesses

Prior to 1978, economists provided very little evidence as to the effect of fiscal variables upon the location of industry. Oakland (1978)[4] identified three interrelated factors that account for this:

1. The processes which influence intrametropolitan industrial location were not fully understood at that time. That is, an acceptable intra-urban industrial model encompassing both the demand for and supply of vacant industrial land had not been identified yet. Earlier models were inappropriate in that they emphasized variables which reflected costs of production and distribution (demand side - firm) which totally ignored the fact that communities have a strong interest in the location choice of firms. That is, the supply side (community) of this market for vacant industrial land is essential in determining the effect of taxes on the choice of industrial location.

2. There was a general lack of necessary data. City Assessment Departments are reluctant to allow the general public into their records for two reasons:

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[4]Oakland, W. H. (1978), "Local Taxes and Intra-urban Industrial Location: A Survey," Metropolitan Finance and Growth Management Policies, TRED-9, Madison, Wisconsin, University of Wisconsin Press, pp. 13-30.

a) confidentiality;

b) Assessors are sensitive to criticism and are reluctant to agree to a detailed examination of their assessment practices.

3. Because of this lack of necessary data, few researchers have attempted to study the issue.

1.3.1 Earlier Studies: Supply Side Analysis

The major focus of earlier studies, carried out by Due (1961) and the Advisory Commission on Intergovernmental Relations (1967), was on the impact of interstate fiscal differentials upon industry's choice among states or large metropolitan cities. That is, from one economic region to another. Neither survey found convincing evidence that such a relationship existed since tax differentials were considered insignificant relative to other "regional" cost differences. Therefore, the important consideration for this study is to concentrate on whether fiscal differentials influence the distribution of industrial firms within Winnipeg's urban limits and not whether industrial development can be attracted from other regions based on specific tax incentives that may exist within the City of

Winnipeg as opposed to the region in which the potential firm already exists.

One approach taken with respect to the effects of tax differentials on the location of industrial activity was a statistical comparison of the relative rates of growth in various states and the relative tax burdens. An Iowa study by C. C. Bloom (1955) ascertained, by simple correlation, "the relations between growth in manufacturing employment and capital outlays of manufacturers with per capita state-local tax collections, and growth in such tax collections in the period 1939 - 1953 and 1947 - 1953."[5]

Although no significant correlations were found, there was a slight positive indication that higher taxed states enjoyed more rapid expansion of manufacturing. However, the conclusion to this study was negative, in that there was no demonstrable evidence that high tax levels had retarded the growth of the states involved.

Due (1961) and the Advisory Commission of Intergovernmental Relations (1967) also studied the

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[5]Bloom, C.C., "State and Local Tax Differentials (1955)," Iowa City: Bureau of Business Research, State University of Iowa.

evidence concerning the effect of property tax differentials upon industrial location. The major focus of these surveys was on the impact of interstate differentials upon industry's choice among states or urban areas. Neither survey found convincing evidence that such a relationship exists. To quote Due, "On the basis of all available studies it is obvious that relatively high business tax levels do not have the disastrous effects often claimed for them. While the statistical analysis and study of location factors are by no means conclusive, they suggest very strongly that the tax effects cannot be of major importance."[6] Despite these negative findings, Due conceded that taxes may play a more significant role in intrametropolitan location analysis, as those factors affecting regional choice had already been neutralized. He based his conclusions on the fact that local business taxes amount to a small fraction of total cost, that local taxes are deductible under the federal income tax as well as that businesses may be in a position to shift the burden of what tax cost differentials remain.

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[6] Oakland, W.H., "Local Taxes and Intraurban Industrial Location: A Survey" in G. Break (ed.) Metropolitan Finance and Growth Management Policies, TRED-9, Madison, Wisconsin, University of Wisconsin Press, p. 15.

The ACIR also arrived at similar results. Intra-urban tax differentials may not exert a significant influence on industrial location choice, because the non-fiscal forces underlying the decentralization of urban employment are very strong.[7] However, it was then pointed out that industrial tax havens existed in certain urban areas in order to identify that tax factors actually do matter in the choice of industrial locations.

1.3.20 Pre-1978 Statistical Studies - Demand Side Analysis:

Only three studies carried out prior to 1978 had attempted to isolate the impact of fiscal variables upon intrametropolitan location through the use of a carefully designed empirical model and according to Oakland they "failed to uncover any solid evidence for or against the proposition that intra-urban location decisions of business firms are significantly affected by fiscal considerations."[8] He was specifically referring to three

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[7] Ibid.

[8] Oakland, (1978), "Local Taxes and Intraurban Industrial Location: A Survey, "Metropolitan Finance and Growth Management Policies, p. 28.

major studies carried out by Beaton and Joun (1968), Fox (1973), and Schmenner (1973). The summary contained within APPENDIX Table 1A.1 of this chapter compares these three models.

Similarities:

Each of these studies uses <u>multiple regression analysis</u> to determine the effect of tax rate differentials upon intra-urban industrial location (APPENDIX Table 1A.2). Oakland has pointed out that "none develops a theoretical model of industrial location. Rather, the choice of non-tax determinants is approached in an ad hoc fashion.[9] As one can see from Oakland's matrix, the non-tax determinants employed in these studies have exceptional similarity. Each study contains one or more measures of access to transportation facilities (proximity to railway and freeway). Two of them utilize other access measures: to labour supply (population density) and to urban markets (distance to city centre). Two of them allow for supply conditions in the market for land (price of land and percentage of industrial zoned vacant land). And finally, two of them include measures of government expenditures considered as amenities to industrial development (safety expenditures per capita and per pupil expenditure as a

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[9] <u>Ibid.</u>, p. 17.

fraction of centre city level). "Despite these similarities, the various authors often offer a completely different rational for the inclusion of a variable, not infrequently their sign expectations are opposite."[10] The results of these studies are contained in APPENDIX Table 1A.2.

1.3.21 Beaton and Joun (1968)

Beaton and Joun carried out a study regarding the effect of property taxes on industrial location decisions within the twenty cities located in Orange County, California. They simultaneously estimated two equations pertaining to:

1. Manufacturing
2. Price of land

It was rationalized that the price of land is a significant component in determining intraurban industrial location decisions and therefore "could not be considered

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[10] Ibid., p. 19.

independent of the other variables in the regression equation."[11]

APPENDIX Table 1A.2 identifies manufacturing employment estimates. From the regression results contained therein, it was identified that the property tax rate retards economic development based on the fact that "its sign is negative and is statistically significant."[12] However, once the price of land equation was solved and substituted back into the employment growth equation, the tax rate coefficient of the latter changed signs. Beaton and Joun (1968) identified that high property taxes encourage industry. Not only does this appear most unusual, but the price of land (table 1A.2) had a large, positive coefficient, indicating higher land prices encourage industrial development, which cannot be logically accepted.

In the price of land equation "employment growth had a large, positive, significant coefficient. In addition, the coefficient of the tax rate was positive and significant.

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[11] Oakland, (1978), Local Taxes & Intraurban Industrial Location: A Survey, p. 19.

[12] Ibid., p. 19.

If we substitute from the land price equation into the employment growth equation, most of the coefficients of the latter change sign - including that of the tax rate. Given the unreasonableness of the signs of the price of land in the employment equation, and of the tax rate in the land price equation, such an incredible result cannot be accepted."[13]

1.3.22 Fox (1973)

Fox initially carried out an unpublished study, financed by the Ohio Department of Economic and Community Development in which he obtained separate results for the metropolitan areas of Cleveland and Cincinnati. As with Beaton and Joun, he simultaneously estimated industrial investment (Y) with the price of land (P). Fox also computed the property tax rate (PT), since he reasoned that "areas which have high industrial investment would, ceteris peribus, tend to enjoy lower property tax rates."[14]

In table 1A.2, Fox's estimate of the structural investment equation identifies that "Cleveland's tax rate

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[13] Oakland (1978), Local Taxes and Intrametropolitan Industrial Location: A Survey, p. 20.

[14] Oakland (1978), Local Taxes and Intrametropolitan Industrial Location: A Survey, p. 20.

coefficient is negative and is statistically significant. An analysis of the elasticity of investment to the tax rate identified that industrial investments are extremely responsive to property tax changes. "Evaluated at the mean, the elasticity was equal to 4.4"[15]

Although the coefficients of land price (P), degree of industrialization (I) and safety expenditures (S) have the expected sign, the "coefficients of vacant land and highway accessibility, run counter to one's intuition." That is, their sign is negative, indicating they are not important to industrial investment (Y), which is an unacceptable conclusion.

Fox's analysis of the Cincinnati area indicates a positive correlation between tax rates and industrial investment which according to Oakland, identifies that "the model, as formulated (pre 1978), is compatible with any response to property tax changes."[16] Taking this fact into consideration along with the poor performance of the other independent variables identified that the model, as originally specified, did not work in Fox's analysis of

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[15] Ibid., p. 20

[16] Ibid., p. 21.

Cincinnati. However, since qualifying his original model, to ensure that supply and demand were simultaneously considered in selecting an appropriate sample of industries, the results of Fox's analysis have decisively identified a strong relationship between tax rates and industrial investment: lower property taxes encourage industrial investment. Prior to 1978, Fox's results were at best, "suggestive, that local taxes were important in the location decision."[17]

1.3.23 Schmenner (1973)

Schmenner's work on this topic analyzes the affect of local income tax differentials on intraurban industrial location as well as the effect of property tax differentials. He also carried his analysis of the effect taxes have on intraurban industrial location one step further, in that he studied the effect of taxation differentials upon the intraurban distribution of manufacturing employment levels, as well as upon their change. The distribution of manufacturing establishments and their change within the urban area was also contained within the scope of this research. He estimated relationships for two separate time periods throughout four

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[17] Ibid., p. 21.

metropolitan areas and provided estimates for each of these areas in conjunction with the behavior of all areas considered together. Schmenner's analysis was unquestionably, the most comprehensive of the three empirical studies carried out prior to 1978. As indicated in APPENDIX Table 1A.2, "his results for the distribution of employment and establishment levels failed to show a significant tax association."[18]

As indicated in table 1A.2, tax differential variables used in his model, such as the effective property tax (t^P) and the income tax rates (t^i) and their percentage of the central city rates, as well as per pupil expenditure as a fraction of the central city level, often had the wrong sign and were statistically insignificant.

According to Schmenner, one of the most significant results of his research regarding changes in establishments (stock) indicated that while property tax differentials did not appear important, income tax differentials were of prime importance in intraurban industrial location decisions. However, this assumption is based on results in

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[18]Oakland, (1978), Local Taxes and Intrametropolitan Industrial Location: A Survey, p. 21.

which R^2 was not especially convincing: the regression fit rarely surpassed .25.

Of even greater significance, is the fact that only an aggregate (table 1A.2) of the four metropolitan areas studied produced this result, due to the fact that local income taxes were not levied on a similar basis through the four cities under consideration. Minneapolis - St. Paul did not even have local income taxes during the study period and Kansas City only levied such a tax within its inner city boundary. In Cleveland, virtually no income tax differentials existed, leaving the Cincinnati area with the only significant income tax changes within its urban limits. It would therefore be expected that the Cincinnati area regressions would be significant. This was not the case. The coefficient was negative, but statistically insignificant and therefore indicates that the results reflected in table 1A.2 are not a precise measurement of tax effects on intraurban industrial location. Schmenner's results for employment changes (flow) enhance this point of view, since in all cases, the income tax was statistically insignificant. Consequently, Schmenner's results do not prove that intraurban industrial location decisions may be based on tax considerations.

Overview: Pre '78 Demand Analysis

As identified in table 1A.1, pre '78 statistical research concentrated on demand side analysis, in which multiple regression technique was employed to analyze the effect of all determinants, tax as well as non-tax, on intraurban industrial location. These models emphasized variables which reflect cost of production and distribution while totally ignoring the fact that communities had a strong interest in the locational choice of firms. Consequently, the results of this analysis were inconclusive due to the fact that a substantial percentage of their samples did not even fall on the demand curve for industrial sites (refer to table 1.1).

A specific policy tool such as "zoning" is effectively used by communities to influence industrial location choices. For example, "bedroom" communities are in direct contrast to the City's industrial neighbourhoods. The obvious differences found within the residential and industrial neighbourhoods serve as evidence that the supply side of the market clearly demonstrates control over the type of development it may choose to promote or keep out. Communities which were effectively "zoning out" industrial development should not be included in a study of the effect fiscal incentives have on industrial location, since they did not fall on the industrial site demand curve. Prior to

'78 Beaton and Joun, Schmenner or Fox had not yet identified this extremely important concept. With this qualification, Fox's '78 analysis became the first to decisively relate property tax differentials with intraurban industrial choice location.

1.3.24 Pre '78 Supply Side Analysis: Fischel

By 1974, Fischel had incorporated much of the previous research on demand side analysis into a model of community behavior in which he identified that "communities seek to maximize an objective function which depends upon their constituents consumption of private goods, locally provided public goods, and the quality of the community's environment."[19] Although industry contributes to a localities consumption of public goods by way of property tax payments, it also generated costs. Fischel hypothesized that the optimum level of industrial development was determined by offsetting environmental costs against new fiscal benefits. These fiscal benefits will depend on the community's desire for public as opposed to private goods. Thus, through its demand for a wide

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[19] Oakland, W. H., Taxes and Industrial Development (1978), p. 24.

variety of goods a community gives rise to a supply of industrial sites. "This supply must then be matched with industry's demand in order to determine the actual locational pattern."[20] Fischel was convinced that to be successful, empirical tests of the importance of property taxes in industrial location decisions must simultaneously estimate both demand and supply. However, unlike Fox, he did not pursue an empirical analysis of his hypotheses relating to demand-supply equilibrium, but rather conducted two indirect tests relating to his theory.

His initial test was to identify whether industry actually provides net fiscal benefits to communities. Such benefits were identified as either a decrease in residential property taxes or an increase in educational expenditure. The analysis was carried out for Bergen County, New Jersey utilizing 1970 data. To measure the effect on residential property taxes, Fischel initially regressed property taxes on the commercial and industrial business tax base, the property tax base, public school pupils, median income and miscellaneous local revenue.

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[20] Ibid., p. 25.

Locally financed expenditure upon education per pupil was regressed upon the same independent variables, in order to measure the increase in educational expenditures. In both cases the results of Fischel's research verified his hypotheses, however, both measures of fiscal benefits proved statistically insignificant.

Although he confirmed both commercial and industrial property decreased taxes, the effect was insignificant ($8.60 and $10.40 per $1,000.00 valuation respectively, compared with an average tax payment of $678.00).[21]

Effect on Educational Expenditures:

While it was discovered that commercial property had a positive, but minimal effect on educational expenditures ($12.10 per $1,000.00 of valuation compared with an average

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[21]Oakland, W. H., Local Taxes and Intraurban Industrial Location: A Survey (1978), p. 25.

outlay of $929.00),[22] the effect of industrial property was statistically insignificant. Consequently, based on Fischel's research, it was identified that fiscal benefits resulting from the presence of business were not worth considering.

Fischel's second analysis estimated the impact of business property upon the level of municipal costs pertaining to business-related expenditures. Municipal expenditures regarding outlays for police, fire, streets, sewers, garbage, environmental protection, and public buildings and grounds were regressed on median income, commercial tax base, industrial tax base and miscellaneous revenue.[23] Once again, a relationship existed, however, the effect was minimal. Therefore, upon relating fiscal benefits with fiscal costs, Fischel managed to identify that business property provides a "small net fiscal gain" to a community.

1.3.3 Post '78 Partial Equilibrium Analysis: William Franklin Fox

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[22] Ibid., p. 26.

[23] Ibid., p. 26.

Fox finally developed a partial equilibrium model in which his entire sample represented both demand and supply equilibria. The crux of his model is based on the conclusion that zoning must be considered in selecting the sample for analysis. Otherwise, as occurred in his original 1973 study, a substantial number of observations would not be representative of the demand for industrial development (refer to table 1.3). By qualifying his model in such a way, Fox obtained a very positive correlation between tax incentives and industrial location choice within the City of Cleveland. The pre '78 studies chose non-tax determinants in a "logical attempt" to analyze factors that would affect the amount of industry wishing to locate at each tax payment. In so doing, they were unable to achieve the satisfactory results that Fox had accomplished with his partial equilibrium analysis of Cleveland in 1978.

The model focuses on the relationship between fiscal variables and their effect on intraurban industrial location. He identifies that "industrial location decisions are hypothesized to be made within a system of supply and demand. On the supply side, communities determine the optimal level of industrial activity based on a trade-off between tax revenues and the local environment. The marginal prices of education and environment faced by communities are derived, and from these we get a supply of industrial sites equation which reveals how much industry a given community would be willing to accept"[24] in order to maximize the welfare of its residents. Higher net tax payments give rise to a greater availability of land for industrial development. Hence, the upward sloping supply curve. "On the demand side, firms choose sites so as to minimize costs."[25] The demand for industrial sites, therefore, would depend on those factors which lead to "differentials in costs" between neighbourhoods throughout the City. Since the model identifies taxes as the compensation paid to the community for allowing industry, the demand for sites may be viewed as the price for location. Besides the property tax, other differential cost variables which vary between communities are locational characteristics of a community, business related services provided by a community and the price of land.

It is essential that empirical tests determining the importance of fiscal variables in industrial location decisions "simultaneously" estimate both demand and supply

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[24] Fox, W., Local Taxes and Industrial Location, 1978, Public Finance Quarterly, Vol. 6, No. 1, Jan. '78, p. 93.

[25] Fox, W., "Fiscal Differentials and Industrial Location: Some Empirical Evidence", Urban Studies (1981), p. 106.

relationships. Otherwise, the sample may include some communities which represent only supply effects and the results of such analysis may be biased.

In 1973, Fox included all firms regardless of whether they were zoning out industrial development and hence were not representative of the supply side of the market (community). However, in 1978, using the identical model, he identified only those firms that exhibited both demand (firm) and supply (community) equilibria. Hence, out of the 43 communities that Fox originally identified in 1973, he excluded 20 firms from his 1978 analysis which were zoning out industrial development. That is, he identified that some communities use constraints on the market other than the price of sites, such as zoning, that keep the amount of industry actually locating below the quantity demanded at that level of taxes and rents.

The results obtained from the remaining 23 communities were appropriate for analyzing business demand for sites and enabled Fox to prove decisively, that "the property tax and other fiscal variables are significant determinants of business location."[26] Property taxes have a definite

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[26] Ibid., p. 110.

negative impact on the demand for industrial sites by firms. This result contrasts with most previous research which had found the property tax rate to be unimportant in location decisions. Estimating the model in a simultaneous manner and choosing a small geographic area (metropolitan city) were important factors in contributing to this conclusion.

In summary, Fox has identified that the property tax and other fiscal variables are significant determinants of industrial location, providing an appropriate sample of industrial communities is undertaken within the same metropolitan centre, excluding areas which effectively zone out industry. That is, property tax incentives are successful in attracting capital growth generated from within the same metropolitan area, whereas intra-urban incentives are not effective in attracting out of province capital.

However, if subsidiaries of an industrial firm exist in Calgary and Winnipeg and property taxes are substantially lower in Alberta, then the sum total of other factor costs being equal, Calgary's capital stock will increase in relation to that of Winnipeg. The firm will choose to expand output in the location which has the lowest cost of production (ceteris peribus). If the firm's overall cost of production with respect to land expenditure, capital expansion and increased labour costs has been equalized, then future expansion will take place in the lower taxed City of Calgary.

A situation may also exist where a firm is forced, by the market place, to consider retooling its entire plant. Based upon a combination of existing labour force inefficiencies, the extent of capital depreciation and innovative technology that may presently be available in the market place, a firm may choose to walk away from an out-dated establishment and its inefficient production methods in search of an entirely different site. In a situation of this nature, fiscal incentives may play a significant role in determining the actual movement of an existing reproducible capital structure to an entirely different region, particularly if the sum total of all other factor costs between various cities is equal.

A firm operating under conditions of equilibrium within the market place will not be drawn away from one urban centre in favour of another based on fiscal incentives alone. However, all other cost considerations being equal (ceteris peribus), new capital in search of profit maximization will be persuaded to locate in the jurisdiction with the greatest fiscal incentives.

Table 1.1 identifies that all communities do not represent equilibrium price (tax) and quantity (amount of business land) relationships.

1.4 Fox's Empirical Results

TABLE 1.1

DEMAND CURVE ESTIMATES[27]

Regression	Constant	TRate	BServ	LPrice	AHigh	Rail	KLand	Popdens
23 obs.	128.795.8	-9,843.9*	2.752*	-53,814	7.687.5	-38,402	-9.030.2	6.24
	(1.31)	(-2.22)	(2.03)	(-0.54)	(0.33)	(-1.15)	(-0.87)	(1.32)
43 obs.	109.621.9	-9,701.4	1,556.3	-70,684.3	-9,494.6	-1.123	9,248.25	7.28
	(1.44)	(-2.10)	(1.11)	(-0.96)	(-0.65)	(-0.06)	(1.00)	(1.64)
20 obs.	-639.1	190.1	-91.8	7,368.3	1,279.4	-3,297.3	1,146.7	-0.66
	(0.05)	(0.20)	(0.39)	(0.33)	(0.52)	(-0.44)	(0.59)	(-0.62)
OLS	99,765.0	-7,604.4*	2,090.3*	-52,692.0	-4,170.8	14,141.1	-3,725.2	4.68
$R^2 = 0.55$	(1A.28)	(-2.19)	(2.70)	(-0.58)	(-0.21)	(-0.51)	(-0.63)	(1.16)
23 obs.								

t values in parenthesis.
* significant at 95 per cent level of confidence.

The results shown for 23 observations are appropriate for analyzing the demand for sites. For purposes of comparison the estimates using 43 and 20 observations are included.

Amount of industrial land was determined by dividing the industrial tax base by the price of land. The industrial tax base, price of land, property tax rate, and capital-land ratio were derived from sources at the Ohio Board of Tax Appeals, Columbus, Ohio. The level of services was taken from information supplied by the Auditor of the State of Ohio. Access to interstate highways and railroads are both dummy variables. Each takes on a value of one if it crosses a city and a value of zero otherwise.

TRate - Effective local property tax rate.
BServ - Level of business related services.
LPrice - Price of land.
AHigh - Dummy Variable for an interstate highway.
Rail - Dummy Variable for the presence of a railway.
KLand - Average Industrial capital to land ratio.
Popdens - Population Density.

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[27] Ibid.

"Communities with zero or less than one percent industrial land were felt to be using means other than fiscal variables to effectively control industry since the intent was to identify municipalities which were effectively zoning out industry, segmenting according to areas with and without zoning restrictions on the use of land for industrial purposes would not accomplish this objective because little or no industry may have desired to locate in the restricted areas. Consequently, the particular segmentation was made under the assumption that communities within the urban area which have both very little industry and very little land available for industrial use relative to neighbouring communities must be zoning out industry. The 23 communities chosen had an average 67 times greater percentage of industry to local tax base compared with the 20 communities in the zoning group. Further 12 of the 20 had zero industry."[28] (refer to Table 1.1 previously indicated)

Consequently, for purposes of this analysis, the logic identified within Fox's model has been chosen in lieu of the other studies carried out to date, based on the successful

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[28] Ibid., p. 108.

emperical analysis he carried out with the 1978 Cuyahoga County, Ohio (Cleveland) sample, in conjunction with the availability of reliable sources of appropriate date required for use in a comparable study of fiscal variables and their affect on industrial location decisions in the City of Winnipeg.

However, the analysis contained within this study goes one step further than Fox and concentrates on property tax capitalization as well as tax incentives, in order to identify whether property tax credits may be effectively used to re-distribute the demand for industrial land in Winnipeg.

1.5 APPENDIX Tables

TABLE 1A.1 SUMMARY OF MULTIPLE REGRESSION MODELS ON THE RELATIONSHIP OF LOCAL TAXES AND INDUSTRIAL LOCATION[29]

Demand Variables *

	Beaton and Joun (1968)	Fox (1973)	Schmenner (1973)
Dependent Variables	Percentage increase in manufacturing employment, 1958-65 (Y)	Per Capita increase in industrial tax base, 1964-69 (Y)	(a) Percentage of SMSA manufacturing employment (establishments), 1967-69, 1969-71 (Y) (b) Percentage increase in SMSA manufacturing employment (establishments), 1967-69, 1969-71 (Y)
Independent Variables Tax	(a) Effective property tax rate (PT) (b) Recent percentage changes in property tax rate (PT)	Statutory property tax rate (PT)	(a) Effective property tax rate as a fraction of central city's rate ( ) (b) Same as (a) but for income tax ( ) (c) Number of years income tax in effect (Du)
Access	(a) Proximity to railroad (R) (b) Proximity to freeway (F)	(a) Access to interstate highway (F) (b) Population density (D) (c) Distance to city centre (U) (d) Percentage of real property base industrial (I)	(a) Access to railroad (R) (b) Number of freeway interchanges (F) (c) Population density (D) (d) Distance to city centres (U)
Land Market	(a) Price of land (P) (b) Percentage of industrially zoned land vacant (V)	(a) Price of land (P) (b) Percentage of land which is vacant (V)	
Sale factor			Percentage of SMSA population or land (%)
Amenities		Safety expenditures per capital (S)	Per pupil expenditure as a fraction of central city level
Other	Capital assets per unit of industrial land (K)		
Simultaneous Variables	Price of land	(a) Price of land (b) Property tax rate	Percentage of SMSA population
Regions Studied	Orange Co., California	Cleveland, Cincinnati	Cleveland, Cincinnati, Minneapolis-St. Paul, Kansas City

Letters in parenthesis represent the notation used when presenting results.

*Depend on those variables which lead to "cost differentials" between communities.

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29 Oakland, W. H., (1978), Local Taxes and Intraurban Industrial Location: A Survey, Metropolitan Finance and Growth Management Policies, p. 17.

TABLE 1A.2 REGRESSION RESULTS[30]

Beaton and Joun (1968)

Orange County, California

Y = -35.08 - 86.94PT - 2.06 (PT) + 3.73P - 48.96K - 1.16R + 1.74F - .54V
(34.06) (6.45) (.75) (9.94) (1.31) (1.06) (.42)
(Figures in parentheses are standard errors; R^2 not applicable)

Fox (1973) - Cleveland

Y = 3.46 - .066PT - .021P + .531u - .051F + .028I - 1A.29V + .0225
(2.24) (3.52) (1.64) (2.09) (2.39) (2.42) (1.73) (2.37)

Cincinnati

Y = .168 + .003PT + .0005P + .010u - .004D - .0009S
(1.41) (1.49) (.198) (.414) (2.06) (9.48)
(Figures in parentheses are t values; R^2 not applicable)

Schmenner (1973)

Percentage of SMSA employment, 1969-71 (all areas)

Y = .029 + .00165t^p + .0045t^i - .00104Du + .00612R + .00235e - .483% Land
(.98) (.08) (.52) (2.06) (.86) (1.45) (3.73)

- .00104U + 1.50F + .00000124D
(1.93) (11.10) (1.34)
(R^2 = .56; figures in parentheses are t values)

Percentages of SMSA new establishments, 1969-71 (all areas)

Y = .0231 + .00244t^p - .01154t^i - .00103Du - .39% Land - .00177e + .00682R
(1.19) (.19) (3.03) (3.10) (4.61) (.11) (1.47)
- .00277U + .170F - .00000071D
(.79) (1.93) (1.17)
(R^2 - .21; figures in parentheses are t values)

* Symbols are explained in Table 1.1

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[30] Oakland, W. H., (1978), Local Taxes and Intraurban Industrial Location: A Survey, Metropolitan Finance and Growth Management Policies, p. 18.

CHAPTER 2

SUPPLY ESTIMATES

"Winnipeg's Supply of Vacant Industrial Land"

2.0 Introduction

Civic policy makers have attempted to provide sufficient land for a wide range of industrial and related uses in suitable locations throughout Winnipeg. However, as will become evident, throughout this study, the distribution of available vacant industrial land is not suitable to satisfy the City's industrial demands.

An inventory of vacant industrial land is an essential component required in developing an industrial development policy for the City of Winnipeg. The location, amount and type of vacant land available for development are supply side elements that the City needs in order to determine whether demand requirements may be adequately met in the present as well as the future.

2.1 Development Procedures:

The following methodology was utilized in developing the 1981 stock of vacant industrial land situated within the City of Winnipeg. The supply consisted of fully serviced land available for immediate development, as well as unserviced or reserve holdings with the potential for future expansion. The major source of this inventory was based upon City of Winnipeg Assessment Department records. By generating a property code analysis of the City's Realty Assessment Roll, it was possible to develop a site by site inventory of all vacant industrial land, both public and private, on a neighbourhood level. As indicated, Planning Department area characterization boundaries (neighbourhoods) were used in order to classify and summarize industrial acreage throughout the City.[1]

The following resume fully itemizes the sources utilized in developing this inventory by type of industrial land category. Two major sources of information, within the City Assessment Department, were used in determining the four industrial neighbourhood categories. They appear as follows:

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[1]The information contained within this chapter, including the methodology employed in gathering, calculating and summarizing all tables on a neighborhood basis was designed and developed by the author. The industrial neighborhood classifications were also developed by the author, based on the City's area characterization boundaries.

Vacant Industrial Land Categories[2]

Category	Source
1.A. Fully Serviced Industrial Parks	A land card filing system consisting of area dimensions for each parcel of industrial acreage was used in conjunction with Assessment Department maps, in order to determine the appropriate size of each industrial site. These records are continually maintained on an up-to-date basis by the City of Winnipeg land accessors. The acreage calculations were verified by comparing each roll number (property) to an on-site survey carried out by district planning, Department of Environmental Planning (1981).
2.B. Major Industrial Neighborhoods	Property Code Analysis - 1981 Realty Roll (City of Winnipeg Assessment Department)
C. Strip Industrial Neighborhoods	Property Code Analysis - 1981 Realty Assessment Roll.
D. Infill Vacant Industrial Land	Property Code Analysis - 1981 Realty Assessment Roll

The "Plan Winnipeg Policy Area Map (June, 1981)" was utilized in order to determine which category the industrial neighbourhoods were to be slotted.

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[2]The industrial land categories were developed by the author, based on City of Winnipeg area characterization boundaries.

As previously mentioned, by designing a property code analysis of the 1980 Winnipeg Realty Assessment Roll, the author was able to analyze all vacant industrial land by Neighbourhood including that of the major industrial parks. However, as indicated above, only categories B, C, and D, used this method of analysis in order to determine their base, as it was determined that more accurate and up-to-date (1981) statistics could be obtained for the industrial parks by "walking through" and identifying each vacant industrial parcel found within the park boundaries. Also few industrial park boundaries coincide with the geo-coded neighbourhood boundaries and therefore do not readily lend themselves to analysis via existing neighbourhood boundaries.

Therefore, the vacant industrial land displayed in APPENDIX Tables B, C, and D plus that found within the industrial parks (fully services) exhibited in Table A equal the total stock of vacant industrial land within the City of Winnipeg.

Since two sources of information, from the same Department, containing comparable information were utilized in analysing vacant industrial land (1980 realty roll and Assessment land title maps) appropriate care was taken in order to avoid duplication that might occur as a result of the same property being included in an industrial park as well as a major industrial neighbourhood in which the park happened to be located. The validity of the industrial park statistics was ensured by relating land ownership within each park (determined by means of Assessment Department land title maps in conjunction with a Planning Department on-site analysis) to those realty roll numbers printed out via the property code neighbourhood analysis. In this way duplication error was virtually eliminated.

The sequence of analysis that determined the four categories of vacant industrial land found summarized in this inventory appear as follows:

A. Fully Serviced Industrial Parks:

In order to plot those parcels of vacant industrial land that existed within the fully serviced industrial parks, specific park boundaries had to be determined. After consultation with the industrial marketing officer of the Winnipeg Business Development Corporation, boundaries for each fully serviced industrial park within the City were defined.

Once these boundaries were plotted on up-to-date zoning atlas sheets, it was determined that industrial parks were contained within the limits of 11 neighbourhood boundaries. The acreage for each property was calculated based on either Assessment Department property code analysis or calculations derived from a combination of land card analysis and the advice acquired through consultation with land assessors familiar with the areas being analyzed.

These calculations were verified by comparing them to comparable statistics derived by a Planning Department (District Planning) on site analysis of the industrial parks.

This vacant industrial land within the fully serviced parks has been segregated into "presently available" and "available for future development". For example, St. Boniface Industrial Park contains 968.016 acres of vacant industrial land, of which only 230.619 acres is presently serviced and available for development. The remaining 737.397 acres is available for future development when the demand presents itself. By utilizing a computerized data access system, which combined geo-coded neighbourhood boundaries with the City of Winnipeg's realty assessment roll, it was possible to generate an industrial property code analysis on a neighbourhood geographic base. An analysis of specific property codes (1981 Roll) related to vacant industrial land enabled a study to be conducted of both public and private ownership of this land in Winnipeg. Property codes 99, 80 and 60 to 69, (inclusive) that existed within the 1980 realty roll, were analysed on a neighbourhood level. Property Code 99 is defined as privately owned vacant industrial land, whereas Code 80 is City of Winnipeg owned land and Codes 60 to 69 are owned by the C.N.R., C.P.R., Midland and National Transcontinental railways.

Virtually all of the vacant industrial land in St. Boniface Industrial Park is classified as a property Code 80, since it is City owned land. The majority of land within Dugald and Pandora Industrial Parks is owned by the Canadian National Railways and therefore unless the municipal and railway owned property codes were taken into consideration, a major sector of the vacant industrial land within the City limits would have been overlooked in this analysis.

Maps were developed for each of the industrial parks (Table A) identifying whether a specific property (Realty Roll number) was vacant or developed, in order to ensure a thorough understanding of the park layout. These maps enable one to be aware of not only how much land existed within the industrial parks, but also where it was situated and the exact shape of each parcel of available land.

By definition, the inclusion of private vacant industrial land (code 99) within this analysis was self-evident, regardless of where it was situated. However, the inclusion of municipal and railway owned land was determined by a number of different factors which enabled me to identify the existing or potential demand for its future industrial development. Municipal and railway owned land situated outside the fully serviced industrial parks qualified as part of the vacant industrial land stock, if it did not have a building assessment associated with it and secondly the land was zoned for industrial development or was likely to be zoned for that purpose based on the surrounding land uses.

Two other boundaries under which vacant industrial land was identified are "major" and "strip" industrial neighbourhoods. Their identification was based on the "Plan Winnipeg Policy Area Map" which illustrates by color code the industrial land use in relation to residential and recreational development that has taken place within the City of Winnipeg as of June 1, 1981.

The 29 **"Major Industrial Neighbourhoods"** (Category B) were obvious to identify since the vast majority of their land use was either developed or zoned for industrial purposes and consequently the entire neighbourhood was identified as such. An example of this category is ST. BONIFACE REFINERY.

However, land use in a **"Strip Industrial"** neighbourhood, of which there are 15 in total, is more diversified, in that other forms of development, both residential and commercial, may also co-exist with the industrial sector. This category (STRIP) of industrial land use has also been identified on the "Plan Winnipeg Policy Area Map" by the industrial color code (green). Sargent Park is an example of such a neighbourhood.

Infill vacant industrial land (Category D) was determined by means of analysing all neighbourhoods, other than those classified as being either industrial parks, major or strip industrial. A total of 31 neighbourhoods qualified as having "infill" vacant industrial land within their boundaries. Since these neighbourhoods do not have major sectors of industrial development within their boundaries, such as the major and strip industrial neighbourhoods identified within this analysis, demand for industrial development was most difficult to determine.

Private vacant industrial land (property Code 99) is identified and included within the infill neighbourhoods. Vacant railway land (property codes 60-69) is also included if the zoning and surrounding land uses indicate a potential demand for future industrial development of this land. Such railway land that exists within the infill neighbourhoods must also be five acres or more in size in order to qualify, since demand for any parcel of land less than this amount would be virtually negligible in a neighbourhood of this type. City owned land (property Code 80) has not been considered for industrial development outside the major and strip industrial neighbourhoods.

Consequently, all vacant industrial land, both private and public, has been taken into consideration in order to ensure a comprehensive analysis be carried out.

2.2 Analysis

In 1981, there were approximately 2,700 acres of vacant fully serviced land available for industrial development in the City of Winnipeg. As indicated in Table 1, the Community Committee areas of St. Boniface-St. Vital, Assiniboine Park-Fort Garry and East Kildonan-Transcona each contained approximately 28% of this stock.

FIGURE I
VACANT INDUSTRIAL LAND

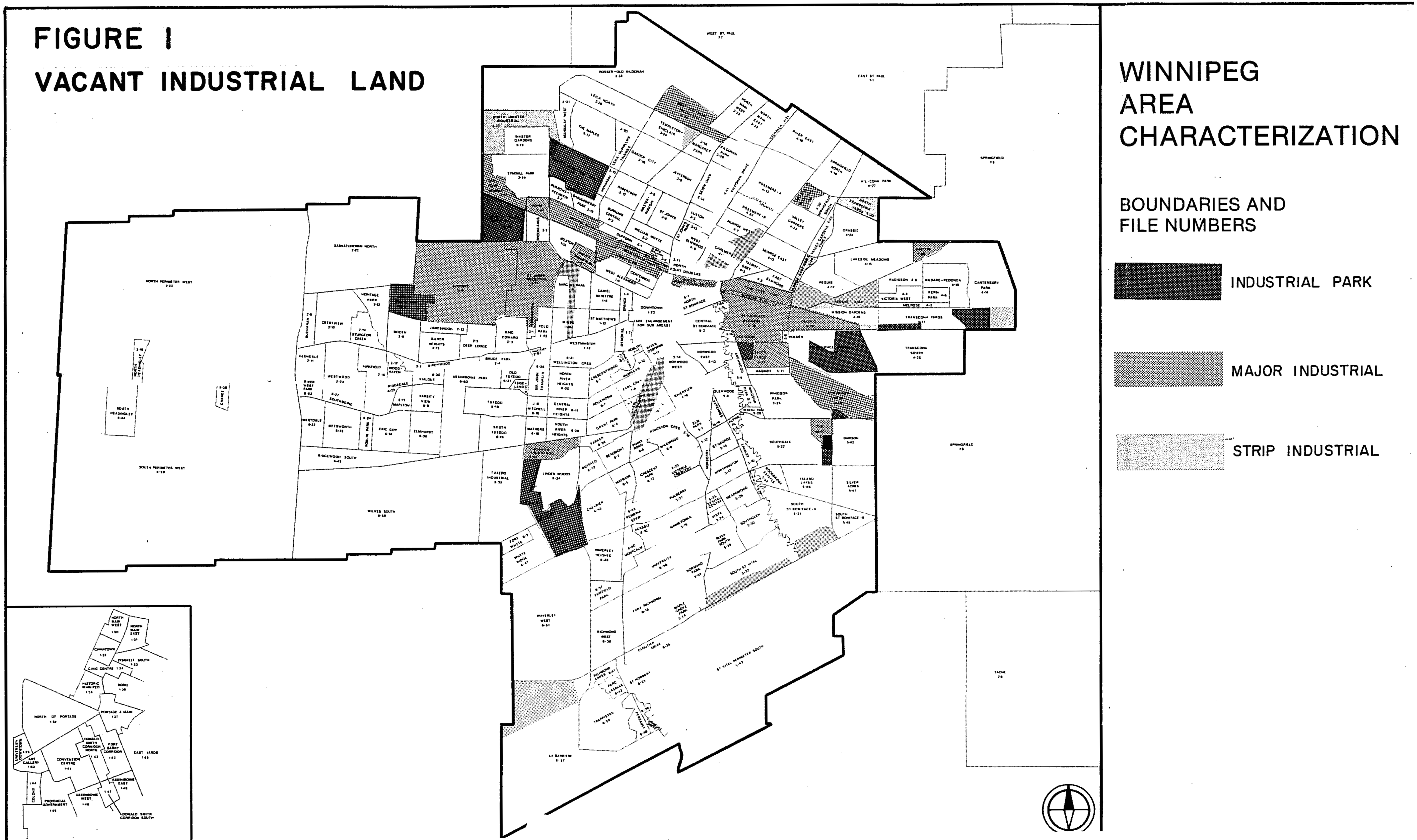

TABLE 2.1
VACANT INDUSTRIAL LAND
BY COMMUNITY COMMITTEE AREA

COMMUNITY COMMITTEE AREA	(ACRES)	%
St. Boniface-St. Vital	715.6	26.3
Assiniboine Park-Fort Garry	786.8	28.9
East Kildonan-Transcona	698.1	25.7
St. James-Assiniboia	269.1	9.9
City Centre-Fort Rouge	110.0	4.0
Lord Selkirk-West Kildonan	140.8	5.2
TOTAL - City of Winnipeg	2,720.4	100.0

Source: Developed by the author from data supplied by the City of Winnipeg Assessment Department

The analysis within Table 2.1 identifies only that acreage which is serviced and "available" for development. However, if unserviced land designated for "future" industrial development is taken into consideration, the vast majority of vacant industrial land shifts to St. Boniface-St. Vital. A potential 737 acre reserve exists within the neighbourhood of St. Boniface Industrial Park, providing the community committee of St. Boniface-St. Vital with a potential stock of 1,500 acres available for development when the demand presents itself. Taking this into consideration the total stock increased to almost 3,500 acres (Table 2.2), of which 42% exists within St. Boniface-St. Vital. This is in relation to approximately 20% within each of the two community committee areas of Assiniboine Park-Fort Garry and East Kildonan-Transcona.

In Table 2.2, the 1981 stock of potential and existing vacant industrial land within the City of Winnipeg was equal to 3,458 acres, out of which 50.7% or 1,752 acres existed within the fully serviced industrial parks. The major industrial neighbourhoods contained 30.2% of this stock and the residual 662 acres was distributed throughout the strip and infill neighbourhoods.

TABLE 2.2

1981 VACANT INDUSTRIAL LAND INVENTORY*

By Industrial Land Classification

Community Committee Area	"A" ACREAGE	%	"B" ACREAGE	%	"C" ACREAGE	%	"D" ACREAGE	%	TOTAL ACREAGE	%
City Centre-Fort Rouge	-	-	57.0	5.5	44.6	9.7	8.4	4.1	110.0	3.2
East Kildonan-Transcona	149.0	8.5	112.8	10.8	366.7	80.2	69.6	34.0	698.1	20.2
St. James-Assiniboia	89.3	5.1	156.9	15.0	-	-	22.9	11.2	269.1	7.8
Lord Selkirk-West Kildonan	63.0	3.6	20.7	2.0	22.8	5.0	34.3	16.8	140.8	4.1
Assiniboine Park-Fort Garry	412.3	23.5	326.8	31.3	18.3	4.0	29.5	14.4	786.8	22.8
St. Boniface-St. Vital	1,038.7	59.3	369.0	35.4	5.2	1.1	40.2	19.6	1,453.0	42.0
CITY OF WINNIPEG	1,752.2	100.0	1,043.2	100.0	457.6	100.0	204.9	100.0	3,457.8	100.0
%	50.7%		30.2%		13.2%		5.9%		100.0%	

Footnotes:

A. Fully Services Industrial Park
B. Major Industrial Neighbourhood
C. Strip Industrial Neighbourhood
D. Infill

*This acreage includes vacant industrial land presently available as well as land designated for future industrial development.

Sources: Developed by the author from data supplied by the City of Winnipeg.

An **Industrial park** is a planned community of industries with a purpose to locate firms with compatible uses and operations, and to ensure a uniform and attractive appearance over the whole area by maintaining construction standards. Fifty-nine percent of all land within Winnipeg's fully serviced industrial parks existed within St. Boniface-St. Vital. Not only does this community committee area contain the vast majority of developable industrial land in Winnipeg, (Table 2.2), but in 1981, 70% of its stock was based upon land situated within fully serviced industrial parks. By far the largest in the City, "St. Boniface Industrial Park" contained 968 acres of developable land, distributed into 231 acres available upon request and 737 acres available for future development. Assiniboine Park-Fort Garry contained 412 acres of 23.7% of the vacant land within this category. The residual 16.8% was distributed throughout East Kildonan-Transcona, St. James-Assiniboia, and Lord Selkirk-West Kildonan.

Table 2.3
FULLY SERVICED INDUSTRIAL PARKS
City of Winnipeg

COMMUNITY COMMITTEE AREA /INDUSTRIAL PARK	TOTAL VACANT LAND (ACRES)	NUMBER OF VACANT SITES	TOTAL ACREAGE
City Centre-Fort Rouge	-	-	-
-nil	-	-	-
East Kildonan-Transcona	149.0	n/a	195.0
(4.31) - Pandora Industrial Park	119.0 (CNR)	n/a	130.0
(4.31) - Dugald Industrial Park	30.0 (CNR)	n/a	65.0
St. James-Assiniboia	69.3	35	372.9
(2.20) - Murray Industrial Park	41.1 (City & Private)	25	260.9
(2.25) - Omand's Creek Industrial Pk.	48.2 (Private)	10	112.0
Lord Selkirk-West Kildonan	63.0	24	720.2
(3.29) - Inkster Industrial Park (proper)	21.9 (Private)	9	587.7
(3.29) - Inkster Industrial Park (south)	41.1 (Private)	15	132.5
Assiniboine Park-Fort Garry	412.3	76	704.5
(6.55) - Lowson Industrial Park	88.7 (Private)	19	123.4
(6.61) - Whyte Ridge Industrial Park	173.6 (Private)	57	395.7
(6.34) - McGillivray Industrial Park	150.0 (City)	n/a	185.4
St. Boniface-St. Vital	1,038.6	63	1,216.1
(5.37) - St. Boniface Industrial Park			
(presently available)	230.6 (City)	58	318.7
(future development)	737.4	n/a	790.5
(5.39) - Winnipeg Industrial Park	21.7 (Private)	n/a	21.7
(5.40) - Winfield Industrial Park	15.0 (Private)	n/a	24.3
(5.41) - Southdale Business Park	33.9 (Private)	n/a	60.9
TOTAL - City of Winnipeg	1,752.2*	198	3,208.7

*NOTE: As of the 1981 R. Assessment Roll 739.4 acres existed in the neighborhood of St. Boniface Industrial Park for the sake of future development (not serviced at that time)

Source: Developed by the author from data supplied by the City of Winnipeg.

Neighbourhoods classified within this analysis as being **Major Industrial** occupied 1,043 acres of vacant industrial land. The vast majority of this land is either developed or zoned for industrial purposes, and next to the industrial parks, this category occupies the largest acreage of serviced vacant industrial land in Winnipeg (30.2%).

TABLE 2.4
MAJOR INDUSTRIAL NEIGHBOURHOOD ANALYSIS
By Community Committee Area

COMMUNITY COMMITTEE AREA	MAJOR INDUSTRIAL NEIGHBOURHOOD STOCK (ACRES)	%
St. Boniface-St. Vital	369.00	35.4
Assiniboine Park-Fort Garry	326.8	31.3
St. James-Assiniboia	156.9	15.0
East Kildonan-Transcona	112.8	10.8
City Centre-Fort Rouge	57.0	5.5
Lord Selkirk-West Kildonan	20.7	2.0
TOTAL - City of Winnipeg	1,043.2	100.0

Source: Developed by the author from data supplied by the City of Winnipeg

As can be seen within Table 2.4, St. Boniface-St. Vital and Assiniboine Park-Fort Garry contain the majority of the vacant industrial land (66.7%) located within the "major industrial" classification.

TABLE 2.5
MAJOR INDUSTRIAL NEIGHBOURHOODS
By C.C.A. and Ownership Classification

	ACREAGE				
COMMUNITY COMMITTEE AREA	A.	B.	C.	TOTAL*	%
St. Boniface-St. Vital	317.9	17.0	34.1	369.0	35.4
Assiniboine Park-Fort Garry	288.2	3.3	35.2	326.8	31.3
St. James-Assiniboia	143.7	-	13.2	156.9	15.0
East Kildonan-Transcona	61.2	0.9	50.7	112.8	10.8
City Centre-Fort Rouge	11.5	0.2	45.3	57.0	5.5
Lord Selkirk-West Kildonan	16.3	2.5	1.9	20.7	2.0
TOTAL - City of Winnipeg	838.8	24.0	180.4	1,043.2	100.0
%	80.4	2.3	17.3	100.0%	

Footnotes:

A. Privately-owned vacant industrial land
B. City of Winnipeg
C. Railway

* Totals may not add exactly due to rounding.

Source: Developed by the author from data supplied by the City of Winnipeg

Land ownership amongst the major industrial neighbourhoods has been examined within Table 2.5. As can be seen 838.8 acres or 80% of the total acreage exists in the form of privately-owned vacant industrial land, whereas 180.5 acres of 17% is railway owned. This ownership distribution differs substantially from that identified within the Industrial Parks, where 43% of the "existing" land available for development is privately-owned, 42% is owned by the City of Winnipeg and approximately 15% is railway owned.

The neighbourhoods identified within Table 2.6 have had the greatest influence upon the stock of vacant industrial land situated within the major industrial classification. Six hundred and sixty-one acres or 70% of the privately owned land located in this category exist within only 4 of the 29 major industrial neighbourhoods identified for purposes of this analysis. Sixty four percent or 115 acres of railway land was also located within 3 of these neighbourhoods.

TABLE 2.6

MAJOR INDUSTRIAL NEIGHBOURHOODS

By Ownership Classification

NEIGHBOURHOOD	PRIVATELY OWNED	RAILWAY OWNED	TOTAL ACREAGE
St. James Industrial	143		143
Dugald	138		138
Symington Yards	105		105
Tuxedo Industrial	275	25	300
McLeod Industrial		45	45
Pacific Industrial		45	45
TOTAL	661	115	776

Source: Developed by the author from data supplied by the City of Winnipeg

Land use in a **"Strip Industrial"** neighbourhood is more diversified, in that other forms of development, both residential and commercial may also co-exist with the industrial sector. Section C in Table 2 indicates that 457.6 acres of vacant strip industrial land was identified throughout the City of which 80.2% was contained within East Kildonan-Transcona. St. Boniface-St. Vital included only 5.2 acres or 1.1% of the available "Strip" Industrial land.

A total of 31 neighbourhoods containing 205 acres qualified as having **"infill vacant industrial land"** within their boundaries. This land is located outside of the three principle vacant industrial neighbourhood classifications (industrial parks, major and strip industrial neighbourhoods) and can be identified as Section D in Table 2 of this analysis. Infill land was evenly distributed throughout the City, unlike the other three categories which identified one or two specific community committee areas as containing the vast majority of their vacant acreage.

In determining appropraite development policies it is essential to know where the existing supply of vacant industrial land is located in Winnipeg. However, as previously identified, the supply of vacant land is but one essential component required to accomplish effecitve policies for the promotion of industrial growth. As will become evident from the model developed in chapter three, locational characteristics and the type of available industrial land, have statistically significant implications regarding industry's demand for such land.

The supply side of the market exerts significant influence on the demand side, based upon the type of land use municipal government will allow in specific locations throughout the city. The Assessment Department's land use or property code analysis, used in identifying Winnipeg's supply of vacant industrial land, has been incorporated into a demand model by means of industrial zoning classifications associated wtih each land sale.

Hence, the model identifying the demand indicators for industrial land in Winnipeg is predicated on the supply side of the market, in that zoning was the fundamental variable used in identifying all bona fide industrial land sales which have been analyzed in this study.

2.3 APPENDIX Tables

Table 2A.1
City of Winnipeg

VACANT INDUSTRIAL LAND INVENTORY (1981)

	"A"		"B"		"C"		"D"		TOTAL	
COMMUNITY COMMITTEE AREA	ACREAGE	% DISTRI-BUTION	ACREAGE	% DISTRI-BUTION	ACREAGE	% DISTRI-BUTION	ACREAGE	% DISTRI-BUTION	ACREAGE	% DISTRI-BUTION
City Centre-Fort Rouge	-	-	56.977	5.462	44.594	9.748	8.391	4.094	109.962	3.180
East Kildonan-Transcona	149	8.503	112.84	10.817	366.680	80.154	60.603	33.963	698.123	20.190
St. James-Assiniboia	89.263	5.094	156.899	15.041	-	-	22.893	11.171	269.055	7.781
Lord Selkirk-West Kildonan	62.989	3.594	20.696	1.984	22.767	4.977	34.339	16.756	140.791	4.072
Assiniboine Park-Fort Garry	412.254	23.527	326.776	31.325	18.280	3.996	29.514	14.406	786.834	22.756
St. Boniface-St. Vital	1,038.686	59.279	368.982	35.371	5.150	1.126	40.190	19.611	1,453.008	42.021
City of Winnipeg	1,752.192	100.00	1,043.170	100.00	457.471	100.00	204.940	100.00	3,457.773	100.00

Footnotes:

A. Fully Serviced Industrial Park
B. Major Industrial Neighbourhood
C. Strip Industrial Neighbourhood
D. Infill
* Includes 737 acres of unserviced land zoned for future industrial development.

Source: Developed by the author from data supplied by the City of Winnipeg Assessment Department.

Table 2A.2

VACANT INDUSTRIAL LAND INVENTORY - CITY OF WINNIPEG, MARCH, 1981

COMMUNITY COMMITTEE AREA	TYPE	% DISTRIBUTION	TOTAL VACANT[3] INDUSTRIAL LAND (ACRES)	NUMBER OF INDUSTRIAL SITES	TOTAL INDUSTRIAL PARK ACREAGE	TOTAL VACANT INDUSTRIAL ACREAGE (C.C.A.)	C.C.A. % DISTRIBUTION
City Centre-Fort Rouge	A	-	-	-	-	-	-
	B	0.518	56.977	85	-	-	-
	C	0.406	44.594	45	-	-	-
	D	0.076	8.391	73	-	109.962 (100%)	3.2
East Kildonan-Transcona	A	0.213	149.000	n/a	195.000	-	-
	B	0.162	112.840	39	-	-	-
	C	0.525	366.680	59	-	-	-
	D	0.100	69.603	18	-	698.123 (100%)	20.2
St. James-Assiniboia[2]	A	0.332	89.263	35	323.564	-	-
	B	0.583	156.899	55	-	-	-
	C	-	*	*	-	-	-
	D	0.085	22.893	27	-	209.055 (100%)	7.8
Lord Selkirk-West Kildonan	A	0.447	62.989	24	720.200	-	-
	B	0.147	20.696	52	-	-	-
	C	0.162	22.767	5	-	-	-
	D	0.244	34.339	25	-	140.791 (100%)	4.1
Assiniboine Park-Fort Garry	A	0.524	412.254	76	704.469	-	-
	B	0.415	326.776	66	-	-	-
	C	0.023	18.280	42	-	-	-
	D	0.038	29.524	13	-	786.834 (100%)	22.8
St. Boniface-St. Vital	A	0.715	1,038.686[5]	63[4]	1,216.055	-	-
	B	0.254	368.982	91	-	-	-
	C	0.004	5.150	2	-	-	-
	D	0.028	40.190	25	-	1,453.008 (100%)	42.0
City of Winnipeg (TOTAL)	A	0.508	1,752.192	198	3,159.288	-	-
	B	0.302	1,043.170	388	-	-	-
	C	0.132	457.471	153	-	-	-
	D	0.059	204.94	181	-	-	-
GRANT TOTAL		1.000	3,457.773	920	-	3,457.773 (100%)	100.0

Source: Type A - November, 1981 field analysis.
Types B, C, D - March, 1981

Footnotes:

1. A. Fully Serviced Industrial Park (November, 1981)
   B. Major Industrial Neighbhourhoods (March, 1981)
   C. Strip Industrial Neighbourhoods (March, 1981)
   D. Infill (Code 99 only) (March, 1981)

2. St. James-Assiniboia does not have any neighbourhoods considered to be "Strip Industrial" whereas all other C.C.A.'s throughout the City have neighbourhoods with industrial strips (C) running through them. However, St. James-Assiniboia does have Fully Serviced Industrial Parks (A) as well as Major Industrial Neighbourhoods (B) within its boundaries (refer to the Plan Winnipeg Area Map).

3. The total vacant industrial land acreage that has been identified includes land available for future development (unserviced) as well as the acreage presently subdivided and available for development at this time.

4. Total number of vacant industrial sites presently available for development. A substantial portion fo the 1,034.936 acres identified as available for industrial development has not been subdivided and, therefore, the number of vacant industrial sites is substantially less than one might expect for an area in excess of 1,000 acres of vacant industrial land. This is particularly true within St. Boniface Industrial Park.

5. Includes 737.397 acres of unserviced land zoned for future industrial development.

Source: Developed by the author from data supplied by the City of Winnipeg Assessment Department.

Table 2A.3
VACANT INDUSTRIAL LAND INVENTORY

A. FULLY SERVICED INDUSTRIAL PARKS
City of Winnipeg
(November, 1981)

COMMUNITY COMMITTEE AREA /INDUSTRIAL PARK	TOTAL VACANT LAND[5]	NUMBER OF VACANT SITES	TOTAL ACREAGE
City Centre-Fort Rouge	-	-	-
- nil	-	-	-
East Kildonan-Transcona	149	n/a[2]	195
(4.31)- Pandora Industrial Park	119	n/a[2]	130
(4.31)- Dugald Industrial Park	30	n/a[2]	65
St. James-Assiniboia	89.263	35	323.564
(2.20)- Murray Industrial Park	41.083	25	260.896
(2.21)- Omand's Creek Industrial Park	48.180	10	112.0
Lord Selkirk-West Kildonan	62.989	24	720.2
(3.29)- Inkster Industrial Park (proper)	21.924	9	587.7
(3.29)- Inkster Industrial Park (South)	41.065	15	132.5
Assiniboine Park-Fort Garry	412.254	76	704.469
(6.55)- Lowson Industrial Park	88.731	19	123.366
(6.61)- Whyte Ridge Industrial Park	173.523	57	395.703
(6.63)- McGillivray Industrial Park	150.0	n/a	185.4
St. Boniface-St. Vital	1,038.686	63[2]	1,216.055
(5.37)- St. Boniface Industrial Park[6]			
(presently available)	230.655	58	318.731
(future development)	737.397	n/a[2]	790.446
(5.39)- Winnipeg Industrial Park	21.714	n/a[2]	21.714
(5.40)- Winfield Industrial Park	14.978	n/a[2]	24.249
(5.41)- Southdale Business Park	33.942	5	60.918
TOTAL - City of Winnipeg	1,752.192	198[2]	3,159.288

Footnotes:

1. Source: Winnipeg Business Development Corporation.
2. A portion of this industrial park has not been sub-divided as of this time and, therefore, the total number of sites is not available (only those in Areas 1 & 5).
3. Vacant land (sites slated for future industrial development).
4. This acreage statistic does not include streets.
5. Total vacant land -- regardless of property code.
6. St. Boniface Industrial Park (5.37):

	Total Vacant	Total Acreage	# Vacant Sites
Area 1	230.655	318.731	58
Area 2	114.090	114.090	
Area 3	118.930	118.930	
Area 4	203.890	203.890	
Area 5	300.487	353.536	8
TOTAL	968.052	1,109.177	66
Area 1 (presently available) =	230.655	318.731	58
Areas 2, 3, 4, 5 (future dev.) =	737.397	790.446	n/a

Area 1, which is presently available for development, is fully serviced. However, Areas 2-5, which are available for future development, are not fully serviced at this time.

7. McGillivray Industrial Park has 150 acres within its boundary.

Source: Developed by the author from data supplied by the City of Winnipeg Assessment Department.

Table 2A.4

VACANT INDUSTRIAL LAND INVENTORY
CITY OF WINNIPEG

B. MAJOR INDUSTRIAL NEIGHBOURHOODS

COMMUNITY COMMITTEE AREA	ACREAGE CODE 99[1]	CODE 80[2]	CODES 60-69[3]	TOTAL
City Centre-Fort Rouge	11.478	0.174	45.325	56.977
East Kildonan-Transcona	61.217	0.903	50.72	112.84
St. James-Assiniboia	143.709	-	13.19	156.899
Lord Selkirk-West Kildonan	16.305	2.514	1.877	20.696
Assiniboine Park-Fort Garry	288.223	3.327	35.226	326.776
St. Boniface-St. Vital	317.854	17.005	34.123	368.982
TOTAL - City of Winnipeg	838.786	23.923	180.461	1,043.170

Footnotes:

1. Property Code 99 - Vacant industrial land (private).
2. Property Code 80 - City of Winnipeg-owned.
3. Property Codes 60-69, Railway-owned.

Source: Developed by the author from data supplied by the City of Winnipeg Assessment Department.

Table 2A.5

VACANT INDUSTRIAL LAND INVENTORY - CITY OF WINNIPEG

B. MAJOR INDUSTRIAL NEIGHBOURHOODS[1]

NUMBER	NEIGHBOURHOOD	VACANT INDUSTRIAL ACREAGE CODE 99	SITES	CODE 80[2]	SITES	CODES 60-60[3]	SITES	TOTAL ACREAGE	TOTAL SITES
	City Centre-Fort Rouge								
1001	Logan-C.P.R.	4.379	49	0.099	2	-	-	4.478	51
1021	Pacific Industrial	2.510	5	-	-	44.923	1	47.433	6
1023	South Point Douglas	4.589	23	0.075	1	0.402	4	5.066	28
	St. James-Assiniboia								
2019	Airport	0.317	2	-	-	13.19	1	13.507	3
2020	Murray Industrial Park	*	-	*	-	*	-	*	-
2021	St. James Industirial[5]	143.392	52	-	-	-	-	143.392	52
	Lord Selkirk-West Kildonan								
3028	Dufferin Industrial	1.769	14	0.342	4	-	-	2.111	18
3029	Inkster Industrial Park	*	-	*	-	*	-	*	-
3030	Lord Selkirk Industrial	1.979	4	1.243	10	-	-	3.222	14
3031	Oak Point Highway	2.509	4	-	-	1.877	2	4.386	6
3032	Vopni	4.829	7	0.840	1	-	2	5.669	10
3033	West Kildonan Industrial	0.330	1	-	-	-	-	0.330	1
3034	Weston Shops	4.889	2	0.089	1	-	-	4.978	3
	East Kildonan-Transcona								
4026	Griffon	20.533	7	-	-	2.04	1	22.573	8
4028	McLeod Industrial	8.320	7	0.510	1	45.02	1	53.850	9
4031	Transcona Yards[4]	*	-	*	-	*	-	*	-
4032	Tyne-Tees	32.364	19	0.393	2	3.660	1	36.417	22
	St. Boniface-St. Vital								
5034	Dugald	137.683	16	16.677	10	7.805	2	162.165	28
5036	Mission	0.517	4	-	-	8.527	2	9.044	6
5037	St. Boniface Industrial Park[11]	*	-	*	-	*	-	*	-
5038	St. Boniface Refinery	30.876	28	-	-	13.677	6	44.553	34
5039	Stock Yards[9]	43.418	14	0.328	1	4.114	4	47.860	19
5040	Symington Yards	105.360	4	(C.N.R. tracks - not vacant)				105.360	4
5041	The Mint[10]	*	-	*	-	*	-	*	-
	Assiniboine Park-Fort Garry								
6052	Buffalo	2.548	2	-	-	-	-	2.548	2
6053	Chevrier	10.666	13	0.132	1	-	-	10.804	14
6054	Parker	n/a	-	0.132	1	10.25	1	10.382	12
6055	Tuxedo Industrial	275.009[8]	32	3.057	1	24.976	5	303.042	38
6061	Whyte Ridge Industrial[6]	*	-	*	-	*	-	*	-
TOTAL -	City of Winnipeg	838.786	309	23.923	36	180.461	43	1,403.170	388

Source: Developed by the author from data supplied by the City of Winnipeg Assessment Department.

Footnotes (See Previous Page B. Major Industrial Neighbourhoods)

*The entire vacant industrial acreage found within this neighbourhood has been accounted for in Table "A" which summarizes the fully serviced Industrial Parks. In order to avoid duplication, these statistics have not been repeated within this table.

1. These neighbourhoods were considered "Major Industrial" based on the Winnipeg Development Plan Review (i.e. Plan Winnipeg Policy Area Map). The acreage has been calculated from the 1980 and 1981 City of Winnipeg Assessment Department Realty Rolls. Supplementary statistics updating the 1980 analysis have also been obtained by comparing the 1981 to the 1980 analysis of assessment by property code. These statistics exclude all vacant land found within the "Industrial Parks".

2. Property Code 80 - City of Winnipeg property. Only those properties displaying a land assessment were considered for this analysis, i.e. any property displaying both land and building assessments would already be developed and, therefore, of no value to this analysis.

3. C.N.R.-owned, with a land assessment only.

4. The vacant industrial land in this neighbourhood is identified in the Industrial Park analysis and, therefore, is not included amongst these statistics (refer to Dugald and Pandora Industrial Parks - property code 63).

5. St. James Industrial Neighbourhood calculations are based on a site analysis carried out by District Planning. These properties were verified using the Assessment Department Realty Roll.

   182.712 acres (site analysis)
   39.320 (Omand's Creek Industrial Park - Assessment records)
   143.392 acres (residual)

6. Whyte Ridge Industrial Park - calculations are based on my analysis, carried out in the Assessment Department using assessment maps with the Realty Roll numbers plotted on them in conjunction with assessment Land Card acreage calculations. The Industrial Park and the Neighbourhood boundary are virtually the same. Since this statistic is included within the Industrial park analysis, it will not be duplicated here.

7. Inkster Industrial Park (Neighbourhood 3.29) is comprised of two district areas known as:

a)	Inkster Park (Proper) =	20.539 acres
b)	Inkster Park (South) =	41.60 acres
	Total vacant land (Code 99) =	61.604 acres

8. Tuxedo Industrial (Neighbourhood 6.55), excluding Lowson Industrial Park = 275.009 acres.

Tuxedo Industrial Neighbourhood =	363.740 acres [P.D.A.S. (Code 99) analysis]
excluding Lowson Industrial Park =	-88.731 acres [analysis of assessment records (maps and Realty Roll)]
	275.009 acres (residual)

9. Winnipeg Industrial Park falls within Neighbourhood 5.39 (Stock Yards).

Stock yards (Code 99 total) =	20.518 acres
Realty Roll #315080 =	4.392 acres
Outside Industrial Park - balance (5.39)	16.126 acres

10. Southdale Business Park is virtually the same as Neighbourhood 5.41 (The Mint). Therefore, in order to avoid duplication of vacant industrial land, the 33.942 acres of land (Code 99) shown in the Industrial Park analysis will not be repeated in the Neighbourhood breakdown. "*" indicates that the Industrial Park and Neighbourhood boundaries are virtually identical and, therefore, in order to avoid duplication the vacant land was only shown in the Industrial Park analysis.

11. In order to avoid duplication, all acreage for St. Boniface Industrial Park has been included in Section A (Industrial Parks). This Neighbourhood is divided into five sections, of which Area I has vacant industrial land presently available for development. Areas 2 - 5 inclusive, are slated for future development.

   Area 1 - City of Winnipeg (Property Code 80)
   Area 2 - City of Winnipeg (Property Code 80)
   Area 3 - City of Winnipeg (Property Code 80)
   Area 4 - C.N.R. ownership (Property Code 60)
   Area 5 - mixed ownership - private and C.N.R. (Property Codes 60, 62, 63, 53, 57, 99, 97, 15 and 1)

   Area 1 = 230.619 acres
   Areas 2-5 = 737.397 acres

Table 2A.6

VACANT INDUSTRIAL LAND INVENTORY

C. STRIP INDUSTRIAL NEIGHBOURHOODS
CITY OF WINNIPEG

NUMBER	NEIGHBOURHOOD	VACANT ACREAGE CODE 99[3]	PROPERTIES	CODE 80[4]	PROPERTIES	CODES 60-69[5]	PROPERTIES	TOTAL	(C.C.A.)
	City Centre-Fort Rouge								
1006	Earl Grey	0.356	(5)	-	-	0.737	(2)		
1007	Ebby Wentworth	0.133	(1)	-	-	0.671	(1)		
1009	Lord Roberts	-	-	0.057	(1)	13.017	(6)		
1015	Minto	1.471	(13)	-	-	11.425	(4)		
1016	Riverview	-	-	0.499	(1)	3.902	(2)		
1018	Sargent Park	3.336	(6)	-	-	8.99	(3)		
	TOTAL	5.296	(25)	0.556	(2)	38.742	(18)	44.594	(45)
2022	Saskatchewan North[1]								
	Lord Selkirk-West Kildonan								
3019	Inkster North	-	-	-	-	-	-		
3024	Templeton Sinclair	8.537	(4)	-	-	14.23	(1)	22.767	(5)
	East Kildonan-Transcona								
4001	Chalmers	3.752	(7)	0.212	(1)	-	-		
4007	Munroe West	0.751	(2)	-	-	-	-		
4014	Canterbury Park	244.916	(7)	-	-	12.070	(4)		
4016	Mission Gardens	10.414	(5)	26.063	(6)	-	-		
4029	Munroe East Annex	0.167	(1)	-	-	-	-		
4030	North Transcona Yards	1.030	(1)	-	-	-	-		
4033	Regent	47.143	(21)	20.882	(4)	-	-		
	TOTAL	307.453	(44)	47.157	(11)	12.070	(4)	366.680	(59)
	St. Boniface-St. Vital								
5031	South St. Boniface	5.15	(2)	-	-	-	-		
5032	South St. Vital	-	-	-	-	-	-		
	TOTAL	5.15	(2)	-	-	-	-	5.150	(2)
	Assiniboine Park-Fort Garry								
6034	Linden Woods	7.350	(24)	0.190	(2)	10.740	(16)		
6057	La Barriere	-	-	-	-	-	-		
	TOTAL	7.350	(24)	0.190	(2)	10.740	(16)	18.280	(42)
TOTAL - City of Winnipeg		333.786	(99)	47.903	(15)	75.782	(39)	457.471	(153)[2]

Footnotes:

1. No longer considered a minimum service industrial neighbourhood. Presently all vacant land is zoned Agricultural.
2. 153 vacant properties with 782.451 acres of land.
3. Code 99 -- privately-owned vacant industrial land.
4. Code 80 -- City of Winnipeg-owned land.
5. Codes 60-69 -- Railway-owned land.

Source: Developed by the author from data supplied by the City of Winnipeg.

Table 2A.7

VACANT INDUSTRIAL LAND INVENTORY

D. INFILL NEIGHBOURHOODS
CITY OF WINNIPEG

NUMBER	NEIGHBOURHOOD	ACREAGE[1] (CODES 99, 60-69)	NUMBER OF SITES	(ACREAGE) C.C.A. TOTAL
	City Centre-Fort Rouge			
1002	Centennial	0.24	2	
1005	West Alexander	1.386	21	
1011	River Osborne	2.356	11	
1014	Weston	0.345	3	
1020	Downtown	3.762	34	
1022	Polo Park	0.302	2	8.391 (73)
	St. James-Assiniboia			
2001	Kensington	20.411	11	
2002	Brooklands	2.482	16	22.893 (27)
	Lord Selkirk-West Kildonan			
3001	Dufferin	1.136	9	
3002	William Whyte	0.278	4	
3003	Burrows Central	0.139	1	
3011	North Point Douglas	1.603	10	
3035	Rosser/Old Kildonan	31.183	1	34.339 (25)
	East Kildonan-Transcona			
4002	Melrose	0.463	3	
4003	Talbot-Grey	0.910	2	
4005	East Elmwood	1.504	1	
4012	Munroe East	0.797	1	
4013	Rossmere	0.182	2	
4019	Springfield North	61.633	5	
4022	Valley Gardens	4.114	4	69.603 (18)
	St. Boniface-St. Vital			
5001	North St. Boniface	2.781	16	
5002	Central St. Boniface	2.007	2	
5011	Maginot	27.475	4	
5026	Meadowood	0.617	1	
5042	Dawson	6.560	1	
5043	St. Vital Perimeter S.	0.750	1	40.190 (25)
	Assiniboine Park-Fort Garry			
6004	Grant Park	0.265	2	
6028	South River Heights	7.800	1	
6047	Whyte Ridge	5.926	6	
6058	Wilkes South	15.533	4	29.524 (13)
TOTAL INDUSTRIAL INFILL - City of Winnipeg				204.94 (181)

Footnote:

1. Property Code 99 -- privately-owned vacant industrial land.
   Property Codes 60-69 -- Railway-owned land.

Chapter 3

DEMAND ANALYSIS

"Price Determinants of Vacant Industrial Land"

3.1 Problem

What are the price determinants of industrial land in the City of Winnipeg and how can such information be used to determine whether property tax incentives may be effectively used to redistribute intraurban demand for industrial land, in order to create a more effective and efficient use of existing municipal resources in Winnipeg?

3.2 Theory:

Price is a function of both the demand for and supply of industrial land. Industry demands industrial sites which are supplied by the community. While communities want industry for the tax base, they reduce the communities' environmental quality. Consequently, the amount of industry actually locating in each community is dependent on both the community and industry.

Industry's profit maximization objective does not necessarily correspond to the objective of municipal government. The welfare utility of the community's inhabitants is dependent on the quantity of private goods, government goods and the living conditions within the community. "Well-being is maximized when the community chooses industry such that the marginal environmental damage from industry is equal to the additional compensation resulting from another unit of industry locating in the community."[1] One way to compensate society for servicing costs and the destruction imposed upon the local environment through such industrial externalties as pollution, excessive noise and congestion, is to assesses local firms with a property tax.

Industry's optimum arrangement would ensure that firms situate themselves such that the total cost of locating in each neighbourhood is identical. In this instance, total cost includes rents, differential location factors, property taxes and in particular, the "price of industrial land".

The market value of industrial land comprises a significant component of the firm's total expenditure with respect to re-location costs. Consequently, the focus here is to analyze the determinants of industrial land prices within the City of Winnipeg. In order to identify these variables, the study will concentrate on the demand side, while incorporating supply effects into the model through

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[1]Fox, W.F., Fiscal Differentials and Industrial Location: Some Empirical Evidence, Urban Studies (1981), 18, p. 106.

the use of land use or zoning classifications associated with each sale.

An important factor to be considered at a later date, regarding the supply of industrial land, is that it may be subject to monopolistic restrictions imposed by the City, in an attempt to direct industrial development in the best interests of its inhabitants. Policy tools, employed by the City, to ensure the community's optimum level of welfare, either control or restrict development along specific guidelines (zoning policy) or impose additional costs (property taxes) on industry which ultimately lower profits. As a result of such controls, the supply of industrial land will be either restricted or promoted within specific areas of the City, and in so doing, may affect the market price of the land involved. The City's ability to expropriate land for the sake of promoting specific development proposals will also have an effect on the market value of the land in question.

Traditional economic theory suggests that the demand of a utility-maximizing consumer for any commodity depends on the prices of all commodities available to the consumer and on his total expenditure.[2]

Like the consumer, the firm must consider the prices of all factors involved in the total expenditure of expanding its existing facilities.

Thus:

$$q_i = q_i \quad (p_1, p_2, \ldots, p_i, \ldots p_n, x) \quad i = 1,2 \ldots n$$

where q_i and p_i are the quantity demanded and price of the nth commodity. There are n commodities in all, and $x = \Sigma p_i q_i$ is total expenditure.

The price of industrial land is one of the most significant variables to be considered by the firm, in determining the total expenditure of a potential expansion of its facilities, particularly when the expansion is to occur within the same metropolitan area. Ultimately, cost minimization, with respect to its expenditure on a new site is essential to the firm's goal of profit maximization.

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[2]Thomas, R.L., Introductory Econometrics: Theory and application, Longman Group Limited (1985), p. 125.

Hence, the price of land becomes one of, the most significant factors with respect to intrametropolitan industrial location decisions. Since the determinants of industrial location decisions within a metropolitan area may have important policy implications for government at both the municipal and provincial levels, an understanding of the determinants of industrial land prices is essential for policy makers.

In this analysis an attempt is made to determine whether property tax incentives and business related services located within specific zoning classifications (industrial parks) influence the demand for industrial land in Winnipeg. Zoning has been used as a proxy for business related services in Winnipeg's industrial land model.

3.21 <u>Institutional Factors</u>

The model was developed in two major stages. A preliminary function based on two municipalities was initially delivered prior to the second stage, in which the entire City of Winnipeg (Unicity) was analyzed.

In the initial version of the preliminary function, identified as specification 1 in table 3A.1, the dependent variable, or market price of vacant industrial land, was a linear function of the assessed value, time, location, zoning and the property tax, as well as a log linear function of the area. The original qualitative variable classifications within this analysis were based on date of sale, zoning, and location. The preliminary **LOCATION** variables were based on St. Boniface and St. James-Assiniboia, the two suburban municipalities which contained the greatest number of industrial land sales in Winnipeg during the time frame of this study. The **DATE** was comprised of an eleven year time series, 1971 to 1981, inclusive. **ZONING** had six classifications which relate to the density and type of industrial development allowed on a site which was a substantial improvement over the business service variables incorporated in Fox's analysis.

According to economic doctrine, such an industrial land analysis must consider only sales of vacant INDUSTRIAL land, while excluding all other zoning types. The crux of a partial equilibrium model developed by Fox, in 1978, was based on this conclusion. Consequently, with the assistance of the City Assessment Department, all non bona fide sales were eliminated from the analysis.

Zoning:

As previously indicated, zoning (land use) is a significant variable to be considered in a study of vacant industrial land price determinants. Consequently, only those vacant land sales which reflect industrial zoning were considered in this analysis. There were originally six different industrial zoning classifications.

M1	MP1
M2	MP2
M3	MP3

"M" refers to industrial use and the number which follows indicates the density of development allowed at that level of zoning. The higher the number, the more dense the industrial use which is allowed on that land. M1 generally refers to light wharehousing activities, whereas M3 refers to a heavy manufacturing use. The MP classification identifies land contained within an industrial park, which is specifically designed for promoting industrial development based upon readily available transportation and servicing facilities which cannot be duplicated outside the parks.

The City of Winnipeg Assessment Department has identified that the type of zoning plays a significant role in determining the assessed value of land. However, different zoning "densities" within the same land use, do not necessarily affect the estimated value to any great extent. Therefore industrial, agricultural, and residential zoning would all have significantly different reflections on the value of a specific piece of land.

However, whether the land was zoned for light industrial use (M1) or heavy use (M3) would not have as critical an influence on the value of the land in question. This observation has been verified by analysis contained in the preliminary as well as the final version of the model.

There is a difference in assessed values reflected by land contained within an industrial park relative to that land for sale outside of the parks. This was based on the fact that land within the industrial parks was subject to much higher servicing costs and other locational factors, such as proximity to major transportation facilities (highways, rail access, airport) which reflect an increase in both the assessed value (estimated value) as well as market value (actual sale price) of the site in question.

Time Series (1971 - 1981)

Through the use of dummy variables identified for each year in my analysis, I was able to pool the cross-sectional data I had developed on Winnipeg's industrial land sales, in an attempt to avoid autocorrelation problems that might exist in a cross-sectional time series of this nature. Out of 10 dummy variables, all were significant.

Locational Variables

In the preliminary version, the locational dummy variable, St. Boniface, is always insignificant and consistently negative regardless of any changes to the model. Because this variable never achieves significance, (refer to Tables 3A.1 and 3A.2) the negative sign of its coefficient, at best, appears to reflect that industrial land prices in St. James are higher than they are in St. Boniface. (St. James is the dummy reflected through the intercept). However, as previously mentioned the t value is insignificant and therefore statistically the coefficient, sign and all, cannot be accepted.

This result was a reflection of an inappropriate sample which merely considered two municipalities within Winnipeg resulting in 247 observations (land sales). The entire data base, contained 943 industrial land sales within 14 different municipal boundaries, which were eventually pooled into four separate markets each of which is statistically significant. It is a well established fact that one of the reasons industrial land prices in St. James-Assiniboia are at a premium relative to the rest of Winnipeg is because the Winnipeg International Airport is situated in that municipality.

As indicated, once all 943 observations were analyzed, the significance of the locational variables increased dramatically, which identified that certain locational factors played a significant role in determining the price of vacant industrial land in the City of Winnipeg.

Tax Rate:

Property taxes are based on the product of the assessed land value (indication of "estimated" value of the land) multiplied by the mill (tax) rate. The tax rate includes the school tax as well as the property tax levy. The school tax rate is based upon the school division boundary and not the municipality.

Higher tax rates reflect increased production costs for industry in the form of higher property taxes which in turn influence the price of industrial land in a negative manner, as indicated by the estimated negative tax rate coefficient.

Area:

In the original linear model, equation 1 in Table 3A.1 the dependent variable (price of industrial land) was a log linear function of area. This was based on the fact that as additional units of land were added to a base area, the sales price would experience diminishing returns. An additional unit of land may not be valued at the same level as the original parcel of land, particularly if the marginal piece of land was to be added on to the back of an industrial site and was considered as rearage.

Others:

Two additional quantitative variables used in developing the model were population density and distance from the city centre. As reliable municipal population estimates were not available on an annual basis, dwelling units were substituted as a proxy for density.

Originally, I had identified 1,007 vacant industrial land sales that had occurred in the City of Winnipeg from January 1, 1971 to December 31, 1981. However, upon further analysis and extensive discussions with City of Winnipeg Assessment Department personnel, I was able to determine that 64 of my original 1,007 observations were considered non bona fide industrial land sales, regardless of their zoning.

At the time of sale, a large percentage of the land sales considered non bona fide by the City's industrial land assessors, represented the fringe of agriculturally zoned land. This transitional agricultural market portrayed the bottom end of industrial land sales from 1971 to 1981, and were purchased for residential and not industrial development. Consequently they should have been designated as either agricultural (A) or residential (R) zoning. A prime example was land purchased in 1974 by B.A.C.M. for the sake of residential development in the former municipality of Tuxedo. This sale consisted of 2,912,422 square feet of M1 zoned land which sold for $818,561. The residential subdivision of "Linden Woods" is presently being developed on this site. As identified by Fox (1979) all observations used in such an analysis must be truly representative of both the demand for as well as the supply of vacant industrial land. Consequently, these observations have been excluded.

Certain industrial land sales on Regent Avenue in Transcona, were also excluded from my analysis, in order to avoid distorting the actual market value of industrial land at the time of the sale. These land sales were also zoned as industrial at the time of the sale. During the time frame of this study (1971 - 1981) a substantial amount of vacant land in Transcona was zoned as industrial, but according to the City Assessment Department it would never be used for anything other than commercial development.

Unlike other municipalities in Winnipeg, Transcona zoned transitional land as industrial rather than agricultural. This may have been done for the sake of convenience, as virtually any land use with the appropriate variance is permitted on industrial land. A re-zoning from agricultural (A) to commercial (C) or industrial (M) is a much more cumbersome and time consuming process. This land along Regent Avenue, was never intended to be used as an industrial factor of production. It's intended, as well as existing use, was and still remains commercial.

Since commercially zoned land is more expensive than industrial land, due to such locational factors as frontage, servicing and transportation requirements, the value of industrial land in Transcona would be inflated unless the land sales along Regent Avenue and its surrounding area were removed. The City of Winnipeg Assessment Department personnel have been consulted on this matter and they have also recommended deleting these sales from the analysis, as they would never become a part of the demand schedule for industrial land in Transcona.

There is no comparison to industrial land sales of this nature elsewhere in the City. Industrial land sales on Regent Avenue may be compared with Pembina Highway, St. Mary's Road, St. Anne's Road and McPhillips Street, which all had commercial zoning to begin with.

Eventually, my database consisted of 943 observations, of which 497 were suburban sales and 446 were from the Inner City wards.

3.30 <u>Preliminary Analysis (Tables 3A.1 and 3A.2)</u>

Appendix tables 3A.1 and 3A.2 identify the results of the analysis carried out in order to develop the preliminary version of this model. The way in which the regression results have been presented are based upon the various stages of development, from the original through to equation 8, considered to be the best version of the preliminary model. The five stages initially summarized are based upon a linear dependent variable, the price of industrial land. The final version, equation 8 in table 3A.2, is a log transformation of equation 5 identified within table 3A.1.

The following equation expresses the best "linear" model identified as equation 5 in Table 3A.1.

$$\begin{aligned} \text{Price} = \; & \alpha + \beta_1 \text{ Area} + \beta_2 \log \text{Area HDUM} - \beta_3 \text{ Assessment} \\ & - \beta_4 \text{ Assessment}^2 + \beta_5 \text{ Taxes} - \beta_6 \text{ Zoning(MP)} - \beta_7 \text{ 1971} \\ & - \beta_8 \text{ 1972} - \beta_9 \text{ 1973} - \beta_{10} \text{ 1974} - \beta_{11} \text{ 1975} - \beta_{12} \text{ 1976} \\ & - \beta_{13} \text{ 1977} - \beta_{14} \text{ 1978} - \beta_{15} \text{ 1979} - \beta_{16} \text{ 1980} \\ & - \beta_{17} \text{ location} + e_i \end{aligned}$$

In equation 5 there is a relatively high R^2 = .8426 (for the number of observations contained in the sample) and virtually all independent variables are significant. Since a high R^2 with low **t** values is an indicator of multicolinearity, the results of this model are very positive and do not indicate such a problem exists. The correlation matrix printed out for equation 5 also indicates no evidence of a strong linear relationship between any of the independent variables.

As a final test for multicollinearity, one of the observations was excluded from the data set, and the model reestimated. An additional 57 observations were included and once again the regression was tested. The results of the OLS analysis were very positive in both situations. The significance of the overall model remained the same when one observation was excluded and improved with additional observations. The standard error of the model remained the same or fell, while the significance of the explanatory variables and the sign of the **t** values remained stable. Based on these results it is concluded that multicollinearity is not a problem in this function.

Equation 5 is considered to be the most reliable of the linear models developed. However, "in cross-sectional data involving heterogeneous units, heteroscedasticity may be the rule rather than the exception."[3] In order to ensure heteroscedasticity did not exist in equation 5 the residuals were plotted against each of the independent quantitative variables in an attempt at identifying whether there was any "increase in the variability in the least squares residuals as the sizes of the X variables increased."[4] No discernable pattern existed.

A test of heteroscedasticity was also done using a Spearman Rank Correlation Coefficient. The Spearman Rank test involves calculating the coefficient of rank correlation between the sample values of the explanatory variable and the absolute values of the associated residuals. It is not possible to use the normal correlation coefficient to access the relationship between the residuals and sample x values and therefore must use

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[3]Gujarati, D., Basic Econometrics, p. 201.

[4]Thomas, R.L., Introductory Econometrics, Theory and Applications, p. 52.

the rank correlation coefficient identified below.[5] Since the rank correlation was not significantly different from zero in all cases, the null hypothesis of homoscedasticity was accepted. Once again, based upon this analysis, there was no sign of heteroscedasticity in the model.

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[5] Spearman Rank Correlation Coefficients

The ranked correlation coefficient generated from the residual and Area variable along with its respective t value appear as follows:

$$r_s = 1 - 6 \frac{d_i^2}{N(N^2 - 1)}$$

Residual and Area: $r_s = .05218$

The appropriate test is as follows:

$$t_{(n-)} = \frac{r_s \sqrt{N - 2}}{\sqrt{1 - r_s}}, \quad t_{(245)} = \frac{(.05218)\sqrt{245}}{\sqrt{1 - (.05218)^2}} = 0.8178602$$

Critical $t_{(245)} = + 1.96$ or $t_{(245)} = + 1.645$

$\alpha = .05$ $\alpha = .10$

H_o : $= 0$ Calculated t = .052 Critical t = 1.645
$\alpha = .10$

H_1 : $\neq 0$

Since the calculated **t** is not significant, even at the 10 percent level of significance (when **t** = 1.645), we accept the null hypotheses since there is no evidence of systematic relationship between the explanatory variable and the absolute values of the residuals, which suggest that there is no heteroscedasticity.

The ranked correlation coefficients between the residual and assessment variables and log Area - HDUM also showed no indication of heteroscedasticity.

Mis-Specified Model:

The model was originally designed to avoid autocorrelation problems, therefore low Durbin-Watson statistics identified in the linear versions (Table 3A.1) were possibly the result of a dynamic mis-specification of the population regression line.[6] Since economic relationships are frequently non-linear in form, an attempt to estimate a non-linear regression by means of a linear equation would be analogous to omitting relevant explanatory variables.

If the omitted variable or mis-specified variables were correlated with any of the other explanatory variables then a case of contemporaneous correlation exists between these variables and the disturbance term.[7] In such cases, the OLS estimators become biased and inconsistent. Hence, the low Durbin-Watson statistics equal to 1.42 and 1.46 in equations 4 and 5 respectively, ultimately led to a concern about mis-specification of the population regression line.

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[6] Thomas, R.L., Introductory Econometrics, Theory and Applications, p. 72.

[7] Ibid.

As can be seen from equation 8 in Table 3A.2, considered the best log linear version of this preliminary function, the economic relationship that exists between the price of vacant industrial land and the determinants of this price is clearly a non-linear one. The Durbin-Watson statistic in this model equals 1.9 (equation 8). The following equation identifies this non-linear relationship.

$$\log \text{Price} = -\log \alpha + \beta_1 \log \text{Area} + \beta_2 \log \text{Area HDUM}$$

$$+\beta_3 \log \text{Assessment} -\beta_4 \log \text{Tax Rate} -\beta_5 \text{Zoning(MP)}$$

$$-\beta_6\, 1971 -\beta_7\, 1972 -\beta_8\, 1973 -\beta_9\, 1974 -\beta_{10}\, 1975$$

$$-\beta_{11}\, 1976 -\beta_{12}\, 1977 -\beta_{13}\, 1978 -\beta_{14}\, 1979 -\beta_{15}\, 1980$$

$$+ \beta_{16} \text{ location} + e_i$$

If the model is restricted to fitting a linear regression equation to all points, there is a large increase in the absolute size of the residuals and hence in the sum of squared residuals for the entire range of industrial land sales (refer to equations 1 to 5). However, by transforming the model into a log linear equation the error terms were substancially reduced.

The use of logarithms restricts percentage differences in values to be the same for any dummy variable, and restricts elasticities of price with respect to other independent variables to be constant. Identification of the explanatory variables and how they evolved into this form appears below:

Original Model: Pre Equation 1

In the original attempt at generating the model, all six zoning classifications were included. M1 was designated as the intercept dummy. Negative signs appeared on all of the zoning variables except MP3, which indicated that M1 zoned land sold for a higher price than the M2, M3, MP1 and MP2 zoned lands. One would expect a heavier or more intense industrial land use to reflect a higher land value (market price) than a "light" industrial use. However, in this preliminary version of the model, zoning tended to reflect location rather than "use." This is due to underspecification with respect to locational variables. The light industrial use tends to be located on major arteries and have much greater servicing amenities available to it. Consequently, this is reflected in the market price. However, when locational factors are appropriately defined within the final version model,(refer to Table 3A.8) it does reflect land use, as would be expected. By including dummy variables for locational factors, such as relative proximity to amenities like major highway, rail and air transportation networks, the industrial park land sales show a higher sales price than those outside the parks. This is identified in the best version of the combined City-wide model (Specification 7, Table 3A.8).

As indicated in Tables 3A.1 and 3A.2 ,equations 2 to 9 of the preliminary model were respecified by combining all MP and M zoned land into two rather than six zoning dummies. All M zoned land was identified through the intercept. This respecification reflected a change in density which is, once again, a location rather than a land use factor. Industrial parks are relatively new to Winnipeg and therefore most are situated in areas where the arterial route land use is much less dense than routes reflecting M1 or M2 zoned land. Hence, density was a major factor reflected in the preliminary analysis of MP versus M zoned land.

As identified in Tables 3A.1 and 3A.2, MP zoned land is significantly different than M zoned land. As previously indicated, the minus sign indicates that MP zoning has a negative effect on the sale price of industrial land relative to M zoned land, due to the underspecification of locational factors in the model during this preliminary stage of development.

<u>Area:</u>

By plotting the residuals against the estimated dependent variable (sales price), it was noticed that 70% of the residuals that had the largest deviation, whether positive or negative, were derived from an observed sales price that was in excess of 100,000. This was an indication of a structural problem in the analysis and through the use of an interactive dummy variable, it was identified that price was a linear function of area up to $135,000 and a log linear function thereafter.[8]

Upon further refinement of the model, the best linear version (equation 5 in table 3A.1) was transformed into a nonlinear model by taking the log of the entire equation. The final version of the preliminary model (equation 8 in Table 3A.2) identified log Area + log Area.HDUM as the

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[8]Foot, D.K., and North, A., "The Use and Misuse of Econometrics," 1977, p. 75.

appropriate specification for this particular explanatory variable.

The elasticity of price with respect to area, identified by the coefficient equal to .27606 indicates that for every 10 percent increase in the "area", the sale price will increase by 2.7%. This can be identified as an inelastic response in the sale price of industrial land to a change in the area.

The best version of this preliminary analysis, identified as equation 8 in table 3.2, was statistically significant at a 99% level of confidence.[9] Since $R^2 = 0.8426$, the "goodness of fit" was relatively high and the standard error of equation 8 was the lowest of all models developed before it.

Based on this preliminary analysis, it was decided to identify individual models for two major areas that represented specific industrial land markets in Winnipeg. From knowledge gained working for the City of Winnipeg Planning Department and developing the detailed vacant

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[9]Since the caluclated F = 76.972> critical F = 2.49, we reject $H_o: \beta=0$ and accept the signifcance of the overall model at 99% level of confidence.

industrial land inventory, it became apparent that certain factors would be different when examining industrial development within the older "Inner City" wards as compared with the suburbs.

Due to changing technology in the post War era, industrial density standards experienced significant change. Lower density requirements based upon the introduction of the forklift resulted in changing demand requirements for industrial land. Consequently, suburban land requirements were much less dense than existed within the older Inner City of Winnipeg.

By identifying the particular specifications that existed within the Inner City as well as those within the suburbs, individual models were developed. These two models were then combined into an overall model encompassing the common factors as well as a number of the idiosyncrasies that existed within the suburbs as well as inner city of Winnipeg.

Utilizing the best log linear model generated in the preliminary analysis as a starting point, additional independent variables were included as indicated below:

QUALITATIVE (DUMMY) VARIABLES)

Municipal Dummies(14)	Industrial Land Markets Quadrents (4)	Transportation
Charleswood	South West	HIGHWAY
East Kildonan	North West (including W1)	RAIL
Fort Garry	East Winnipeg	HIGHWAY • RAIL
North Kildonan	Inner City (Wards 2 and 3)	AIR
Old Kildonan		
St. Boniface	**Time**	
St. James-Assiniboia	Pre 1974 Sales	
St. Vital		
Transcona		**Misc. Dummies**
Tuxedo	**Zoning (4)**	City of Winnipeg Land
West Kildonan	M1	Inkster Indus. Park
Winnipeg-Ward 1	M2	
Winnipeg-Ward 2	M3	
Winnipeg-Ward 3	M4	

3.31 SUBURBAN MODEL

Of the four developmental stages identified when analyzing the suburban component of Winnipeg's industrial land market, specification 3, located in APPENDIX Table 3A.3, was the best version.

$$\log \text{Price} = -\beta_1 \text{ MP Zoning } -\beta_2 \text{ Pre 1974 Sales } + \beta_3 \log \cdot \text{Assessment } +\beta_4 \log \cdot \text{Area } + \beta_5 \log \cdot \text{Tax Rate } + \beta_6 \text{ South West Quadrant } +\beta_7 \text{ Eastern Quadrant } + \beta_8 \text{ Highway} \cdot \text{Rail } + \beta_9 \text{ St.James} \cdot \text{Air } -\beta 10 \log \cdot \text{Tax Rate} \cdot \text{HDUM} + e_i$$

The statistical results of these equations are located in APPENDIX Table 3A.3.

Originally, I attempted to define the model by specifying a dummy variable for each tax rate from 1972 to 1981 inclusive. 1971 was the intercept dummy. Equations 1 and 2 were defined in this fashion, in an attempt to avoid specification problems in the model. Because the suburban data base consists of eleven different municipal tax rates identified over an eleven year time frame, the probability of autocorrelation and heteroscedasticity is very high if the model is not appropriately specified.

In specification 2, the dummy variable X30 was included, which identifies all industrial land sales which occurred from 1971 to 1973 inclusive, relative to the intercept dummy which included all sales from 1974 to 1981 inclusive. St. James was actively promoting industrial development in the pre 1974 era and therefore sold land at prices below market value. In an attempt to determine the effect of these sales on other areas in Winnipeg, I specified variable X30 as pre 1974 vacant industrial land sales. Although X30 is statistically significant and has the appropriate negative sign, these results merely reflect the fact that post 1974 industrial land sales sold for higher prices than those sales in the 1971 to 1973 period. This most certainly would have been based on the rate of inflation as well as the possibility that pre 1974 St. James sales affected industrial land prices in surrounding municipalities. The affect of municipal intervention in the industrial land market is more appropriately defined in sections 3.2 and 3.3, which identify the Inner City and comprehensive City of Winnipeg demand models.

In specification 3, of Table 3A.3 the annual tax rate dummy variables, from 1974 to 1981 were deleted, whereas pre 1974 sales (X30) were retained. As indicated, the F ratio increased from 123.165 to 237.301, while the error terms and Durbin-Watson statistic remained virtually unchanged. Pre'74 Sales was excluded from the model in specification 4, in order to determine the effect it had on the model, and as indicated, the interactive dummy variable X63, became statistically insignificant. X63 represents all industrial land sales in St. James from 1971 to 1981 that had immediate access to the airport. It may be noted that the locational dummy variables, X50 and X53 remained insignificant throughout all four specifications in the suburban model. As identified in section 3.3, upon completion of the comprehensive City wide model, all locational dummy variables became statistically significant.

Therefore, of the four individual site characteristics identified within specification 3, all were statistically significant, and each had the appropriate sign. Of the neighbourhood characteristics identified, the tax rate variables X39 and X74 were significant with respective t values equal to 9.458 and -4.815. At this stage of development, the effective property tax rate was not being used and therefore the log tax rate variable (X39) had a positive sign. Variable X74, known as log tax rate•HDUM represents the tax rate of all land sales in excess of $135,000 and is significant with the expected negative coefficient. Once the effective property tax rate is introduced to the model, only one tax rate variable is required and that variable takes on the expected negative sign.

Two transportation dummies have been included in the suburban model. Both X59 (Highway•Rail) and X63 (St. James•Air) are significant and each has a positive sign associated with its coefficient.

3.32 INNER CITY MODEL

As indicated by the way in which I have structured APPENDIX tables 3A.4, 3A.5 and 3A.6, the Inner City demand function was developed in three basic stages. In table 3A.4, specifications 1 to 3 include annual sales price dummy variables, annual property tax rate dummies, assessment, area, a variety of location and transportation dummy variables, and a number of interactive dummy variables which identify particular characteristics that relate to this aspect of Winnipeg's industrial land market.

For example, Ward 1·M1 or X53 is an interactive dummy variable that tests the statistical significance of those industrial land sales which existed in the Inner City, Ward 1 and were zoned M1. The intercept would be all industrial land sales that were in Ward 1 but not zoned M1 as well as all sales that existed in Wards 2 and 3.

Variable X60 is an interactive dummy which tests the statistical significance of those industrial land sales which had access to both rail and highway transportation facilities. Because the north-west quadrant of Winnipeg is home to the Canadian Pacific Railway marshalling yards in conjunction with the vast majority of Winnipeg's trucking industry, X58 and X60 were obvious choices for statistically significant variables within the Inner City of Winnipeg. The negative sign associated with X58 identifies that the land prices in Wards 2 and 3 are less than those within Ward 1. This is a logical sign for this variable, since the majority of land sales in Ward 1 were zoned M1, which ordinarily has a higher market value than M2 or M3 zoned industrial land. This conclusion is verified by the significant and positive coefficient associated with the interactive dummy Ward 1•M1 (X53), identified in specification 2 of Table 3-4, as well as variable X81, which identifies that the price of industrial land per square foot is higher in Ward 1 than it is in Wards 2 and 3. Variable X60 known as Rail-Hwy is also negative in sign, identifying that land sales within the intercept of this variable that have immediate access to air transportation, command a higher market value than those sales which have access to both rail and highway transportation facilities. This result has been identified within the suburban model and will be confirmed in the comprehensive City of Winnipeg model.

Because the annual sale price dummy variables were statistically insignificant and had an inappropriate sign associated with their coefficients, the model was respecified by using annual tax rate dummies. However, these variables were also insignificant, and therefore equations 2 and 3 in APPENDIX Table 3A.4 were respecified by excluding the annual tax rate variables. (The results of specifications 4 to 7 inclusive, all include variable X81, the price per square foot in Ward 2.) Upon deleting the annual dummy variables indicated above, the price per square foot in ward 2 became statistically significant with a positive sign, identifying that the square foot price of vacant industrial land in Ward 2 was higher than existed in

Wards 1 and 3. By re-specifying the Inner City model as identified in equations 4 to 7, it has become apparent that although M1 zoning, identified in variable X53, commands a higher market price than M2 or M3 zoning, the increased density of industrial land use experienced in Ward 2 has resulted in a higher square foot price than exists in either of Wards 1 or 3 within the Inner City.

The neighbourhood characteristics introduced in APPENDIX Table 3A.5, identified that log distance (X17) is a positive and statistically significant variable in all specifications included within this table.

Because of the relationship identified between X58 (Wards 2 and 3) and X60 (Rail-Hwy) in APPENDIX Table 3A.4, these variables were combined into one interactive dummy known as X75. This variable identifies those industrial land sales situated in the Inner City Wards 2 and 3 that had immediate access to both a major rail line as well as a primary trucking route. It is statistically significant and as expected, has a negative sign, which identifies that the intercept dummy for this variable had higher land prices. The intercept consists of those land sales which had immediate access to the airport in Wards 2 and 3, as well as all industrial land sales in Ward 1.

An important interactive dummy identified in specifications 4 through 10, is X74 or those industrial land sales which occurred in Inkster Industrial Park from 1971 to 1973 inclusive. The intercept of this variable includes all post 1973 Inkster Industrial Park Land Sales, as well as all sales in the Inner City that were located outside of the industrial park from 1971 to 1981 inclusive.

This dummy identifies that municipally owned land in Inkster Park sold for less than other industrial sites within the Inner City of Winnipeg. As the pre '74 marketing strategy of industrial land in this City owned industrial park was based on reduced land costs in order to promote the sale of municipally owned land, X74 identified a significant independent variable whose coefficient value remained very stable throughout all versions of the model identified within APPENDIX Table 3A.5. Refer to specification 7 identified below:

<u>Table 3A.5 - Specification 7</u>

$$\underset{(X35)}{\log \text{Price}} = \alpha + \beta_1 \underset{(X17)}{\log \text{Distance}} + \beta_2 \underset{(X31)}{\log \text{Assessment}} + \beta_3 \underset{(X36)}{\log \text{Area}}$$

$$+ \beta_4 \underset{(X43)}{\log \text{Area} \cdot \text{HDUM}} + \beta_5 \underset{(X39)}{\log \text{Tax Rate}} + \beta_6 \underset{(X53)}{\text{M1}}$$

$$- \beta_7 \underset{(X74)}{\text{Pre '74} \cdot \text{Inkster}} - \beta_8 \underset{(X75)}{\text{Hwy} \cdot \text{Rail} \cdot \text{W2 W3}}$$

$$+ \beta_9 \underset{(X81)}{\text{Unit Price} \cdot \text{W2}} + e_i$$

In specifications 8 to 10 inclusive, the price per square foot in Ward 2 (X81) was deleted in order to determine whether there were potential autocorrelation problems associated with it. As indicated, the Durbin-Watson statistic increased from 1.4 to 1.7, by excluding the price per square foot in Ward 2. Although the R^2 and F ratio both declined as a result of excluding X81, and the sum of absolute errors increased slightly, it was decided that the higher Durbin-Watson statistic justified excluding this variable. If the residuals generated within the model were highly correlated with each other, then the coefficient values could not be trusted and the results of the model would be biased.

<u>Table 3A.5, Specification 10</u>

$$\underset{(X35)}{\log \text{Price}} = \alpha + \beta_1 \underset{(X17)}{\log \text{Distance}} + \beta_2 \underset{(X31)}{\log \text{Assessment}} + \beta_3 \underset{(X36)}{\log \text{Area}}$$

$$+ \beta_4 \underset{(X43)}{\log \text{Area}\cdot\text{HDUM}} + \beta_5 \underset{(X53)}{\text{M1}} + \beta_6 \underset{(X39)}{\log \text{Tax Rate}}$$

$$- \beta_7 \underset{(X74)}{\text{Pre '74}\cdot\text{Inkster}} - \beta_8 \underset{(X75)}{\text{HwyRail}\cdot\text{W2 W3}} + e_i$$

In APPENDIX Table 3A.6, the model was revised to include log effective tax rate. This was possibly the most significant revision made within this model. In so doing, X39 was generated by dividing the property tax paid by the market value instead of the assessed value. Log effective tax rate is both statistically significant and has the expected negative coefficient. It should be noted that the price elasticity of vacant industrial land with respect to the effective tax rate is very close to that identified within the comprehensive Winnipeg model. Whereas the elasticity of the effective tax rate variable (X39) is equal to 0.5 in the Inner City model, it becomes 0.4 in the combined model. This indicates that this model is quite stable, once log effective tax rate has been introduced. It should be noted that variable X18 or pre 1974 industrial land sales has replaced X74 located in Table 3A.5.

As indicated in Table 3A.6, all individual site characteristics as well as all neighbourhood characteristics became statistically significant once the effective tax rate was introduced.

The R^2 and F ratio improved and the error terms declined. The best version of the Inner City model is specification 14 with an R^2 = .869, an F value equal to 364.118 and a residual sum equal to 0.00008. The Durbin-Watson statistic is equal to 1.528.

Table 3A.6, Specification 14

$$\log \text{Price} = \alpha - \beta_1 \log \text{Distance} - \beta_2 \text{ Pre '74 Sales} + \beta_3 \log \text{Area}$$

(X17) (X18)

(X36)

$$+\beta_4 \log \text{Area} \cdot \text{HDUM} - \beta_5 \log \text{EFFECTIVE Tax Rate}$$

(X43) (X39)

$$+\beta_6 \text{ M1} \cdot \text{W1} - \beta_7 \text{ Hwy} \cdot \text{Rail} \cdot \text{W2} \cdot \text{W3} + \beta_8 \text{ Price/Sq.Ft.} \cdot \text{W2}$$

(X55) (X75) (X81)

$$+e_i$$

3.33 Comprehensive City of Winnipeg Model

Upon completion of the suburban as well as the inner city equations, these two components were combined into one model, which identified the price determinants of vacant industrial land within the entire City of Winnipeg. As indicated, in Table 3A.7, the level of refinement achieved within the final version of this composite model would never have been capable without initially identifying the individual characteristics that exist within the suburban and inner city markets, and how they independently affected industrial land prices in Winnipeg. The composite model encompasses individual characteristics representative of each of the two industrial land markets in the City. Those factors common to both the suburban and inner city models appear below:

The original Winnipeg composite, appearing as specification 1 in Table 3A.7, is a log linear model in which the price of vacant industrial land is a function of time, area, zoning, distance of the site from the city centre, population density, the effective property tax rate, transportation facilities, location and a variety of interactive variables that are both quantitative and qualitative (dummy variables) in nature. Since reliable municipal population data was not available on an annual basis, the annual municipal dwelling stock was substituted as a proxy. The source of this variable was the City of Winnipeg realty assessment roll.

Suburban Model[1]	Independent Variables	Inner City Model[2]
	log Distance	17
	pre '74 Land Sales	18
19	log Dwelling Units	19
36	log Area	36
39	log Effective Tax Rate	39
	log Area•HDUM	43
50	South West Winnipeg	
53	East Winnipeg	
	M1•Ward1	55
59	Hwy•Rail	
63	St. James•Air	
64	log•Tax Rate 1972	
65	log•Tax Rate 1973	
66	log•Tax Rate 1974	
67	log•Tax Rate 1975	
68	log•Tax Rate 1976	
69	log•Tax Rate 1977	
70	log•Tax Rate 1978	
71	log•Tax Rate 1979	
72	log•Tax Rate 1980	
73	log•Tax Rate 1981	
74	log•Tax Rate•HDUM	
	Hwy•Rail•Wards 2 and 3	75
	Price/Sq. Ft.•Ward 2	81

Footnotes:

1. Table 3A.3.
2. Table 3A.6.

Specification 1 (Table 3A.7)

Log Price =

$$-\beta_0 + \beta_1 \underset{(X20)}{1972} + \beta_2 \underset{(X21)}{1973} + \beta_3 \underset{(X22)}{1974} + \beta_4 \underset{(X23)}{1975} + \beta_5 \underset{(X24)}{1976}$$

$$+\beta_6 \underset{(X25)}{1977} + \beta_7 \underset{(X26)}{1978} + \beta_9 \underset{(X27)}{1979} + \beta_{10} \underset{(X28)}{1980} + \beta_{11} \underset{(X29)}{1981}$$

$$+\beta_{12} \underset{(X36)}{\text{log·Area}} + \beta_{13} \underset{(X43)}{\text{log Area·HDUM}} - \beta_{14} \underset{(X55)}{\text{M1·SWWpg}}$$

$$+\beta_{15} \underset{(X81)}{\text{log X79·W23}} - \beta_{16} \underset{(X17)}{\text{log Distance}} + \beta_{17} \underset{(X19)}{\text{log DU}}$$

$$-\beta_{18} \underset{(X39)}{\text{log Effective Tax Rate}} + \beta_{19} \underset{(X69)}{\text{Private·Air}}$$

$$-\beta_{20} \underset{(X86)}{\text{Wards 2 and 3}} - \beta_{21} \text{ NW·Wpg} - \beta_{22} \underset{(X91)}{\text{East·Wpg}} + e_i$$

This original version of the comprehensive model was also designed with the preliminary analysis carried out on St. Boniface and St. James-Assiniboia in mind. Note that all independent variables are statistically significant in each specification identified within Table 3A.7. As indicated, the initial attempt (specification 1) at developing a comprehensive model for the City of Winnipeg was highly successful, generating an R^2 equal to 0.8267, an F value equal to 209.211 and an extremely small residual sum equal to 0.00027. There was no indication of a strong linear relationship between any of the independent variables and therefore multicolinearity should not present a problem in this equation. Based on the model's design, in which annual dummy variables were used to avoid a correlation between any two disturbances, one might accept the conclusion that a Durbin-Watson statistic equal to 1.6 was a reasonable indicator that autocorrelation was not present in specification 1.

The location variable Rail•Hwy was included in specification 2, as it is considered of prime significance to industrial development in this City. Winnipeg's significance as a transportation centre to the rest of Canada and the United States was developed as a direct result of the westward expansion of the trans-continental rail line through the junction of the Red and Assiniboine Rivers. Winnipeg's hinterland and northern Manitoba were opened up to development due to trunk rail lines extending from Winnipeg. Aside from rail transportation, trucking also played a very significant role in Winnipeg's industrial expansion. As indicated in Table 3A.7, Rail•Hwy was appropriately included and became a statistically significant independent variable in determining the demand for industrial land.

Not only did all independent variables appear statistically significant, but after including this additional variable to the model, the signs and size of all coefficients remained virtually unchanged from specification 1. Statistically, the model appeared very stable, with the coefficient of multiple determination

(R^2), the F value, and error terms remaining virtually unchanged.

As in specification 1, investigation for signs of autocorrelation and multicolinearity proved negative. However, an indication of heteroscedasticity was discovered, by means of a Spearman Rank Correlation Coefficient test that identified variables X17 (log distance), X19 (log dwelling units) and X81 (log X79•W23) were correlated with the residual (X99).

In order to shed these heteroscedastic tendencies from specification 2 log distance was deleted from the model to form specification 3. Once again, the R^2, the F value and the error terms of this model, remained virtually identical to those in the first two specifications. Consequently, the model did not suffer, as a result of deleting this variable.

However, as identified in specification 4, by attempting to further increase the reliability of this model, the dwelling unit variable was also deleted, based on its heteroscedastic tendencies, resulting in changes to the coefficient size of most independent variables. There was also a change in sign for the independent variable W23

(X84), which is a locational dummy variable representing inner city wards 2 and 3. The coefficient went from β = -1.057 to β = 0.332. As indicated in Table 3A.7, the R^2 and F values declined substantially, whereas the error terms all increased. The Durbin-Watson statistic also dropped to 1.232 from 1.599, which is an indication of autocorrelation within this equation. Consequently, log dwelling units (X19), was retained in the model.

Economic theory identifies that the dwelling unit variable, a proxy for population density in this model, should be a prime factor taken into consideration with respect to identifying the demand for industrial land.[10] Since industry is producing partially for local markets and wants to locate near these markets, density is an independent variable that should be considered.

In order to appropriately specify the model with respect to zoning, I included the dummy variable X50, which represents all vacant industrial land in Winnipeg, zoned either M2 or M3. The intercept dummies are zoning classifications M1 and MP zoned land. As identified in

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[10] Fox, W. F. Fiscal Differentials and Industrial Location: Some Empirical Evidence, Urban Studies (1981), 18, pg. 109.

specification 5 the independent variables are all statistically significant, including X50, at a 99% level of significance, except for X20 (1971) which is near, but does not achieve, a 95% confidence level. The coefficient signs remain the same as existed in specifications 1 to 3 inclusive, and the value of the coefficients all remain stable.

The resulting equation, identified as specification 5 in Table 3A.7 is virtually identical to all models previously specified, in that the R^2, the F value, the sum of absolute errors and the standard error remained virtually unchanged. However, specification 5 more accurately defines the zoning classifications.

<u>Specification 5</u>

$$\underset{\text{(X93)}}{\underline{\text{log Price}}} = -\beta_0 + \beta_1 \underset{\text{(X20)}}{1972} + \beta_2 \underset{\text{(X21)}}{1973} + \beta_3 \underset{\text{(X22)}}{1974} + \beta_4 \underset{\text{(X23)}}{1975} + \beta_5 \underset{\text{(X24)}}{1976}$$

$$+\beta_6 \underset{\text{(X25)}}{1977} + \beta_7 \underset{\text{(X26)}}{1978} + \beta_8 \underset{\text{(X27}}{1979} + \beta_9 \underset{\text{(X28)}}{1980} + \beta_{10} \underset{\text{(X29)}}{1981}$$

$$+\beta_{11} \underset{\text{(X95)}}{\text{log Area}} + \beta_{12} \underset{\text{(X97)}}{\text{log Area}\cdot\text{HDUM}} - \beta_{13} \underset{\text{(X55)}}{\text{M1}\cdot\text{SWWpg}}$$

$$+\beta_{14} \underset{\text{(X50)}}{\text{M2}\cdot\text{M3}} + \beta_{15} \underset{\text{(X81)}}{\text{log Price/Sq.Ft.}\cdot\text{W23}} + \beta_{16} \underset{\text{(X19)}}{\text{log D.U.}}$$

$$-\beta_{17} \underset{\text{(X39)}}{\text{log Eff}\cdot\text{Tax Rate}} - \beta_{18} \underset{\text{(X60)}}{\text{Rail}\cdot\text{Hwy}} + \beta_{19} \underset{\text{(X69)}}{\text{Priv}\cdot\text{Air}}$$

$$-\beta_{20} \underset{\text{(X84)}}{\text{W23}} - \beta_{21} \underset{\text{(X86)}}{\text{NW}\cdot\text{Wpg}} - \beta_{22} \underset{\text{(X91)}}{\text{East}\cdot\text{Wpg}} + e_i$$

In an attempt to alleviate specification 5 of heteroscedasticity problems with independent variables X19 and X81, transformation of the regression was attempted by dividing the entire equation (both sides) by X19, by $\sqrt{X19}$ as well as by the estimated dependent variable, $\hat{Y}$. That is, as a matter of speculation, it was felt that the residual may have been proportional to either the square of the explanatory variable, the explanatory variable itself or the predicted dependent variable. The results of these three transformations were unsuccessfull in alleviating the model of the indicated heteroscedastic problems associated with the two variables under concern.

However, it should also be noted that by regressing each independent variable against the residual generated from specification 5, none of these t values were even close to being significant, which in turn, indicates that heteroscedaticity does not exist in any variable within this model, including X19 and X81.

By graphing the residuals against each independent variable, the same conclusion is reached. That is, there is no systematic relationship that exists within this model between the residuals and any of the independent variables, including X19 and X81.

Within all versions of the combined City of Winnipeg model all of the coefficient signs remain the same and all of their values remain very stable.

Therefore, taking all tests into consideration I have concluded that the heteroscedastic tendencies indicated within this model are limited and not of a magnitude that would negatively affect the reliability and accuracy of the respective coefficient values or the model in general.

The final version of this model appears as specification 5 in Table 3A.7 of the appendix. An additional zoning dummy variable, identified as M2•M3 (X50) was included, to ensure that zoning, a primary factor in identifying the demand for industrial land, was appropriately specified in the model. As indicated in specification 5, the addition of this variable does not affect the model's statistical results, except to identify that zoning classifications M2 and M3 are statistically significant relative to those zoning classifications situated within the intercept and identified as M1 (light industrial) and MP (industrial park) zoned land.

Testing the model's stability and level of statistical significance

MULTICOLLINEARITY:

A variety of tests were carried out in order to determine whether multicollinearity was a problem. Based on the correlation matrix of coefficients generated for this regression, there is no indication of a strong linear relationship between any of the independent variables. If multicollinearity is a problem the coefficients, although determinate, will possess large standard errors, which means they cannot be estimated with great precision or accuracy. Several t values will become insignificant and the F ratio will decline. Such results do not exist in specification 5. The standard error of these coefficients are all extremely low, regardless of the tests run against the model, and all t values are significant and remain that way when a variable or observation is excluded. The F ratio is high and also remains stable regardless of the testing carried out on this regression.

In summary, the model has a low standard error, a high R^2 and all independent variables are statistically significant, so that multicollinearity is highly improbable.

As a further test, I chose to exclude the independent variable X60. The R^2, F value, standard error, and sign as well as relative size of each coefficient remained virtually the same. By excluding this variable, the regression's statistical results did not change, which is an indication of stability and lack of multicollinearity with X60 in the model.

<u>Statistical Results Specification 6 Excluding X60(Test 1)</u>

R^2	0.826	0.825
F	199.57	207.146
Standard Error	0.574	0.576

Three additional tests were run, by excluding different observations and determining if this affected the model and once again there is no sign of instability or multicollinearity.

Statistical Results	Sample 2	Sample 3	Sample 4
R^2	0.827	0.826	0.821
F	199.828	199.512	183.278
Standard Error	0.574	0.574	0.584

As identified above, from samples 2 to 4 inclusive, the statistical results relating to the model's coefficient of multiple determination (R^2), the F value, and standard error are not affected by the exclusion of different observations. In sample 2, observation number 1 was excluded, whereas in sample 3, observation number 943 was deleted. In sample 4, the last 43 observations were excluded. In all three instances not only did the above-indicated statistical results remain stable but the sign and size of each coefficient remained quite stable.

As a final test, each explanatory variable was regressed on all others to determine whether any of the X variables were correlated with each other. By reviewing the correlation matrix generated for the regression of each independent variable on all others, it was determined that all correlation coefficients were low, with the highest registering 0.78. Therefore, after considering the results of all tests performed on this model, it has been concluded that multicollinearity does not appear to be a problem in specification 5.

<u>AUTOCORRELATION</u> occurs when the disturbance term relating to any observation is influenced by the disturbance term from another observation. This is particularly common to time series analysis. In order to avoid a lag correlation of a given time series with itself, the model was specified to include an annual dummy variable for each year in the data.

As a test for autocorrelation the residual has been plotted against time and as identified, there is no discernable pattern in e_t. Secondly, the Durbin-Watson statistic, which is the ratio of the sum of squared differences in successive residuals to the residual sum of squares is equal to 1.597. The combination of these results identifies that autocorrelation is not a problem in this model.

HETEROSCEDASTICITY:

A classical asumption of linear regression assumes there is an equal variance between the error terms. That is, the conditional variance of Y_i upon the given X_i, remains the same regardless of the values taken by the variable X. However, if there is an unequal variance amoung the residuals, the coefficients become inefficient. That is, they no longer have a minimum variance, regardless of how large the sample size becomes. As a result, confidence intervals becomes unnecessarily wide and the tests of significance are not as powerful, in that there is a much greater chance of accepting the significance of an estimator, when in reality, it is not true.

Certain forms of analysis, with cross-sectional data such as that which exists within this industrial land price model may be expected to encounter heteroscedasticity, as small, medium and large industrial land sales have been sampled together. The use of dummy and interactive dummy variables have been effectively used in an attempt to counter problems relating to unequal variance amoungst the residuals. Such explanatory variables have more precisely defined reality amongst price determinants within Winnipeg's industrial land market and in so doing has reduced the possibility of heteroscedasticity in this model.

In testing for heteroscedasticity, the residuals were plotted against each of the independent variables as well as the estimated dependent variable in search of a systematic pattern. Is there any increase in the variability of the least squares residuals as the sizes of the X variables increase? As indicated, no set pattern exists in any of these graphs. Secondly, the residual (X92) was regressed against all explanatory variables in the model, as well as the estimated dependent variable, and in each case the R^2 or coefficient of explained error and the F ratio was equal to zero. All t values were statistically insignificant. This identifies that the variance of the disturbance term is not related to any of the X variables. In all of these tests, the model showed no indication of heteroscedasticity.

As a final check, the Spearman Rank Correlation Coefficient test was run against each of the explanatory variables in the model. Upon testing each variable's rank correlation coefficient for significance, it became apparent that all but three of the variables were free of heteroscedasticity. Log distance (X17), and log DU (X19), and log price per square foot in Ward 2 and Ward 3 (X81) appeared heteroscedastic. That is, their residuals had unequal variance.

INDIVIDUAL SITE CHARACTERISTICS

As identified in the preliminary analysis, summarized in tables 3A.1 and 3A.2, the final version of this model pools the cross-sectional data by means of annual dummy variables identified for each sale year in the database.

By specifying annual dummy variables in this way, autocorrelation problems that might exist in a cross-sectional time series of this nature may be avoided. I originally used 1981 as the intercept dummy, when developing the preliminary analysis on St. Boniface and St. James-Assiniboia. Therefore, in order to test the model's stability, 1971 was chosen as the intercept year for the City wide version. All ten annual dummy variables were significant and each coefficient had the appropriate positive sign.[11] Since 1971 was the intercept dummy, each successive year reflected the rate of increase, on average, in prices within the industrial land market.

The size of each annual coefficient increases with time which identifies that the price of industrial land was continually increasing relative to the 1971 intercept dummy sales. The 1973 coefficient is larger than the 1972 coefficient. This trend continues until 1979 - 1980 when the coefficient size levels off and drops ever so slightly. This change occurred as a result of a dramatic reduction in the demand for vacant industrial land in Winnipeg at this time. As may be identified in Table 3A.9 the absorption of vacant industrial land, calculated via analysis of Winnipeg's building permit records, began a sharp decline in 1980.[12] This reduction in the demand for vacant industrial land is reflected in the slight decline experienced in the annual dummy coefficients in 1980 and 1981. This

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[11]Since the calculated t value was greater than the critical t value at a 95% level of confidence, the null hypothesis of H_o: $\beta = 0$ is rejected for all annual dummy variables X21to X29 inclusive. X 20 is significant at a 90% level of conficence, as the calculated t = 1.94 is greater than the critical t equal to 1.645. Based on this analysis, there is a positive non-linear relationship between the sale price of vacant industrial land and the advance of time from 1971 to 1981 inclusive.

[12]City of Winnipeg, Department of Environmental Planning, Research Branch building permit records.

significant reduction in the demand for industrial land, resulted in a decline in its price.

Area

Both area variables, log Area and log Area DHUM are statistically significant and each has a positive sign associated with its coefficient indicating that as the size of industrial land sale increases, the price responds in an upward fashion. A larger site will command a higher market price, ceteris peribus. However, as originally identified in the preliminary analysis, before transforming the model into a log linear function, there was a change in this variable's structure once a market price of $135,000 was achieved. Therefore, it has been identified that price has a linear relationship with area up to $135,000, after which incremental units of land experience diminishing returns with respect to the price obtained for this additional area.

Variable	log Area	log Area• HDUM
Calculated t Value	41.75	7.37
Coefficient Value	$\beta_{11} = 0.677$	$\beta_{12} = 0.044$
Critical t Value	2.57	2.57
	$H_o: \beta_{11} = 0$	$Ho: \beta_{12} = 0$
	$H_1: \beta_{11} \neq 0$	$H_1: \beta_{12} \neq 0$

In both instances, the calculated t value is greater than the critical t value. Therefore, we reject the null hypotheses that $\beta_{11} = 0$ and $\beta_{12} = 0$, which identifies that both explanatory variables are significant at a 99% level of confidence.

The elasticity of price with respect to area, identified by the coefficient equal to 0.677 indicates that for every ten percent increase in the "area", the market price will increase by 6.77%.

This may be identified as a inelastic response in the price of industrial land to a change in the area. For sale prices in excess of $135,000, the price elasticity of demand with respect to area is negligible based on the coefficient equal to 0.047.

Of all the quantitative independent variables identified in this model, AREA has one of the strongest impacts on the price of vacant industrial land, second only to the proxy substituted for population density, identified as log dwelling unit (X19).

Zoning

As identified in my preliminary analysis, I had chosen strictly vacant industrial zoned land sales to ensure all observations would reflect a point on the demand curve for lindustrial sites. Two zoning dummy variables, M2•M3 and M1•SW•Wpg, have been identified within specification 5 of Table 3A.7. M2•M3 relates to all industrial land sales that occurred between 1971 and 1981, that were zoned either M2 or M3. The second variable, M1•SW•Wpg identifies M1 zoned land that exists in south-west Winnipeg. The use of these particular zoning variables, was designed to reflect reality within the City of Winnipeg's industrial land market and in so doing, develop an industrial land price model which accurately identifies demand components and forecasts, with reasonable accuracy, the price of industrial land in the City.

"The purpose of M1 and M2 Industrial Districts is to provide for light manufacturing, commercial and warehousing uses which carry on their operations in such a manner that no nuisance factor is created or emitted outside an enclosed building. The purpose of the M3 Restricted Industrial District is to provide for industrial uses where a certain level of nuisance factors must be accepted as characteristic of the use. Wherever practical they are located as far as possible from residential districts and in such a way as to minimize any detrimental effect on other uses of land."[13]

M1•SWWpg is an interactive dummy variable that relates to all M1 zoned land sales that occurred during the time frame of this study, within the south-west quadrant of the City. For the sake of this analysis, the south-west quadrant consists of all land south of the Assiniboine River and west of the Red River plus that land north of the Assiniboine River contained within Inner City Ward 1. Hence, analysis of the zoning classifications in the combined city wide version of the model, located in Tables 3A.7 and 3A.8 identified M2 and M3 zoned land as one variable and M1 • SW Wpg as another.

Variable	M2•M3	M1•SW•Wpg
Calculated t value	-3.09	-7.32
Coefficient value	$\beta_{14} = -0.134$	$\beta_{13} = -0.839$
Critical t value	-2.57	-2.57
	$H_o: \beta_{14} = 0$	$H_o: \beta_{13} = 0$
	$H_1: \beta_{14} \neq 0$	$H_1: \beta_{13} \neq 0$

[13]City of Winnipeg Zoning By-law No. 4440, Part IX, Industrial, pg. IX-2.

Since both calculated t values are less than the critical t value equal to -2.57, we reject $H_o: \beta_{13} = 0$ and $H_o: \beta_{14} = 0$ and accept that both explanatory variables are significant at a 99% level of confidence.

For variable M2•M3 the intercept dummy is equal to all industrial land sales zoned either M1 or MP. Since M1 zoning has very similar land use characteristics to industrial park or MP zoning, the combination of these two zoning classifications in equation 5 of Table 3A.7, quite appropriately specifies this independent variable from an economic as well as a statistical point of view. The negative sign associated with this variable identifies that M2 and M3 industrial land has sold for less than land zoned either M1 or MP, ceteris peribus. Based on the fact that other amenities considered essential to industrial development are found within the intercept zoning classifications, this is a logical conclusion. Light manufacturing and warehousing activities are usually situated adjacent to commercial land uses which command high market values based on their proximity to prime location factors and major transportation facilities.

For the interactive zoning dummy variable identified as M1•SW•Wpg, the intercept dummy would include all industrial zoning classifications other than M1 in the south-west quadrant as well as all industrial land sales, regardless of their zoning classification, that occurred outside of the south-west quadrant. These particular zoning and locational classifications were identified within the same variable because it was identified that there was an excess supply of vacant industrial land in this part of the City relative to this area's absorption of industrial land. Although the land was designated as industrial, by means of its zoning classification, its highest and best use was not considered industrial, but rather future residential. This surplus of M1 industrial land, in the south-west quadrant resulted in lower industrial land prices than would otherwise have been experienced in this part of Winnipeg. Consequently, it was the supply side of Winnipeg's industrial land market that resulted in lower M1 land prices in the south-west quadrant relative to other parts of the City. It should be noted that according to variable X50 although M1 and MP zoned land received higher market prices than M2 and M3 land when analyzing the entire City, sales of M1 land in the south-west quadrant did not follow suit, as indicated by variable X55, which represents the price of M1 zoned industrial land in south-west Winnipeg.

The six different zoning classifications identified within this model represent a proxy for the business service variables contained within Fox's (1981) analysis. Specific types of industrial development associated with particular zoning classifications have enabled the author to accurately reflect the influence of the supply side of Winnipeg's industrial land market within this demand function.

Fox did not incorporate zoning into his model but rather identified specific types of business services. These business services were unable to appropriately reflect specialized services contained within particular zoning types, such as exist within the various MP classifications.

Industrial park zoning, for example, identifies that minimum business related services relating to density standards, sewer and water availability, appropriate street lighting, adequate police and fire protection, essential transportation and comparable land use will exist for each parcel of MP zoned land. Zoning classifications introduce specific types of industrial land use into the model which enables the analyst to accurately reflect what type of industrial development the supply side of the market is willing to allow or encourage. This is contained within the business related services variables in Fox's model, but only to a limited extent.

The presence of industrial services bids up the price of industrial land. This is identified in this model by the fact that M1 and MP zoned land has a positive influence on the price of industrial land in Winnipeg, relative to M2 and M3 zoned land. Land use standards and available services are much higher in the M1 and MP zoning districts than elsewhere.

Price Per Square Foot in Wards 2 and 3

This variable identifies the price per square foot obtained in Inner City wards 2 and 3 relative to the rest of the City. It was formulated based upon a deduction that evolved while reviewing the land sales data base. It became apparent that high land prices existed in the area associated with the Canadian Pacific Railway Yards, located north-east of Logan Avenue and Keewatin Street. By further analysis, it was determined that Inner City Wards 2 and 3 was a statistically significant independent variable.

H_o: $\beta_{15} = 0$

H_1: $\beta_{15} \neq 0$

Since the calculated t value equal to 15.75 is greater than the critical t value equal to 2.57, we reject the null hypotheses that H_o: $\beta_{15} = 0$ and identify that the variable identified as the price per square foot in Wards 2 and 3 (X81) is statistically significant at a 99% level of confidence. Since the coefficient sign is positive, this model identifies that the price per square foot of industrial land, situated in Inner City Wards 2 and 3, is greater than that identified in the rest of the City. The north-west quadrant of Winnipeg has very significant locational as well as transportation amenities associated with it, based on the fact that the C.P.R. main line and primary trucking routes leading to all northern and western markets are located there. However, a limited supply of available industrial land remains in this area. Consequently, the positive coefficient sign and level of statistical significance might well be expected, based on the economics associated with this part of the City's industrial land market. A high demand for and limited supply of industrial land in the north-west quadrant, particularly in Wards 2 and 3, has resulted in higher unit land prices in this sector of the City. The density of municipal servicing in this area would also be very high, which in turn would increase the price per square foot of industrial land.

The coefficient β_{15} = 0.504 identifies an inelastic response in the price of vacant industrial land in Winnipeg to the explanatory variable X81. For every ten percent increase in the price of industrial land per square foot within Inner City Wards 2 and 3, there is a corresponding increase in the price of industrial land equal to 5.04%.

NEIGHBOURHOOD CHARACTERISTICS

There are eight explanatory neighbourhood variables identified within specification 5, all of which are statistically significant.

Dwelling Unit (X19)

This variable is based upon the total housing stock that existed within each municipality during the year in which the industrial land sales occurred. As previously indicated, dwelling units were chosen as a proxy for population density, since reliable municipal population data was not available on an annual basis. The variable is highly significant.

The sign associated with this variable in specification 1 of Table 3A.7 still exists in specification 5 and identifies that population density has a positive impact on the price of vacant industrial land in Winnipeg. As previously indicated, this positive coefficient also provides evidence that firms are producing partly for local markets and want to locate near these markets.

$\beta_{16} = 0.644$ identifies that the price elasticity of demand with respect to density is inelastic. That is, for every ten percent increase in the municipal housing stock the price of vacant industrial land will go up by 6.44%.

It may be noted that this coefficient is very stable, in that it remains almost identical after transforming the equation in specification 6 through specification 8. The coefficient ranges from .64 to .67, which barely represents a change of 5% in β_{16}.

<u>EFFECTIVE Tax Rate</u>

The effective property tax rate is defined as the actual property tax divided by the market value or sale price of the industrial site under consideration.

$$H_o: \beta_{17} = 0$$
$$H_1: \beta_{17} \neq 0$$

Since the calculated t value equal to -13.52 is less than the critical t value equal to -2.57, this variable is statistically significant at a 99% level of confidence. The negative sign associated with this variable indicates that the effective tax rate has a negative impact of the demand for industrial land. Originally the analysis utilized the nominal property tax rate as opposed to the effective tax rate. That is, tax dollars divided by the assessed value of the land rather than tax dollars divided by the respective market value. The coefficient sign of the nominal property tax rate variable was positive, because it was positively correlated with time, unlike the revised version of this variable.

Based on the fact that economic doctrine has identified that property taxes have a negative impact on the demand for industrial land, I chose to re-specify the property tax variable, taking the effective rate into consideration. Based upon this re-specification, the sign became negative, and the coefficient, β_{17}, became quite stable, as evidenced by the statistical results indicated in Table 3A.7. The elasticity of price with respect to the effective property tax rate, identified by the coefficient equal to -0.382 indicates that for every ten percent increase in the effective tax rate (X43), the sale price of vacant industrial land (X35) in Winnipeg will respond by declining 3.82 percent. An elasticity equal to 0.38 may be identified as an inelastic response in the dependent variable, the sale price of vacant industrial land, to a change in the effective property tax rate (ceteris peribus).

TRANSPORTATION DUMMY VARIABLES:

Rail•Hwy (X60)

This transportation dummy variable identifies the significance of those industrial land sales which exist in a neighbourhood that has immediate access to both a major rail line and a highway for the purpose of transporting factors of production and finished goods to and from their place of manufacture or storage. RAIL•HWY is one of four transportation dummy variables identified within this study. Therefore when measuring the effect of Rail˙Hwy against all other transportation dummies, the intercept would consist of those industrial neighbourhoods which have immediate access to either rail, highway or air transportation. The effect of combining rail and highway transportation as an individual dummy variable, became apparent after reviewing the land sales data base, as a significant number of industrial neighbourhoods in Winnipeg were located in a primary industrial area of the City, which had immediate access to both rail and highway transportation facilities. This area was the north-west quadrant of the City, which services the majority of Winnipeg's trucking industry as well as the C.P.R. shops.

H_o: $\beta_{18} = 0$

H_1: $\beta_{18} \neq 0$

Critical $t_{\alpha = .01} = -2.57$

Calculated t = -2.81

Since the calculated t = -2.81 is less than the critical t = -2.57, we reject H_o: $\beta_{18} = 0$ and accept that this variable, which represents those neighbourhoods with access to both rail and highway transportation facilities, is statistically significant at a 99% level of confidence.

The fact that the coefficient is negative identifies that in Winnipeg, combined access to rail and highway transportation facilities have less of an impact on the price of industrial land relative to the intercept dummies. Because access to air transportation unquestionably has the most significant impact on the demand for industrial land in Winnipeg, X60 appears as a negative variable in this model. That is, it is negative relative to those land sales which exist in industrial neighbourhoods adjacent to the airport.

Priv•Air (X69)

The variable Priv•Air, represents all privately owned industrial land sales that occurred within industrial neighbourhoods with immediate access to the Winnipeg International Airport. For the sake of this study, "immediate accesss" is defined as those industrial neighbourhoods which have a common boundary with the airport. Murray Industrial Park, Omand's Creek Industrial Park, St. James Industrial, the Airport and King Edward were the neighbourhoods identified using this methodology.

The original attempt at generating the combined City of Winnipeg model incorporated all of the industrial neighbourhoods identified above. The suburban model, identified in Table 3A.3, successfully included all vacant industrial land sales adjacent to the airport that occurred within St. James, regardless of whether the land was privately or publically owned. However, in attempting to incorporate both public and private land sales into the comprehensive model, the variable AIR (X62) had a calculated t value = 0.053, which was statistically insignificant. Because of the insight gained by developing the Inner City model, it became apparent that City owned industrial land sales had a statistically significant and negative impact of the price of industrial land in this part of the City. Since a number of the industrial neighbourhoods butting up against the airport boundary contained publically owned industrual land, a dummy variable was generated which would identify only those neighbourhoods with privately owned industrial land sales that had immediate access to the airport.

In so doing, the variable X69 (Priv•AIR) was introduced in place of AIR (X62). The calculated T value for this revised transportation variable was equal to 3.74. Since 3.74 > 2.57, we reject H_o: $\beta_{19} = 0$ and accept that X69 is statistically significant at a 99% level of confidence. The coefficient sign identifies that Priv•AIR has a positive impact on the price of industrial land in Winnipeg, relative to all other transportation intercept dummies for X69, including those sales which have occurred in industrial neighbourhoods which consist primarily of City owned industrial land adjacent to the airport.

LOCATIONAL DUMMY VARIABLES

The comprehensive City wide model incorporates four locational dummy variables, each representing a specific industrial land market identified within the City of Winnipeg.

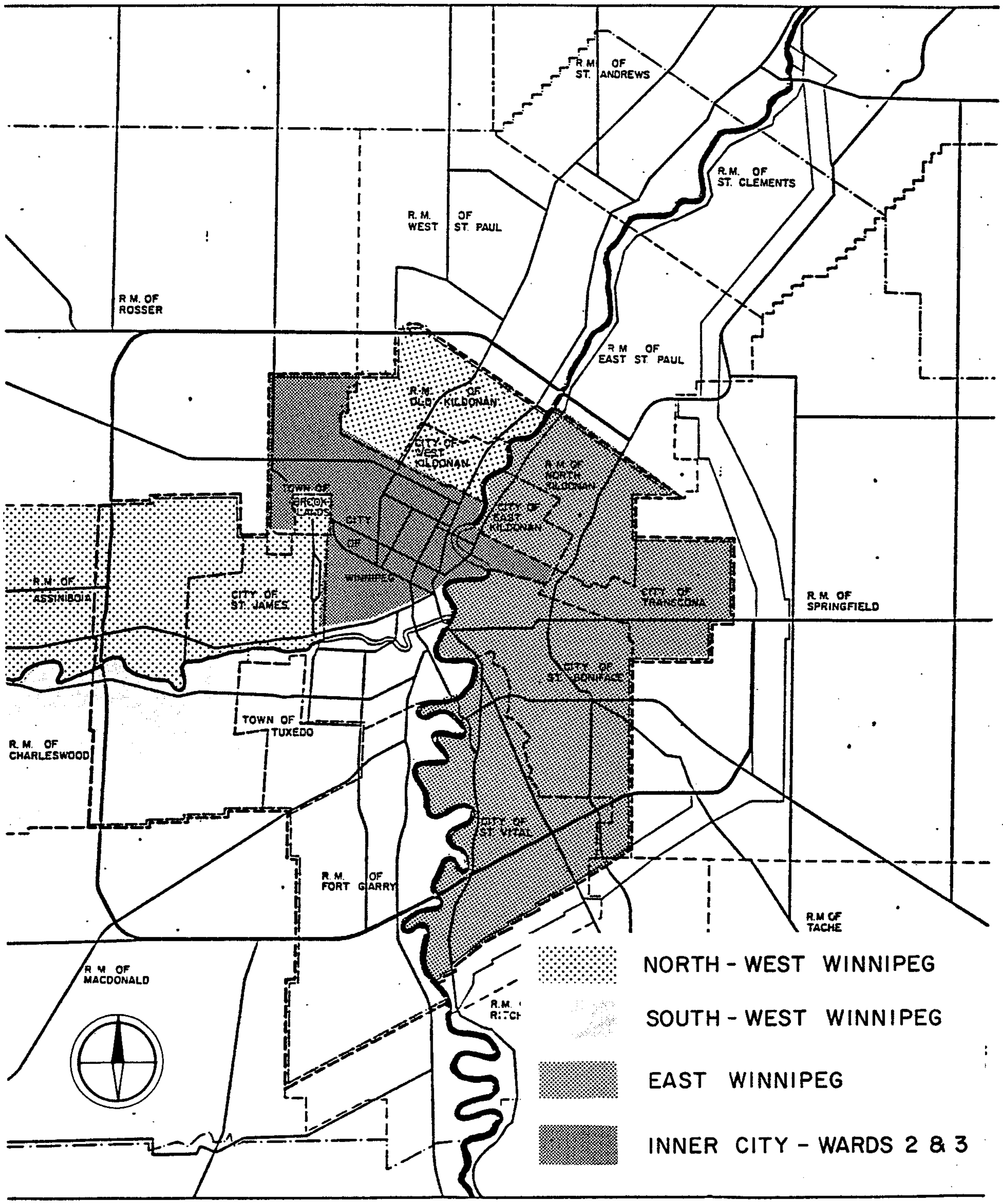

FIGURE 2: CITY OF WINNIPEG -
INDUSTRIAL LAND MARKETS

In defining these areas, I considered primary transportation routes and complementary zoning characteristics around which industrial development would flourish. Because waterways were the major transportation routes used by Winnipeg's early settlers, the Red and Assiniboine Rivers were identified as appropriate industrial market boundaries.

The main rail lines that pass through the City were also of prime significance in Winnipeg's development. The City experienced extensive growth after the Trans-Canada railway was directed through the junction of the Red and Assiniboine Rivers. Consequently, the area identified within the old Inner City of Winnipeg Ward 2 and Ward 3 boundaries was considered as a possible market since the marshalling yards for the Canadian Pacific Railway were located in Ward 3 and the zoning characteristics within these two former municipal boundaries were designed to accommodate complementary land uses surrounding the C.P.R. shops.

Since the Inner City area south of Portage Avenue to the Assiniboine River had comparable zoning characteristics to the area located south of the Assiniboine River and west of Red River, the data base was reviewed in order to determine whether comparable land sales existed in each of the areas. The price per square foot of industrial land was quite similar and therefore that portion of Inner City Ward 1 located north of the Assiniboine River was included as part of the south-west industrial land market.

<u>Variable</u>

X84 = W23	Inner City Ward 2 and Ward 3
X86 = NW•Wpg	North-West Winnipeg
X91 = EAST•Wpg	East Winnipeg
Intercept Dummy = SW•Wpg	South-West Winnipeg

The intercept dummy consists of all land in Winnipeg south-west of the junction of the Red and Assiniboine Rivers, as well as that area north of the Assiniboine River known as Inner City Ward 1. North of the Assiniboine River, Ward 1 consists of land situated south of Portage Avenue, west of the Red River and east of St. James Street.

<u>Variable X84</u> (W23) represents the area contained within the former Inner City of Winnipeg Ward 2 and Ward 3 boundaries. The southern limit of this market extends east from St. James Street along Portage Avenue to Portage Avenue East and then along Thistle Lane to the Red River. The boundary then turns north along the Red River until it intersects with the eastward extension of McAdam Avenue.

Go west from the Red River, along a line running between Smithfield Avenue and McAdam Avenue to McGregor Street. Turn southerly along McGregor to Carruthers Avenue and then turn west along Carruthers. The boundary continues west along Carruthers until it intersects with Keewatin Street. Turn north on Keewatin to Jefferson Avenue, and go east along Jefferson to Ritchie Street. Turn north on Ritchie to Mallard Road and go west on Mallard Road to Brookside Boulevard. Then turn south on Brookside Boulevard to its intersection with the C.P.R. Carberry Main Line. The boundary then basically follows the tracks to Selkirk Avenue and then turns east to Keewatin Street where it goes south to Notre Dame Avenue. It then turns west along Notre Dame to St. James Street, where it goes south to its intersection with Portage Avenue.

Variable X86 (NW·Wpg) is contained within the area north-west fo the Red and Assiniboine Rivers, excluding Inner City Wards 2 and 3, as described in variable X84.

Variable X91 (EAST·Wpg) consists of that area east of the Red River, contained within the City of Winnipeg boundary limits.

Locational Variables	Coefficients	Calculated t values
X84 (W23)	-1.088	-10.72
X86 (NW·Wpg)	-0.522	- 5.19
X91 (EAST·Wpg)	-0.313	- 4.21

As all of the calculated t values are less than the critical t = -2.57, we accept that each locational dummy is statistically significant at a 99% level of conficence. This model identifies four major vacant industrial land markets in Winnipeg. Since the coefficient values are all negative, each of the locational variables indicated above, have lower industrial land prices than the intercept dummy identified as south-west Winnipeg.

There appears to be a discrepancy in the model between results identified by the zoning variables and those based upon the locational dummies. According to the locational dummies identified by X84, X86 and X91, south-west Winnipeg's industrial land sales were the highest in the City. However, the interactive dummy variable, X55, identified that from 1971 to 1981 M1 zoned land sales in south-west Winnipeg were the lowest in the City. How can M1 zoned land in south-west Winnipeg have the lowest land prices when variables X84, X86 and X91 identify that the south-west quadrant contained the highest industrial land sales, regardless of the zoning? These results become even more suspect when considering that X50 identifies that M2 and M3 zoned land sold for less than M1 and MP zoned land in Winnipeg.

The answer to this apparent anomaly is based on the extensive amount of M1 zoned vacant industrial land which existed in the south-west quadrant of Winnipeg. A substantial amount of this supply was based on agricultural land that was rezoned to M1 for the sake of potential industrial development. Since the best and highest use associated with this M1 land was agricultural rather than industrial at the time of the sale, such land which existed on the periphery of the industrial land market in south-west Winnipeg was selling at lower prices than industrial land elsewhere in the City.

Hence a sub-market existed within the south-west quadrant of Winnipeg, which was selling M1 land for prices that were associated with the bottom end of the industrial land market regardless of their zoning. This sub-market is identified by the variable M1˙SW˙Wpg (X55).

Although problems associated with non bona fide industrial land sales were alleviated by removing the obvious sales from the south-west quadrant based on advise provided by the City Assessment Department,[14] it became apparent that the supply of this peripheral industrial-agricultural land was much higher than the demand for such land in the south-west quadrant during the period of this study, thus driving the price of comparable land down in this part of Winnipeg.

3.4 Problems Associated with the Model

It should be acknowledged that this model contains certain structural problems that may be identified in the following manner:

Two Stage Least Squares

The demand function contains an endogenous explanatory variable, which has not been identified separately in order to avoid the possibility of the effective tax rate being correlated with the disturbance in the equation. Ordinary, two stage least square should be used when estimating an over-identified equation. Each endogenous variable (log effective tax rate) is regressed on all of the other exogenous variables in the model. Then by replacing the endogenous effective tax rate variable on the right hand

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[14]Refer to the list of such non bona fide industrial land sales in the appendix of this chapter.

side of the equation by its "predicted value" obtained from the OLS regression performed in the first stage, one would effectively purge the effective tax rate variable of any correlation with the disturbance in the equation. In so doing, the coefficient estimates would be unbiased and consistent. That is, they would not be correlated with the disturbance term and the residual would have equal variance. In other words, auto-correlation and heteroscedasticity would not exist in the model.

However, based upon the analysis carried out on this model, such statistical problems did not exist, particularly with respect to the effective tax rate variable.

Structurally Different Markets: Inner City versus Suburbs

It should be noted that the former Metropolitan Corporation of Greater Winnipeg, merged into one regional local government body known as the City of Winnipeg (Unicity), on January 1, 1972. Originally, Metropolitan Winnipeg had twelve separate municipal governments, each of which contained its own administration that was responsible for local government services. In order to promote a more efficient use of municipal services, Unicity was formed. The goal was to provide Metropolitan Winnipeg with less costly services without any loss in effectiveness or quality of service. Property tax rates became uniform across the newly formed Unicity, and therefore all vacant industrial land sales used within this study, became eligible observations. Aside from the economic benefits, political improvements in the form of increased citizen participation was also accomplished by means of this merger.For administrative purposes, the revised "City of Winnipeg" (Unicity) Assessment Department chose to retain the fourteen original (pre 1972) municipal boundaries. These former political and economic jurisdictions, exist as one of the boundary systems identified within the demand side data base developed for this study. However, as previously indicated, the inclusion of the former municipal boundaries does not indicate that property tax differentials existed amongst them. As of January, 1972 only one municipal property tax existed within the Unicity boundary. If this were not the case, then individual cities or municipalities within a given metropolitan area would not be eligible as observations for analyzing industrial location.

Two structurally different equations were identified in developing the City wide (Unicity) model. Separate models were individually developed for each of the "Inner City" and "Suburban" industrial land markets. The overall city wide, or Unicity model does not acknowledge these structural differences. The reason for this choice, was based on the fact that the final version of Winnipeg's model encompassed explanatory variables that were common to both the inner city and the suburbs as well as those specific idiosyncrasies that existed within each separate component. However, because these two structurally different markets were not identified by means of a series of separate dummy variables within the final version of the model, the coefficients may be biased to a certain extent.

Simultaneous System

A demand and supply relationship exists within every price function. That is, price is definitely a function of the quantity demanded as well as the quantity of industrial land supplied. The supply chapter is not structurally tied in with the demand function as a separate component of the model and therefore the size of the coefficients would be subject to change, based on a simultaneous system of equations that would encompass a totally separate equation for Winnipeg's supply of vacant industrial land during the period of this study.

However, the industrial land price function developed for the City of Winnipeg, reflects factors originating on both the demand and the supply side of the market. In order to ensure that a demand-supply relationship existed within the demand function, zoning was used to identify only bona fide industrial land sales that occurred within the City of Winnipeg during the period under consideration.

As previously identified, this acknowledges the fact that municipal government exerts control over the supply side of the industrial market place through the use of zoning. As will become evident, by building this supply consideration into the demand function, the model developed herein, represents both the demand for and the supply of vacant industrial land in Winnipeg...if only to a limited extent.

3.5 APPENDIX TABLES

Table 3A.1 **Price Determinants of Vacant Industrial Land (Linear Function) Preliminary Analysis[1] - St. Boniface and St. James-Assiniboia**

(Y) Linear Dependant Variable = Sale Price

Independant Variables	Specification 1 β	Specification 1 t	Specification 2 β	Specification 2 t	Specification 3 β	Specification 3 t	Specification 4 β	Specification 4 t	Specification 5 β	Specification 5 t	Independant Variables
Area	-	-	.042	9.416	.040	8.900	.043	10.498	.042	10.088	X1
Log Area	21,334	4.658	-	-	-	-	-	-	-	-	X2
Log Area•HDUM	-	-	-	-	4,194.100	2.860	3,900.100	2.905	5,454.000	3.617	X3
Assessment	-9.784	-5.347	-9.517	-5.751	-9.955	-6.081	-10.060	-6.713	-9.933	-6.713	X4
(Assessment)^2	-	-	-0.00004	-4.024	-0.00002	-2.437	-0.00002	-2.264	-0.00002	-2.112	X5
Taxes	104,73	8.432	127.480	11.637	117.45	10.353	120.22	11.547	116.930	11.232	X6
Zoning (MP)	-64,175[2]	-3.072	-51,806	-3.111	-51,439	-3.136	-53,622	-3.571	-46,101	-3.067	X7
1971	-91,332	-2.515	-53,868	-1.726	-46,194	-1.496	-52,727	-1.829	-59,300	-2.085	X8
1972	-64,471	-1.858	-50,347	-1.690	-43,046	-1.461	-47,969	-1.744	-55,319	-2.039	X9
1973	-83,856	-2.801	-76,528	-2.973	-69,952	-2.748	-73,337	-3.061	-77,753	-3.290	X10
1974	-57,682	-1.990	-61,072	-2.469	-56,559	-2.316	-64,784	-2.823	-68,352	-3.013	X11
1975	104,210	-3.270	-90,928	-3.351	-78,829	-2.955	-86,270	-3.420	-91,510	-3.695	X12
1976	-87,197	-2.832	-95,555	-3.636	-88,569	-3.407	-93,703	-3.848	-103,080	-4.291	X13
1977	-74,055	-2.246	-71,874	-2.544	-66,502	-2.384	-44,003	-1.672	-53,546	-2.056	X14
1978	-45,733	-1.460	-42,513	-1.591	-39,266	-1.490	-43,996	-1.790	-51,416	-2.112	X15
1979	-63,750	-2.274	-59,129	-2.464	-57,586	-2.436	-61,518	-2.773	-63,767	-2.903	X16
1980	-81,925	-2.674	-78,520	-2.991	-70,195	-2.697	-80,190	-3.306	-89,917	-3.766	X17
St. Boniface	-15,468	-1.187	-12,425	-1.131	-17,634	-1.607	-15,520	-1.532	-15,880	-1.588	X18[3]

	Specification 1	Specification 2	Specification 3	Specification 4	Specification 5
N	249	249	249	247	247
R^2	.631	.731	.740	.783	.787
F	26.587	39.403	38.714	48.807	50.025
Sum of Absolute Errors	10.503 million	9.406 m	8.876 million	8.426 million	8.560 million
Residual Sum	3.938	7.394	7.007	6.860	6.691
D.W.	2.006	2.048	2.072	1.428	1.468

Footnotes:

1. Preliminary analysis, carried out on St. Boniface and St. James-Assiniboia.
2. In Specification 1, the zoning dummy relates specifically to MP2 zoning, whereas in Specification 2 to Specification 5, the zoning dummy variable is based on all MP zoning with M zoning (M1, M2, M3) as the intercept.
3. St. Boniface is the locational dummy variable identified within this sector of the analysis. St. James-Assiniboia is the intercept dummy in this instance.

Source: Developed by the author from data supplied from the City of Winnipeg Assessment Department.

Table 3A.2 Price Determinants of Vacant Industrial Land (Log Linear Function) Preliminary Analysis[1] - St. Boniface and St. James-Assiniboia

(Y) log-linear dependant variable = lot price

Independant Variables	Specification 7 β	Specification 7 t	Specification 8[3] β	Specification 8[3] t	Specification 9[4] β	Specification 9[4] t	Independant Variables
Zoning (MP)	-0.346	-3.270	-0.364	-3.335	-0.375	-3.474	X14
1971	-4.366	-2.577	-4.572	-2.698	-4.228	-2.596	X19
1972	-3.383	-2.412	-3.531	-2.514	-3.237	-2.404	X20
1973	-3.474	-2.734	-3.600	-2.830	-3.343	-2.733	X21
1974	-2.398	-2.446	-2.526	-2.577	-2.331	-2.470	X22
1975	-1.949	-2.761	-2.039	-2.888	-1.904	-2.793	X23
1976	-1.791	-3.310	-1.848	-3.412	-1.752	-3.333	X24
1977	-1.396	-2.464	-1.453	-2.562	-1.339	-2.454	X25
1978	-0.950	-2.156	-1.003	-2.277	-0.918	-2.159	X26
1979	-0.871	-2.263	-0.900	-2.332	-0.827	-2.217	X27
1980	-0.677	-2.601	-0.716	-2.755	-0.675	-2.659	X28
St. Boniface	0.040	0.519	0.057	0.746	-	-	X29[2]
log•Assessment	0.732	3.453	0.404	9.260	0.303	9.539	X31
log•Assessment²	-0.020	-1.586	-	-	-	-	X32
log•Area	0.270	7.127	0.276	7.289	0.284	7.883	X36
log•Tax Rate	-3.254	-1.601	-3.463	-1.702	-3.015	-1.552	X39
log•Area HDUM	0.043	4.145	0.036	3.821	0.035	3.818	X43

	Specification 7	Specification 8	Specification 9
N	247	247	247
R^2	.844	.842	.842
F	73.071	76.972	82.224
Sum of Absolute Errors	91.217	91.994	91.919
Residual Sum	0.00029	0.00031	0.00026
D.W.	1.962	1.959	1.958

Footnotes:

1. Preliminary analysis, carried out on St. Boniface and St. James-Assiniboia.
2. St. Boniface is the locational dummy variable identified within this sector of the analysis. St. James-Assiniboia is the intercept dummy in this instance.
3. Specification 8 is the best preliminary version of this model.
4. Although specification 9 may be statistically superior to specification 8, economic doctrine identifies that location is a very important factor in determining the price of industrial land and therefore should be included as an independant variable in this model. Because this preliminary analysis is underspecified with respect to locational variables, St. Boniface is statistically insignificant. However, as will become evident, location becomes a very significant factor, once the entire City is analyzed. However, specification 9 may prove usefull in forcasting the price of industrial land in a municipality such as Transcone, which has very similar characteristics to that of St. Boniface.

Source: Developed by the author from data supplied by the City of Winnipeg Assessment Department.

Table 3A.3 Price of Vacant Industrial Land Function
City of Winnipeg - Suburban Model

Y = log linear dependant variable = log price

Indopendant Variables		Specification 1 β	Specification 1 t	Specification 2 β	Specification 2 t	Specification 3 β	Specification 3 t	Specification 4 β	Specification 4 t
Individual Site Characteristics									
Log Assessment	(X31)	0.493	15.933	0.490	15.875	0.494	16.406	0.485	12.859
Log Area	(X36)	0.249	9.153	0.250	9.227	0.247	9.298	0.262	8.057
MP Zoning	(X19)	-0.400	-4.177	-0.395	-4.144	-0.425	-4.432	-0.429	-4.145
Pre 1974 Sales	(X39)	-	-	6.889	2.444	-0.244	-2.375	-	-
Neighbourhood Characteristics									
Log Tax Rate	(X39)	1.451	2.550	2.594	3.540	1.788	9.458	1.793	8.599
Log Tax Rate•DUM	(X74)	-0.244	-4.799	-0.248	-4.905	-0.244	-4.815	-0.231	-4.147
Log Tax Rate - 1972	(X64)	-0.043	-0.696	0.022	0.328	-	-	-	-
Log Tax Rate - 1973	(X65)	-0.030	-0.438	0.077	0.934	-	-	-	-
Log Tax Rate - 1974	(X66)	-0.202	-1.958	-3.233	-2.598	-	-	-	-
Log Tax Rate - 1975	(X67)	-0.128	-0.862	-3.291	-2.527	-	-	-	-
Log Tax Rate - 1976	(X68)	-0.151	-0.845	-3.414	-2.535	-	-	-	-
Log Tax Rate - 1977	(X69)	-0.307	-1.755	-3.556	-2.652	-	-	-	-
Log Tax Rate - 1978	(X70)	-0.263	-1.257	-3.610	-2.607	-	-	-	-
Log Tax Rate - 1979	(X71)	-0.360	-1.673	-3.739	-2.673	-	-	-	-
Log Tax Rate - 1980	(X72)	-0.285	-1.125	-3.767	-2.604	-	-	-	-
Log Tax Rate - 1981	(X73)	-0.329	-1.105	-3.937	-2.615	-	-	-	-
South West Winnipeg	(X50)	0.080	0.786	0.087	0.859	0.073	0.726	0.130	1.061
East Winnipeg	(X53)	0.102	1.120	0.067	0.727	0.118	1.302	0.139	1.281
Highway•Rail	(X59)	0.226	3.257	0.202	2.903	0.241	3.524	0.238	2.779
St. James•Air	(X63)	0.293	2.421	0.277	2.302	0.292	2.415	0.204	1.380
N		498		498		498		498	
R^2		.835		.837		.829		.799	
F		128.001		123.165		237.301		158.770	
Sum of Absolute Errors		207.78		206.500		214.550		160.810	
Residual Sum		-.00034		-.00004		-.00046		-.00034	
D.W.		1.808		1.813		1.762		1.769	

Independant Variables
X31
X36
X19
X30
X39
X74
X64
X65
X66
X67
X68
X69
X70
X71
X72
X73
X40
X53
X59
X63

a) Two-tailed t-test 5% critical value = 1.96
b) Two-tailed t-test 1% critical value = 2.57

Source: Developed by the author from data supplied by the City of Winnipeg Assessment Department.

Table 3A.4 Price Determinants of Vacant Industrial Land
City of Winnipeg - Inner City Model

Dependant Variables = Log Y = log price

Independant Variables	Specification 1 β	Specification 1 t	Specification 2 β	Specification 2 t	Specification 3 β	Specification 3 t	Independant Variables
1972	-0.213	-1.638	-	-	-	-	X20
1973	-0.197	-0.734	-	-	-	-	X21
1974	-0.654	-1.242	-	-	-	-	X22
1975	-0.802	-0.977	-	-	-	-	X23
1976	-0.843	-0.796	-	-	-	-	X24
1977	-0.994	-0.909	-	-	-	-	X25
1978	-1.096	-0.898	-	-	-	-	X26
1979	-0.961	-0.733	-	-	-	-	X27
1980	-1.278	-0.866	-	-	-	-	X28
1981	-1.516	-1.027	-	-	-	-	X29
Log Assessment	0.350	7.987	0.363	8.278	0.350	7.986	X31
Log Area	0.538	12.282	0.527	12.050	0.538	12.284	X36
Log Tax Rate[1]	2.931	1.336	2.152	1.076	2.807	1.407	X39
Log Area HDUM[2]	0.045	5.011	0.045	5.038	0.045	5.018	X43
Ward 1•M1[3]	-	-	0.163	2.514	-	-	X53
Combin•Wards 2 & 3[4]	-0.691	-7.341	-0.583	-5.667	-0.691	-7.344	X58
Rail•Hwy[5]	-0.535	-6.033	-0.534	-6.058	-0.535	-6.032	X60
Log Tax Rate 1972	-	-	0.096	1.737	0.091	1.646	X63
Log Tax Rate 1973	-	-	0.051	0.463	0.083	0.751	X64
Log Tax Rate 1974	-	-	0.224	0.976	0.299	1.305	X65
Log Tax Rate 1975	-	-	0.259	0.677	0.381	1.015	X66
Log Tax Rate 1976	-	-	0.251	0.480	0.521	0.815	X67
Log Tax Rate 1977	-	-	0.313	0.574	0.543	0.939	X68
Log Tax Rate 1978	-	-	0.366	0.585	0.625	0.927	X69
Log Tax Rate 1979	-	-	0.283	0.411	0.687	0.746	X70
Log Tax Rate 1980	-	-	0.450	0.554	0.809	0.891	X71
Log Tax Rate 1981	-	-	0.580	0.713	0.809	1.068	X72
Log X79•W1[6]	0.581	13.754	0.570	13.447	0.042	13.743	X81

	Specification 1	Specification 2	Specification 3
N	447	447	447
R^2	0.848	0.850	0.848
F	140.994	135.179	141.009
Sum of Absolute Errors	183.92	180.92	
Residual Sum	-0.0005	-0.0004	
D.W.	1.450	1.470	

Footnotes:

1. Log Tax Rate equals the log function of the municipal property tax.

2. Log Area•HDUM is an interactive dummy variable which tests the statistical significance of the AREA of those industrial land sales whose price was in excess of $135,000. The intercept would be comprised of all land sales less than or equal to $135,000.

3. Ward 1•M1 is an interactive dummy variable that tests the statistical significance of those industrial land sales which existed in the Inner City, Ward 1 and were zoned M1. The intercept would be all industrial land sales that were in WARD 1 but were not zoned M1 as well as all sales that existed in Wards 2 and 3.

4. Combin•Wards 2 and 3 is a dummy variable testing the statistical significance of Wards 2 and 3 in the Inner city on the price of industrial land. The intercept is Inner City Ward 1.

5. Rail•Hwy is an interactive dummy variable testing that statistical significance of those industrial land sales which had access to both rail and highway transportation facilities.

6. Log X79•W1 is the log function of an interactive dummy variable which tests the statistical significance of the price per square foot of industrial land sales in Ward 1.

Source: Developed by the author from data supplied by the City of Winnipeg Assessment Department.

Table 3A.5 Price of Vacant Industrial Land Function
City of Winnipeg - Inner City Model

Independant Variables	Specification 4[1] β	Specification 4[1] t	Specification 5[1] β	Specification 5[1] t	Specification 6[1] β	Specification 6[1] t	Specification 7[2] β	Specification 7[2] t	Specification 8[2] β	Specification 8[2] t	Specification 9[2] β	Specification 9[2] t	Specification 10[2] β	Specification 10[2] t	Independant Variables
Individual Site Characteristics															
Log Assessment	0.462	10.28	0.488	10.66	0.462	10.30	0.462	10.27	0.650	13.31	0.653	13.34	0.658	13.30	X31
Log Area	0.430	9.59	0.468	10.33	0.430	9.60	0.430	9.60	0.216	4.54	0.206	4.34	0.205	4.28	X36
Log Area•HDUM(P≥135,000)	-0.001	-0.01	-	-	-	-	0.044	4.89	-0.147	-2.04	-	-	0.057	5.42	X43
M1[3] (Intercept = M2,M3)	0.276	4.60	0.275	4.49	0.276	4.62	0.276	4.61	0.253	3.66	0.252	3.64	0.251	3.61	X53
Pre '74•Inkster[4] (1972-1973 ≡1)	-0.546	-3.19	-0.617	-3.53	-0.546	-3.20	-0.543	-3.18	-0.456	-2.30	-0.437	-2.21	-0.436	-2.19	X74
Unit Price•W2[5]	0.498	12.13	0.526	12.85	0.498	12.37	0.504	12.56	-	-	-	-	-	-	X81
Neighbourhood Characteristics															
Log Distance	0.063	2.86	0.064	2.81	0.063	2.86	0.06	2.83	0.053	2.08	0.05	1.95	.049	1.90	X17
Log Tax Rate	1.179	9.42	1.283	10.31	1.179	9.59	1.16	9.43	1.571	11.24	1.53	11.02	1.527	10.907	X39
Log Tax Rate•HDUM (P≥135,000)	-0.298	-7.33	-	-	-0.291	-4.95	-	-	-1.320	-2.87	-0.39	-5.81	-	-	X82
Highway Rail•W2•W3[6]	-0.488	-5.16	-0.522	-5.41	-0.489	-5.18	-0.494	-5.24	-0.380	-3.49	-0.39	-3.60	-.399	-3.65	X75
N	447		447		447		477		447		447		447		N
R^2		.842		.833		.842		.842		.789		.787		.785	R^2
F	233.3		274.5		259.9		259.5		182.06		202.84		200.48		F
Sum of Absolute Errors	188.4		193.0		188.4		188.2		214.37		213.99		214.28		Sum of Absolute Errors
Residual Sum	-0.00022		-0.00023		-0.00022		-0.00022		-0.00031		-0.00031				Residual Sum
D.W.		1.47		1.42		1.47		1.47		1.71		1.70		1.70	D.W.

Footnotes:

1. Specification 4-7 all include X81 (Price per square foot in Ward 2).
2. Specification 8-10 all exclude X81 (Price per square foot in Ward 2).
3. M1 zoning allows low-density industrial development (M1=1, otherwise 0).
4. Inter-active dummy in which pre 1974 industrial land sales were identified within Inkster Industrial Park.
5. Price per square foot of vacant industrial land.
6. Interactive dummy variable in which those industrial land sales situated in the Inner City wards that had immediate access to both a major rail line as well as a primary trucking route (highway) were set equal to 1.

Table 3A.6 Price of Vacant Industrial Land Function
City of Winnipeg - Inner City Model

Dependant Variable = log Y = log price

Independant Variables	Specification 11 β	Specification 11 t	Specification 12 β	Specification 12 t	Specification 13 β	Specification 13 t	Specification 14 β	Specification 14 t	Specification 15 β	Specification 15 t	Independant Variables
Individual Site Characteristics											
Pre 74	-0.401	-6.241	-0.021	-0.213	-0.226	-3.767	-0.280	-5.142	-	-	X18
Log Area	0.757	28.796	0.703	33.671	0.699	33.353	0.822	36.472	0.830	37.174	X36
Log Area HDUM	0.054	5.502	0.047	5.225	0.051	5.632	0.041	4.988	0.036	4.449	X43
M1•W1	0.305	2.915	0.683	6.874	0.703	7.045	0.612	6.761	0.585	6.537	X55
Price per sq. ft • W2	-	-	0.529	12.810	0.530	12.733	0.513	13.671	0.514	13.937	X81
Neighbourhood Characteristics											
Log Distance	-0.180	-8.031	-0.123	-5.717	-0.128	-5.939	-0.103	-5.237	-0.096	-4.928	X17
Log DU	-	-	2.773	2.598	-	-	-	-	3.634	6.261	X19
Log Eff TR	-0.741	-18.095	-0.570	-14.050	-0.581	-14.298	-0.561	-15.280	-0.547	-15.031	X39
Hwy•Rail•Wards 2 and 3	-0.815	-8.917	-	-	-	-	-0.771	-10.050	-0.785	-10.367	X75

	Specification 11	Specification 12	Specification 13	Specification 14	Specification 15
N	446	446	446	446	446
R^2	0.813	0.841	0.839	0.869	0.873
F	273.396	290.755	327.032	364.118	375.646
Sum of Absolute Errors	195.62	182.02	184.23	163.67	160.88
Residual Sum	0.00008	0.00074	0.00005	0.00008	0.0009
D.W.	1.633	1.567	1.541	1.528	1.574

Source: Developed by the author from data supplied by the City of Winnipeg Assessment Department.

Table 3A.7 Price Determinants of Vacant Industrial Land
City of Winnipeg - Combined Model

Dependant Variable = lot Y = lot price

Independant Variables		Specification 1[1.] β	Specification 1[1.] t	Specification 2 β	Specification 2 t	Specification 3 β	Specification 3 t	Specification 4 β	Specification 4 t	Specification 5[2.] β	Specification 5[2.] t	Revised Independant[3.] Variables
Individual Site Characteristics												
1972	(X20)	0.192	2.05	0.200	2.14	0.195	2.07	0.348	3.17	0.182	1.94	X20
1973	(X21)	0.205	2.40	0.227	2.65	0.228	2.64	0.479	4.81	0.215	2.50	X21
1974	(X22)	0.323	4.08	0.340	4.28	0.342	4.28	0.614	6.68	0.336	4.23	X22
1975	(X23)	0.374	4.37	0.389	4.54	0.376	4.36	0.638	6.42	0.365	4.25	X23
1976	(X24)	0.466	5.40	0.485	5.61	0.466	5.36	0.772	7.73	0.462	5.34	X24
1977	(X25)	0.623	6.60	0.649	6.84	0.651	6.82	0.943	8.55	0.667	7.00	X25
1978	(X26)	0.657	6.83	0.675	7.01	0.665	6.86	1.021	9.19	0.670	6.95	X26
1979	(X27)	0.847	9.35	0.882	9.63	0.889	9.65	1.288	12.28	0.883	9.62	X27
1980	(X28)	0.808	7.91	0.830	8.11	0.823	7.99	1.243	10.56	0.819	7.98	X28
1981	(X29)	0.795	8.24	0.821	8.48	0.830	8.51	1.162	10.36	0.831	8.56	X29
Log Area[4.]	(X36)	0.676	43.95	0.690	42.23	0.680	41.81	0.615	33.10	0.677	41.75	X36
Log Area•HDUM[5.]	(X43)	0.044	7.44	0.043	7.24	0.044	7.45	0.056	8.11	0.044	7.37	X43
M2•M3[6.]	(X50)	-	-	-	-	-	-	-	-	-0.134	-3.09	X50
M1•SWWpg[7.]	(X55)	-0.571	-5.83	-0.679	-6.31	-0.716	-6.63	-0.338	-2.72	-0.839	-7.32	X55
Log X79 W23[18.]	(X81)	0.491	15.91	0.464	14.17	0.495	15.46	0.440	11.80	0.504	15.75	X81
Neighbourhood Characteristics												
Log Distance[9.]	(X17)	-0.084	-3.96	-0.082	-3.88	-	-	-	-	-	-	X17
Log DU[10.]	(X19)	0.626	17.47	0.622	17.37	0.651	18.47	-	-	1.644	18.33	X19
LogEff TR[11.]	(X39)	-0.391	-13.78	-0.406	-14.01	-0.380	-13.37	-0.292	-8.92	-0.382	-13.52	X39
Rail•Hwy[12.]	(X60)	-	-	-0.142	-2.39	-0.151	-2.52	-0.214	-3.06	-0.168	-2.81	X60
Priv•Air[13.]	(X69)	0.406	4.00	0.354	3.42	0.332	3.19	0.531	4.38	0.395	3.74	X69
W23[14.]	(X84)	-0.955	-9.67	-1.012	-9.99	-1.057	-10.42	0.162	1.80	-0.088	-10.72	X84
NW•Wpg[15.]	(X86)	-0.335	-3.64	-0.405	-4.20	-0.433	-4.47	-0.272	-2.41	-0.522	-5.19	X86
East•Wpg[16.]	(X91)	-0.235	-3.29	-0.264	-3.65	-0.262	-3.60	-0.261	-3.07	-0.313	-4.21	X91

	Specification 1	Specification 2	Specification 3	Specification 4	Specification 5
N	943	943	943	943	943
R^2	0.8267	0.8278	0.825	0.760	0.826
F	209.211	200.986	206.686	146.05	199.57
Sum of Absolute Errors	411.06	411.01	413.76	485.20	412.66
Residual Sum	0.00027	0.00030	0.00033	0.00005	0.00032
Standard Error	0.574	0.573	0.577	0.675	0.574
D.W.	1.610	1.593	1.599	1.232	1.597

Source: Developed by the author from data supplied by the City of Winnipeg Assessment Department.

Table 3A.7 Price Determinants of Vacant Industrial Land
City of Winnipeg - Combined Model

FOOTNOTES:

1. Original version of the combined City of Winnipeg model.
2. Final version of the combined City of Winnipeg model.
3. Revised independant variables relating to specification 5 and specification 6. Revisions are based upon the transformation carried out on these 2 equations by dividing all QUANTITATIVE independant variables by the square root of X19. This was done in order to overcome heterascedasticity problems experienced with X19 in specifications 1-4.

   X19 becomes X94 (RV•LOG DU - revised log dwelling unit)
   X36 becomes X95 (RV•LOG AREA - revised log site area)
   X39 becomes X96 (RV•LGEFFTR - revised log effective tax rate)
   X43 becomes X97 (RV•ARHDUM - revised area HDUM)
   X81 becomes X98 (RV•SQFTPR - revised price per square foot located in inner City Wards 2 and 3).

4. Log function of the site area.
5. Log Area•HDUM is an interactive dummy variable which tests the statistical significance of the AREA of those industrial land sales whose price was in excess of $135,000. The intercept dummy would be comprised of all industrial land sales less than or equal to $135,000.
6. M2•M3 is a zoning dummy variable (X50 =1) that tests the statistical significance of those land sales that were zoned M2 or M3. The intercept (X50 =0) would be all land zoned M1, MP1, MP2, or MP3 within the City of Winnipeg.
7. M1•SWWpg is an interactive dummy variable (X55 =1) that tests the statistical significance of industrial land sales in south-west Winnipeg that are zoned M1. The intercept (X55 =0) would be all land sales in south-west Winnipeg that are not zoned M1 as well as all other land sales that occured in other locations outside south-west Winnipeg.
8. Log X79•W23 is the log function of the price per square foot of land sales that occured in Wards 2 and 3 of the Inner City of Winnipeg.
9. Log•Distance is the log function of distance that exists between Portage Avenue and Main Street and a central location identified within the neighbourhood in which the industrial land sale took place.
10. Log dwelling unit is the log fuction of the number of dwelling units that existed in the neighbourhood where the industrial land sale occured. This variable is a proxy for population density.
11. Log effective tax rate is the log function of the effective municipal property tax rate. The effect or REAL tax rate is the actual tax dollars paid on the property under consideration decided by sale price.
12. Rail•Hwy is a transportation dummy variable (X60 =1) which tests the statistical significance of all industrial land sales which had immediate access to both rail and major highway facilities.
13. Priv•Air is a dummy variable (X69 =1) which tests the statistical significance of those industrial land sales that had immediate access to the Winnipeg International Airport and were not owned by any level of the public sector.
14. W23 is a locational dummy variable (X84 =1) which tests the statistical significance of those industrial land sales that occured in Wards 2 and 3 of the Inner City of Winnipeg. The intercept (X84 =0) would be land sales that occured outside of these two municipal wards.
15. NW•Wpg is a locational dummy variable (X86 =1) that tests the statistical significance of those industrial land sales that occured in the north-west quadrent of Winnipeg. This quadrent consists of the municipalities of Old Kildonan, West Kildonan and St. James-Assiniboia.
16. East•Wpg is a locational dummy variable (X91 =1) that tests the statistical significance of those industrial land sales that occured east of the Red River. This area consists of the municipalities of East Kildonan, North Kildonan, St. Boniface, St. Vital and Transcona.

Table 3A.8 Price Determinants of Vacant Industrial Land
City of Winnipeg - Combined Model

Individual Variable		Specification 5		TRANSFORMATION[10] Specification 6[1]		Specification 7[2]		Specification 8[3]		REVISED Independant Variables	
		β	t	β	t	β	t	β	t		
Individual Site Characteristics											
1972	(X20)	0.182	1.94	0.061	2.00	0.020	2.09	0.022	2.35		(X20)
1973	(X21)	0.212	2.50	0.074	2.68	0.026	2.89	0.027	3.21		(X21)
1974	(X22)	0.336	4.23	0.113	4.42	0.038	4.63	0.038	4.89		(X22)
1975	(X23)	0.365	4.25	0.122	4.41	0.041	4.59	0.040	4.70		(X23)
1976	(X24)	0.462	5.34	0.154	5.50	0.051	5.66	0.050	5.89		(X24)
1977	(X25)	0.667	7.00	0.222	7.20	0.074	7.39	0.070	7.40		(X25)
1978	(X26)	0.670	6.95	0.218	7.00	0.071	7.06	0.070	7.44		(X26)
1979	(X27)	0.883	9.62	0.288	9.68	0.094	9.76	0.090	10.02		(X27)
1980	(X28)	0.819	7.98	0.267	8.04	0.087	8.11	0.083	8.28		(X28)
1981	(X29)	0.831	8.56	0.272	8.66	0.089	8.77	0.086	9.06		(X29)
Log Area	(X36)	0.677	41.75	0.658	39.64	0.641	37.68	0.732	39.00	RV•LGAREA	(X95)[6]
Log AreaHDUM	(X43)	0.044	7.37	0.047	7.84	0.051	8.33	0.039	5.52	RV•ARHDUM	(X97)[8]
M2•M3	(X50)	-0.134	-3.09	-0.044	-3.14	-0.014	-3.15	-0.014	-3.32		(X50)
M1•SWWpg	(X55)	-0.839	-7.32	-0.284	-7.67	-0.096	-7.99	-0.087	-7.04		(X55)
Lg X79W23	(X81)	0.504	15.75	0.476	13.81	0.447	11.96	0.554	16.73	RV•SQFT•PR	(X98)[9]
Neighbourhood Characteristics											
Log Distance	(X17)	-	-	-	-	-	-	-	-		
Log DU	(X19)	0.644	18.33	0.635	17.76	-4.333	-9.82	0.677	18.44	RV•LOG•DU	(X94)[5]
Log EFF TR	(X39)	-0.382	-13.52	-0.398	-13.75	-0.415	-14.01	-0.438	-14.84	RV•LGEF•TR	(X96)[7]
RAIL•HWY	(X60)	-0.168	-2.81	-0.052	-2.70	-0.016	-2.61	-0.019	-3.11		(X60)
PRIV•AIR	(X69)	0.395	3.74	0.125	3.66	0.039	3.57	0.034	3.23		(X69)
W23	(X84)	-1.088	-10.72	-0.327	-10.30	-0.098	-9.85	-0.110	-9.98		(X84)
N.W.Wpg	(X86)	-0.522	-5.19	-0.167	-5.13	-0.053	-5.03	-0.049	-4.70		(X86)
East•Wpg	(X91)	-0.313	-4.21	-0.106	-4.42	-0.036	-4.59	-0.028	-3.67		(X91)
		N/A	N/A	-4.567	-10.52	N/A	N/A	-5.942	-12.75	RAN INTR	(X92)[4]
N			943		943		943		943		
R^2			0.826		N/A		0.887		N/A		
F			199.57		N/A		330.87		N/A		
Sum of Absolute Errors			412.66		N/A		43.03		N/A		
Residual Sum			0.00032		N/A		-0.00023		N/A		
Standard Error			0.574		N/A		0.060		N/A		
D.W.			1.597		N/A		1.546		N/A		

Source: Developed by the author from data supplied from the City of Winnipeg Assessment Department.

Table 3A-8 Price Determinants of Vacant Industrial Land City of Winnipeg - Combined Model

Footnotes:

1. Transformation of specification 5, by dividing both sides of the equation by $\sqrt{X19}$. This regression must be forced through the origin and therefore the model's R^2 and F value cannot be used.
2. Transformation of specification 5, by dividing both sides of the equation by X19.
3. Transformation of specification 5, by dividing both sides of the equation by the predicted dependant variable $\hat{Y}$. This regression must be forced through the origin and therefore the model's R^2 and F value cannot be used.
4. In specification 8, the transformed intercept variable is X93.
5. In specification 8, the transformed log dwelling unit variable is X95.
6. In specification 8, the transformed log area variable is X96.
7. In specification 8, the transformed log effective tax rate variable X97.
8. In specification 8, the transformed log area HDUM variable is X98.
9. In specification 8, the transformed log price per square foot variable is X99.
10. The coefficients identified for the transformed specifications are those generated by means of the regression analysis. In order to determine the appropriate effect of these variables on the dependant variable, the transformed intercept, as well as the qualitative (dummy) variables must be multiplied by the mean value of their respective dividend. That is, the mean value of the variable used to transform the equation. In specification 6, this variable is equal to the square root of X19 (log dwelling unit) or X40, whereas, in specification 7, X19 is the transformation variable. In specification 8, the equation (specification 5) was transformed by dividing through by the predicted dependant variable, equal to $\hat{Y}$ or X92, that was generated by means of the AP option in SHAZAM.

Table 3A.9 Industrial Building Construction and Land Absorption City of Winnipeg, 1972 - 1984

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Total Space Constructed	1,508.4	1,374.4	3,221.3	1,364.2	1,414.9	681.0	1,002.8	2,090.8	1,788.0	1,376.7	558.3	613.9	629.3	499.3	1,173.3
Less-Additions to Existing Buildings (000's sq. ft.)	50.2	84.7	149.1	97.5	2.5		21.6	734.6	856.9	582.7	361.0	371.6	364.8	286.8	573.6
Total Space Constructed on Vacant Sites (000's sq. ft.)[1]	1,458.2	1,289.7	3,072.2	1,266.7	1,412.4	681.0	981.2	1,356.2	931.1	794.0	197.3	242.3	264.5	212.5	599.7
New as a % of Total Space Constructed	97%	94%	95%	93%	99%	99%	98%	65%	52%	58%	35%	39%	42%	43%	51%
Estimated Land Comsumption (Acres)	208	184	438	180	201	97	140	208[2]	150	102	29	10	49	24	30.3

Source: City of Winnipeg Building Permit Records

Footnotes:

1. The total square footage constructed on vacant sites may not equal the sum of its parts due to rounding.
2. This statistic excludes the 229 acre CNR Piggyback facility located in Assiniboine Park/Fort Garry.
3. For this analysis, railway acreage is not considered part of the existing stock of readily available vacant industrial land.

Source: Developed by the author from data supplied by the City of Winnipeg Assessment Department.

CHAPTER 4

"Conclusions, Policy Implications and Speculations"

4.1 Conclusions: Synopsis of the Supply Estimates and Demand Analysis

As identified in Chapter 2, the distribution of existing vacant industrial land in Winnipeg was primarily concentrated within three community committees areas in the City. St. Boniface/St. Vital, Assiniboine Park/Fort Garry and East Kildonan/Transcona each contained approximately 26% to 29% of the developable vacant land inventory that existed in 1981. The north-west sector of the City, consisting of City Centre/Fort Rouge, St. James/Assiniboia and Assiniboine Park/Fort Garry contained the balance.

Industrial growth initially occurred in the northwest quadrant of the City. Traditionally, investors preferred this sector of Winnipeg for a number of reasons, not the least of which relates to its close proximity to the airport and access to other major transportation facilities like the C.P.R. marshalling yards and such primary highway facilities such as Route 90 and the Perimeter Highway 101. However, two significant factors that originally promoted industrial development within this part of Winnipeg, were inexpensive land costs associated with a substantial amount of readily available vacant industrial land and property taxes that were minimal relative to other municipalities within the City at that time.

As identified in the following table, industry's demand for serviced land from 1971 to 1981 still remained very strong in the north-west quadrant.

TABLE 4-1

City of Winnipeg Vacant Industrial Land Sales

1971-1981

Municipality	Sales Volume	% Distribution
Charleswood	27	2.86
East Kildonan	26	2.76
Fort Garry	74	7.85
North Kildonan	23	2.44
Old Kildonan	11	1.17
St. Boniface	145	15.38
St. James - Assiniboia	100	10.60
St. Vital	8	0.85
Transcona	69	7.32
Tuxedo	9	0.95
West Kildonan	5	0.53
Inner City - Ward I	44	4.67
Inner City - Ward 2	223	23.65
Inner City - Ward 3	179	18.98
Total - City of Winnipeg	943	100.0%

Source: Developed by the author from data supplied by the City of Winnipeg

The majority of Winnipeg's industrial demand, as identified by means of vacant industrial land sales, occurred within the area north-west of the Red and Assiniboine Rivers, excluding that portion of Inner City Ward 1 that lies south of Portage Avenue. This quadrant contained 55% of all sales that took place from 1971 to 1981 inclusive. An interesting observation identifies that 78% of sales within this north-west sector occurred within Inner City wards 2 and 3. That is, on their own, wards 2 and 3, contained 43% of Winnipeg's entire sales volume during this period.

However, readily available serviced land close to the airport was, and still is in very short supply. The City has a substantial financial investment in the regions east of the Red River (St. Boniface) and south of the Assiniboine River (Assiniboine Park - Fort Garry) since this is where the vast majority of its serviced vacant industrial land banks presently exist.

As previously identified, determining whether the City can successfully direct investment to pre-determined neighborhoods designated as the most efficient for purposes of industrial development, in order to achieve an optimum use of its resources, is a matter of urgency at this stage of Winnipeg's development. A substantial financial investment on the City's behalf, in addition to that which it has presently committed itself, would be required to open up the northwest quadrant to further industrial development. With the 2700 acres of fully serviced vacant industrial land available in Winnipeg as of 1981, pursuit of further debt to accommodate the traditional interests of Winnipeg's industrial community should not be the only means of encouraging industrial development in the City.[1]

Based upon the model developed in Chapter 3, this study will identify industrial policies capable of directing development to existing vacant serviced land in order to achieve the most efficient use of the City's existing resources. Although appropriate industrial development policies would encompass a combination of possibilities, one of which would certainly involve expansion in the north-west, the exact location and extent of such an expansion is beyond the bounds of this study, and therefore, policy recommendations will concentrate on demand indicators identified within the model, in an attempt to encourage a more efficient use of existing

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[1]Based on an updated version of the 1981 Supply developed within this study, the volume and distribution of Winnipeg's available industrial land has remained virtually unchanged as of 1988.

resources. However, if industry wishes to pursue development in this sector of the City, the civic administration should attempt to facilitate such economic growth by providing an appropriate supply of developable industrial land in the north-west quadrant. New industrial growth has a positive impact on Winnipeg's finances, in that it provides an incremental source of revenue that will continue to produce municipal tax dividends as long as the factories and warehouses remain standing.

A detailed examination of growth in the City of Winnipeg from 1972 to 1977 inclusive has "been strongly positive in its impact on the finances of the City...a substantial surplus of increased revenues over increased costs has been the result of the City's decisions to approve and provide services for new growth."[2]

4.2 Policy Implications

4.2.1 Property Tax Incentives versus Land Cost Reductions

Policy recommendations designed to redistribute the demand for industrial land in Winnipeg are based on reducing the cost of industrial land in City owned

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[2]McArton, D., "Winnipeg: The Impact of Growth 1972-1978," published by the Urban Development Institute, Manitoba Division, December 1978, p. iii.

industrial parks and the provision of property tax incentives. Although price reductions on City-owned industrial land have been effectively used as a means of attracting industrial development to specific locations in the past, such an incentive, changes the relative price structure between public and privately held land in the City and therefore raises questions regarding equity.

Although property tax reductions would not change the relative price structure between public and privately owned land, they would change prices between the area in which the incentive has been offered and the rest of the City, which is exactly what such a policy is designed to accomplish. That is, effective property tax reductions would attempt to redistribute the demand for industrial land based on locational rather than ownership parameters, which would provide civic policy makers with the most equitable means of redistributing such demand from the north-west to the south-west quadrant of Winnipeg, if such tax incentives were not totally capitalized into the price of land.

Based on Winnipeg's model, a one per cent reduction in the effective property tax rate would result in an increase of $253.42 in the market value of the average land price contained within this study.[3]

The extent of property tax capitalization is an important factor to be considered in designing appropriate policy recommendations to redistribute the demand for industrial land in Winnipeg. The affect of a one percent reduction in the effective property tax rate reduces the average tax paid in this study by $10.55.[4] Using a discount rate equal to 5%, the present value of such a tax change is equal to $211.00.[5] This study identifies that based on a one percent reduction in the effective tax rate and a 5% real rate of return, property tax incentives would eventually be capitalized into the price of industrial land by an amount equal to 120% of the present value of the tax reduction.

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[3]The coefficient of log effective tax rate is 0.38281. Therefore, a 1% reduction in the effective property tax would result in a 0.38% increase in the dependant variable. As the average price contained within this analysis was $66,201.00, the result of a 1% reduction in the effective property tax would be equal to a (.0038281) ($66,201.00) = $253.42 increase in the price of land.

[4]Average tax paid (x30) equals $1,054.70. Therefore a one percent reduction in the effective tax rate equals $10.55.

[5]Present Value = $/r, where $=Tax change and r=.05. r is the discount rate or real rate of return over an infinite number of years. Therefore, P.V. = 10.55/.05 = $211.00

That is, the change in market value relative to the present value of the change in the average industrial property taxes contained within this study, is equal to 1.20.[6]

A discount rate of approximately 4% would generate 100% capitalization of a 1% reduction in property taxes.[7] A four to five percent discount rate would be considered a reasonable real rate of return on a public investment in 1988, after deducting the rate of inflation. Therefore, the use of such a rate in determining the extent of property tax capitalization is justifiable.

Consequently, based on the results of this model, any savings in cost due to reduced property tax rates would probably be offset by increased land costs which result from the 100% capitalization of property tax incentives introduced by the City. This has a very significant impact

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[6] Change in market value/Present value of the change in average industrial property taxes = 253.42/211.00 = 1.20

[7] P.V. = $/r, P.V. = 10.55/.0416 = $253.60
Therefore, $253.42/$253.60≈100%

on what policy implications might be implemented in order to redistribute the demand for industrial land in Winnipeg. Whereas Fox identified that property tax incentives could effectively be used to redistribute intra-metropolitan demand for industrial land, the results of this model contradict those findings. Although the effective property tax rate variable in Winnipeg's model is statistically significant at a 99% level of confidence and has the appropriate sign associated with its coefficient, the extent of capitalization identified within this model determines that property tax incentives would be ineffective in redistributing the demand for industrial land in Winnipeg from the north-west to the south-west or eastern parts of the City.

If for example, only 50% capitalization had evolved, then tax credits would have achieved a real reduction in costs and property tax incentives would have been viewed as successful in redistributing the demand for industrial land within the City of Winnipeg. However, this was not the case, and therefore land cost reductions are viewed as a superior incentive for the sake of redistributing the demand for industrial land in this City. It should be noted that Fox never discussed capitalization in his analysis of intrametropolitan property tax incentives.

Unlike Netzer (1973) and Mieszkowski (1972), who both agree that proponents of the new view cannot ignore the effect of tax burden shifting because of the way in which the existing system assesses property, this study of Winnipeg's industrial land market concludes that shifting has not occured and land owners eventually pay the full price of the tax.

A possible alternative to the implementation of either land cost reductions or property tax incentives, would be a combination of both policies. Although the real effect on the price of industrial land would not be any different than already identified, the psychological impact of such a combined policy might further encourage a redistribution of the demand for industrial land within the City. Expectations regarding the state of the economy and the potential to improve industry's profit margin have a significant impact on the private sector's willingness to invest. Therefore, if such a combined policy is considered, implementation should take place just prior to or at the peak of the business cycle in order for the City to most effectively capitalize on the positive expectations of industry at this time.

With aggregate demand in the upswing, low interest rates and stability in the market place, industry could be enticed to expand its existing facilities in designated industrial areas especially if the appropriate incentives were in place.

4.2.2 Transportation Requirements

As identified in the supply analysis contained within Chapter 2, appropriate transportation facilities linking the north and south-west quadrants are essential to accomplishing a re-distribution of demand for industrial land from an area of high demand and low supply to one of high supply and limited demand. Based on the transportation and locational variables contained within the land price model, it was clearly indicated that the airport and north-west quadrant of the City were two variables that had a positive, statistically significant impact on the demand for industrial land in Winnipeg. Therefore in order to promote growth in the south-west, industry should have appropriate access to the north-west quadrant. Such access would exist, if transportation facilities linking these two areas were developed as indicated in the transportation component of Plan Winnipeg. Proposed development within the next 10 years would include:

1. Expansion of existing route 90 (Kenaston Boulevard - Century Street - King Edward Street)

2. Expansion of Oak Point Highway

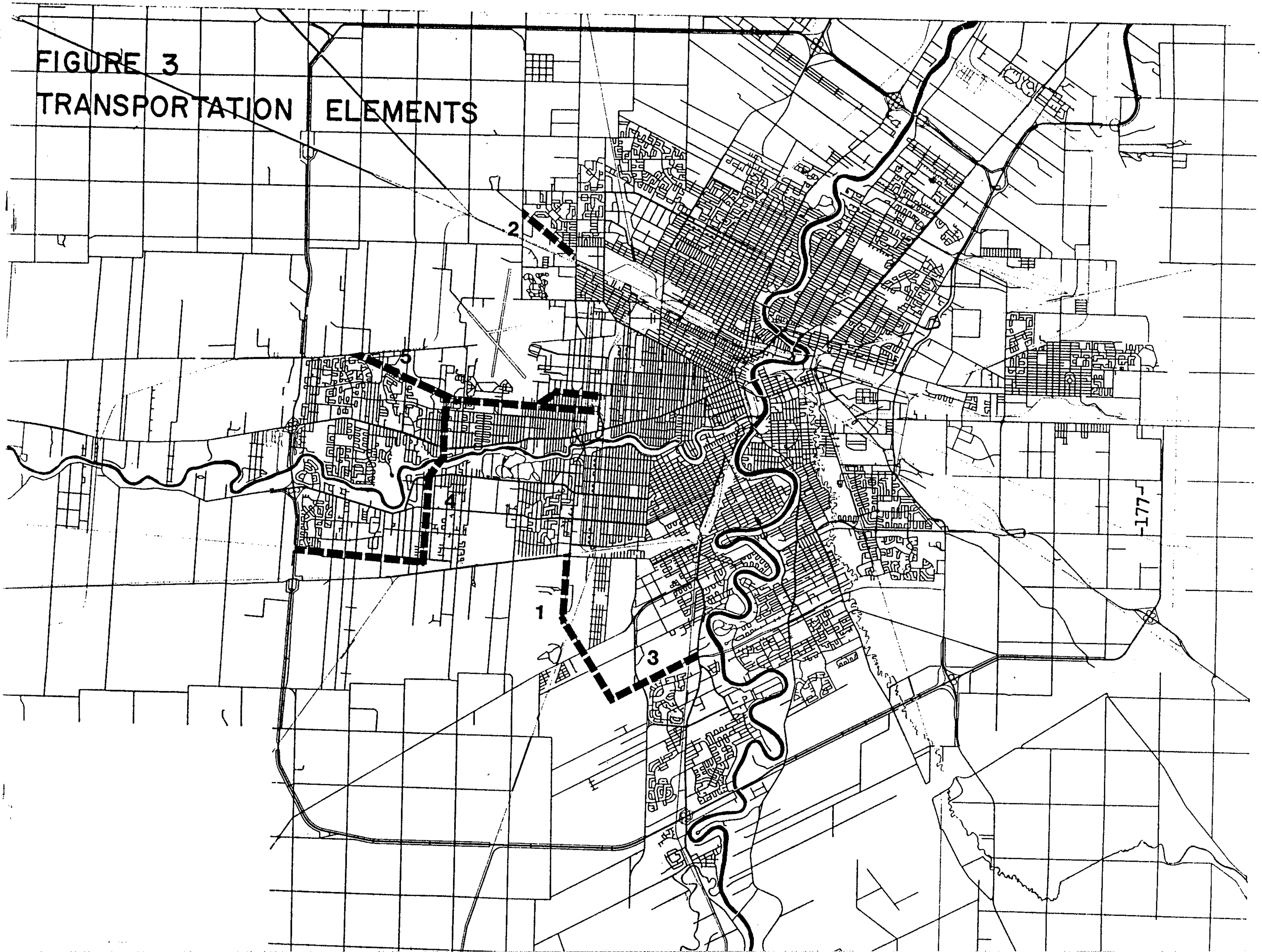
3. Extension of route 165 (Bishop Grandin Boulevard) due west to intersect with the proposed southern extension of Kenaston Boulevard.

4. Charleswood Corridor would link St. James with Charleswood by crossing the Assiniboine River at Moray Street and in so doing alleviate existing congestion problems associated with Route 90

5. Western expansion of Silver Avenue, intersecting with Saskatchewan Avenue

Based on such proposals, industry would be able to locate south of the Assiniboine river or north of the C.P.R. mainline and have suitable access to airport facilities.

FIGURE 3
TRANSPORTATION ELEMENTS



4.2.3 Zoning Matters: Implications of Zoning Classifications to Industry in Winnipeg

Based on the results obtained from the zoning variables in the land price model, in conjunction with the 1981 supply of vacant industrial land, it is apparent that a reduction in the supply of City owned industrial park land in the south-west quadrant would have a positive impact on development in this area. This may be achieved by rezoning existing City owned M1 or MP land for the sake of residential development or by encouraging the rezoning of industrial land in this part of Winnipeg which happens to exist on the periphery of the industrial land market, back to a more appropriate zoning such as agricultural, in order to reflect its actual or most suitable land use at this point in time. In so doing, the excess supply of such land that exists in the south-west quadrant would be reduced, which in turn would provide relief to the industrial land market in this area.

It appears that the City's administration has undertaken just such a policy with respect to industrial land contained within the City owned industrial subdivision known as McGillivray Industrial Park, as 83 acres of municipally owned, vacant MP zoned land was transferred to Genstar Developments and rezoned back to residential, in order to accommodate a southern extension of the Linden Woods residential development.[8]

A further example of a rezoning in Assiniboine Park/Fort Garry which reduced the supply of industrial land that existed on the periphery of Winnipeg's industrial land market, was based on a 57 acre downzoning of industrial land to that of agricultural. This was carried out in order to preserve a Hydro rights-of-way as a buffer between an industrial area on one side and a residential development on the other, and to prevent any further encroachment of the industrial development into the Hydro rights-of-way.[9]

4.3 Speculations:

4.3.1 Locational Factors Associated with the C.P.R. Marshalling Yards

It has been identified that the supply of industrial land should be expanded in the north-west sector of Winnipeg. This fact is based on a combination of both demand and supply indicators in Winnipeg's industrial land

[8]DASZ 33/86 that received final reading by City Council on November 13th, 1987.

[9]DAZ 230B/82 that received final reading by Winnipeg's City Council on May 4, 1983.

market. One possible means of achieving such a goal is based on relocating the C.P.R. shops, to the area north of Saskatchewan Avenue and promoting the development of their existing facility into a privately owned industrial park. This would resolve a number of concerns regarding industrial development in this part of the City.

If appropriately negotiated, the City of Winnipeg would receive substantial economic benefits from federal and provincial funding required to accomplish this task. The recently announced federal Western Diversification Fund would be the ideal grant program to promote the revitalization of the C.P.R. marshalling yards as an extension of Winnipeg's Core Area Initiative Program. A site relocation within the City limits, north of Saskatchewan Avenue, would be a likely choice for such a development, as it would not interfere with existing land uses in the surrounding area and would continue to provide the City of Winnipeg with the needed tax benefits associated with its existing site.

Such a relocation would enable the City to increase its tax revenue based on a combination of the relocated C.P.R. Yards and the additional industrial land made available in the north-west quadrant of the City. Depending upon the extent of financial commitment obtained from the senior levels of government, infrastructure costs associated with the redevelopment of the C.P.R. Yards could be minimized. The model has determined that the price per square foot of industrial land in this area is the highest in the City. This, in conjunction with the fact that 43% of all industrial land sales from 1971 to 1981 occurred here, identifies the extent of demand that exists for an industrial park in this part of Winnipeg. The zoning associated with the "Weston Shops" is condusive to a development of this nature and would enhance rather than detract from the surrounding land uses. The employment opportunities generated from a project of this magnitude would certainly complement the Core Area Initiative Program, a tripartite agreement between the governments of Canada, Manitoba and Winnipeg designed to revitalize the economic and social strengths of the City's core area.

As the western boundary of the "Core Area" butts up against the C.P.R. Shops, the economic spin-offs associated with an industrial park located on the site of the existing C.P.R. Yards would contain immense benefits for Core Area merchants and residents.

4.3.2 Relocation of the Inner City Equipment and Material Services Yard

Another option available to the City would be the relocation of its equipment and material services yard, presently located just north-west of the Health Science Centre, to a site in either the south-west quadrant or east of the Red River. The area between Alexander and the lane north of William Avenue, east of Arlington and bracketing Tecumseh Street is zoned "M2" to permit the City Works Yard.

The model developed for this study has identified the price per square foot of industrial land situated in Inner City Wards 2 and 3, as the most valuable in the metropolitan Winnipeg Area. The use of such land as a City works yard is an unproductive and inefficient use of a valuable civic resource, relative to other forms of industrial development that may be promoted on this site.

Based on its proximity to the Health Science Centre, the availability of this site would enhance the possibility of approaching the federal government for development of the National Health Sciences Research Institute in the City of Winnipeg. Also, potential expansion of the existing Health Science Complex on the Tecumseh Yard site would also be a viable option when the demand presents itself. The land on this site should be rezoned to M1 in order to accommodate such development, which in turn, would complement rather than detract from the surrounding land use.

By providing this industrial land for a development of such magnitude, the City would, in turn, be encouraging development associated with the industrial park site proposed for the C.P.R. marshalling yards. As identified on the enclosed map, the C.P.R. yards, the City Works Yard and the Health Science Complex are situated in immediate proximity to each other.

A redevelopment of this nature within Inner City wards 2 and 3, would promote an increase in demand for industrial development within the City of Winnipeg, above and beyond that which presently exists. That is, such a development policy would not only encourage existing demand on an intrametropolitan basis, but would effectively encourage an intermetropolitan redistribution of industrial demand from outside the City into the heart of Winnipeg's Core Area boundary. From an economic as well as a planning perspective, this would be a most effective use of intergovernmental funds not only as a means of promoting economic growth in Winnipeg's Core Area but also for the entire City of Winnipeg.

The additional property tax revenue generated from such industrial growth would unquestionably benefit all citizens in the City.

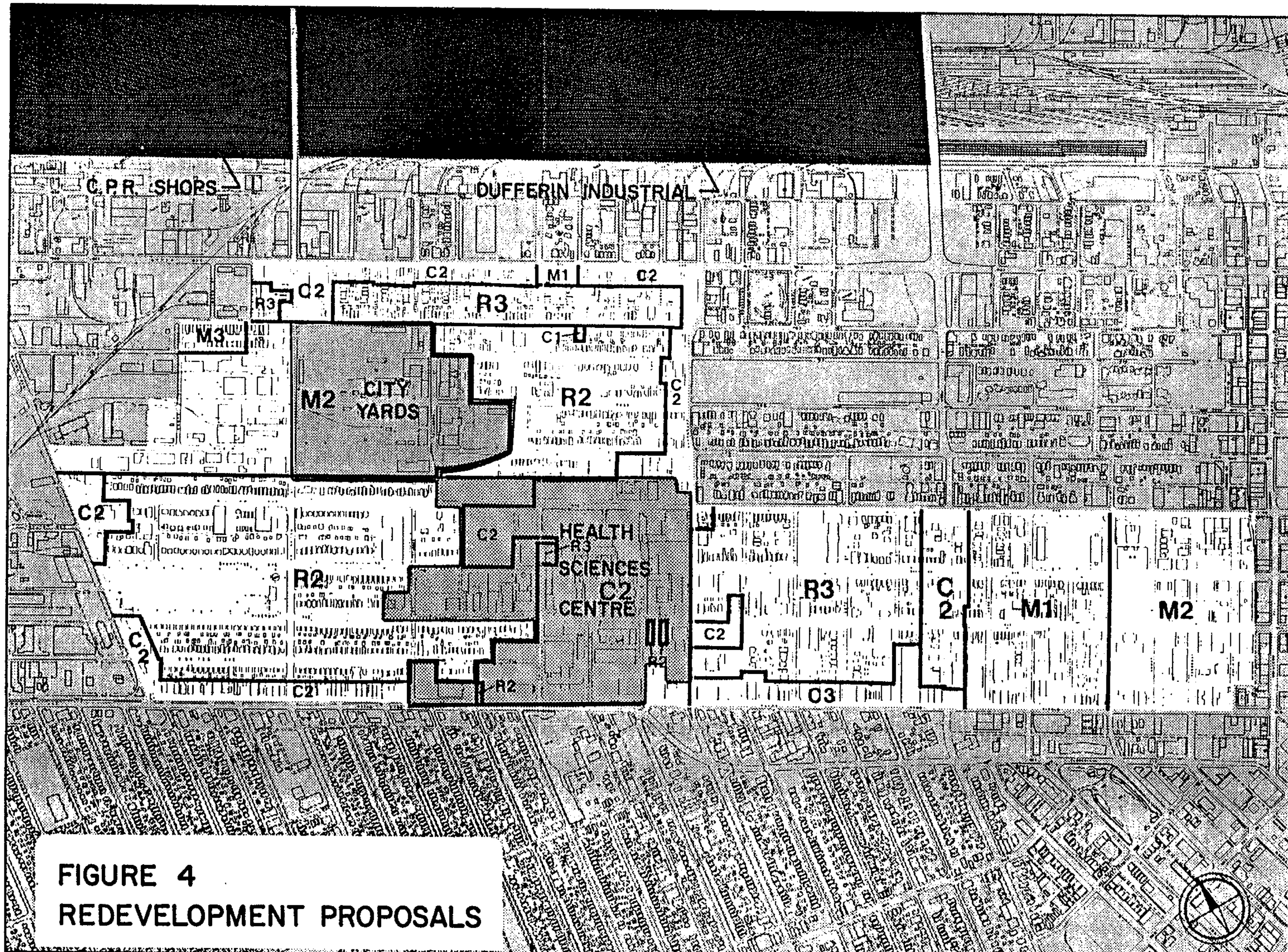


FIGURE 4
REDEVELOPMENT PROPOSALS

WEST ALEXANDER

ZONING

R2 -TWO FAMILY
R3 -MULTIPLE FAMILY
C1 -LIMITED COMMERCIAL
C2 -COMMERCIAL
C3 -COMMERCIAL
M1 -LIGHT INDUSTRIAL
M2 -LIGHT INDUSTRIAL
M3 -HEAVY INDUSTRIAL

THE CITY OF WINNIPEG
DEPARTMENT OF
ENVIRONMENTAL PLANNING

NOVEMBER 1984

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