THE IMPACTS OF REZONING ON ADJACENT PROPERTY VALUES

by

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Abstract

Urban areas such as the City of Vancouver offer employment opportunities and living amenities that are attractive to other Canadians and immigrants. The result is a rate of growth that exceeds the national average. It is the responsibility of the elected representatives to implement public policy that will provide housing for these new residents. As the amount of available land diminishes, increased density plays a more significant role.

The purpose of this paper is to determine how, if any, increased density impacts the value of adjacent properties. It has been argued by individuals and local area interest groups that property values will decline if increased density residential development is allowed to occur in their neighborhoods. One such neighborhood, the Kitsilano neighborhood in Vancouver's west side, is undergoing a rezoning from light industrial to higher density residential relative to the adjacent neighboring properties.

Using a statistical procedure known as hedonic modelling, the results indicate that the rezoning has had no impact on property values. This could result from the fact that the rezoning indeed has no effect on property values as is evidenced by a great deal of the literature on the subject. However, the model may be mis-specified and these results may be interpreted in a number of other ways. For instance, the rezoning studied in this paper has two components. The area is experiencing a land-use change from light industrial to residential which theoretically ought to increase property values in a predominantly residential neighborhood. The second component involves the proposed increased density relative to the existing neighborhood with an anticipated negative effect. The results of these two forces may be cancelling each other out in the empirical model.
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Chapter 1 Introduction

It is a common occurrence that when redevelopment or rezoning applications come under scrutiny of the general public, there is an outcry from local interest groups. Evidence of this is abundant and can be found by reading the local newspaper or minutes of local council meetings. A proposal to subdivide a single lot to provide two single family dwellings while still within the existing minimum lot requirements has led to such charges as "plummeting property values" and "cheapened neighborhood appearance". By making public their intention to sell part of their land holdings to the British Columbia Housing Corporation for 21 affordable townhomes, a local church has met with neighborhood opposition who fear that it would lower property values in the area. The City of Vancouver’s plan to rezone the Arbutus Industrial Area to provide affordable housing within the central area has met with resistance by residents in the surrounding area who are concerned about the destruction of the "west-side" style of life.

Rezoning reports such as the ones referred to above typically use such terms as 'affordable housing' and 'increased density' interchangeably. With the land component

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1The Vancouver Sun, Tuesday July 27, 1993, page B3. "70 Oxford Heights Residents Protest Proposed Subdivision". They fear it would drastically change the character of the area and cause property values to plummet. They ask for local government protection from unscrupulous developers.

2The Vancouver Sun, Monday August 24, 1992, page B1. "Residents Picket Church to try to Stop Housing Project for the Poor". The church argues there is a real need for affordable housing yet neighbors fear the increased density will destroy the visual appeal of the neighborhood and will take away from the value of their homes.

3The Vancouver Sun, Tuesday January 13, 1992, page B3. "Arbutus-Area Residents Fight for Local Lifestyle". The neighborhood opposition group says that rezoning from light industrial to higher density residential relative to the low density residential neighborhood is "illogical and harmful". They indicate there is a lot of evidence to show that high density cities don’t work.
currently playing such a significant role in many areas of Vancouver, an increase in the building density effectively reduces the per unit cost of land.

As noted, the property value argument is not the only one brought into the political arena by those opposed to neighborhood change. Other concerns such as increased noise and traffic, increased crime, decreased levels of safety and security, and a general loss of community values have been raised to oppose such neighborhood changes as increased density. This collection of arguments encompass a common theme, namely a resistance to change.

People's attitudes are generally resistant to change (Worchel, 1988). This phenomenon can be observed in all aspects of peoples lives. Whether examining interaction patterns between family members, cohort relationships in the workplace, or resident's associations with their neighbors a degree of consistency is apparent in the observed behaviour patterns. However, people usually deny that they are unyielding to change. An increase in density in a particular neighborhood will bring a flurry of responses, many of them negative. Simply citing an unwillingness to change is considered an inadequate response, a response that has no justification. Cite plummeting property values though and suddenly the response appears justified.

People are not likely to become less resistant to change. As the population ages we find ourselves less willing to cope with change. In his analysis of population and housing in Vancouver, David Baxter (1989) indicates that,
It is the demographic process of the aging of the post war baby boom into the 35 to 44 age group (1986-1990) and then into the 45 to 54 age group (1991-2006) that will determine the characteristics of changes in housing demand in metropolitan Vancouver. . . . This will mean change in our communities, such has happened before in other metropolitan areas as they have grown, with increased density of development in highly accessible locations and new development in suburban locations (p. 79).

Anyone working in a profession that advocates change must therefore tolerate and be able to deal with opposition. For instance, urban planners in a growing area such as the Lower Mainland are going to experience a great deal of pressure from neighborhood groups to maintain the status quo. The ‘Not In My BackYard’ syndrome is a common response to increased density and affordable housing.

However, change is inevitable. People have an impeccable ability to proliferate. The global population is reaching the five billion mark and is continuing to grow. The population has to be housed. People migrate to areas that offer jobs. There appears to be an increasing desire to move to areas that offer amenities for a desired lifestyle (Gappert and Knight, 1982). Change will be faster and more sudden in the areas that offer jobs and amenities. The Lower Mainland is currently such a place. The Vancouver Planning Department has realized that this change is inevitable and in June of 1986 produced a document investigating the reaction of neighbors to increased density in their neighborhoods (City of Vancouver, 1986).

The above discussion brings us to a typical string of events. People are going to

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3Vancouver Sun, Friday December 11, 1992, p.B1. "Affordable Housing a Right, Residents Say". In a recent survey, two thirds of Greater Vancouver residents say affordable housing is a 'Canadian right'. Forty percent blame government while 21 percent blame developers for lack of affordable housing. However, fifty-five percent do not want to see increased density in their neighborhood.
move into specific urban areas that offer jobs and desirable amenities. This appears to be inevitable. Existing density patterns will be unable to accommodate an increased population. Planners and civic officials will seek out opportunities to increase density in order to provide affordable housing. Current residents will oppose proposed changes to their neighborhoods. They will attempt to thwart density change using such arguments as declining property values, decreased amenities or increased costs. This conservative stance appears to be fact.

If private property values are indeed affected by such an external action as rezoning an adjacent property, there is an argument that there ought to be some form of compensation. This appears to be the basis for the Uthwatt Committee in Britain in 1943 when determining how to compensate private landholders for post-war reclamation projects (Young, 1943). In their report they consider both compensation and betterment, the former when the external action negatively affects property and the latter when the external action positively affects property. External actions therefore create both winners and losers. It seems rather obvious that if neither winner nor loser were responsible for the external action, the winner ought to forfeit his or her betterment and the loser be compensated. Yet not all external actions produce a tidy list of winners and losers. For instance, when rezoning a parcel of land that is surrounded by a variety of land uses, the ramifications will be felt both near and possibly far from the site. The total assessed values of the area, however defined, may or may not remain the same.

The purpose of this paper is not to alter any of the above facts nor is it to determine an assured compensation scheme. The purpose of this paper is to address the merits of one particular argument. This argument can be stated in the following manner:
"A rezoning to a higher density use has a negative impact on adjacent property values".

The intention here is to effect a better understanding of this argument from a pool of related literature. Chapter two reviews the economic literature on externalities and zoning and how they affect property values. Although the numerous studies have come to different conclusions, the dominant result is that there are no apparent significant impacts on property values. In addition, chapter two determines the important elements that are to be employed in a statistical analysis of a rezoning on adjacent property values. The studies that are discussed in Chapter two consider a variety of external actions and how they affect property values.

Chapter three incorporates the elements gleaned from chapter two and uses them to analyze the current rezoning issue facing the residents of the Kitsilano neighborhood in the City of Vancouver. A section of this neighborhood, the Arbutus Industrial Area (AIA), is a 10.4 Hectare (25.8 acre) block of currently zoned light industrial land situated south of Broadway and west of Arbutus Street. The need for affordable housing in the region has prompted Vancouver City Council to identify areas for infill high density housing. The AIA is undergoing a land use transition which has local area residents in opposition with the planning department and the land owners of the site. Statistical analysis on the determinants of property values and interpretation of the results form the basis of the chapter. The results, like so many of the studies outlined in Chaper two, indicate no statistically significant impact on property values due to the anticipated rezoning. This could stem from the result that the rezoning has not been approved and is still facing public debate.
Finally, chapter four concludes the study by reiterating the salient outcomes as well as cautioning the reader on interpretation of the results.
Chapter 2 Review of the Literature

2.1 Zoning and Externalities - An Introduction

This paper is concerned with the impacts of density on the spatial separation of land uses. The discussion that follows will direct its efforts towards this particular aspect of zoning. It must be noted that zoning is seldom done in isolation from such other forces as development restrictions, setbacks, and height restrictions to mention only a few.

Zoning, as the term implies, is the segregation of land into a variety of uses. Broadly speaking, these uses are frequently divided into residential, commercial, industrial and public space. Each of these can further be subdivided as determined by the local governing body. For example, residential zoning in Vancouver can be seen as a combination of single family, duplex and/or conversion, and apartment.

There typically have been three main arguments justifying zoning in an urban area (Mark and Goldberg, 1981, p.419):

1. The existence of **negative externalities** in urban land markets and the corresponding need to control such externalities by ensuring that incompatible land uses do not exist in close proximity with each other. Another variant of this externality argument is that there is a need to preserve and protect property values from external effects and that exclusive use zones can do this. (The externality argument).

2. The haphazard development pattern resulting from market forces leads to leapfrogging of development and sprawl. Such **inefficient patterns** of development lead to high costs of servicing and leave undeveloped pockets of land. Zoning, it is argued, can provide for more efficient development patterns. (The spatial
efficiency argument).

3. Market forces also lead to speculative cycles and to neighborhood instabilities. By regulating land use and land use succession through zoning controls, a more orderly market can be achieved (according to zoning proponents) with preservation of neighborhoods and orderly evolution of land uses over time. (The intertemporal efficiency argument).

From an economic standpoint, zoning is presented as a tool that reduces or eliminates the inefficiencies in the unregulated land market. These inefficiencies have been referred to in the literature as externalities, external economies, external diseconomies and spillovers. According to the MIT dictionary of modern economics, an externality is defined as the "interdependence of utility and/or production functions...which has not been accounted for through trade" (Pierce, 1986). The term ‘neighborhood effect’ implies that these externalities have a spatial component. For example, the noise generated from the operation of a night club would constitute a negative neighborhood effect on nearby residents while a beautiful park would constitute a positive neighborhood effect.

Whether zoning has mitigated such neighborhood effects as higher density has been the subject of many empirical studies with differing results. Kain and Quigley (1970), Avrin (1977), Jud (1980), Peterson (1974) and Stull (1975) have all found some evidence that externalities impact property values. On the opposing side, Crecine, Davis and Jackson (1967), Reuter (1973), Grether and Mieszkowski (1980) and Mark and Goldberg (1981, 1986) have all found inconclusive evidence of such effects. The benefits of zoning appear more pronounced when segregating seemingly incompatible land uses such as heavy industry and residential. On a more subtle level, segregating single family residential from duplex may be regarded as questionable from an efficiency standpoint.
In a metropolitan area such as Vancouver where there has been moderate growth in recent years (Baxter, 1989) and little room for suburban expansion, the concept of rezoning becomes critical. Add to this the earlier cited evidence implying increased density in the central urban area is an expected result in metropolitan growth and rezoning becomes demand driven.

Rezoning is typically classified as up-zoning, down-zoning or different land use zoning. Although these terms have been used interchangeably, the term up-zoning will be used when there is an increase in the allowable density or when a less desired use is allowed. In the Arbutus Industrial Area rezoning, there has been what some consider down-zoning as residential development is more desirable than light industrial. However, some consider the rezoning an up-zoning issue as the density of the area is being increased relative to the adjacent residential neighborhood.

There are both public and private costs associated with rezoning. There is little basis to refute the notion that increasing density imposes private gross costs on the existing residents. An example of private costs is the increased traffic congestion as a result of the added density. Less obvious and somewhat questionable with respect to private costs are the loss of views that a higher density structure would impose on the neighborhood and the increased use of the public facilities such as schools and parks. An example of a public cost of up-zoning would be the additional infrastructure requirements to meet the standards set by the local governing agency.

Of course there are also benefits, both private and public, associated with up-zoning. Increased density may trigger the establishment of convenience stores which would reduce
travel time, and hence be considered a private benefit. Efficient use of public infrastructure is often achieved only after a given level of density (enrolment in schools). There is also public benefit to housing residents in an affordable manner. Economists argue that the combination of private costs and public costs should be compared to the combination of private and public benefits when assessing public policies. However, a more common occurrence posits private costs against public benefits in the public arena.

In addition to the economic and social implications of rezoning, there are political implications as well. Council ought to act in the best interests of the population as a whole when approving public policy. However, council also wants to be voted for in the next election and will not want to dissuade potential supporters nor provoke dissenters. It is also at the political level that input from interest groups impacts the decision making process. For these reasons, the political implications with regards to rezoning are difficult to quantify.

The above discussion encompasses the economic, social and political implications of zoning with respect to public policy. The review of the literature that follows focuses on the economic effects of zoning and on various neighborhood effects, both of which are perceived to have an effect on land values. A thorough understanding of this literature and effective interaction between local government and the public may enable a more efficient outcome from the public policy forum.
2.2 The Economic Theory of Zoning

As an impediment to the free market mechanism, zoning is an ideal candidate for study by economists. However, little work has been done in the area as is evident by the scarcity of literature on the theory of zoning relative to such urban issues as property taxation. Zoning as a regulation of land use is based on the fact that "some forms of land use in any circumstances, and most forms of land use in some circumstances, have beneficial or harmful effects on neighboring properties" (Bailey, 1969). Since the turn of the century\(^6\) zoning has become an omnipresent phenomenon in urban North America. It has only been since 1974 with the work of such economists as William J. Stull, James Ohls, Richard Weisburg and Michelle White that zoning has become a focus of mathematical modelling.

In their review of the theory of zoning, Pogodzinski and Sass (1990) have categorized the effects of zoning. Although neither mutually exclusive nor exhaustive, Table 2.1 covers the important urban economic categories. This disaggregation of zoning impacts is to simplify analysis and in no way implies one category is more important than another. A brief discussion of the impacts of zoning on each category provides an indication of the complexities and inter-relatedness of studying zoning.

Supply side and demand side effects typically form the basis of economic analysis. An example of a supply side effect would be the restriction of available land for a

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TABLE 2.1

<table>
<thead>
<tr>
<th>Category</th>
<th>Impacts</th>
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<tr>
<td>Supply Side Effects</td>
<td>Suppliers of Housing Services</td>
</tr>
<tr>
<td>Demand Side Effects</td>
<td>Consumption of Housing Services</td>
</tr>
<tr>
<td>Tiebout Effects</td>
<td>Consumer Mobility</td>
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<tr>
<td>Externality Effects</td>
<td>Non-conforming Uses / Congestion</td>
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<tr>
<td>Endogenous Zoning</td>
<td>Introduction of Zoning as a Land Use Restriction</td>
</tr>
<tr>
<td>Rent-seeking Behavior</td>
<td>Self-interest use of Zoning</td>
</tr>
</tbody>
</table>

particular use. If, for example, large-lot zoning was enforced in a particular jurisdiction, then given demand levels, the cost of producing housing services would increase. Courant (1976) shows as a result, that housing prices rise and welfare falls. Henderson (1985) also considers large-lot zoning as a restriction on the supply side but extends the analysis by examining this effect upon the demand for housing. Henderson shows that in the presence of zoning, average total costs of a quality adjusted unit are greater.

Consumer mobility is the focus of the Tiebout Hypothesis\(^7\) and becomes integral in economic analysis when the assumption of equalized utility levels across jurisdictions is imposed. The ability to move intra or inter-jurisdictionally is appealing to residents in the event of a favorable zoning restriction in another equally desirable neighborhood or community. White (1975) attempts to determine the effects of zoning on the utility levels of central city versus suburban dwellers. Although her assumptions have been criticized by academics, her modelling provides insight into income discrepancies and the role zoning plays in maintaining this disparity.

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\(^7\)The Tiebout Hypothesis states that the existence of numerous competing local governments provides consumers of local services a large number of choices regarding residential and work location. This competition evokes local government efficiency if residents are mobile.
The ability to incorporate endogenous zoning into the economic model provides a valuable tool for evaluating zoning reform. Epple, Romer and Filimon (1988) develop a model based upon Henderson’s (1980) work on community development. They endogenize zoning in order to determine whether exclusionary zoning\(^8\) occurs under various decision making regimes. Additionally, they analyze the effectiveness of development fees\(^9\) as a method of dealing with inefficient land use.

As an extension of the endogeneity of zoning, wealth maximizing individuals will expend resources influencing civic officials to pass zoning by-laws favorable to them. If this were the case, zoning as a socially beneficial regulation becomes questionable. This rent-seeking category is the focus of Fischel (1978) in his discussion of private property rights. Zoning is considered a transfer of property rights from the individual land owner to the civic authority or, through market forces, to another land owner. In an attempt to minimize the costs of maintaining neighborhood quality, the existing residents rely upon zoning to restrict the owners of vacant land from ‘over-development’. The result is that restrictive zoning creates a lower market price of land than in the absence of zoning, as the existing residents do not realize the actual opportunity cost of land. This, in turn, leads to a smaller than optimal community size.

The final category examines externality effects and will dominate the remainder of this section. As the focus of this paper is on the effects of a ‘non-conforming’ use on

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\(^8\)Exclusionary zoning has been defined as "zoning which results in land in some incorporated community being unoccupied, while higher cost land is developed" (Epple, Romer and Filimon, 1988, p.135).

\(^9\)Development fees, lot levies or subdivision exactments intend to defray the cost of certain public-sector capital outlays specific to the new development. For a more detailed description, refer to Bird and Slack (1983).
adjacent property values, the contributions set forth in this section are emphasized.

Stull (1974) is one of the first economists to employ zoning into an urban economic model. He constructs a two sector model (manufacturing and residential) in an attempt to show how a "change in the allocation of land between the two sectors affects the spatial pattern of land rents, the size of the urban labor force, and the wage rate" (Stull, 1974, p. 337). The spatial pattern of land rents are of interest in this discussion as decreased property values in the residential sector resulting from an increased size of the manufacturing sector would be considered a negative externality.

Stull's model is based upon a number of simplifying assumptions. The first assumption is that of a linear city. There is a fixed central transportation node from which a featureless line extends infinitely out in two directions. The only connection with the outside world is from the central node. The second assumption is that all transactions occur at this central node. There are only two markets operating in this city, a labor market and a land market. Residents must commute to this central node thus incurring commuting costs which are a function of the distance from the central node. The third assumption is that there are only two uses for land, as a location for residential activities and as a location for manufacturing activities. Fourthly, there is a profit maximizing developer who is in control of the spatial structure of the city. Assumptions one and three are for simplification while all the assumptions are typical of the literature. As can be seen in Figure 2.1, the developer allocates the portion from \( t_b^* \) to \( t_s^* \) to manufacturing activities and the two portions, \( t_b' \) to \( t_b^* \) and \( t_s^* \) to \( t_s' \) to residential activities. This spatial allocation embodies the tenet that residential and manufacturing activities do not mix. All land to the left of \( t_b' \) and to the
right of $t_a'$ remain agricultural.

The positions of $t_b^*$ and $t_a^*$ are dependent upon the profit maximizing developer optimizing the spatial relationship between the manufacturing and residential sector. Residents must commute and work in the manufacturing sector, yet presumably do not desire to live in close proximity to the manufacturing sector. This is where the neighborhood externality effect becomes apparent.

![Diagram](image)

**Figure 2.1**

In deriving the model, all residents are assumed to have identical utility functions as follows:

$$u = u(x_1, x_2, \ldots, x_n, q, t, t - t^*) \quad (2.1)$$

where:

- $x_i =$ the quantity of ordinary commodity $i$ purchased,
- $q =$ the quantity of land rented,
- $t =$ the distance from the consumer's residence to the urban centre,
- $t^* =$ the distance from the nearest zoning boundary to the urban centre.

The last component in the utility function introduces the neighborhood externality effect.
The first order partial derivatives are assumed to be:

\[ u_{xi} > 0 \quad (i=1,2,\ldots,n) \]
\[ u_q > 0 \]
\[ u_t < 0 \]
\[ u_{t^*} > 0 \]

The last partial derivative implies that consumers prefer living farther away from a zoning change boundary. This consumer preference and the intensity of its impact on property values forms the basis of this study.

Each resident is also faced with a budget constraint of the following form:

\[ y = p_i x_i + mq + h(t) \quad (2.2) \]

where:
\[ y = \] the annual urban money wage rate,
\[ p_i = \] the implicit or hedonic\(^{10}\) price of the residential property attributes,
\[ m = \] the annual land rent payment per unit of land,
\[ h = \] the transportation cost function.

Given the three functional restrictions that 1) every household must always be within its budget constraint, 2) the quantity of land purchased is fixed in advance and constant at all locations, and 3) the utility level is fixed, together with the assumption of consumer rationality; the land rent gradient for the residential sector can be derived in the following form:

\(^{10}\)For the foundational literature on hedonic price theory, see Rosen (1974).
\[ m = m(t; y, t^*) \]  \hspace{1cm} (2.3)

Similar analysis can derive the land rent gradient for the manufacturing sector as follows\(^{11}\):

\[ M = M(t; y) \]  \hspace{1cm} (2.4)

Figure 2 provides a graphical representation of these rent gradients. The slope of the rent gradient for the residential sector can be derived through use of the envelope theorem and is expressed as follows:

\[ \frac{\partial m}{\partial t} = \left[ \frac{1}{q^*} \right] \left[ -h'(t) \right] + \lambda \int u_t + u_{t,*} \]  \hspace{1cm} (2.5)

As is evident in Figure 2.2, the sign of this expression is dependent upon the externality effect. If there is substantial opposition to residing near the manufacturing sector, then the residential rent gradient may behave as depicted in Figure 2.2. However, the depiction in Figure 2.2 is not consistent with equilibrium in the land market. If other economic factors such as commuting costs play a more salient role in the consumer's utility function, a more traditional downward sloping continuous rent gradient may be observed (refer to dashed line).

\(^{11}\)In his paper, Stull (1974) leads the reader through the mathematics of deriving both of these land rent gradients.
The purpose of this section has been to validate the legitimacy of zoning as a candidate for economic research. The theory argues that there are many economic categories that have been incorporated into theoretical modelling. One of these categories is the effects of externalities. The important result to draw from the theory on externalities and zoning is that the distance between two different land uses may have an impact on their respective property values. This impact is responsive to the degree of incompatibility of land uses and the intensity of other economic factors.
2.3 Empirical Research on Zoning and Property Valuation

Although neighborhood effects have been the topic of academic research for over fifty years (Haig, 1926), the first attempt to quantify these effects statistically is in research carried out by Crecine, Davis and Jackson (1967). They use the available data from select census tracts in the city of Pittsburgh from 1956 to 1963 to determine the nature and extent of neighborhood externalities. In order to view neighborhood effects, given that the urban property markets are competitive, Crecine, Davis and Jackson assume that buyers have similar tastes. If individual tastes were diverse, an efficient and competitive market would imply that what some deemed a diseconomy, others would consider an economy and prices would reflect neither the diseconomy nor the economy. In the context of the Arbutus Industrial Area rezoning, those who deem the rezoning a diseconomy will move from the neighborhood and those who do not view the rezoning as a diseconomy will move into the neighborhood.

In establishing their model, they divide their study into ‘insular’ neighborhoods by referring to the land use block in which the sale took place. Thus, a sale price would be affected by an externality within the determined land use block, but would not be affected by an externality that was across the street from the subject property. This implies that there are no spillovers, an assumption that has been questioned by subsequent research (Strange, 1992). The model formulation adopted by Crecine, Davis and Jackson follows one defined by Brigham (1965). The value of a site is a function of access, amenities, topography, present and future use, and other historical factors. Mathematically this can be defined as
follows:

\[ V_i = f(P_i, A_i, T_i, U_i, H_i) \]  \quad (2.6)

where \( V_i \) = the value of the \( i \)th site,
\( P_i \) = the \( i \)th sites' accessibility to economic activities,
\( A_i \) = the 'amenities' (including neighborhood effects) of the \( i \)th site,
\( T_i \) = the topography of the \( i \)th site,
\( U_i \) = the present and future use of the \( i \)th site,
\( H_i \) = historical factors affecting the utilization of the \( i \)th site,

This general framework, known as hedonic modelling, forms the basis of much of the research in property valuation. This model must be modified to take into account the available data. In the Crecine, Davis and Jackson paper, the dependent variable used is a price per square foot of the site. This is regressed on a vector of zoning externality variables defined as the percentage of total land area in the block associated with a particular land use. Additionally, a vector of non-zoning externalities and a monthly index are also included as independent variables. In essence, their model stipulates that the price per square foot of single family dwelling site is a linear combination of time and externalities. Their results imply that the property market is independent of externalities. It is cautioned that this result may be partially due to the specification of the model. The authors imply that the neighborhood effects could extend beyond the defined block (spillover), or could be considered "next door" phenomenon (p. 93). Thus, the arbitrary division of the city into insular neighborhoods fails to accommodate the spatial dimension of the externality. Another explanation for the results is that prospective purchasers have heterogeneous tastes. An externality may be deemed undesirable by some, yet be considered desirable by others.
Those that do not find a particular land use undesirable will be indifferent to locating near it and the price paid for their property will thus not reflect the externality.

The results espoused by Crecine, Davis and Jackson imply that zoning, in its current form, is perhaps not the most appropriate vehicle to handle neighborhood externalities. This result has stimulated subsequent research into the effectiveness of current zoning practices. Grether and Mieszkowski (1980) consider the weaknesses in the Crecine et. al. study and attempt to overcome them. They criticize using only lot size as a control for individual properties and propose using a vector of variables representing various structural, lot and age characteristics. They also attempt to overcome the 'insular' neighborhood problem by utilizing a continuous distance measure from each property sold to the particular neighborhood externality for each of 16 experiments. Their results are consistent with Crecine et al. in that there are no statistically significant effects on housing prices due to the proximity of a variety of minor commercial developments and low density apartments. However, they have a problem with sample size, with the number of observations in some of their experiments being less than 50.

In addition to finding similar results to the Crecine et al. study, Grether and Mieszkowski (1980) provide insight into model specification. Two models are discussed in their paper. Their first model "allows for different appreciation rates for structural and nonstructural characteristics, the cost being that a nonlinearity is introduced" (p. 7). Their second model is a semilogarithmic specification, and is used in the analysis partially due to its simplicity. In an earlier paper, Grether and Mieszkowski (1974) provide an extensive discussion on the hedonic formulation they have incorporated in their 1980 study. It is a
refined version of the model described by equation 3.1 and can be formulated as shown:

\[ \log v_i = S_i \alpha + L_i \beta + N_i \gamma + \epsilon_i \]  \hfill (2.7)

where:
- \( \log v_i \) is the natural logarithm of actual sales price,
- \( S_i \) is a vector of structural characteristics,
- \( L_i \) is a vector of lot characteristics, and
- \( N_i \) is a vector of neighborhood characteristics.
- \( \alpha, \beta, \gamma, \text{ and } \epsilon_i \) are the coefficients and error term.

Whether to use a semilogarithmic specification, a nonlinear specification or some other variant as the correct specification in these studies on property values has been a topic of debate. The semilogarithmic form has economic appeal as it implies that the independent variables provide a constant percentage change to the value of the house. For this reason, the semilogarithmic specification has been used extensively in the research and will be considered in this study.

2.3.1 Zoning and Property Values in a Local Context

Both the impacts of zoning and rezoning on property values have been analyzed in the Vancouver area. While both papers in this section focus on the impacts of zoning on the actual property, they shed insight on how to look for neighborhood effects. In their first paper on the topic, Mark and Goldberg (1981) consider the impacts of rezoning and actual property values. In addition, they want to assess the ability of zoning to "mitigate externalities" (p. 418). Their paper considers three separate methodologies and three studies
performed in the Vancouver metropolitan area. The first study was done by Tunnicliffe (1975) as an M.Sc. thesis and incorporated all rezonings in the City of Vancouver for a period extending from 1966 to 1972. He looks at property values before and after a rezoning and compares the change in value to a comparable change in property values in a control group. Although a departure from the standard statistical analysis discussed above, Tunnicliffe finds two interesting results. The first is that 'up-zoning' does not necessarily lead to higher property values. This seems to contradict the view that increased density allows increased revenue generation per unit area of land, which should lead to increased property values. The second result is that there does not seem to be consistent increases from similar rezonings. Both of these results imply that it would be difficult to tax the affected property owners in order to redistribute the benefits gained from the rezoning. One flaw in this study that has been addressed in subsequent research is that assessed values are used rather than actual sales data.

The next study of the Vancouver region considered the rezoning of the Kerrisdale neighborhood and incorporated data from 1956 to 1966\textsuperscript{12}. This area had been exclusively single family low density, and in 1961 a portion of the area was upzoned to multi-family medium-density (10-12 story apartment buildings). The study consists of breaking the affected area into seven concentric half block bands in addition to four independent areas as control. Actual sales data on 979 properties that sold before and after the rezoning are used. It was found that properties greater that 5000 square feet show a significant increase in value

\textsuperscript{12}For a complete discussion regarding this study, the reader is referred to: Goldberg, Michael and P. Horwood, \textit{Zoning: Its Costs and Relevance for the 1980's}, Vancouver: The Fraser Institute, 1980).
due to the rezoning than smaller properties. This makes intuitive sense as the larger lots would be viewed by developers as ideal sites for redevelopment. They also find no significant neighborhood effects imposed on the surrounding single family dwellings. Again, this finding is consistent with the Crecine, et.al. study. A third result implies that there is little evidence that speculative activity increased due to the rezoning.

The final study area examined in the Mark and Goldberg (1981) paper is the city of New Westminster. This study considers the impacts of a specific zoning on existing property values. The zoning in question is RT-1 which allows conversion to a duplex structure if the lot size is greater than 6000 square feet. The methodology used is a standard hedonic regression consistent with earlier hedonic studies. The authors attempt to sort out three potential zoning impacts which are described in Peterson's (1974) working paper on the influences of zoning regulation on property values. These three impacts are:

1) Fiscal impacts arising from the attraction or exclusion of certain activities,
2) Impacts from zoning which act as a land use constraint, and
3) Impacts due to externalities as a result of zoning.

The results of the study again provide little or no statistical significance of zoning on property values.

It is interesting that the three studies outlined in the Mark and Goldberg article come to similar conclusions, yet the methodologies are remarkably different. This has led the authors to consider why these results may occur. Earlier work typically found similar results and concluded that perhaps zoning was not performing the regulatory task it was intended
to. However, Mark and Goldberg determine that perhaps zoning is only one constraint that may or may not be binding in a particular market. For example, in New Westminster, the market for duplex dwellings at the time of the study was slow, which may explain the insignificant results. This issue must be addressed when interpreting results of any study. An insignificant result may imply that zoning is not a binding constraint. This result has different implications when addressing public policy issues than the result that zoning or rezoning has no impact on property values.

In a subsequent paper, Mark and Goldberg (1986) extend their analysis of the Kerrisdale neighborhood in Vancouver using a study period spanning from 1957 to 1980. The methodology used is an hedonic regression using the natural logarithm of actual selling price as the dependent variable. Three hypotheses are considered (Mark and Goldberg, 1986, p. 260):

1) A parcel's zoning classification affects its sale price, and the magnitude and direction of the effect are consistent over time (a price-effect hypothesis).

2) A parcel's sale price is lowered by permitting non-single family uses in the neighborhood (an externality-effect hypothesis).

3) A parcel's sale price is raised by zoning changes which allow higher densities and different uses, and these effects are consistent through time (a rezoning-effect hypothesis).

It is the second hypothesis that is of interest in this current analysis on neighborhood effects. However, all three effects must be considered in the model specification in an attempt to separate the individual effects. This may be constrained by data availability. The major departure in this study is that while previous studies analyzed zoning impacts at one point in time, the authors consider the long run impacts of zoning.
The data used in this study is obtained from the British Columbia Assessment Authority which keeps detailed information on single-family parcels including actual sales prices, transaction histories and an extensive matrix of structural characteristics. Two neighborhoods are included in this study, Kerrisdale and Fraser. The first neighborhood is typified by a higher affluence than the latter. Both neighborhoods had major rezonings to multi-family in 1961 with divergent market responses. The Fraser neighborhood had little demand for multi-family residential, and as a result of the rezoning there was little market response.

The results for both neighborhoods provide little support for zoning advocates. The Kerrisdale results only marginally support the price-effect hypothesis, provides some support for some of the externalities in the externality-effect hypothesis and offers no support for the rezoning effect hypothesis. Results for the Fraser neighborhood provide even less support for the three hypotheses. In addition the authors find little or no consistency in the results in both neighborhoods, indicating that the externality argument often espoused by zoning advocates is questionable.

The major findings to come from the Mark and Goldberg (1986) study are twofold. First, zoning may not be the panacea to externalities as there may be additional salient forces such as consumer preference behavior and other market forces that impact the price of housing. Secondly, the cross-sectional methodology used in earlier research comes under suspicion as the impacts of zoning have a temporal impact. Data that has both a cross-sectional and a temporal component, sometimes referred to as panel data, should be used when studying such phenomenon as rezoning.
2.3.2 Additional Research on the Externality Argument

There are four additional papers that merit discussion in this section. Although they do not directly address the zoning issue, they each contribute to the understanding of some of the major issues.

Grieson and White (1989) attempt to answer the question of why the current literature has found little support for the capitalization of negative externalities in residential property values. Grieson and White extend the hedonic specification to incorporate a variant on the 'agglomeration economy' theme and offer the following model:

\[
P = f( W, E, g(N), g(F), g(S) )
\]  
(2.8)

where:
- \( g(N) = \) the probability of conversion in the near future,
- \( g(F) = \) the probability of conversion in the far future,
- \( g(S) = \) the probability of no conversion,
- \( E = \) a measure of neighborhood externalities,
- \( W = \) a vector of other salient characteristics.

Their 'agglomeration' argument implies that "a lot at the edge of an externality producing district has a higher probability of conversion in the future than a lot with no externality producing uses in the neighborhood" (p. 70). Since these probabilities of conversion are not observable, the authors derive two dichotomous variables, zoning (Z) and externality (E). The control case is stipulated as both being zero. E equalling one and Z equalling zero is the case of a 'pure externality'. E equalling zero and Z equalling one is the case of a 'pure conversion'. When both equal one, there is a 'combination' effect. The 'pure externality' case implies that conversion is more distant, hence a proxy for g(F). The 'combination' case
implies that conversion is more near, a proxy for \( g(N) \). This provides support for the idea that the impacts of a rezoning are spatial and adjacent properties appear to bear the greatest impact.

The results of their new specification seem to refute earlier reported results regarding lack of capitalization. Grieson and White conclude that previous studies suffer from missing variable bias. They also add that their proxy measures for the probability of conversion are over simplified. Their methodology has appeal in that it implies that residential properties that are adjacent to a non-residential area may actually appreciate due to the high probability of rezoning or conversion in the near future.

The effects of high-rise office buildings on residential property values have been studied by Thibodeau (1990). His motivation for research on the topic parallels the concerns outlined in the introduction to this paper, namely that "public debates are fuelled more by emotions and misinformation than they are by statistical evidence" (p. 402). An hedonic estimation technique is employed to assess the impacts of an eleven-story office building constructed in North Dallas in 1980. The model breaks down the ‘proximity to nonconforming uses’ variable into two functions, a logarithmic function and a negative exponential function. A negative sign on the estimated parameter of the logarithmic function and a positive sign on the estimated parameter of the negative exponential function implies that the log component measure the positive benefit and the exponential component measures the negative benefit of the proximity to the nonconforming use. Empirically this formulation requires use of nonlinear least squares and the results of this estimation are as follows:

1) Prior to construction, there were no externalities associated with the vacant lot.
2) After construction there were significant externalities, negative for properties less than 1000 feet from the development and positive for properties 1000 to 2500 feet from the development.

The author concludes that homeowners' concerns regarding reduced property values are indeed justified, but on an aggregate level there are net benefits to home values. If there were some method of redistributing these gains (ie: through taxation), a more equitable solution would occur.

Michaels and Smith (1990) use hedonic modelling to study the impacts of hazardous waste sites on housing prices. They use a semilogarithmic form and incorporate three variables to measure the externality. These are a distance measure and two interaction variables that attempt to capture short-term response to an announcement such as a rezoning proposal. Their results of concern here are that in the hedonic model 1) market segmentation is important and can greatly influence the interpretation of coefficients, and 2) introduction of interaction variables may capture important temporal patterns in externalities.

In another paper related to analysing the impacts of toxic waste sites, Palmquist (1992) "demonstrates that hedonic techniques are particularly well adapted to studying localized externalities since the key problems with the hedonic methodology and benefit estimation do not arise" (p. 59). The author highlights the fact that the hedonic methodology generally requires an estimated hedonic price schedule and an estimated demand or bid function. This second step is much more complex both at a theoretical and at an econometric level. The author argues that the nature of localized externalities allows analysis to stop at the first step. This is because while some residents are affected by the
neighborhood externality, there are many more who are not, which implies that the equilibrium hedonic price schedule remains unchanged. The implication for the current study is that a relatively homogeneous study area be considered when analyzing the impacts of a localized externality.

These four papers each contribute to the understanding of estimating the impacts of externalities on property values. They can be seen as a sample of the extensive literature on the topic of using the hedonic methodology to study neighborhood externalities.

2.3.3 Higher Density Housing and Property Values

This final section takes a specific externality, namely low-income housing, and its effects on property values. Since low-income housing often implies increased density, it is assumed that the results will act as a proxy for the increased density issue. Of the six papers discussed here, only one found negative effects on property values. This enhances the generalization that there is statistically little or no evidence supporting the hypothesis that increased density lowers adjacent property values. However, other issues aside from the density issue may be producing these insignificant results. An increase in crime that is often associated with low neighborhood income or bigotry directed at the poor are difficult to incorporate into a model of property values but may play a significant role. Since previous sections have gone into great detail, only a brief summary of the results will be reported here.

Guy, Hysom and Ruth (1985) study subsidized housing in Fairfax County, Virginia
between 1972 and 1980. They analyze four ‘clusters’ of townhomes, two near subsidized housing, one separated from the subsidized housing by an elementary school and the fourth cluster approximately one half mile from the housing project. An hedonic regression is utilized incorporating a ‘distance from subsidized housing’ variable from the time the housing projects were constructed. They find the coefficient on the distance variable to be statistically significant and positive meaning that the further away from the project, the higher the value of the house, holding all else constant.

Nourse (1963) is evidence of the early work on the subject matter. The author looks for positive spillover effects of public housing on adjacent housing sites. The study period is from 1937 to 1959 in St. Louis, Missouri. A repeat sales methodology of constructing a price index is incorporated into three affected areas and study areas. The price indexes for the control areas are then compared against those constructed in the affected areas. The results indicate that no significant differences are apparent in two of the areas while the third area shows a slight increase in property values.

Mitchell-Lama, or The Limited-Profit Housing Companies program provides a liaison between private and public enterprises in the construction of rental housing in New York. In an effort to document the effects of their projects, a study was performed in New York City during 1964-1969 (DeSalvo, 1974). Fifty neighborhoods are studied, each neighborhood comprising approximately two city blocks. Each borough acts as a control area for a number of sites. Comparisons using assessed values are done between the neighborhoods and the control sites. The results indicate that assessed values around the rental housing projects increased, on average, five percent higher than in the control areas.
This implies that these projects are actually beneficial to the neighborhoods providing assessed values reflect market values.

Rabiega, Lin and Robinson (1984) look at public housing projects in Portland, Oregon between 1963 and 1978. This study focuses on low income whites. This removes the need to consider ethnic mix, simplifying the analysis. Single family house sales around six public housing projects are used in the analysis. The sales prices are adjusted for inflation and appreciation. Two statistical methods are used on sales before and after the construction of a project. These are regression analysis and paired t-tests. The results indicate that residential property gained in value after public housing was introduced. The authors add that their results may indeed be conservative due to their methods of adjustment.

Bab, Pol and Guy (1984) consider the impact of Federally-assisted housing on single-family housing sales in Memphis, Tennessee between 1968 and 1979. Natural neighborhood boundaries are established around 22 study areas. Control areas as close to the study sites as possible are identified in order to maintain homogeneity. Regression analysis is performed using as the dependent variable the ratio of sales prices in the study areas to prices in the city. This ratio effectively adjusts for inflation and provides a check for price appreciation. The results imply that the introduction of public housing did not cause home sales prices near the housing projects to decline.

Farber (1986) studies the impact of group homes for the mentally handicapped in the Shreveport-Bossier City, Louisiana metropolitan area between 1979 and 1983. This study is a departure from the others in this section in that the group homes are not structurally different than the neighboring single-family homes. The local residents did oppose the
introduction of a group home in their neighborhood citing decreased property values as an inherent result. Regression analysis finds no price effects on homes in higher income areas after the introduction of a group home and also finds positive price effects on homes in lower income areas. However, the introduction of a group home in a higher income area increases the time-on-market for homes closer to the group home.

There is an abundance of literature pertaining to specific urban markets. Since housing markets are localized in nature, generalization of any of these studies to any other sub-market would be imprudent.

The intent of this literature review has been to determine whether a rezoning would affect adjacent property values, and if so, how can one go about testing for this impact. Both the theoretical and empirical literature indicate zoning affects many aspects of the typical urban model. Distance from a zoning change boundary has been incorporated into Stull’s theoretical model, indicating that econometric analysis of zoning ought to consider such a measure in the estimating model. This has been the case in many of the empirical studies examined in this literature review. Hedonic modelling appears to be a standard tool for examining housing prices and their determinants. The inclusion of a zoning distance measure into a hedonic framework will form the basis of the analysis to follow in the next chapter.
Chapter 3  The Study

The hypothesis to be tested in this study is as follows\textsuperscript{13}: "A parcel’s sale price is lowered by permitting non-single-family uses in the neighborhood or, in Mark and Goldberg’s term, an externality-effect hypothesis". Refutation of this hypothesis does not necessarily imply that rezoning has no effect upon adjacent property values. It could also imply that the impacts of a rezoning are combined with other non-quantifiable impacts which are difficult to separate and analyze independently. One divergence from much of the earlier work is that the study area, the Arbutus Industrial Area, is being rezoned from industrial to residential, a rezoning that theoretically ought to increase property values in the surrounding neighborhood.

In order to undertake such a study, a number of steps are to be considered. A thorough understanding of the neighborhood is essential in order to identify any historical and/or current concerns that may impact property values. Secondly, a detailed outline of the methodology sheds light on the various factors that ought to be incorporated into a model. Thirdly, the appropriate data must be aggregated and suitable proxies determined to fit the model. Finally, the model is to be implemented and the results analyzed.

\textsuperscript{13}This hypothesis is the second of three that Mark and Goldberg (1986) tested in their study of the impacts of zoning over time in Vancouver.
3.1 Kitsilano: A Brief History

The neighborhood of Kitsilano was born in 1905 with the extension of a streetcar line over the Kitsilano Trestle Bridge and extending to Balsam Street (refer to Figure 3.1). Four years later, another streetcar line was built that extended service along 4th Avenue to Alma Street. The area developed along these service lines which in essence produced two developed areas that later merged into one unified area.

During this period of development of the neighborhood, the Kitsilano Ratepayers' Association formed (1906) and it has the honor of being the first association of its kind in Canada. It had as its mandate the responsibility "to look after the interests of property owners through orderly development in Kitsilano, and through keeping in contact with Vancouver-wide projects that might affect the area" (The Vancouver Urban Research Group, 1972, p. 69).

In 1929, Vancouver adopted a zoning by-law which had as its major explicit goal "the belief that the single-family home owner was the backbone of society" (Gutstein, 1975, p. 104). This by-law created three types of residential areas; single-family, two-family and multiple-family. Since much of the neighborhood was built up before this zoning by-law was passed, Kitsilano was primarily composed of single-family dwellings.

Little happened from this time until after World War II at which time there was considerable construction of three-storey walkup apartments in the eastern part of Kitsilano. It was at this point in time that illegal secondary suites began to appear in single-family residences.
Figure 3.1

Control Area

Study Area
In an attempt to eliminate these illegal secondary suites, the City of Vancouver in 1951 aimed its attention at the Kitsilano neighborhood. The Kitsilano Improvement Association (KIA) formed as an interest group maintaining that these secondary suites were necessary for housing the population of the neighborhood. They fought for rezoning to two-family residences and in 1959 a new zoning by-law was approved that would in essence make these illegal suites legal in certain areas of the neighborhood. Amendments were added in 1961 which was the construction of several highrises on the lower slopes of Kitsilano between 1962 and 1968.

Developers were busy buying up the transitional properties which were zoned two-family in anticipation that as growth continued, these properties would be rezoned for multiple-family residential. They rented out these speculative properties to a less stable population. It is interesting to note that at this time in history, the general feeling was that Kitsilano would eventually be all multiple-family residential which would then put pressure on areas such as Point Grey and Dunbar. This view is consistent with the 'growth perspective' which was common at the time.

By 1971, the population of Kitsilano had reached 34,000 which was only a six percent increase from the population in 1951. In this same time period, the population of Vancouver as a whole increased 25 percent making Kitsilano one of the slowest growth areas in the city. This slow growth can be attributed to the change in the demographic structure of the neighborhood. Once a common area for families with children, Kitsilano, perhaps due to the pressures of central city development, became a haven for the 20-to-34-year-old group.
The Kitsilano Area Resources Association (KARA) had recently formed by this time and were busy protecting the neighborhood from transportation improvements that would have seen the area severed. This interest group took on a proactive stance as they became involved in a diverse set of issues including alternative housing schemes for the neighborhood, fighting the 'almighty' highrise, beautification of Broadway Avenue, the infamous third crossing, and improved public transportation for the area.

Another interest group stood up to the redevelopment of the neighborhood in 1974 when a developer proposed razing seven houses on one block to make was for a three-storey condominium apartment. The West Broadway Citizens Committee (WBCC) stood between a house and the bulldozer as the residents of the house pondered their legal entitlements. The developer won this fight in the end but not without bringing some interesting media coverage. The 1970's was a decade that was witness to high growth in many cities in North America, which led to the boom of neighborhood groups that were created in response to this unprecedented growth.

3.2 Kitsilano Today: The Arbutus Industrial Area

It has been determined that by 1992, the population of Kitsilano had dropped by several thousand from its 1952 level. The continued high growth rates that the Greater Vancouver region was experiencing was prompting civic officials to determine alternative...
solutions to alleviate the already tight housing market. The Planning Department was asked to identify specific area in Vancouver that would be suitable to redevelopment into higher density residential. In the fall of 1989, Vancouver City Council identified the opportunity of transforming the Arbutus Industrial Area (AIA) into much needed housing. Up to 1300 new housing units would be realized in an area bounded by Vine Street, Broadway Avenue, Maple Street, and West 12th Avenue.

By December of that year, the Kitsilano citizen’s Planning Committee (KCPC) formed with a mandate to reach a consensus with city and developers. The main issue was density of the Arbutus site. Four months later, the property owners of the retired Molson Breweries site presented a scheme for the area which included high density development, Floor Space Ratio (FSR) of 3.45 and building heights reaching 13 stories.

KARA (now an abbreviation for Kitsilano Arbutus Resident’s Association) voiced their opinion in May 1991 by stating that the neighborhood could not support densities higher than 1.5 FSR and building heights of no higher than four stories. The City Planning Department indicated trigger density ratios of 1.8 to initiate redevelopment and 2.3 to provide social housing, park space and other amenities.

In November 1991, yet another interest group emerged. It was called the Arbutus Vine Improvement Group (AVIG) and represented the interest of the developers of the industrial area. Their high quality pamphlet, which was distributed to residents in the neighborhood, contained impressive pictures of what high density redevelopment would look like. KARA immediately took a stance and accused the AVIG of trying to subvert the planning process.
By January of 1992, the City Planning Department released its proposals and recommendations for the AIA in a public meeting in the Kitsilano High School. There was such a tremendous turnout of concerned citizens that three additional meetings were scheduled in order to hear all the concerns. One of the arguments used by KARA was that the existing infrastructure would not accommodate such a grand redevelopment scheme. To make this point clear to the Kitsilano residents and to the residents of Vancouver as a whole, members of KARA drove around the AIA protesting the increased congestion and thus creating an environment which they thought would transpire were the redevelopment to proceed.

One month later yet another interest group emerged, one representing the existing land owners and labelling themselves the Arbutus Industrial Area Landowners Group (AIALOG). It was this group that accused the KCPC of playing the YIMBY-BUTNOT (Yes In My Back Yard, BUT NOT like This) game. Instead of implying that other areas in Vancouver submit to redevelopment, the KCPC welcomed the AIA proposal, 'on their terms'. These terms would make the redevelopment scheme infeasible for any developer and thus the NIMBY results would be attained without succumbing to the negative connotations of protecting self interests. AIALOG tried to argue that the AIA was a 'distinct' neighborhood from Kitsilano, perhaps trying to disqualify the arguments of KARA and KCPC.

In March 1992, City Council rejected the moderate density proposal submitted by the Planning Department stating that the neighborhood would be 'adversely affected by the redevelopment plan'. A motion was also passed which effectively reduced the community
amenity contributions and dropping the amount of social housing necessary on the site in an attempt to stimulate the revised redevelopment scheme. It seems ironic that reducing the amount of social housing contradicts their original mandate of finding affordable housing alternatives for the residents of Vancouver.

Nearly four months later, City Council approved a redevelopment scheme which would realize building heights with maximum heights of eight stories. Both resident associations felt that the City had not listened to their concerns and that the Non-Partisan Association (NPA) dominated council was siding with the corporate interests. As of late summer, 1993, the rezoning issue has yet to be finalized.

3.3 Methodology

The method chosen to test the 'externality-effect' hypothesis is the hedonic approach discussed extensively in the literature review. In simple terms, this approach considers the attributes that significantly affect the selling price of a parcel of land. Such attributes include the size of the lot, and the age and size of the improvements (structure). The variable of interest, distance from the AIA rezoning, is incorporated into the model and tested to determine whether it significantly impacts the selling price.

There have been many functional forms of the hedonic price function deemed appropriate for use in studying housing price impacts (Hamilton, 1992) but the one chosen for this study is based in the Cobb-Douglas framework. This framework is used as it has been found that the various housing characteristics used in the hedonic studies have a
diminishing effect upon housing prices. For example, the marginal impact of a third bedroom is intuitively higher than the marginal impact of a sixth bedroom in the determination of housing prices.

Equation 3.1 summarizes the basic model.

\[
R_{Price_i} = \alpha X_{1i}^{\beta_1} X_{2i}^{\beta_2} X_{3i}^{\beta_3} X_{4i}^{\beta_4} e_i \quad (3.1)
\]

where:
- \( R_{Price_i} \) = real price of household,
- \( X_{1i} \) = vector of continuous structural attributes for household (for example, number of bedrooms),
- \( X_{2i} \) = vector of dichotomous structural attributes for household (for example, garage: 0=no, 1=yes),
- \( X_{3i} \) = vector of neighborhood attributes for household,
- \( X_{4i} \) = vector of zoning effects for household,
- \( \alpha, \beta, \epsilon \) = constant, coefficients and error term respectively.

As this study is confined to one homogeneous neighborhood\(^\text{15}\) the vector of neighborhood attributes can be removed from the basic model. By taking the log of both sides of this model, a linear form is constructed suitable for estimation using ordinary least squares\(^\text{16}\). As prices are typically collected in nominal terms, a series of quarterly dichotomous variables are added to the model to identify the local price trend. The regression model is thus constructed in the following manner.

\[
\ln P_i = \alpha + \beta_1 \ln X_{1i} + \beta_2 X_{2i} + \beta_3 \ln X_{4i} + \beta_5 Q_{5i} + \epsilon_i \quad (3.2)
\]

\(^\text{15}\)For model simplification, only one neighborhood is used in this study. This takes care of the problem of estimating coefficients that are considered unique to each particular neighborhood. The trade off is that the sample size is rather limited.

\(^\text{16}\)Ordinary Least Squares (OLS) is the most common method of estimating a linear equation. For details of the estimation procedure, any introductory statistics text is suitable.
where: 

\[ \ln P_i = \text{log of nominal price of household}_i, \]
\[ \ln X_{ii} = \text{vector of log of continuous structural attributes for household}_i \text{ (for example, } \ln(\text{number of bedrooms})\text{)}, \]
\[ X_{si} = \text{vector of dichotomous structural attributes for household}_i \text{ (for example, garage: } 0=\text{no}, 1=\text{yes}), \]
\[ \ln X_{4i} = \text{vector of log of zoning effects for household}_i, \]
\[ Q_i = \text{vector of dichotomous quarterly variables used to identify a local price trend}, \]
\[ \alpha, \beta, e_i = \text{constant}, \text{ coefficients, and error term respectively}. \]

The estimated coefficients in this functional form are read as elasticities. In other words, if the estimate of \( \beta \) for lot size is 0.006, a one percentage increase in lot size, holding all else constant, would imply a 0.6 percent increase in the price of the house. Caution is in order in interpreting the dichotomous variables as a mathematical transformation is required before reading their coefficients as elasticities\(^{17}\).

3.4 The Data

The vector of structural attributes required for a complete specification of the hedonic price equation would be costly in terms of data collection. However, previous hedonic modelling studies have determined that a select number of variables prove sufficient for estimation. Table 3.1 lists the variables that are used in this study.

The dependent variable used in the hedonic model is price which is estimated in both nominal and real dollars. This is the transaction price that is reported to the Land Titles

\(^{17}\)The coefficient of a dichotomous variable in a log model is a percent change in price but the percent is \((e^\beta - 1)\) rather than \(\beta\). For example, if the coefficient is estimated to be 0.03, the percentage increase is \((e^{0.03} - 1)\times100\), or 3.04 percent.
Office. The year and month variables coincide with the closing date of the sale. The remaining variables require no additional explanation.

The British Columbia Assessment Authority (BCAA) maintains a database of sales activity in the province. This database, in conjunction with information collected by the Multiple Listing Service (MLS) allow the construction of a large and comprehensive cross index maintained by Stan Hamilton at the University of British Columbia. The data for this study are taken from these combined files.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price (in nominal dollars)</td>
<td>Continuous</td>
</tr>
<tr>
<td>Year sold</td>
<td>&quot;</td>
</tr>
<tr>
<td>Month sold</td>
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<td>Age of house (years)</td>
<td>&quot;</td>
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<td>Lot width (feet)</td>
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</tr>
<tr>
<td>Lot depth (feet)</td>
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</tr>
<tr>
<td>Main floor area (square feet)</td>
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</tr>
<tr>
<td>Number of bedrooms</td>
<td>&quot;</td>
</tr>
<tr>
<td>Number of other rooms</td>
<td>&quot;</td>
</tr>
<tr>
<td>Number of basement rooms</td>
<td>&quot;</td>
</tr>
<tr>
<td>Number of fireplaces</td>
<td>&quot;</td>
</tr>
<tr>
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<td>&quot;</td>
</tr>
<tr>
<td>Number of partial baths</td>
<td>&quot;</td>
</tr>
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</tr>
<tr>
<td>Curb &amp; gutter</td>
<td>&quot;</td>
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<td>&quot;</td>
</tr>
<tr>
<td>Prime view</td>
<td>&quot;</td>
</tr>
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</table>

In addition to the variables outlined above, a set of quarterly dichotomous variables are used to capture the temporal nature of the data. Alternatively, an hedonic price index
for single detached housing in the city of Vancouver is used to deflate the nominal housing prices, thus removing the time trend. Over the short study period, it is assumed that the other variables are time insensitive.

The zoning variables added to the list include DIST, a distance measure (in metres) between each individual parcel the AIA and EXP, an indicator variable separating the study area data from the control area data. The distance variable is the euclidean distance between each property and the proposed rezoned area of the Arbutus Industrial Area. This direct measure of distance is preferred over another more indirect measure of following the existing roadway network as the diseconomies associated with this particular rezoning include excessive noise levels and blocking of the views of the north shore mountains, both being uncorrelated with the defined street layout.

3.5 The Study Area

There are two reasons for choosing this particular rezoning for analysis. The first is due to the close proximity to single family residential zoning. The second is that the magnitude of the rezoning and the public response make it an attractive study area. The north boundary of the study area is West 12th Avenue which also constitutes the south boundary of the proposed Arbutus rezoning. The study area extends south to the lane separating West 15th Avenue and West 16th Avenue and lies between Arbutus Street on the east and Larch Street on the West. The study area is comprised of a total of 266 residential homes, 12 commercial buildings and three multi-family complexes. This area can be divided equally
into two segments, seven blocks immediately south of the Arbutus site and seven blocks
directly south of Connaught Park (refer to Figure 3.2).

Of the 83 actual sales that occurred in the study area (refer to Table 3.3) over the 1987 to 1992 time period, 69 sales occurred in the area directly south of Connaught Park while only 14 sales occurred in the area directly south of the Arbutus site. Two explanations can be offered for this unusual distribution of sales. The first relates to speculative activity while the second relates to the social mix of the residents. With a rezoning imminent, sales activity may slow down pending the outcome of the process, a result of speculative activity. This result is most common in transition zones that

**TABLE 3.2 SUMMARY STATISTICS**

Combined Study Area and Control Area (n=388)

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<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std Dev</th>
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</thead>
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<td>FULL BATHS</td>
</tr>
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</tr>
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</tr>
</tbody>
</table>
Figure 3.2

KITSILANO, N.S.

CONNAUGHT PARK

N = 69

N = 14

STUDY AREA
typically circle the central business district. A characteristic of these transition zones is an obvious lack of structural maintenance. However, visual inspection indicates that the area with low sales activity is more stable with larger, well maintained homes and yards which may contradict the speculative theory. It also seems unlikely that there could be enough social diversity in such a small neighborhood to create the unbalanced distribution of sales. Although both theories have their merits, realtors familiar with the neighborhood could only offer an explanation to reinforce the stability hypothesis\(^{18}\).

3.6 The Control Area

The control area used in this study is situated in the same neighborhood thus hopefully mitigating extraneous neighborhood effects into the analysis. Ideally, the area must be far enough away from the Arbutus Industrial Area so as not to capture the externality effect of the rezoning. The area chosen is situated west of Macdonald Street, east of Blenheim Street, and has the same north and south boundaries as the study area (refer to Figure 3.3). Of the 383 homes that occupy the control area, there are a total of 305 sales, a number almost four times as great as the sales activity in the study area. Again, the reasons discussed above regarding the distributional disparities in the study area can be again referred to.

\(^{18}\)This phenomenon was brought to the attention of two realtors that are familiar with the neighborhood. Both found the results unusual but could not provide an alternative explanation to the ones offered above in the text. One realtor stated that he made cold calls in the area and found that there are many older home owners that are just not interested in selling their properties.
### TABLE 3.3 SUMMARY STATISTICS

#### STUDY AREA (n=83)

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<td>(years)</td>
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#### CONTROL AREA (n=305)

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3.7 Discussion of the Study Area and Control Area

The characteristics of the combined study area and control area are outlined in Table 3.2. Table 3.3 provides summary statistics of each separate area for comparison purposes. The average sales price of a single family home during the six year study period is $355,000 in the study area as compared to $290,000 in the control area. This difference in values can be explained by observing the summary statistics. The age of structures in the study area are, on average, 49 years compared to 52 years in the control area. Although the study area appears to have more older homes, there have been many renovations in the area which would explain the younger average age. The homes in the study area are, on average, on larger lots, have more bedrooms and other rooms, and encompass larger floor plates. The study area is characterized as having less infrastructure with only 82 percent of the sales having such amenities as curb and gutter, sidewalks and sewer. The comparable number in the control area is 97 percent.

The distance from the proposed rezoning averages 280 metres for the study area with the closest property being 45 metres and the farthest property being 550 metres. The control area has a minimum distance of 900 metres and extends to 1400 metres away from the proposed rezoning. It is anticipated that this distance and the fact that the control area is separated from the Arbutus Industrial Area by a major arterial roadway (Macdonald Street) will minimize the impact of the rezoning on the control area.

Both the study area and the control area have similar access to the central business district (CBD) and to the Broadway corridor. Both are situated near a major park with the
study area adjacent to Connaught Park and the control area adjacent to Carnarvon Park. The schools in the area are evenly distributed between the areas. This implies that incorporating such variables as access to the CBD and proximity to parks and schools can be omitted from the analysis, simplifying the model.

3.8 Regression Results

Ordinary least squares regression was run using the model discussed in Equation (3.2). The results are reported in Table 3.4. The highly significant coefficients on the quarterly indicator variables indicate that there is a substantial temporal trend in the housing prices. This result is not surprising. Aside from the quarterly variables, there are five variables that are significant at the ten percent level of significance. These five variables all display the expected signs and the coefficients are comparable to other studies of housing data in the lower mainland (Hamilton and Carruthers, 1993). The zoning variable reported is the log of the distance measure (LNDST). The coefficient is not significant and the negative coefficient contradicts the assumed externality effect. A second regression was run substituting the dichotomous zoning variable for the continuous measure. The results do not vary substantially.

Residual analysis indicated the presence of two outliers in the data. An investigation indicated these observations were not errors in the data and were thus not removed from the data set. Aside from the outliers, the residuals appear homoscedastic and thus no corrections have been made to the model.
One of the results that was to be determined from the analysis was whether there has been a change in the zoning impact due to the announcement of the rezoning in the fall of 1989. It is assumed that in an efficient land market, the announcement of a possible rezoning would immediately be capitalized into the price of the surrounding land.

In order to investigate this announcement effect a second model was constructed with two major departures from the first model. This second model is formulated as follows,

$$\ln DefPrice_i = \alpha + \alpha' POST + \beta_1 \ln X_{ii} + \beta_1' POST \ln X_{ii} + \beta_2 X_{2i} + \beta_2' POST X_{2i} + \beta_4 \ln X_{4i} + \beta_4' POST \ln X_{4i} + \varepsilon_i \quad (3.3)$$

where:

- $\ln DefPrice_i$ = log of deflated price of household $i$,
- $\ln X_{ii}$ = vector of log of continuous structural attributes for household $i$ (for example, $\ln$ (number of bedrooms)),
- $X_{2i}$ = vector of dichotomous structural attributes for household $i$ (for example, garage: 0 = no, 1 = yes),
- $\ln X_{4i}$ = vector of log of zoning effects for household $i$,
- POST = Indicator variable (=1 after announcement),
- $\alpha, \alpha', \beta, \beta', \varepsilon_i$ = constant, coefficients, and error term respectively.

The quarterly indicator variables had to be removed from the model and this required deflating the nominal prices with some measure of inflation. One such deflator, the consumer price index for housing in Vancouver as reported in the Cansim\(^{19}\) database, proved to be a poor indicator of the temporal nature of the data. An additional two price indexes constructed from single family sales in Vancouver were also used to deflate the

\(^{19}\)Statistics Canada maintains an electronic database titled Cansim.
nominal price. It was found that the hedonic price index based on sales in the City of
Vancouver proved to be the best indicator of temporal price changes.

A differential intercept and a series of differential slope coefficients (Gujarati, 1988,
p.446) were added to the model incorporating a new indicator variable (POST) which equals
zero before the announcement and one after the announcement. The variables LNBASERM
and LNRMS were deleted from the second regression as they were suspected of producing
multicollinearity.

The second regression results are outlined in Table 3.5. By deflating the nominal
prices the time trend is ideally eliminated. An initial regression incorporating the quarterly
variables indicated that the hedonic index performed well in removing the temporal nature
of the data.

Four variables were found to be significant in this regression with an adjusted $R^2$ of
66 percent. These variables include the log of the age of the structure, the log of the main
floor area, the log of the lot size and the log of the number of fireplaces. In addition, the
differential slope coefficients for age and garage are significant indicating that there appears
to be some structural change occurring for these variables after the
fall of 1989. It appears that the negative impact associated with age has increased since
1989 while the presence of a garage now has a significant impact on price.
### TABLE 3.4 REGRESSION RESULTS

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F = 88.61497  Signif F = .0000

Dependent Variable.. LNP

------------------------- Variables in the Equation -------------------------

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As has been found in all the regressions run, the DIST variable is statistically insignificant at the ten percent level, both before 1989 and after 1989. It appears from this result that the distance separating individual properties from the AIA has not had any impact on the value of those properties. This result is consistent with the vast majority of studies mentioned earlier in the literature review. In subsequent regressions substituting the dichotomous EXP variable for the DIST variable, similar results were obtained. These results tend to refute the tested hypothesis and imply that a parcel’s sale price is not affected by permitting non-single-family uses on the previously zoned light industrial land.

The results can also be interpreted in a number of other ways. It is quite possible that the distance variable is capturing more than one externality. If it is capturing the positive externality of rezoning from industrial to residential, and the negative externality of increased density relative to adjacent densities then the two opposing results may be cancelling each other out.

A final interpretation offered in this analysis is the fact that the rezoning has not been finalized at the time of this writing. Perhaps the announcement effect will be more pronounced when the official rezoning occurs as opposed to when it was first announced. This interpretation is rather weak and is discussed further in the concluding remarks.
**Table 3.5 Regression Results**

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Chapter 4  Conclusion

There are many factors that impact property values in any particular jurisdiction. The more obvious ones include distance from the central business district and the size of the parcel of land. Structural attributes such as floor area and age have also been deemed significant contributors to the total value of the property. These and many others have been quantified in hedonic studies which have attempted to identify the determinants of value. In addition to these overt attributes there are numerous covert attributes which also have an impact on property values. Such neighborhood externalities including traffic congestion, noise and various adjacent land uses have been topics of academic study. The results of these studies have varied, with some showing significant impacts on property values related to proximity to a particular externality and others showing no significant impacts.

Local area interest groups have often used the negative impacts of neighborhood externalities in their arsenal of defenses to fight against rezoning applications. The speed and intensity in which interest groups form against any particular rezoning application appears to be correlated to the sense of neighborhood and the history of interest group activity. Chosen for this study is the Arbutus Industrial Area which is situated in the Kitsilano neighborhood in Vancouver’s west side. There is a strong sense of community which goes as far back as the formation of the neighborhood earlier this century. The decision to rezone the industrial lands into medium density residential has met with a great deal of opposition from two prominent interest groups. Although they have been unsuccessful of their optimal choice of single-family residential for the area, they have seen
a reduction in the overall density slated for the area. At the time of this writing, the final density of development was still undecided.

Statistical analysis was performed on the neighborhood surrounding the Arbutus Industrial Area to determine whether the rezoning has had any impact on adjacent property values. The method chosen, the hedonic approach, has been used widely in the area of externality research.

Results of statistical analysis indicate that the distance variable is insignificant. This result can be interpreted in many ways. One interpretation would be that the rezoning has had no impact on adjacent property values. This interpretation has a significant amount of research to back it up.

A second interpretation is that the distance variable is measuring more than one externality. For example, the Arbutus Industrial Area is being rezoned from light industrial to residential. Intuitively this conversion to a more compatible land use ought to positively affect adjacent property values. However, the increased density relative to the surrounding neighborhood can be considered a negative externality. The combination of these two externalities may be producing the insignificant results.

A final interpretation is a result of the current status of the rezoning application. It can be argued that the market is confident the rezoned density will not exceed the level considered appropriate for the area. However, the market is fully aware that rezoning is imminent and the density is going to be higher than adjacent densities. If the market were efficient, property values should already reflect these changes and the legal rezoning date would not be considered a significant factor.
In the introduction, three cases were addressed regarding neighborhood opposition to increased density in their neighborhoods. One case introduced the Arbutus area and the neighborhood concerns regarding the rezoning. This case has been the focus of this paper.

The second case involved a neighborhood in the City of Coquitlam. The Oxford Heights residents fear that the subdivision of one lot into two smaller lots in their neighborhood would cause their property values to plummet. The results from this paper appear to counter their fears. This specific case involves no land-use change and requires no changes to the existing zoning regarding minimum lot size. This case appears to be an example of the residents fears of neighborhood change and their use of ‘declining property values’ to legitimize these fears.

The third case articulated the concerns of residents in one of Vancouver’s east side neighborhoods regarding the introduction of a multi-family development on property owned by a local church. Again, the results here appear to indicate that their property values will not be affected by the proposed rezoning. In addition, the results from the City of Vancouver’s ‘New Neighbours’ document (City of Vancouver, 1986) indicate that the overall neighborhood concerns regarding a rezoning of this nature appear to subside after the higher density has been introduced into the neighborhood.

Statistical analysis may appear to be a harsh and cold method of determining whether or not residents fears of change in their neighborhoods are in fact true. However, the method is quantitative and the results are based on factual data. A more complete study of the problem addressed in this paper would involve the introduction of a qualitative component. Interviewing neighbors both before and after a rezoning, similar to the method
used by the City of Vancouver in their study on neighborhood change, would compliment the quantitative research of this study. This more balanced approach would address the concerns of all residents as opposed to focusing on overall impacts on a neighborhood.

As cities such as Vancouver evolve and the inner industrial areas become out-dated, there will be a desire to rezone them to more appropriate uses. In an effort to reduce urban sprawl, civic officials will rely more heavily on increased density. This may mean that people and neighborhoods are going to have to adapt to their ever changing surroundings. Existing residents have adapted in the past and they will adapt in the future.
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