DISSERTATION

ASSESSING THE MARKET FOR INSTITUTIONS:

THE CASE OF HOMEOWNER ASSOCIATIONS

Submitted by

William H. Rogers

Department of Economics

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY WILLIAM H. ROGERS ENTITLED ASSESSING THE MARKET FOR INSTITUTIONS: THE CASE OF HOMEOWNER ASSOCIATIONS BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTORATE OF PHILOSOPHY.

Committee on Graduate Work

Charles F. Revier

Adviser

Department Head/Director

ABSTRACT OF DISSERTATION

THE IMPACT OF COVENANTS ON ORGANIZING NEIGHBORHOODS

This dissertation is three works focused on the use of spatial analysis in urban research. It is broken into three separate works which all use a common topic: covenants and community associations. The aim of the dissertation is to demonstrate how the use of space can change the application of established economic theory and practice and to investigate the impact that covenants are having on the housing market.

The first work provides evidence from three hedonic models that community associations provide value for the homeowners who use them. This is true despite the fact that the community associations studied exist within a city and county that does zone. The dataset used is of micro-level housing data for the cities of Windsor and Greeley, Colorado.

The second work uses the same dataset as noted above but the focus changes to spatial econometrics. Techniques have been developed to identify and correct for spatial dependence in the variables of the specified model. These techniques are heavily dependent on the creation of a spatial weight that models the nature of that spatial dependence. Chapter 3 compares the use of two strategies to generate the spatial weighting matrix. The results are found to be very sensitive to the specification of the spatial weights. Some variables change economic and statistical significance enough to

ignore the variables with one weight but warrant serious consideration in using another weight.

The third and final work explores the community association using a Coasean approach and examines some details of the voting process. The Coasean approach is argued to hold important consideration when examining the housing market; while the voting decision made by the creators of a covenant are argued to follow the basic cost minimization outlined in Buchanan and Tullock (1962). A dataset for all homeowner associations in Greeley and Windsor is used to further the argument.

William H. Rogers
Department of Economics
Colorado State University
Fort Collins, CO 80523
Summer 2004

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Ch I Introduction

1.1 Background

The development of regional economics is an important next step for economic theory. In fact, Paul Krugman (1998) went so far as to title his regional promotion piece "Space: The Final Frontier." Distance and other locational variables can have strong impacts on decisions made by firms, households, and governments. Certainly, the inclusion of space variables is an important step in the developments of economic theory, but space is not simply a third variable to include in the modeling of supply or demand. Space can also change our thoughts on market failures and the role of government.

Public goods and externalities are two major types of market failures. Often the remedy that is suggested includes some government involvement. Roads[1] are a common example of a congestible public good. The example follows: roads are non-excludable because the cost to charge users is currently prohibitive[2] and roads are non-congestible to a point. Therefore, the price charged for use should be zero during times of little use and positive during times of congestion, while the free market will not be able to provide such a product because it is non-excludable. For most residential areas the roads are used by primarily local residents. The value of the road will be included in the price of the land close to the road.

[1] Often microeconomics textbooks will use the example of a highway but the characteristics used to explain a public good are the same for highways and roads.

[2] This element of roads and highways are changing with new technology.

Second-hand smoke is a common example of an externality. The by-product of consuming a cigarette is second-hand smoke but there are no markets for clean air, so the smoker will not include the cost of disposal in his consumption decision[3]. The markets will fail to produce an optimal outcome and the government may be able to improve the situation. A tax could be levied on cigarettes so the total price will include the cost of disposal. Again space should play a role in the understanding of the supposed market failure.

The disposal must take place in a space, a restaurant for example. Let us assume that the restaurant has an absentee owner who is only interested in profit-maximization. If the second-hand smoke is considered an economic bad by some, then cigarette smoking will impose a cost on those close to the smoker. If the restaurant exists under sufficient competition in the input and output markets, then the cost of smoking will be related in a lower price of food and a higher price of labor. The owner will adjust behavior by raising the price of food (and thus catering to smokers), banning smoking from the restaurant, or segregating customers within the building. The process can be described using Gary Becker's famous treatment of discrimination. The economic bad will continue to exist but the market failure will not because the disposal takes place in a space and thus can be internalized in the decisions of the restaurant owner.

When dealing with externalities, an institution can influence quantity or influence price. Zoning, direct controls, and deed restrictions are three tools used to influence quantity. Zoning and direct controls are really the same tool and they are associated with

[3] There are several issues with altruism, which will change this example. I will discuss some of the issues with externalities and altruism below.

traditional government actions. A deed restriction (or restrictive covenant) is a tool used by community associations.

User fees, Pigouvian taxes, and assessments are three tools used to influence price. Assessments are normally used by community associations to collect funds for neighborhood projects; however, these assessments also can act as a Pigouvian tax or a user fee.

Still, there are differences in the institutions which employ these tools. Municipalities (cities), for-profit corporations, and non-profit corporations are all treated differently in American common law. Two such distinctions are the flexibility given to community associations in choice on voting policy compared to municipalities and the vigorous review process over the reasonableness of deed restrictions compared to municipal zoning (Ellickson 1982). These differences, among others, impact the appropriateness of zoning and deed restrictions.

This dissertation is an inquiry into the valuation and operation of homeowner associations, how these varied institutions are shaping, and land use policy. Chapter 2 examines the impact of restrictive covenants on housing prices. The data set is limited to housing that is currently located within a municipality and is thus subject to zoning ordinances. This chapter will show that even with the municipal zoning efforts, more specific zoning is valued. Chapter 3 questions how spatial weights are produced for the correction procedure of spatial dependence. Using the same dataset as in chapter 2, chapter 3 will show how important the generation of the spatial weight is. Chapter 4 will expand on chapter 2 by comparing the more public use of zoning (municipal law and thus criminal courts) to the more private use of covenants (private contract and thus civil courts) using a Coasean framework. An examination of these two types of institutions should provide a better understanding of when, and where, zoning or covenants are more appropriate.

1.2 First Paper Overview

Zoning and local public goods are commonly provided by the municipal government. However, community associations have been a rapidly growing institution in the housing market. In some cases community associations are providing public goods and zoning in place of a municipal government and, in some cases, within a municipal government. A large amount of literature has been devoted to the impact of municipal zoning. In contrast, private zoning has not received as much attention from economists. However, private zoning has been used by the private sector before municipal zoning and is increasing in popularity. This paper will be an analysis of private zoning in light of previous work on municipal zoning and will use hedonic pricing to attempt to isolate the effects of private zoning.

The argument for municipal zoning and much of government action is one of public goods and externalities. Still, these arguments become harder to make at the local level, since local level externalities and public goods are, by definition, limited in scope. Here, externalities and public goods are more likely to be handled by voluntary action. The smaller scope also implies smaller bargaining costs or at least a smaller effective area, and thus, individuals or other private organizations will have more opportunity to correct these failures. It is no wonder that many such private organizations has developed to provide limited public goods (often called club goods) and possibly even correct for externalities.

The question rests in who is better able to provide for club goods and internalize externalities. If private communities are better able to correct for market failures then the benefits should be capitalized in the price of the housing. Another possibility includes reduced risk on investment. Many household have a majority of their wealth in the form of home equity. This equity cannot be easily diversified, therefore, homeowners would be very cautious about the future risks involved in their investments. Still, the potential of risk is tied up in the chance for future externalities to come along (the deterioration of the neighborhood, for example).

The empirical work on zoning has been limited to natural experiments where a city has changed its zoning policy or created one. This paper will review the private zoning within the context of a municipality who has a current zoning policy. Therefore, the price of housing within public zoning will be compared to housing within private and public zoning. Since private zoning is becoming more common, I expect the added layer of private zoning does provide a useful service to the specific neighborhood, thus the benefits are capitalized in the price.

Prices for housing sales (including numerous characteristics of the housing) are widely available and have been used in much of the public zoning literature. Deed restrictions or convents, which are needed for the existence of many of the private institutions, are also public data.

1.3 Second Paper Overview

Although the idea of spatial statistics is relatively old, the use of spatial statistics (or econometrics) has been rapidly developing in the last decade. This growth can largely be attributed to the dramatic decline in price of computing power. The basic idea for spatial econometrics is two fold: first to provide the researcher with tools to create and use spatial variables; and second is to correct for any spatial dependence in other variables.

The first arena of spatial econometrics is focused on better spatial measurement. The creation of new spatial variables is greatly enhanced by the progress of global information systems (GIS). GIS allows the user to view and measure the area in question with much better ease and accuracy than in the past. The inclusion of these direct variables increases the richness and usefulness of the inquiries. Still, not all useful variables are measurable.

The second arena focuses on the general correction of missing spatial variables, and is similar to the issues that arise with common heteroskidasticity, autocorrelation, and autoregression. All of these econometric issues arise from missing variables or an incorrect functional form. If the information on a property specified model is available, then the researcher will want to use it. However, many times all important information is not available or is costly to acquire. In this case, the researcher may want to use a statistical correction.

The problem with the statistical correction is deciding how the missing information should be modeled. It may not be clear to the researcher what the appropriate correction method is. This issue can be particularly problematic for spatial inquiries and therefore the second paper will highlight some of the problems with correcting for spatial dependence with micro-level housing data.

Particular attention will be paid to the generation of a spatial weighting matrix. This matrix is generated to be a composite spatial variable as a substitute for the missing spatial information. The weight is then used to lag a dependent or independent variable. However, the spatially lagged variable is far more complex, because of the multidimensional nature of space. This lagged variable concept is familiar to those who study time-series econometrics.

1.4 Third Paper Overview

Land use policy does not operate without conflict and complaints. The complaints about zoning have been well documented (Fischel 1985). No doubt the rise of community associations has been partially prompted by public zoning failures. The rise of community association has led some (Boudreaux and Holcombe 2002, Foldvary 1994 and 2002, Nelson 2002, and Stabile 2000) to promote this emergence in the housing market. Still others like Evan McKenzie (1994), view these community associations to be a burden on the housing market, which must be regulated by government authorities. Regardless of one's conclusion about community association, land use policy must still deal with local externalities and public goods. Most economists believe both externalities and public goods cannot be dealt with through voluntary means but can be dealt with through proper tax policy. Although voluntary solutions have been proposed (Coase 1960), most economist view externalities and public goods as too great a problem for voluntary action (Baumol and Oates 1988). For the neoclassical economist, externalities are corrected by use of some Pigouvian tax (Varian 1992, chapter 24) and public goods can be funded by use of taxes (Varian 1992, chapter 23).

Under current law, zoning and user fees can be properly viewed as similar to direct controls and Pigouvian taxes (as in the environmental economics literature), or as quotas and tariffs (as in the international trade literature). However, private land use policy, through the use of covenants, does not fit as nicely into those categories. Covenants change the property rights so that the externality laden elements of owning property are limited and regulated by a local collective entity, while the other components are left up to private decisions. So the right to have pets, for example, will be held collectively. Therefore, the analysis of community associations should be done through the private property tradition.

The public choice literature has given many reasons why democracies will fail to produce optimally. Given that many externalities and public good are limited by space, developers of property do have an incentive to correct for these issues. After the development has been sold, it is up to the residents of the property to continue dealing with land use policy.

Democratic voting is the one political system that is held in high regard. Still, from an economic point of view, there are many reasons that a one-person-one-vote system may not provide the optimal allocation of resources. The pubic choice literature is full of examples. Many authors have divided voting into a matrix that includes two types of choices, monetary and non-monetary, and two types of voting, one-person-one-vote and one-share-one-vote, where the one share simply represents any system that weights votes based on economic incentives. Barzel and Sass (1990) believe a consensus can be found where purely monetary decisions should be made with one-share-one-vote and purely non-monetary decisions should be made with one-person-one-vote. Most economists do not have qualms about corporate voting, where voting power is adjusted by the monetary stake a person has in the decision. Likewise, most economists do not have a problem with equal voting status for every citizen for political races. Both of the previous examples are not purely monetary or non-monetary, but the current literature accepts the view that they are close. Still, issues with housing are far more mixed. The typical household has a majority of their wealth in their house asset and at the same time neighborhoods also include many non-monetary aspects. The Supreme Court has established that municipalities must require a one-person-one-vote policy but allows private organizations the chance to use a wide variety of voting policies.

This paper will develop a theory to describe community associations and attempt to establish which voting policy would be more appropriate in the urban community setting. Can voluntary action correct for market failures? Are there reasons to believe alternative voting systems are inherently better suited for the decisions that must be made at the local level? Or should all neighborhood decisions be limited to the one-person-one-vote policy that is required of public cities? Developers are not only constructing an institution to maintain the zoning restrictions and public goods but they are also constructing the institution in such a way as to reduce the cost of operating the homeowners association.

1.5 Summary

The inclusion of space is an important but complex task. Complex problems arise whenever scientists (social or physical) setout to increase the detail of the models they work with. This dissertation highlights some of the importance of adding space to our inquiries. It also includes the direction of the housing market with respect to community associations and the rise of private collective action.

Space can change the way we look at solutions to public goods and externalities, as is seen in chapter 2 and chapter 4. All externalities are limited to a particular area and public goods are only public in a particular area. By understanding the area of impact, one can make more useful decision about correcting the market failures. Likewise, this can lead to a conclusion about the appropriate institution for which to deal the market failure.

Space can change the econometric techniques we use. Spatial dependence can manifest in complex ways, which a composite correction variable may not be able to replicate. This can lead to misplaced confidence in a particular econometric correction.

Finally, the use of covenants in the United States has provided the foundation for a large housing development of the community association. Here private governments are providing zoning and public goods despite the fact that municipal governments have traditionally provided these services. These community associations are able to take advantage of the spatial nature of public goods and externalities to provide useful services, which are capitalized into the housing price.

Ch II The Impact of Homeowner Associations on Housing Prices: a Hedonic Model

2.1 Background

Mathematics has allowed economic theory to increase its precision and complexity. This development has produced the computable general equilibrium model (CGE models): the apex of applied mathematical modeling. Given these tools and the widespread use of computers, a representative local government may be able to significantly reduce externalities, which should result in higher property values. If these externalities are fully or mostly accounted for, then others would not be able to improve housing values through more restrictions. However, the empirical evidence on the benefits of zoning is mixed. (Pogodzinski and Sass 1990) Furthermore, covenant restrictions are very common even in neighborhoods with zoning and user fees. This alone suggests that municipal governments are not zoning efficiently.

Despite the fact that covenants are quickly becoming a common feature of improved land, Hughes and Turnbull (1996a) have characterized the economic literature as being sparse with respect to covenants and their impact on land use. They cite only three works: Cannaday (1994), Seigan (1972), and Speyrer (1989). Only a few can be added to this list: Boudreaux and Holcombe (2002), Foldvary (1994), Foldvary (2002), Hughes and Turnbull (1996a and b), Nelson (2002), and Stabile (2000).

This paper will investigate the impact of restrictive covenants on single-family housing values in Weld County, Colorado, using a hedonic pricing method. Issues of spatial dependence will be taken up in chapter 4. The dataset will include a five-year period of sales but the econometric approach will treat the data as cross-sectional by including a dummy variable for the quarter sold. I expect to find the added restrictions will correct for market failures beyond what the local zoning boards have. The reduction of externalities should be evidenced with higher land values. If the expected evidence is found, then the benefit of exclusive zoning by the municipality could be called into question. It may then be useful for the municipal zoning boards to limit their regulations to externalities that cover a larger space than the individual HOAs.

2.2 Covenants and Zoning as Housing Insurance

Homeowners' insurance is almost ubiquitous. The insurance commonly covers physical damages to property, but it does not cover all damages to the owner's wealth. Externalities can move into the neighborhood. An open view of the Rocky Mountains can later be obscured by new developments on adjacent land. Since there are no property rights to the view, the owner could not purchase the right to view the Rocky Mountains without purchasing all the land in between. The missing property right leaves him only able to purchase the view for an undetermined time. Risk is involved.

Assuming the owner is risk adverse with respect to the view, he will be willing to purchase insurance to reduce the risk of a loss of property value. The March 22nd, 2003 edition of *The Economist* published the article "Risk Management for the Mass." The article was based on Professor Robert Shiller's work in the insurance industry, which outlined the future of insurance technology, and noted that this type of housing insurance may not be far away. Diana Mok (2002) views the housing insurance problem as one of capital diversification[4]. If housing were divisible in ownership, then people would wish to purchase only a share of housing. Conceivably, a household could purchase a share of the house they live in and other shares of real estate (maybe through a mutual fund) to diversify the risk of lost investment. These types of housing insurance, sadly, do not exist. Still, there is reason to believe that insurance may not be the most sought after answer to the problem of housing amenity risk.

William Fischel (2001)[5] notes the creation of such insurance would require more information on the risks involved. The two informational problems that arise with housing insurance (Fischel, 2001) are identifying damage to property value and moral hazard from third-party insurance. Damage from a flood is easy to identify compared to the damaged caused by the construction of an office building which blocks a mountain view. Moral hazard problems also arise with the homeowners being less willing to protect their neighborhood from harmful rezoning or other development. The end result will be incomplete insurance.

In a perfect world, the risk and the owner's valuation of the mountain view would be known with certainty. Without this certainty some owners would look for other tools to reduce this risk. Zoning and covenants are two not entirely identical tools to accomplish this task. Both institutions place constraints on the ability for other owners to change the state of nature; therefore, these institutions reduce the risk for the view-valuing owner.

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[4] Diversification of one's assets is one way to purchase insurance for capital.

[5] Fischel also credits Albert Breton (1973) for the connection between imperfect insurance and zoning.

2.2.1 The Hughes and Turnbull Model

Hughes and Turnbull (1996a) use an expected utility function $E[u^i(h, y)]$, where h is the risky consumption of housing services, y is the certain nonhousing consumption, and the utility index is assumed to be strictly concave. The amount of housing consumption is

$$h = f(\mathbf{x}) + g(\mathbf{x})\sigma\varepsilon, \tag{1}$$

where $\mathbf{x}$ is the attribute vector of the housing and $f(\mathbf{x})$ and $g(\mathbf{x})$ are known functions with $\partial f/\partial \mathbf{x}_i > 0$ and $\partial g/\partial \mathbf{x}_i > 0$. The known positive parameter to measure riskiness of the consumption of housing is σ; ε is stochastic and distributed with mean zero and a finite positive variance.

The household is constrained by

$$m_i = c^i(\alpha) + p(\mathbf{x}, \alpha, \sigma) + y, \tag{2}$$

where m_i is the money budget, $c^i(\alpha)$ is the commuting cost, and $p(\mathbf{x}, \alpha, \sigma)$ is the price of housing services with the characteristics of $\mathbf{x}$, α, and σ. The cost of nonhousing consumption, y, is normalized to one. The variable α an index of residential accessibility to non-residential sites[6], where $dc^i/d\alpha > 0$.

The household will choose $\mathbf{x}$ and α to maximize utility subject to (1) and (2).

6 Examples include employment centers, shopping centers or entertainment.

Solving (2) for y and substituting into (2) will result in

$$E[u^{i}(f(\mathbf{x}) + g(\mathbf{x})\sigma\varepsilon, m_{i} - c^{i}(\alpha) - p(\mathbf{x}, \alpha,\sigma))]. \qquad (3)$$

The relevant first order conditions are

$$E[(\partial u^{i}/\partial h)((\partial f/\partial \mathbf{x}_{j}) + (\partial g/\partial \mathbf{x}_{j})\sigma\varepsilon) - (\partial p/\partial \mathbf{x}_{j})(\partial u^{i}/\partial y)] = 0,$$
$$\mathrm{j} = 1,\ldots,\mathrm{n} \qquad (4)$$

where $\partial p/\partial \mathbf{x}_{j} > 0$. The location equilibrium condition is

$$E[\partial u^{i}/\partial y](- \partial p/\partial\alpha - \partial c^{i}/\partial\alpha) = 0, \qquad (5)$$

where $\partial p/\partial\alpha < 0$.

Hughes and Turnbull (1996a) focus their attention on the relationship between consumption risk and the equilibrium hedonic price function by adjusting local variation in σ. The final spatial equilibrium equation is

$$E[u^{i}(f(\mathbf{x}^{*}) + g(\mathbf{x}^{*})\sigma\varepsilon, m_{i} - c^{i}(\alpha^{*}) - p^{*}(\mathbf{x}^{*}, \alpha^{*}, \sigma))] = E[u^{i*}], \qquad (6)$$

where the equilibrium values are denoted by asterisks. The utility function is a measure of a type of household *i*. Since they assume the household types reside over the whole market area then $E[u^{i}*]$ will be exogenous to the smaller area under examination. Upon differentiation,

$$\partial p^*(\mathbf{x}^*, \alpha^*, \sigma)/\partial\sigma = E[(\partial u^{i}/\partial h)g(\mathbf{x}^*)\varepsilon]/E[\partial u^{i}/\partial y] < 0 \qquad (7)$$

will result. Under risk aversion the sign should be negative. This gives a clear empirical implication: housing prices will be lower as more risk is present in future outcomes.

2.2.2 Measuring Risk

The key variable is a measurement of risk. Hughes and Turnbull (1996a) use the documented covenant restrictions as a proxy for neighborhood stability. They hypothesize the more behaviors that are listed in the covenant the less risky the future condition of the neighborhood will be and the greater the premium the residents will be willing to pay. The risk is, of course, of a future negative externality. Homeowners are attempting to establish a durable neighborhood norm that will be less susceptible to decay from the exodus of current neighbors and the introduction of neighbors with different and non-compatible norms.

There are many ways to measure risk. Hughes and Turnbull (1996a) are able to objectively measure the number of restrictions in a covenant, but they are not able to measure the enforcement of these rules. Hughes and Turnbull must then implicitly assume that the rules are being enforced, or that consumers will assume the rules will be enforced.

In defense of the first assumption, one could claim that it is in the best interest of the homeowners to enforce the rules. The rules exist to reduce the risk of future negative externalities and thus there are many potential (direct and indirect) benefits to enforcing the rules. There are also costs with enforcement. The cost can be divided into two components: bureaucratic costs and social costs. The bureaucratic costs are the basic costs of monitoring the residents, fining, collecting fines, and any other legal fees associated with enforcing the covenant. Social costs include the cost of any social friction generated in the enforcement of the rules. This second cost will reduce the enforcement of rules and is much more difficult for the developer to predict. Therefore, assuming enforcement will take place because of the benefits simply ignores the cost of enforcement.

The second assumption is also tenuous. Risks and benefits must also be discovered. Hughes and Turnbull (1996b) look at the discovery process of developers in Baton Rouge. They find developers increasing the restrictiveness of covenants in newer subdivisions. Hughes and Turnbull (1996b) conclude that developers are discovering the optimal covenant given the location in the city. This discovery process also extends to the consumers who must discover what the actual and optimal enforcement for the subdivision is.

These assumptions may still be adequate if community associations act as a signal to potential buyers. Homeowners may attempt to reduce risk by finding neighbors who have similar preferences. The covenants could detour any potential buyers who do not agree with the rules of the covenants.

2.3 The Colorado Common Interest Ownership Act

The Colorado Common Interest Ownership Act (2000) was designed with the recognition that "economic prosperity of Colorado is dependent upon the strengthening of homeowner associations in common interest communities…" Much of the legislation of the Act is valid "unless otherwise provided by the declarant," which makes most HOA organizations legally defendable and leads to some interesting points to make note of.

First, courts may find the covenant "unconscionable" at the time it was made and therefore unenforceable. Ellickson (1982) argues that courts are more rigorous in examination of covenants than they are for zoning code. However, while the Act is not adding any additional restrictions, it does clarify what cannot be considered sufficient evidence of an "unconscionable" contract.

Secondly, the Act does provide some protection from local governments. Municipal zoning cannot impose additional structure requirements on HOA units that it would not apply on other units. Eminent domain must also be sensitive to property with common interests. If any unit is acquired by eminent domain the compensation must include the unit's allocated interests.

Finally, small HOAs have a cap, which is adjusted to inflation, of $400 for the average annual common expense liability. This does not include insurance premiums or optional user fees.

2.4 A Description of Covenants in Weld County

All covenants are required by law to be submitted to the county clerk and recorders office. They are considered public information. I constructed a data set using the covenant records from information gathered at the Weld County Clerk and Recorders office.

The scope of this paper is limited to the study of how covenants are used to organize neighborhoods; however, covenants are used to accomplish a broad range of goals. Covenants have been filed in Weld County to restrict the sale date and buyer of a house. Habitat for Humanity, for example, restricts when a recipient of a house may sell or how they may use the said house. Some covenants restrict water rights as to irrigation or limit grazing practices. Other covenants require rent control on property or limit future filing of legal suits pertaining to the said property.

Covenants which cover multiple housing units vary in detail and scope from one page documents to be completely enforced by the civil courts to 120 page documents with several self regulating agents. Still, there are eight characteristics that can be categorized: use restrictions, architectural restrictions, easements, bureaucratic organization, assessments, developer's rights, mortgagee's rights, and amendment and termination. Not every covenant has all eight characteristics; some only have two.

2.4.1 Bureaucratic Organization

Covenants are enforced through the civil court system, which can require a large expenditure of resources to enforce a contract. It may be beneficial for a collection of property owners to have an intermediate organization to settle some disputes. Of course, all bureaucratic organizations tie up resources to operate; however, an organization made up of neighbors may provide judgments at a lower cost. A decision must be made as to when the addition of a homeowners association provides a net benefit. No covenant in

Weld County that is written for a single property, includes an intermediate organization to enforce the contract. However, large communities offer multiple layers of origination: subassociations attached to master associations.

At the simplest level of covenants in Weld County, the contract is enforced purely by the civil courts with no intermediate organization present. These simple contracts are often limited to one or two properties and often restrict only one use (irrigation or grazing restriction for example).

The next level of complexity includes an architectural committee (henceforth committee). Although this intermediate organization is often called the "architectural committee," its charter is to enforce the whole of the covenant, which may include use restrictions. Initially the developer will create the committee with between three and five homeowners of his choosing, of which are usually uncompensated. After the developer loses control of the operation of the development, the composition of the committee is under the control of the homeowners.

The powers of the committee can be quite broad and are spelled out in the covenant. The committee often has the power to interpret the covenant; for example they may decide what is meant by "keeping the exterior of the housing in character of the neighborhood." They also may be allowed to write more rules to better specify details of housing construction or even allow variances for specific owners. The committee may be allowed to employ management companies to enforce rules or employ experts to provide advice.

Finally there is a combination of a homeowner association (henceforth association) with an architectural committee. The association is most often employed if there are common areas to manage. In this case the association is the superstructure to which the committee is attached to.

If common property is present, the job of the association is to maintain the property. Maintaining property includes the general maintenance and repair, insurance, and construction of any improvements. The associations have the power to raise funds (henceforth assessments) and hire contractors and consultants.

2.4.2 Voting Membership and Amendments

All residents of a city or county over the age of 18 are given one vote to cast in any election. This is of course true regardless of owning property in the jurisdiction and is protected by the Supreme Court's interpretation of the US Constitution[7]. By contrast, to be a voting member of the development with a covenant a person must own or have a direct economic interest in property in the development. Depending on the condition of the development and the nature of the covenant, homeowners, developers, and first mortgage holders can all be voting members in the development. The voting membership is not given to each individual. Rather the voting power is divided by the economic interest in the development, much like a corporation.

Barzel and Sass (1990) found condominium associations assigned voting rights in three ways: one-unit-one-vote, voting shares by square feet of the unit, and voting shares by assessed value of the unit. However, in Weld County all associations of single family homes assigned votes via one-lot-one-vote; not by one-person-one-vote.

[7] Special districts are one notable exception to this decision. These districts are allowed some additional freedoms to alter voting systems. A complete comparison of special districts and community association would likely produce interesting results; however, that comparison is beyond the scope of this study.

These covenants can be terminated or amended with the approval of the members. Most covenants are valid for 10 to 20 years and then are automatically renewed every 10 or 20 years, while other covenants perpetually "run with the land." To terminate or amend a covenant a majority of members must agree to the change. What constitutes an adequate majority depends on the contract. In Weld County, approved majorities span the entire spectrum from a simple 51 percent to a unanimous 100 percent.

A single covenant may have different approved majorities depending on the activity. For example an amendment may require approval of 67 percent of the units, while a termination requires 75 percent, and a change to the common property only requires 51 percent. Majorities can change over time. Some covenants require 90 percent agreement to any amendment in the first 10 years and 75 percent afterwards. Out of 220 covenants, in Weld, since the summer of 2003 only ten have been terminated, while there have been almost 100 amendments.

2.4.3 Developer's and Mortgagees' Rights

Developing a subdivision is not a quick process. Developers will sell some completed homes in the subdivision while they continue construction on other homes and property. Risk on this investment increases with time. Therefore, the developer will desire to shorten the development time and maintain property values of the neighborhood until all the homes are sold. In most Weld County covenants the developer (often called the "declarant") holds voting and direct amendment rights until a specified number of lots are sold and/or a specified period of time has passed. In every contract where the developer held voting rights, three votes were assigned to every lot still owned by the developer.

Use restrictions were also limited with respect to construction in general and to some activities of the developer. For example, most covenants restrict the use of signs to the "For Sale" type. Even then, the signs could not be greater than 5 feet square. In all cases the developer was exempted from the size restriction.

First mortgage holders also shoulder risk and hold an economic interest in the value of the development. Many covenants are written with the first mortgage holders in mind. Some covenants require all first mortgage holders be given notice of any amendments or termination of the covenant and notice of any changes to the common areas (if any exist). Furthermore, all financial and general meeting records must be presented to the first mortgage holder upon request.

Other covenants give the first mortgage[8] holders voting rights. In every covenant which gives first mortgage holders voting rights, the voting requirements are held separate from the homeowner/developer voting. This does not mean that the homeowners lose their voting rights if they mortgage their homes. Rather the practice is akin to a federal bill passing both the House and the Senate before approval. For example, to pass an amendment a covenant may require 67 percent of the homeowners' votes and 51 percent of the first mortgage holders' votes.

2.4.4 Use Restrictions

Use restrictions, summarized in table 2.01, limit the actions of the homeowners. The restrictions are limited to what can be publicly seen and do not limit activities within

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[8] In no case did a covenant extend rights to second mortgage holders.

the house unless it affects the neighborhood. For example noise and odor restrictions can limit parties and storage of odiferous items. Home occupation regulations do limit the kind of home offices but in most Weld County covenants the restriction is limited to occupations that would increase traffic from the home.

Table 2.01 Use Restrictions	
Characteristics	Percent
Other Vehicles	92.35
Pets	89.74
Garbage Control	83.02
No Signs	82.97
Antenna	82.16
Car Repair	78.89
Junk Car	78.89
Odor	75.44
Noise	75.15
Light	75.15
No Subdivision	74.90
Maintenance	72.76
No Storage	64.96
No Tanks	64.94
Temporary Structures	58.44
Home Occupation	49.88
No Mining	40.03
Nuisance	38.75
Utilities	36.69
No Burning	35.63
Construction Time	15.50
No Machinery	9.82

Table 2.01 lists 22 use restriction variables, which almost all use restrictions in Weld County can fit into. The table also shows the percent of covenants which employ the restriction in the economic analysis presented below. Each use restriction variable is counted as a dummy if the covenant regulates the activity. In no way is the variable attempting to measure the strictness of each restriction but is rather recorded to measure overall strictness of the covenant. A "one" was recorded if the covenant listed and

explained the nature of the restriction. If the covenant simply referred to the local zoning ordinance then a "zero" was recorded.

The most common restrictions are on the use of vehicles, which is not surprising considering the public display of disharmony about recreational vehicle storage in Greeley, the largest city in Weld County. Auto Repair, No Auto Abandonment, and Other Vehicles all relate to the restriction of parking personal, commercial, and recreational vehicles. Few covenants actually ban recreational vehicles or auto repair; rather they require that the vehicle in question be stored out of public view. Antennae and Dishes is regulation of any receiving equipment. Maintenance of Lots relates to the general maintenance and appearance of the lot including landscape (mow your lawn) and improvements (fix broken windows). Noise, Odor, and Light Restrictions is regulation of one set of nuisances. Pets is the restriction of household pets and commercial animals. All covenants banned commercial animals but the limitations on pets varied greatly. No Signs is a limit on all signs except "For Sale" signs of a certain size. Home Occupation limits home businesses or home businesses, which create traffic.

2.4.5 Architectural Restrictions

Architectural restrictions limit changes to existing buildings and limit the characteristics of new buildings. The restrictions are enforced by an architectural committee, which is designed to make judgments about the enforcement of the covenant. Architectural committees are often given authority to write further restrictions that are not publicly published. The architectural restriction variables are recorded only if the covenant specifies a restriction that the committee is to enforce and that deviation would require a variance or amendment to the covenant. If the covenant requires residents to follow the local zoning laws, then a zero is recorded for that variable. All architectural restriction variables are dummies.

Table 2.02 Architectural Restrictions	
Characteristics	Percent
Fences	74.56
Landscape	66.68
Garage Size	65.16
Outbuildings	55.46
Attached Garage	52.76
Floor Space	49.53
Character	49.38
Minimum Standards	48.70
Setback	45.13
Drainage	40.48
Roof Pitch	31.40
Water	29.63
No Pre Fabrication	23.50
Open Space	21.70
Color	16.71

Table 2.02 lists the variables and the percent of covenants that use the restriction for this category. The most common architectural restriction is the regulation of fences, which limits the height and style. In Character requires that all houses be built in the same style as others in the neighborhood. Landscape denotes a style limitation and Open Space is a minimum on land/building space. Outbuildings include any other buildings including storage sheds and clubhouses. Outbuilding restrictions usually limit the size and placement of the structure. Min Garage Size is also a dummy variable but covenants usually measure garages by the number of cars that can be parked in them and Attached Garage means the garage must be attached. Min Floor Space is also a dummy but the covenants measure the amount of living space (not garages, porches, or other "non-living" areas) in square feet and often differentiate the limit for first and second floors.

Roof Pitch standardizes the pitch of the roofs and Set Backs regulates the location of the home and fencing on the property. Grading and Drainage is similar to Landscape except it restricts landscape changes that will affect water runoff. Many covenants give the architectural committee authority to regulate the color of a house but the Color variable is recorded only if specific colors are written. No Modular/Mobile Homes is recorded only if the covenants ban such structures. Water and Sewer is any requirement of the homeowner to tap into the city or the association water and sewer system.

2.4.6 Enforcement and Variances

Enforcement of all restrictions ultimately depends on the residents' willingness. Enforcement can cause additional strife in the community even if the enforcement is done with the greatest care. Furthermore, some restrictions may not be appropriate at a certain time or place.

To keep the covenant from being too rigid, developers often allow the committees of the HOA to use their judgment in what is allowed and not allowed. Developers also give, in some contracts, the option of a variance. These variances are given to people not property. Therefore, a variance given to a household will move when and if the household moves.

The uncertainty about enforcement will inhibit the value to be gained from a covenant. This can be a major issue when studying the effect of a covenant. Future research could shed light on enforcement issues and how they affect the overall impact of HOAs.

2.4.7 Common Areas

Many of the developments with covenants also have common area that is not maintained by the local city or Weld County (see table 2.03). Nationally, these common areas include parks, pools, golf courses, lakes, docks to public water, small airports, and even shooting ranges. For Weld County, the common areas are often parks, pools, and golf courses, but some developments also include infrastructure commonly associated with a city. Some developments provide buildings for meetings and entertainment, small recreational lakes, security, commercial zoning, or roads. These types of goods are congestible and therefore can be adequately produced and maintained through private organizations.

Table 2.03 Common Area	
Characteristics	Percent
Common Area[9]	57.75
No Imperiling of Insurance	28.37
Mortgagee Voting	20.21

Table 2.03 lists the variables and the percent of covenants that use the restriction for this category. All variables for the common area category are dummied. The first variable simply shows the percent of covenants that include a common area of some kind. No Imperiling of Insurance forbids any activity, which may risk the loss of the common area insurance or increase its premium. Mortgagee Voting is recorded if the covenant requires permission from the first mortgagee holders before any changes can be made to

[9] There are no requirements for HOAs to record in detail the common property. Therefore the percent with common grounds is likely a minimum. No attempt is made to further record common property at this time. Future research is required to include the impact of common property. However, HOAs are required to detail the institutions that are given authority; therefore, if a developer wishes to have a common area in the future, the HOA must provide the proper documentation in the declaration.

the common areas. Some covenants only require 51 percent of the first mortgage holders' permission while others require 100 percent.

The production of public goods is one obvious benefit to a HOA. A fee is charged to perties for the maintenance of such goods. Any consumer surplus that is generated should be capitalized, along with reduced risk, in the price of the house. The benefits of a public good could lead to a misspecified estimation of the effects of voting and restrictions if the voting and number of restrictions are related to the value of the public good. If the amount of public good provided is also related to the voting policies then all estimates of impact would be biased.

2.4.8 Easements

Easements are the part of property which nothing above the ground may be built because something below has been built or future flexibility is desired. Commonly, easements are placed to support the installation, replacement, repair, and maintenance of utilities. Easements are also placed for emergency personal (for example police and paramedics), water drainage, and temporary construction.

2.4.9 Assessments

Assessments are the tax assignment and collection of the association. The details vary by association but generally the assessment section of the covenant outlines what is appropriate to fund and how the division of burden is to be distributed among homeowners. An annual budget is formulated based on the cost of management including but not limited to maintenance of common area (if any exists), construction of improvements, and insurance premiums. There also can be additional charges to individual homeowners if they were to engage in activity that would imperil the public good insurance.

2.5 Regression Model

The choice of functional form is often a difficult one and the hedonic valuation literature offers little guide to a specific functional form. The hedonic price method does attempt to estimate the marginal prices of each house characteristic using the market price, which simultaneously is affected by supply and demand. Economic theory does make clear that the hedonic model should include a full set of all significant determinates of the housing price, i.e. variables that are costly to produce and which provide benefit to the buyer (Bowen *et al* 2001). Economic theory also does predict these supply and demand functions should come from non-linear relationships. Therefore, the functional form should be able to deal with non-linear relationships (Rosen 1974) and interactions of the independent variables (Bryan and Colwell 1982). Furthermore logarithmic forms can reduce or eliminate estimation issues that are associated with heteroskedasticity (Dubin 1998). Given that OLS is a common and well understood tool, the semi-log model, where the natural log of the sales price is regressed on the dependent variables, is most commonly used in the literature. However, some authors do report multiple functional forms.

Both Speyrer (1989) and Hughes and Turnbull (1996a) use a log-linear function regressing the natural log of the sales prices on the housing characteristics. Speyrer's defense of the functional form is straightforward: the semi-log function allows for the independent coefficients to vary with the price of the house because the coefficients can be converted into a percent of sales price. Therefore, she argues, an automatic adjustment is made for the expected improved quality at higher prices. Only the percentage contribution of each characteristic must remain constant. Speyrer also estimated linear functions but does not report them because they are "less satisfactory either theoretically or with respect to the overall fit."

Hughes and Turnbull do not explicitly defend their chosen functional form; rather they cite Witte *et al* (1979) and Palmquist (1984) for a general summary of the hedonic theory. Neither Witte *et al* (1979) or Palmquist (1984) provide any theoretical direction for a specific functional form. Palmquist tested four functional forms[10] and chose the best fit using standard econometric techniques.

Cannaday (1994) uses a functional form suggested by Bryan and Colwell (1982), which they call a double-log[11]. The model is stated as

$$P_i = \alpha_0 X_{1i}^{\alpha_1} X_{2i}^{\alpha_2} \cdots X_{mi}^{\alpha_m} e^{\beta_1 Z_{1i} + \beta_2 Z_{2i} + \cdots + \beta_n Z_{ni} + \mu_i}, \tag{8}$$

where P_i is the sales price of the i^{th} house; X_{1i} through X_{mi} are variables that do not take the value of zero; Z_{1i} through Z_{ni} are variables that may take the value of zero; μ_i is the random error term; and α's and β's are the parameters to be estimated. The OLS transformation is

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[10] The four functional forms Palmquist tested are linear, semi-logarithmic, log-linear, and inverse semi-logarithmic. Of the seven cities investigated he preferred the linear function for six cities and semi-log for one.

[11] This form is often also called log-log.

$$\ln P_i = \ln \alpha_0 + \alpha_1 \ln X_{1i} + \ln X_{2i} + \cdots + \alpha_m \ln X_{mi} + \beta_1 Z_{1i} + \beta_2 Z_{2i} + \cdots + \beta_n Z_{ni} + \mu_i, \quad (9)$$

where terms are defined as above.

The main advantage of the double-log, Bryan and Colwell (1982) argue, is generally its ability to deal with a concave hedonic price function. Specifically, it can handle with ease both nonzero cross partial derivatives and nonzero second partial derivatives. Semi-log and linear functions do not allow for negative second partial derivatives without some transformation of the independent variables.

Linear and semi-log functions are still used in the current literature, notwithstanding the above criticism. One drawback of the double-log or log-log function is that it is difficult to interpret the marginal prices of the transformed variables. (Bastian *et al*, 2002 and Bowen *et al* 2001) The coefficient produced by OLS estimation is the marginal effect of the transformed independent variable on the transformed price variable. This interpretability problem has encouraged some researchers to report several functional forms or limit the forms to linear and/or semi-log.[12]

Given the above discourse, three functional forms will be presented: linear, semi-log, and double-log. The general form is

$$P = f(H, L), \quad (10)$$

[12] See Bastian *et al* (2002), Bowen *et al* (2001), and Dubin (1998) for a discussion of the issue and examples of hedonic modeling.

where P is a vector of sales price, H is a vector of housing characteristics, and L is a vector of locational characteristics.

2.6 Housing Data

The area of interest includes the two largest cities in Weld County, Greeley and Windsor. Both communities are surrounded by agricultural land and are growing significantly as is the entire Colorado Front Range. Greeley is a city of about 80,000 people and includes large employment centers but is also a bedroom-community for other employment centers in the surrounding counties. Windsor is a town of about 12,000 and includes a Kodak manufacturing plant but Windsor is largely a bedroom-community for other employment centers including Greeley.

Only single-family detached homes sold in the years 1998-2003[13] are used; the entire sample for Greeley includes 6,907 such sales and Windsor includes 1,633. All housing characteristics, and sale price information were obtained through public sources: the Weld County GIS Department and the Weld County Assessors Department[14]. All covenant information was gathered from the Weld County Clerk and Recorder Department.

Homes that are sold more than once during this period are included for each sale. The sales are included because there are unobserved variables that would cause the same house with the same characteristics (including locational) to be sold at a different price even controlling for the date of sale. The housing market is not a perfectly competitive

[13] Only half of 2003 is used. A total of 48 sales were not included because of missing data.

[14] Hughes and Turnbull (1996a) use the Multiple Listing Services (MLS) for there study. Therefore only sales with a real estate broker are included.

market, thus the price will be set in part by the relative bargaining power of the buyer and seller. Sellers and buyers may have time or cash flow constraints that limit their ability to stay on the market for a normal amount of time. These constraints could push the sale price below or above what it would sell for in a competitive market.

The building characteristics for the sample are summarized in the appendix tables 2A.1 and 2A.3. The tables are split into three aggregates: full sample, housing without covenants, and housing with covenants. Clearly, the housing which includes a covenant are, on average, newer, larger, more likely to have a fireplace, more likely to be rated above average quality, and fetch a higher price (table 2.05). However, price variation for HOA housing and non-HOA housing is similar, save one outlier in Windsor.

All variable definitions are seen in table 2.04a and 2.04b. The distance characteristics for the sample are summarized in the appendix tables 2A.2 and 2A.4. Distance variables are created using ArcView's buffer operation, where bands of 25 yard width are created around each of the areas of interest. For example: instead of using a single central point for Windsor Lake, the boarder of the lake was used. If the house for sale rested inside the 25 yard band it was counted at 25 yards from the lake and if the house was located in the 50 yard band is was counted as 50 yards from the lake.

Table 2.04a Variable Definitions	
Housing Characteristics	
Area	Square feet of the parcel area in hundreds.
Residential	Square feet of the living area not including the basement in hundreds.
Basement	Square feet of the basement in hundreds.
Garage Attached	Square feet of the attached garage in hundreds.
Garage Detached	Square feet of the detached garage in hundreds.
Porch	Square feet of the porch in hundreds.
Outbuilding	Square feet of the outbuildings (mostly storage sheds) in hundreds.
Bedrooms	Number of bedrooms.
Bathrooms	Number of bathrooms.
Fireplace	Number of fireplaces.

Table 2.04b Variable Definitions		
Central Air	Dummy Variable: 1 if Central Air exists and 0 if not.	
Age	Number of years in age from 2004.	
Quality Excellent	The overall quality of the house is assessed. Dummy Variable: 1 if Excellent and 0 if Fair	
Quality Very Good	Dummy Variable: 1 if Very Good and 0 if Fair	
Quality Good	Dummy Variable: 1 if Good and 0 if Fair	
Quality Average	Dummy Variable: 1 if Average and 0 if Fair	
Location Characteristics	City	
Agriculture	Both	Distance in yards/100 from agricultural land.
CBD	Both	Distance in yards/100 from the CBD.
Industry	Both	Distance in yards/100 from any industrial zoned parcels.
HOA	Both	Distance in yards/100 from a HOA.
Feedlot	Greeley	Distance in yards/100 from the major feedlot in Greeley.
Park with Lake	Greeley	Distance in yards/100 from a park with a year-round water.
Park	Both	Distance in yards/100 from a park without a year-round water.
Windsor Lake	Windsor	Distance in yards/100 from the recreational lake in Windsor.
Road	Both	Distance in yards/100 from the major road arteries.
Covenant Characteristics		
Amendment	The percentage of units required to pass an amendment * 100.	
Mortgagee	The percentage of first mortgagee required to pass an amendment * 100.	
Restrictions	The number of restriction.	
Covenant Year	The year of filing.	

Table 2.05 Sales Price Descriptive Statistics				
Greeley	Mean	Max	Min	StDev
All Greeley (6,907 Sales)	155,672	1,049,100	10,800	66,442
HOA Only (3,076 Sales)	175,258	775,000	20,500	66,003
Non-HOA Only (3,831 Sales)	139,946	1,049,100	10,800	62,504
Windsor				
All Windsor (1,634 Sales)	199,589	4,400,000	12,500	167,977
HOA Only (988 Sales)	227,537	4,400,000	36,000	209,254
Non-HOA Only (646 Sales)	156,778	351,000	12,500	36,907

This approach allows for asymmetrical shapes to be accurately accounted for, which is especially important for the elongated and fork-like shape of Greeley's central business district (CBD). For both cities, HOAs are, on average, farther from the main arterial roads, CBD, parks, the feedlot (Greeley), and Windsor Lake (Windsor). Figure 2.1 provides a summary.

The covenant characteristics for the sample are summarized in table 2.06 and in the appendix tables 2A.5 though 2A.8. In Greeley, less than half of the housing sales are in a HOA, while in Windsor over half are. This is due in part to the proportionally larger housing boom in Windsor.

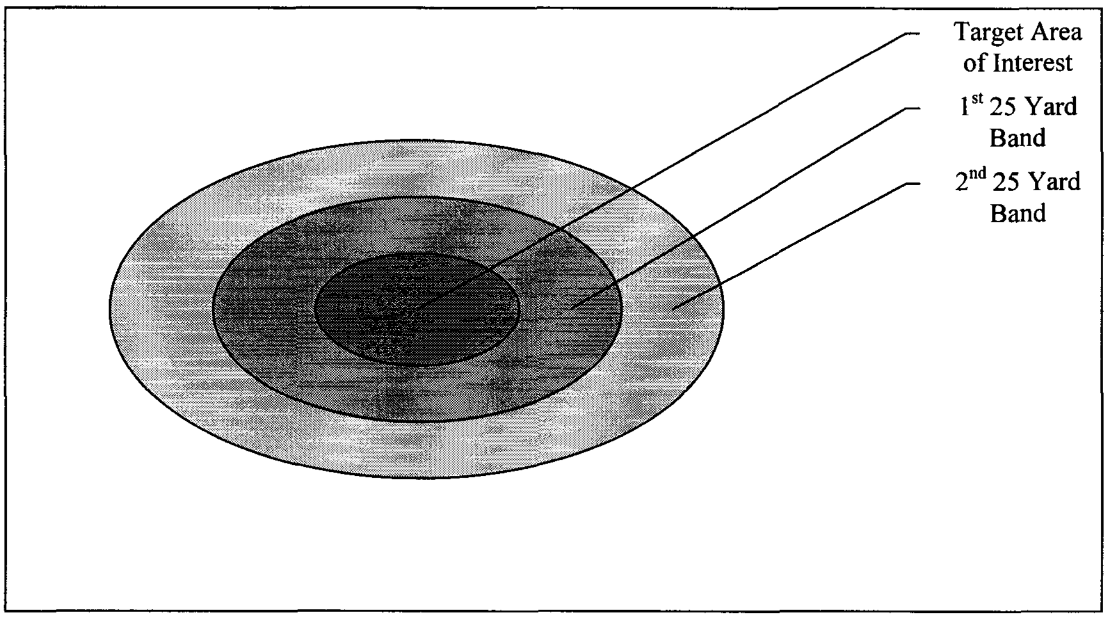

Figure 2.1 An Example of the Band Process

Table 2.06 Covenant Characteristics	
Covenants	Mean
Greeley	0.4453
Windsor	0.6050

2.7 Results

The results section is split into two sections by city: Greeley and Windsor. Four basic models are tested for each city. Model 1 is the most basic model including only the structural and locational characteristics. Model 2 adds the HOA dummy variable for a simple test of significance. Model 3 adds the Distance to HOA variable. Model 4 removes the HOA dummy and includes the HOA detail, amendment, mortgagee, and restrictions. All models presented include 21 dummy variables to control for changing market conditions. Each time-control dummy covers three months, where the middle quarter is not included. For example, the first control dummy includes all sales in the first quarter of 1998 and zeros of all other sales. For brevity, the time-control variables are not included in the tables.

For both cities Model 2 will capture the effect of an HOA in a simple comparison fashion. If, controlling of other factors, HOA homes sell for a higher average price, then the dummy variable will reflect the difference. However, homes closer to the HOAs may capture some of the benefit in the form of higher housing prices because of spatial dependence. That is, the potentially improved quality of the HOA neighborhoods provides a better environment for neighboring homes. Model 3 is expected to capture the impact of HOAs in two parts. First the HOA dummy variable should capture the average improvement and second, the distance to HOA variable will capture any neighborhood spillover.

Model 4 includes additional information on the specifics of the HOA contract. This is the main thrust of inquiry. The number of restrictions can be seen by a buyer of current strictness, while the amendment and mortgagee measure future strictness. Given the assumption of risk aversion, all three variables should be positive.

For Greeley three additional models are included. The first is a structural stability test of the HOA and non-HOA data sets. Models 1 through 4 include all of Greeley but impact of HOAs may come in the form of improved value for complements. For example, more open space or a lake may increase the value of having a porch. A simple Chow test will provide a simple test of the two datasets followed by a dummy variable approach on each variable.

The second additional model explores adjustments to the HOA variables including a quadratic form. Additional strictness may have decreasing marginal returns. Therefore an optimal amount of strictness may be evident.

The final additional model for Greeley includes each HOA as a dummy variable controlling for housing and locational characteristics. The value added compared to the average non-HOA house is estimated.

For Windsor, only one additional model is included. This model includes each Windsor HOA as a dummy variable controlling for housing and locational characteristics.

2.7.1 Greeley Results

The initial results for Greeley summarized in table 2.07. All three functional forms for Greeley produce reasonable results with high R^2 and F-statistics plus few statistically insignificant variables. There are no signs that violate any clear economic theory. In only two variables, To Agriculture and To Golf, do the signs switch depending on the function. Still, the absolute value of the coefficients from each form is small relative to other distance variables and one may conclude that the impact of golf courses and agricultural land in Greeley is negligible. It may be surprising, given the above discussion that the linear form performed so well. The linear form has the highest R^2 of the group but the nonlinear forms have only one insignificant (>0.10) variable each compared to linear form's five insignificant variables.

Table 2.07 Model 1 Basic Greeley Results [15]

N = 6,907	Linear		Semi-Log		Log-Log	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Area (Log)	82.8	0.000	0.00028	0.000	0.05862	0.000
Residential (Log)	4,099.5	0.000	0.02151	0.000	0.31201	0.000
Basement	2,493.2	0.000	0.01420	0.000	0.01425	0.000
Garage Attached	2,219.8	0.000	0.01303	0.000	0.01246	0.000
Garage Detached	2,376.5	0.000	0.01600	0.000	0.01373	0.000
Porch	906.9	0.000	0.00379	0.000	0.00352	0.000
Outbuilding	2,743.2	0.000	0.01096	0.000	0.01305	0.000
Bedrooms (Log)	-2,446.2	0.000	-0.00481	0.089	-0.02979	0.001
Bathrooms (Log)	5,855.0	0.000	0.03604	0.000	0.07735	0.000
Fireplace	1,184.1	0.153	0.02881	0.000	0.02416	0.000
Central Air	4,620.9	0.000	0.02031	0.000	0.02253	0.000
Age (Log)	-3.4	0.878	-0.00146	0.000	-0.01445	0.000
Quality Excellent	585,511.8	0.000	0.30663	0.052	0.88570	0.000
Quality Very Good	179,798.8	0.000	0.28017	0.000	0.45199	0.000
Quality Good	68,195.3	0.000	0.22433	0.000	0.27788	0.000
Quality Average	8,003.2	0.000	0.06729	0.000	0.06468	0.000
To Agriculture (Log)	-66.4	0.435	0.00064	0.187	0.00060	0.808
To CBD (Log)	-331.1	0.000	-0.00221	0.000	-0.01194	0.000
To Industry (Log)	74.9	0.239	0.00104	0.004	0.01595	0.000
To Golf (Log)	-13.7	0.648	0.00044	0.009	-0.00568	0.109
To Feedlot (Log)	219.0	0.000	0.00106	0.000	0.06275	0.000
To Park with Lake (Log)	-240.9	0.008	-0.00558	0.000	-0.02669	0.000
To Park (Log)	725.5	0.000	0.00587	0.000	0.01276	0.000
To Main Road (Log)	459.2	0.002	0.00227	0.007	0.00640	0.008
C	22,562.0	0.000	11.19698	0.000	10.32457	0.000
R-squared	0.836		0.824		0.822	
Adjusted R-squared	0.835		0.823		0.821	
F-statistic	775.947		712.354		703.758	
Prob. (F-statistic)	0.000		0.000		0.000	

Model 2 (summarized in table 2.08) includes the HOA dummy variable to estimate the general impact of the HOA on housing prices.

[15] All variables with (Log) next to them are in logs only for the Log-Log functional form. The probabilities are based off of the t-statistics. The dummy variables for each sales quarter are not reported.

Table 2.08 Model 2 Greeley Results with HOA Dummy						
N = 6,907	Linear		Semi-Log		Log-Log	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Area (Log)	83.0	0.000	0.00028	0.000	0.05838	0.000
Residential (Log)	4,074.0	0.000	0.02142	0.000	0.31139	0.000
Basement	2,475.1	0.000	0.01413	0.000	0.01424	0.000
Garage Attached	2,200.5	0.000	0.01296	0.000	0.01246	0.000
Garage Detached	2,349.1	0.000	0.01590	0.000	0.01370	0.000
Porch	924.7	0.000	0.00386	0.000	0.00355	0.000
Outbuilding	2,786.2	0.000	0.01113	0.000	0.01311	0.000
Bedrooms (Log)	-2,388.5	0.000	-0.00458	0.105	-0.02949	0.001
Bathrooms (Log)	5,941.9	0.000	0.03638	0.000	0.07770	0.000
Fireplace	1,020.3	0.219	0.02818	0.000	0.02381	0.000
Central Air	4,576.9	0.000	0.02014	0.000	0.02262	0.000
Age (Log)	13.4	0.559	-0.00139	0.000	-0.01316	0.000
Quality Excellent	587,959.3	0.000	0.31611	0.045	0.89015	0.000
Quality Very Good	180,578.3	0.000	0.28319	0.000	0.45368	0.000
Quality Good	68,033.6	0.000	0.22371	0.000	0.27786	0.000
Quality Average	7,707.5	0.000	0.06615	0.000	0.06430	0.000
To Agriculture (Log)	-18.7	0.830	0.00082	0.096	0.00107	0.667
To CBD (Log)	-287.7	0.000	-0.00205	0.000	-0.01133	0.000
To Industry (Log)	62.4	0.328	0.00099	0.006	0.01607	0.000
To Golf (Log)	-33.8	0.273	0.00037	0.037	-0.00607	0.088
To Feedlot (Log)	207.0	0.000	0.00101	0.000	0.06180	0.000
To Park with Lake (Log)	-231.3	0.010	-0.00554	0.000	-0.02644	0.000
To Park (Log)	679.8	0.000	0.00569	0.000	0.01274	0.000
To Main Road (Log)	467.6	0.001	0.00230	0.006	0.00634	0.009
HOA	2,567.6	0.007	0.00995	0.068	0.00589	0.293
C	22,064.0	0.000	11.19505	0.000	10.32322	0.000
R-squared	0.836		0.824		0.822	
Adjusted R-squared	0.835		0.823		0.821	
F-statistic	759.925		697.179		688.494	
Prob. (F-statistic)	0.000		0.000		0.000	

The results of table 2.08 are mixed. The linear and semi-log provide a positive and significant (at standard levels) coefficient, where the linear model predicts a marginal price of $2,597 and the semi-log predicts a marginal price of one percent or $1550 for the average priced house. The log-log form provides a coefficient equal to 3/5 of one percent but it is insignificant at standard levels of acceptance.

Model 3 (summarized in table 2.09a and 2.09b[16]) adds the To HOA variable to capture some additional neighborhood effect from the HOAs. The results are more mixed than in Model 2. All the signs meet expectations and are consistent across functional forms. The distance to a HOA is significant at the 13 percent level for the linear model and significant at the 2 percent level for the nonlinear models. The economic impact of To HOA is relatively weak compared to the other distance variables in the linear model but relatively strong in the semi-log model.

Table 2.09a Model 3 Greeley Results with HOA Dummy and Distance to HOA

N = 6,907	Linear		Semi-Log		Log-Log	
Variable	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Area (Log)	83.2	0.000	0.00028	0.000	0.05906	0.000
Residential (Log)	4,066.2	0.000	0.02131	0.000	0.31070	0.000
Basement	2,472.0	0.000	0.01408	0.000	0.01424	0.000
Garage Attached	2,191.3	0.000	0.01283	0.000	0.01233	0.000
Garage Detached	2,314.2	0.000	0.01541	0.000	0.01352	0.000
Porch	926.6	0.000	0.00388	0.000	0.00354	0.000
Outbuilding	2,774.5	0.000	0.01096	0.000	0.01292	0.000
Bedrooms (Log)	-2,396.5	0.000	-0.00469	0.097	-0.03013	0.000
Bathrooms (Log)	5,975.6	0.000	0.03685	0.000	0.07800	0.000
Fireplace	958.0	0.249	0.02731	0.000	0.02342	0.000
Central Air	4,564.4	0.000	0.01997	0.000	0.02277	0.000
Age (Log)	16.4	0.475	-0.00135	0.000	-0.01187	0.000
Quality Excellent	587,753.0	0.000	0.31324	0.047	0.88886	0.000
Quality Very Good	180,392.1	0.000	0.28059	0.000	0.45204	0.000
Quality Good	68,033.3	0.000	0.22370	0.000	0.27772	0.000
Quality Average	7,654.3	0.000	0.06540	0.000	0.06347	0.000

16 For formatting issues, some tables are split into two parts a and b.

Table 2.09b Model 3 Greeley Results with HOA Dummy and Distance to HOA (Cnt.)						
N = 6,907	Linear		Semi-Log		Log-Log	
Variable	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
To Agriculture (Log)	42.1	0.660	0.00167	0.002	0.00275	0.288
To CBD (Log)	-274.1	0.000	-0.00186	0.000	-0.00997	0.001
To Industry (Log)	39.5	0.547	0.00067	0.072	0.01381	0.000
To Golf (Log)	-34.6	0.263	0.00036	0.043	-0.00531	0.137
To Feedlot (Log)	219.1	0.000	0.00118	0.000	0.06513	0.000
To Park with Lake (Log)	-207.4	0.023	-0.00521	0.000	-0.02580	0.000
To Park (Log)	654.3	0.000	0.00533	0.000	0.01234	0.000
To Main Road (Log)	434.3	0.003	0.00184	0.030	0.00565	0.021
To HOA	-148.5	0.128	-0.00207	0.000	-0.00127	0.017
HOA	1981.9	0.054	0.00178	0.761	0.00176	0.764
C	21927.4	0.000	11.19315	0.000	10.31087	0.000
R-squared	0.836		0.824		0.822	
Adjusted R-squared	0.835		0.823		0.821	
F-statistic	743.948		683.921		674.43	
Prob. (F-statistic)	0		0		0	

Since the dummy variable is estimating the difference between the HOA and non-HOA house, any positive spillover would prop up the average price for all non-HOA houses. However, the HOA dummy variable does not respond as expected. This effect would result in an underestimate of the impact of HOAs. The sign is positive and consistent but only in the linear model is it statistically significant. In both nonlinear models it is highly insignificant.

Model 4 (summarized in table 2.10) is the main focus. The variables of prime concern for this study are the final five: To HOA, Amendment, Mortgagee, Restrictions, and HOA. The proximity of an HOA to any other house has a positive value as is represented in the negative and significant coefficient for all forms. A non-HOA loses value the farther it is from a HOA. That lost value is in similar magnitude as a park with a lake and about two-thirds the impact of living close to the CBD for the linear form. For the semi-log form, the impact is about half of the park-with-lake impact and similar to the

CBD impact. For the log-log form, living close to an HOA has much less value than predicted by the semi-log form but since all of the other distance variables in log-log form are in logs, no direct comparisons can be made. Therefore it is unclear to the magnitude of the positive impact from HOAs to other house prices in the log-log form.

Table 2.10 Model 4 Greeley Results with HOA Detail						
N = 6,907	Linear		Semi-Log		Log-Log	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Area (Log)	85.5	0.000	0.0003	0.000	0.0602	0.000
Residential (Log)	4,036.2	0.000	0.0212	0.000	0.3097	0.000
Basement	2,469.0	0.000	0.0141	0.000	0.0142	0.000
Garage Attached	2,230.3	0.000	0.0132	0.000	0.0127	0.000
Garage Detached	2,294.3	0.000	0.0153	0.000	0.0134	0.000
Porch	913.1	0.000	0.0039	0.000	0.0035	0.000
Outbuilding	2,750.3	0.000	0.0109	0.000	0.0128	0.000
Bedrooms (Log)	-2,285.2	0.000	-0.0042	0.142	-0.0279	0.001
Bathrooms (Log)	5,824.7	0.000	0.0363	0.000	0.0755	0.000
Fireplace	796.6	0.337	0.0270	0.000	0.0222	0.000
Central Air	4,382.2	0.000	0.0196	0.000	0.0224	0.000
Age (Log)	17.1	0.460	-0.0013	0.000	-0.0099	0.002
Quality Excellent	588,129.8	0.000	0.3145	0.046	0.8890	0.000
Quality Very Good	180,114.3	0.000	0.2811	0.000	0.4516	0.000
Quality Good	68,100.6	0.000	0.2242	0.000	0.2775	0.000
Quality Average	8,304.8	0.000	0.0677	0.000	0.0636	0.000
To Agriculture (Log)	77.3	0.423	0.0018	0.001	0.0024	0.354
To CBD (Log)	-286.9	0.000	-0.0020	0.000	-0.0093	0.002
To Industry (Log)	43.4	0.509	0.0007	0.051	0.0131	0.000
To Golf (Log)	-15.0	0.637	0.0005	0.008	-0.0028	0.445
To Feedlot (Log)	233.8	0.000	0.0012	0.000	0.0670	0.000
To Park with Lake (Log)	-188.7	0.041	-0.0051	0.000	-0.0259	0.000
To Park (Log)	518.6	0.000	0.0047	0.000	0.0104	0.000
To Main Road (Log)	398.0	0.008	0.0019	0.027	0.0069	0.006
To HOA	-203.7	0.039	-0.0023	0.000	-0.0016	0.003
Amendment	116.8	0.046	0.0008	0.017	0.0006	0.062
Mortgagee	2.5	0.904	0.0001	0.578	0.0003	0.022
Restrictions	354.6	0.000	0.0009	0.055	0.0009	0.054
HOA Dummy	-13,002.8	0.002	-0.0712	0.003	-0.0611	0.007
C	21,346.2	0.000	11.1891	0.000	10.2922	0.000
R-squared	0.837		0.824		0.822	
Adjusted R-squared	0.835		0.823		0.821	
F-statistic	701.868		643.944		635.404	
Prob. (F-statistic)	0.000		0.000		0.000	

The amendment, mortgagee, and restriction variables all have consistently positive signs, while the HOA dummy is negative. Amendment, Restrictions and the HOA dummy are significant throughout the functional forms. The amendment variable is more highly priced than mortgagee voting and is significant throughout. However, mortgagee voting is significant only in the log-log form.

The HOA variables have the expected signs except for the HOA dummy. Model 2 (table 2.08) showed a positive and significant price impact of HOAs in the linear and semi-log forms but when adding the To HOA variable in Model 3 (table 2.09) the impact lost its significance in the nonlinear forms. The HOA dummy variable in Model 4 should be picking up any impacts of the HOA other than the reduction of riskiness. A negative sign on the HOA dummy and positive signs on the institutional variables (amendment and restrictions) of Model 4 and the positive impact of the HOA dummy in Model 2 suggests that the major impact of the HOAs come from their risk reducing function.

The results of Model 4 meet most of the expectations; however, given the results of Model 4 and Model 3, the variable To HOA may be suspect. Model 4 was thus run again without To HOA. Removing the variable did little to the HOA results with respect to signs as is seen in table 2.11. Although Amendment, Restrictions, and HOA are still significant at reasonable levels[17], the magnitude and significance has decreased with the removal of To HOA, which is expected. When controlling for houses that are close to the HOAs, and thus able to capture some of their benefit, the coefficients become slightly more robust statistically and economically.

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[17] Amendment is insignificant at the 10 percent level in the log-log form but only just.

Table 2.11 Model 4 Greeley Results without To HOA						
N = 6,907	Linear		Semi-Log		Log-Log	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Amendment	101.1	0.082	0.0006	0.062	0.0005	0.123
Mortgagee	2.7	0.898	0.0001	0.568	0.0002	0.032
Restrictions	345.2	0.000	0.0008	0.089	0.0008	0.088
HOA Dummy	-10,987.9	0.007	-0.0480	0.038	-0.0466	0.036

The evidence suggests that covenants do have a positive effect on the housing price. Furthermore, homes close to HOAs benefit from these positive effects. However, this does not necessarily mean that HOAs improve the wellbeing of every household they cover. HOA could largely benefit a particular preference set. If there is a dual market in the housing industry, then simple sorting could take place. Therefore, simply placing an HOA in any existing neighborhood may not improve welfare.

To test the hypothesis of a dual market, a simple test for structural stability was implemented, with the null-hypothesis being that the two markets are the same. Two datasets were taken from the main set: one with only non-HOAs and the other with only HOAs. An OLS regression was run for all three datasets (results summarized in table 2.12) with each functional form using only the housing characteristics and location characteristics. The Chow test for each functional form calculated a probability of at least greater than 2 percent level for all functional forms. This provides additional confidence that the HOA market is different than the non-HOA market. Of course this is not surprising given that the HOA dummy variable in table 2.08 is significant in two of the three functional forms. Still, the Chow test provides evidence that all the functional forms provide significantly different estimations of Model 1 (table 2.07) depending on the market used.

Table 2.12 Greeley Chow Test		
Functional Form	F Value	P Value
Linear	8.542	0.000
Semi-Log	1.550	0.014
Log-Log	3.347	0.000

The Chow test results generate questions about which variable coefficients diverge depending on the dataset used. That is, are there special complements of a home's characteristics to the HOA? To identify the areas of significant departure within the dataset each variable was duplicated and dummied with respect to HOAs. The results are summarized in table 2.13a and table 2.13b.

Table 2.13 Greeley Results Testing for Structural Stability						
N = 6,907	Linear		Semi-Log		Log-Log	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Area (Log)	140.9	0.000	0.0004	0.000	0.0690	0.000
*HOA	-79.4	0.000	-0.0002	0.018	-0.0160	0.228
Residential (Log)	3,230.9	0.000	0.0210	0.000	0.2860	0.000
*HOA	1,472.6	0.000	-0.0005	0.703	0.0549	0.014
Basement	1,893.9	0.000	0.0127	0.000	0.0124	0.000
*HOA	1,285.9	0.000	0.0029	0.001	0.0037	0.000
Garage Attached	1,986.0	0.000	0.0132	0.000	0.0123	0.000
*HOA	313.9	0.529	-0.0010	0.727	-0.0018	0.538
Garage Detached	2,000.8	0.000	0.0163	0.000	0.0150	0.000
*HOA	788.1	0.446	-0.0110	0.066	-0.0095	0.113
Porch	737.3	0.000	0.0027	0.000	0.0027	0.000
*HOA	683.5	0.006	0.0045	0.002	0.0036	0.013
Outbuilding	1,678.3	0.000	0.0090	0.001	0.0122	0.000
Bedrooms (Log)	-1,581.1	0.007	0.0016	0.633	-0.0084	0.426
*HOA	222.2	0.829	-0.0148	0.013	-0.0423	0.018
Bathrooms (Log)	6,035.6	0.000	0.0369	0.000	0.0862	0.000
*HOA	1,939.3	0.111	0.0037	0.603	-0.0190	0.179
Fireplace	97.2	0.925	0.0182	0.002	0.0135	0.026
*HOA	2,509.4	0.140	0.0183	0.064	0.0192	0.052
Central Air	4,283.5	0.000	0.0205	0.001	0.0236	0.000
*HOA	-908.9	0.563	-0.0030	0.746	-0.0074	0.419
Age (Log)	-51.6	0.072	-0.0017	0.000	-0.0248	0.000
*HOA	-109.8	0.285	0.0012	0.049	0.0256	0.000

Table 2.13b Greeley Results Testing for Structural Stability						
N = 6,907	Linear		Semi-Log		Log-Log	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Quality Excellent	616,666.6	0.000	0.2958	0.064	0.901	0.000
Quality Very Good	207,320.2	0.000	0.3073	0.000	0.514	0.000
*HOA	-86,956.7	0.000	-0.0491	0.482	-0.167	0.012
Quality Good	87,807.7	0.000	0.2600	0.000	0.352	0.000
*HOA	-40,397.1	0.000	-0.0358	0.225	-0.125	0.000
Quality Average	9,349.9	0.000	0.0561	0.000	0.051	0.000
*HOA	-5,633.6	0.055	0.0333	0.050	0.012	0.450
To Agriculture (Log)	204.6	0.067	0.0016	0.016	-0.007	0.085
*HOA	-91.4	0.735	0.0000	0.998	0.008	0.181
To CBD (Log)	-289.2	0.003	-0.0022	0.000	-0.015	0.000
*HOA	-37.3	0.800	-0.0001	0.872	0.003	0.686
To Industry (Log)	-109.1	0.271	0.0006	0.269	0.014	0.001
*HOA	353.3	0.013	0.0012	0.161	0.001	0.935
To Golf (Log)	124.5	0.018	0.0011	0.000	0.018	0.000
*HOA	-66.8	0.393	-0.0007	0.106	-0.033	0.000
To Feedlot (Log)	337.0	0.000	0.0010	0.001	0.065	0.000
*HOA	-99.3	0.161	0.0003	0.474	0.011	0.588
To Park with Lake (Log)	-193.7	0.119	-0.0062	0.000	-0.041	0.000
*HOA	-236.3	0.304	0.0032	0.017	0.034	0.001
To Park (Log)	969.5	0.000	0.0062	0.000	0.012	0.001
*HOA	-1,250.5	0.000	-0.0059	0.000	-0.012	0.050
To Main Road (Log)	263.7	0.259	0.0041	0.003	0.011	0.000
*HOA	182.5	0.570	-0.0024	0.189	-0.005	0.386
To HOA	-532.8	0.000	-0.0028	0.000	-0.001	0.021
Amendment	167.2	0.017	0.0015	0.000	0.001	0.015
Mortgagee	-60.1	0.009	-0.0002	0.207	0.000	0.558
Restrictions	290.3	0.001	0.0010	0.046	0.001	0.036
HOA	-35,796.0	0.000	-0.1445	0.005	-0.222	0.063
C	25,066.9	0.000	11.1973	0.000	10.352	0.000
R-squared	0.844		0.827		0.826	
Adjusted R-squared	0.843		0.825		0.824	
F-statistic	515.223		453.492		450.242	
Prob. (F-statistic)	0		0		0	

The coefficients are separated into the non-HOA set and the HOA set. For example, the variable parcel area in the linear function is split into the non-HOA coefficient 140.9 and the HOA coefficient [140.9 – 79.4] = 61.5. More importantly we can see the differing effect of HOA housing prices. Provided that they are not significant differences in construction cost between HOA and non-HOA housing characteristics, then the resulting marginal price differences should be due to differences in demand.

There are five HOA adjusted variables which both have a consistent sign and significance across the functions: basement, porch, average quality, parks, and the intercept. The marginal price for basements almost doubles in the linear function and increase by about one quarter in the non-linear. The marginal price for porches more than doubles in all functions, which would be expected if homeowners will be directly dealing with one another more often then non-HOA owners. The greater value for porches could also be generated because the porch is a complement to other elements in the HOA including open space or other public goods. The HOA adjustment coefficient changes the parks coefficient from a negative impact for parks to either little positive or no impact.

There are six other HOA adjusted variables which have the same sign but are not consistently significant across functions: parcel area, fireplace, central air, quality very good, quality good, and golf courses. Since these marginal price adjustments are not consistently significant, they should be viewed with caution. HOA data results in lower marginal price for parcel area and central air. The quality variables of very good and good improve HOA housing by less. Finally, golf courses are more highly priced. All other coefficient adjustments are inconsistent with respect to significance and sign.

None of the five HOA variables of interest in this study lose statistical significance and only Mortgagee change signs after the dataset adjustment and becomes significant in the linear model[18]. Distance to an HOA does increase in impact for two of the functions. The economic significance roughly doubles for the amendment variable in all three forms. The economic significance for covenant year also increases dramatically, while restrictions only slightly changes.

Clearly, the two subsets of data require separate coefficients and possibly separate functional forms. This makes estimation of the impact of HOAs on housing prices problematic. If HOAs are costless to produce, then it is just a matter of developers estimating the correct number of people who prefer covenants and the marginal price of covenants will be driven to zero. Any error in judgment would either keep the marginal price positive or drive it negative. The cost of producing HOAs in beyond this study; however, several developers have expressed, in informal interviews with me, that covenants are far from costless to produce.

To complete the study on Greeley, two regressions were run to see the impact of restrictions and HOA neighborhoods. The results are summarized in table 2.14 and 2.16.

Although the nonlinear models allow for the impact of HOAs to adjust for higher priced properties, the coefficients for all models are constant regardless of price. Economic theory would predict an optimal strictness pattern. A quadratic or log adjustment to these variables could provide additional information about the nature of restrictions. Table 2.14 shows the results of three models testing alternative covenant variables. Amendment squared, mortgagee squared and restrictions squared are added to the three functional forms.

[18] The variable mortgagee was not consistently significant in the first regression although the linear form becomes significant and the log-log form loses significance.

Table 2.14a and b reports the results. The Amendment variable set operates in the manner expected. The two variables are not significant in the linear form but are in the nonlinear forms. They also have the expected signs. The Mortgagee variable set becomes significant in all three forms but it has the opposite signs. Given the magnitude of the coefficients, the Mortgagee set has a combined negative impact. The Restrictions variable set has the opposite signs as expected and is only significant in the linear form. To HOA does not change much from the original Model 4. The HOA dummy, however, does change. It becomes positive and insignificant in the linear form but more negative and significant in the nonlinear forms compared to the original Model 4.

Table 2.14a Greeley Results: Alternative Covenant Variables

N = 3,076	Linear		Semi-Log		Log-Log	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Area (Log)	87.2	0.000	0.00029	0.000	0.06275	0.000
Residential (Log)	3,975.6	0.000	0.02118	0.000	0.30881	0.000
Basement	2,407.3	0.000	0.01373	0.000	0.01390	0.000
Garage Attached	2,157.0	0.000	0.01261	0.000	0.01196	0.000
Garage Detached	2,304.5	0.000	0.01538	0.000	0.01358	0.000
Porch	912.0	0.000	0.00387	0.000	0.00347	0.000
Outbuilding	2,738.9	0.000	0.01082	0.000	0.01247	0.000
Bedrooms (Log)	-2,158.7	0.000	-0.00336	0.237	-0.02603	0.002
Bathrooms (Log)	6,024.6	0.000	0.03700	0.000	0.07662	0.000
Fireplace	597.7	0.473	0.02508	0.000	0.02122	0.000
Central Air	4,293.8	0.000	0.01837	0.000	0.02154	0.000
Age (Log)	15.5	0.512	-0.00139	0.000	-0.01180	0.000
Quality Excellent	590,928.1	0.000	0.31576	0.045	0.88871	0.000
Quality Very Good	179,244.1	0.000	0.27836	0.000	0.44588	0.000
Quality Good	67,935.7	0.000	0.21937	0.000	0.27044	0.000
Quality Average	8,792.1	0.000	0.06616	0.000	0.06203	0.000
To Agriculture (Log)	77.3	0.429	0.00199	0.000	0.00325	0.213
To CBD (Log)	-264.2	0.000	-0.00190	0.000	-0.00764	0.011
To Industry (Log)	6.1	0.927	0.00068	0.073	0.01157	0.002
To Golf (Log)	-23.0	0.481	0.00038	0.041	-0.00515	0.162
To Feedlot (Log)	250.8	0.000	0.00127	0.000	0.07174	0.000
To Park with Lake (Log)	-183.3	0.060	-0.00490	0.000	-0.02323	0.000
To Park (Log)	457.3	0.001	0.00389	0.000	0.00871	0.002
To Main Road (Log)	373.0	0.015	0.00155	0.077	0.00406	0.118

Table 2.14b Greeley Results: Alternative Covenant Variables						
N = 3,076	Linear		Semi-Log		Log-Log	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
To HOA	-223.5	0.024	-0.00252	0.000	-0.00172	0.001
Amendment	119.7	0.831	0.01107	0.001	0.00948	0.002
Amendment^2	-0.2	0.954	-0.00008	0.001	-0.00007	0.004
Mortgagee	-547.6	0.000	-0.00172	0.008	-0.00238	0.000
Mortgagee^2	8.3	0.000	0.00003	0.010	0.00004	0.000
Restrictions	-1,392.6	0.000	-0.00249	0.177	-0.00007	0.971
Restrictions^2	46.5	0.000	0.00008	0.079	0.00002	0.708
HOA Dummy	3,741.2	0.840	-0.36609	0.001	-0.32795	0.001
C	22,444.3	0.000	11.19592	0.000	10.27994	0.000
R-squared	0.838		0.825		0.823	
Adjusted R-squared	0.836		0.824		0.822	
F-statistic	666.795		609.015		601.687	
Prob. (F-statistic)	0.000		0.000		0.000	

The mixed results from the alternative variables make any conclusion difficult. Therefore the alternative variables will not be used as the final model set. Table 2.15 provides a summary of the slopes and elasticities for the significant HOA variables from the original Model 4 (table 2.10) and Model 2 (table 2.08). The impact from the HOAs in Model 2 is $2,567 for the linear function and a 1 percent and 6/10 of a percent increase for the semi-log and log-log respectively. To calculate the slope and elasticities the mean house price of the non-HOA housing was used for the HOA dummy and the mean house price and mean independent variable of the HOA housing was used[19].

[19] Of course, no transformation was used to calculate the slopes for the linear function because the estimated coefficients are the slope of price/independent variable in the linear function.

Table 2.15 Greeley Results of Model 2 and Model 4				
		Linear	Semi	Log-Log
HOA Dummy (Table 2.08)	Slope	2,567	1,392	824
To HOA (Table 2.10)	Slope	-203.7	-321.9	-223.9
	Elasticity	-0.945	-1.493	-1.039
Amendment (Table 2.10)	Slope	116.8	140.2	105.2
	Elasticity	0.0004	0.0005	0.0004
Restrictions (Table 2.10)	Slope	354.6	157.7	157.7
	Elasticity	0.051	0.018	0.018

The final interest for Greeley is in the individual HOA neighborhoods. Table 2.16[20] lists the results for a regression using the full Greeley dataset. The only HOA variables are the neighborhood dummies. Clearly not all HOAs improve housing values. Four HOAs have negative and significant estimated impacts in all three models. However, seven HOAs have positive and significant impacts in all three models. The results of table 2.16a and b include the impact of governance and public goods.

Table 2.16a Greeley Results: The Impact of HOA Neighborhoods						
N = 6,907	Linear		Semi-Log		Log-Log	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Boomerang	9,858.2	0.124	0.06387	0.083	0.04898	0.174
Cambridge Glen	72,849.7	0.000	0.27542	0.000	0.20894	0.000
Cedarwoods	-2,877.2	0.435	-0.00898	0.672	-0.00334	0.858
College Green	2,202.7	0.545	0.02867	0.170	0.04353	0.039
Cottesmore Reserve	3,335.8	0.265	0.04628	0.007	0.03682	0.026
Drakes Crossing	918.4	0.796	0.03234	0.113	0.01239	0.476
Country Club Estates	3,657.2	0.569	0.01255	0.734	0.02551	0.492
Country Club West	-3,133.4	0.126	-0.01735	0.141	-0.00999	0.374
East Meadows	1,891.5	0.594	0.02350	0.249	0.04028	0.038
Forest Glen	25,524.2	0.000	0.14861	0.000	0.09757	0.001
Foxhill	47,728.3	0.000	0.15289	0.000	0.18097	0.000
Gateway Estates	3,820.2	0.183	0.02863	0.083	0.00019	0.990
Glen Eden	-11,312.6	0.000	-0.05434	0.000	-0.02462	0.055

[20] The control variables, intercept, and regression statistics are reported in table 2A.9 in the appendix.

Table 2.16b Greeley Results: The Impact of HOA Neighborhoods						
N = 6,907	Linear		Semi-Log		Log-Log	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Homested Hights	-11,958.6	0.002	-0.00757	0.728	-0.00439	0.797
Hunters Cove	-9,022.0	0.024	0.02311	0.316	0.02799	0.196
Larson	-2,736.9	0.623	0.02362	0.460	0.00451	0.889
Mayfair Green	12,188.1	0.024	0.07429	0.017	0.12595	0.000
Meadows	12,496.5	0.039	0.03779	0.278	0.07155	0.044
Mountain Vista	12,924.5	0.001	0.04874	0.030	0.05844	0.002
North View	1,670.2	0.584	-0.04041	0.021	-0.03214	0.076
Orchards	12,138.2	0.004	0.04866	0.047	0.06979	0.006
Parkview	-6,620.8	0.038	-0.03478	0.057	-0.01795	0.279
Parkview South	-11,099.5	0.000	-0.1047	0.000	-0.09524	0.000
Pheasant Run	1,512.4	0.603	0.01642	0.326	0.01144	0.497
Sommersett	-10,367.9	0.002	-0.03401	0.082	-0.03608	0.061
Summit View	-5,583.4	0.613	0.00438	0.945	0.01905	0.765
Virginia Hills	2,450.5	0.425	-0.01728	0.327	-0.03445	0.056
West Point	6,060.8	0.036	0.02564	0.123	0.05547	0.001
West T Bone	17,156.1	0.000	0.07136	0.000	0.01762	0.336
Westmoor West	-5,084.5	0.041	-0.04173	0.003	-0.03884	0.006
All Other HOAs	278.4	0.888	-0.00526	0.644	0.00149	0.898

2.7.2 Windsor Results

The next set of tables show the results of Windsor. Table 2.17 reports the first regression of Windsor including the full dataset. Clearly the Greeley regressions are in much better standing than the Windsor results. The linear function performs unsatisfactorily with only 6 of 23 variables significant at the 10 percent level. The constant is also insignificant at any reasonable level and the R^2 statistic is quite poor. Furthermore, the coefficients on the variables Area, Garage Attached, Outbuilding, and Fireplace negative even though they are insignificant.

Table 2.17 Model 1 Basic Windsor Results						
N = 1,634	Linear		Semi-Log		Log-Log	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Area (Log)	-16.9	0.666	0.00001	0.816	0.00217	0.893
Residential (Log)	8,344.3	0.000	0.02651	0.000	0.50437	0.000
Basement	2,124.7	0.025	0.01039	0.000	0.01109	0.000
Garage Attached	-463.2	0.875	0.01352	0.002	0.01793	0.000
Garage Detached	3,746.3	0.338	0.02724	0.000	0.02800	0.000
Porch	25.7	0.987	0.00750	0.001	0.00659	0.004
Outbuilding	-415.0	0.885	0.00177	0.672	0.00257	0.516
Bedrooms (Log)	-3,849.4	0.590	-0.01341	0.197	-0.04217	0.208
Bathrooms (Log)	4,132.1	0.604	0.03894	0.001	0.04992	0.062
Fireplace	-1,607.1	0.859	0.01471	0.264	0.00574	0.669
Central Air	2,493.2	0.764	0.02592	0.032	0.03099	0.012
Age (Log)	-133.2	0.659	-0.00074	0.091	0.00029	0.552
Quality Excellent	1,062,051.9	0.000	1.02141	0.000	1.18712	0.000
Quality Very Good	209,461.4	0.000	0.20885	0.014	0.29616	0.000
Quality Good	107,540.9	0.000	0.15880	0.000	0.17802	0.000
Quality Average	949.0	0.938	0.02801	0.117	0.00682	0.718
To Agriculture	2,144.9	0.291	0.00385	0.194	-0.00742	0.364
To CBD (Log)	1,730.6	0.322	0.00486	0.057	0.03004	0.002
To Industry (Log)	62.9	0.918	0.00196	0.028	-0.00150	0.865
To Road (Log)	-440.7	0.653	0.00183	0.202	0.01785	0.043
To Parks (Log)	1,505.7	0.027	0.00156	0.115	0.00115	0.796
To Windsor Lake (Log)	1,418.7	0.132	0.00537	0.000	0.03557	0.014
C	-12,549.0	0.715	11.16966	0.000	10.27132	0.000
R-squared	0.235		0.654		0.646	
Adjusted R-squared	0.214		0.644		0.637	
F-statistic	11.324		69.793		67.517	
Prob. (F-statistic)	0.000		0.000		0.000	

The nonlinear functions do perform better: their R^2 statistic is reasonable, they have the expected signs for building characteristics, and twice the number of significant variables at the 10 percent level. Still, the nonlinear regressions for Windsor do not perform as well as the Greeley regressions (table 2.07). Only about half of the explanatory variables in Windsor are significant at the 10 percent level, while 24 of 25 explanatory variables are significant in the Greeley regression.

The impact of HOAs in Windsor, summarized in table 2.18, is larger than in Greeley. The impact in Windsor is about 3.5 percent and 5.4 percent for the semi-log and log-log functions respectively. This translates into almost a substantial $7,000 or $10,600 impact of the average priced house.

Table 2.18 Model 2 Windsor Results with HOA Dummy						
N = 1,634	Linear		Semi-Log		Log-Log	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Area (Log)	-11.6	0.768	0.00003	0.637	0.00743	0.645
Residential (Log)	8,044.7	0.000	0.02573	0.000	0.48016	0.000
Basement	2,074.7	0.029	0.01026	0.000	0.01077	0.000
Garage Attached	-216.3	0.942	0.01417	0.001	0.01804	0.000
Garage Detached	3,447.0	0.379	0.02645	0.000	0.02695	0.000
Porch	173.6	0.911	0.00788	0.001	0.00748	0.001
Outbuilding	-336.9	0.907	0.00198	0.636	0.00246	0.532
Bedrooms (Log)	-4,131.0	0.563	-0.01415	0.174	-0.04440	0.184
Bathrooms (Log)	5,382.4	0.503	0.04221	0.000	0.06229	0.021
Fireplace	-805.0	0.929	0.01681	0.202	0.00788	0.557
Central Air	1,850.0	0.824	0.02423	0.045	0.02874	0.019
Age (Log)	-71.5	0.815	-0.00058	0.191	0.00049	0.325
Quality Excellent	1,056,106.7	0.000	1.00585	0.000	1.17503	0.000
Quality Very Good	208,206.0	0.000	0.20557	0.016	0.29278	0.000
Quality Good	105,811.8	0.000	0.15427	0.000	0.16992	0.000
Quality Average	-1,866.2	0.881	0.02065	0.256	0.00019	0.992
To Agriculture	2,289.7	0.260	0.00423	0.154	-0.00457	0.577
To CBD (Log)	1,400.2	0.428	0.00399	0.121	0.02406	0.014
To Industry (Log)	-90.6	0.884	0.00156	0.086	-0.00812	0.368
To Road (Log)	-576.3	0.559	0.00147	0.306	0.01968	0.026
To Parks (Log)	1,455.9	0.033	0.00143	0.149	0.00576	0.215
To Windsor Lake (Log)	1,075.3	0.273	0.00447	0.002	0.03195	0.027
HOA	13,118.2	0.214	0.03432	0.026	0.05219	0.001
C	-6,863.3	0.843	11.18453	0.000	10.31058	0.000
R-squared	0.235		0.655		0.649	
Adjusted R-squared	0.214		0.645		0.639	
F-statistic	11.105		68.492		66.619	
Prob. (F-statistic)	0.000		0.000		0.000	

As with Greeley, the variable To HOA is included to control for houses that are closer and able to capture some the benefit of the HOAs. The results are summarized in table 2.19. With Windsor as with Greeley To HOA has a negative sign which signifies a positive impact but again similar to Greeley the To HOA variable weakens the economic and statistical significance of the HOA dummy. In Windsor, the To HOA is close but not significant at the 10 percent level. The HOA dummy from the semi-log is not significant, whereas the log-log is both economically and statistically significant. The log-log coefficient returns about a 4.1 percent impact that translates into over an $8,000 impact on the average priced house.

Table 2.19 Model 3 Windsor Results with HOA Dummy and Distance to HOA						
N = 1,634	Linear		Semi-Log		Log-Log	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Area (Log)	-10.3	0.794	0.00003	0.593	0.00858	0.595
Residential (Log)	8,041.6	0.000	0.02572	0.000	0.47958	0.000
Basement	2,135.1	0.025	0.01042	0.000	0.01087	0.000
Garage Attached	-8.1	0.998	0.01472	0.001	0.01838	0.000
Garage Detached	3,681.5	0.349	0.02708	0.000	0.02769	0.000
Porch	182.5	0.907	0.00791	0.001	0.00755	0.001
Outbuilding	-146.2	0.960	0.00249	0.553	0.00277	0.482
Bedrooms (Log)	-4,368.9	0.541	-0.01478	0.155	-0.04608	0.168
Bathrooms (Log)	5,488.6	0.495	0.04249	0.000	0.06393	0.018
Fireplace	-539.6	0.952	0.01751	0.184	0.00842	0.531
Central Air	1,781.1	0.830	0.02405	0.047	0.02883	0.019
Age (Log)	-14.0	0.964	-0.00043	0.345	0.00059	0.236
Quality Excellent	1,052,639.9	0.000	0.99660	0.000	1.16559	0.000
Quality Very Good	207,446.0	0.000	0.20354	0.017	0.28756	0.001
Quality Good	107,152.5	0.000	0.15785	0.000	0.17100	0.000
Quality Average	-2,776.4	0.825	0.01822	0.317	-0.00194	0.919
To Agriculture (Log)	2,530.7	0.218	0.00487	0.103	-0.00293	0.723
To CBD (Log)	1,249.6	0.482	0.00359	0.165	0.02207	0.025
To Industry (Log)	-64.4	0.918	0.00163	0.073	-0.00769	0.394
To Road (Log)	-811.3	0.428	0.00084	0.571	0.01758	0.050
To Parks (Log)	1,547.4	0.025	0.00168	0.095	0.00805	0.103
To Windsor Lake (Log)	916.2	0.359	0.00405	0.005	0.03023	0.037
To HOA	-3,490.5	0.378	-0.00931	0.106	-0.00838	0.166
HOA	7,097.3	0.572	0.01826	0.318	0.03989	0.030
C	1,849.9	0.959	11.20777	0.000	10.32808	0.000
R-squared	0.236		0.655		0.649	
Adjusted R-squared	0.214		0.646		0.639	
F-statistic	10.874		67.096		65.219	
Prob. (F-statistic)	0.000		0.000		0.000	

The covenant variables in Windsor (summarized in table 2.20a and b and table 2.21) do differ from Greeley. Restrictions is the only consistently significant variable in Windsor, while in Greeley Mortgagee was the only insignificant variable and it was not consistently so. Both Amendment and Mortgagee result in consistently negative signs and Amendment with insignificant results in Windsor. However Restrictions is positive, statistically significant, and far more economically significant than is the case in Greeley. Finally, the impact of To HOAs does have the expected sign and a greater economic significance than Greeley but it is not statistically significant until at least the 15 percent level.

Table 2.20a Model 4 Windsor Results with HOA Detail						
N =1,634	Linear		Semi-Log		Log-Log	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Area (Log)	-11.3	0.774	0.0000	0.666	0.0010	0.950
Residential (Log)	7,872.6	0.000	0.0248	0.000	0.4636	0.000
Basement	2,225.0	0.020	0.0108	0.000	0.0113	0.000
Garage Attached	409.8	0.893	0.0172	0.000	0.0207	0.000
Garage Detached	2,502.5	0.532	0.0215	0.000	0.0218	0.000
Porch	183.7	0.906	0.0079	0.000	0.0073	0.001
Outbuilding	-36.8	0.990	0.0029	0.481	0.0034	0.391
Bedrooms (Log)	-3,596.5	0.617	-0.0107	0.305	-0.0328	0.327
Bathrooms (Log)	4,456.1	0.583	0.0371	0.002	0.0511	0.058
Fireplace	-1,045.9	0.908	0.0147	0.262	0.0091	0.498
Central Air	143.0	0.986	0.0164	0.176	0.0222	0.069
Age (Log)	38.8	0.903	-0.0002	0.735	0.0007	0.171
Quality Excellent	1,051,612.4	0.000	0.9886	0.000	1.1561	0.000
Quality Very Good	207,641.2	0.000	0.2025	0.017	0.2986	0.000
Quality Good	108,721.4	0.000	0.1658	0.000	0.1753	0.000
Quality Average	-2,562.1	0.840	0.0193	0.294	-0.0016	0.934
To Agriculture (Log)	2,899.3	0.175	0.0061	0.048	0.0089	0.328
To CBD (Log)	296.7	0.875	-0.0008	0.767	-0.0016	0.881
To Industry (Log)	-197.0	0.768	0.0012	0.210	-0.0104	0.264
To Road (Log)	-354.9	0.754	0.0026	0.111	0.0281	0.003
To Parks (Log)	1,482.9	0.032	0.0014	0.169	0.0072	0.145
To Windsor Lake (Log)	1,120.3	0.278	0.0051	0.001	0.0354	0.019

Table 2.20b Model 4 Windsor Results with HOA Detail						
N =1,634	Linear		Semi-Log		Log-Log	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
To HOA	-3,024.3	0.447	-0.0073	0.204	-0.0087	0.150
Amendment	-124.1	0.908	-0.0005	0.763	-0.0002	0.899
Mortgagee	-122.2	0.585	-0.0007	0.027	-0.0006	0.042
Restrictions	3,691.0	0.140	0.0165	0.000	0.0176	0.000
HOA Dummy	-58,963.6	0.519	-0.2806	0.034	-0.2998	0.029
C	-2,599.8	0.943	11.1878	0.000	10.364	0.000
R-squared	0.237		0.661		0.652	
Adjusted R-squared	0.214		0.650		0.642	
F-statistic	10.238		33.936		61.907	
Prob. (F-statistic)	0		0		0	

Table 2.21 Model 4 Windsor Results without To HOA						
N = 1,634	Linear		Semi-Log		Log-Log	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Amendment	-115.5	0.914	-0.0004	0.773	-0.0002	0.897
Mortgagee	-119.9	0.592	-0.0007	0.028	-0.0006	0.040
Restrictions	3,851.4	0.122	0.0169	0.000	0.0175	0.000
HOA Dummy	-57,798.4	0.527	-0.2778	0.036	-0.2853	0.037

Table 2.21 summarizes the same experiment as with Greeley' Model 4. Even though To HOA is insignificant at the standard levels, all coefficients in the semi-log become slightly more significant. For the log-log function, Amendment becomes slightly more significant with To HOA, but is still insignificant. The other three variables in the log-log form become less significant with the addition of To HOA. In Windsor excluding To HOA improves the number of significant variables.

The impact of individual HOA neighborhoods in Windsor is recorded in table 2.22. None of the neighborhoods are significant in the linear model. However, given the poor performance of the linear model, the results are ignored. In the nonlinear models there are five statistically significant (at the 10 percent level) neighborhoods. Again, not all HOAs are associated with improved house prices.

Table 2.22 Windsor Results: The Impact of HOA Neighborhoods						
	Linear		Semi-Log		Log-Log	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Cornerstone	14979.2	0.828	0.04017	0.682	0.03210	0.748
River Trails	-14334.8	0.747	0.01571	0.804	0.02775	0.671
Chestnut Village	2239.9	0.955	-0.01115	0.842	0.00862	0.878
North Shores	-38809.7	0.585	-0.07693	0.447	0.12722	0.119
Windsor Manor	-9970.0	0.869	-0.05042	0.559	-0.04938	0.565
Windsor Manor 6th	12841.3	0.800	0.08706	0.228	0.10336	0.152
Governors Farm	-18343.2	0.309	-0.05804	0.024	-0.05488	0.026
Windsor Estates	28418.2	0.724	0.10050	0.381	0.17624	0.102
Brunner Farm	28954.2	0.230	0.15012	0.000	0.15830	0.000
Water Valley	34843.8	0.128	0.07832	0.016	0.13103	0.000
Hilltop Estates	-73928.4	0.357	-0.42415	0.000	-0.29349	0.007
Grasslands Park	11275.3	0.806	0.10779	0.099	0.17816	0.026
Other HOAs	5492.2	0.771	-0.01454	0.589	0.02288	0.363

2.8 Summary

Municipalities and county governments are not the only governing agent who directly impacts local housing markets. Homeowner associations are growing in influence in the housing market and offer an alternative and/or a complement to common local governing structures. At the same time, little research has been done to document and analyze the impact of HOAs on the housing market or, more generally, the health of the neighborhoods.

This study is a narrow inquiry into the impact HOAs have on housing prices using a hedonic model. Other, equally narrow, hedonic studies on HOAs have looked at the impact of the general existence of a HOA (Speyrer 1989) without municipal zoning, the impact of a specific restriction (Cannaday 1994), or the impact when a composite measure of restriction is used (Hughes and Turnbull 1996a). The models presented in this study include additional institutional explanatory variables; including the voting rules. The impact of HOAs on non-HOA housing is also considered.

Two cites in Weld County, Colorado and three functional forms (linear, semi-log, and log-log) are considered. For Greeley, the larger of the two cites, housing prices increase as the amendment decision rule moves to unanimity. This suggests that homeowners are concerned with the uncertainty of future changes in the rules of the covenant. In Windsor, the effect is inconclusive.

The impact of mortgagee voting is also unclear from this study. In some covenants, the holder of the first mortgagee does have voting rights. These rights give the mortgagee some influence in the alteration of the covenant and common ground. However, further study is necessary do discover the impact of mortgagee voting.

The number of categories of activities that the covenant makes clear to the residents is also positively related to the housing price in both Greeley and Windsor. The specific details of each restriction were not included; however, the results can be interpreted as homeowners placing value on clearly knowing what behavior is acceptable for their neighbors and themselves. Furthermore, the number of restrictions is conceivably correlated with the overall strictness of the HOA. If that is the case, then these results match the conclusion made by Hughes and Turnbull (1996a): a premium is paid by homeowners for greater restrictiveness. This restrictiveness will lower the risk of future unforeseen changes to the neighborhood. However, there are two main problems with stressing this conclusion.

First, actual restrictiveness of the covenant and the enforcement of the covenant is difficult to measure. There are social and physical costs to enforcement, which some homeowners may not be willing to pay in certain cases. Furthermore, some covenants explicitly allow for variances from the covenant. These variances are given by the HOA committee and are not recorded with the county government.

Secondly, if it is the case that simply adding more restrictions will increase the housing value then homeowners could simply vote for more restrictive municipal zoning. Still, HOAs are growing rapidly even within zoned municipalities. This suggests that current preferences are not being met through the traditional governing methods. Homeowners may be cautious with allowing zoning boards more power because the homeowner will have less influence in the greater pool of voters. Homeowners may also not prefer the same restrictions. Clearly the evidence from table 2.8 shows HOA owners and non-HOA owners place different valuation on the qualities of their house.

The age of the covenant also seems to positively impact the housing price, albeit the impact is small in table 2.7 but larger in table 2.8. Older covenants may have an advantage because the neighborhood may be more established and the residents there may have more experience with living in a HOA. Newer neighborhoods may have some learning curve with enforcing rules with neighbors. The age factor may explain the lack of clarity in the Windsor results because the average covenant in Windsor is younger than in Greeley.

Non-HOA homeowners also benefit from HOA neighborhoods. The distance from a HOA is negatively related to the price of the non-HOA house. This effect is likely broken in to two components; the first being the general upkeep of the HOA neighborhoods. Better upkeep can improve the value of surrounding neighborhoods by simply providing a more ascetic environment. The second component would include the impact of HOAs on HOA housing, which then will spread through the housing market in a process of spatial dependence.

Clearly HOAs have a positive impact on housing price, which is expected given the rapid growth of HOAs. This study attempts to provide evidence into the reasons why covenants improve housing values. Future research should focus on 1) the ways in which restrictions and voting practices impacts the neighborhood, 2) how mortgagee voting impacts mortgage interest rates and, 3) if club public goods are more efficiently provided by local homeowners. The growth and diversity of HOA communities provides a wonderful natural experiment for economists and social scientists in general to study alternative local governance.

Ch III An Inquiry into Spatial Weighting

3.1 Introduction to Spatial Econometrics

The use of spatial correction of econometric models is quite appealing conceptually. There are many variables that one might consider spatially connected especially in the urban and regional fields of economics. The heart of spatial corrections is no different than the basic temporal dependence seen in time series data. Independent or dependent variables may show signs of temporal dependence or even just the residuals may be temporally dependent. To correct for temporal dependence, one must use some type of lag or lag system. There are, of course, many ways to create and test these lags. Still, there can be much disagreement of the appropriate lag for any particular inquire.

Spatial dependence also must deal with the lag decision, even though spatial dependence has more pitfalls than temporal dependence. The major diversion from time series is the fact that spatial dependence is at least two if not three dimensional, while time series has only one dimension. This means that the number of possible lags increases dramatically.

Furthermore, time series theory is often treated sequentially. The GDP of 1995 may affect the GDP of 2000, but it cannot be the case that the GDP of 2000 can affect the GDP of 1995. That is, time series is one directional. Spatial dependence, by contrast, may operate in all directions (i.e. the benefits to housing prices by being close to a lake) or in only some directions (i.e. the nuisance of the odor from a feedlot that is directed by wind patterns).

Finally, time lags are treated in a decay or a delayed decay model. That is, the GDP of 2000 may be affected by the interest rates two or so quarters past and the interest rate of two or so years ago will have little to no affect. However, spatial dependence may be positive or negative. For example, the price of housing in a gated community may be much more correlated with the housing in another gated community one mile away; while at the same time weakly correlated with the housing 100 yards away.

To deal with the issue of spatial dependence, a large literature has developed. This literature has largely been developed by Anselin, La Sage, and Pace[21]. Their work and others stems from the time series analysis and then extends into special spatial issues. However, there are some complaints about the development of the spatial literature in that a rigorous and well accepted method of developing the appropriate spatial lag has not been established.

This paper will review two approaches to developing a weighting matrix for spatial dependence. The first focus will be to show how different the results can be from both approaches. The second focus will be to introduce spatial variables to improve the regression results.

[21] For a review of spatial econometrics see Anselin (1988), Anselin and Hudak (1992), Anselin and Florax (1995), Bowen, Mikelbank, and Prestegaard (2001), Florax, Folmer, and Rey (2003), and Pace and Barry (1997).

3.2 Modeling the Housing Market with Spatial Dependence

If the goal is purely prediction of housing prices at a certain place, then Freidman's famous physics/billiard player example makes a great point: it does not really matter what variables you use as long as the model predicts accurately. However, if the motivation is the impact of a particular highway on land values, then the relationship of the highway the land values must be carefully developed.

3.2.1 A Basic Housing Model

The basic model is taken from chapter 2. The model is summarized by

$$\ln P = \beta_1+\beta_H+\beta_S+\varepsilon,$$

where lnP is the natural log of price, β_H is the physical housing characteristics, and β_S is the distance to amenity or nuisance variables.

The semi-log functional form is chosen from chapter 2. This form is the most common in the hedonic literature partially because a nonlinear function is most appropriate for consumer theory and partially because this specific form lends its self well to the use of OLS. Two other functional forms were tested in chapter 2, a simple linear and a log-log, they also performed well.

3.2.2 Spatial Dependence Theory

To model spatial dependence of any investigation, a proper theory must be developed. While the techniques to econometrically deal with spatial dependence are well developed; the reason for and explanation of spatial dependence is not well developed. Of the articles used in this investigation only Bowen, Mikelbank, and Prestegaard (2001) make specific note of the reasons for spatial dependence. This section will expand on those ideas.

Housing prices can be spatially correlated because of two general issues: the housing shares characteristics, and the neighboring prices that may affect the behavior of the buyers and sellers. The first issue is a simple misspecification argument. There may be unmeasured variables that neighboring housing share. These variables may include physical housing characteristics, shared amenities, shared nuisances, or shared governance.

The generation of spatial dependence from a shared characteristic is illustrated in figure 3.1. In this example the housing shares the benefits of a neighboring lake. The benefits of the lake will increase the housing prices in the neighborhood, although not necessarily by the same amount or percentage for each house. This type of spatial dependence is not generated because the price of one house causes or influences the price of another house but rather is generated because the four houses a similar distance to the said lake.

The first unmeasured variable is shared physical characteristics. In this case the neighborhood amenity is the actual housing characteristics in the area. These characteristics include the general type of housing placed by the original developer or simply from what has developed. For example, a subdivision may be constructed with all similar housing styles like Dutch Colonial. As the housing style becomes more or less popular, the housing prices will change with some unity. The housing in an area could have well manicured lawns and maintained exteriors. Any of these variables, if not accounted for in the regression, would give rise to spatial dependence.

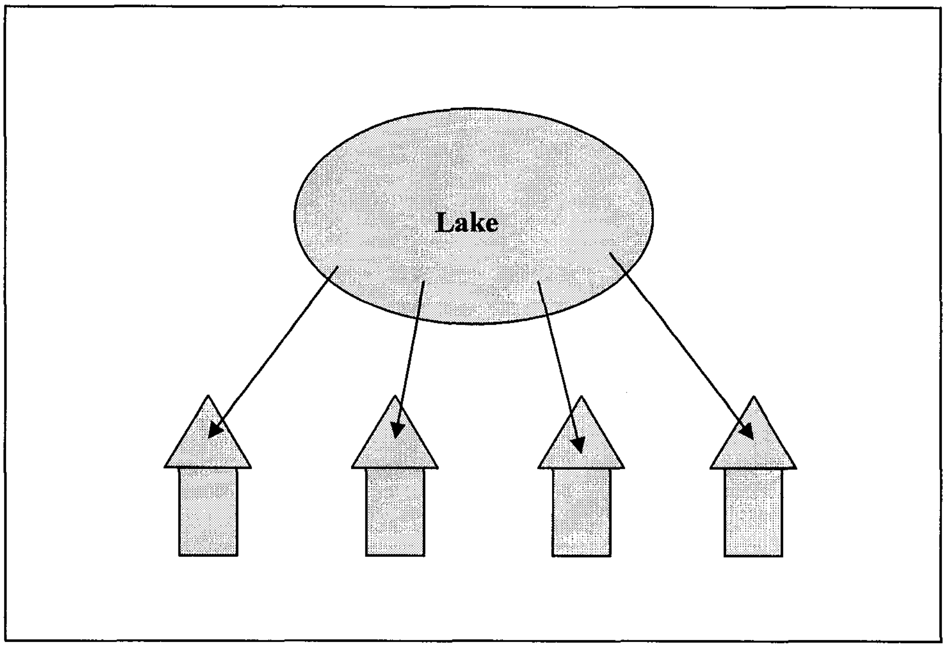

Figure 3.1 Spatial Figure

In practice the shared characteristics would, all else equal, cause the hedonic model to misestimate the value of the housing in that area. Therefore, the residuals of the hedonic in the neighborhood would be positively related.

Shared amenities or nuisances may also create a spatial dependence. The proximity to a lake, park, CBD, or any other amenity will provide some value to the neighboring housing. Access to these amenities or proximity to the nuisances, if unmeasured, will give rise to spatial dependence in the same manor as the shared characteristics.

Shared governance is the last shared variable that may cause spatial dependence. Depending on the size of inquiry, the housing may cover many school districts, planning boards, municipalities, or any other governing agency. These governing agencies can increase or decrease the average value of the housing in the area in the same manor as the shared characteristics.

In the above cases, the impact of spatial dependence is really an issue of missing variables. The spatial dependence adjustments would thus be a composite effect of the missing variables. The composite variable will average the missing neighborhood variables. This averaging will improve the perdition of the model by reducing the residuals and thus increasing the R^2, but this may come at a cost of hindering the estimation of a particular included neighborhood variable. Just as a model can be misspecified because spatial corrections are not done a model can be misspecified because the spatial dependence is incorrectly modeled.

The second type of issue deals with the perception of the neighborhood premium[22]. Prices convey information and sellers will use other home sales to gauge the value added of the neighborhood. However, it is difficult to breakdown the sales price of a particular house into individual parts. This is partially due to imperfect information but it is complicated by imperfect competition. Each house has a unique combination of attributes. Therefore, when a house is sold the price will not only contain the housing characteristics, the neighborhood characteristics, and location but it will also contain the

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[22] Bowen, Mikelbank, and Prestegaard (2001) use a similar argument for the existence of spatial dependence. A particular seller may have an attitude that they will not sell "for a penny under $120K, because I know that is what my neighbor got for his!"

negotiations of two parties. These market realities mean that a house sold by different parties, all else equal, will result in different sales prices.

Real estate agents and other parties provide services to buyers and sellers to reduce the uncertainty in each transaction but they will not eliminate it. When the comparable house sales ("comps") are generated by the agent, buyer, or seller the information gathered is incomplete. The result of imperfect information will blur the impact of spatial dependence and all other estimations.

Still, the seller must decide on an asking price. That decision will in part be affected by the seller's impression of the distribution of buyers and the seller's preference to risk aversion. If a house across the street sells for $100 per square foot in a short amount of time, then a prospective seller may believe that the distribution of buyers is such that $100 per square foot may be the appropriate price for that neighborhood.

3.2.3 Spatial Dependence Modeling[23]

Autocorrelation is a violation of the classical linear model that is normally found in the time series literature. The violation is one where the error term of one observation is related to another. For example, if the error of one observation in a time series model is related to the error in past observations, then the estimation of standard errors will not be efficient:

$$\ln P = \beta_1+\beta_H+\beta_S+\varepsilon,$$

$$\varepsilon^* = \varepsilon + \lambda\varepsilon_{t-1}.$$

[23] This section is based on discussions from Anselin (1988), Anselin and Florax (1995), and Bowen, Mikelbank, and Prestegaard (2001).

In this case, the classical linear model is still unbiased but it is not producing the minimum variance among unbiased estimators (i.e. it is no longer BLUE). The estimated residual variance is likely to be underestimated, which will mean the R^2 is overestimated. Still, even if the variance is not underestimated the variance of the $\hat{\beta}$ s may be underestimated, which will mean the usual t and F tests are no longer valid.

This problem of autocorrelation can also occur within space. The nature of the problem and the consequences are the same. If spatial autocorrelation is present, then

$$\ln P = \beta_1 + \beta_H + \beta_S + \varepsilon^*,$$

where

$$\varepsilon^* = \varepsilon + \lambda W \varepsilon,$$

is the new spatial econometric problem. The term W is a spatial weighting matrix that represents the nature of the spatial error dependence and Lambda is the measure of the size of the spatial dependence.

The correction for the spatial autocorrelation is

$$\ln P = \beta_1 + \beta_H + \beta_S + \varepsilon^*,$$

where

$$\varepsilon^* = \varepsilon + \lambda W \varepsilon,$$

$$\varepsilon \sim N(0, \sigma^2 I_n).$$

One commonly used test for the presence of spatial autocorrelation is the Lagrange Multiplier (LM) test (Anselin, 1988), which uses the residuals from a least-squared regression and the spatial weight matrix. The test is represented by

$$LM = (1/T)[(e'We)/\sigma^2]^2 \sim \chi^2(1)$$

$$T = tr(W + W').*W \quad ,$$

where e is the residuals of the least-squares regression and .* denotes the element by element matrix multiplication.

Autoregression is a violation of the classical linear model where (at least part of) the error term is related to the dependent variable. If the temporal components of a model are not corrected for, then the model will be biased:

$$\ln P = \beta_1 + \beta_H + \beta_S + \varepsilon,$$

$$\varepsilon^* = \varepsilon + \rho \ln P_{t-1}.$$

The error term is related to the dependent variable and thus the assumptions of the classical linear model are violated. The standard correction is some type of lagged variable of the dependent variable, where Rho (the coefficient on the lagged variable) is considered a measure of economic significance of time.

Spatial autoregression causes the same problems with the classical linear model assumptions. If the dependent variable is spatially dependent, then the hedonic model will be:

$$\ln P = \beta_I + \beta_H + \beta_S + \varepsilon,$$

$$\varepsilon^* = \varepsilon + \rho W \ln P,$$

where W is the weighting matrix and ρ is the spatial autoregressive coefficient. To correct for the spatial dependence the spatially lagged dependent variable must be included:

$$\ln P = \beta_I + \beta_H + \beta_S + \rho W \ln P + \varepsilon,$$

$$\varepsilon \sim N(0, \sigma 2).$$

Clearly, the estimation of the weighting matrix is of prime importance to the estimation of spatial dependence. The weighting matrix is a row-standardized $n \times n$ matrix that holds the information about the spatial relationship of all housing.

Weights of four basic types are possible to calculate: 1) a simple congruity, where a value of unity is recorded where a boarder is shared; 2) a distance congruity, where a value of unity is recorded for all housing within a set distance; 3) a decay, where the value is the inverse of some distance; and 4) a closest neighbor, where a value of unity is recorded for all k closest neighbors.

Regional theory does not provide much guidance on selecting the right type of weight. Still, some weights are clearly more appropriate. A simple congruity will not be useful for a micro-level study of the housing market because the sample will not likely include many houses who share a parcel area boarder. The closest neighbor weight also may not be appealing given that the distance to each neighbor will not be uniformed. Some houses may have ten neighbors within 50 yards and other may need 500 yards to find ten neighbors. In contrast, a distance congruity and the decay weights provide a matrix for a limit on spatial dependence. This can be appealing given that the strength of spatial dependence may be limited to less that the total area of the study.

After the type of matrix is chosen, the size of the spatial dependence must be chosen. For a distance congruity, the distance limit must be chosen and for a decay, the rate of decay must be chosen. If the weighting matrix is not properly estimated, then the tests for significance could improperly reject or accept the presence of spatial dependence.

3.2.4 Visualizing Spatial Dependence[24]

[24] This section is based on discussions from Johnson, Ver Hoef, Krivoruchko, and Lucas (2001) and McCoy and Johnson (2001).

Variography is study of spatial dependence, specifically the mapping of spatial dependence. The approach maps a variable against the distance of any two observations. This mapping provides visual information on possible spatial dependence. The variogram is calculated by:

$$2\hat{\gamma}(h) = \left(\frac{1}{n(h)}\right)\sum (y_i - y_j)^2,$$

where y_i and y_j are the housing observations with n number of observations. As distance h is varied, an empirical variogram is created. The empirical variogram reaches a maximum at a *sill* and the distance recorded at that maximum can be used as an estimate of the maximum range of spatial dependence.

Standard errors are not calculated with the empirical variogram but the weights that are created can be tested for significance using the Lagrange Multiplier. This process, Bowen, Mikelbank, and Prestegaard (2001) argue, improves the estimation of the spatial weights in question.

3.3 Comparing Methods

This section will include the comparison of two approaches to estimating the spatial weights. The first half will compare the approaches with a basic hedonic model (i.e. no spatial variables). The second half will compare the approaches with a hedonic model that includes 12 spatial variables.

The two major articles I will compare are Bowen, Mikelbank, and Prestegaard (2001) and Bell and Bockstael (2000). Both use cross-sectional single-family housing in a hedonic model. However, they take different approaches to estimating the weighting matrix. First, Bell and Bockstael (2000) compare using maximum likelihood and generalized method of moments to correct for spatial dependence. Generalized method of moments[25] (GMM) does allow for multiple weighting matrices to be used, which provides flexibility to the model; however a standard error cannot be calculated on the Rho estimate. Therefore, the GMM process will not be used at this time.

Bell and Bockstael create four weights: a simple distance decay that ends at 600 meters and three distance congruity of 200, 400, and 600 meters respectively. These weights are chosen based on the average size of housing developments[26]. All weights are highly significant using the standard tests of spatial dependence. For the maximum likelihood method all weights also produce highly significant Rho coefficients, where the size of Rho peaks at 400 meters and declines at 600.[27]

Bowen, Mikelbank, and Prestegaard (2001) use an empirical variogram to guide the choice of spatial weight. For one sample they run a standard OLS hedonic model and record the residuals. They then plot the residuals using the empirical variogram. From this they found that the residuals relationship increased (a sign but not proof of spatial dependence) until it reached a plateau (a sill) after a certain distance. There were three such sills. A weight was created for each and was tested using Moran's I and only one

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[25] For a discussion of the cost and benefits of using the generalized method of moments including a discussion of the calculations of eigenvalues see Bell and Bockstael (2000).

[26] The motivation for Bell and Bockstael (2000) is not the estimation of the exact neighborhood, but rather a comparison of the maximum likelihood and GMM.

[27] After using the flexible GMM model, Bell and Bockstael conclude that the spatial dependence is limited between 400 and 600 meters. Again these estimates are unable to calculate standard errors for Rho.

weight was found significant. This weight (capping the distance of spatial dependence at 0.93 miles) was used to correct for spatial dependence.

Given these approaches, four weights are used for the Greeley sample: three weights at 100, 200, and 300 yards and one based on an empirical variogram using the residuals from the standard OLS procedure. The first three weights are smaller than Bell and Bockstael but the 300-yard distance is large enough to completely cover almost every subdivision. The empirical variogram produced only one sill at a distance of 3,010 yards. Therefore the fourth weight is based on that distance. Clearly the two procedures return large differences in distance. All weights are highly significant using the Lagrange multiplier[28] and therefore none are rejected. To show the importance of choosing the correct weight, I compare an OLS regression with the four other spatially adjusted models.

Table 3.1 Variable Names

H01	Area	D01	To Agriculture
H02	Residential	D02	To CBD
H03	Basement	D03	To Industry
H04	Garage Attached	D04	To Golf
H05	Garage Detached	D05	To Feedlot
H06	Porch	D06	To Park with Lake
H07	Outbuilding	D07	To Park
H09	Bedrooms	D08	To Main Road
H10	Bathrooms	D09	To HOA
H11	Fireplace	C01	Amendment
H12	Central Air	C02	Mortgagee
H13	Age	C03	Restrictions
H14	Quality Excellent	C04	HOA Dummy
H15	Quality Very Good		
H16	Quality Good		
H17	Quality Average		

[28] See Anselin (1988) for a description of the Lagrange multiplier test for spatial dependence in the error terms.

Table 3.2 reports the tests for spatial autocorrelation and table 3.3 summarizes the results of the original regression (A) and four additional regressions (B-E) including the correction for spatial dependence. The dependent variable is the natural log of the sales price, table 3.1 provides a list of the dependent variables, and there are 5,628 observations for all regressions. The number of observations have been reduced by removing all multiple sales of any house. The last sale of all houses was taken. This was done to reduce the potential of problems with the creation of the weighting matrix.

In table 3.2, the test for spatial autocorrelation are presented with the first baseline regression presented as "Non-Spatial Regression" because it does not contain the locational variables and the second baseline regression is presented as "Spatial Regression" because it does include the spatial variables. Clearly all four weights can be deemed significant and thus the hypotheses of no spatial autocorrelation can be rejected.

Table 3.2 LM Tests for Spatial Autocorrelation

		W00300s	W00600s	W00900s	W06028s
Non-Spatial Regression	LM	44.606	5.071	9.893	93.992
	Prob	0.000	0.024	0.002	0.000
Spatial Regression	LM	39.805	4.859	7.692	53.886
	Prob	0.000	0.027	0.006	0.000

In table 3.3 coefficients are provided in the first column followed by t-statistics. Dummy variables are used in the regression to adjust for the sales date. All of the 22 quarters are accounted for but all dummy variables to control for time are not reported.

Unlike Bell and Bockstael's experience, the Lambda value falls as the weights include more neighbors until it troughs around 200 yards and then rises again. Still, all four Lambdas are highly significant. The H independent variables are all housing characteristic which are unique to each house. The C independent variables are all homeowner association (HOA) characteristics, which are not unique to each house. In fact many houses share the same HOA.

Table 3.3 Base Model Comparison of Spatial Weights

R^2	0.839		0.841		0.839		0.839		0.839	
$Rbar^2$	0.838		0.839		0.838		0.838		0.838	
$sigma^2$	0.020		0.020		0.020		0.020		0.020	
	A. N=5,628		B. 100		C. 200		D. 300		E. Variogram	
	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
C	11.161	797	11.165	13,424	11.160	25,257	11.160	51,391	11.161	39,942
H01	0.0002	6.57	0.0002	6.77	0.0002	6.66	0.0002	6.69	0.0002	6.59
H02	0.0201	28.78	0.0201	29.52	0.0201	29.52	0.0202	29.64	0.0201	29.52
H03	0.0155	37.20	0.0153	36.89	0.0154	37.35	0.0154	37.28	0.0155	37.51
H04	0.0132	9.34	0.0131	9.60	0.0132	9.67	0.0133	9.76	0.0132	9.70
H05	0.0152	8.46	0.0151	8.46	0.0150	8.41	0.0149	8.38	0.0152	8.54
H07	0.0045	7.06	0.0043	6.90	0.0045	7.15	0.0045	7.11	0.0045	7.16
H09	0.0130	5.02	0.0134	5.22	0.0132	5.11	0.0131	5.08	0.0130	5.06
H11	-0.0007	-0.24	-0.0008	-0.30	-0.0003	-0.11	-0.0007	-0.24	-0.0006	-0.21
H12	0.0476	13.87	0.0473	13.90	0.0477	14.00	0.0476	13.96	0.0478	14.02
H13	0.0414	8.75	0.0416	8.85	0.0414	8.83	0.0413	8.79	0.0413	8.81
H14	0.0265	5.73	0.0265	5.75	0.0263	5.72	0.0263	5.73	0.0262	5.70
H15	-0.0013	-10.28	-0.0013	-11.31	-0.0013	-11.22	-0.0013	-11.12	-0.0013	-11.30
H19	0.3551	2.42	0.2749	1.90	0.3473	2.39	0.3529	2.43	0.3544	2.44
H20	0.2976	8.67	0.2999	8.96	0.2934	8.71	0.2916	8.66	0.2959	8.79
H21	0.2544	20.21	0.2523	20.53	0.2522	20.60	0.2510	20.50	0.2542	20.83
H22	0.1024	16.94	0.1018	16.73	0.1017	16.82	0.1012	16.70	0.1020	16.99
C01	0.0003	2.41	0.0003	2.25	0.0003	2.37	0.0003	2.40	0.0003	2.46
C02	-0.0009	-1.07	-0.0009	-1.11	-0.0008	-1.05	-0.0008	-1.02	-0.0009	-1.11
C03	0.0028	6.77	0.0028	6.60	0.0028	6.66	0.0028	6.65	0.0028	6.78
C04	-0.0448	-3.83	-0.0433	-3.68	-0.0438	-3.79	-0.0440	-3.77	-0.0450	-3.91
Lambda			0.1220	15.84	0.0710	8.33	0.1330	16.31	0.1350	16.41

Table 3.4 summarizes the impact of the weights on the coefficients and the t-statistics. Each variable is measured in percentage change from the original OLS regression (A). The cases where the spatial weight increases the t-statistic are in bold.

The results on the t-statistics are relatively mild on all of the variables except for the intercept, Fireplace, and Quality Excellent. Furthermore, the variables of main interest remain largely unchanged. There are no variables that change significance or sign. The intercept increases dramatically in its significance but all four weight raise the t-statistic. Fireplace and Quality Excellent are two variables that do have large changes in their t-statistics depending on the spatial weight used.

Table 3.4 Analysis of Spatial Weights

	T-Statistics			
Variable	100	200	300	Variogram
C	**1,582.39**	**3,065.22**	**6,340.31**	**4,905.52**
H01	**3.10**	**1.39**	**1.94**	**0.41**
H02	**2.58**	**2.59**	**2.99**	**2.59**
H03	-0.83	**0.40**	**0.22**	**0.85**
H04	**2.73**	**3.56**	**4.45**	**3.84**
H05	**0.08**	-0.58	-0.87	**0.98**
H07	-2.33	**1.16**	**0.67**	**1.42**
H09	**4.04**	**1.75**	**1.27**	**0.82**
H11	**0.00**	**52.19**	-1.99	**9.44**
H12	**0.22**	**0.95**	**0.67**	**1.08**
H13	**1.12**	**0.85**	**0.48**	**0.64**
H14	**0.39**	-0.09	-0.06	-0.49
H15	**0.00**	-9.11	-8.14	-9.92
H19	-21.37	-1.21	**0.47**	**0.77**
H20	**3.40**	**0.54**	-0.04	**1.40**
H21	**1.58**	**1.91**	**1.42**	**3.04**
H22	-1.28	-0.71	-1.43	**0.31**
C01	-6.67	-1.76	-0.42	**1.95**
C02	**0.00**	**2.28**	**4.46**	-3.29
C03	-2.49	-1.60	-1.83	**0.04**
C04	**0.00**	**1.12**	**1.51**	-2.06

3.4 Adding Spatial Variables

Section 3.4 is focused on adding observed spatial and neighborhood data. Regression A in tables 3.5a and b shows that the addition of distance data is highly significant except To Industry. When the spatial corrections are made, the Lambdas are clearly still significant and the corresponding t-statistics follows the same U-shaped pattern. All Lambdas still estimate highly significant t-statistics.

Table 3.5a Spatial Model Comparison of Spatial Weights

R^2	0.847		0.848		0.847		0.847		0.847	
$Rbar^2$	0.845		0.847		0.846		0.846		0.846	
$sigma^2$	0.019		0.019		0.019		0.019		0.019	
	A. N=5,628		B. 100		C. 200		D. 300		E. Variogram	
Variable	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
C	11.167	598	11.172	46,382	11.167	19,835	11.167	7,641	11.165	18,268
H01	0.0003	8.03	0.0003	8.28	0.0003	8.11	0.0003	8.12	0.0003	8.06
H02	0.0207	29.85	0.0206	30.44	0.0206	30.46	0.0207	30.57	0.0206	30.41
H03	0.0141	34.01	0.0139	33.73	0.0141	34.17	0.0140	34.13	0.0141	34.38
H04	0.0125	8.89	0.0121	8.73	0.0124	8.92	0.0124	8.96	0.0125	8.99
H05	0.0134	7.57	0.0134	7.62	0.0132	7.53	0.0132	7.52	0.0135	7.66
H07	0.0043	7.00	0.0042	6.78	0.0043	7.02	0.0043	7.00	0.0044	7.09
H09	0.0115	4.55	0.0121	4.80	0.0117	4.65	0.0116	4.62	0.0116	4.60
H11	-0.0008	-0.29	-0.0008	-0.28	-0.0005	-0.18	-0.0009	-0.32	-0.0007	-0.26
H12	0.0381	11.12	0.0378	11.17	0.0381	11.24	0.0381	11.21	0.0383	11.30
H13	0.0291	6.13	0.0290	6.13	0.0290	6.12	0.0289	6.11	0.0288	6.09
H14	0.0236	5.17	0.0233	5.14	0.0234	5.16	0.0235	5.17	0.0234	5.16
H15	-0.0011	-8.50	-0.0011	-8.85	-0.0011	-8.87	-0.0011	-8.78	-0.0012	-9.04
H19	0.3298	2.30	0.2409	1.70	0.3191	2.24	0.3228	2.27	0.3257	2.29
H20	0.2625	7.71	0.2603	7.86	0.2578	7.74	0.2562	7.70	0.2576	7.73
H21	0.2214	16.71	0.2158	16.64	0.2185	16.93	0.2177	16.88	0.2203	17.10
H22	0.0665	9.23	0.0648	9.06	0.0653	9.16	0.0649	9.09	0.0652	9.16
D01	0.0017	2.96	0.0018	3.27	0.0016	3.02	0.0016	2.97	0.0016	3.08
D02	-0.0017	-4.12	-0.0017	-4.08	-0.0017	-4.30	-0.0018	-4.36	-0.0017	-4.27
D03	0.0006	1.54	0.0006	1.47	0.0006	1.69	0.0007	1.79	0.0006	1.69
D04	0.0004	1.97	0.0003	1.34	0.0003	1.86	0.0004	1.90	0.0004	2.13
D05	0.0010	6.08	0.0011	6.74	0.0011	6.63	0.0011	6.66	0.0010	6.60
D06	-0.0047	-8.79	-0.0046	-9.29	-0.0047	-9.72	-0.0047	-9.71	-0.0047	-9.79
D07	0.0052	6.84	0.0048	6.21	0.0050	6.63	0.0050	6.58	0.0052	6.93
D08	0.0025	2.96	0.0027	3.16	0.0025	3.05	0.0025	3.04	0.0024	2.92
D09	-0.0021	-3.66	-0.0021	-3.56	-0.0021	-3.54	-0.0021	-3.52	-0.0021	-3.68

Table 3.5b Spatial Model Comparison of Spatial Weights										
	A. N=5,628		B. 100		C. 200		D. 300		E. Variogram	
Variable	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
C01	0.0008	2.24	0.0007	1.99	0.0007	2.09	0.0007	1.96	0.0007	2.17
C02	0.0000	0.31	0.0000	0.18	0.0000	0.29	0.0000	0.37	0.0001	0.45
C03	0.0014	3.02	0.0013	2.77	0.0013	2.91	0.0013	2.87	0.0013	2.90
C04	-0.0646	-2.71	-0.0547	-2.21	-0.0595	-2.45	-0.0556	-2.27	-0.0617	-2.56
Lambda			0.1230	15.76	0.0740	8.58	0.1250	14.98	0.2800	40.43

Table 3.6a and b summarizes the impact of the spatial corrections on the t-statistics in the form of percentage change from the original OLS regression (A). There are two variables (To CBD and To Industry) that change significance depending on the weight. Again the direction change in the t-statistic is highly sensitive to the choice of spatial weight. The variables of interest for this dissertation do not change significance with the additions of the spatial correction. Still, with the addition of the spatial variables, the covenant variables do change by a larger percent.

Table 3.6a Analysis of Spatial Weights				
	T-Statistics			
Variable	100	200	300	Variogram
C	7,649.65	3,214.10	1,176.75	2,952.28
H01	3.01	0.91	1.07	0.29
H02	1.98	2.04	2.41	1.86
H03	-0.82	0.45	0.36	1.09
H04	-1.79	0.34	0.82	1.18
H05	0.71	-0.54	-0.67	1.20
H07	-3.14	0.32	-0.01	1.24
H09	5.50	2.12	1.46	1.09
H11	0.00	39.96	-9.76	9.94
H12	0.41	1.09	0.84	1.65
H13	0.12	-0.05	-0.21	-0.53
H14	-0.59	-0.17	0.04	-0.17
H15	0.00	-4.30	-3.25	-6.30
H19	-25.80	-2.23	-1.06	-0.24

Table 3.6b Analysis of Spatial Weights				
	T-Statistics			
Variable	100	200	300	Variogram
H20	1.92	0.42	-0.18	0.27
H21	-0.39	1.34	1.02	2.36
H22	-1.75	-0.69	-1.52	-0.76
D01	10.34	2.04	0.23	4.03
D02	0.00	-4.29	-5.84	-3.51
D03	-4.52	9.78	16.24	9.26
D04	-31.94	-5.66	-3.46	8.00
D05	10.86	9.14	9.67	8.63
D06	0.00	-10.48	-10.46	-11.29
D07	-9.10	-2.97	-3.73	1.39
D08	6.74	2.91	2.82	-1.32
D09	0.00	3.29	3.67	-0.81
C01	-11.18	-6.54	-12.59	-3.13
C02	-42.45	-6.53	16.90	43.11
C03	-8.40	-3.59	-4.89	-3.92
C04	0.00	9.65	16.07	5.65

These results do no change the conclusion of chapter 2: three of the four variables remain significant regardless of the addition of the spatial corrections. Still, the t-statistics are more sensitive when the spatial variables are added.

3.5 Summary

The use of spatial statistics is becoming more common in the regional hedonic literature. With the declining cost of computers, researchers are able to add more spatial statistics with greater ease of use. This is attractive to researchers because the problems associated with spatial dependence are potentially great. The software available today provides many options to better incorporate spatial elements. Still, when it comes to correcting for spatial dependence, the econometrics available today is only as good as the choice of weight.

This chapter's first goal is to illustrate the types of weights to use and the result of adding the spatial variables. Two approaches to choosing a spatial weight were estimated using micro-data for housing. The first approach borrowed from Bell and Bockstael (2000), used three weights of 100 yards, 200 yards, and 300 yards. These weights were chosen because they represent the size of a common subdivision in the city of inquiry. The second approach comes from Bowen, Mikelbank, and Prestegaard (2001). They use an empirical variogram to estimate the size of the spatial dependence. These two approaches yielded different results on certain variables even though all spatial weights passed significances tests.

The second goal of the chapter is to illustrate the effects of explicitly adding spatial variables. Since it is the case that spatial dependence in estimation is generated from missing variables, it must also be the case that some benefit can be gained by increasing the detail of spatial description. The reduced cost of computing power also makes the measurement of spatial variables easier to conduct.

Nine spatial variables were added to the basic model to control for spatial dependence. Spatial corrections were then made, which produced results that varied slightly depending on the weight used. Of the four homeowner association variables, three can be accepted at least at the 10 percent level. This is also true with the addition of the spatial variables.

Clearly, spatial dependence is more complicated than temporal dependence. Spatial dependence includes at least one additional dimension and the direction of influence is not as clear as temporal dependence. These additional complications make modeling spatial dependence difficult. No current method in spatial econometrics allows for much flexibility in the weighting matrix and still produces standard errors[29].

This chapter illustrates the three avenues for future research: 1) continued development of a commonly recognized method of creating a weighting matrix, 2) create a more flexible procedure to use the weights and still generate standard errors, and 3) use the current developments in GIS technology to include spatial variables.

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[29] As discussed above, Bell and Bockstael (2000) do present a generalized method of moments procedure which allows for multiple weights to be used simultaneously. But their approach did not produce standard errors and therefore common statistical significance cannot be tested. Their approach also does not give guidance to generating the spatial weight.

Ch IV A Coasean Look at Homeowner Associations

4.1 Background

Zoning and user fees are akin to direct controls and Pigouvian taxes, and deed restrictions and hazard charges[30]. All six tools are used to correct for market failures and they are either a price tool or a quantity tool. However, there are differences in the institutions that implement them. Differences between municipalities and community associations are significant but only because the American law treats them differently. This, of course, raises two questions: why does the law treat them differently and should the law treat them differently? Frug (1980) and Ellickson (1982) have both made these inquiries and came to different conclusions; Frug generally desired more regulation of community associations and less regulation on cities, while Ellickson generally desired less regulation of cities and community associations.

Chapter 2 provided evidence that community associations improve land values even within zoned municipalities, which begs the question, are community associations better equipped to correct for market failures? This paper will further explore the differences between municipal governance and community associations using some examples of Weld County, Colorado.

Residential zoning in Weld County allows for a wide variety of signs to be placed on private property. The political advertising sign that a homeowner places in his yard

[30] Hazard charges are assessed by HOAs to homeowners who engage in activity that will imperil the insurance of any public good.

has characteristics that are excludable but not congestible in normal use, although the streets and sidewalks necessary to see the sign are congestible and possibly excludable. The homeowner gains a positive net benefit from placing the sign in his yard; evidenced by the fact that he presented the sign. Some neighbors gain utility from the sign, while to others the sign is a nuisance. Since the homeowner has the property right to place the sign, the local government will uphold the status quo. The sign will be removed only if voluntary exchange takes place. Assuming the homeowner's preference for the sign does not change, the sign will stay unless the homeowner is adequately compensated. The necessary compensation for voluntary exchange may be greater than the value the homeowner places on the sign. For instance, if the homeowner believes that by accepting compensation to remove the sign others in the community will view him as a "sellout," he will hold out for an offer greater than the value he places on the sign.

Any person bothered by the sign could offer to compensate the homeowner and if the compensation was great enough then voluntary exchange would take place – both parties would be better off. However, this event may not be Pareto improving on a social scale because not all of the affected people have been contacted. To organize everyone affected by the sign would be costly. Social efficiency will not be attained except by accident.

Can the local government lower the transaction cost incurred by voluntary exchange? Local governments can hold city (or county) meetings. However, non-government oragnizations can do this as well[31]. It is not clear that a local government

[31] One such example happened in Eaton, Colorado. The local high school's mascot is the Eaton Reds. Some Native Americans were offended by the mascot and pressured the school district to remove the mascot. Many residents of Eaton met in the ensuing months with and without the sponsorship of the city or other government institutions.

could generally organize people at a lower cost. The local government could place the decision on a ballot to be voted on during a normal election cycle. The marginal cost could be small in this case, but a vote cast does not signal the intensity of one's willingness to pay or willingness to accept payment. Social efficiency will not be attained except by accident.

Can the local government correct the market failure without directly organizing the people? It has long been widely accepted in the economics profession that the problem of externalities can be solved with a properly constructed Pigouvian tax. The problems of finding the correct tax are enormous. The local government will need to find the value each person affected by the sign places on the sign's existence or removal. Social efficiency will not be attained except by accident.

The next option for the local government is a direct control commonly called zoning. In this case the city will attempt to fix the number or type of signs that can be used in a place. The problems of zoning are similar to those of a Pigouvian tax; the city will still have to decide the right level of restrictions. Social efficiency will not be attained except by accident.

The goal of this chapter is three fold. First, I will compare the Pigouvian and Coasean approaches. Second, I will discuss the potential impact of community associations in a property rights view based on the Coasean ideal that getting the entitlements right is more important than the Pigouvian ideal of getting the prices right. Finally, I will present some empirical evidence describing the decision of different voting requirements on residential property.

4.2 Critique of the Pigouvian Approach

William J. Baumol and Wallace E. Oates (1988) quickly dismiss the "Coase Theorem" as an impractical method to correct for market failures: "Even where the number of polluters in a particular neighborhood is small, so long as the number of persons affected significantly by the emissions is substantial, the process of direct negotiation and agreement will generally be unmanageable" (Baumol and Oates 1988, pp. 10). They also suggest that Coase himself acknowledges this limitation (Baumol and Oates 1988, pp. 11). However, Coase (1988, pp. 179) has responded to this criticism as missing his point. His point was not that we live in a world with zero transaction costs but that transaction cost are significant and all economic actors face them. The government or any other organization will find many obstacles in their quest to correct prices. In light of the complications of Pigouvian taxes, an alternative could direct efforts to reduce transaction costs, assign property rights, or redistribute property rights in the spirit to correct market failures.

This section will evaluate further concerns of a Pigouvian tax system, critique Baumol and Oates' proposal, and offer an alternative using the Coasean tradition. This section will use the specific example of community associations in support of the Coasean alternative. The choice of example is partially in response to Baumol and Oates' (1988, pp. 12) list of externalities that are too difficult for the market to handle.

4.2.1 Baumol and Oates' Second-Best Solution

Baumol and Oates recognize the severe problems in coordinating such an activity as a large-scale externality correction. The amount of information needed to find optimality is costly and much of it may not exist. The debate of economic calculation on a large scale was typified by Hayek (1945) who made clear his belief that these calculations cannot be made. It is true that Hayek's plea has often fallen on deaf ears but that is not to say that his point is not valid. Baumol and Oates (1988) do recognize this issue[32] and suggest a second-best policy.

Their policy is one that requires iterations. The basic process is as follows: build biomedical information on the relation of the pollution to people; use a political process to find an acceptable level of pollution; set a tax or a permit level to achieve the desired level of pollution; if the desired level is not achieved then adjust the tax accordingly. This process will not meet optimality, except by accident, but it will provide a system of pollution controls that are cost minimizing and in most cases[33] are far superior to direct controls. This iterative process is designed to deal with the information issues and stems from an entrepreneurial process of discovery.

Entrepreneurs are not mystically endowed with the ability to avoid imperfect information issues. Rather, they too must work through iterations to *discover* information that did not previously exist. Their reward is temporary economic rent; therefore they have an incentive to continue these iterations just as a miner continues to dig. As long as there are rents to obtain then the entrepreneur will use his/her creativity to overcome obstacles. Baumol and Oates (1988) also suggest this iterative approach.

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[32] Baumol and Oates (1988, pp. 176) make clear their intentions: "the rational for the imposition of environmental standards is clear, and it seems to us that the rejection of such crude measures on the grounds that they will probably violate the requirements of optimality may well be considered a kind of perverse perfectionism."

[33] Baumol and Oates (1988, Chapter 13) argue when a short run stochastic process mainly drives externalities, then direct controls may be the best choice.

What institution will carry out this task? – the private entrepreneur? No, rather some level of government agency, preferably federal or even international level, will determine and fund the program. Is a federal government the best institution to carry out iterations? Baumol and Oates (1988) do warn the reader of potential dangers but leave the warning in a small footnote on page 163: "Of course, the political problems likely to beset either iterative process must not be minimized." The political problems likely to beset these iterative processes may be so great that it makes the problem of an externality much worse. Furthermore, how would one know that the problem is worse when true optimality is unclear?

4.2.2 Perfection and Comparing Institutions

Without understanding the possible government failures that can arise no economist can rationally compare the market outcome with the government intervention outcome[34]. Anderson and Leal (1997) list many examples of private organizations producing and protecting public goods. One such example is the bird sanctuaries on Avery Island, which is owned by the McIlhenny Company. Visitors may see the birds for a fee of $5.25 for adults and $3.75 for children. A well trained economist might point out that the bird sanctuaries are a public good and the price for admission should be zero or close to it in times of congestion. Still, the total cost of the sanctuary must be met with

[34] One example of institutional comparisons comes from Klibanoff and Morduch (1995) who are from Northwestern University and Harvard University respectively. They compared a system where individuals negotiate to internalize externalities (patterned from Coase, 1960) and an operating Pigouvian tax system. They conclude on page 241: "when autonomy is respected, and when firms or localities decide whether to make investments of a given size, voluntary agreements may or may not improve the outcome in a large range of cases." Furthermore "since even with private information and externalities, a central government can implement efficient outcomes." Klibanoff and Morduch (1995) may be just making another point about market failures, which would be fine, but to continue to suggest that the government can be assumed to costlessly overcome these information issues is - in my view - a mistake.

revenue from somewhere. The argument here is the private company cannot charge non-users for the operations in a lump-sum tax because they have no legal right. Thus, the government should tax the citizens for the operation and charge no admission fee.

Lory State Park in Colorado is another example of a public good. The State of Colorado is in charge of the operations and they also charge an admission fee. They should find the willingness to pay for everyone who has a non-zero valuation on the use or existence of these public goods. Furthermore, to avoid any improper redistributional effects, each person should be taxed the same amount for the public good or the amount of their willingness to pay.

Information and the tax system are imperfect and the state must make do. The economic literature is deep on all of the practical corrections. Still, they often miss some of the more important issues. We live in a second-best world but our models often make assumptions that require a perfect or mostly perfect world. This thought process can be helpful but taken too far will lead to the wrong conclusions. There are two points about incentives I will make here.

First, the world is dynamic and therefore the government must change with it. The population over time will change in size, socio-economic makeup, and preferences. Every one, five, or ten years, the economist will need to come back and study the optimality of Lory State Park. The longer the time between assessments the more economic inefficiency is created but there is a tradeoff between the lost economic inefficiency and the cost of completing the study. Therefore, the economist must study the optimal amount of time between assessments, which will also be a dynamic measurement. Furthermore, the study must cost-minimize, which will mean the economist will sometimes choose not to gather all the relevant information. On the other hand, the McIlhenny Company has information given to them through the market. The price they charge reveals the willingness to pay. They have at all times an incentive to change their size, advertise their existence, or change the price of the sanctuary depending on the market information they receive. The cost of acquiring this information will be the economic loss due to some people being deterred from going. This cost will likely be minimized if people or corporations donate to the preservation of the bird sanctuary. What inefficiency is left must be compared to the lost of inefficiency and explicit cost of having an economist do the assessment.

The second point: who is to measure the quality of Lory State Park? If the state park system was completely funded by the general state tax system then the price paid for the parks will be hidden in the bulk of other taxes that must be paid. However, only the visitors of the park will be able to observe the quality of the park and critique its upkeep. By placing some or the entire price on the users, the proper feedback will exist. Individuals can see the cost and evaluate the net worth of the park.

In conclusion of this section, setting the price to zero for a public good may not be optimal in a second-best world. There is information provided to the operator of the public good that is difficult to gain elsewhere and without a market price. Proper incentives must also be inline to the operators of the public good. With these points in mind, one can conclude that the market provision of public goods may be better than the public provision. *It is not a matter of dogma but a matter of empirical analysis.* However, by focusing on only the imperfections of the market or assuming the market creates the externality alone economists tend to lose sight of real improvement potentials.

If economists would compare institutions in the second-best instead of assuming one is always better than the other given the situation, then a more rational discussion of solutions can be established.

4.3 Coasean Economics: An Alternative

The famous 1960 paper written by Professor Coase did not come to an exciting or interesting conclusion as Professor Stigler (1966) suggested. The idea that commodities tend to end up with people who desire them the most had been suggested by Adam Smith almost 200 years earlier. Coase simply removed the assumptions of the neoclassical model and replaced them with the equally constraining assumption of zero transaction costs. Coase did not prove the efficiency of the market. Under the assumptions of zero transactions costs, socialism could function equally as well (Fischel 1985). What Coase did do was provide another approach to understanding and correcting market failures. All market failures are by definition a profit potential waiting to happen. Coase's approach is to first examine why this profit has not been realized. In this section, there are three points I wish to make: 1) both private and public entities face transaction costs so one cannot conclude *apriori* that transaction cost favor public action; 2) firms and other private institutions exist to reduce transaction cost and they may be better at overcoming these obstacles; 3) Coasean economics and the Pigouvian approach are not in conflict but should rather complement each other.

First, Coase's 1960 paper was not intended to promote the idea that we live in a world of zero transaction costs but just the opposite. Both the private entity and the government face these costs. Much of the cost comes from informational issues, which I have discussed at length above. Other costs can stem from the legal system. For example, zoning laws prohibit certain uses that may be very beneficial for all the parties involved. Zoning laws cannot, however, be exchanged for compensation (Fischel 1985, Chapter 5). Catalytic converters are legally mandated on all vehicles regardless of other technologies that might be available or where the vehicle is operated. Most roads, highways, and interstates, are operated by some level of government without the internalization of the total cost to society of those roads. These examples are given to illustrate the possibility that some externalities exist because certain laws and government activities prohibit or limit the ability of private entities to exchange. Thus, the policy should be to remove these impediments.

Secondly, in Coase's other famous paper (Coase 1937), he inquired why a firm would exist. He concluded that there are costs associated with using the market for all transactions. Firms internalize some of these activities but not all because there are costs to excluding the market. A cost-minimizing firm will only take on activities if the marginal bureaucratic cost of the activity is less than the marginal cost of using the market. There is an incentive for firms to find ways to reduce the bureaucratic and market costs. Individuals may not find it profitable to exchange or negotiate through the market but rather through a government, corporation, non-government organization, or a private government.

Finally, there is no reason to believe that the Coasean approach and the Pigouvian approach are in conflict. These approaches come from different points of view but do not exclude each other. The approach can give you different results, however. As McCloskey (1997) explains: the Pigouvian approach focuses on getting the prices right, the Coasean approach focuses at getting the entitlements right and promoting an environment for exchange.

To illustrate this point let us use an example. People may wish to live closer to their work and shopping centers. They may not want to use their vehicles but walk or use public transportation and in fact may wish to live in a place like Portland or Los Angelis (the most dense place in America according the 2000 census). Still, the 2000 census shows a trend in America of people still wishing to move out of the city even in the face of lower wages. One explanation of the census data could be that people are not being offered the public goods they desire in the city. Flores and Graves (2001) explore this possibility. Graves (2001) further extends this analysis to explain why we see the amount of suburbanization that we do. He concludes that people are trying to purchase small private pieces of open space because the cities are not providing enough.

If people do want these public goods, then we should see, all else equal, higher housing prices (or at least higher land prices) in the areas that do provide more of these public goods. Developers have an incentive, if they can capture the returns, to then promote this type of land use design. Furthermore, large developers would then wish to design these cities themselves and internalize all the gain. That is, this market failure has large profit potential - so why is it not being exploited? I will argue below that it is being exploited.

The major obstacle to providing better cities may be a government failure. Fischel (1997) contends that the zoning laws are too restrictive. Zoning laws are the driving forces behind the large suburbanization in the U.S. because it forces developers to limit density and prohibits much of the mixed-use neighborhoods people presumably desire. Still, entrepreneurs have found ways to convert the externalities and public goods into a profit opportunity.

4.3.1 There Is Gold in Those Market Failures

The "Coase Theorem" coined by Professor Stigler is not an interesting theoretical conclusion and has properly received much criticism. Its assumptions are very restrictive. What Coase did offer was an *approach* to viewing the workings of the market in a second-best world. The goal of this paper was to illustrate some further caveats of the Pigouvian tax system, critique Baumol and Oates' alternative, and to provide another alternative offered by Coase.

In a second-best world a Pigouvian tax system can easily be misguided and generate more inefficiencies. Baumol and Oates (1988) clearly define such problems but there are four, which are worthy of consideration: first, there are incentives to mislead an agency about the cost or benefits of any action; second, defensive activities may be large enough to require no correction; third, altruism has a significant effect depending on how it is defined; and finally, the double dividend is unlikely to be a net benefit[35].

Baumol and Oates' solution to these problems is the design of an iterative approach. Their approach is no different than an entrepreneurial process in that it is a discovery processes. The information needed must be discovered through study and trial-and-error. However, the validity of this process must be determined through a study of the institution that is charged with running the tax system. The public choice literature has illustrated many possible faults with government activities, most notably the

[35] See Shibata and Winrich (1983) and Johansson (1997).

principle-agent problem. Baumol and Oates do recognize these issues but do not include it into their analysis of a Pigouvian tax system. Thus, they leave little opportunity to compare alternative systems.

A very viable alternative approach to the study of market imperfections comes from the Coasean tradition. This approach places emphasis on examining the cause of the externality - why are transactions not taking place? From this beginning, an economist may find the cause to be government restrictions, market, or the legal system. With this broad range of culprits, an array of solutions could be suggested including Pigouvian taxes, assignment of entitlements, removal of laws, redistribution of entitlements, or doing nothing. However, the total effectiveness of each must be analyzed or one could conclude falsely that a Pigouvian tax is always feasible and optimal. The obstacle that keeps the transaction from happening may be technical or legal and they may require a great deal of ingenuity to overcome. Community associations are a good example of non-government actors finding solutions to these obstacles.

4.4 Community Associations

The central theme of Coase's most famous work, The Problem of Social Cost, is that when transaction costs do matter, the assignment of rights becomes important (Coase 1988). By focusing on the property rights of an institution a better understanding of how that institution will be able to deal with economic problems. This approach is well suited to urban economics where people, because of the fact that they live in close proximity, are swarmed with externalities and opportunities for public goods. Individual and collective action will need to take place and the institutions housing this action must be suited to specific tasks.

The mix of institutions most often seen in the urban areas is a combination of municipal government and market activity. These institutions are not separate of each other. While it may seem that municipal governments deal with collective action and markets with individual, municipal governments exist within a market for government services, as Tiebout (1956) has clearly detailed.

Under Tiebout's theory, if there is enough mobility by residents then municipal governments will act like cost minimizing agents looking to attract residents otherwise they will experience a decline in tax revenues. Public goods would be provided and externalities would be dealt with as well as can be expected given current technologies.

If a municipal government were providing the best possible corrections for public goods and externalities, then an opportunity to gain from additional action would not exist. This is most evident in the sustained growth of community associations within the jurisdiction of municipalities.

Furthermore, the institutions that exist in western markets are themselves very diverse and flexible. They provide a wide variety of products while doing so within many forms of organization. By contrast, there are no examples (to the best of my knowledge) of cities who offer a franchise (decentralized) style of organization. Compared to community associations, cities are quite centralized and offer little direct power to neighborhoods. Community associations of as little as 500 homes will often allow individual neighborhoods to tailor the covenant to their specific desires. The result is that community associations exhibit a great deal of diversity between and within (Rogers 2004)[36].

The above discussion is not to imply that community associations are free from conflict. McKenzie (1994) provides, in detail, some examples that arise in community associations. Still, conflict is an inevitable part of a society that exists with scarcity. The promise of community associations is not the elimination of conflict but a useful and perhaps cost minimizing organization to allow people to deal with conflict. The final subsections will inquire into some elements of community associations and their ability to deal with conflict.

4.4.1 Dealing with Public Goods

Community associations are not only capable of providing many public goods through the use of covenants but they may be in a better position to provide the goods compared to a municipality. Coase (1974) provided the example of lighthouses in England. He argued that even though the lighthouse is a public good (thus subject to a general tax in economists' minds); the maritime industry is in a far better position to judge the operation of the lighthouses and should therefore fund the good. In the same vein, community associations are more local and thus have greater access to time and place specific information than the local government.

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[36] One such example includes a cul-de-sac neighborhood in Littleton Colorado where one elderly couple had a problem with the children playing in the cul-de-sac. The State of Colorado bans any person from walking or playing in a street. The State has left the counties to decide what they consider a street. Douglas County did not make a decision and therefore all streets are illegal to play in but the law in rarely enforced in residential and low traffic areas. The situation was eventually resolved and the neighborhood did purchases the house from the elderly couple but only after more than a year of negotiations and after Douglas County provided one variance to the specific cul-de-sac to allow children to play in it. By contrast many large HOAs allow individual neighborhoods to decide directly (without the approval of the entire HOA or county) how to set such policy.

Many economists have documented the impact of non-municipal provision of public goods including, Foldvary (1994), Stabile (2000), Boudreaux and Holcombe (2002), and Beito (2002). These studies do not attempt to provide a dollar value of improvement over municipal provision but instead are written to show that non-municipal organization can provide a vibrant (i.e. the market has not rejected it) form of public good.

4.4.2 Dealing with Externalities

This subsection will compare how municipalities differ from community associations in dealing with externalities. The municipality (Fischel 1985) and the covenant can be viewed from a property rights approach. Municipal zoning can be thought of as a property to be bought and sold (Fischel 1985) but legally zoning cannot be outright sold to the highest bidder. However, covenants are treated explicitly as property rights by the legal system, while zoning is not. Furthermore, the community associations may be in a better position to decide on the cost of many externalities.

Without zoning or covenants a party is free to do as they wish without regard to neighbors. However, improvements to a house and the neglect of a house will spill over to other neighbors. Neighbors could ask or offer payment to neglectful neighbors in return for more acceptable behavior. If the willingness to pay by the neighbors is at least as large as the willingness to accept by the homeowner then a transaction might take place and the nuisance will end. If a transaction does not take place, then the homeowner may simply value the generation of this nuisance more than the neighbors are willing to pay or a transaction cost may be involved. The former situation is not often regarded as a problem because the person who values the property the most owns it. The latter situation is normally considered a problem. The neighbors may value the property greater than the homeowner but the transaction cost is too high to be overcome.

In a Coasean view, the options are to adjust the property rights or to reduce the transaction costs. Covenants change the property rights to the house and can offer a forum in which to lower transaction costs. The covenant restrictions are really identification of property. A restriction on burning trash means that your neighbor has some right to how your parcel is used. This adjustment of property rights can improve social welfare if the neighbors value a trash-burning free environment greater than a homeowner values burning trash. A developer has no way of knowing who will value the right more but by creating the covenant the community has two advantages to deal with externalities.

First, the very acknowledgement of restrictions will signal to potential homeowners the brand of community that the neighbors are looking for. For example, a restriction on where and when recreational vehicles may be parked can reduce the number of recreational vehicle owners in the development and thus sort them to other communities where those vehicles are more tolerated or even celebrated. By explicitly signaling to potential home buyers of the social norms of the community, the community can avoid some future conflicts instead of relying on a social norm where the average behavior can come in conflict with an outlier.

Of course, sorting people into communities is nothing new; the most infamous examples being informal racial segregation. Still, the more reprehensible forms of sorting are illegal and the gain from being clear to all parties involved can be quite large.

The second advantage of a community association over a common neighborhood is the established and explicit organization to deal with conflicts. Covenants normally come with some form of association that can provide a forum for grievances and formal communication among neighbors. This formal institution can reduce the cost of organizing and identifying the wishes of the members.

Of the two advantages community associations have, neither has been rigorously studied to identify if these advantages produce any value. A great deal of information on urban/community organization could potentially be gained from such study.

Several studies have been produced, which show the benefits of covenants regardless of if the community association exists within municipal zoning or not. The literature on community associations and zoning includes, Seigan (1972), Speyrer (1989), Cannaday (1994), Fischel (1994), Foldvary (1994), Hughes and Turnbull (1996a and b), Boudreaux and Holcombe (2002), Foldvary (2002), and Nelson (2002). In the case of the hedonic literature,[37] the estimates range from 2 to 6 percent improvement on lot values depending on the age and existence of municipal zoning.

4.5 Neighborhood Voting

After the community association development is constructed and populated, new externalities will rise. What should be the mechanism which deals with these problems? If democracy has problems in the public and corporate arenas, then won't it still have problems with community associations? Is it wiser to divide votes by property or by individual? This section will summarize the sparse economic literature on voting within

[37] See Speyrer (1989), Cannaday (1994), and Hughes and Turnbull (1996a) for example.

community associations and provide some empirical description of community association voting in Weld County, Colorado.

4.5.1 Literature on Neighborhood Voting

Collective action requires some discussion making process. A democratic process entails some survey of those involved with the action. This process can be quite varied. Municipalities are required by the *Avery* decision to apply a one-person-one-vote system to all residents (Ellickson 1982). Whether the *Avery* decision is the best voting system has not been rigorously established but it only applies to government agencies. Corporations of all kinds, including community associations, are exempt from this ruling and therefore free to choose among many voting systems. And yet with the large number of community associations that do exist, there are no current examples of an association that follow *Avery* (Ellickson 1982 and Rogers 2004). Rather, community associations divide voting share by ownership, require ownership of property for a voting status, and/or require super-majorities or unanimous votes for decisions.

Barzel and Sass (1990) provide a look at condominium association voting in Bernalillo County, New Mexico. They posit that organizations must deal with three costs to voting: the wealth transfer cost, the decision making cost, and information costs. The first two costs come from Buchanan and Tullock (1962) and the last from Barzel and Sass (1990). The wealth transfer cost is the resources expended in order to use the voting system to transfer wealth or to avoid wealth transfers. The decision making cost is the resources used to reach a decision, which includes the cost of strategic bargaining.

Developers who wish to sell communities with covenants and public goods must convince the buyers that the association will provide them a net benefit. Barzel and Sass (1990) identify three factors that potential buyers will be interested in: the current value of the property, the perceived future growth (decline) in value of the property, and the cost of the voting system. Constructing a low cost voting system is one way to fetch a higher price for the property involved. Thus, a developer will attempt to line up the interests of the voters with the association benefits.

Given the results of Barzel and Sass (1990), the expectation is that homeowner associations (HOAs) will follow a voting system pattern similar to the condominium associations (COAs). There will likely be several voting systems where some assign votes by square foot of living area, value of house, or even parcel size. However, despite the fact that Colorado law allows for many voting systems, there are no HOAs in Weld County, Colorado, that provide shares of voting on the basis of square feet of living space or assessed value. All HOAs in this study have only two types of voting membership, one-vote-one-lot and three-votes-one-lot. The first membership is for homeowners. Each lot is provided one vote regardless of how many people live in the house[38]. The second membership is reserved for the developer and is normally phased out after a certain percentage of houses in the development are sold.

This homogeneity more closely resembles corporate voting than the multiple voting systems described by Barzel and Sass (1990). Still, voting mechanisms based on size of home or other characteristics that a homeowner can have influence over, will encourage additional construction in order to acquire more votes. Owners in a HOA, in

[38] Families or individuals may own more than one lot and receive a vote from each lot owned.

contrast, are not as able to change the characteristics of the condo[39]. It is not clear, at this time, if condo owners would actually attempt to change their voting share by changing their housing characteristics. Owners of a single-family home are less constrained to build additions to their property.

Voting systems do differ in two respects. First, HOAs do set different standards on the voting decision rule. For example, the decision rule for passing an amendment to a covenant ranges from 51 percent to 100 percent in Weld County. Furthermore, the decision rule is not constant in every HOA. Some HOAs have decision rules that start out at 90 percent and after 5 or 10 years, the rule automatically falls to 75 percent.

The second differentiation in voting is the addition of voting membership to outside members. In some HOAs, the owner of a home's first mortgage is given a vote for each property. To pass an amendment in this case, the decision rule must be met for the owners of the property and the owners of the first mortgages on each property. This system operates similar to Congressional voting. By Colorado law, no homeowner can lose his/her vote to the owner of the first mortgage.

To promote harmony with the interests of the homeowners and the functions of the HOAs, the developer must keep several things in mind: I will discuss four. First, when a developer decides to set a decision rule, a trade off must be meet between strategic bargaining and wealth transfers (Buchanan and Tullock 1962). To avoid any transfers of wealth a unanimous decision rule could be set but that would increase the chance and cost of strategic bargaining. Reducing the cost of strategic bargaining solely through the decision rule can only be made by reducing the level for a passed

[39] Condo owners are able to change their voting share in a value based voting system if they keep their condo more marketable over time.

amendment. Both Buchanan and Tullock (1962) and Barzel and Sass (1990) conclude that the more heterogeneous a development is planned to be, the more inclusive (i.e. the closer to unanimous) the voting system will be. The reasoning follows; the greater the inclusiveness the higher the voting costs but the less likely that the minority will be harmed by the majority.

Second, developers must also consider the size of development. Buchanan and Tullock argue that as a group becomes lager the voting cost, due to strategic behavior, will increase as a lager number of votes are necessary to reach an agreement. However, Kiesling (1968) argues that it is also the case that the number of votes necessary to block a decision. Barzel and Sass concluded that the size of condominium is ambiguous with respect to the inclusiveness of the voting.

Third, developers for HOAs commonly add a (or several) public good(s). If these goods are constructed then, Barzel and Sass (1990) argue, they are less likely to become a voting issue and therefore the voting can be made less inclusive in order to reduce the decision costs. Still, public goods require maintenance as they depreciate. Since there can be many ways to combat depreciation and many levels of effort to combat depreciation, it may be the case that the public goods require additional decisions. Some members of the HOA may wish for the pool to be in "pristine" condition, while others may be satisfied with an average level of maintenance. However, only one level of maintenance can be pursued and all members will be required to pay for it. In this scenario, I would predict that the inclusion of public goods would increase the inclusiveness of the voting.

The final decision I will discuss is the "branding" of the HOA. Developers can try to avoid future conflicts by attracting a homogeneous group of buyers. The HOA can thus be made to reduce potential conflicts before families even move into the neighborhood. Therefore, I would expect that HOAs are designed to be homogeneous within the development.[40]

4.5.2 Empirical Tests on Neighborhood Voting

To test these theories, a dataset including all the single-family housing of both Greeley and Windsor, Colorado is constructed but subcode. Subcodes are by no means the only definition of a neighborhood by they do represent a conscious effort by a developer to construct housing. A separate subcode can include hundreds of houses or only one depending on the conditions a particular developer is facing. Furthermore, individual subcodes may reflect the different stages of construction of a neighborhood. For all HOA neighborhoods there is clear documentation of which subcodes are meant to be considered a neighborhood. Therefore, all subcodes meant to construct a neighborhood and thus under the same covenant are grouped together. Unfortunately, that is not the case for non-HOA developments. There are 263 non-HOA subcodes in Greeley and 34 in Windsor that have more than one house. There are 50 HOA subcode groups in Greeley and 17 in Windsor.

The first test will look at the decision of developers to construct neighborhoods with similar characteristics (see table 4.1) to reduce the chance for conflict. The results are summarized in table 4.2. The second test will look at the decision of developers to set

[40] As stated above, HOAs are very diverse neighborhoods when compare to each other.

voting rules that are sensitive to the issues discussed above. The results are summarized in table 4.4.

Table 4.1 Descriptive Statistics by Subcode [41]				
Greeley Non-HOA (263)	Mean	Max	Min	St. Dev
Number of Homes	15.7	313.0	2.0	26.9
Parcel Area	9,321			2,782
Living Area	1,360			589
Parcel Area % St. Dev.	0.22	1.15	0.00	0.19
Living Area % St. Dev.	0.27	2.26	0.00	0.26
Greeley HOA (50)	Mean	Max	Min	St. Dev
Number of Homes	56.8	219.0	4.0	51.2
Parcel Area	9,205			1,870
Living Area	1,528			285
Parcel Area % St. Dev.	0.22	0.63	0.03	0.12
Living Area % St. Dev.	0.19	0.56	0.05	0.10
Public Good	0.62	1	0	0.49
Windsor Non-HOA (34)	Mean	Max	Min	St. Dev
Number of Homes	15.8	61.0	2.0	16.8
Parcel Area	11,413			2,349
Living Area	1,355			294
Parcel Area % St. Dev.	0.22	0.83	0.00	0.16
Living Area % St. Dev.	0.24	0.71	0.01	0.16
Windsor HOA (17)	Mean	Max	Min	St. Dev
Number of Homes	49.2	272.0	4.0	72.2
Parcel Area	13,193			2,874
Living Area	1,776			430
Parcel Area % St. Dev.	0.24	1.00	0.06	0.22
Living Area % St. Dev.	0.20	0.36	0.06	0.09
Public Good	0.71	1	0	0.47

The variation of parcel area and square feet of living space will be used to proxy neighborhood homogeneity. This is by no means a perfect measurement but this data is readily available and parcel area and living area are both positively related to the price of a home. These variables should be related to income. Further study could be done to

[41] See the appendix of chapter 2 for all minimum and maximum housing values.

more precisely measure the characteristics of homeowners by neighborhood: subdivision or census block.

Table 4.1 provides the descriptive statistics for Greeley and Windsor by HOA status. The variation of parcel area and living area is provided by the percent of standard deviation of each subdivision or subdivision group. The percent of standard deviation is simple the standard deviation divided by the average. This way a useful comparison can be made between subdivisions with differing average size.

The HOA subdivisions are clearly larger (more homes) on average but that is to be expected because many HOAs include public goods that require some economics to scale and HOA subdivisions are grouped together if they are under the same covenant. Even with the larger number of houses in the developments the percent standard deviation of parcel area is very similar among all four groups. There is more variation between the groups with the percent standard deviation of living area with HOA division have less variation. It is also of interest that for non-HOA divisions, the percent standard deviation for parcel area is larger than living area but that characteristic is reversed for HOA divisions. The last statistic in table 4.1 is the percent of divisions with public goods. This data is collected by scoring a one for every covenant that has a HOA designed to deal with a public good. Some HOA divisions are still under construction and thus have not built or completed their public goods. Therefore, the variable Public Good measures at least the intention and contractual ability to add a public good.

To describe the difference between the HOA division and a non-HOA one, the percent standard deviation of parcel area and then living area are regressed on the dummy variable Covenant. This variable measures if a covenant is present in the division. Table 4.2 summarizes the results.

Table 4.2 Regression Results on Developers' Decisions to Homogenize				
Variation in Parcel Area	**Greeley (313)**		**Windsor (51)**	
Variable	Coefficient	Prob.	Coefficient	Prob.
Covenant	0.0008	0.9763	0.0186	0.7240
C	0.2159	0.0000	0.2167	0.0000
R-squared	0.0000		0.0025	
Adjusted R-squared	-0.0032		-0.0174	
F-statistic	0.0009		0.1261	
Prob. (F-statistic)	0.9763		0.7240	
Variation in Living Area	**Greeley (313)**		**Windsor (51)**	
Variable	Coefficient	Prob.	Coefficient	Prob.
Covenant	-0.0728	0.0544	-0.0394	0.3412
C	0.2672	0.0000	0.2410	0.0000
R-squared	0.0118		0.0181	
Adjusted R-squared	0.0086		-0.0015	
F-statistic	3.7271		0.9233	
Prob. (F-statistic)	0.0544		0.3412	

The top half of the table presents the results for the percent standard deviation of parcel area. As expected, there is no significant difference between the variation parcel area of HOAs and non-HOAs. The bottom half of the table presents the same but for the percent standard deviation for living area. The variation is significantly different in Greeley but not so for Windsor. Still, both signs are negative as expected. This shows, for Greeley at least, that developers do construct HOA neighborhoods with about 7 percent less variation in living area.

The second objective is to identify what impacts the decision to construct a voting decision rule. Table 4.3 provides the summary statistics of the four additional variables. All divisions that have less than ten houses are removed from this set because the percent decision rule will have little meaning. The dependent variables are Amendment, which is the decision rule for homeowners on amendment multiplied by 100, and Mortgagee (also multiplied by 100), which is the decision rule for first mortgage holders. The additional independent variables are Restrictions, which is the number of restrictions stated in the covenant for use or construction, and Covenant Year.

Table 4.3 Descriptive Statistics on Covenant Details by HOA

Greeley (47)	Mean	Max	Min	St. Dev	% St. Dev
Amendment	65.9	100	51	10.2	0.155
Mortgagee	21.3	75	0	30.1	1.409
Covenant Year	1994.6	2003	1976	7.1	0.004
Public Good	0.60	1	0	0.5	0.831
Restrictions	20.5	36.0	1.0	6.1	0.298
Windsor (14)	Mean	Max	Min	St. Dev	% St. Dev
Amendment	71.9	90	51	10.8	0.150
Mortgagee	23.0	100	0	36.0	1.567
Covenant Year	1995.8	2003	1989	3.3	0.002
Public Good	0.69	1	0	0.5	0.696
Restrictions	22.1	30.0	13.0	4.7	0.213

The results of the second regression set are summarized in table 4.4[42]. Windsor is not included in this regression because of the low number of observations. For the mortgagee decision rule, only Public Good is significant. This does have the expected positive sign. First mortgage holders do have an interest in the value of the property and will have an interest in the common goods which each house will derive value from.

For the amendment rule, only 1 of the 8 variables is strictly significant at the 10 percent level. However, three others are close to the 10 percent level. The variation of parcel area is significant and has the expect sign. Table 4.2 showed that HOA

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[42] Interaction terms were also tested between the standard deviation of parcel area and number of houses as well as standard deviation of parcel area and average parcel area but no significant coefficients resulted. The same was true with living area.

neighborhoods have less variation in living area possibly because developers are reducing heterogeneity but no difference was detected in parcel area. This may be because developers have decided to directly deal with heterogeneity with living area but to indirectly deal with parcel area through the voting system. Still, the economic significance seems small; a one percent increase in the standard deviation of parcel area leads to an increase in the voting decision rule by over .31 percentage points.

Table 4.4 Regression Results

Greeley (47)	**Amendment Rule**		**Mortgagee Rule**	
Variable	Coefficient	Prob.	Coefficient	Prob.
Parcel Area % St. Dev. *100	0.31	0.017	0.40	0.264
Living Area % St. Dev. *100	-0.06	0.713	-0.36	0.394
Number of Homes	-0.02	0.479	0.06	0.449
Public Good	6.97	0.048	36.22	0.000
Restrictions	0.19	0.397	0.36	0.556
Covenant Year	0.47	0.072	-0.85	0.240
C	-886.40	0.088	1,683.32	0.241
R-squared	0.406		0.325	
Adjusted R-squared	0.317		0.224	
F-statistic	4.556		3.210	
Prob. (F-statistic)	0.001		0.011	

The Public Good variable is also highly significant. As expected, the addition of a public good of any sort will increase the amendment rule. What the Public Good variable does not include is any description of the value or type of good available. A more detailed data may show differences in impact with respect to the amount of maintenance required; where high-maintenance goods requiring a greater inclusiveness in the voting rule.

The rest of the variables hold less economic and statistical significance but they are still of note. The number of properties in the HOA has a negative sign but is insignificant. The result of size is largely indeterminate, which does follow expectations. The variable Restrictions is also insignificant but does have a positive sign. Finally, Covenant Year shows a general trend to increase the amendment decision rule. This may be caused by a general recognition that the optimal decision rule is greater than developers previously expected.

The final note of the results is the low R^2 for both the amendment rule and the mortgagee rule. There still is more than half of the variation that is not explained in this model. Further research should shed light on the remaining variation.

4.6 Summary

This chapter's goal is three fold: compare and contrast the Pigouvian approach with the Coasean approach, connect the Coasean approach with the development of community associations, and to describe the voting systems utilized by homeowners associations (HOAs).

The Coasean and Pigouvian approaches are dealing with a problem of missing markets – there is no market for a silent evening, for example. The common complaint of the Coasean approach is the failure of zero transaction costs. Therefore, the optimal solution is unlikely to be had by voluntary trade. An alternative to the Coasean approach is a tax or subsidy program to correct the prices. However, the transaction cost failure is also present in the Pigouvian approach, in that the correct tax or subsidy must be discovered without the direct aid of the market. Baumol and Oates (1988) clearly recognize this problem with corrective subsidies or taxes and thus propose a solution where the governing agent will create an iterative process. This process will try many tax levels until the appropriate one is discovered. Therefore, *a priory* there is no certainty that the Pigouvian approach is superior in a practical sense.

The process that Baumol and Oates (1988) describe is an entrepreneurial one, which begs the question; will a political institution provide a dependable entrepreneurial process? Or more specifically, what type of political institution will provide a dependable entrepreneurial process? The answer depends on the externality or public good at hand.

All public goods and externalities are confined to a specific space, which means that the benefits of correcting the market failures will also be confined to a specific space. This reality provides the possibility correct through changing the property rights in the area of interest. By changing from a "price is right" Pigouvian focus to a "property rights are right" focus, one can allow voluntary exchange to determine the entrepreneurial process.

This Coasean approach is being practiced in the development of community associations. Community associations (CAs) do change the property rights of the community in response to the transaction costs. They also provide public goods to a specific community. Despite the presence of a municipal provision of public goods (and the advantage of municipalities to raise funds) and the presence of municipal zoning, CAs are growing in popularity.

This growth in popularity may be, in part, caused by the different political process of the CA compared to the municipality. Barzel and Sass provided evidence that condominium associations setup their voting classes to minimize the cost of operating the political system. This chapter also provides evidence that homeowners association (single-family homes in Weld County, Colorado) setup their voting decision rule to minimize the cost of the political system. The voting becomes more inclusive as the parcel area variation increases and if a public good is present.

Ch V Conclusions

5.1 Summary of Chapters and Results

The twentieth century saw the introduction of municipal zoning as an incredibly popular tool to deal with externalities. Zoning allows a municipality to clarify the property rights of each neighborhood.[43] Homeowners in a neighborhood zoned for single family housing can make decisions about investing in their house knowing that no manufacturing plants will be built near by. The zoning should thus provide a more externality free environment and one that holds more certainty in the future development of the neighborhood. Still, zoning has not eliminated the mid-century exodus from the central cities[44]; nor has it eliminated the use of the property covenant. Instead, covenants have become ever more popular.

The rapid rise of covenants in the form of community associations sends a clear signal that municipal zoning is not a complete answer to the problem of missing markets in the form of externalities. The rise does show that a non-government collective action can deal with local externalities and in some cases may even be more appropriate. The community associations can act as either a substitute for municipal zoning or as a complement to refine and tailor the zoning to each neighborhood. Chapter 2

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[43] Of course, zoning is not in itself a property to be owned (Fischel 1985) and it is illegal to treat as a property right. This provides the neighborhood less flexibility in the decision to change zoning. The discussion of zoning as a property right is beyond the scope of this dissertation.

[44] The general migration out of the cities, which begun in the 1950s, was after zoning had become well established in most major cities.

demonstrates that even in a zoned municipality, a community association can provide additional value by further specifying the properties in the neighborhood.

The introduction of space is also important in the estimation of housing prices. It is likely that the models used to estimate the prices are not completely specified and thus some spatial dependence may be left unaccounted for. A researcher may be interested in adjusting for this spatial dependence by introducing a (or many) spatially lagged variable(s). However, the modeling of this spatial dependence has many pitfalls because of the complex nature of spatial dependence. Chapter 3 demonstrates the importance of choosing the appropriate lagging technique and the difficulty in choosing the appropriate method.

The above chapters demonstrate the importance of including space in urban research and some of the issues that arise from its inclusion. Chapters 2 and 4 illustrate the difference that space can make on our discussion of externalities and public goods. Chapter 3 reviews some of the problems with attempting to include space in the common econometric techniques.

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Appendix For Chapter 2

This appendix provides the rest of the tables for chapter 2. See chapter 2 for definitions and explanations of variables, models, and conclusions.

Table 2A.1 Descriptive Statistics for Greeley												
	All Greeley				HOA Only				Non-HOA Only			
Housing Characteristics	Mean	Max	Min	StDev	Mean	Max	Min	StDev	Mean	Max	Min	StDev
Area	8,927.05	121,389	1330	6,382.10	8,987.55	111,554	2,438	7,438.02	8,878.48	121,389	1,330	5,387.04
Residential	1,405.68	7,174	432	497.11	1,532.08	7,174	768	457.73	1,304.19	6,047	432	504.23
Basement	893.91	3,368	0	575.83	1,055.02	3,368	0	569.92	764.55	3,276	0	547.29
Garage Attached	410.00	1,746	0	240.17	527.41	1,435	0	171.39	315.74	1,746	0	245.90
Garage Detached	40.82	1,115	0	129.29	5.09	950	0	50.94	69.51	1,115	0	161.89
Porch	358.79	4,164	0	359.81	274.86	3046	0	268.93	426.17	4,164	0	406.42
Outbuilding	4.64	2,880	0	72.18	-	-	-	-	8.36	2,880	0	96.77
Bedrooms	2.99	9	1	0.76	3.02	9	1	0.64	2.97	9	1	0.85
Bathrooms	2.13	6	1	0.84	2.25	6	1	0.83	2.03	6	1	0.84
Fireplace	0.44	1	0	0.50	0.54	1	0	0.50	0.37	1	0	0.48
Central Air	0.38	1	0	0.49	0.52	1	0	0.50	0.28	1	0	0.45
Age	24.74	128	1	36.45	6.07	110	1	7.23	39.73	128	1	43.00
Quality Excellent	0.0001	1	0	0.0120	-	-	-	-	0.0003	1	0	0.0162
Quality Very Good	0.0041	1	0	0.0635	0.0036	1	0	0.0597	0.0044	1	0	0.0665
Quality Good	0.0523	1	0	0.2226	0.0793	1	0	0.2703	0.0305	1	0	0.1721
Quality Average	0.4133	1	0	0.4925	0.5832	1	0	0.4931	0.2770	1	0	0.4476

Table 2A.2 Locational Descriptive Statistics for Greeley												
	All Greeley				HOA Only				Non-HOA Only			
Location Characteristics	Mean	Max	Min	StDev	Mean	Max	Min	StDev	Mean	Max	Min	StDev
Agriculture	743.14	2,550	25	598.58	388.75	2,000	25	286.85	1,027.70	2,550	25	630.97
CBD	1,350.16	4,400	25	974.46	1,461.96	4,350	125	917.45	1,260.40	4,400	25	1,009.12
Industry	1,860.37	6,300	25	1,197.57	2,072.61	5,475	125	1,165.73	1,689.95	6,300	25	1,195.72
HOA	360.21	2,625	0	531.30	-	-	-	-	649.33	2,625	25	566.75
Feedlot	5,841.07	12,550	475	2,295.82	7,001.25	12,550	2,525	1,981.08	4,909.54	12,550	475	2,098.56
Park with Lake	1,269.56	2,550	25	766.89	1,403.88	2,550	25	804.89	1,161.72	2,550	25	717.07
Park	490.50	2,550	25	330.54	578.75	2,550	25	365.08	419.65	2,550	25	280.56
Road	370.33	2,475	25	273.46	455.31	2,475	25	268.73	302.09	2,125	25	257.68

Table 2A.3 Descriptive Statistics for Windsor

	All Windsor				HOA Only				Non-HOA Only			
Housing Char.	Mean	Max	Min	StDev	Mean	Max	Min	StDev	Mean	Max	Min	StDev
Area	11,059.90	324,074	2740	17,208.37	12,255.10	162,906	4,498	19,180.75	9,229.12	324,074	2,740	13,455.10
Residential	1,631.97	4,503	616	528.35	1,798.48	4,413	864	538.81	1,376.90	4,503	616	393.42
Basement	1014.83	3,438	0	509.42	1,150.88	3,438	0	448.25	806.42	2,649	0	527.05
Garage Attached	482.95	1,302	0	219.91	539.88	1,302	0	210.36	395.75	1,016	0	205.28
Garage Detached	35.98	930	0	126.13	32.45	930	0	126.31	41.39	720	0	125.77
Porch	319.90	2,578	0	263.76	305.52	1824	0	239.95	341.93	2,578	0	295.37
Outbuilding	11.26	3,174	0	158.35	10.71	3152	0	158.61	12.09	3,174	0	158.07
Bedrooms	3.10	8	1	0.60	3.19	8	2	0.59	2.95	6	1	0.60
Bathrooms	2.47	6	1	0.72	2.63	6	1	0.65	2.22	4	1	0.74
Fireplace	0.62	1	0	0.49	0.71	1	0	0.45	0.46	1	0	0.50
Central Air	0.47	1	0	0.50	0.58	1	0	0.49	0.29	1	0	0.46
Age	12.30	119	0	21.50	4.56	94	0	6.15	24.16	119	2	29.68
Quality Excellent	0.0006	1	0	0.0247	0.0010	1	0	0.0318	-	-	-	-
Quality Very Good	0.0055	1	0	0.0741	0.0091	1	0	0.0951	-	-	-	-
Quality Good	0.0398	1	0	0.1956	0.0617	1	0	0.2408	0.0062	1	0	0.0786
Quality Average	0.8151	1	0	0.3884	0.8755	1	0	0.3303	0.7225	1	0	0.4481

Table 2A.4 Locational Descriptive Statistics for Windsor

	All Windsor				HOA Only				Non-HOA Only			
Location Characteristics	Mean	Max	Min	StDev	Mean	Max	Min	StDev	Mean	Max	Min	StDev
Agriculture	449.97	1,150	25	299.55	402.05	1,125	25	321.26	523.37	1,150	25	245.55
CBD	387.92	2,550	25	343.76	458.83	2,550	25	388.85	279.30	2,550	25	219.55
Industry	1,541.21	2,550	25	891.45	1,730.39	2,550	25	856.93	1,251.43	2,550	50	865.68
Road	679.85	2,500	25	414.09	749.72	2,500	25	399.55	572.83	1,600	25	413.41
Parks	267.82	2,300	25	559.66	269.03	2,300	25	700.88	265.97	1,250	25	202.14
Windsor Lake	1,587.00	2,550	50	588.27	1,831.71	2,550	50	553.57	1,212.17	2,550	50	418.02
HOA	110.27	1,250	0	157.37	-	-	-	-	244.96	1,250	25	180.65

Table 2A.5 Covenant Characteristics	Greeley HOA Only			
	Mean	Max	Min	StDev
Amendment	0.6482	1	0.51	0.0986
Mortgagee	0.1977	0.75	0	0.2774
Covenant Year	1995.80	2003	1976	5.8434
Restrictions	19.9886	36	1	4.1632

Table 2A.6 Covenant Characteristics	Windsor HOA Only			
	Mean	Max	Min	StDev
Amendment	0.7232	0.9	0.51	0.0560
Mortgagee	0.2157	1	0	0.3244
Covenant Year	1996.01	2003	1989	1.8003
Restrictions	21.9615	34	6	2.9049

Table 2A.7 Neighborhoods	All Greeley	
HOA Neighborhoods	Mean	StDev
Boomerang	0.0033	0.0576
Cambridge Glen	0.0039	0.0624
Cedarwoods	0.0130	0.1134
College Green	0.0085	0.0920
Cottesmore Reserve	0.0161	0.1258
Drakes Crossing	0.0164	0.1269
Country Club Estates	0.0026	0.0510
Country Club West	0.0414	0.1992
East Meadows	0.0158	0.1246
Forest Glen	0.0048	0.0690
Foxhill	0.0026	0.0510
Gateway Estates	0.0187	0.1354
Glen Eden	0.0301	0.1709
Homestead Heights	0.0169	0.1291
Hunters Cove Sub	0.0104	0.1016
Larson	0.0035	0.0588
Mayfair Green	0.0038	0.0612
Meadows	0.0030	0.0551
Mountain Vista	0.0132	0.1140
North View	0.0138	0.1165
Orchards	0.0067	0.0813
Parkview	0.0194	0.1379
Parkview South	0.0347	0.1832
Pheasant Run	0.0139	0.1171
Sommersett	0.0155	0.1235
Summit View	0.0009	0.0295
Virginia Hills	0.0136	0.1159
WestPoint	0.0159	0.1252
West T Bone	0.0129	0.1128
Westmoor West	0.0217	0.1458
All Other HOAs	0.0484	0.2145

Table 2A.8 Neighborhoods	All Windsor	
HOA Neighborhoods	Mean	StDev
Cornerstone	0.0031	0.0553
River Trails	0.0080	0.0889
Chestnut Village	0.0110	0.1044
North Shores	0.0122	0.1100
Windsor Manor	0.0043	0.0654
Windsor Manor 6th	0.0061	0.0780
Governors Farm	0.0839	0.2773
Windsor Estates	0.0037	0.0605
Brunner Farm	0.0943	0.2923
Water Valley	0.1849	0.3884
Hilltop Estates	0.0043	0.0654
rasslands Park	0.0135	0.1153
All Other HOAs	0.1758	0.3807

Table 2A.9 Control V	Linear		Semi-Log		Log-Log	
Variable (N = 6,907)	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Area (Log)	101.4	0.000	0.00037	0.000	0.07331	0.000
Residential (Log)	3939.5	0.000	0.02082	0.000	0.29967	0.000
Basement	2246.7	0.000	0.01286	0.000	0.01309	0.000
Garage Attached	2223.0	0.000	0.01242	0.000	0.01266	0.000
Garage Detached	2268.2	0.000	0.01533	0.000	0.01366	0.000
Porch	924.1	0.000	0.00365	0.000	0.00342	0.000
Outbuilding	2613.3	0.000	0.01022	0.000	0.01234	0.000
Bedrooms (Log)	-1606.3	0.001	-0.00069	0.810	-0.01668	0.056
Bathrooms (Log)	6670.1	0.000	0.03887	0.000	0.07896	0.000
Fireplace	224.2	0.788	0.02196	0.000	0.01851	0.000
Central Air	3800.2	0.000	0.01580	0.001	0.01910	0.000
Age (Log)	-5.6	0.828	-0.00158	0.000	-0.01366	0.000
Quality Excellent	584255.6	0.000	0.31312	0.047	0.88296	0.000
Quality Very Good	171927.4	0.000	0.25395	0.000	0.42505	0.000
Quality Good	56236.8	0.000	0.17319	0.000	0.23750	0.000
Quality Average	7835.8	0.000	0.06100	0.000	0.05890	0.000
To Agriculture (Log)	296.1	0.005	0.00190	0.002	0.00242	0.431
To CBD (Log)	-213.2	0.018	-0.00164	0.001	-0.00645	0.059
To Industry (Log)	-272.4	0.002	-0.00020	0.694	0.00755	0.079
To Golf (Log)	-41.8	0.318	0.00064	0.008	0.00043	0.921
To Feedlot (Log)	348.5	0.000	0.00137	0.000	0.07307	0.000
To Park with Lake (Log)	-3.3	0.977	-0.00556	0.000	-0.02825	0.000
To Park (Log)	666.3	0.000	0.00500	0.000	0.00872	0.003
To Main Road (Log)	584.0	0.001	0.00329	0.002	0.00811	0.003
To HOA (Log)	-469.4	0.000	-0.00314	0.000	-0.00216	0.000
C	24280.2	0.000	11.25220	0.000	10.30559	0.000
R-squared	0.841		0.826		0.823	
Adjusted R-squared	0.839		0.824		0.821	
F-statistic	474.328		426.684		417.709	

Table 2A.10 Control V	Linear		Semi-Log		Log-Log	
Variable (N = 1,634)	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Area (Log)	20.9	0.671	0.00018	0.012	0.03768	0.082
Residential (Log)	7,191.5	0.000	0.02224	0.000	0.38008	0.000
Basement	2,038.5	0.035	0.00994	0.000	0.01042	0.000
Garage Attached	829.8	0.793	0.02007	0.000	0.01950	0.000
Garage Detached	1,765.0	0.667	0.01869	0.001	0.01776	0.003
Porch	63.7	0.968	0.00737	0.001	0.00768	0.001
Outbuilding	-1,498.6	0.627	-0.00416	0.344	0.00031	0.937
Bedrooms (Log)	-929.1	0.898	-0.00149	0.886	-0.01052	0.751
Bathrooms (Log)	3,358.2	0.682	0.03163	0.007	0.05798	0.032
Fireplace	-2,509.3	0.786	0.00813	0.538	0.00436	0.744
Central Air	-1,341.9	0.874	0.01139	0.346	0.01612	0.185
Age (Log)	68.5	0.843	0.00019	0.706	0.00076	0.169
Quality Excellent	1,066,390.5	0.000	1.03098	0.000	1.19499	0.000
Quality Very Good	233,677.6	0.000	0.34533	0.000	0.45628	0.000
Quality Good	108,114.1	0.000	0.17033	0.000	0.18926	0.000
Quality Average	-2,922.4	0.820	0.02130	0.245	0.01042	0.583
Agriculture	738.2	0.767	0.00141	0.690	-0.00503	0.630
CBD (Log)	1,688.3	0.463	0.00184	0.574	0.00080	0.945
Industry (Log)	-136.4	0.859	0.00123	0.264	-0.00990	0.328
Road (Log)	289.7	0.837	0.00420	0.036	0.04057	0.000
Parks (Log)	1,428.5	0.040	0.00120	0.227	0.00693	0.155
Windsor Lake (Log)	527.4	0.749	0.00666	0.005	0.04827	0.043
HOA (Log)	-1,997.3	0.627	-0.00288	0.623	-0.00359	0.553
C	8,633.1	0.842	11.17084	0.000	10.354629	0.000
R-squared	0.241		0.672		0.667	
Adjusted R-squared	0.213		0.660		0.655	
F-statistic	8.763		56.514		55.383	
Prob. (F-statistic)	0.000		0.000		0.000	