The George Washington University
WASHINGTON DC

DEPARTMENT OF FINANCE

September 3, 1997

Mr. Andres Duany
Duany/Plater-Zyberk
1023 Southwest 25th Avenue
Miami, FL 33135

Dear Mr. Duany:

Gayle Berens of the Urban Land Institute suggested that you may be interested in the findings of the research that my coauthor, Charles Tu, and I undertook on Kentlands. With the data support of Bryan Dickson of Chevy Chase Bank, we assess the impact of the new urbanism on single-family home prices in Kentlands.

Our findings reveal that for the new and resale home markets, single-family housing units in Kentlands transact at a $30,000-40,000 premium over comparable units in the 20878 zip code, which includes Kentlands. While a portion of that premium may be attributable to factors other than neotraditional planning, which include the quality of single-family construction, we believe that a majority of the premium is attributable to the new urbanism.

The enclosed manuscript was sent to Real Estate Economics (formerly Journal of the American Real Estate and Urban Economics Association) for possible publication. Any thoughts or comments that you might have about the paper are welcome.

Sincerely,

Mark J. Eppli, Ph.D.
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cc: Gayle Berens, ULI
Bryan Dickson
Matt Shannon ✓
Charles Tu

VALUING THE NEW URBANISM: THE CASE OF KENTLANDS*

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* We are indebted to William "Bryan" Dickson of Chevy Chase Bank for supplying us with the analysis data and his insightful comments on the Kentlands development.

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VALUING THE NEW URBANISM: THE CASE OF KENTLANDS

Abstract

In this paper we assess the impact of the new urbanism on single-family home prices. Specifically, we use Duany/Plater-Zyberk's neotraditionally planned community of Kentlands and surrounding conventionally planned communities to estimate the premium, if any, that single-family homeowners are willing to pay to reside in a neotraditionally planned area. Using 1,850 single-family home transactions and several hedonic pricing models, the empirical evidence reveals that consumers are willing to pay a premium to locate in Kentlands.

Keywords: new urbanism; neotraditional planning; hedonic pricing; single-family valuation; Kentlands

Introduction

The New Urbanism, also called neotraditional planning, is one of the hottest topics in urban architecture, planning and design. It not only has drawn considerable media attention but also has evoked substantial academic debate. Promoters of the new urbanism believe that it is the cure for ills caused by the current suburban sprawl approach to development. By encouraging people to drive less and interact more, neotraditonal developments reduce traffic congestion, mitigate air pollution, and restore a sense of community. Critics, on the other hand, argue that the new urbanism, being too concerned with appearances and architectural details, has ignored the more essential social, political and economic issues in developments. Others claim that consumers do not care about the features offered by neotraditional planning and that the conventional auto-oriented subdivisions have provided what homebuyers want. Does the new urbanism offer consumers something unique and desirable and are consumers willing to pay a premium for it?

We assess the new urbanism from the housing market perspective and estimate, with actual transaction data, the price differential between what homebuyers pay for houses in neotraditional communities and what they pay for comparable units in conventional subdivisions. A premium may imply that consumers regard neotraditional planning as desirable and valuable, whereas an insignificant, or a negative, price differential will indicate the opposite. The paper is organized as follows. The next section briefly describes the characteristics of the new urbanism and its evolution. Section III describes the Kentlands development. The hedonic pricing model and data used in the analysis are discussed in section IV and V. Section VI presents the empirical results. In the last two sections we discuss the implications of the results and make concluding remarks.

The New Urbanism

Since World War II, suburbia has become most American's choice of lifestyle as problems in inner cities have forced people to find a better place to live. Additionally, advancements made in the highway transportation system have provided suburbanites with an opportunity to move away from the problems of the inner city. Suburban living has many advantages; however, the rapid growth in suburban areas has been accompanied by numerous new issues and challenges. Sprawling suburban development creates miles of undifferentiated new subdivisions, destroying the sense of place; people become alienated from their neighbors; green space is transformed into houses, shopping centers, and parking lots; local governments are forced to allocate limited resources to the creation of new infrastructure rather than to maintaining existing infrastructure; and isolated land uses increase the reliance on the automobile, causing traffic congestion and air pollution. Aware of these problems, urban planners started searching for new solutions.

The new urbanism, a movement to reform the sprawling growth pattern, emerged in the 1980s with Peter Calthorpe, Andres Duany and Elizabeth Plater-Zyberk as leading representatives. The individuals at the forefront of this movement established an organization known as the Congress for the New Urbanism (CNU), and have convened a series of congresses to discuss the principles, policies, and techniques of the new urbanism. The *Charter of the New Urbanism*, prepared by CNU's board of directors, was signed by 262 delegates at the fourth congress in spring 1996. The new urbanists assert that they stand for "the restoration of existing urban centers and towns within coherent metropolitan regions, the reconfiguration of sprawling suburbs into communities of real neighborhoods and diverse districts, the conservation of natural environments, and the preservation of our built legacy."[1] They also developed guidelines to reconstruct public policies and development practices: "neighborhoods should be diverse in use and population; communities should be designed for the pedestrian and transit as well as the car; cities and towns should be shaped by physically defined and universally accessible public spaces and community institutions; urban places should be framed by architecture and landscape design that celebrate local history, climate, ecology, and building practice."[2]

Two alternatives to the conventional auto-oriented development have been proposed by new urbanists. The transit-oriented development (TOD) concept, introduced by Peter Calthorpe, combines regional transportation and land-use plans with detailed blueprints for each proposed community. A TOD would be a dense, tightly woven community that mixes stores, housing, and offices in a compact area surrounding a transit station. The idea is to create a community with walkability, convenient access, and less auto dependence. The traditional neighborhood development (TND), conceived by Duany and Plater-Zyberk, also calls for higher density, a greater mix of housing types per unit area, and convenience for pedestrians. Moreover, it emphasizes recreating historical styles and controlling architectural form. In general, a neotraditional community should be characterized by high density, mixed land uses, diverse housing types, a street network with frequent connections, provision of public transit, and accommodation of pedestrians.

Kentlands

The town of Kentlands is the first application of neotraditional planning to a year-round, working community. This 356-acre project, located in Gaithersburg, Maryland, 23 miles northwest of Washington, D.C., was designed by Andres Duany and Elizabeth Plater-Zyberk in 1988. The original master plan includes 1,600 dwelling units, 1 million square feet of office space, and 1.2 million square feet of retail space. As of June, 1997, 1,100 units and 400,000 square feet of retail space have been completed; due to excess supply of office space in the region, the office space component of the development has been postponed.

Sited on the historic Kent Farm tract, Kentlands includes a variety of civic facilities and public open spaces. A lake and wetland preserve, greenbelts and small squares help to define individual neighborhoods, and each of them has its distinctive character. For example, the Old Farm neighborhood surrounds the original Kent homestead, which currently serves as the town's cultural arts center; the Hill District overlooks Old Farm and the lake, and is centered around a community clubhouse. Housing types in the community include single-family homes,

[1] Congress for the New Urbanism (1996).
[2] Ibid.

townhouses, condominiums, and apartments. The design of houses in Kentlands is inspired by pre-twentieth-century small towns, with white picket fences, porches, and alleyways. Open space is a major planning feature of the development, covering approximately 28 percent of the development. The clearly differentiated neighborhoods, unique architectural details, and other neotraditional features make Kentlands stand out from competing subdivisions.

Methodology: Hedonic Price Model

In this study we use the hedonic pricing technique developed by Rosen (1974) to investigate the price differentials homebuyers pay for housing in neotraditional communities and conventional subdivisions. In hedonic price models, housing is viewed as a bundle of goods including building, site and neighborhood characteristics. The number and type of attributes embodied in a particular house distinguish it from others and determine its price. A practical issue is that the price of housing features is not directly observable because no explicit markets exist for them. Instead, the transaction of housing traits are carried out through implicit markets that comprise the housing market. The implicit price of housing traits can be estimated using multiple regression, provided that the traits can be quantified and the relationship with housing price is meaningful.

A properly specified regression equation can produce price approximations for housing attributes. However, the critical issue of empirical implementation of the hedonic model is that housing valuation theory specifies neither the set of traits to be included in the model nor the functional form of the regression equation.

Variable Selection

Developments in the use of the hedonic technique to analyze housing prices have been extensive. Still, choosing and defining the exact list of variables for inclusion in the hedonic equation is not an easy task because economic theory provides very little guidance. Ideally, all the traits people consider in valuing a property should be included in the analysis; but in reality, some of the attributes can not be easily defined or measured. Omission of variables that should be in the regression model may result in inconsistent and inefficient estimates. On the other hand, inclusion of highly correlated variables causes collinearity problems and thus reduces the precision of estimated parameters (Linneman 1982). To address this tradeoff, econometricians have proposed a variety of approaches to variable selection. Among them is the backward elimination method which involves computing a regression equation with all available housing variables, then going back and deleting variables that are not significant to the model.

Functional Form

Another important specification issue is the choice of functional form for the hedonic regression. Functional form of the model dictates the type of relationship between house price and those variables used to estimate the price. Several general types of relationships include a linear relationship, a decreasing returns to scale, and an increasing returns to scale. Again, economic theory places few restrictions on the form of hedonic function. This issue has received considerable attention in the literature. Most researchers use the goodness-of-fit criterion in comparing the variety of basic forms and the more complicated forms derived from the Box-Cox transformation. Early studies favor the Box-Cox formulation, which specifies the best fit by way of a likelihood ratio test (Halvorsen and Pollakowski 1979; Milon, Cressell and Mulkey 1984). These researchers also find that restrictions imposed by the basic forms may lead to biased estimates.

Other studies, however, reveal the shortcomings of using the Box-Cox flexible form. According to Linneman (1980), a major problem in applying the Box-Cox approach is that it is not suitable for independent variables that are dichotomous. This problem is important in the context of the binary variables employed in this study. A number of the structural variables, the location variables, and the Kentlands variable therefore cannot be transformed. Another serious problem is that the large number of coefficients estimated with the Box-Cox transformation reduces the accuracy of any single coefficient (Cassel and Mendelsohn 1985). In the current study, accuracy of the estimated coefficient of the Kentlands variable is particularly important. Finally, Cropper, Leland and McConnell (1988) find that the Box-Cox forms outperform the basic restricted forms when all attributes are observed; however, when variables are omitted or replaced by proxies, it is the simpler functional forms that perform better. Because of the above mentioned problems in applying Box-Cox transformation and the nature of the current study, we use the more basic but restrictive linear form.

Data

The data used in this study is drawn from TRW REDI Property Data, containing all single-family residence sale transactions in the zip code 20878 from 1994 to 1996. The zip code is located in Montgomery County, Maryland and covers the Kentlands development and its surrounding area. The data set includes 2,079 records, each with information about the transaction, the site, and the improvements. Among them, 102 observations are missing important information such as sale price, number of bathrooms, or the year the property was built, and thus are deleted. Variable descriptions are presented in Table 1.

In order to increase the robustness of the hedonic model, we eliminate outliers based on several arbitrarily selected criteria. The removal of outlying observations prevents coding errors or a unique characteristic of a specific property unduly influencing parameter estimates. First, luxurious or shabby properties are excluded from the analysis. A price ceiling of $500,000 and a floor of $30,000 are employed, and these price parameters reduce the number of transactions in the data set by 44 and 10, respectively. We also use the size of living area as a criterion and accordingly remove one observation with living area greater than 5,000 square feet and one less than 500 square feet. One of the characteristics of neotraditional planning is higher density, and consequently neotraditionally planned communities maintain smaller lot sizes. In Kentlands, no houses have a lot size greater than a quarter of an acre; therefore, 71 properties with lot size exceeding one acre are also excluded from the analysis. A total of 1,850 transaction records remain in the final data set. As the new home market and the resale market may respond differently to neotraditional planning, we define two data subsets based on the age of the property – the New Home Sales sample comprises 345 homes with a house age one year or less, and the remaining 1,505 sale transactions are classified as Resale. Summary statistics and a correlation matrix are provided in Table 2 and Table 3.

Model Specification and Estimation Results

The sale price recorded on the deed is the dependent variable in the hedonic regression. The explanatory variable set primarily consists of variables specifying a property's structural characteristics, site characteristics, and location characteristics. Lot size, one of the independent variables, has a non-linear relationship with the dependent variable; thus, we replace it with the natural logarithm of lot size in the regression models to more accurately reflect the relationship between lot size and house price. All other variables maintain the original form. Locational traits are proxied by a group of eight binary variables representing different census tracts in the zip code. To capture possible changes in housing market conditions over time, two binary variables representing the year of transaction are included. Finally, a binary variable is created for properties with age of one year or less, because homebuyers are likely to pay a premium for a new house over the price of a resale property with comparable features.

To examine whether homeowners are willing to pay a premium for the neotraditional planning, we employ a binary variable representing properties in Kentlands. The parameter of this Kentlands variable is the main focus of this study for it measures the price differential between houses in neotraditionally planned and conventionally planned communities. The null hypothesis is that the coefficient of this binary variable is not significantly different from zero, meaning that people pay similar prices for houses in Kentlands and those in the nearby areas. If this coefficient is significantly greater (less) than 0, then it indicates the existence of a premium (discount) paid by consumers for houses in Kentlands.

We first estimate the hedonic model using the all sales transaction data set of 1,850 observations and then reduce the number of variables by applying the backward elimination method. Table 4 shows the OLS estimation results. Model 1 in the table includes all property, site and location variables collected. The advantage of this specification is that it reduces the chance of inconsistent estimates caused by omitted variables and maximizes the explanatory power of the model. However, it may result in collinearity if highly correlated variables coexist in the model. We use variance inflation factor (VIF) and coefficient variance-decomposition matrix to measure the severity of collinearity among independent variables. If the diagnostics detect severe collinearity, variables are deleted to reduce the problem. The reduced variable model is specified in Model 2, which sacrifices explanatory power for more precise parameter estimates. In Model 1, collinearity is detected between the intercept term and *LOGLOT*. Since the problem generally affects only the parameters of variables involved and since we are primarily concerned about the coefficient of the Kentlands variable, the existence of collinearity between intercept and

LOGLOT is not expected to have significant impact on the result of our hypothesis testing, and no adjustment is made accordingly. Because no variables are deleted for collinearity, Model 2 is identical to Model 1, and thus not shown in Table 4.[3] In this model, the parameter of Kentlands is positive and significant at the 1% level.

In model 3, we delete independent variables that are not significant at the 5% level. The deletion of insignificant variables, as expected, does not substantially lower the explanatory power of the model, nor does it change the significance of the coefficient of the Kentlands variable – it is positive and significant. In formulating Model 3, some of the binary variables are deleted. When one of a group of binary variables is removed from the regression, interpretation of the parameters of remaining variables no longer has the same meaning. For example, coefficient of *STORY1* initially represents the price differential between a 1-story house and a 2-story house, holding other factors equal; in Model 3, since *STORY15* has been removed, the interpretation of the coefficient becomes the difference between the price of a 1-story house and the average price of 2- and 1.5-story houses. To avoid the misleading interpretation issue, we create Model 4 by eliminating the whole group of binary variables.

In all specified models, the parameter estimate of the Kentlands variable is positive and significant at the 1% level, with a coefficient value ranging from $26,296 to $33,434. The results suggest that homeowners in Kentlands pay approximately a $30,000 premium over houses in conventionally developed and zoned neighborhood.

Table 5 and 6 present the estimates of hedonic models using different subsets of data. In Table 5, models are estimated with new house transactions, so *NEW* and *AGE* variables are excluded; in Table 6, which includes resale transactions, the *NEW* variable is excluded. When Model 1 is estimated with the new data subset, multicollinearity is detected among *CSHINGLE*, census tract 7008.06, and Kentlands. Therefore, in Model 2 of Table 5, *CSHINGLE* and *C7008.06* are excluded to reduce the collinearity problem. VIF and the decomposition matrix indicate that no collinearity exists among other independent variables. The remaining models in Tables 5 and 6 are estimated following the same procedures utilized in Table 4. Again, parameters of the Kentlands variable are positive and significant at 1% level in all models.

Implications

Table 7 provides a summary of the coefficient of the Kentlands variable estimated using various models presented in Table 4-6. All estimates are positive and significant at the 1% level. The empirical evidence strongly suggests that residents in Kentlands pay a premium for their houses over comparable homes in the surrounding conventional subdivisions. However, do

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[3] To assure that the collinearity does not affect the parameter of Kentlands, we estimate another set of models by replacing *LOGLOT* with *LOT*, which is not as highly correlated with the intercept term. No collinearity is detected in the new models and the results are presented in Appendix. The estimated parameters of the Kentlands variable are similar in corresponding models, indicating that the collinearity between intercept and *LOGLOT* does not affect the analysis results.

homeowners pay the premium for the features offered exclusively by neotraditional planning, such as architectural designs, walkability, public transit, public open space and the enhanced sense of community, or are there other factors not captured in the hedonic models that induce the higher price?

A survey in 1993 reports that Kentlands residents respond favorably to the new urbanism (Southworth 1997). The survey suggests that residents are more likely to walk in a neotraditional community; residents regard features like front porches and alleys desirable; and residents feel more neighborliness than people in conventional developments. The favorable reactions imply that consumers may be willing to pay more for neotraditional planning. Nevertheless, does the new urbanism account for the entire price premium presented in Table 7?

Factors other than neotraditional planning may account for a portion of the Kentlands premium. An omitted variable in all models is housing quality, and without a proxy for quality, the Kentlands variable may be explaining the fact that a higher quality house is built in Kentlands for which residents pay a premium. While the homes in Kentlands are built by a variety of contractors, subdivision restrictions may require all units to be constructed with premium building materials. For instance, all single-family homes in Kentlands have wood shingled roofs, while the majority of nearby developments use composite shingles, a cheaper material. Construction using wood shingles is controlled for in the hedonic models with the *CSHINGLE* variable. This variable indicates that composite shingle construction comes with a $15,000–$22,000 discount for the all transaction and resale transaction models. While composite shingle construction is less expensive than wood shingle construction, the cost differential is considerably less than the estimated discount. As such, the *CSHINGLE* variable is probably a proxy for quality of construction.

While models using new home and resale transactions have *CSHINGLE* as proxy for construction quality, the variable is removed from models using the new home sample due to collinearity. Collinearity between *CSHINGLE* and Kentlands makes it difficult to separate the effects of these two variables on home price, possibly resulting in unreliable parameter estimates. In models where no collinearity is detected, *CSHINGLE* represents a $15,000–$22,000 discount and Kentlands represents a $33,000–$42,000 premium; in Model 1 using new home data, however, the coefficient of *CSHINGLE* becomes positive and the coefficient of Kentlands jumps to over $75,000. The deviation is probably caused by collinearity. To solve the problem, we remove *CSHINGLE* in formulating Model 2, 3 and 4 of Table 5, but there is no longer a proxy for construction quality in these three models. As a result, the Kentlands variable may now be a proxy for both neotraditional planning and construction quality, causing the parameter estimates in these three models to be substantially higher than the estimates in other models (see Table 7). If we subtract an amount equivalent to the *CSHINGLE* discount from the estimated premium in the new sale transaction parameter estimates, the results are comparable to the parameter estimates in the all sale and resale transaction models.

Without a unit quality variable, we are unable to separate the effects of the neotraditional planning from other factors in the hedonic regression analysis with certainty. In order to assess the impact of quality related factors on the estimated premium, we collected additional information on the lot cost in Kentlands and in nearby projects. This cost, paid by builders to the land developer for finished lots, should include the value generated by the master planning of the development and should be independent of the quality of physical construction. Therefore, if the cost of a finished lot in neotraditional community corresponds with those in conventional developments, then the premium paid by the homebuyers is likely to be attributed to factors other than community planning. Table 8 shows the average cost per lot and average lot size in 14 subdivisions in the Gaithersburg area. The cost per square foot of lots in Kentlands is substantially higher than the cost in other conventionally planned communities. The difference, however, may be a result of the economy of scale, which causes a nonlinear relationship between the lot cost and its size. We further examine the relative lot cost in subdivisions by regressing the logarithm of square footage on the price per lot.[4] The fitted line of this regression represents the estimated relationship between lot size and cost, and the residuals are the premium or discount paid by builders for each finished lot, adjusted for the size differential. The results suggest that builders in Kentlands pay a considerably higher price for each lot than contractors in other developments. The difference in finished lot prices provides an indirect evidence supporting the argument that the neotraditional planning creates value. The magnitude of this difference indicates that the neotraditional features account for most of the price premium.

Conclusion

This paper examines the new urbanism from the housing market perspective. Applying several hedonic pricing models, we estimate the price that homeowners are willing to pay for houses in Kentlands and comparable homes in surrounding conventional subdivisions. The analysis provides empirical evidence showing that consumers are willing to pay a $30,000–$40,000 premium for properties in Kentlands. The premium is statistically significant and exists in both new and resale markets. The results, however, do not distinctly identify the effects of neotraditional planning and other factors, specifically the quality of construction. Supplementary data is thus utilized to assess the price differential attributed to the neotraditional features and suggests that the new urbanism accounts for a majority of the premium.

[4] The logarithm is used to capture the decreasing returns to scale. A quadratic form regression is also computed and generates residuals with comparable magnitudes.

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Table 1. Variable Descriptions

Variable	Description
PRICE	Sale price recorded on the deed.
AREA	Square footage of living area, excluding basement.
LOT	Square footage of site.
LOGLOT	Natural logarithm of lot size.
BATH	Number of bathrooms. Bathrooms with only a sink and a toilet are counted as one-half.
FIREPLACE	Number of fireplaces.
PARKING	Number of parking spaces.
AGE	Property age in years.
BASEMENT	Binary variable. 1, if the house has a basement; 0, otherwise.
CSHINGLE[a]	Binary variable. 1, if the house has composite shingle roof; 0, otherwise.
NEW	Binary variable. 1, if age of the house is one year or less; 0, otherwise.
STORY1[b]	Binary variable. 1, if number of stories is 1; 0, otherwise.
STORY15[b]	Binary variable. 1, if number of stories is 1.5; 0, otherwise.
STORY25[b]	Binary variable. 1, if number of stories is 2.5; 0, otherwise.
STORY3[b]	Binary variable. 1, if number of stories is 3; 0, otherwise.
SPLITFOYER[b]	Binary variable. 1, if the house has split foyer; 0, otherwise.
ALUMINUM[c]	Binary variable. 1, if the house has aluminum/vinyl exterior wall; 0, otherwise.
FRAMEWOOD[c]	Binary variable. 1, if the house has frame wood exterior wall; 0, otherwise.
YEAR95[d]	Binary variable. 1, if the transaction occurred in 1996; 0, otherwise.
YEAR96[d]	Binary variable. 1, if the transaction occurred in 1995; 0, otherwise.
KENTLANDS	Binary variable. 1, if the house is in Kentlands; 0, otherwise.
LOCATION[e]	Binary variables.

a The missing variable is wood shingle.
b For the story binary variables, the missing variable is 2 stories.
c For exterior wall binary variables, the missing variable is brick.
d The missing year is 1994.
e A group of eight location binary variables are used to represent census tracts in the zip code. The missing variable is 7006.06.

Table 2. Single-Family Home Transaction Summary Statistics

	All Sales (1,850)				New Homes Sales (345)		Resale Homes (1,505)	
Variable	Mean	Std. Dev.	Minimum	Maximum	Mean	Std. Dev.	Mean	Std. Dev.
PRICE (000)	224.44	85.92	30.32	499.60	288.50	91.37	209.76	775.16
AREA	2,016.21	741.00	922.00	4,486.00	2,454.88	800.50	1,915.65	688.63
LOT	8,352.88	7,580.24	775.00	43,560.00	8,092.45	7,827.94	8,412.58	7,523.71
LOGLOT	8.63	0.93	6.65	10.68	8.59	0.93	8.64	0.93
BATH	2.66	0.58	1.00	5.50	2.95	0.59	2.59	0.55
FIREPLACE	0.83	0.56	0.00	6.00	0.78	0.54	0.84	0.57
PARKING	1.11	0.86	0.00	3.00	1.39	0.69	1.05	0.88
AGE	9.98	8.08	0.00	84.00	- -	- -	12.25	7.26
BASEMENT	0.85	0.35	0.00	1.00	0.57	0.49	0.92	0.28
CSHINGLE	0.83	0.37	0.00	1.00	0.54	0.50	0.90	0.30
NEW	0.19	0.39	0.00	1.00	- -	- -	- -	- -
STORY1	0.04	0.21	0.00	1.00	0.00	0.05	0.05	0.23
STORY15	0.01	0.07	0.00	1.00	0.00	0.05	0.01	0.08
STORY25	0.02	0.13	0.00	1.00	0.05	0.23	0.01	0.09
STORY3	0.03	0.18	0.00	1.00	0.03	0.18	0.03	0.17
SPLITFOYER	0.02	0.13	0.00	1.00	0.00	0.00	0.02	0.15
ALUMINUM	0.28	0.45	0.00	1.00	0.33	0.47	0.27	0.44
FRAMEWOOD	0.61	0.48	0.00	1.00	0.59	0.49	0.61	0.48
YEAR95	0.32	0.47	0.00	1.00	0.37	0.48	0.31	0.46
YEAR96	0.28	0.45	0.00	1.00	0.04	0.19	0.33	0.47
KENTLANDS	0.11	0.31	0.00	1.00	0.46	0.49	0.03	0.16

The data set contains 1,850 single family residence transactions in the zip code 20878 from 1994 to 1996; among them, 345 were new house sales and 1,505 were resale transactions.

Table 3. Correlation Matrix

	PRICE	AREA	LOT	LOGLOT	BATH	FIREPLACE	PARKING	AGE	BASEMENT	CSHINGLE
PRICE	1.00									
AREA	0.87	1.00								
LOT	0.52	0.48	1.00							
LOGLOT	0.65	0.60	0.89	1.00						
BATH	0.43	0.39	0.09	0.10	1.00					
FIREPLACE	0.48	0.43	0.39	0.44	0.31	1.00				
PARKING	0.69	0.57	0.53	0.67	0.22	0.41	1.00			
AGE	-0.40	-0.35	0.19	0.15	-0.26	-0.03	-0.17	1.00		
BASEMENT	0.04	0.00	-0.01	0.07	0.02	0.10	0.06	0.18	1.00	
CSHINGLE	-0.38	-0.22	0.07	0.02	-0.24	-0.15	-0.36	0.36	-0.02	1.00
NEW	0.36	0.28	-0.02	-0.02	0.24	-0.04	0.16	-0.59	-0.38	-0.37
STORY1	-0.07	-0.20	0.18	0.20	-0.14	0.04	0.07	0.33	0.05	0.07
STORY15	0.04	0.01	0.07	0.06	0.02	0.07	0.04	0.05	0.03	-0.07
STORY25	0.04	0.02	-0.10	-0.13	0.15	-0.02	0.07	-0.14	0.05	-0.19
STORY3	-0.19	-0.05	-0.17	-0.27	-0.02	-0.10	-0.20	-0.09	-0.38	0.07
SPLITFOYER	-0.07	-0.14	0.08	0.10	-0.07	-0.02	0.01	0.10	-0.32	0.06
ALUMINUM	-0.13	-0.12	-0.05	-0.05	-0.04	-0.11	-0.17	-0.12	-0.07	0.14
FRAMEWOOD	0.22	0.17	0.05	0.11	0.00	0.16	0.26	-0.14	0.03	-0.10
KENTLANDS	0.28	0.10	-0.18	-0.15	0.22	0.03	0.30	-0.40	-0.08	-0.75

Table 3. Correlation Matrix (Continued)

	NEW	STORY1	STORY15	STORY25	STORY3	SPLITFOYER	ALUMINUM	FRAMEWOOD	KENTLANDS
NEW	1.00								
STORY1	-0.10	1.00							
STORY15	-0.02	-0.02	1.00						
STORY25	0.15	-0.03	-0.01	1.00					
STORY3	0.01	-0.04	-0.01	-0.02	1.00				
SPLITFOYER	-0.07	-0.03	-0.01	-0.02	-0.02	1.00			
ALUMINUM	0.05	-0.01	-0.01	-0.06	0.00	0.08	1.00		
FRAMEWOOD	-0.02	0.01	-0.02	0.03	0.03	-0.04	-0.78	1.00	
KENTLANDS	0.54	-0.07	-0.00	0.25	-0.04	-0.05	-0.09	0.04	1.00

Table 4. Explanation of Single-Family Home Sale Prices (1,850 Transactions)

	Model 1	Model 3	Model 4
INTERCEPT	-97,513	-99,515	-172,317
	(-7.53)	(-8.21)	(-15.51)
AREA	63.33	63.18	56.16
	(36.54)	(37.52)	(35.56)
LOGLOT	20,116	20,156	29,438
	(12.23)	(12.77)	(20.51)
BATH	12,097	12,201	11,531
	(8.85)	(9.01)	(8.14)
FIREPLACE	8,798	8,774	9,363
	(6.03)	(6.09)	(6.17)
PARKING	4,748	4,553	6,280
	(3.45)	(3.35)	(4.49)
AGE	-1,500	-1,523	-1,768
	(-9.75)	(-11.99)	(-13.87)
BASEMENT	12,715	12,905	13,776
	(4.78)	(5.10)	(6.19)
CSHINGLE	-15,125	-15,153	-17,786
	(-5.13)	(-5.27)	(-5.85)
NEW	7,609	8,288	10,015
	(2.60)	(2.97)	(3.55)
STORY1	22,966	22,915	- -
	(5.95)	(5.98)	
STORY15	6,888	- -	- -
	(0.74)		
STORY25	-21,947	-22,514	- -
	(-3.91)	(-4.06)	
STORY3	-36,960	-37,132	- -
	(-8.06)	(-8.16)	
SPLITFOYER	33,628	33,272	- -
	(6.65)	(5.65)	
ALUMINUM	-211	- -	- -
	(-0.07)		
FRAMEWOOD	-1,813	- -	- -
	(-0.62)		
C7006.01	-21,979	-20,917	- -
	(-5.80)	(-6.37)	
C7006.04	-2,043	- -	- -
	(-0.56)		
C7006.05	-5,824	-5,917	- -
	(-2.21)	(-2.91)	
C7006.07	1,217	- -	- -
	(0.41)		
C7007.06	-34,210	-32,630	- -
	(-6.65)	(-7.11)	
C7008.01	-19,654	-18,852	- -
	(-5.71)	(-6.97)	
C7008.05	-24,444	-23,236	- -
	(-7.58)	(-9.85)	
C7008.06	-12,692	-12,848	- -
	(-4.13)	(-4.90)	
YEAR95	495	- -	- -
	(0.30)		
YEAR96	-2,304	- -	- -
	(-1.30)		
KENTLANDS	33,303	33,434	26,296
	(7.41)	(7.61)	(6.24)
R-Square	0.8895	0.8892	0.8745

T-statistics are in parentheses.

Table 5. Explanation of New Single-Family Home Sale Prices (345 Transactions)

	Model 1	Model 2	Model 3	Model 4
INTERCEPT	-216,488	-204,173	-203,407	-300,967
	(-4.34)	(-4.27)	(-4.83)	(-10.87)
AREA	60.31	60.31	60.19	57.85
	(11.63)	(11.65)	(12.28)	(12.47)
LOGLOT	27,285	27,512	31,275	43,506
	(4.32)	(4.39)	(5.66)	(10.96)
BATH	11,544	11,093	10,096	14,790
	(2.80)	(2.72)	(2.54)	(3.90)
FIREPLACE	6,602	6,662	- -	- -
	(1.30)	(1.36)		
PARKING	3,169	3,340	- -	- -
	(0.59)	(0.63)		
BASEMENT	18,275	17,775	7,787	8,795
	(2.48)	(2.43)	(1.68)	(1.93)
CSHINGLE	13,856	- -	- -	- -
	(0.88)			
STORY1	3,695	3,760	- -	- -
	(0.09)	(0.09)		
STORY15	9,882	9,753	- -	- -
	(0.24)	(0.24)		
STORY25	-13,405	-13,188	- -	- -
	(-1.26)	(-1.25)		
STORY3	-41,575	-41,400	-43,627	- -
	(-2.89)	(-2.91)	(-3.25)	
ALUMINUM	9,086	9,827	- -	- -
	(0.96)	(1.05)		
FRAMEWOOD	17,676	18,192	10,242	- -
	(2.04)	(2.11)	(2.15)	
C7006.01	8,586	8,501	- -	- -
	(0.73)	(0.82)		
C7006.04	42,199	41,790	39,318	- -
	(2.77)	(3.10)	(3.29)	
C7006.05	26,923	26,024	23,299	- -
	(2.26)	(2.71)	(2.94)	
C7006.07	56,880	57,664	55,165	- -
	(2.94)	(3.24)	(3.22)	
C7008.01	10,406	10,605	- -	- -
	(0.60)	(0.63)		
C7008.06	16	- -	- -	- -
	(0.00)			
YEAR95	11,897	12,355	- -	- -
	(1.54)	(1.63)		
YEAR96	9,455	11,705	- -	- -
	(0.72)	(0.92)		
KENTLANDS	75,390	62,229	61,441	54,915
	(3.83)	(6.60)	(11.11)	(11.51)
R-Square	0.8338	0.8334	0.8288	0.8137

T-statistics are in parentheses.

Table 6. Explanation of Resale Single-Family Home Sale Prices (1,505 Transactions)

	Model 1	Model 3	Model 4
INTERCEPT	-57,149	-64,239	-130,114
	(-4.42)	(-5.12)	(-11.13)
AREA	60.88	61.13	53.13
	(33.85)	(35.33)	(32.56)
LOGLOT	16,615	16,439	25,288
	(10.48)	(10.50)	(17.33)
BATH	10,515	10,667	9,765
	(7.56)	(7.69)	(6.56)
FIREPLACE	8,841	8,482	9,203
	(6.24)	(6.05)	(6.07)
PARKING	8,952	8,792	10,554
	(6.46)	(6.42)	(7.30)
AGE	-1,401	-1,251	-1,643
	(-9.49)	(-10.72)	(-13.90)
BASEMENT	18,121	18,291	16,269
	(5.16)	(5.28)	(6.20)
CSHINGLE	-18,825	-19,915	-22,461
	(-6.99)	(-7.61)	(-7.87)
STORY1	22,641	21,986	- -
	(6.52)	(6.36)	
STORY15	6,107	- -	- -
	(0.72)		
STORY25	-31,373	-30,743	- -
	(-3.52)	(-3.46)	
STORY3	-26,335	-26,115	- -
	(-5.31)	(-5.27)	
SPLITFOYER	40,679	39,969	- -
	(6.98)	(6.92)	
ALUMINUM	-4,439	- -	- -
	(-1.45)		
FRAMEWOOD	-5,752	- -	- -
	(-1.95)		
C7006.01	-27,549	-25,761	- -
	(-7.09)	(-7.47)	
C7006.04	-14,269	-11,178	- -
	(-3.99)	(-3.59)	
C7006.05	-11,196	-9,383	- -
	(-4.48)	(-4.68)	
C7006.07	-2,914	- -	- -
	(-1.07)		
C7007.06	-41,249	-37,135	- -
	(-8.88)	(-9.11)	
C7008.01	-24,978	-22,299	- -
	(-7.68)	(-9.01)	
C7008.05	-29,591	-26,338	- -
	(-9.86)	(-12.24)	
C7008.06	-17,646	-15,602	- -
	(-6.11)	(-6.36)	
YEAR95	-738	- -	- -
	(-0.46)		
YEAR96	-3,504	-3,456	- -
	(-2.17)	(-2.46)	
KENTLANDS	40,864	41,820	30,138
	(7.46)	(7.70)	(5.82)
R-Square	0.8975	0.8971	0.8755

T-statistics are in parentheses.

Table 7. Price Premium for Kentlands[a]

	All Sale Transactions	New Sale Transactions	Resale Transactions
Model 1	33,303	75,390[b]	40,864
Model 2	33,303	62,229[c]	40,864
Model 3	33,434	61,441[c]	41,820
Model 4	26,296	54,915[c]	30,138

[a] All parameter estimates are significant at the 1% level. Models estimated with different samples are not directly comparable.

[b] May not be reliable due to collinearity.

[c] The coefficients may be inflated because CSHINGLE, which is negatively correlated with Kentlands, is removed from the models.

Table 8. Comparison of Cost per Finished Lot[a]

Subdivision	Sample Size	Price/sf	Avg. Price per Lot	Avg. Lot Size	Premium (Discount)[b]
Kentlands	99	$ 15.92	$ 93,172	$ 5,853	$ 30,242
Hickory Grove Eastgate	28	10.40	91,747	8,821	13,808
Milestone	44	9.89	68,391	6,916	-644
Gablefield	13	9.44	97,317	10,308	13,678
Quince Orchard Knolls	23	9.40	115,156	12,250	25,202
Orchard Hill	49	8.79	70,342	8,000	-4,021
Clopper Mill West	71	8.27	99,250	12,000	10,050
East Village	36	6.91	65,314	9,448	-15,136
Pheasant Run	42	6.77	64,000	9,450	-16,458
Seneca North Park	81	6.75	50,617	7,500	-21,385
King Square	115	5.31	52,962	9,976	-29,478
Brooke Manor	50	5.00	100,000	20,000	-7,890
Talley Ho	19	4.46	102,474	23,000	-10,530
Quail Run	30	4.04	140,704	34,785	12,562

Source: *Montgomery Newsletter*

a Data cover transactions of finished lots in the Gaithersburg area from 1993 to 1995. Only developments with 10 or more lots sold during the period are included. Subdivisions with an average lot size greater than one acre are excluded.

b Premiums (or discounts) are the residuals of regressing logarithm of lot size on lot price. Logarithm of lot, instead of lot size, is used because of the nonlinear relationship between lot size and price.

Appendix

In this appendix we present a set of hedonic models in which *LOGLOT* is replaced by *LOT*. In the original models, *LOGLOT* is found highly correlated with the intercept term, causing some collinearity. To assure that the collinearity does not affect the result of hypothesis testing, we estimate this new set of models where VIF and coefficient variance-decomposition matrix do not detect severe collinearity. A comparison of coefficients of the Kentlands variable estimated in the different specifications suggest that the impact of collinearity between intercept and *LOGLOT* on the estimates is negligible.

Table A1. Explanation of Single-Family Home Sale Prices Using Lot (1,850 Transactions)

	Model 1	Model 3	Model 4
INTERCEPT	40,471	42,187	35,078
	(5.83)	(7.43)	(6.05)
AREA	70.91	70.49	64.50
	(46.04)	(46.62)	(41.63)
LOT	1.42	1.46	2.06
	(8.88)	(9.16)	(14.16)
BATH	10,908	10,895	8,698
	(7.88)	(7.91)	(5.88)
FIREPLACE	9,152	9,266	10,804
	(6.15)	(6.30)	(6.76)
PARKING	9,360	9,354	15,334
	(7.26)	(7.37)	(11.70)
AGE	-1,164	-1,303	-1,312
	(-7.70)	(-10.24)	(-10.08)
BASEMENT	14,001	14,593	16,695
	(5.17)	(5.65)	(7.11)
CSHINGLE	-14,061	-13,606	-15,392
	(-4.68)	(-4.65)	(-4.81)
NEW	8,671	9,270	12,940
	(2.91)	(3.24)	(4.36)
STORY1	29,697	30,180	--
	(7.71)	(7.90)	
STORY15	7,390	--	--
	(0.78)		
STORY25	-29,184	-30,660	--
	(-5.16)	(-5.49)	
STORY3	-48,001	-48,186	--
	(-10.60)	(-10.70)	
SPLITFOYER	44,624	45,060	--
	(7.53)	(7.70)	
ALUMINUM	4,401	--	--
	(1.45)		
FRAMEWOOD	840	--	--
	(0.29)		
C7006.01	-22,557	-20,912	--
	(-5.84)	(-6.10)	
C7006.04	-8,646	-8,304	--
	(-2.15)	(-2.31)	
C7006.05	-7,007	-7,520	--
	(-2.61)	(-3.44)	
C7006.07	1,735	--	--
	(0.58)		
C7007.06	-38,876	-37,828	--
	(-7.47)	(-8.13)	
C7008.01	-22,324	-20,656	--
	(-6.40)	(-7.46)	
C7008.05	-24,695	-23,139	--
	(-7.51)	(-9.40)	
C7008.06	-16,915	-17,803	--
	(-5.47)	(-6.72)	
YEAR95	-306	--	--
	(-0.18)		
YEAR96	-2,884	--	--
	(-1.60)		
KENTLANDS	33,508	33,522	19,591
	(7.31)	(7.47)	(4.43)
R-Square	0.8854	0.8849	0.8609