Estimation of Apartment Submarkets in Dublin, Ireland

Authors   James Berry, Stanley McGreal,
                 Simon Stevenson, James Young and
                 James R. Webb

Abstract   This study compares apartment submarkets within a major
                  European city. The price behavior of the Dublin, Ireland
                  apartment market is tested using hedonic models and aggregate
                  and disaggregate data. The results strongly indicate that the
                  modeling of apartment markets at the disaggregate level does
                  result in significant improvements in comparison to estimations
                  undertaken at an aggregate level. This particular apartment
                  market is especially interesting, due to the introduction of fiscal
                  incentives. To fully understand the Dublin apartment market
                  requires an appreciation of the role played by tax breaks for
                  owner-occupiers and investors in urban renewal locations. The
                  results show that different submarkets responded differently.

Introduction

Hedonic analysis is a well-established technique, the theoretical basis of which is that an observed product price (apartments in this study) contains several attributes, each of which has an implicit hedonic price (Rosen, 1974). The technique has been used to construct house price indices (Mark and Goldberg, 1984) and model housing markets, including the identification of submarkets (Adair, Berry and McGreal, 1996; Maclennan and Yu, 1996; and Hoesli, Thion and Watkins, 1997). The argument of market segmentation was formerly raised by Straszheim (1975), who postulated that the housing market was a series of single markets (or sub-markets) for which different hedonic price functions could be estimated. Maclennan and Tu argue that after standardization for the full range of hedonic factors, significant price differences exist across the product or area groupings. This finding is in general agreement with Adair et al. who, on the basis of location and property type, constructed different hedonic models for nine submarkets within the city of Belfast, Ireland. Similarly Watkins (1999) used principal components analysis to identify submarkets in the Glasgow, Scotland market, while Bourassa, Hamelink, Hoesli and MacGregor (1999) used cluster analysis to define markets in Sydney and Melbourne, Australia. Bourassa et al.

found that hedonic estimations using market-derived classifications is, in several cases, better than a priori classifications. A number of studies have examined other issues in relation to submarkets and the estimation of hedonic models. A related issue is whether hedonic models are better estimated at an aggregate or disaggregate level. Fletcher, Gallimore and Mangan (2000b) estimate hedonic models for the Midlands housing market in England and find improvements in estimation when the models are estimated at a disaggregate level. However, the authors note that improvements in forecasting ability are marginal and that the statistical significance of the difference between the two approaches is, to some degree, dependent on the sample size.[1]

This study analyzes two main questions. First, the relative effectiveness of estimating hedonic models on an aggregated versus a disaggregated basis and secondly, an examination of the effects of some specific fiscal reforms. The second part of this study extends the analysis of Berry, McGreal, Stevenson and Young (2001), who examined the impact overall of government intervention on the residential market in greater Dublin in the late 1990s. The remainder of this article is structured as follows. A review of housing markets and taxation instruments is provided next, followed by a consideration of the tax incentives including recent reports commissioned by the government, details of the data, and the empirical analysis. The final section contains the conclusions.

Residential Markets and Tax Instruments

The short run supply of residential real estate is relatively inelastic, but increases in demand (due to growth in disposable income, rising employment levels and/ or lower interest rates) result in a shift in the demand curve. As a consequence, real prices escalate (Poterba, 1984). Fiscal policy and taxation measures can be used on both the demand and supply-side to stimulate or deflate real estate markets. The use of tax expenditures and tax allowances has been argued on the merits of stimulating demand, the relative ease of administration and the ability to assist residential real estate investors and owner occupiers (Grigsby, 1990; and Wood, 1990). In terms of encouraging (or discouraging) investment in the existing housing stock, policies may focus on either acquisition or occupancy costs. Adair, Berry and McGreal (1995) have discussed how tax penalties and allowances can be used for either or both of these categories. Yates and Wood (1996) argue that tax concessions to investors can be rationalized on the basis that such concessions promote the supply of residential real estate.

There is considerable variation in practice internationally in the use of tax allowances for residential real estate. Wood (1990) outlined a number of tax expenditure initiatives used in France, Ireland and Sweden to encourage investment in the improvement of the existing housing stock. Adair, Berry and McGreal (1994) examined the inter-relationships between capital allowances, income tax relief, urban renewal and the stimulation of inner city housing markets in the owner-occupier and apartment real estate investment sectors in Ireland.

Berry and McGreal (1996) discussed special depreciation allowances (of up to 50%) on fixed assets that were available in the new länder in Germany for the acquisition, construction, modernization and refurbishment of real estate. In the U.K., Housing Investment Trusts (HITs) were aimed at encouraging institutional investment in the private rental sector—apartments included—by offering tax benefits in the form of exemption from capital gains tax and payment of corporate taxes at the lower, ''small'' company rate (Crook, Hughes and Kemp, 1998).

The Dublin Housing Market

In recent times fiscal incentives were introduced by the Irish Government in order to encourage private real estate investment in the inner city of Dublin. The incentives were put in place in several locations throughout the country. However, the primary focus was the inner city of Dublin. The Urban Renewal Act of 1986 and the Finance Act of 1986 were the two primary pieces of legislation put in place for urban renewal (Berry and McGreal, 1993). The former act permitted the establishment of specific areas, which were to become the primary focus for urban renewal, while the Finance Act introduced various taxation allowances applicable only in the designated areas. The linkage of these measures created a distinctive demand-side approach. The key mechanism that was to stimulate inner city residential development was income tax relief, which was available in two forms.

First, within the designated areas, owner-occupiers who built or remodeled residential structures conforming to specified standards and conditions were entitled to deduct 5% of the cost from their taxable income for a period of ten years. The maximum incentive was therefore 50% of the cost (5% for ten years, ignoring present value). It was required that the individual claiming the tax relief be the first owner-occupier after the expenditure occurred and that the property be used as either the sole or main residence. The second mechanism, the provision of tax allowances on rented residential property, is potentially the more interesting in that it provided a tax shelter by which investors could convert a tax liability into a real estate asset. Commonly referred to as ''Section 23'' relief, this measure was initially introduced by the Finance Act of 1981 for a period of three years, but later reintroduced under the Finance Act of 1988. Section 23 relief applied to qualifying residential property anywhere throughout the Republic of Ireland. Since July 1992, the allowance has been restricted to designated urban renewal areas. Section 23 relief can be claimed by a person or company against expenditures incurred on the construction of qualifying premises. A key attraction of Section 23 relief was that the deduction was allowable against all rental income from properties in the Republic of Ireland, including commercial and industrial premises, and was not restricted to rents received from the subject property on which the expenditure was made. In essence, other properties in the Republic could become virtually rent-free by deducting the relief from Section 23 projects from their income (Adair, Berry and McGreal, 1994). However relief was subject to several conditions. In particular, the property must be leased on a qualifying

lease to a tenant (or successive tenants) for a minimum of ten years. If, during this ten-year period, ownership of the property changed, then the allowance was taken back from the original owner.

At the same time, while the incentives provided an important catalyst for private real estate investment and inner city renewal, the Irish Republic's economy was booming. In addition to the strong economic performance, positive demographic changes and a lagging supply of residential units—apartments, as well as single-family units—helped cause further price increases in the Dublin market. Indeed, Roche (1999), using a regime switching model, found significant evidence of a speculative bubble in the Irish market.

Due to concerns about affordability, the Irish Government commissioned an independent report on the housing market. Bacon, MacCabe and Murphy (1998) made a number of recommendations aimed at slowing price increases. The report recognized that, although it was desirable for investors to continue to participate, there was concern that such investment was influenced to a large degree by expected short-term appreciation and, therefore, speculative demand. Such a situation was not considered to be in the best interests of the long-term development of a broadly based residential rental market. Consequently, in order to achieve a better balance between demand and supply in the short-term, the Bacon Report recommended a refocusing of the fiscal incentives. The primary changes implemented at that time were the removal of Section 23 for investment in residential property, the discontinuation of mortgage interest relief on investment purchases and reform of the stamp duty bands and rates.[2]

The changes to the stamp duty—a tax paid when purchasing real estate—were perhaps, in retrospect, the most controversial (see Exhibit 1). Prior to the 1998, there was no stamp duty on new homes. However, starting in 1998, new residential structures purchased by investors—non-occupier owners—were charged duty at the standard rates. The questionable rationale behind the reduction in rates, and more importantly the widening of the bands, was the idea that high stamp duty rates were impairing housing turnover and, therefore, supply. However, what perhaps was not fully appreciated was that such reforms would effectively create significant discounts in most sectors of the residential market. For example, an apartment building selling for £60,000 to £100,000 saw stamp duty rates reduced by half to 3%. While it may be argued that this price range is that of the first-time buyer, more expensive homes also saw large reductions (see Exhibit 1). For example a house selling for £200,000 would see the rate fall from 9% to 5%, providing an effective discount of £8,000[9% − 5% = 4% (of £200,000)].

Bacon and MacCabe (2000) lamented that, although considerable progress had been achieved against an increasingly complicated backdrop, the market remained some distance from a sustainable equilibrium. A combined supply and regressive tax-based approach was seen to promise a rapid return to market stability with increased affordability. Stamp duty thresholds and rates were again revised to ease the burden on first-time buyers, with different rates applying for existing owners

Exhibit 1 | Stamp Duty Rates and Bands

1997 Rates		1998 & 1999 Rates	
Price Range (£)	Stamp Duty (%)	Price Range (£)	Stamp Duty (%)
0–5,000	0	0–60,000	0
5,001–10,000	1	60,001–100,000	3
10,001–15,000	2	100,001–170,000	4
15,001–25,000	3	170,001–250,000	5
25,001–50,000	4	250,001–500,000	7
50,001–60,000	5	500,000 +	9
60,001–150,000	6		
150,001–160,000	7		
160,001–170,000	8		
70,000 +	9		

and investors (see Exhibit 2). The most recent changes have effectively reversed many of those implemented in 1998, with an increase in most stamp duty rates (see Exhibit 2). The changes have sought to clearly differentiate between first-time buyers and existing home owners for new houses, with the stamp duty abolished for first-time buyers on new houses valued under £150,000. In addition, first-time buyer rates were differentiated across a wider range, with slightly lower rates up until £300,000 (approximately $450,000 USD).

Exhibit 2 | Stamp Duty Rates 2000

First-Time Buyers		Existing Owners	
Price Range (£)	Stamp Duty (%)	Price Range (£)	Stamp Duty (%)
0–100,000	0	0–100,000	0
100,001–150,000	0	100,001–150,000	3
150,001–200,000	3	150,001–200,000	4
200,001–250,000	3.75	200,001–250,000	5
250,001–300,000	4.5	250,001–300,000	6
300,001–500,000	7.5	300,001–500,000	7.5
500,000 +	9	500,000 +	9

Data and Methodological Framework

The data used in this study consists of 4,312 sales of used apartment structures (apartment condos in U.S. terminology) sold between 1997:1 and 2001:4.[3] In addition to sales price, the data contain various characteristics of the property, such as the number of bedrooms, number of bathrooms and parking availability. Descriptive statistics are shown in Exhibit 3. However, other information is unavailable, notably size and age, and thus are not reported. Such factors have been found to be of particular importance in the presence of heteroscedasticity for the estimation of a hedonic model (Goodman and Thibodeau 1995, 1997; Fletcher, Gallimore and Mangan, 2000a; Stevenson, 2002).

The lack of economic and demographic data on a location-specific basis also limits the analysis of submarkets in a manner similar to that in studies such as Bourassa, Hamelink, Hoesli and MacGregor (1999) and Watkins (1999). The lack of a longer-term data set also limits the empirical tests, in terms of analyzing the underlying fundamentals of the apartment market and whether a speculative bubble was present in the market during the late 1990s. In the absence of such information, broad markets are defined by location. The central city is defined as those properties within Dublin (post codes 1, 2, 7 and 8). The outer city is classified into North and South, with the South further subdivided into South City and South County Dublin due to the distinctiveness of these areas. The following equation shows the aggregate model estimated first.

$$\ln P = a + \beta x_{1-19} + \beta \ln x_{20} + \beta \ln x_{21} + \beta x_{22} + \beta x_{23-25} + \mu, \quad (1)$$

where $\ln P$ is the log of the price, x_{1-19} are dummy variables for date of sale, $\ln x_{20}$ is the log of the number of bedrooms, $\ln x_{21}$ is the log of the number of bathrooms, x_{22} is a dummy for parking availability, x_{23-25} are dummy variables for location and μ is the residuals vector.

Exhibit 3 | Description of Sample

	Price (£)	Bedrooms	Bathrooms
Min.	35,000	0.50	1.00
Max.	2,500,000	4.00	6.00
Mean	173,746	1.16	1.64
Median	150,000	1.00	2.00

Note: Data are for apartment condos in U.S. terminology.

Empirical Analysis

Models are estimated for both the overall market and then individually for each of the submarkets defined previously. The results of the aggregate hedonic model are reported in Exhibit 4. Location and time period of sale are controlled for by

Exhibit 4 | Aggregate Hedonic Model for the Dublin Apartment Market

Variable	Coefficient
Constant	10.997**
1997:2	0.069*
1997:3	0.115**
1997:4	0.243**
1998:1	0.304**
1998:2	0.434**
1998:3	0.412**
1998:4	0.448**
1999:5	0.518**
1999:6	0.568**
1999:3	0.597**
1999:4	0.684**
2000:1	0.762**
2000:2	0.784**
2000:3	0.815**
2000:4	0.847**
2001:1	0.813**
2001:2	0.830**
2001:3	0.801**
2001:4	0.838**
Bedrooms	0.460**
Bathrooms	0.450**
Parking Availability	0.181**
Central City	−0.040**
South City	0.201**
South County	0.267**
R^2	0.634

Notes: Number of observations = 4,312.
* Significant at the 0.10 level.
** Significant at the 0.01 level.

using dummy variables. The base apartment used in this estimation is located in North Dublin and was sold in the first quarter of 1997. All of the *t*-Statistics are significant at the 99% level, with the single exception being the time dummy for the second quarter of 1997, which is significant at the 90% level. The adjusted R^2 is .6335. The results indicate a large contribution to price from bedrooms and bathrooms. This is reasonable since most units have only one bedroom and one

Exhibit 5 | Hedonic Models for Apartment Submarkets

	Central City	South City	South County	North City & County
Constant	10.851***	11.239***	11.308***	11.115***
1997:2	0.054	0.133*	−0.010	0.024
1997:3	0.094	0.119	0.064	0.188**
1997:4	0.250***	0.242***	0.339***	0.054
1998:1	0.321***	0.274***	0.274***	0.318***
1998:2	0.498***	0.411***	0.458***	0.334***
1998:3	0.453***	0.366***	0.436***	0.400***
1998:4	0.493***	0.397***	0.467***	0.395***
1999:1	0.601***	0.454***	0.484***	0.504***
1999:2	0.688***	0.542***	0.526***	0.423***
1999:3	0.689***	0.535***	0.600***	0.516***
1999:4	0.823***	0.609***	0.619***	0.601***
2000:1	0.925***	0.693***	0.726***	0.593***
2000:2	0.915***	0.759***	0.711***	0.598***
2000:3	0.937***	0.711***	0.788***	0.744***
2000:4	0.991***	0.792***	0.771***	0.702***
2001:1	0.976***	0.662***	0.864***	0.754***
2001:2	0.955***	0.789***	0.787***	0.696***
2001:3	0.986***	0.686***	0.747***	0.706***
2001:4	0.994***	0.782***	0.769***	0.686***
Bedrooms	0.479***	0.488***	0.427***	0.394***
Bathrooms	0.433***	0.444***	0.450***	0.485***
Parking Availability	0.190***	0.192***	0.292***	−0.082***
R^2	0.5996	0.533	0.7032	0.5794
Number of Observations	1531	1391	645	745

*Significant at the 0.10 level.
**Significant at the 0.05 level.
***Significant at the 0.01 level.

Exhibit 6 | Hedonic Submarkets for Dublin Apartment Market: 1997–2001
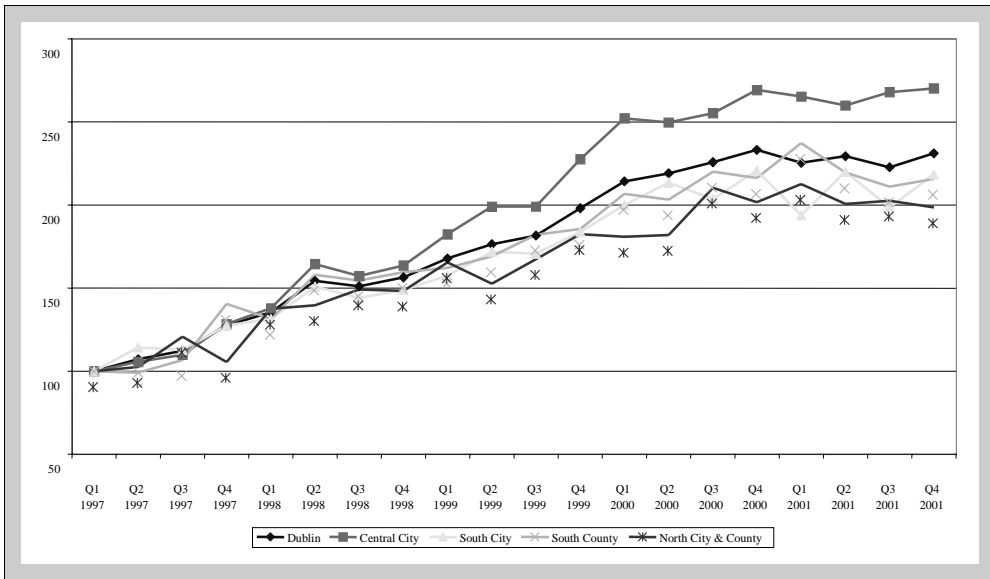
bathroom (see Exhibit 3). The availability of parking also adds significantly to price. In addition, central city units sell for a slight discount to the control area (North Dublin), while units in the other areas sell at a premium to the control area. Exhibit 5 presents the estimates of the submarket models. All of the variables are significant at the 99% level, except the time dummy variables for the 1997: 2–1997:4 for North Dublin. The adjusted R^2 ranges from .533 to .703.

The estimated apartment submarket models permit an examination of the impact of the Bacon reforms across both the overall market and the specified submarkets

Exhibit 7 | Residual Sum of Squares of Aggregate and Disaggregate Models

	Residual Sum of Squares
Aggregate Model	374.97
Central City	137.60
South City	151.17
South County	33.47
North City & County	40.04
Chow Test	6.796*

*Significant at the .01 level.

(see Exhibit 6). In terms of overall trends, the residential market in Dublin in the late 1990s experienced large upward price increases, with apartment prices increasing by 130%, on average, over the sample period. Substantial differences between the submarkets are also evident, with the central city market seeing a price increase of 170%, on average, while the northern part of the city and county saw an increase of 98%, on average.

The reaction of the market to the reforms in 1998 is apparent from the behavior of the graph. With the exception of North Dublin, each graph sees a slight fall in 1998:3. The Bacon report was published and implemented in April, 1998. This would indicate that the removal of tax incentives and the reforms to mortgage interest relief and stamp duty did have a short-term impact on the apartment market. However, rents rose dramatically during the second half of 1998.[4] It would therefore appear that the reforms proposed and implemented had only a short-term impact. By 1999:1, price increases were again starting. In the central city, prices increased by 11% during this quarter, while the corresponding figure was a 7% increase for greater Dublin.

In order to more explicitly compare the estimation of hedonic models on an aggregated and disaggregated basis, a similar procedure to that adopted by Fletcher, Gallimore and Mangan (2000b) is used. The Chow test compares the sum of the squared residuals for the aggregate model with the total residual sum of the squared residuals for the four disaggregated submarket models. Squaring the residuals removes the negative signs and is a common statistical technique for estimating the amount of variance in the data unexplained by the independent variables. The results (see Exhibit 7) report a *t*-Statistic of 6.796, significant at the 99% level, inferring that significantly more of the variance in the dependent variable was explained by the independent variables when the models were estimated on a disaggregated basis.

Conclusion

The modeling approach used in this study is sufficiently sensitive to detect the short-term slow down in the last half of 1998—following the publication of the first Bacon Report—at an aggregate level and to identify variations in this pattern at a submarket level. Indeed, the results of the Chow test indicates the validity of the submarket estimations and demonstrates that significant improvements in estimation are obtainable using appropriately specified submarkets. In addition, the residential real estate market in Dublin during the 1990s has been operating in an environment driven by tax breaks. However, the outcomes suggest that the reforms only achieved a short-term impact. In terms of the stamp duty reforms, the impact on the market was not what was originally envisioned. These outcomes indicate that the role of government intervention within markets, particularly rapidly rising markets, may have limited effects.

Endnotes

[1] Other related studies include Chu and Lentz (1998) and Watkins (1999).

[2] One further fiscal change was the introduction of a 50% rebate on the capital gains tax for land zoned residential that was brought into residential development within four years.

[3] Database provided by Property Research International (Dublin).

[4] See the Department of the Environment and Local Government report on the private rented sector.

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James Berry, University of Ulster–Jordanstown, Newtownabbey, Co. Antrim, BT37 0QB, Northern Ireland or jn.berry@ulster.ac.uk.

Stanley McGreal, University of Ulster–Jordanstown, Newtownabbey, Co. Antrim, BT37 0QB, Northern Ireland or ws.mcgreal@ulst.ac.uk.

Simon Stevenson, University College Dublin, Dublin, Republic of Ireland or simon.stevenson@ucd.ie.

James Young, PRI, County Dublin, Republic of Ireland or priusa@att.net.

James R. Webb, Cleveland State University, Cleveland, OH 44114 or j.webb@ csuohio.edu.