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'The Price You Pay': The Impact of State-Funded Secondary School Performance on Residential Property Values in England[1]

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Summary:

This paper examines the relationship between state-funded secondary school performance and local residential property values in seven major English cities. When choosing which secondary school they wish their children to attend, parents will be aware of the school's performance in Key Stage 3, GCSE and A- level examinations. We suggest that GCSE examination results will be the measure of school performance that parental choice will be most closely correlated with. Therefore, secondary schools with good GCSE examination results will be 'oversubscribed' in that more students will wish to attend these schools than there are places available. Schools will then have to develop mechanisms for rationing the available places - central to rationing strategies in English schools at the moment is geographical proximity of the family home to the school of choice. Parents will thus have a strong incentive to purchase houses in the 'catchment' area of high performing schools. Our results suggest that this is the case, with high performing schools stimulating a price premium in local residential property markets of between 1% and 3% for each additional 10% point improvement in the pass rate in GCSE examinations.

Keywords: Hedonic, capitalisation of school performance, property prices**.**
JEL Classification: R23, R53, and I20.

1. Introduction

Stephen Gibbons and Stephen Machin (2008) state that anecdotal evidence, media reports, and even dinner party discussions lend credence to the claim that good schools raise local house prices. The capitalisation of school performance into local property values has been the subject of a number of studies in the US and latterly in the UK. Typically, these studies have been cross-sectional and have found a positive relationship between a chosen measure of standardised student test scores performance and local residential property values.

The *1988 Education Reform Act* introduced the national curriculum into English schools and legislated for the provision of testing of school children at ages 7, 11 and 14 at the end of Key Stages 1, 2 and 3 respectively. Students would then typically complete GCSE (General Certificate of Secondary Education) examinations at the end of Key Stage 4, aged 16. The Act placed a focus on measuring the outputs of state-funded education in England at the end of all four Key Stages. This reflected a general concern on the part of those legislating to provide outputs from the state education system which would equip the UK labour force with the skills, knowledge and competencies necessary to drive economic growth in an increasingly competitive global economy (Tom Elkins and John Elliott, 2004).

The introduction of testing of school pupils at ages 7, 11 and 14, as well as public examinations at GCSE and A-level (at age 18), has provided a wealth of information on the performance of school children at specific stages of their school lives. In addition, the formal inspection of schools by OFSTED (Office for Standards in Education) has provided additional detailed information on the performance of children, teaching staff and management in state-funded schools. This has given parents a plethora of data upon which to assess the performance of schools. Furthermore, these data are readily available to parents at the Department for Children, Schools and Families (DCSF) web site.

The single measure of school performance employed in this paper is the percentage of students gaining five or more GCSE passes at grades A* - C in any one year. Full performance results (discussed later) are published each year by the DCSF (now referred to as the Department for Education). It is reasonable to suggest, by implication, that good school performance will enhance future job possibilities. However, this particular relationship is outside the scope of this study.

This paper is concerned with the impact of state-funded secondary school performance on house prices in the owner-occupied sector in seven major cities/urban conurbations in England – Greater London, Birmingham, Bristol, Leeds, Greater Manchester, Liverpool and Newcastle. State-funded schools account for well over 90% of the total student population (see Chris Ryan and Luke Sibieta, 2010) while owner-occupied housing represents 87% of all properties (see Kathleen Scanlon and Christine Whitehead, 2004). These cities have been selected on the basis of geographical diversity and because they represent some of the largest conurbations in England.

The cities are analysed separately because we wish to allow for the fact that housing markets in different parts of the country may capitalise school performance to a different extent. For a discussion and justification of this approach involving segmentation of the database into a number of metropolitan areas see David M Brasington and Diane Hite (2005).

The structure of the paper is as follows: the next section provides a review of the literature on the capitalisation of school performance into residential property prices, focusing on the so-called *hedonic* approach to measurement (the methodology adopted in this study). Section 3 describes the data employed and the main procedures adopted to render it suitable for statistical analysis. Section 4 outlines the modelling framework adopted, while Section 5 discusses the main empirical results. Finally, Section 6 draws together the main conclusions and findings.

2. Literature Review

The value which parents place on good school performance would be easy to assess if education services were sold in a free and competitive market. However, since there is no observable market price for state-provided schooling, an indirect method must be found to place a monetary value on the services provided by state-funded schools.

The hypothesis we are proposing in this paper is that, *ceteris paribus*, a higher level of school performance will be capitalised into higher property values. In other words, parents wishing to gain access to schools with a superior academic performance will bid up the price of properties which are most geographically proximate to a high performing school. They will do this in order to ensure that their children are in the catchment area of the high performing/oversubscribed school and are therefore eligible for entry into that school (for a general discussion of the capitalisation of spatially differentiated environmental amenities – as in this study involving property prices, neighbourhood characteristics and school performance – see Sherwin Rosen (1974) and Roland Benabou (1996)).

In reviewing the literature related to this study we are mindful of three key issues. The first is concerned with the question of what parents are implicitly purchasing when they buy a house proximate to a high performing school; that is, what is the most appropriate measure of 'good' school performance? Secondly, what conditions are necessary in a local housing market for ‘good school performance’ to be capitalised into residential property prices? Finally, what are the methodological issues faced by researchers attempting to model such a relationship?

A body of literature has focused on what parents are buying when they select schools for their children. In this context Thomas A Downes and Jeffrey E Zabel (2002) in their study of the impact of school characteristics on house prices in Chicago found that homeowners paid attention to school *outputs, i.e.* test scores, and not *inputs* in the form of per pupil expenditures by schooling authorities. David M Brasington and Donald R Haurin (2006) examined the extent to which homeowners valued traditional measures of school performance (absolute test scores) of which the UK’s GCSE examination pass rates are an example. These traditional measures contrast with the relatively new value-added measures of school quality, which attempt to measure the capability of students as they enter the secondary schooling process and compare this with the test scores on exit, the difference between the two being the *value added*. With this approach it is the measure of value added which acts as a measure of school quality rather than the absolute performance at the end of the process.

Whilst educationalists may argue that the value-added approach represents a much more effective evaluation of school performance, Brasington and Haurin (2006) report that homeowners value average test scores and levels of expenditure on education above any measure of student value-added when assessing local school performance. They argue, therefore, that it is average test scores which are capitalised into local property prices rather than value-added measures of school performance.

In relation to what conditions must exist in the local housing market for good school performance capitalisation to occur David A Starrett (1981), David E Wildasin (1987), William H Hoyt (1999) and Christian A L Hilber and Christopher C J Mayer (2002) all argue that where there is a relatively inelastic supply of housing, land and house prices will rise in those areas which provide relatively more attractive amenities, to the point where the additional price paid reflects the perceived additional value of high-quality local amenities. The capitalisation of local amenities and neighbourhood effects into residential property values has been widely researched in the USA. Brasington (2002) provides a thorough overview of the capitalisation debate, the key point being that capitalisation of any differential in local amenity is contingent upon a supply of housing which is inelastic with respect to price. However, Paul Cheshire and Stephen C Sheppard (2004) challenge this view and argue instead that differences in housing supply elasticities *do not* imply different levels of capitalisation. In particular, they point out that 'it is possible that observed reductions in capitalisation might exist for other reasons, related to the availability of substitute sources of education, variations in the physical characteristics of the housing stock making it more or less suitable for accommodating children or the degree of uncertainty attached to current measures of school quality' (pp. 400-1).

Furthermore, Cheshire and Sheppard (2004) concur with Timothy J Bartik (1988) who argues that it is the elasticity of supply of the local amenity, in this paper good schooling, that will influence the extent of capitalisation. On this basis we might expect a reduction in the premium paid for good school performance, as the average level of school performance increases.

Some of the literature in this area focuses upon the inter-temporal nature of the capitalisation of improved local amenity. Bartik (1988) identifies a three stage process. In the first instance there is an improvement in local amenity. This is followed by a second stage whereby the improvement in local amenity is recognised by those agents who are active in the local property market. The third stage involves these agents reflecting improvements in local amenity in their willingness to pay a premium for properties that embody the improved local amenity. This process is important in the context of this study. Schools are incentivised to improve the academic performance of their students in public examinations; this improved performance is then reported in official statistics released by the DCSF and, finally, house buyers can be expected to react to the improved school performance in their willingness to pay for properties which are proximate to the high performing schools.

Finally, there is a rich literature dealing with the capitalisation of secondary school performance on residential property prices based on the so-called hedonic approach to measurement in which the sale price of a property is a function of the physical characteristics of the house as well as its environmental amenities and location. Lori L Taylor (2005) and Ian

Davidoff and Andrew Leigh (2007) provide reviews of this literature, citing studies by Cheshire and Shepherd (2002, 2004); Gibbons and Machin (2003, 2006); Leslie Rosenthal (2003); Patrick J Bayer, Robert McMillan and Fernando V Ferreira (2003); Sandra E Black (1999); Downes and Zabel (2002); Thomas J Kane, Douglas O Staiger and, Stephanie K Riegg (2005); Randall Reback (2005); David L Weimer and Michael J Wolkoff (2001); Kathy J Hayes and Lori L Taylor (1996); Brian A Cromwell and William T Bogart (1997); Haurin and Brasington (1996) and Dennis Leech and Erick Campos (2003).

A fundamental challenge facing the hedonic approach in this context is to ensure that neighbourhood quality is correctly modelled. Failure to do so would result in biased estimates of the impact of local school quality (performance) on local house prices. Specifically, as Black (1999) indicates, the standard hedonic approach will produce upwardly bias estimates of the impact of school performance on house prices if there are unobserved neighbourhood characteristics that are correlated with school quality and likely to influence house prices. Residential property prices reflect not only the characteristics of the properties themselves but also those of the surrounding neighbourhood – and it is reasonable to assume that higher status neighbourhoods tend to have better schools due to the pupils' family backgrounds, the general quality of teachers, resources paid for by parents etc. Theodore M Crone (1998) argues that empirical evidence is available to show that academic achievement can be improved by the peer group effect. The existence of this 'endogeneity problem' can be addressed in a number of ways.

Davidoff and Leigh (2007) indicate there are four broad approaches to tackling the 'endogeneity problem'. One approach is to control for variation in neighbourhood effects by using data relating to properties adjacent to but on opposite sides of school catchment boundaries - see Black (1999) and Gibbons and Machin (2003, 2006). In doing so, this approach *implicitly* controls for differences in neighbourhood quality by assuming that such properties will have identical neighbourhood characteristics. This approach, however, does not take into account distance between properties on either side of the school catchment boundaries and the fact that properties at opposite ends of a particular school catchment boundary may exhibit very different and perhaps unobservable neighbourhood characteristics.

A second approach is to investigate whether the data allow for any 'natural experiments' such as changes in school quality over a number of years, schools which may have been closed, opened or other changes in their characteristics and to investigate whether property prices follow such changes. This approach is adopted by Kane, Staiger and Riegg (2005) and Reback (2005). The weakness of this approach is that it assumes that the mix of neighbourhood characteristics does not change over time.

A third approach is do adopt an instrumental variables methodology which predicts residential property values independent of school performance and then rigorously tests for school quality effects. An example of this approach can be found in Rosenthal (2003) who uses government inspections as an instrument for school quality. As Gibbons and Machin (2008) suggest the challenge for such an approach is to find appropriate instruments which are causally related to variations in school performance while 'otherwise unrelated to housing prices'.

The fourth approach, and the one adopted in this study, is to *explicitly* include variables which measure the 'quality' of the residential neighbourhood which may change over time alongside information concerning the physical characteristics of houses and the performance of the closest school. Examples of this approach include Weimar and Wolkoff (2001) and Downes and Zabel (2002). As noted above it is vital that the effect of neighbourhood characteristics is correctly modelled.

The study reported in this paper seeks to make a contribution to this expanding area of research. This contribution can be gauged in a number of ways: we employ (a) a data set which has exceptional breadth and depth; (b) we *explicitly* incorporate neighbourhood characteristics effects, thereby addressing the endogeneity issue common to studies of this kind;[4] (c) our ability to disaggregate the data set across different metropolitan areas allows for housing market segmentation and (d) the inter-temporal nature of our data set allows us to model the impact of changes in average

[4] We acknowledge the comments made by a referee concerning the importance of addressing the problem of endogeneity in studies of this kind. The depth and quality of the data set employed here has allowed us to control for the physical house and neighbourhood environmental characteristics in a way that ensures that parameter estimates on our focus variable (school performance) are not upwardly biased (see Section 5 below for additional discussion of the empirical results).

school performance and changes in neighbourhood composition over time.

3. Description of the Dataset

The results reported in this paper are based on an exceptionally large dataset developed by HBoS (the largest residential mortgage lender in the UK). The dataset covers all the house purchase transactions on which the HBoS plc group has provided mortgage loans although for the purpose of this paper, we have only selected data for the years 2001 to 2007. This period is chosen as a result of a desire to present estimations of capitalisation which are contemporary rather than historical and, following Bartik (1988), a desire to allow for a period of time to elapse whereby house purchasers were fully aware of differing school performances and could reflect this in their willingness to pay for properties.

Data on School Quality

In the analysis below the data on 'school quality' measure the performance of individual schools in terms of the percentage of students attaining five passes at GCSE grades A* to C. This percentage score was entered as a continuous variable in our preferred hedonic house price regression model. The data on school performance was obtained from the DCSF website for the years 2000-2006. The website also provided us with the required locational data in terms of the postcode of each school. In order to allow for the capitalisation of school performance into property prices we have lagged the school performance data one time period. Thus, we have regressed 2002 property prices on 2001 school performance results. The rationale for this approach is that it is historical school performance data that will impact current offer prices for residential properties. In addition, we are suggesting that it is the most recent historical school performance data that will have the most immediate impact on the price offered by house purchasers. We experimented with three-year moving averages of school performance but found that school performance in the previous year performed more effectively as an explanatory variable.

Data on Physical House Characteristics

The data on physical house characteristics is provided from the HBoS mortgage data set. The richness of the dataset allows us to analyse the impact of school performance on residential property values to an extent which we feel has not been possible for researchers previously in the UK. The database includes a detailed breakdown of the information on the following house characteristics:

- purchase price of the property recorded at the mortgage approval stage
- property type, ie. whether the house is detached, semi-detached, terraced, bungalow, flat or maisonette;
- number of habitable rooms;
- floor space area;
- number of bathrooms;
- number of toilets;
- availability of central heating;
- number of garages and garage spaces;
- garden;
- age of property.

Data on Neighbourhood Characteristics

Over and above these physical house characteristics, the database also includes information on the location of each property in terms of postcodes. In order to locate each property and each school in our dataset, we employed Royal Mail Post Office postcodes. We then utilised the Royal Mail's POSTZON software to provide us with an Ordnance Survey (OS) grid map reference. This grid reference effectively places each property on the bottom left-hand corner of a 100 metre by 100 metre grid. To each of the Eastings and Northings of the OS grid reference a five was added, which effectively located each of our properties at the centre of the 100 metre by 100 metre grid; i.e., at the expected location of any property within a 100 metre grid. We then developed a simple computer macro which applied Pythagoras's theorem and calculated the straight line distance between each property in the dataset and the nearest school.

Rosenthal (2003) reports that POSTZON locates each school and house within a maximum of 70 metres of its true location and concludes that for the purpose of locating the nearest school to a given residential property, the use of the POSTZON database is unlikely to result in a serious misallocation of houses to the nearest school. Gibbons and Machin (2008) suggest that a lack of clearly defined catchment areas for state schools introduces an amount of ambiguity in the link between residential property locations and accessibility to school. However, of primary interest to this study is the motivation for parents to purchase a property close to their school of choice. Parents will do this when they believe that a school is oversubscribed and that the criteria which may be applied to their child's application for entry, *in extremis*, is straight line distance from the family home to the school of choice. Interestingly, the incentive to purchase a house close to a 'high performing' school may be greater in households where the oldest child is about to enter secondary education and there are younger brothers and sisters. In this case the 'straight line distance' criteria may be applied to the eldest child but subsequent children would be 'guaranteed' a place on the basis that an elder brother or sister attended the school. We have not been able to control for this effect in this study.

The dataset also includes a special locational classification regime used in the UK, known as ACORN, *A Classification of Residential Neighbourhoods* – for the full details of the ACORN classification system, based on postcodes, see CACI (2006). This regime allocates ratings according to geo-demographic information, allowing for the categorisation of the location of each property at two levels: at the micro level (immediate residential neighbourhood) and at the macro level (wider surrounding area). In our study the inclusion of ACORN codes, in so far as they allow for the influence of the socioeconomic characteristics of a neighbourhood population, should pick up some of the so-called peer group affects; ie, our study allows for the socio-economic impacts on school performance noted by Crone (1998).

Based on postcode information, the location of each property is classified into one of eight main ACORN groups as shown in Table 1 below.

Table 1: Description of Main ACORN Groups

ACORN Group	Main Characteristics of Group
A	Areas where residents are wealthy investors
B	Prospering families
C	Areas of traditional money
D	Young urbanites
E F G	Areas of middle-aged families (comfortable), contented pensioners and families and individuals looking to settle down (Middle Aged Comfort (E), Contented Pensioners (F) and Settling down (G))
H	Moderate living
I K	Meagre means and impoverished pensioners
J	Inner city existence (low income singles and couples, multi ethnic young singles renting flats, high rise poverty – dependent on welfare-poor young – financially inactive)

Finally, it should be noted that prior to estimation the dataset has been 'cleansed' to exclude properties which are atypical or can be described as outliers as well as to take account of coding errors in the data entry processes. In addition, houses are excluded if the nearest school is further than 10 kilometres away in order to provide an outer boundary to the urban conurbations that we have studied.

4. Modelling Framework

In this study we employ the hedonic approach to pricing to determine a monetary valuation which parents place on the performance of schools. The hedonic method makes use of information on property prices ($\mathbf{P}_{it}$) and property characteristics to determine the value of individual attributes. These attributes include physical attributes of a particular house (denoted by $\mathbf{X}_{ht}$) as described earlier, as well as neighbourhood variables ($\mathbf{X}_{nt}$), and environmental variables ($\mathbf{X}_{et}$) which in this study include the 'quality' of the most proximate state school.

Thus the general hedonic price model to be estimated is as follows:

$$\mathbf{P_{it} = f\ (X_{ht}, X_{nt}, X_{et}, e_{it})} \qquad \mathbf{(1)}$$

where:
$\mathbf{P_{it}}$ = house price i in time period t
$\mathbf{X_{ht}}$ = physical housing characteristics
$\mathbf{X_{nt}}$ = neighbourhood (location) characteristics
$\mathbf{X_{et}}$ = environmental characteristics
$\mathbf{e_{it}}$ = unmeasured factors

By regressing the physical, neighbourhood and environmental characteristics of a set of properties against the purchase price as the dependent variable, it is possible to calculate implicit prices for each of the characteristics.[5]

It should be noted that in hedonic estimation attention must be given to the choice of an appropriate functional form, the optimal combination of explanatory variables and the potential problem of multicollinearity. Tests developed by George E P Box and D R Cox (1964) are employed in this study and resulted in a semi-log specification as the most appropriate functional form. This particular functional form has the advantage of ease of interpretation of parameter estimates. Analyses were also carried out to determine the optimal combinations and appropriate transformations of the explanatory variables in the regression model. In particular, the results showed that floor area consistently outperforms the number of habitable rooms in explaining house prices.

With such a rich data set it is desirable to use as many variables as possible to define our house price equation; however, in practice, some explanatory variables may be correlated with each other – in other words, the problem of multicollinearity may exist. Garrod and Willis (1992)

[5] Hedonic pricing methods have also been employed to calculate the value of a wide range of both "welcome" and "unwelcome" local amenities. These include aircraft noise (Terrence J Levesque, 1994), air quality (Kenneth Y Chay and Michael Greenstone, 2004), hazardous waste sites (Jill J McCluskey and Gordon C Rausser, 2000), woodland (Guy Garrod and Ken Willis, 1992) and the proximity of churches (A Quang Do, Robert W Wilbur, James L Short, 1994; Thomas M Carroll, Terrance MClauretie, Jeff Jensen, 1996).

indicate that multicollinearity is a common problem in hedonic price functions and one which is often conveniently ignored. Tests for multicollinearity were conducted based on the methodology outlined in David A Belsey, Edwin Kuh and Roy E Welsch. (1980).

The performance of what Philip Graves *et al* (1988) term 'focus' variables – in this paper, the school performance variable - is of primary importance. We experimented with dummy variables including those which separated the dataset into discrete deciles and excluded the deciles which included the national average and local average school performances; we also experimented with excluding lower deciles and higher deciles. Dummy variables were included to pick up the effect of better than and worse than performances with respect to national and local averages. In all of these cases the dummy variables failed to work as effectively as the continuous specification of the school performance variable that we ultimately included in our preferred equation.

Finally, as the preferred regression equation covered more than one time period we have indexed the equation using the 'time dummy' method (Michael C Fleming and Joseph G Nellis, 1985). Therefore, with time incorporated as a dummy variable, percentage changes in price can be observed directly as the coefficient on the time variable, our base year in all cases being 2001.

5. Empirical Results

The final regression model uses the natural log of house price as the dependent variable (*ln P*). Combinations of the following independent variables were used: dummy variables to capture the impact of house type (detached, semi-detached, terraced, flat and bungalow); the existence of a garden; none or partial central heating; the age of the property (split into five distinct classifications – properties built prior to 1919, properties built between 1919-45, 1945-60, post-1960 and new build). A set of ACORN ratings dummy variables was included to allow for variability in neighbourhood characteristics while annual time dummy variables were included to allow for the influence of inflationary effects over the period 2001-2007 not associated with the physical, neighbourhood or environmental characteristics of the properties in our dataset. A dummy variable was incorporated to link each property in our dataset with the nearest secondary school. Continuous measures of numbers of bathrooms, toilets, garages and garage spaces and the size of a property, which measures the internal floor space (measured in square metres) were also included in the final equation. Our data set allowed us to experiment with specifications which included the number of habitable rooms but this specification was rejected in favour of a continuous floor space variable on the basis of goodness-of-fit and the overall performance of other variables in our preferred equation.

Therefore, the model provides an estimate of the influence of property characteristics with reference to a 'standard' house (David Forrest *et al* 1996). In this study our standard property in each city was determined on the basis of identifying the modal characteristics. Thus in all cities the standard house had full central heating and no garden while the excluded house types, house ages and ACORN types are reported in Table 2 below. The modal characteristics are excluded from our equation and the coefficients on the included dummy variables can be interpreted as a percentage premium or discount relative to the excluded modal characteristic.

Table 2: Excluded house type, house age and ACORN code by city

City	House type	House Age*	ACORN
Birmingham	Semi-detached	1960+	IK
Bristol	Terraced	Pre 1919	EFG
Leeds	Terraced	1960+	IK
Liverpool	Semi-detached	1960+	IK
London	Flat	Pre 1919	D
Manchester	Terraced	1960+	IK
Newcastle	Semi-detached	1960+	IK

*1960+ denotes properties built after 1960, but not new build.

The regression results are presented in the Appendix, Tables A – G for each of the seven cities in turn.

Table 3 below reports the estimated regression coefficient on the school performance variable in each of the seven cities along with the corresponding average standard deviation. This allows us to report a percentage house price premium for an additional one standard deviation of school performance above the average in each city. The inclusion of the average house price in each city in 2007 allows us to monetise the premium for an additional one standard deviation of school performance above the mean.

Table 3: Coefficient on school performance variable and the residential house price premium for a local school with GCSE performance one standard deviation above the local average.

City	Coefficient	Average standard deviation of GCSE results	Percentage house price premium for one additional standard deviation in school performance	Average house price (£, 2007)	House price premium for one additional standard deviation (£, 2007)
Birmingham	0.001	17.31	+1.7%	197,086	3,350
Bristol	0.003	18.07	+5.4%	250,210	13,511
Leeds	0.002	18.33	+3.6%	178,284	6,418
Liverpool	0.001	21.08	+2.1%	188,378	3,956
London	0.001	18.64	+1.9%	367,029	6,973
Greater Manchester	0.002	15.96	+3.2%	188,372	6,028
Newcastle	0.001	16.06	+1.6%	169,858	2,718

Source: average standard deviation based on authors' calculations employing DCSF data.

The above results suggest that in Birmingham, Liverpool, London and Newcastle, for every 10% point improvement in the average GCSE pass rate (% or more GCSEs at grades A*-C), property prices increase by 1%. This would imply that, *ceteris paribus*, a school which had a pass rate of 80% would give rise to a local property price premium of 4% compared to properties where the local state-funded secondary school had a pass rate of 40%.

In order to facilitate comparison across a number of studies, Gibbons and Machin (2008) and Davidoff and Leigh (2007) summarise the results of various studies by reporting the percentage increase in house prices stemming from an increase in school performance equivalent to one standard deviation above the city mean. Table 3 shows the average standard deviation of results, in each city, over the period of this study and the resulting house price premia (in percentage terms) based on the school performance coefficients. For example, in Birmingham an additional one standard deviation of school performance increases residential property prices by 1.7% whereas in Bristol an additional standard deviation of school performance increases property prices by 5.4%. In addition, Table 3 also shows the value of these house price premia in absolute terms (£). Note that these premia are computed on the basis of average house prices in each city in 2007 multiplied by the corresponding percentage house price premium averaged over the seven years of this study. It is clear from these results that the cost of 'good' education varies across the cities studied ranging from £2.7k in Newcastle to £13.5k in Bristol. This would appear to justify our geographical segmentation approach to modelling the relationship between school performance and house prices. The monetary values attached to a one standard deviation improvement would not appear to be out of line with those reported by Black (1999) and Gibbons and Machin (2006). Furthermore, in Greater London in 2006, DCSF statistics indicate that the range of school performance varied from a pass rate of 21% for the lowest performing school to 98% for the highest performing school. The house price premia that the highest performing school generated in 2007 compared to the lowest performing school is approximately £33,400. This is less than the comparable 2004 figure for Greater London of £61,000 reported by Gibbons and Machin (2008). This may be partially explained by a greater range of school performance in 2004 (12%-99%) compared to 2006 (22%-98%). It would also appear to be the case that our preferred strategy for modelling neighbourhood characteristics has resulted in coefficient estimates on the school performance variable which are not upwardly biased.

Furthermore, the results provide some support for the assertion in the hedonic literature that where the elasticity of supply of good schooling is unresponsive then price premia will be greater. To illustrate this point, Table 4 below reports the percentage of students obtaining 5 or more GCSE's at grades A* - C in the seven cities over the period 2000 to 2006. Students' performance in 2007 is not reported in this table as our model suggests that house prices in any one year will be contingent upon the previous year's GCSE performance of the nearest state school. Table 4 shows that Bristol started and ended the period with the lowest average school performance of the seven cities. This contrasts with Newcastle which started the period with an unspectacular average performance but exhibited a much greater elasticity of supply of 'good schools' on the basis of average school performance over the period.

Table 4: Percentage of students gaining five or more GCSE passes at grades A* - C (2001-2006)

City	2000	2001	2002	2003	2004	2005	2006
Birmingham **Mean**	**35**	**36.9**	**41.3**	**46.1**	**48.1**	**53.9**	**56.7**
Bristol **Mean**	**32**	**32.9**	**32.2**	**38**	**36.9**	**37.5**	**46.4**
Leeds **Mean**	**37.7**	**38**	**39.6**	**43.2**	**45.2**	**50.3**	**52.3**
Liverpool **Mean**	**34.9**	**36.7**	**39.5**	**41.7**	**45.3**	**51.6**	**57.2**
London **Mean**	**43.2**	**44.6**	**47.3**	**50.2**	**53**	**54.9**	**58.1**
Manchester **Mean**	**40.9**	**41.9**	**43.7**	**46**	**46.4**	**50.4**	**53.7**
Newcastle **Mean**	**32.1**	**39.8**	**41.9**	**41**	**45.2**	**59.6**	**56.1**

Source: Department for Children, Schools and Families (see www.education.gov.uk/researchandstatistics/attainmenttables).

Finally, in order to examine the impact that including ACORN values had on the school quality variable we estimated our hedonic equation with housing characteristic variables only and then with housing characteristic and ACORN values included. As Table 5 below indicates, in the cases of Birmingham, Bristol, Leeds, Greater London, Manchester and Newcastle the impact of adding ACORN codes was to reduce the coefficient on the school performance variable, suggesting that any endogeneity issues that existed with respect to 'neighbourhood quality' in these local housing markets have been (at worst, partially) accounted for.

Table 5: Comparison of School Quality coefficient when regression model includes only housing characteristics variables with a regression model including housing characteristic variables and ACORN values. (R^2 coefficient of determination values are also reported)

City		Housing characteristics included	Housing characteristics and ACORN values included
Birmingham	School Quality	0.007	0.006
	R^2	0.577	0.639
Bristol	School Quality	0.007	0.006
	R^2	0.586	0.636
Leeds	School Quality	0.008	0.007
	R^2	0.536	0.587
Liverpool	School Quality	0.005	0.005
	R^2	0.472	0.521
London	School Quality	0.004	0.004
	R^2	0.571	0.629
Manchester	School Quality	0.007	0.006
	R^2	0.537	0.574
Newcastle	School Quality	0.004	0.003
	R^2	0.529	0.598

6. Summary and Conclusions

The results in this study provide robust evidence that the differences in state-funded secondary school performance in GCSE examinations is consistently capitalised into residential property prices; ie., residential properties which are located proximate to high performing state-funded secondary schools attract a price premium. The extent of the price premium varies between different cities. In Greater London, Liverpool, Birmingham and Newcastle a 10% point differential in GCSE performance produces a 1% point differential in residential properties located close to the high performing school. In Greater Manchester and Leeds the same differential in school performance produces a 2% point increase in residential properties located close to the high performing school, while in Bristol a 10% point differential in GCSE performance produces a 3% point increase in residential properties located close to the high performing school. Note that this implies that in Bristol a property where the closest school had a pass rate of 80% compared to a property where the closest school had a pass rate of 40% would attract a price premium of 12% points, *ceteris paribus.* Using average prices in 2007 and the average percentage premia for an improvement in school performance since 2001, we find that the value placed on 'good education' in terms of a premium on house prices ranges from £13.5k in Bristol to £2.7k in Newcastle.

We experimented with different representations of school performance. Specifically, we examined if there were threshold values of GCSE pass rates which defined a 'good' school. We also examined the relative performance of schools to ascertain if a house price premium was paid for an above local average or above national average performance. In all cases none of the alternative specifications of school performance produced superior results to our preferred specification. This reinforces the suggestion that it is the absolute performance of the nearest state funded secondary schools that parents focus upon when making house purchasing decisions.

The cities which attracted the highest price premia for 'good' school performance were those where the average pass rate in GCSE examinations was the lowest. In other words, in those cities where the supply of good schools was lower, the price premium for a 'good' school, in terms of the rate at which school performance was capitalised into local property prices, was higher. This finding has implications for students' ability to access high performing schools, in so far as their parents have an inability to pay the price premium required to purchase a house which would guarantee access. The response of the current UK government to the paradox of pupils being denied access to state-funded education due to their parents 'inability' to pay a shadow price that exists in the local residential property market is to introduce a lottery into the allocation of places at 'oversubscribed' schools. We would suggest that this is inappropriate in that it deals with the symptoms of the problem rather than the causes. We would argue that the government should focus on improving school quality as doing so would remove the extent of the price premium that ‘high performing’ schools attract, thereby reducing the extent to which students would be excluded from state-funded secondary education because of their parents inability to ‘pay the price’ in local residential property markets.

Finally, it may be the case that the private sector may be willing to fund improvements in state-funded secondary schooling, as low performing schools will mean that they may find it difficult to attract workers with children of secondary school age to areas where secondary school performance is poor. In such circumstances workers may require wages which allow them to educate their children at private schools or in *extremis* they may not move to a particular city. In addition, appropriate public transport policy may enable students to access good performing schools from a greater geographical distance and perhaps alleviate any upward pressures on local house prices. These points are worthy of further investigation.

References:

Bartik, Timothy J. 1988. "Measuring the benefits of amenity improvements in hedonic price models" *Land Economics,* **64**(2): 172-183.

Bayer, Patrick J, Robert McMillan, and, Fernando V Ferreira. 2003. "A unified framework for measuring preferences for schools and neighbourhoods" Yale University Economic Growth Center, Discussion Paper 872..

Belsey, David A, Edwin Kuh, and Roy E Welsch. 1980. *Regression Diagnostics: Identifying Influential Data and Sources of Collinearity.* New York: Wiley.

Benabou, Roland. 1996, "Equity and efficiency in human capital development: The local connection" *Review of Economic Studies,* **63,** 237-264.

Black, Sandra E. 1999, 'Do better schools matter? Parental valuation of elementary education' *Quarterly Journal of Economics*, **114** (May): 577-599.

Bogart, William T, and Brian A Cromwell. 1997, "How much more is a good school district worth?" *National Tax Journal (1986-1998),* **50**(2): 215-232.

Box, George EP, and D R Cox. 1964, "An analysis of transformations" *Journal of the Royal Statistical Society, Series B,* **21**, 1-44.

Brasington, David M. 2002, "Edge versus center: finding common ground in the capitalization debate" *Journal of Urban Economics,* **52**(3): 524-541.

Brasington, David M, and Diane Hite, 2005 "Demand for environmental quality: A spatial hedonic analysis" LSU Department of Economics Working Paper 2005-08.

Brasington, David M, and Donald R Haurin, 2006, "Educational outcomes and house values: A test of the value added approach" *Journal of Regional Science,* **46**(2): 245-268.

CACI, 2006, *The ACORN user guide* (London)

Carroll ,Thomas M, Terrance M Clauretie, and Jeff Jensen. 1996, "Living next to godliness: residential property values and churches" *Journal of Real Estate Finance & Economics,* **12**(3): 319-330.

Chay, Kenneth Y, and Michael Greenstone. 2004, "Does air quality matter? Evidence from the housing market" *SSRN Working Paper Series.*

Cheshire, Paul, and Stephen C Shepherd. 2004, "Capitalising the value of free schools: the impact of supply characteristics and uncertainty" *The Economic Journal,* **114**(499): 397-424.

Crone, Theodore M. 1998, “House prices and the quality of public schools: What are we buying?” *Business Review - Federal Reserve Bank of Philadelphia,* (September/October): 3-14.
Davidoff, Ian, and Andrew Leigh. 2007, “How much do public schools really cost? Estimating the relationship between house prices and school quality” Australian National University, Centre for Economic Policy Research, Discussion Paper 558
Do, A Quang, Robert W Wilbur, and James L Short. 1994, “An empirical examination of the externalities of neighborhood churches on housing values” *Journal of Real Estate Finance & Economics,* **9**(2): 127-136.
Downes, Thomas A, and Jeffrey E Zabel. 2002, “The impact of school characteristics on house prices: Chicago 1987-1991” *Journal of Urban Economics,* **52**, 1-25.
Elkins, Tom, and John Elliott. 2004, “Competition and control: the impact of government regulation on teaching and learning in English schools” *Research papers in education,* **19**(1): 15-30.
Fleming, Michael C, and Joseph G Nellis. 1985, “The application of hedonic indexing methods: a study of house prices in the United Kingdom” *Statistical Journal of the United Nations,* **ECE 3**, 249-270.
Forrest, David, John Glen, and Robert Ward. 1996, “The impact of a light rail system on the structure of house prices: A hedonic longitudinal study” *Journal of Transport Economics and Policy,* **30**(1): 15-29.
Garrod, Guy D, and Ken G Willis. 1992, “Valuing goods' characteristics: an application of the hedonic price method to environmental attributes” *Journal of Environmental Management,* **34**, 56-76.
Gibbons, Stephen, and Stephen Machin. 2003, ‘Valuing English primary schools’ Journal of Urban Economics, **53** 197-219.
Gibbons, Stephen, and Stephen Machin. 2006, ‘Paying for primary schools: Admissions constraints, school popularity or congestion’ *Economic Journal,* **116**, C77-C92.
Gibbons, Stephen, and Stephen Machin. 2008 “Valuing school quality, better transport, and lower crime: evidence from house prices” *Oxford Review of Economic Policy,* **24**(1): 99-199.
Graves, Philip, James C Murdoch, Mark A Thayer, and Donald M Waldman. 1988, “The robustness of hedonic price estimation: Urban air quality” *Land Economics,* **64**(3): 220-233.

Haurin, Donald R, and David M Brasington. 1996, "School quality and real house prices: Inter- and intra-metropolitan effects" *Journal of Housing Economics,* **5**(4): 351-368.
Hayes, Kathy J, and Lori L Taylor. 1996 "Neighborhood school characteristics: What signals quality to homebuyers?" *Economic Review - Federal Reserve Bank of Dallas,* **4:** 2-9.
Hilber, Christian AL, and Christian J Mayer. 2002, "Linking house price capitalization to school Spending" *Business Review (Federal Reserve Bank of Philadelphia),* **34**.
Hoyt, William H. 1999, "Leviathan, local government expenditures, and capitalization" *Regional Science and Urban Economics,* **29**(2): 155-171.
Kane, Thomas J, Douglas O Staiger, and Stephanie K Riegg. 2005, "School quality, neighborhoods and housing prices: The impacts of school desegregation" NBER Working Paper 11347, NBER, Cambridge, MA.
Leech, Dennis, and Erick Campos. 2003, "Is comprehensive education really free? A case study of the effects of secondary school admissions policies on house prices in one local area" *Journal of the Royal Statistical Society: Series A (Statistics in Society),* **166**(1): 135-154.
Levesque, Terrence J. 1994, "Modeling the effects of airport noise on residential housing markets: a case study of Winnipeg International airport" *Journal of Transport Economics and Policy,* **28**, 199-210.
McCluskey, Jill J, and Gordon C Rausser. 2000, "Hazardous waste sites and housing appreciation rates" *mimeo,* University of California, Berkeley.
Reback, Randall. 2005. "House prices and the provision of local public services: Capitalisation under school choice programs", *Journal of Urban Economics*, **57**, 275-301.
Rosen, Sherwin. 1974, "Hedonic prices and implicit markets: Product differentiation in pure competition", *Journal of Political Economy*, **82**, 34-55.
Rosenthal, Leslie. 2003, "The value of secondary school quality" *Oxford Bulletin of Economics and Statistics,* **65**(3): 329-355.
Ryan, Chris, and Luke Sibieta. 2010, "Private schooling in the UK and Australia", Institute for Fiscal Studies
Scanlon, Kathleen and Christine Whitehead. 2004, "International trends in housing tenure and mortgage finance", Council of Mortgage Lenders, London.
Starrett, David A. 1981, "Land Value Capitalization in Local Public Finance" *Journal of Political Economy,* **89**(2): 306-327.

Taylor, Lori L. 2005, "Revealed preference measures of school quality" in *Measuring school performance and efficiency: implications for practice and research.* Eds. Leanna Stiefel, Amy Ellen Schwartz, Ross Rubenstein, Jeffrey E Zabel, Larchmont NV: Eye on Education.
Weimer, David L, Michael J Wolkoff. 2001, "School performance and housing values using non contiguous district and incorporation boundaries to identify school effects" *National Tax Journal,* **45**, 231-254.
Wildasin, David E, 1987, "Theoretical Analysis of Local Public Economics" in *Handbook of Regional and Urban Economics: 2,* ed. Edwin S Mills, 1132-1178. Amsterdam: North Holland.

Appendix: Tables A-G

Table A: Birmingham

Variable	Coefficient	Standard Error	T-statistic
Constant	10.482	0.007	1398.444**
House Type			
Detached	0.157	0.005	30.731**
Terraced	-0.114	0.004	-30.089**
Bungalow	0.133	0.012	11.459**
Flat	-0.200	0.006	-31.713**
Number of Bathrooms	0.116	0.004	31.813**
Number of Toilets	0.051	0.003	18.532**
Number of Garages	0.083	0.003	29.270**
Number of Garage Spaces	0.035	0.002	22.201**
Garden	0.106	0.008	14.004**
Size (in square metres)	0.003	0.000	72.675**
Availability of Central Heating			
None	-0.066	0.004	-17.616**
Partial	-0.055	0.005	-11.718**
Age of Property			
Pre-1919	0.070	0.005	15.173**
1919-1945	0.071	0.004	18.879**
1945-1960	0.029	0.005	6.248**
New	0.097	0.006	16.021**
Acorn Classification			
A	0.617	0.007	83.179**
B	0.433	0.006	66.959**
C	0.435	0.008	57.806**
D	0.444	0.007	60.832**
EFG	0.284	0.004	71.109**
H	0.173	0.004	42.342**
J	-0.035	0.005	-6.402**
Time			
Yr 2002	0.234	0.006	41.514**
Yr 2003	0.417	0.005	76.379**
Yr 2004	0.515	0.006	93.308**
Yr 2005	0.580	0.005	110.609**
Yr 2006	0.624	0.005	119.508**
Yr 2007	0.669	0.005	129.969**
School Quality	0.001	0.000	18.133**
	Sample size	38,456	
	Adjusted R^2	0.772	
	F-Statistic	4348.164	

**Significant at the 5%, or higher level, of significance

Table B: Bristol

Variable	Coefficient	Standard Error	T-statistic
Constant	10.938	0.011	1031.013**
House Type			
Detached	0.190	0.008	24.540**
Semi-detached	0.084	0.006	15.107**
Bungalow	0.125	0.013	9.278**
Flat	-0.073	0.008	-8.813**
Number of Bathrooms	0.134	0.005	27.555**
Number of Toilets	0.061	0.004	14.417**
Number of Garages	0.089	0.004	22.016**
Number of Garage Spaces	0.034	0.003	13.584**
Garden	-0.038	0.009	-4.268**
Size (in square metres)	0.003	0.000	56.701**
Availability of Central Heating			
None	-0.014	0.007	-2.098**
Partial	-0.065	0.009	-7.418**
Age of Property			
1919-1945	-0.048	0.007	-6.862**
1945-1960	-0.117	0.008	-14.913**
1960+	-0.123	0.006	-20.193**
New	-0.103	0.009	-11.172**
Acorn Classification			
A	0.252	0.010	25.580**
B	0.116	0.008	15.137**
C	0.103	0.011	9.386**
D	0.188	0.007	25.879**
H	-0.068	0.006	-11.032**
IK	-0.224	0.007	-34.156**
J	-0.176	0.014	-12.246**
Time			
Yr 2002	0.256	0.009	29.399**
Yr 2003	0.346	0.008	41.816**
Yr 2004	0.417	0.008	51.046**
Yr 2005	0.439	0.008	56.215**
Yr 2006	0.534	0.007	73.467**
Yr 2007	0.609	0.007	83.455**
School Quality	0.003	0.000	24.614**
	Sample size	13,698	
	Adjusted R^2	0.774	
	F-Statistic	1561.433	

**Significant at the 5%, or higher level, of significance.

Table C: Leeds

Variable	Coefficient	Standard Error	T-statistic
Constant	10.133	0.007	1466.668**
House Type			
Detached	0.230	0.005	43.328**
Semi-detached	0.102	0.004	27.111**
Bungalow	0.217	0.007	30.926**
Flat	0.042	0.006	6.517**
Number of Bathrooms	0.139	0.004	38.986**
Number of Toilets	0.071	0.003	23.791**
Number of Garages	0.104	0.003	38.990**
Number of Garage Spaces	0.037	0.001	25.507**
Garden	-0.025	0.006	-4.177**
Size (in square metres)	0.003	0.000	83.712**
Availability of Central Heating			
None	-0.103	0.003	-31.379**
Partial	-0.074	0.006	-12.351**
Age of Property			
Pre-1919	-0.005	0.004	-1.300
1919-1945	0.014	0.004	3.660**
1945-1960	-0.025	0.005	-5.289**
New	0.052	0.006	8.580**
Acorn Classification			
A	0.612	0.007	84.666**
B	0.391	0.006	68.846**
C	0.391	0.007	52.240**
D	0.505	0.007	73.340**
EFG	0.288	0.004	77.070**
H	0.173	0.004	47.179**
J	-0.082	0.007	-11.656**
Time			
Yr 2002	0.211	0.005	40.816**
Yr 2003	0.402	0.005	80.616**
Yr 2004	0.571	0.005	112.998**
Yr 2005	0.686	0.005	140.757**
Yr 2006	0.756	0.005	160.369**
Yr 2007	0.824	0.005	174.231**
School Quality	0.002	0.000	27.721**
	Sample size	44,278	
	Adjusted R^2	0.794	
	F-Statistic	5681.224	

**Significant at the 5%, or higher level, of significance.

Table D: Liverpool

Variable	Coefficient	Standard Error	T-statistic
Constant	10.267	0.010	977.921**
House Type			
Detached	0.125	0.008	15.994**
Terraced	-0.152	0.006	-26.672**
Bungalow	0.128	0.013	9.581**
Flat	-0.034	0.008	-4.066**
Number of Bathrooms	0.117	0.005	21.849**
Number of Toilets	0.057	0.004	13.697**
Number of Garages	0.102	0.005	22.469**
Number of Garage Spaces	0.043	0.003	16.398**
Garden	-0.056	0.007	-8.352**
Size (in square metres)	0.003	0.000	52.314**
Availability of Central Heating			
None	-0.065	0.006	-11.774**
Partial	-0.012	0.005	-2.249**
Age of Property			
Pre-1919	0.070	0.007	10.153**
1919-1945	0.130	0.006	22.866**
1945-1960	0.039	0.007	5.570**
New	0.110	0.008	13.522**
Acorn Classification			
A	0.598	0.013	44.689**
B	0.416	0.010	41.192**
C	0.470	0.011	42.314**
D	0.452	0.011	39.993**
EFG	0.330	0.006	56.030**
H	0.224	0.006	38.875**
J	0.030	0.013	2.257**
Time			
Yr 2002	0.158	0.008	20.013**
Yr 2003	0.386	0.008	51.218**
Yr 2004	0.625	0.008	80.198**
Yr 2005	0.739	0.007	100.985**
Yr 2006	0.783	0.007	109.475**
Yr 2007	0.814	0.007	112.168**
School Quality	0.001	0.000	12.589**
	Sample size	19,506	
	Adjusted R^2	0.772	
	F-Statistic	2200.021	

**Significant at the 5%, or higher level, of significance.

Table E: Greater London

Variable	Coefficient	Standard Error	T-statistic
Constant	11.499	0.004	2940.455**
House Type			
Detached	0.223	0.005	45.849**
Semi-detached	0.208	0.003	67.335**
Terraced	0.165	0.002	70.117**
Bungalow	0.267	0.008	34.091**
Number of Bathrooms	0.254	0.002	137.899**
Number of Toilets	0.064	0.002	40.188**
Number of Garages	0.035	0.002	17.343**
Number of Garage Spaces	0.012	0.001	9.728**
Garden	0.048	0.002	22.272**
Size (in square metres)	0.004	0.000	167.389**
Availability of Central Heating			
None	-0.023	0.002	-9.640**
Partial	-0.029	0.004	-7.933**
Age of Property			
1919-1945	-0.100	0.002	-44.586**
1945-1960	-0.183	0.003	-59.782**
1960+	-0.211	0.002	-96.259**
New	-0.178	0.004	-42.480**
Acorn Classification			
A	0.020	0.005	4.085**
B	-0.126	0.005	-27.624**
C	-0.227	0.008	-29.390**
EFG	-0.294	0.002	-124.190**
H	-0.373	0.003	-120.579**
IK	-0.483	0.003	-138.289**
J	-0.291	0.002	-124.842**
Time			
Yr 2002	0.163	0.003	47.055**
Yr 2003	0.245	0.004	69.459**
Yr 2004	0.279	0.003	82.525**
Yr 2005	0.330	0.003	107.994**
Yr 2006	0.420	0.003	140.998**
Yr 2007	0.523	0.003	178.558**
School Quality	0.001	0.000	24.127**
	Sample size	167,807	
	Adjusted R^2	0.699	
	F-Statistic	13003.140	

**Significant at the 5%, or higher level, of significance.

Table F: Greater Manchester

Variable	Coefficient	Standard Error	T-statistic
Constant	10.082	0.006	1580.512**
House Type			
Detached	0.233	0.005	46.175**
Semi-detached	0.133	0.003	38.038**
Bungalow	0.218	0.007	30.836**
Flat	0.111	0.006	20.015**
Number of Bathrooms	0.153	0.003	47.627**
Number of Toilets	0.054	0.003	20.702**
Number of Garages	0.087	0.003	33.226**
Number of Garage Spaces	0.061	0.001	41.786**
Garden	-0.083	0.004	-20.070**
Size (in square metres)	0.003	0.000	94.968**
Availability of Central Heating			
None	-0.036	0.004	-10.072**
Partial	-0.062	0.007	-9.517**
Age of Property			
Pre-1919	0.102	0.004	26.737**
1919-1945	0.082	0.004	22.602**
1945-1960	0.006	0.005	1.408
New	0.110	0.005	22.106**
Acorn Classification			
A	0.712	0.007	106.397**
B	0.449	0.005	93.784**
C	0.437	0.006	67.623**
D	0.508	0.006	81.769**
EFG	0.337	0.004	95.624**
H	0.191	0.004	52.921**
J	-0.023	0.007	-3.168**
Time			
Yr 2002	0.168	0.005	34.905**
Yr 2003	0.332	0.005	70.920**
Yr 2004	0.545	0.005	117.642**
Yr 2005	0.651	0.004	147.466**
Yr 2006	0.708	0.004	166.047**
Yr 2007	0.759	0.004	180.704**
School Quality	0.002	0.000	21.378**
	Sample size	60,502	
	Adjusted R^2	0.776	
	F-Statistic	7006.727	

**Significant at the 5%, or higher level, of significance.

Table G: Newcastle

Variable	Coefficient	Standard Error	T-statistic
Constant	10.509	0.012	856.103**
House Type			
Detached	0.084	0.007	11.668**
Terraced	-0.089	0.005	-16.156**
Bungalow	0.102	0.009	10.794**
Flat	-0.173	0.007	-23.150**
Number of Bathrooms	0.144	0.005	28.842**
Number of Toilets	0.052	0.004	13.255**
Number of Garages	0.121	0.004	30.089**
Number of Garage Spaces	0.035	0.003	11.565**
Garden	-0.014	0.007	-2.056**
Size (in square metres)	0.003	0.000	55.719**
Availability of Central Heating			
None	0.017	0.006	2.962**
Partial	-0.064	0.010	-6.671**
Age of Property			
Pre-1919	0.114	0.006	17.712**
1919-1945	0.062	0.006	11.064**
1945-1960	0.016	0.006	2.555**
New	0.093	0.008	11.883**
Acorn Classification			
A	0.569	0.012	47.837**
B	0.348	0.009	40.009**
C	0.350	0.010	33.478**
D	0.465	0.009	54.551**
EFG	0.270	0.005	49.393**
H	0.151	0.006	25.714**
J	0.071	0.011	6.552**
Time			
Yr 2002	0.237	0.010	23.525**
Yr 2003	0.382	0.009	41.649**
Yr 2004	0.527	0.009	58.073**
Yr 2005	0.575	0.009	62.962**
Yr 2006	0.611	0.009	68.039**
Yr 2007	0.663	0.009	73.474**
School Quality	0.001	0.000	3.566**
	Sample size	15,206	
	Adjusted R^2	0.729	
	F-Statistic	1361.268	

**Significant at the 5%, or higher level, of significance