The Impact of a Light Rail System on the Structure of House Prices

A Hedonic Longitudinal Study

By David Forrest, John Glen and Robert Ward*

1. Introduction
The aim of this paper is to examine the relationship between the availability of commuter rail services and the pattern of house prices in an urban area, and to assess whether modernisation of facilities can modify prices. The setting for the study is Greater Manchester, the largest conurbation in the North of England.

Greater Manchester’s 2.5 million population is served by a dense rail network. In an area of some 1,300 sq km, there were 115 stations open in 1990 (the year to which our first data set pertains); and in our large sample of property transactions the mean distance to the nearest station was only 1.36 km. The rail lines were mostly constructed in the nineteenth century and radiate from central Manchester to satellite towns.

Although the number of train services is large, the system has long been regarded as inadequate. The principal perceived problem has been that the stations serving the city centre are on its periphery and most users therefore face a walk of ten minutes or more to their final destination. In the 1980s the Greater Manchester Passenger Transport Executive made proposals to address this problem and won central government approval and funding for a new light rapid transit (LRT) line called Metrolink; it was to comprise Phase 1 of a future LRT network. Metrolink opened in 1992. It involved the conversion of two conventional rail lines to LRT operation: these were the busiest commuter routes, serving Bury to the north and Altrincham to the south. New vehicles provide through-service.

---

* Department of Economics, University of Salford. The Nationwide Building Society generously supplied much of the data on which the analysis is based. The work was carried out in conjunction with the Metrolink Impact Study based at the Department of Geography, University of Salford. The Metrolink Impact Study was jointly funded by the GMPT and the ESRC. Keith Grime, John Dodgson, Richard Knowles, Chris Law and Martin Senior provided valuable comments and Liz Fairweather assisted by assigning grid references to stations. Material from Crown Copyright records was made available through the Post Office and the ESRC Data Archive.
between Bury and Altrincham, using newly constructed lines on city centre streets with stations to provide direct access to central facilities. The quantified benefit to justify the investment was time savings to travellers who would avoid or reduce the extra journey from station to final destination. This benefit had a large monetary value because savings in walking time are valued at double the rate of in-vehicle time savings in standard government methodology (Department of Transport, 1987). Existing bus passengers also stood to make time savings because a proportion was thought to use buses because that mode had better access to final destinations: when LRT gave rail an equal advantage in this regard, passengers were expected to switch mode and enjoy faster journey times from the suburbs.

We present a two-stage study designed to test whether the perception of Metrolink in operation is sufficiently favourable to be reflected in the market value of properties with good access to the service. First, on the basis of a rich data set for a period predating the service, we use the hedonic price method to estimate price differentials for properties with good access to railway stations either on the Metrolink routes or on other Greater Manchester lines. Then we use a similar data set for the period after Metrolink opened to check whether these price differentials have changed following the introduction of LRT.

Although our study was designed as a method for evaluating the success of Metrolink, we found the results of the pre-LRT exercise to be interesting in themselves. In Section 2 we discuss the hedonic price method. In Section 3, we describe the 1990 data set that we used. Section 4 discusses the specification of regression equations for 1990. Section 5 reports results that rail corridors in 1990 comprised areas of unusually low property prices. In Section 6, we attempt an interpretation of this perhaps surprising result. In Section 7, we report the results of our second-stage exercise where we check for any Metrolink impact. Section 8 offers a summary of the implications of our findings both for Metrolink and for the methodological issues on which our study throws light.

2. The Hedonic Price Method

In equilibrium, the price of a house provides a market valuation of the future stream of benefits expected from living in it. These benefits will be related to the characteristics of the house and its neighbourhood and to the level of transport services nearby. Where an improved transport link is installed, prices should rise to reflect the value placed by purchasers on access to the new amenity. An estimation of such price differentials therefore comprises a convenient method for valuing the benefit derived from new services.

A relationship between transit lines and property prices has long been identified. In evidence presented to the Royal Commission on Metropolis Railway Termini (1846), Mr Charles Pearson, commenting on the effect of urban rail schemes in London, stated:

"I have in my hand a report made to me by a gentleman appointed for the purpose, who has visited all the neighbourhoods where these improvements have taken place. He has gone from street to street, and from house to house, to ascertain what
effect has been produced upon the condition of the poor by these improvements. He finds the rents for the wretched hovels of the poor increased 10, 15, 20 and 25 per cent in all the surrounding districts where these improvements have taken place, and that the weekly rents of their rooms have generally increased also."

(Quoted in Kellett, 1969).

If we assume that capital values moved in line with rents, Mr Pearson's consultant may be interpreted as reporting that rail lines in early Victorian London raised house prices by 10-25 per cent.

Modern investigators mostly use econometric techniques to identify the relationship between capital values and transport services. Typically, researchers estimate what are essentially reduced form price equations in which capital value is related to a measure of proximity to the service and to whatever measures of house and neighbourhood characteristics are available. Inspection of the coefficient estimated on the transport access variable is used to gauge the market's valuation of the service. An outline of this hedonic method is available in Johansson (1987) and an assessment is provided by Freeman (1979).

Empirically, the most likely limitation on the usefulness of the method may be multicollinearity. As Butler (1982) comments, one is unlikely to find a fourteen-bedroom property with only one bathroom and vice versa! However, whether multicollinearity is a problem in drawing conclusions from any given data can only be determined statistically, and we report below the findings of a test designed to assess whether it is a cause for worry in our exercise.

Damm et al. (1980) is an example of the use of the methodology for evaluating the effect of new infrastructure. It was found that proximity to stations on the new Washington metro system had a significant effect on property values. In Section 6, we explore the contrast between this result and our Manchester findings. Bajic (1983) employed the methodology in the context of subway development in Toronto and his results are also considered below.

In Europe, a recent attempt to evaluate transport investment was Laaskso (1992). He employed the hedonic method to claim that a new Helsinki metro system had raised property prices. The weaknesses of his use of the methodology are also discussed in Section 6.

Thus far, the hedonic price method has not been used formally to evaluate transport services provision in Britain. However, there have been less formal attempts to assess the effects on house prices of the Tyne and Wear Metro (see Miles et al., 1981; Lewis, 1986; and CURDS, TORG and DTCP, 1990).

3. The Data Set

Our data set for 1990, provided by the Nationwide Building Society, gave information on 892 property sales in Greater Manchester for which the Society had advanced mortgages. Ninety were discarded from our analysis because of missing information. We eliminated
a further seven for which the price differed from the Society's own valuation by more than 20 per cent; this was an ad hoc procedure to prevent the results from being contaminated by transactions made at non-market prices. We were left with a sample of 795 properties. For each, we had information on the characteristics of the property itself and on neighbourhood and location. A full account of the information in the data set is provided by Fleming and Nellis (1989).

**Property characteristics**

Information on the property included form of tenure, age, house type (detached, semi-detached, terraced, flat, maisonette or bungalow), floor area, and numbers of bedrooms, bathrooms and garages. The amount of central heating (full, partial or none) and its fuel type were also recorded. Unfortunately, there was no measure of the property's condition or of plot size. However, these omissions may not be serious. Dodson and Topham (1990) reported an experiment in which a sample of properties was valued using hedonic price equations and on-site surveyors' inspections. Valuations from the methods were broadly similar, suggesting that condition (known only to the surveyors) was typically not of decisive importance to price. Plot size is likely to be correlated with some measured variables in the data set, such as age and number of garages, and a limited allowance is therefore made for it in the equations we estimate. Nevertheless, we will report that the absence of a measure of plot size makes interpretation of our results more difficult.

**Neighbourhood characteristics**

The price of a property will reflect not only its own characteristics but also the quality of its neighbourhood. On the basis of postcodes, the Nationwide data set allocates two measures of neighbourhood type, ACORN Code (which has 39 possible values) and Parliamentary Constituency Class (a nine-point classification).

The ACORN code (A Classification of Residential Neighbourhoods) is assigned by CACI Marketing. On the basis of postcode, each property is allocated to a census enumeration district which is then classified according to key census characteristics. Since each enumeration district comprises only 100-150 households, this gives a detailed measure of neighbourhood. Within this framework, each category refers to a description of neighbourhood such as "inter-war council estates, older people" (ACORN 20). Appendix 1 lists the 34 ACORN codes represented in our data.

It is plausible that the price of a house will be related to the status of a much wider area. For example, buyers may be willing to pay more for a property for which the immediate surroundings are ordinary but which is close to a high-status suburb offering good schools and speciality shopping. The Parliamentary Constituency Class possibly captures this broader concept of neighbourhood. Each property is allocated to one of nine "PC classes" with descriptions such as "deprived inner cities" (PC3). A list of the six categories represented here is provided in Appendix 1.

Another entry determined by postcode tells us which of the ten councils in Greater Manchester is responsible for each address. This will be relevant because authorities offer different tax/service combinations. The significance of local fiscal baskets for house prices in Greater Manchester was explored by Topham and Ward (1992).
Property location
We were fortunate to have the full postcode for each property. By using the Post Office Central Postcode Directory (POSTZON) we converted this to a relatively precise measure of the location of each property. POSTZON consists of a single-entry data record for each of the 1.6 million postcodes in the system. It includes an eight-figure Ordnance Survey (OS) grid reference for the first address in each postcode. Thus we were able to allocate each postcode in our sample to the south-west corner of a 100 metres square.

Of course, if one is told that a property lies within a given square, its expected position is not the south-west corner quoted by POSTZON, but rather the exact centre. Therefore we converted each eight-figure grid reference generated by POSTZON to a ten-figure reference: we inserted the figure 5 as a new fifth and a new tenth digit of the grid reference. Each property in the sample is thereby given an estimated position at the centre of a 100 metres square.

Using very large scale OS maps, we identified the positions of stations even more accurately: each of the 115 in Greater Manchester was given a ten-figure OS reference, thus associating it with a box only ten metres square.

OS grid references are divided into two parts, known as Eastings and Northings. The first identifies location by reference to a north-south line; the second refers to a line running along a west-east axis. By comparing the first half of the reference for any property with that for any station, we were able to obtain the distance between them as measured along the relevant line of longitude. A similar process of subtraction for the Northings of the respective references gave us our estimate of the distance between them measured along a north-south line.

The straight-line distance between property and station was then calculated by Pythagoras’ Theorem. This gave, for every property in the sample, an estimate of the linear distance to each of the 115 stations. It was then a simple matter to create the variable “distance to nearest station”; its mean value across the sample was 1.36 km.

We were also interested in distance to the Central Business District (CBD). This was calculated by the same method as our measure of access to the railway system with Manchester Town Hall representing the CBD.

Of course, the sample had a temporal as well as a spatial dimension: the transactions extended over a year. Unfortunately, while each observation had a date, this appeared to relate to an aspect of the Society’s book-keeping rather than to the transaction. We therefore decided not to use a time variable.

Fortunately, 1990 was a year of relatively stable prices in North West England (the Nationwide Anglia house price index for the region rose by only 3.1 per cent). Again, there is little reason to suppose that different types of house will have different temporal patterns of sales. The effect on our results of not having reliable transaction dates should not, therefore, bias our estimates.

On an overall view, the 1990 data set available to us was richer than that used by others who have carried out hedonic studies. In particular, the location of properties is identified more precisely than in any other study with which we are familiar. We therefore expected to be able to attach a relatively high degree of confidence to the results.
4. Specification of Equations

Almost all the information in the data set on property characteristics was included in the estimation. Thus we have as the dependent variable property price and, as independent variables, the continuous measures of age and floor area and a number of dummy variables to capture the effects of property type, form of tenure, number of garages, bedrooms and bathrooms, and the presence or absence of central heating and its type. Our choice of excluded category was made by reference to the frequency distribution of the sample. Thus our equations explored the influence of property characteristics by reference to a “standard” property which was a terraced house with freehold tenure, no garage, three bedrooms, one bathroom and full gas central heating. All these characteristics were the modal ones in the 1990 data.

Of the two continuous variables, floor area in square metres was straightforward. However, age was expected to be a complex variable because it could influence price in a variety of ways. For example, it may serve as a proxy for unrecorded physical characteristics such as height of ceiling. We therefore experimented with various specifications of age and also recorded it as actual age plus one: this eliminated zero readings and allowed Box-Cox estimation.

Neighbourhood effects are represented by a series of dummies representing ACORN and parliamentary constituency classifications. ACORN 11 (older private housing, skilled workers) and PC2 (older industrial, textile towns) were modal groups and were taken as excluded categories. Local authority is represented by nine dummies, these carrying the names of the boroughs outside the reference category, the City of Manchester itself.

Locational characteristics were included to assess the significance of the property’s distance from the CBD and the importance of its access to stations. For the latter purpose, we divided properties into five categories:

(a) properties within 1 km of the nearest station where this lies on the Metrolink route (ML1) (6.7 per cent of sample);

(b) properties within a distance of 1-2 km of the nearest station where this lies on the Metrolink route (ML12) (5.8 per cent of sample);

(c) properties within 1 km of the nearest station where this lies on a non-Metrolink line (NONML1) (35.5 per cent of sample);

(d) properties within a distance of 1-2 km of the nearest station where this lies on a non-Metrolink line (NONML12) (32.1 per cent of sample); and

(e) properties more than 2 km from the nearest station (19.9 per cent of sample).

To highlight the significance of railway services, the first four of these categories were represented by dummy variables, prices being measured against the reference grouping of properties with no close proximity to a station.
The Impact of a Light Rail System on the Structure of House Prices

D. Forrest et al.

Table 1
Regression Results from the 1990 Data Set
Dependent Variable: natural log of price

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t</th>
<th>Variable</th>
<th>Coefficient</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>10.28</td>
<td>188.43</td>
<td>ACORN 10</td>
<td>0.19</td>
<td>2.99</td>
</tr>
<tr>
<td>Age</td>
<td>-0.0044</td>
<td>-6.67</td>
<td>ACORN 13</td>
<td>-0.07</td>
<td>-2.22</td>
</tr>
<tr>
<td>Age Squared</td>
<td>0.000020</td>
<td>4.22</td>
<td>ACORN 16</td>
<td>-0.37</td>
<td>-2.68</td>
</tr>
<tr>
<td>Area (sq m)</td>
<td>0.0043</td>
<td>11.96</td>
<td>ACORN 20</td>
<td>-0.11</td>
<td>-2.65</td>
</tr>
<tr>
<td>Detached house</td>
<td>0.46</td>
<td>11.48</td>
<td>ACORN 26</td>
<td>-0.27</td>
<td>-3.32</td>
</tr>
<tr>
<td>Semi-detached house</td>
<td>0.16</td>
<td>7.85</td>
<td>ACORN 27</td>
<td>-0.12</td>
<td>-2.32</td>
</tr>
<tr>
<td>Detached bungalow</td>
<td>0.50</td>
<td>7.52</td>
<td>ACORN 30</td>
<td>0.085</td>
<td>1.58</td>
</tr>
<tr>
<td>Semi-detached bungalow</td>
<td>0.30</td>
<td>4.28</td>
<td>ACORN 33</td>
<td>0.058</td>
<td>1.69</td>
</tr>
<tr>
<td>Purpose-built maisonette</td>
<td>0.26</td>
<td>1.60</td>
<td>ACORN 34</td>
<td>0.16</td>
<td>3.74</td>
</tr>
<tr>
<td>One garage</td>
<td>0.065</td>
<td>3.85</td>
<td>ACORN 35</td>
<td>0.23</td>
<td>2.21</td>
</tr>
<tr>
<td>Two garages</td>
<td>0.085</td>
<td>1.53</td>
<td>ACORN 36</td>
<td>0.33</td>
<td>5.65</td>
</tr>
<tr>
<td>No central heating</td>
<td>-0.097</td>
<td>-5.75</td>
<td>PC 1</td>
<td>0.044</td>
<td>1.65</td>
</tr>
<tr>
<td>Full solid fuel central heating</td>
<td>-0.19</td>
<td>-1.93</td>
<td>PC 6</td>
<td>0.18</td>
<td>3.13</td>
</tr>
<tr>
<td>One bedroom</td>
<td>-0.091</td>
<td>-2.00</td>
<td>PC 7</td>
<td>0.25</td>
<td>6.55</td>
</tr>
<tr>
<td>Two bedrooms</td>
<td>-0.044</td>
<td>-2.44</td>
<td>PC 8</td>
<td>0.10</td>
<td>3.72</td>
</tr>
<tr>
<td>Four bedrooms</td>
<td>0.13</td>
<td>3.15</td>
<td>Oldham</td>
<td>-0.078</td>
<td>-2.40</td>
</tr>
<tr>
<td>Five bedrooms</td>
<td>0.17</td>
<td>1.51</td>
<td>Rochdale</td>
<td>-0.083</td>
<td>-2.14</td>
</tr>
<tr>
<td>CBD DISTANCE</td>
<td>0.0052</td>
<td>1.94</td>
<td>Salford</td>
<td>0.11</td>
<td>3.88</td>
</tr>
<tr>
<td>ML1</td>
<td>-0.021</td>
<td>-0.53</td>
<td>Tameside</td>
<td>0.10</td>
<td>2.93</td>
</tr>
<tr>
<td>ML12</td>
<td>-0.081</td>
<td>-2.09</td>
<td>Trafford</td>
<td>0.12</td>
<td>2.93</td>
</tr>
<tr>
<td>NONML1</td>
<td>-0.045</td>
<td>-2.15</td>
<td>Wigan</td>
<td>-0.12</td>
<td>-2.14</td>
</tr>
<tr>
<td>NONML12</td>
<td>-0.044</td>
<td>-2.11</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$R^2 = 0.79$

All coefficients are reported to two significant figures. A further 36 regressors were included in the estimation but excluded from the table (not significant at the 15 per cent level).

**Functional form**

There is no guidance from theory on functional form but most researchers have based their estimation on a semilog specification: we followed Garrod and Willis (1992) who favour this on the basis of an $R^2$ criterion, and Laasko (1992) who cites its ease of interpretation as the appealing characteristic. However, we also estimated our model using the more general Box-Cox specification. The results, available from the authors, were imperceptibly different from the semilog results.
5. Results

The semilog regression results are presented in Table 1. They are based on estimation which included all the variables discussed above. However, for clarity of presentation we omit from the table any coefficients (other than on our focus variables) where the point estimate is insignificant at the 15 per cent level.

Almost all the variables representing property characteristics attract significant coefficients. For example, inspection reveals the following estimates: a 13 per cent premium for a four-bedroomed house (over a three-bedroomed house); a 16 per cent premium for a semi-detached house (over a terraced one); a 10 per cent discount for the absence of central heating. No significance was found on the bathroom variables, perhaps because few properties departed from the standard one bathroom.

The results on the measures of neighbourhood also produce no surprises. For example, relative to the modal ACORN11, ACORN36 (detached houses, wealthy suburbs) carries an estimated 33 per cent premium and ACORN26 (multi-occupied areas, poor Asians) a 27 per cent discount. The broader measure of neighbourhood, PC CLASS, adds further explanatory power; the "solid middle class" tone of PC7, for example, is estimated to increase value by 25 per cent. The results for local authority dummies are similar to those found in the Topham and Ward (1992) study of Greater Manchester using different data.

On location, the estimated equation suggests that property price increases with distance from the CBD. This increasing price gradient is not necessarily in conflict with trade-off theory, which predicts lower land values further from the centre. In that model, those demanding more space move further out to where the land is cheaper. Plot size should therefore increase with distance. This may make an identical property more expensive the further it lies from the centre because it will lie on a larger plot. Plot size is unfortunately not observed by our data set and CBD DISTANCE may to an extent serve as a proxy for it. An alternative interpretation of the positive coefficient is that people may be willing to pay to escape the problems associated with the centres of conurbations.

All these comments refer to what Graves et al. (1988) termed free variables, those included in the equation as controls. Their coefficients are not of any special interest in themselves, so that any problems resulting from multicollinearity should not be a source of concern.

Finally, we consider what Graves et al. would term our focus variables, those describing the degree of access to stations. We find that proximity to stations tends to lower property price. The result holds whether one considers good access to be defined by a radius of 1 km from the station or a zone 1-2 km from the station. It also holds whether one focuses on the lines chosen for Metrolink or on other railway routes. Estimated differentials relative to properties with no nearby station are:

- **ML1**: 2.1 per cent discount
- **ML12**: 8.1 per cent discount
- **NONML1**: 4.5 per cent discount
- **NONML2**: 4.4 per cent discount

Three of these coefficients are significantly negative at the 5 per cent level. The
coefficient on ML1 is negative but not significant; this lack of significance may be the result of a relatively small number of properties (53) falling within this zone. In a series of F-tests none of the four coefficients was found to be significantly different from the others.

Multicollinearity is said by Garrod and Willis (1992) to be a “common problem in hedonic price functions and one which is often conveniently ignored”. Fortunately, it does not seem a major cause for concern when considering the results on our focus variables. We implemented the Klein procedure (see Maddala, 1992, pp.272-3) for assessing whether multicollinearity should be regarded as a problem: for each focus variable we regressed it on all the other (non-focus) explanatory variables included in our equation. Klein suggested that if the $R^2$ measures for these subsidiary equations are lower than the $R^2$ for the principal equation then multicollinearity may be regarded as unlikely to have affected seriously the reliability of the coefficients. Maddala commends this test as the most rigorous means of assessing multicollinearity. We found here that the Klein test was easily satisfied.\(^1\)

We believe we have allowed for more property, neighbourhood and locational characteristics than previously published studies on the relationship between property prices and transport facilities. After making such allowances, we find that the railway corridors of Greater Manchester comprise corridors where the value of property has a negative premium.

6. Interpretation

Those conducting hedonic price studies often presume that transport facilities enhance property values. However, we were prepared for a zero coefficient on the railway access variables. Greater Manchester has low rail usage, given the density of its commuter network (Fairweather, 1991, found that only 9 per cent of the population used the train more than once a week). So the demand for housing with rail access is likely to be limited. Yet such property is in abundant supply: the mean distance to a station in our sample of properties was only 1.36 km. Given this conjunction of demand and supply conditions, railway access seemed unlikely to command scarcity value in Greater Manchester.

Yet our findings go beyond a denial that railway access raises property values. We actually found a negative effect on house prices. The results require careful consideration for it can scarcely be supposed that the availability of a train service per se would lower the bids made for a given house.

One possible rationalisation would stress the externalities generated by a train route: stations may be associated with noise and traffic congestion, lines with noise and possible road diversions. However, we are not convinced that these problems explain our findings.

\(^1\) When each of the railway access variables is regressed in turn on all the other (non-railway) explanatory variables in the principal equation, resulting $R^2$ measures are 0.39, 0.28, 0.19 and 0.18. Even where all the other railway access variables are included on the right-hand side the $R^2$ measures rise only to 0.54, 0.46, 0.55 and 0.54.
Our results indicate no significant price difference according to whether the property is within a 1 km radius of a station or within the outer 1-2 km zone. Now, of course, some properties in the latter zone will in fact be adjacent to the tracks. But the "expected" distance of a property from the tracks will be less in the 1 km zone than in the outer zone. Were the externalities of railways the main story, one would expect the discount to be larger in the inner zone. In fact we found no significant difference in either the Metrolink or the non-Metrolink case. Further, in unreported experimentation, we followed Damm et al. (1980) by having a specification where distance was represented by the constructed variable 1/(1 + distance) (to capture non-linearity) and by an additional variable set equal to one for properties very close to a station (to capture its external effects). Like Damm, we could attach no significance to the coefficient on the latter variable.

Another possible explanation of our findings is that some omitted variable is closely correlated with the presence of a station. In this case, the influence of an omitted variable would be attributed incorrectly to the railway itself. Under the heading "house characteristics", we stressed the potential difficulties in interpretation that might follow from the omission of plot size from the data. It is plausible that when railway routes were laid down in Victorian Manchester, builders responded with new intensive developments along the corridors. Thus, plot size and railway access might be correlated in present-day data.

Alternatively, one might focus on the inadequacy of measures of neighbourhood: possibly neighbourhoods through which railway lines pass are systematically associated with some characteristics which are not picked up in the allocation of ACORN codes. Of course, ACORN codes are distinguished for very small areas and take into account many factors such as age of housing stock, social class and racial composition. However, they cannot be expected to reflect every facet of neighbourhood likely to influence price.

So what could be different about the railway corridors? Since most of the system dates from the nineteenth century it seems likely that the omitted characteristics may be related to the age of the neighbourhoods. We have already accounted for the age of the property itself in our equation, but older areas may be perceived as unsatisfactory locations because, for example, local public facilities are dilapidated. More generally, one may invoke the life-cycle of the city as explanation. Railway lines put down a century ago were positioned to serve the places between which people wished to travel in that period or places to which they could be persuaded to move by the availability of developments generated by the railway itself. It is in the nature of the life-cycle of the city that loci of activity shift over a period of one hundred years. The railway corridors on the map correlate with where people wanted to be at the time of construction rather than where people want to be today and one can scarcely be surprised that their locational characteristics appear to be viewed unfavourably by our contemporary housing market.

These ideas pose a serious undiscussed problem for the hedonic method. For an analogy, consider the Washington Metro evaluated by Damm et al. (1980). They found a positive association between house prices and proximity to new or projected stations.

\footnote{We compared our reported equation with one in which the coefficients were constrained to be the same for the inner and outer zones: an $F$-test revealed no statistically significant difference between the two specifications ($F = 0.53$ compared with a critical value of $F$ at the 5 per cent significance level of 3.00).}
The Impact of a Light Rail System on the Structure of House Prices

D. Forrest et al.

It is our contention that such a positive association is likely to exaggerate the benefits of the line. Subway stops are not located randomly as they would need to be to secure unbiased estimates. Rather, planners must be presumed to design new transit facilities which link together currently busy loci of activity or which serve new developments planned in conjunction with the scheme itself. The observed residential price differentials may give the verdict of the housing market not on the transit line per se but on the advantages of living near all the amenities associated with the route of the transit line.

This problem of interpreting hedonic-based analyses of transport investment arises again in the Laasko (1992) study of the effects of the Helsinki Metro. Laasko’s paper looks as if it gives a longitudinal dimension to the hedonic method because his data embrace the years 1980, 1985 and 1989: 1980 was a construction year, and 1985 and 1989 were years of operation following the opening of sections of the line. Distance to the Metro is defined by a series of dummy variables similar to ours, but distance is specified to whatever was the nearest existing Metro station at the time of the transaction. Laasko therefore has effectively a series of slope dummies. However, their coefficients reveal the price differences between a house near the Metro sold in 1985 or 1989 and houses generally in 1980. By failing to include a variable on distance to the (non-existent) Metro in 1980, Laasko makes his paper subject to the same criticism as Damm et al. (1980): apparently beneficial effects may just be the result of being near locations popular enough to be designated for Metro stations.

Railway lines in Greater Manchester are no more randomly situated than are the lines of modern systems like those in Washington or Helsinki. In our Manchester case, the distribution of stations reflects not today’s pattern of urban activities, but that of one hundred years ago; and if this does not match today’s lifestyle preferences, then this will be reflected in the results of the hedonic estimation which will thereby be liable to mask the value of the railway itself. All that can be said safely is that, however the railway itself is perceived, the rail corridors of Greater Manchester mark out areas where the market verdict is that the level of urban amenity is lower than in the rest of the conurbation.

Fortunately, this weakness of the hedonic method need not undermine its potential for assessing Metrolink. This was an upgrading scheme. If it is perceived as offering a significantly improved transport service, the analysis of post-Metrolink data sets should reveal that the Metrolink corridors have improved their relative price position compared with corridors served by conventional rail. Given our results for 1990, we were looking for some degree of reversal of the discount associated with housing within 2 km of that line.

The closest published study to the spirit of ours is that of Bajic (1983) who examined the impact of the new Spandina subway in Toronto by means of “before” and “after” hedonic equations. He found that it raised house prices along the route and that all of the effect could be attributed to the influence of a variable measuring the time taken by public transport from the property to the CBD. The Spandina route effectively “moved” houses nearer the centre and the benefit was capitalised in house prices. The result could not necessarily be expected to be replicated here, however, as there is likely to be a difference between the effect of an entirely new line and that of upgrading an existing line.
7. Did Metrolink Alter The Pattern?

Metrolink opened in stages in the spring and summer of 1992. We therefore obtained the Nationwide data set for the last quarter of 1992 and for all of 1993 in order to assess how much difference existed in the pattern of prices before and after Metrolink. We included five quarters of data to obtain a sample more comparable in size to that of 1990 when housing activity was at a higher level: 535 usable observations were obtained for this 1992-3 period. The information available on each was similar to that in the 1990 data set.

To assess changes between the “before” and “after” periods, we pooled data for 1990 and 1992-3 to obtain a combined set of 1,330 observations. We then ran the regressions as before but with the addition of a shift dummy and a series of slope dummies, one for each variable in the previous exercise (except for the three-bathroom and ACORN 39 attributes which were only represented in the 1990 data). As there was an additional attribute, full oil central heating, in the 1992-3 data, there were 157 regressors in all. The coefficients on the original variables were, of course, those reported above. Inspection of the coefficients on the slope dummies was intended to reveal changes in the pattern of prices between the periods.

In fact, the striking result of our analysis is that the structure of prices was extraordinarily stable. In only five cases was the estimated coefficient on the slope dummy significant at the 5 per cent level: two bathrooms attracted a premium not detected in 1990; Salford lost its price premium; PC1, PC8 and ACORN23 all lost position in the price hierarchy (the coefficients on these variables were: 0.21, -0.12, -0.12, -0.09, and -0.25 respectively, with (absolute) t-statistics of 2.93, 2.05, 2.10, 2.08 and 2.79). For the other 71 slope dummies, estimated coefficients were insignificant: the relative values of the great majority of housing attributes remained constant between the periods. The result is encouraging for the potential of longitudinal studies which can only be convincing for assessing the effect of policy initiatives if the background picture of house prices exhibits a certain stability and predictability.

So far as our focus variables are concerned, the discounts associated with proximity to stations fail to show any amelioration. The coefficients estimated on the slope dummies corresponding to ML1, ML12, NONML1 and NONML12 are all close to zero and in no case does the t-statistic exceed 0.5. Thus the data show no improvement in the relative position of houses near railway lines and this is as true for houses near Metrolink as for houses near other railway lines. Metrolink offers better access to the city core (and a more frequent service) than the railways it replaced but the public’s perception of it shows no sign of being sufficiently favourable to be reflected in relative house prices.

8. Conclusions

The justification of the Metrolink project was made in terms of time savings. But supporting material (GMPTE, 1985) claimed that it would also “assist in the regeneration of the inner areas”. The claim that such a scheme is appropriate as part of an urban renewal
strategy is given plausibility by our results to the extent that the expenditure is well-targeted: areas served by the rail lines constructed in the nineteenth century seem to be systematically perceived as offering a lower quality of urban services than the conurbation norm. Proposals to modernise old and outdated transport infrastructure should therefore be self-selected to the extent that they may improve the urban environment for areas which have suffered a relative long-term decline.

Kellett (1969) stresses the dramatic impact on suburban property values of new railway lines in nineteenth-century London. He cites an assertion of 1861 that:

“If the first railway engine had been laden and fed funnel-wise with guineas, and if the wheels had been constructed with an apparatus for whirling the gold by centrifugal action over the land traversed, we should have an allegory in action which would correctly describe the working of the railway system”.

However, we have not found that the residents of the Metrolink corridors have been similarly enriched by the provision of a new type of rail service in the 1990s. Of course, changes in values cannot be ruled out for the longer term if, for example, road pricing or greater traffic congestion were to persuade motorists to seek alternative commuting lifestyles. But no discernible impact has been found so far. This negative result stands in apparent contrast to published findings relating to the introduction of rail-based transit investment in cities such as Washington, Toronto and Helsinki. However, the methodology is unsound for some of these published studies and all of them in any case relate to different kinds of development from Metrolink. This Manchester system is on a brownfield site and offers a revised rather than a new facility, and this may account for what may be regarded as a disappointing failure for benefits to be claimed from housing market price data. Another difference from other cities is that Metrolink was introduced into a deregulated transport environment and franchised to a private operator; fare levels are higher than on other rail services and the company has very limited participation in travelcard schemes. User benefits may therefore have been captured by the operator and this may account for the zero impact on the housing market. In most cities with new subways, users have had minimal liability to higher prices because of the prevalence of flat fare pricing across the whole transit service.

In this paper, we have pointed out pitfalls associated with the application of the hedonic method to the appraisal of transport projects: there is what might be termed inherent historical collinearity. However, the use of longitudinal studies can avoid these pitfalls and we found a degree of stability in the house price structure that is encouraging for the potential of further longitudinal studies in this and other contexts.
Appendix 1

ACORN Codes Represented in the Data Set
3  Cheap modern private housing
4  Recent private housing, young families
5  Modern private housing, older children
6  New detached houses, young families
8  Mixed owner-occupier and council estates
9  Small town centres and flats above shops
10 Villages with non-farm employment
11 Older private housing, skilled workers
12 Unimproved terraces with older people
13 Pre-1914 terraces with older people
14 Tenement flats lacking amenities
15 Council estates, well-off older workers
16 Recent council estates
17 Council estates, well-off younger workers
19 Low-rise council estates in industrial towns
20 Inter-war council estates, older people
21 Council housing for the elderly
22 New council estates in inner cities
23 Overspill council estates, high unemployment
25 Council estates with worst poverty
26 Multi-occupied areas, poor Asians
27 Owner-occupied terraces with Asians
28 Multi-let housing with Afro-Caribbeans
29 Better-off multi-ethnic areas
30 High status area, few children
31 Multi-let big old houses and flats
32 Furnished flats, mostly single people
33 Inter-war semis, white-collar workers
34 Spacious inter-war semis, big garden
35 Villages with wealthy older commuters
36 Detached houses, wealthy suburbs
37 Private houses, well-off elderly
38 Private flats, with single pensioners
39 Unclassified

PC Classes represented in the data set
1  Immigrant areas
2  Older industrial textile towns
3  Deprived inner city
6  Most affluent suburbs
7  Solid middle-class
8  Fairly prosperous/some industry
The Impact of a Light Rail System on the Structure of House Prices

D. Forrest et al.

References


CURDS, TORG and DTCP (1990): The Longer Term Effects of the Tyne and Wear Metro. A report to the Transport and Road Research Laboratory, Department of Transport by the Centre for Urban and Regional Development Studies (CURDS), the Transport Operations Research Group (TORG) and the Department of Town and Country Planning (DTCP), University of Newcastle-Upon-Tyne.


Date of receipt of final manuscript: June 1995