

The impact of aircraft noise and complaints on Brisbane residential property investment performance

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Abstract

Any increase in airport operations or development, with increased flight movements, tends to be an issue in major cities and towns. Whenever such proposals are first advertised there is usually an increased public backlash based on a number of issues such as impact on lifestyle, health as well as the premise that they believe that the value of their residential properties will decrease and it will become more difficult to sell their properties.

Since the early 1970s there have been an increasing number of academic research papers demonstrating that aircraft noise reduces residential property values. At the same time there have also been a number of popular media reports that state value features such as proximity to the CBD, good transport links, access to good schools and services are more important than the location of the house under a flight path or close to an airport. This is particularly the case in very high density cities, with airports close to the major business centres.

This study compares median and average house prices over the period 1988 to 2013; across 36 suburbs of Brisbane to assess the long term impact of aircraft noise on residential property capital growth and volatility. These suburbs cover locations directly under the existing flight paths, areas of differing levels of noise complaints and locations not under flight paths nor subject to aircraft noise complaints. All sales transactions for these suburbs have been analysed to determine if there is any impact of aircraft noise on the long term investment performance of the Brisbane residential property market.

Results show that suburbs under flight paths in Brisbane, Australia subject to aircraft noise on a long term capital gain basis have performed equally, if not better, than less or not affected locations in Brisbane based. On average annual capital returns and risk/return ratios for a range of suburbs from high socio-economic status to low middle socio-economic status have performed at similar levels regardless of location under flight paths. The movement in sales volume from year to year has also been very similar indicating that affected locations do not always result in reduced sales volume activity.

Keywords

Aircraft noise, aircraft noise complaints, residential property, property performance, property prices

1. Introduction

The impact of aircraft noise on surrounding property values has been the subject of much media attention and many international academic studies. Academic and media reports state that the impact of aircraft noise may reduce property values by up to 20%. Although many authors recognize that aircraft noise is one factor that is balanced against others in the decision to purchase a home, it is also common for locations with a high level of aircraft noise to be close to the CBD (Central Business District), transport, schools or other social infrastructure, factors which can add value to residential property depending on the individual value drivers of the purchasers.

Many studies adopting the Hedonic Price Models (HPM) have shown a reduction in price for houses located under flight paths or subject to aircraft noise; however, these studies have not considered if this possible lower initial price also results in lower capital growth in the longer term. This study has been undertaken to determine if the actual average annual investment performance (capital returns) of aircraft noise affected property is similar to the investment performance of houses in non or less affected locations over extended time periods. The data covers two major cities in Australia; Brisbane and Melbourne. These cities service both domestic and international air traffic

Literature Review

Literature on the impact of aircraft noise on communities can be categorised into the following areas:

- Impact on physical and mental health issues
- Stress levels
- Sleep deprivation
- Cognitive learning impacts on children
- Property impact
- Environmental impacts

The literature in relation to the negative impact of aircraft and transport noise on health, stress, the environment and learning is extensive (for example Brunelle-Yeung et al, 2014; Stansfeld et al, 2011 and 2005; Mahashabde et al, 2011; Eriksson et al, 2007; Upham et al, 2003; Hygge et al, 2002; Franssen et al, 2002). Additional studies have also identified the type and reason for aircraft noise complaints including factors such as number of aircraft movements, type of aircraft and deviation from established flight paths (Hume et al. 2003).

As this study is focussed on long term capital returns, the focus of the literature is based on studies that have reviewed the effect of aircraft noise on residential property prices

A review of literature showed that the majority of academic studies in this area have been undertaken in the USA or The Netherlands with significantly less attention in the UK and Australia. Predominantly these studies have been based on econometric modeling using hedonic price models, with the pre 1980 studies showing price reductions for aircraft noise impact from 2 to 24% (Mieszkowski and Saper, 1978; Gautrin, 1975). Nelson (1980) also lists the various authors and their studies to arrive at the above statistics.

Later studies from 1990 to 2000 also were HPM based and generally recorded reductions in prices for houses impacted by aircraft noise. Most commonly these later studies also found that there was some negative impact on residential properties. However, there were also studies that showed the close proximity to an airport can actually result in higher residential house prices, but aircraft noise is not the only factor that determines residential property prices. Also the distance from the airport resulted in less impact, with for commercial and industrial property the impact was not significant compared to residential property (Pennington et al,1990; Frankel,1991; Collins and Evans,1994; Levesque,1994; Feitelson,1996; Schipper,1996; Kaufman and Espey,1997; Johnson and Button,1997; Schipper et al,1998; Tomkins et al,1998; Little V Dept Natural Resource QLD,1999). Since 2000 the aircraft noise studies have also been Hedonic Price Model basis and have shown reductions in the most affected properties of 11 to 16%, with a lower impact on residential property rents (Morrell & Lu,2000; Bell,2001; Burns,2001; WAPC,2004; Theebe,2004; McMillen,2004; Praag & Baarsma,2005; Baranzini & Ramirez,2005; Lazie & Golaszewski,2006). Overall these academic studies showed the impact of aircraft noise on residential property was mainly evident beyond 60dB and had no impact up to this level.

A more recent study by He et al (2014) proposed a method and model to measure a range of monetary costs of aircraft noise. This model not only looked at reduction in house prices but also the cost of rental lost work and school performance based on a meta-analysis of 63 aircraft noise HPM from 1970 to 2010. The model estimated that the capitalised global monetary impact of aircraft noise for 2005, including lost work and school productivity, was estimated at US\$28 billion.

Research Method and Data

A deficiency of the majority of these studies was the limited time period over which they were undertaken of 12 or 24 months, this time short time period can indicate the difference in price but not the actual impact on long term capital returns, nor the risk return performance of these impacted residential sectors.

This study considers the issue of the impact of aircraft noise on the long term investment performance of residential property in Brisbane and Melbourne, and is more comprehensive and longitudinally significant than previous international studies. The study is specific to Brisbane and Melbourne and covers one of the most extensive time periods for a study of this type, from the opening of the current Brisbane airport in 1988 through to December 2014 and the Melbourne Airport from 1990-2015. The data for this project comprised all residential house sales for 40 suburbs in Brisbane and 62 suburbs in Melbourne, based on a data set of over 480,000 sales transactions.

36 suburbs in both Brisbane and Melbourne were identified for this paper in the overall study based on the number of noise complaints to Air Services Australia and reported on their website. The suburbs were grouped according to high level of noise complaints (HNC), moderate levels of noise complaints (MNC) and suburbs that have

not recorded any noise complaints or very limited occasional noise complaints over the past five years (NNC). The high noise complaint suburbs were located on the southern flight paths and within 10 kms from the existing main runway at Brisbane airport and on the North/South and East/West flight paths of Melbourne Airport. The moderate MNC suburbs covered a range of locations to the south, west, north and east of the Brisbane and Melbourne Airports but all inner ring or middle ring Brisbane suburbs and middle to outer ring suburbs of Melbourne. The NNC suburbs were also geographically diverse including inner ring, middle and outer middle ring suburbs of Brisbane and Melbourne.

Suburbs classified as within the 60-70 decibel noise level are identified in Tables 1 and 2, as are those Brisbane suburbs within ANEF 20 (Australian Noise Exposure Forecast), Noise exposure levels are calculated in ANEF units, which take into account the following factors of aircraft noise: the intensity, duration, tonal content and spectrum of audible frequencies of the noise of aircraft take offs, approaches to landing, and reverse thrust after landing (for practical reasons, noise generated on the aerodrome from aircraft taxiing and engine running during ground maintenance is not included); the forecast frequency of aircraft types and movements on the various flight paths, including flight paths used for circuit training; and the average daily distribution of aircraft arrivals and departures in both daytime and night-time. Suburbs located within ANEF 20 or within the flight path 60-70 decibel noise contours are identified in Tables 1 and 2,

Table.1: Brisbane Suburb Comparison

High Noise Complaints	Low Noise complaints	No/minimal noise complaints
**Morningside	Gordon Park	Annerley
**Coorparoo	Northgate	Mitchelton
**Camp hill	Bulimba	New Farm
**Cannon Hill	*Mount Gravatt East	Mansfield
*Tarragindi	*Balmoral	Virginia
*Seven Hills	Clayfield	Chelmer
*Tingalpa	Ashgrove	Sherwood
*Norman Park	Chapel Hill	Jindalee
*Holland Park West	Wynnum	Forest Lake
The Gap	Fairfield	Kenmore
*Murarrie	*Hawthorne	Graceville
*Belmont	*Ascot	Hamilton

*Within the N70 Noise Contour location

** Within ANEF 20 and the N70 Noise Contour location

Suburbs were classified initially based on the number of aircraft noise complaints (contacts and clients) recorded by Air Services Australia over the past 5 years. These suburbs were identified as High Noise Complaints (HNC); Moderate Noise Complaints (MNC) and Minimal/No Noise Complaints (NNC) based on the data and mapping provided in the Brisbane Airport Corporation Current and Future Flight Path and Noise Information Booklet, as well as the flight path maps for Melbourne Airport.

Table 2: Melbourne Suburb Comparison

High Noise Complaints	Low Noise complaints	No/minimal noise complaints
Avondale Heights	Ardeer	Attwood
Broadmeadows	Albion	Coolaroo
Caroline Springs	Ascot Vale	Dallas
Diggers Rest	Balwyn North	Doncaster
Kealba	Braybrook	Dandenong
Keilor	Campbellfield	Heathmont
Keilor East	Gladstone Park	Glenroy
Keilor Park	Greenvale	Mill Park
Kingsville	Maidstone	Ringwood
Sunshine North	Niddrie	Rowville
St Albans	St Albans	Seaford
Thomastown	Taylors Hill	Wantirna

*Within the 70 Decibel location

Sale transactions were analysed to compare the residential property investment performance of these varying aircraft noise affected suburbs, based on median house prices, average annual capital returns, return volatility and the correlation between annual median house prices.

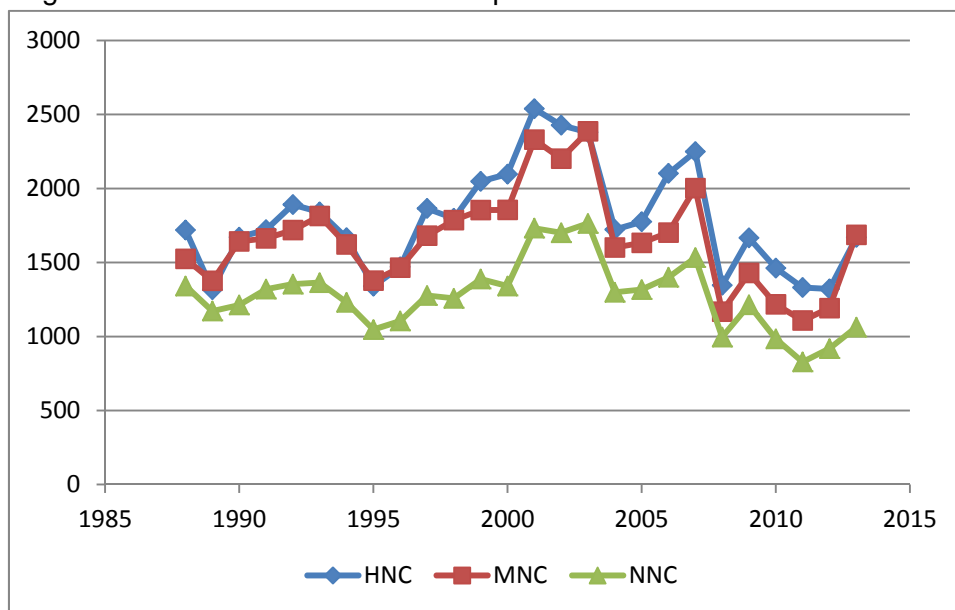
Results

Brisbane Airport

Noise Complaint Suburbs

Figure 1 shows the volume of house sale transactions for the HNC, MNC and NNC suburbs for the period 1988 to 2013.

Figure.1 Sales Volume Comparison: 1988-2013



The numbers of sales for the HNC and MNC locations were higher than the NNC suburbs, with the HNC suburbs having a high of 2,539 sales in 2001 and a low of 1,168 sales in 2008; however, this was expected as the majority of suburbs in the HNC classification locations are in the middle socio-economic locations of Brisbane, which traditionally have a higher rate of sales compared to the higher socio-economic suburbs of Brisbane. The interesting findings from these suburb comparisons is the fact that despite the variation in the number of sales per annum, the actual trend in sales has been consistent across all the noise complaint areas, especially for the HNC and MNC suburbs, with all classifications showing increasing and decreasing rates of sales over each year of the 26 year period. This is also confirmed in Table 3, which shows the correlation between the number of annual sales across the three suburb classifications.

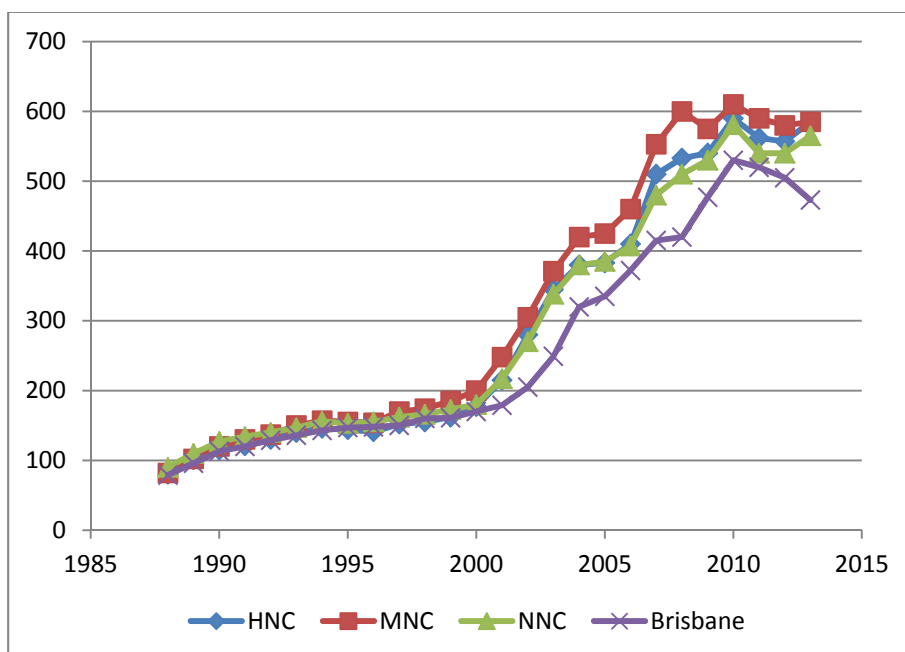
Table 3: Correlation Analysis: Sales Volume: Noise Complaint Comparison: 1988-2013

	<i>HNC</i>	<i>MNC</i>	<i>NNC</i>
HNC	1.00		
MNC	*0.90	1.00	
NNC	*0.89	*0.91	1.00

*Significant at the 5% Level

This table shows the correlation co- efficient are very highly positively correlated at $r = 0.90$ (HNC, MNC), 0.89 (HNC,NNC) and 0.91 (MNC,NNC). The very high significance of these correlations are evidenced by the fact that a significant co-efficient at the 5% level is $r = +/-0.37$. These results show that the location of a suburb under a flight path has no impact on the volume of residential house sales at any point in time compared to suburbs that have some or no exposure to flight paths and aircraft noise. Ownership of a property under a flight path and subject to aircraft noise in Brisbane does not affect the ability to sell that house compared to moderate or non-affected houses.

Figure 2: Median House Price: Noise Complaint Comparison: 1988-2013



Figures 2 shows the annual trend in median house prices for the 36 suburbs from 1988 to 2013.

From the period 1988 to 2000, there was limited movement in median house prices across all the 36 suburbs in Brisbane, with the HNC, MNC, NNC and Brisbane LGA median house prices increasing at a similar rate, with all classifications showing 100% increases in median prices over this 13 year period.

However, from the year 2000, there has been a significant difference in the median price of the suburbs in the HNC, MNC and NNC suburbs compared to the Brisbane median house price. This is due to the fact that over the period 2000 to 2013 much of the growth in housing supply in Brisbane has been in the outer middle and outer Brisbane suburbs, with limited increases in housing supply in the suburbs in the inner and inner middle ring suburbs.

The other major finding from this analysis of the median house prices in the suburbs that are subject to high to moderate aircraft noise is that the trend in house prices has been very similar and the higher median house prices in the MNC suburbs is based more on the fact that half the suburbs in this noise classification are high socio-economic suburbs as described above.

Table 4: Correlation: Suburb Comparison: Median Price: 1988-2013

	<i>HNC</i>	<i>MNC</i>	<i>NNC</i>	<i>Brisbane</i>
HNC	1.00			
MNC	*0.95	1.00		
NNC	*0.96	*0.93	1.00	
Brisbane	*0.62	*0.62	*0.69	1.00

*Significant at the 5% level

Table 4 also supports the strong correlation between house price movements across the suburbs in the study. The annual change in median house prices between houses in the HNC to houses in MNC and NNC suburbs are highly positively correlated with correlation coefficients of $r = 0.95$ (HNC,MNC) and $r = 0.96$ (HNC, NNC). These extremely high correlation coefficients state that over the 26 year time period the movement in house prices across the suburbs in the high, moderate and no aircraft noise complaint suburbs have been identical, regardless if the suburb is located close to the airport or under the various flight paths for the current Brisbane airport runway.

Table 5: Capital Return and Investment Performance: Median Price 1988-2013

Location	Average Annual Capital Return (%)	Average Annual Volatility (%)	Risk return Ratio
High Noise	8.66	9.49	1.09
Moderate Noise	8.52	8.87	1.04
No/Low Noise	7.93	8.47	1.07
Brisbane LGA	7.72	8.35	1.08

The investment performance of the HNC, MNC and NNC suburbs and the Brisbane Median house price are shown in Table 5. This Table shows that over the 26 year period the average annual capital return based on median house prices for HNC

suburbs under the southern flight path has been 8.66%. This capital return has been greater than the average annual capital return for MNC suburbs (8.52%) and NNC suburbs (7.93%). All the HNC, MNC and NNC suburbs returned a higher average annual capital return compared to the Brisbane median capital return of 7.72%

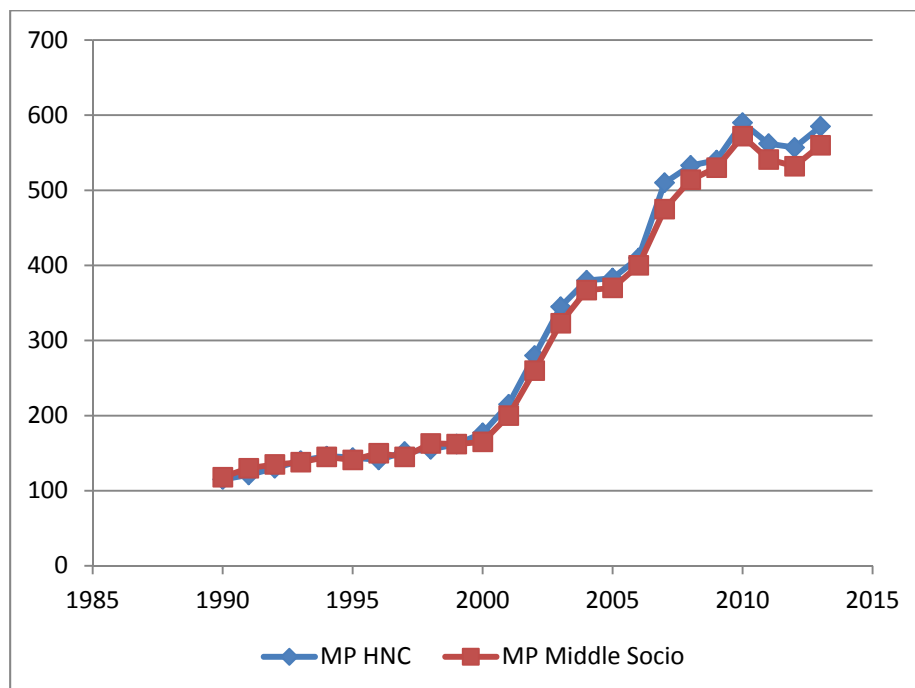
The HNC suburbs also had the highest volatility at 9.49%, with the NNC suburbs having a very similar volatility to the Brisbane median volatility and the MNC suburb volatility. On a risk return basis based on median price change over the study period, each of the noise affected and non-noise affected suburbs have a very similar risk return ratio ranging from 1.04 (MNC), 1.07 (NNC), 1.08 (Brisbane) and 1.09 for HNC suburbs. This again shows that the investment performance and risk for houses in high aircraft noise suburbs is no different to the investment performance of the moderate and no noise suburbs with similar location characteristics.

Suburb Comparison: Houses (High Noise Complaint Suburbs v Middle Socio Economic Suburbs)

The suburb comparisons above are based on levels of noise complaints with the HNC suburbs comprising the middle socio-economic suburbs on the southern flight path ranging from 2 to 7 kms from the current Brisbane airport runway. The MNC and LNC suburbs comprised a mixture of upper low, middle and high socio-economic suburbs. To compare the price difference between noise affected and moderate to non-noise affected suburbs, the 12 HNC suburbs were matched with 12 middle socio-economic suburbs in the MNC and LNC categories. This has allowed a comparison of median and average house prices for affected and non-affected suburbs to be assessed to determine average price differences for the period 1990 to 2013. If the variation in price is similar in each case than the main determinant of value in these matched socio-economic suburbs would be locational based rather than actual exposure to aircraft noise.

Figure 3 shows the trend in median prices movement for the period 1988 to 2013 based on the comparison of middle socio-economic suburbs in the HNC suburbs to the middle socio-economic suburbs in the MNC and NNC locations. This figure shows that from the period 1988 to 2000, the annual trend in the movement of median house prices for the HNC suburbs was virtually the same for middle socio economic suburbs in inner and middle ring locations of Brisbane, as well as the median price for houses in Brisbane. From 2000 to 2010 the median house price for the HNC and middle socio-economic suburbs have been higher but followed a similar trend to the Brisbane median house price. While the median house price in Brisbane showed a decline from 2010, this was not the case for the HNC suburbs from 2012 to 2013. This figure also shows that the change in annual median prices for HNC suburbs has been very similar to the middle socio-economic suburbs in the MNC and NNC locations and over a number of years has actually been higher.

Figure 3 Houses Median Price:High Noise Complaint Suburbs v Middle Socio Economic Suburbs:1988-2013



Again, the very highly positive significant correlation between the movement in house prices in the HNC suburbs to middle socio-economic suburbs in Brisbane is confirmed in Table 6, with the correlation coefficient for HNC v Middle socio-economic $r = 0.86$ (significant coefficient at 5% level $r = 0.37$). The correlation between the HNC and middle socio-economic suburbs is stronger than the correlation with the Brisbane median house price.

Table 6: Correlation Analysis: Median and Average Prices 1988-2013

	<i>MP HNC</i>	<i>MP Middle Socio</i>	<i>AP HNC</i>	<i>AP Middle Socio</i>	<i>Brisbane</i>
MP HNC	1.00				
MP Middle Socio	*0.86	1.00			
AP HNC	*0.97	*0.84	1.00		
AP Middle Socio	*0.75	*0.89	*0.78	1.00	
Brisbane	*0.62	*0.67	*0.59	*0.66	1.00

*Significant at the 5% level

Table 7 again shows that over the full 26 year period of this study the median and house price in the southern flight path suburbs subject to the highest number of aircraft noise complaints and under the main southern flight path have shown a higher average annual capital return compared to middle socio-economic suburbs and the overall Brisbane housing market, with very similar volatility and risk/return ratios.

Table 7: Capital Return and Investment Performance: Median Price 1988-2013: HNC v Middle Socio-economic Suburbs

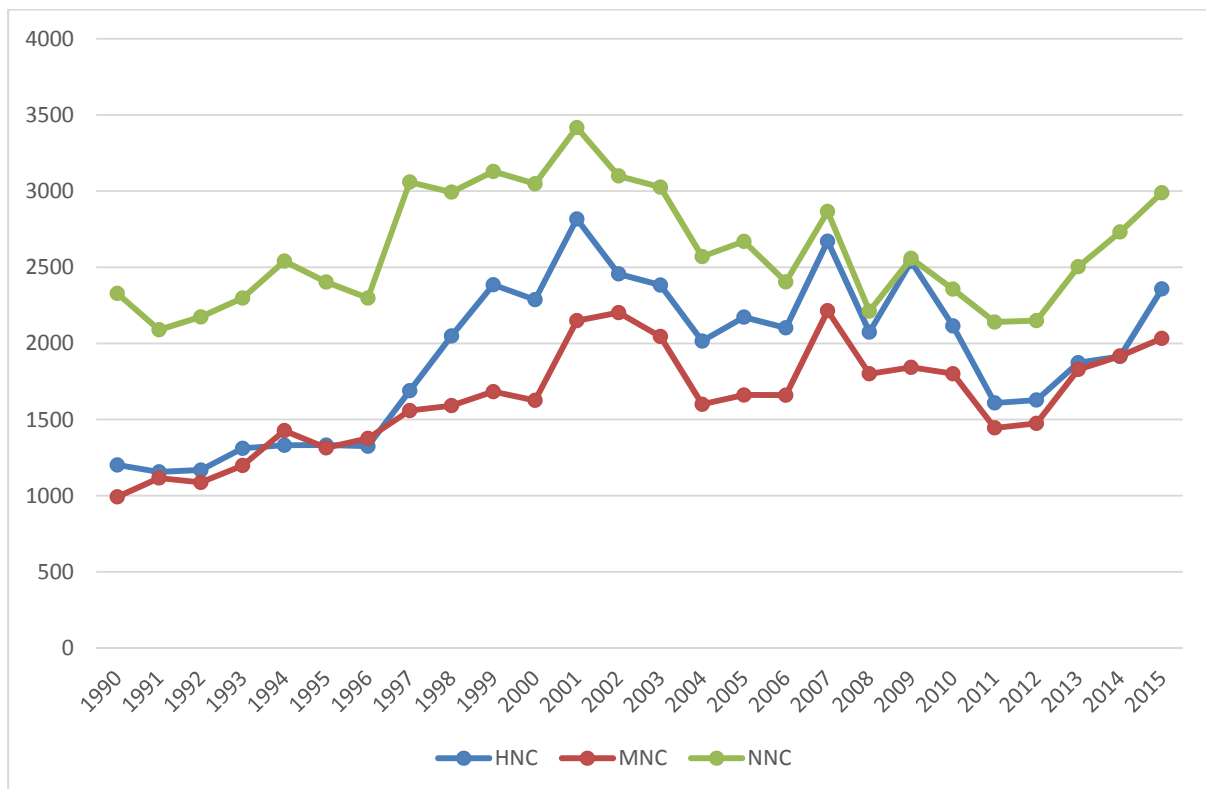
Location	Average Annual Capital Return (%)	Average Annual Volatility (%)	Risk return Ratio
High Noise Suburbs	8.66	9.49	1.09
Middle socio Economic Suburbs	8.43	9.54	1.13
Brisbane LGA	7.72	8.35	1.08

Melbourne Airport

Noise Complaint Suburb Analysis

Figure 4 shows that number of sales per annum for the HNC, MNC and NNC Melbourne suburbs.

Figure 5.1: Sales Transaction Volume Noise Complaints: 1990-2015



From this figure, it can be seen that over the study period, the NNC suburbs have shown the greatest number of annual house sales compared to the MNC and HNC suburbs, with the MNC suburbs having similar annual sales to the HNC suburbs from 1990 to 1997, however since 1998, the volume of annual sales has been higher in the HNC suburbs compared to the MNC suburbs. This figure also shows that although the number of these annual sales

has differed the trend in sales volume has been very similar. Figure 5 confirms trend when the percentage change in sales volume from one year to the next is compared. From this figure, it also shows that despite the number of sales per annum can vary across the noise classification suburbs; the actual percentage change has been very similar with similar peaks and troughs occurring in the same years. The HNC and NNC suburbs had the highest sales in 1997 and 2007, with the MNC suburbs recording their highest levels in 2001 and 2007. All suburb noise classifications recorded their lowest sales volume in 2008

Figure 5: Sale Transactions: Annual Change %: HNC, MNC, NNC: 1990-2015

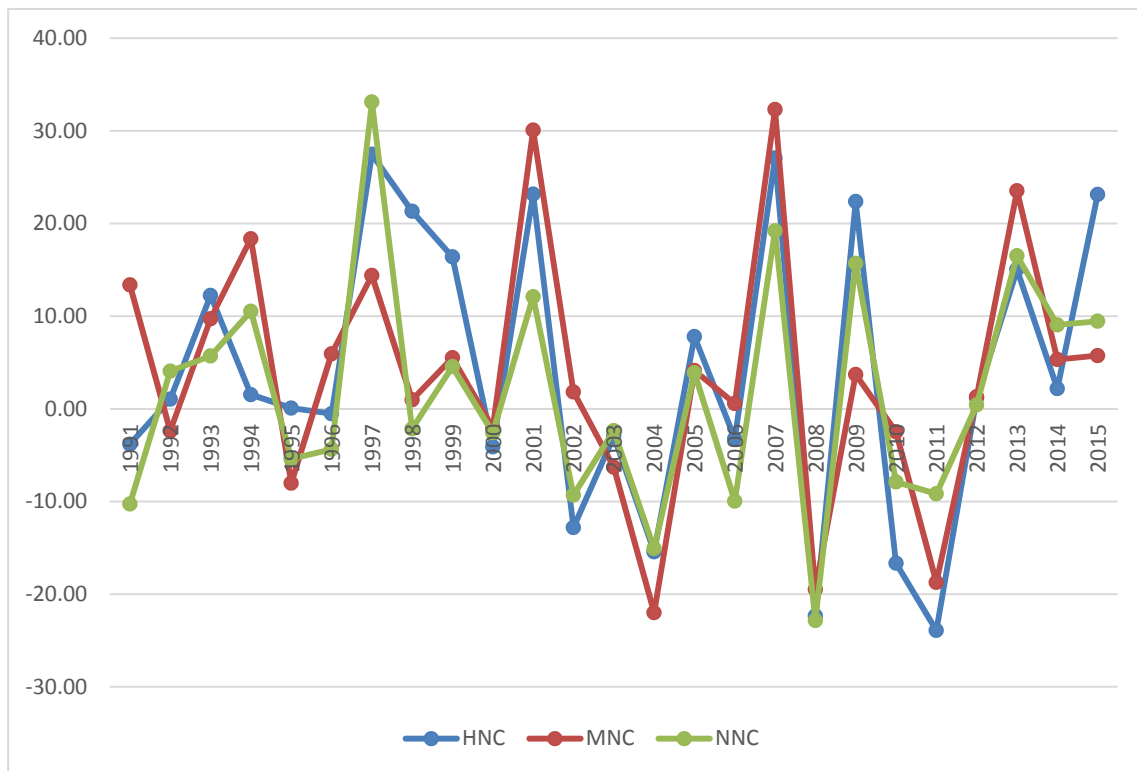


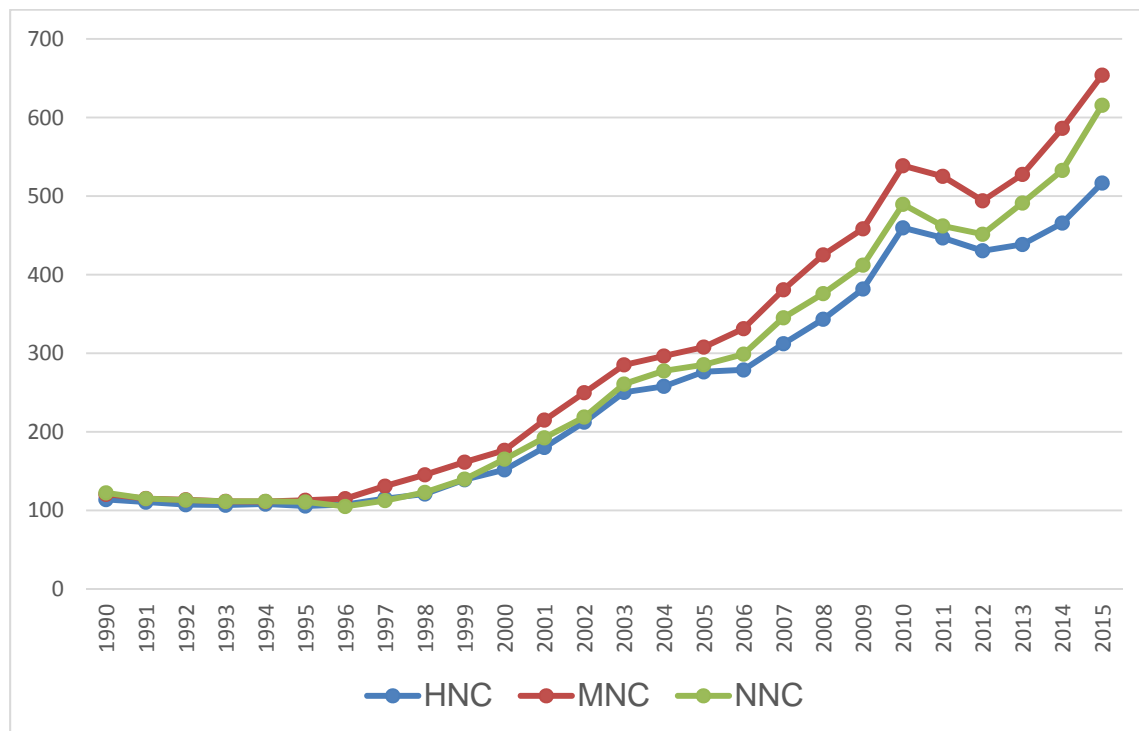
Table 7: Correlation Analysis: Sales Volume Annual Change

	<i>HNC</i>	<i>MNC</i>	<i>NNC</i>
<i>HNC</i>	1.00		
<i>MNC</i>	*0.73	1.00	
<i>NNC</i>	*0.84	*0.73	1.00

*Significant at the 5% Level

Table 7 shows the correlation analysis based on the comparison of the percentage changes in sales volume per annum for the various noise affected suburb groupings. For this longitudinal study a significant correlation coefficient is $r = \pm 0.37$. From this table it can be seen that the correlation between both HNC/MNC suburbs ($r=0.73$) and HNC/NNC suburbs ($r=0.84$) is very significantly positively correlated, confirming that the annual change in sales volume has been near identical across the full 26 years of the study. This confirms that suburbs located within aircraft noise contours and under flight paths have shown similar sales transaction per year compared to less or not affected suburbs, with changes in sales from year to year being virtually similar across both boom and bust property cycles.

Figure 6 Median Price Comparison: Noise Complaints: 1990-2015



The actual movement and trend in median house prices are shown in Figure 6. This figure shows that from the period 1990 to 1995, the residential property market in all suburbs was very flat and had periods of negative growth. However, from 1996 to 2010 there has been significant growth in the median house price across all the suburbs regardless of level of aircraft noise complaints. Although the median house price has been lower across the HNC suburbs, with the MNC suburbs recording the higher median house price per year, the actual trend in house price movements have been very similar. An important aspect that has to be considered in relation to Figure 6 and Table 7 is the actual suburb mix in each of the noise complaint classifications. These suburbs comprise a mix of low, middle and high value suburbs so the comparison is not necessarily like with like and this is addressed later in the analysis. Despite this limitation Table 5.2 shows that the average annual capital returns for the 26-year period have been very similar across all noise classifications. During this period the average annual capital returns have been highest in the MNC and HNC suburbs (7.80%

and 7.37% respectively), both higher than the NNC suburbs at 7.15%. In all cases, these suburbs have outperformed the Melbourne median house price return of 6.44%

Table 7 Investment Performance Noise Complaint comparison

	Capital Return: median Price (%)	Volatility Price (%)	median	Risk return Ratio
High Noise Complaints	7.37	11.05		1.49
Moderate Noise Complaints	7.80	10.50		1.35
No Noise Complaints	7.15	11.86		1.66
Total Study Suburb Average	7.14	11.02		1.54
Melbourne median House price	6.44	5.87		0.86

The actual average annual return for the HNC suburbs have shown consistently higher capital growth compared to the suburbs in the NNC locations. All noise complaint suburb classification had similar levels of volatility over the 26-year period, resulting in very similar risk/return ratios, ranging from 1.35 for MNC and 1.66 for NNC suburbs. In all cases these three suburb groupings achieved a better risk return ratio than the full 62 suburb average.

Table 8: Correlation Analysis: Median House Price Comparison: 1990-2015

	<i>HNC</i>	<i>MNC</i>	<i>NNC</i>
HNC	1.00		
MNC	*0.90	1.00	
NNC	*0.89	*0.89	1.00

*Significant at the 5% Level

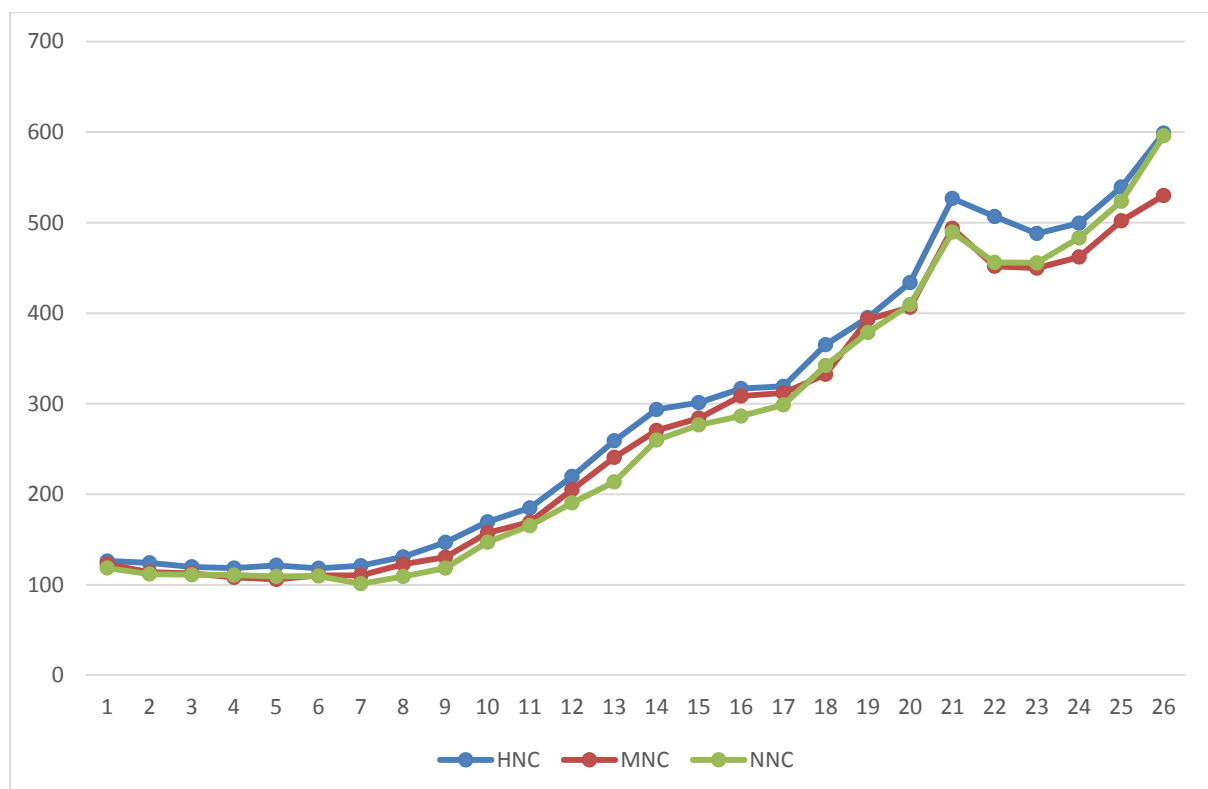
Again, the similarity in the long-term investment performance of the suburbs in each of the three aircraft noise complaint classifications is also reflected in the correlation analysis of the annual percentage change in median house prices across the period 1990-2015. Table 8 shows that over this 26-year period the correlation coefficients have been extremely highly correlated. With correlation coefficients of $r = 0.90$ (HNC/MNC); $r = 0.89$ (HNC/NNC and MNC/NNC). These very significant correlation coefficients indicate that the movement in median house prices across these various suburbs has been virtually identical over the past 26 years regardless of the level of aircraft noise affectation.

Figures 5 and 6 and Tables 7 and 8 show that a property purchased in a high to moderate noise complaint suburbs of Melbourne have shown very similar changes in median house prices for the period 1990 to 2015 and have recorded a higher level of capital growth over the same period compared to the analysed suburbs that have not been subject to aircraft noise complaints. As previously stated, the selection of suburbs for each of the noise complaint classifications includes a range of suburbs considered to be low, middle and high value suburbs of Melbourne. Results later in this section of this report will also compare the long-term investment performance of these suburbs on a socio-economic basis to reflect the any differences based on suburb quality and location to Melbourne airport.

Middle Value Suburbs Only: HNC, MNC and NNC Suburbs

As stated previously, the suburbs analysed based on levels of aircraft noise complaints comprised a range of socio-economic locations from low to high value suburbs. A review of these suburbs showed that the majority of the 12 suburbs in the HNC classification were considered to be middle socio-economic locations, whereas the MNC and NNC suburbs included both low and high socio-economic locations. The following analysis is based on the investment performance of middle socio-economic suburbs across the three aircraft noise classifications. This provides a much more rigorous and accurate analysis of the impact of varying levels of noise across the main suburbs affected by the current operations at Melbourne airport compared to location that have limited or no exposure to aircraft noise.

Figure 7: Median House Price Comparison Middle Socio-economic suburbs only



When only the middle value suburbs are compared, the results differ compared to the previous analysis. From Figure 7, it can be seen that the median house price in middle value suburbs in the HNC locations have been higher than the median house price for similar middle value suburbs in both the MNC and NNC locations.

Table 9: Investment Performance Summary: Middle Socio-economic only: Noise Complaints

		Capital Return: Average Price (%)	Volatility Price (%)	Average	Risk/Return Ratio
High Complaints	Noise	6.68	7.61		1.14
Moderate Complaints	noise	6.35	8.59		1.35
No Complaints	Noise	6.99	8.60		1.23
Total Study Suburb Average		7.14	11.02		1.54
Melbourne Median House Price		6.44	5.87		0.86

This figure also shows that while the median house price has been consistently higher for the HNC suburbs the trend in house price movements from year to year have also been very similar, with minimal growth from 1990 to 1998, and more significant price increases each year from 1998 to 2010, with all locations showing price decreases from 2010 to 2013.

The comparison of only middle socio-economic suburbs shows that over the period 1990-2015, the suburbs in the HNC locations have recorded an average annual capital return of 6.68% per annum, compared to 6.35% for MNC suburbs and 6.99% for the NNC suburbs. Based on middle value suburbs only, the HNC and MNC suburbs have continued to show a higher average annual capital return compared to the Melbourne average annual return. This is a reversal to the full suburb analysis, where the MNC were the best performing, with HNC second and the NNC third. The other difference highlighted in this analysis is that the volatility for the HNC suburbs has been lower than the MNC and NNC middle value suburbs. This in turn has resulted in the risk/return ratio being significantly better for the HNC suburbs. Over the 26-year period the HNC suburbs have recorded the best investment performance on a risk adjusted basis (Refer to Table 9).

Table 10 also confirms the very significant correlations between the annual movements in price across the various middle value suburbs in the three noise complaint classifications. The correlation coefficients of $r = 0.85$ and $r = 0.86$ for HNC/MNC and HNC/NNC suburb classifications respectively confirm that house price movements across these suburbs has been very similar across the study period regardless of their exposure levels to aircraft noise and complaints

Table 10: Correlation Analysis: Median House Price Comparison: Middle Value Suburbs: 1990-2015

	<i>HNC</i>	<i>MNC</i>	<i>NNC</i>
HNC	1.00		
MNC	*0.85	1.00	
NNC	*0.86	*0.85	1.00

*Significant at the 5% level

2. Conclusions

The first major study on the impact of aircraft noise on Brisbane and Melbourne residential property has shown that locations close to the airport or under a flight path, has minimal or no impact on residential property prices, rental returns and residential property investment performance.

In Brisbane, over the study period 1988 to 2013, the research found the location of a property under a flight path will have minimal if any impact on the price, saleability, investment performance and capital growth of a property. These results were also replicated when the Melbourne analysis was carried out

Residential property value drivers, such as proximity to transport, the Melbourne or Brisbane CBD, schools, recreation facilities and other services, can outweigh any negative impact experienced as a consequence of being under a flight path or from aircraft noise.

Suburbs with exposure to aircraft movements (visual) display similar long term investment performance to suburbs with no visual exposure to aircraft even if the suburb adjoins the airport

The long-term investment performance of aircraft noise affected suburbs is more in line with the socio-economic status of the suburb rather than the level of aircraft noise

Socio-economic factors have a greater impact on house prices than aircraft noise. Low middle and high socio-economic suburbs within the N60-70 noise contours have shown similar, and in some cases, better long term investment performance compared to equivalent suburbs totally removed from any levels of aircraft noise.

This comprehensive study analysed all residential property sale transactions across 36 Melbourne and Brisbane suburbs ranging from high aircraft noise affectation to minimal or no aircraft noise impact. The data covered all sales transactions providing a rigorous data set to review long term investment performance. In the case of Brisbane Airport, the study period covers the years since the commencement of airport operations at the current Brisbane Airport site.

3. References

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