

***'A study of the relationship between changes in housing values
and variations in macroeconomic factors.'***

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Abstract

The purpose of this research is to analyse the changes in housing values in Windhoek, Namibia over the past ten years and explore links in property value variation to macroeconomic changes during that period. The objectives of this research are twofold. Firstly this research compiles and assesses the movement of housing values over the past ten years. Secondly this research assesses if there is a causal relationship between changes in macroeconomic factors and housing values, and to define the nature of this relationship. The timing and magnitude of response by housing values to changes in macroeconomic factors are investigated.

The primary data requirements for this study are a monthly relative value index of housing prices for the Windhoek area and macroeconomic factors. Macroeconomic data collected relates to macroeconomic conditions within Namibia that could have an effect on housing prices. This includes information on housing supply, GDP, population levels, inflation and interest rates. The results of this study explore the relationship between these factors and changes in housing prices as reflected by changes in the housing index.

The most significant result of this study is the effect of housing availability on housing values. Changes in the total supply of housing as estimated by the number of houses built in a month affect changes in housing values after 5 and 6 months. A total of 20.5% of the change in housing values can be explained by the change in total housing supply. The effect of interest rates found by this study was lower than the theory and literature reviews would have led us to expect. The results of the Pearson correlation test for the relationship between percentage changes in interest rates and percentage changes in future housing values found that a relationship exists 8 months after the change in interest rates occurred. Interest rates were found to explain 5.5% of the change in housing values 8 months later.

No significant effects were noted for changes in inflation. For population and income changes there was insufficient data to perform more than a high level look at possible interactions with the level of housing prices.

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Table of contents

Abstract i

Acknowledgements ii

List of tables v

List of figures vi

Chapter 1: Orientation 1

 1.1 Introduction 1

 1.2 Purpose or objectives of this research 2

 1.3 Statement of the problem and sub-problems 2

 1.4 Definitions 3

 1.5 Delimitation of the study 4

 1.6 Importance of the study 4

 1.6.1 The importance of a drop in housing values 5

 1.6.2 The importance of changes in macroeconomic variables 5

 1.6.3 The importance of the changes in housing supply 6

 1.6.4 The importance of changes in population levels 6

 1.6.5 The importance of changes in inflation and income levels 6

 1.6.6 The importance of changes in interest rates 6

 1.6.7 Conclusion 8

 1.7 Assumptions of the study 9

 1.8 Outline of the research report 9

Chapter 2: Theoretical foundation of the study 12

 2.1 Introduction 12

 2.2 Supply and demand and housing markets 12

 2.3 Economic, business and real estate cycles 17

 2.3.1 The primary real estate cycle 18

 2.3.2 Forces affecting real estate cycles 20

 2.3.3 Cyclical components making up the primary real estate cycle 21

 2.4 Conclusion 23

Chapter 3: Literature review 25

 3.1 Introduction 25

 3.2 Property and housing values 25

 3.3 The influence of macroeconomics on housing prices 27

 3.4 The effect of supply and demand on housing prices 34

 3.5 The relationship between interest rates and housing values 36

 3.6 Conclusions of the literature review 39

Chapter 4: Research Methodology	41
4.1 Introduction	41
4.2 Data requirements	41
4.3 Data collection	42
4.4 Data analysis	44
4.4.1 The Windhoek Housing Index (WHI)	44
4.4.2 Determining the influence of housing supply	46
4.4.3 Determining the influence of housing demand	48
4.4.4 Changes in income as measured by changes in GDP	49
4.4.5 Changes in population as measured by census statistics	50
4.4.6 Changes in inflation as measured by the Consumer Price Index (CPI)	50
4.4.7 Changes in interest rates as measured by the Prime Interest Rate	51
Chapter 5: Research results	52
5.1 Introduction	52
5.2 The Windhoek Housing Index (WHI)	52
5.2.1 Formulation of the index	52
5.2.2 Seasonal variation	55
5.2.3 Neighbourhood variation	56
5.3 Influence of housing supply	60
5.4.1 The effect of changes in income	68
5.4.2 The effect of changes in population	69
5.4.3 The effect of inflation	71
5.4.4 The effect of interest rates	75
5.5 Conclusions	78
Chapter 6: Discussion, conclusions and recommendations	79
6.1 Introduction	79
6.2 Discussion of results	79
6.2.1 Trends in the overall index	79
6.2.2 Influence of housing supply	81
6.2.3 Influence of changes in income	82
6.2.4 Influence of changes in population	83
6.2.5 Influence of changes in inflation	83
6.2.5 Influence on changes in interest rates	84
6.3 Conclusions	88
6.4 Recommendations for future research	86
List of References	90
Appendix A: Calculating effect of 1% change in housing per capita	93

List of tables

Table 2.1 Perfect markets versus the typical real estate market

Table 3.1 Impact of variables on housing prices

Table 3.2 Potential interest effects on home price

Table 4.1 Changes in housing supply to consecutive housing index months

Table 5.1 Correlation between houses built and housing values

Table 5.2 Linear regression between housing complete and housing value after 5 months

Table 5.3 Linear regression between housing complete and housing value after 6 months

Table 5.4 Average number of people per house, 1997 to 2007

Table 5.5 Correlation between the CPI and the housing index

Table 5.6 Correlation between interest rates and housing index

Table 5.7 Linear regression results for the relationship between interest rates and the housing index after 8 months

List of figures

Figure 2.1 The effect of demand increases on housing prices

Figure 2.2 The effect of supply increases on housing prices

Figure 2.3 Forces affecting real estate cycles

Figure 2.4 Construction supply and demand relationship

Figure 5.1 Windhoek Overall Housing Index

Figure 5.2 Windhoek Annual Housing Index

Figure 5.3 Monthly changes in index for each year

Figure 5.4 Monthly index change average for ten year period

Figure 5.5 Average neighbourhood housing values

Figure 5.6 Changes in housing values by neighbourhood

Figure 5.7 Annual housing index vs houses completed

Figure 5.8 Monthly housing index vs total number of houses available

Figure 5.9 Monthly housing index vs. number of houses built per month

Figure 5.10 Annual Gross Domestic Product vs annual housing index

Figure 5.11 Annual population vs housing index for Windhoek

Figure 5.12 Annual inflation vs Annual housing index

Figure 5.13 Monthly consumer prices vs housing prices

Figure 5.14 Average annual interest rates vs Annual housing index

Figure 5.13 Monthly interest rates vs housing values

Figure 6.1 Interest rate effect for August 2002 to April 2003

Chapter 1: Orientation

1.1 Introduction

This research will analyse the changes in housing values in Windhoek, Namibia over the past ten years and explore links in property value variation to changes in macroeconomic factors during that period.

During the past several years housing values in the Windhoek area have gone through significant growth. A major source of this growth has been attributed to interest rates that have been at historically low levels. Another source of growth in housing prices has been attributed to a decline in the number of new houses being built. This decrease in new construction has been occurring despite an increase in the population of Windhoek. Other macroeconomic factors such as inflation and changes in income may also have an effect on the growth in housing values experienced in Windhoek. However, although the relationship between macroeconomic factors and housing prices has been the subject of research in other parts of the world, local investigation to determine the nature of the relationship has not been conducted. This research would thus seek to verify the findings of previous research abroad and its applicability to the local environment in Windhoek, Namibia.

Due to the sustained and sometimes rapid growth in housing values during the past few years in Windhoek there is a risk that houses may be above their long term fundamental values. In addition, the low interest rates have meant that house values are high relative to income as home owners can afford to borrow more to buy a home. This is due to lower interest rates resulting in lower monthly repayments being required for the home loan. During the past year the Bank of Namibia has raised interest rates and there are indications that future increases in interest rates may be expected. Exploring past interactions between interest rates and house values can aid in estimating the impact of future movement of interest rates on housing values.

Currently no published figures on housing values in Windhoek exist. In addition no research into the relationship between macroeconomic variables and housing values in Windhoek has been conducted. Since there is little information on historic housing

values and their relationship to economic factors no conclusions can be drawn regarding the sustainability of the current level of housing prices.

1.2 Purpose or objectives of this research

The objectives of this research are twofold. Firstly this research aims to compile and assess the movement of housing values over the past ten years. This will facilitate the identification of any periods of significant growth or declines. The durations of any cycles evident in the historical housing values will be determined. In addition, seasonal or cyclical movement in growth in housing values will be identified.

Secondly this research aims to assess if there are relationships between changes in macroeconomic factors and housing values, and to describe the nature of these relationships. The timing and magnitude of response by housing values to changes in population as well as economic variables such as income, interest rates, inflation and new housing construction will be determined. It is expected that there will be some lag in the response of housing values to the changes mentioned above. This may be due to the time required to process the sales of houses and the time needed to overcome market inertia. In addition the magnitude of the response will be assessed in an attempt to develop a formal relationship between macroeconomic changes and changes in the growth of housing values.

1.3 Statement of the problem and sub-problems

The statement of the problem

This research proposes to compile and assess the movement of housing values in Windhoek, Namibia over the past ten years and to determine the nature of any relationships that may exist between changes in population or economic variables and housing values.

The sub-problems

1. The first sub-problem. To compile a monthly index of housing values over the last ten years that will facilitate analysis of the growth in housing value over that period.

2. The second sub-problem. To identify and assess the changes of macro-economic events over the ten year period.
3. The third sub-problem. To determine the magnitude and timing of the impact of macroeconomic fluctuations on housing values over the ten year period.

1.4 Definitions

The following definitions are relevant to this study:

Consumer Price Index (CPI): The level of prices for a basket of consumer goods and services relative to some base period. The CPI change over a month, quarter or year is commonly used as a measure of the rate of inflation.

Correlation: The tendency of two variables to move together.

Correlation coefficient: A standardised measure of how two random variables covary. A correlation coefficient of +1.0 means that the two variables move up and down in perfect synchronisation, while a correlation coefficient of -1.0 means the variables always move in opposite directions. A correlation coefficient of zero suggests that the two variables are not related to one another; that is, they are independent.

Discretionary income: Income minus income taxes, the amount that households have to spend or save.

Gross Domestic Product (GDP): The total market value of all goods and services produced within a given period by factors of production owned by a country's citizens.

Housing index: A method of presenting housing values, equal to the housing value for a time period divided by the housing value for some base period

Inflation: An increase in the overall price level.

Inflation rate: The percentage change in the price level.

Interest rate: The annual interest payment on a loan expressed as a percentage of the loan. Equal to the amount of interest payable per year divided by the amount of the loan.

Market: A place where buyers and sellers meet to exchange items of value.

Prime interest rate: The interest rate published by the Bank of Namibia, used as a basis for determining interest rates of financial institutions for different lending instruments, including home loans.

Real income: The amount that income can buy in terms of goods and services.

Real interest rate: The difference between the interest rate on a loan and the inflation rate.

1.5 Delimitation of the study

The data required for conducting an analysis the changes in housing values will relate to those that concern Windhoek, Namibia.

Only factors that could be reasonably expected to have a significant effect on housing values or the economic environment of Windhoek, Namibia will be included in this study. Factors that could be considered to affect housing values include significant changes in inflation, population movements, income levels, interest rates, taxation law, local economic conditions, and regional economic conditions.

1.6 Importance of the study

Buying a home is the biggest personal investment that most families make in their lifetimes. With the increase in housing prices in Namibia, many people are unable to afford to purchase their first house. Higher house prices also make it more expensive for families to move into a larger house. An example would be if a family has grown and would like to move from their 2 bedroom house into a 3 bedroom house. As housing prices increase, the price for the 3 bedroom house and for their existing 2 bedroom house both increase in direct proportion to the percentage increase in

house prices. Thus the difference in price between the two houses increases by the same proportion as the price increase. If the difference in price between the two houses was initially N\$ 200,000, after a 20% increase in the price of houses the difference becomes N\$ 240,000. Thus in order to move into a larger house the family must be able to afford to pay N\$ 40,000 more than before the housing price increase. Costs of transfer, real estate agents fees, stamp duties and other costs of purchasing a house are usually charged as a percentage of the selling price for the house. This also makes it expensive for a family to relocate to another house from their existing property.

1.6.1 The importance of a drop in housing values

As house prices climb higher, many buyers and existing home owners are worried that at some point in the future there will be a drop in house prices. This may mean that houses would sell for significantly less than their current purchase price. Many people fear that should the market fall significantly, the outstanding mortgage amount on their home would be more than its selling price. If the mortgage amount were higher than the selling price, a home owner would have to pay to sell their home. If they chose not to sell, they would be paying off on a mortgage that exceeded the value of the property they were paying for. This would be a devastating position for most families given that their largest investment is their family home.

1.6.2 The importance of changes in macroeconomic variables

In this study relationships between macroeconomic variables and housing prices are examined. No previous studies have been done to investigate these relationships within Namibia. This study will allow potential and existing homeowners, financial institutions and investors to make a more informed decision involving the purchase of housing. This will be possible by taking account of the level and variation in several macroeconomic factors in their decision making process. Macroeconomic factors such as levels and changes in housing supply, population levels, inflation, income levels and interest rates may have an effect on the future housing values. If these effects are known, future housing prices can be more accurately estimated. This will increase the confidence in the housing market as more is understood about its future prospects and its present level.

1.6.3 The importance of the changes in housing supply

Housing supply changes are caused by the amount of new housing construction, alterations and additions, demolitions and changes in zoning for properties. The number of new houses built each year in Windhoek varies considerably from year to year and month to month within a particular year. This could cause a shift in the balance between supply and demand resulting in changes in housing prices. The large variations in the number of houses built in a year or month may have an effect on future housing prices. If this effect is understood, interested parties could make more informed decisions regarding future housing prices.

1.6.4 The importance of changes in population levels

Changes in population levels can have effects on housing demand. All things being equal an increase in population will increase demand for housing. This may increase the price of houses if the increase in demand is not met by a similar increase in housing supply. This relationship between population levels and housing supply could be reflected by change in the average number of occupants per house. If the population increases without enough new housing being made available, the number of occupants per housing unit increases as more people live together since no other housing is available.

1.6.5 The importance of changes in inflation and income levels

If the price of housing increases at a higher rate than the overall price index, housing becomes relatively more expensive than other goods and services. This means that a higher proportion of a person's income would have to be spent on housing compared to other expenses that increased at a reduced rate. If house prices grow at a faster rate than income levels housing becomes less affordable. Again an increased proportion of a person's income would need to be spent on housing. These changes in the affordability due to inflation or income may have a subsequent effect on housing prices. For example if housing prices were high relative to income at some point in time, the housing market may respond by growing at a lower rate in the future until housing prices return to a more affordable level.

1.6.6 The importance of changes in interest rates

Interest rates are one of the most accessible macroeconomic variables for potential and existing home owners. The changes in interest rates are also directly felt in the

form of changes in the monthly repayments for a home loan. These two points mean that most potential and existing home owners are aware of changes in interest rates. Existing home owners are fearful of increasing interest rates, and thus increased monthly mortgage repayments. Over the past several years, interest rates in Namibia have been at low levels. The prime rate dropped from over 24% in 1998 to under 12% in 2005. Indeed these low levels are what some real estate professionals ascribe as the cause of the higher property prices. Real estate professionals point out that the lower cost of debt associated with lower interest rates allows individuals to pay a lower monthly instalment for a more expensive house. This is due to the monthly instalment being determined by the combination of the house price and the interest rate. At lower interest rates a more expensive home can be purchased for the same monthly payment as a cheaper house at a higher interest rate. Currently in Namibia interest rates have bottomed out and have started increasing. This has driven a fear that they may increase to a point where the home owner cannot afford the monthly payment. The home owner would then be in a position where they must either default on the loan or move into a more affordable home that is either smaller or less well situated.

The effect of increasing interest rates affects the existing home owner and a potential purchaser in the same way. For both existing home owner and a potential purchaser the house becomes less affordable at a higher interest rate. This is what leads many people to fear that they would have to drop the selling price of their house in order to sell their house should interest rates increase. The belief is that a higher interest rate means that the selling price of the house must be lower in order to attract a buyer who can afford the monthly payment.

For families purchasing a home or who have recently purchased a home the worst case would be that interest rates increase and that at the same time there is a decrease in the value of their house. If these families were unable to afford the monthly mortgage repayments, their alternatives would be unpleasant. One alternative would be to default on the loan. Another option would be to sell their property and purchase a cheaper house. In this case they would have to sell for less than the purchase price. With transfer costs and the money lost in the sale of their home they would owe a significant amount before even purchasing another home. They would then need to move into a significantly cheaper house for two reasons.

Firstly they would need to compensate for their debt after the sale of their previous house. Secondly the house would have to be cheaper for the monthly mortgage payment to be affordable at the higher interest rate.

Many first time buyers who cannot afford a home at existing prices would welcome a drop in housing prices. However lower housing prices on their own would not enable first time buyers to afford the monthly payment, it would just make the amount of deposit that was required by the bank lower. The drop in housing prices would have to be enough to still make the monthly mortgage repayment affordable at the current interest rate. If the interest rate increased at the same time such that there was no reduction in the monthly repayment required the house would still be unaffordable.

Although a drop in house prices may benefit potential home owners who are currently priced out of the market, lower interest rates would be welcomed by both existing and potential home owners. This is only if the lower interest rate does not drive up housing prices. Conversely, a higher interest rate is bad news for both groups as a higher rate effectively makes housing more expensive by raising the monthly mortgage repayment. This is especially true for current home owners if the higher interest rate were to cause a drop in housing prices.

1.6.7 Conclusion

Understanding the effect of a change in the above macroeconomic factors on housing prices is thus important to current and potential home owners. It is also of value to lending institutions as it facilitates the understanding of the risks involved with home loans affected by changes in these factors. Investors may also gain insight and valuable information from an understanding of the true nature of the relationship between these factors and house prices. This information is valuable for risk analysis as well as determining occupancy rates of residential rental properties, both of which are dependent on housing prices.

Although the relationship between housing prices and macroeconomic factors has been extensively investigated in other countries, there is some variation in the results of the different studies. This makes an analysis of the local effects of interest to local institutions and individuals. The study will also add value to the existing body of knowledge in the study of housing values that has been conducted in other countries

such as the USA, the UK, other parts of Europe, Japan, Hong Kong, South Africa and Australia.

1.7 Assumptions of the study

The first assumption of this study is that there exists a meaningful relationship between housing prices and the environment in which those prices are set.

A second assumption is that the housing market in Windhoek, Namibia responds in a relatively consistent manner to specific changes in the macroeconomic environment.

A third assumption is that an exploration of the relationship between housing prices and the macroeconomic environment will enhance our understanding of the variation in house prices.

A fourth assumption is that the data utilised in this analysis may not be an accurate representation of the reality that exists within the housing market in Windhoek, Namibia.

A final assumption is that a change in one or more of the macroeconomic factors considered has no predictable effect on housing prices within the Windhoek, Namibia housing market.

1.8 Outline of the research report.

Introduction

In this section the content of remainder of the report is summarised. This will allow an overview of the research process and structure of the report. This report is divided into 6 chapters: In Chapter 1 the study is introduced and the broad objectives and purpose of the study are explained. In Chapter 2, existing theory is reviewed to form the theoretical foundation of the study. In Chapter 3 recent literature relating to housing market research is examined in a literature review. The Research methodology is then described in Chapter 4, followed by the results of the research which are presented in Chapter 5. In chapter 6 of the report the results are discussed

and conclusions and recommendations are drawn based on the results. The content and purpose of each chapter is discussed below in more detail.

Chapter 2

Chapter 2, the foundation of the study, theory relevant to the relationship between macroeconomic factors and housing prices is reviewed. This starts with a review of the economic laws of supply and demand. These are then discussed in the context of the housing market to allow an understanding of the interaction between supply, demand, housing prices and macroeconomic factors. This is followed by a discussion of current theory relating to cycles present in real estate markets, which is valuable in discerning the impact of variation in macro-economic factors on housing prices.

Chapter 3

Chapter 3, the literature review looks in detail at literature on recent studies and research relating to housing markets. This consists of 4 sections. The first section starts with a brief look at the current position of the housing markets, both local and global. Concerns about over pricing and housing bubbles as well as trends in local and global interest rates are discussed. The second section of the literature review explores the influence of macroeconomic factors on housing prices. Important macroeconomic factors that previous studies have identified, plus their effect on housing prices are assessed to enable determination of what factors should be considered within the research design for this study. The third section of the literature review deals with the effects of supply and demand factors on the housing price. This facilitates an understanding of the mechanisms behind the response of housing prices to changes in external factors. The final section of the literature review deals with the assessment of the existing research literature surrounding the interaction between interest rates and housing prices. Many of the studies involving other macroeconomic factors also include conclusions about the effects of interest rates and these are restated if relevant to the understanding of current thinking about interest rate and housing price interaction.

Chapter 4

In Chapter 4 the research methodology is discussed. The data requirements of housing values, interest rate data and macroeconomic data and their sources are

outlined. This is followed by an assessment of the methods of data acquisition. Data analysis methods and techniques are then discussed in detail, and the choice of analysis methods substantiated.

Chapter 5

Chapter 5 contains the results where the data collected and the corresponding results of the analysis are tabulated and represented graphically followed by a verbal explanation of the results. Analysis techniques are then applied where possible to determine the nature and timing of relationships between the macroeconomic variables under consideration and housing prices.

Chapter 6

Discussion, conclusions and recommendations based on the results obtained are included in Chapter 6, the final chapter of the report ending with recommendations for future research and the implications of the report.

Chapter 2: Theoretical foundation of the study

2.1 Introduction

In this chapter the theoretical basis of real estate and specifically housing markets is discussed. This chapter specifically reviews the underlying theories relating to housing markets. As such it forms the basis for the literature review that follows in Chapter 3. Where this chapter focuses on presenting well established theory on housing markets, the literature review chapter focuses on the review of recently published research.

This chapter starts with an explanation of theory relating to the supply and demand of real estate, and the effect that macroeconomic factors have on supply and demand. Following this, the theory regarding the cyclical nature of economies, markets and specifically real estate markets is discussed.

2.2 Supply and demand and housing markets

Prices in housing markets are influenced by the economic laws of supply and demand. These are two basic laws of economics and have been defined as:

“Law of Demand: The negative relationship between price and quantity demanded: As price rises, quantity demanded decreases. As price falls, the quantity demanded increases.” (Case and Fair, 2004:G-5).

“Law of Supply: The positive relationship between price and quantity of goods supplied. An increase in the market price will lead to an increase in quantity supplied, and a decrease in market price will lead to a decrease in quantity supplied.” (Case and Fair, 2004:G-5).

For perfectly competitive markets, supply and demand tend towards a state of equilibrium, however as illustrated in Table 2.1 below from McKenzie and Betts (2006) significant differences exist between perfectly competitive markets and real estate markets.

Table 2.1 Perfect markets versus the typical real estate market

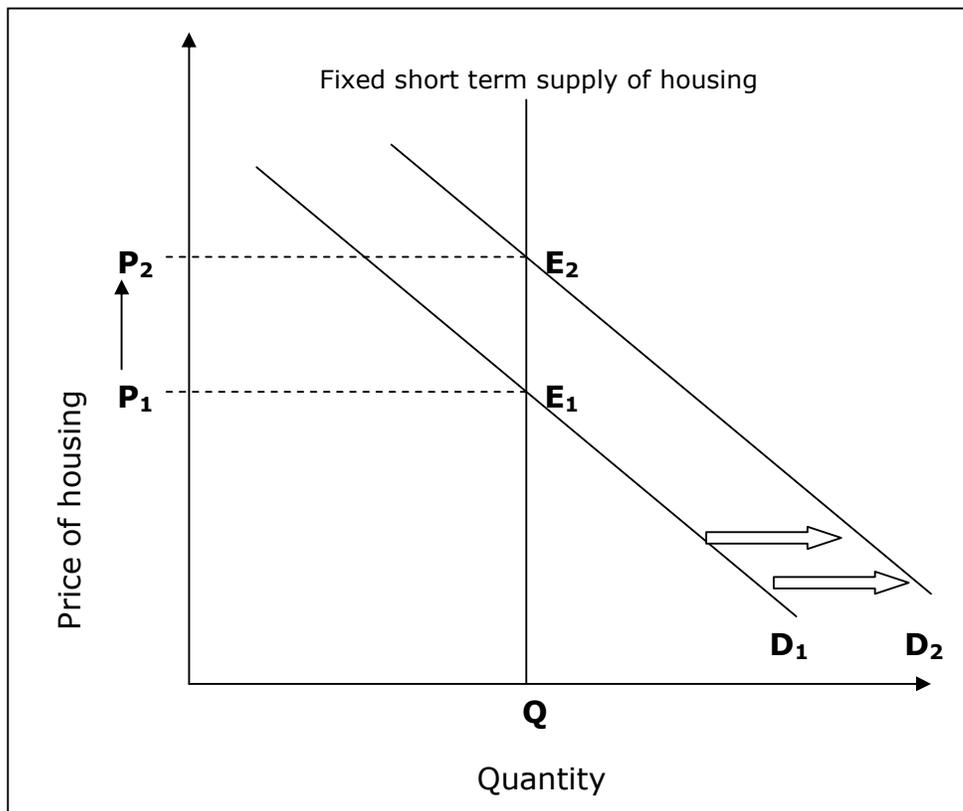
Characteristic	Perfect Market	Typical Real Estate Market
1. Number of buyers and sellers.	Many participants; no monopoly, oligopoly, or monopolistic competition.	Few participants; seller controls during a 'seller market', and buyers control during a 'buyers market'.
2. Product knowledge and market exchange.	Buyers and sellers are highly knowledgeable; the exchange takes place with ease	Buyers and sellers are not always knowledgeable; the exchange is legalistic, complex and expensive.
3. Standard products.	All products are alike and interchangeable; there is little difference between products of different sellers.	Each parcel of real estate is unique and separate from all others; no two are exactly alike.
4. Mobility.	Products can be transported to capitalise on more lucrative markets.	The location is fixed; a real estate parcel cannot be moved to another location; a real estate market is local, not regional or national.
5. Size and frequency of purchase.	The item purchased is small and relatively inexpensive; it is purchased frequently.	Real estate is purchased infrequently; a home represents the largest single investment made by the average family.
6. Government's role.	Government plays little if any role; laissez-faire prevails.	Government plays a dominant role in encouraging or discouraging real estate development through the use of fiscal and monetary tools and by use of other controls such as zoning, environmental and health codes.
7. Prices	Prices are established by the smooth action of supply and demand.	Prices are influenced by supply and demand, but this interaction is not smooth.

Source: McKenzie and Betts (2006)

According to Wurtzebach and Miles (1994), only effective demand is relevant for real estate pricing – potential buyers must exist that have the purchasing power to acquire the desired property. In addition, according to Wurtzebach and Miles (1994) supply is fixed in the short term for property markets. This is due to the fact that the total amount of land is fixed - the intensity of land use can change which in turn increases or decreases the supply of real estate. However Wurtzebach and Miles (1994) state that the time required for changing land use intensity is considerable as it involves developers acquiring land and then permits and financing and finally construction. The implication of this is that over the short term changes in market prices are determined by changes in demand for housing. As demand for housing increases, supply cannot respond in the short term and the housing market response is reflected by rising prices as buyers compete for a fixed level of supply.

Taking the above into consideration the reaction of the housing market to an increase in demand above the normal increase over time can best be demonstrated by the supply and demand curves from McKenzie and Betts(2006) shown below:

Figure 2.1 The effect of demand increases on housing prices

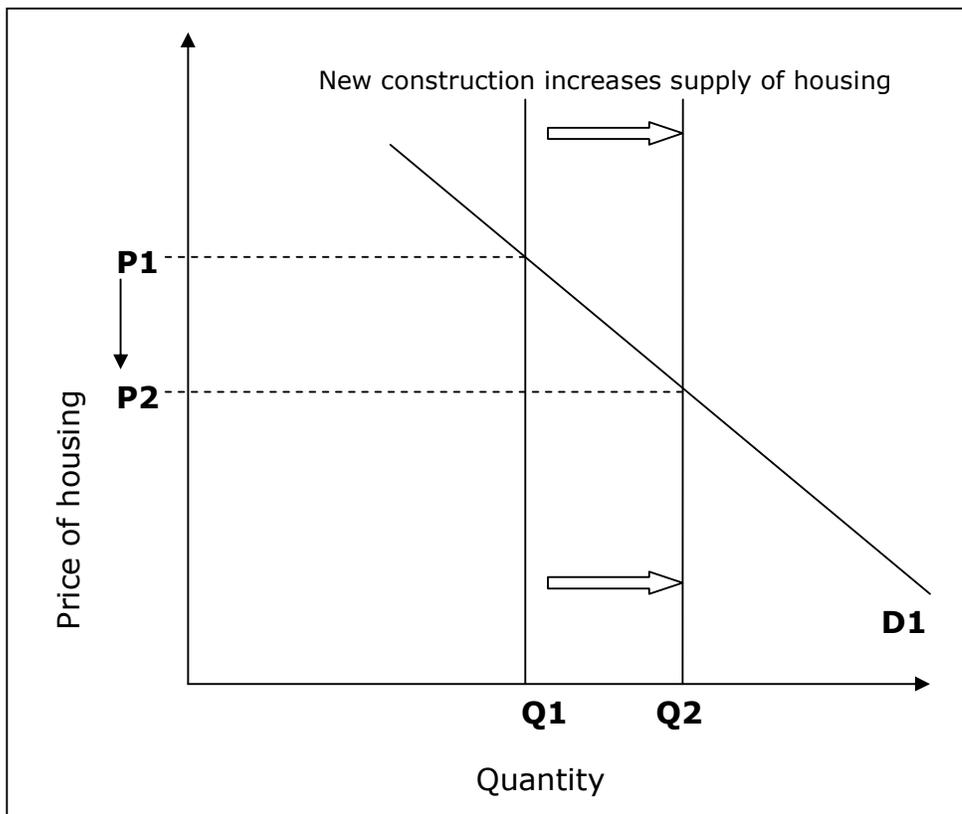


Source: McKenzie and Betts (2006:111)

In figure 2.1 above, as demand increases from D_1 to D_2 short term supply is constrained by the time taken to increase land use intensity as discussed above. Thus equilibrium (point of intersection of demand line D_1 and supply line Q) changes from point E_1 to point E_2 . This in turn results in prices increasing from P_1 to P_2 . The increase in prices increases the profitability of new housing, thus stimulating developers to obtain financing and permits to begin new construction.

According to McKenzie and Betts (2006), over the long term supply responds to the increased demand and supply increases represented by the vertical supply line moving right as shown in Figure 2.2 below:

Figure 2.2 The effect of supply increases on housing prices



Source: McKenzie and Betts (2006)

As can be seen from figure 2.2 above, if supply increases at a time when the increase in demand has remained stable, overbuilding results and a situation develops where there is a higher supply than required by existing demand, D_1 – thus prices drop from P_1 to P_2 .

According to McKenzie and Betts (2006), Wurtzebach and Miles (1994), Pyhrr, Cooper, Wofford, Kapplin & Lapidés (1989) and others, the drivers of housing demand are identified as:

- changes in population,
- income,
- availability and cost of mortgage credit,
- personal lifestyles
- and government actions.

Similarly from McKenzie and Betts (2006), Wurtzebach and Miles (1994), Pyhrr, Cooper, Wofford, Kapplin & Lapidés (1989) and others the mechanisms of changes in long term supply are identified as:

- new construction,
- conversion of existing buildings,
- demolition
- and government actions.

These are driven by construction costs, availability and cost of mortgage credit, existing house prices and government actions.

According to McKenzie and Betts (2006) the cost of mortgage credit is directly related to the interest rate. McKenzie and Betts (2006) go on to point out that the interest rate has an effect on both the supply and demand for housing. A decrease in interest rates results in an increase in demand over the short term and an increase in supply over the longer term. Thus McKenzie and Betts (2006) state that interest rate variations will increase prices over the short term, but that this will be moderated by a subsequent response in the form of an increase in supply over the longer term.

For the purposes of this study the above has identified the macroeconomic factors driving supply and demand in housing markets. The shift in housing prices is determined through the relationship between the level of supply for housing and the demand for housing. The shifts in supply and demand are a major cause of cycles in the real estate markets that are discussed in the following section.

2.3 Economic, business and real estate cycles

A study of the cyclical nature of markets is essential to this study to enable the understanding of the changes in the housing market over time. Some portion of the changes that will be explored may be considered to be part of a natural business or economic cycle. This needs to be taken into account when assessing the impact of the various macroeconomic factors to ensure that changes are not ascribed to other causes, when the real cause may be a change in the overall economic environment due to cyclical change. According to Case and Fair (2004) government has a significant interest in economic cycles and attempts to reduce the effects of cycles through fiscal and monetary policy. Governments attempt to prevent periods of boom being followed by periods of decline or recession. The primary monetary tool available to governments according to Case and Fair (2004) is the interest rate. Governments may use changes in interest rate to stimulate or slow growth of the economy or to control the level of inflation.

In general terms theory regards cycles as up and down movements in economic activity and breaks cyclical change into seasonal fluctuation, business cycle or long term secular trends, based on the duration of a typical cycle. In this section, definitions relating to each form of cycle will be defined, followed by a more in depth look the theory related to each type of cycle.

Seasonal fluctuations are defined by McKenzie and Betts (2006:45) as “short term changes in business and economic activity that occur within the year”. For the housing market this may be affected by climate, builders holidays or tax considerations.

Long term secular trends are defined by McKenzie and Betts (2006:46) as “economic changes that occur over an extended period of time, perhaps 50 years or more”.

Case and Fair (2004: 379) define a business cycle as “The cycle of short term ups and downs in the economy”. These cycles are typically between two and six years long and are significantly linked to the cycle of inflation within an economy, and have a significant impact on the real estate cycle as described by Pyhrr, Cooper, Wofford,

Kaplin & Lapides (1989), the starting point of which is the start of a new real estate upswing after the previous trough has passed. This primary real estate cycle is discussed in the next section.

2.3.1 The primary real estate cycle

According to Phyr, *et al.* (1989) the real estate market can be seen to follow several stages as described below:

Stage 1: Imbalance between supply and demand exists. Low interest rates, increasing population, rising income and better employment are all increasing the demand for housing. However new construction is still slow after the real estate trough experienced and thus supply is relatively fixed over the short term as described in the previous section. (Pyhrr, *et al.*, 1989)

As demand increases, vacancies decrease since supply is relatively fixed. This leads to a rise in prices, builders become more optimistic as prices rise and construction begins to pick up speed. Government monetary and fiscal policies are expansionary, and ample construction mortgage credit is available at favourable rates. (Pyhrr, *et al.*, 1989)

Stage 2: Demand is still very high due to availability of low cost mortgage credit. Supply is starting to catch up as more new construction is completed. An increasingly active real estate market exists with selling prices increasing but also construction costs – houses still selling soon after completion. Apartments and commercial constructions start to increase. Investors and speculators enter the market to take advantage of the construction boom and availability of credit and this leads to further increases in selling prices. However inflation and interest rates are starting to rise. (Pyhrr, *et al.*, 1989)

Stage 3: Too many new houses come onto the market at once as construction that started during the previous stages is completed. This causes an oversupply of housing and home markets become saturated. Inflation has increased rapidly as government applies monetary brakes, causing interest rates to rise higher. High numbers of apartment projects and commercial properties are completed and put into the market. More difficulty obtaining mortgage credit and higher mortgage rates

mean that the effective demand for properties is reduced as fewer families can afford to enter the market with the high home prices. Builders become pessimistic as completed houses no longer sell quickly and inventory builds up, coupled with higher lending costs. (Pyhrr, *et al.*, 1989)

Stage 4: Government continues to use monetary brakes to slow inflation causing a slow down in business and real estate activity. Overbuilding has occurred and builders are experiencing more difficulties selling their properties. Vacancies and mortgage rates increase, both of which mean that owners experience difficulties meeting mortgage obligations and foreclosures increase. (Pyhrr, *et al.*, 1989)

Stage 5: Effective demand begins to decrease, but new completions continue to come to market since they were started during the previous stages when the demand was still strong. Real estate begins to decline, the extent of the decline dependent on the degree of overbuilding and restrictions on lending and monetary practices. (Pyhrr, *et al.*, 1989)

Once the economy starts to pick up again in the future, the real estate cycle starts again at stage 1.

From the above it is apparent that the imbalance of supply and demand plays a significant role in the cycle. In the initial stages, when demand is high and profitability is high, builders begin increasing amounts of new construction which at a point in the future results in oversupply and a decrease in prices and profitability. (Pyhrr, *et al.*, 1989)

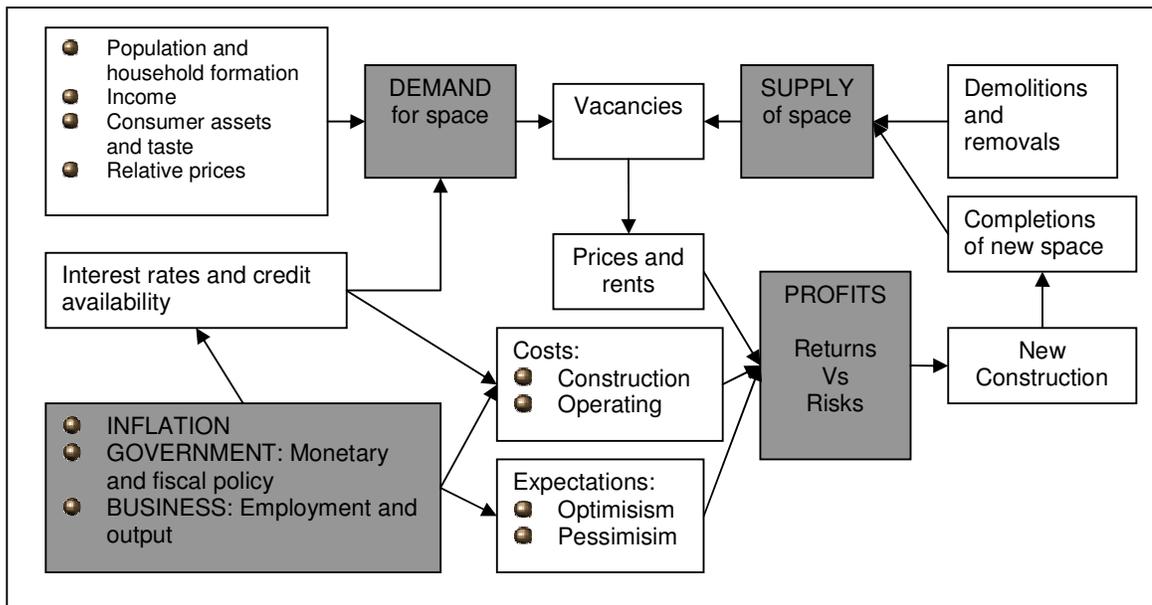
Thus we see that the forces of supply and demand discussed in section 2.1 play an important role in determining the cycle for real estate. This relationship is explored in more detail in the section below that expands on the factors contributing to the real estate cycle.

2.3.2 Forces affecting real estate cycles

From the previous section we see that the primary real estate cycle outlined by Phyr, *et al.* (1989) is affected by the interaction of supply and demand. Phyr, *et al.* (1989) go on to combine this with the drivers of supply and demand as shown below.

Figure 2.3 from Phyr, *et al.* (1989) below outlines some of the factors that contribute to the real estate cycle, as well as to supply and demand that drive the cycle.

Figure 2.3 Forces affecting real estate cycles.



Source: Phyr, *et al.* (1989)

In figure 2.3 above from Phyr, *et al.* (1989) it can be seen that supply and demand interact to determine the level of vacancies. The level of vacancies in turn affects the levels of prices and rents. Inflation, fiscal and monetary policy by the government and the levels of employment and output in business all affect interest rates, costs and expectations. Interest rates combined with income, relative prices, population and consumer behaviour all in turn affect demand for space. Interest rates also affect operating and construction costs. Costs and expectations combine with the levels of housing prices and rents to determine the profitability of housing in relation to risk and return. This profitability then drives the volume of new construction. New construction levels affect the completion of new space. New space combined with demolitions and removals then in turn affect housing supply.

Aside from the business cycle and the overall real estate cycle outlined above, there are nine other cycles relating to real estate. The nine cycles will be discussed in the next section.

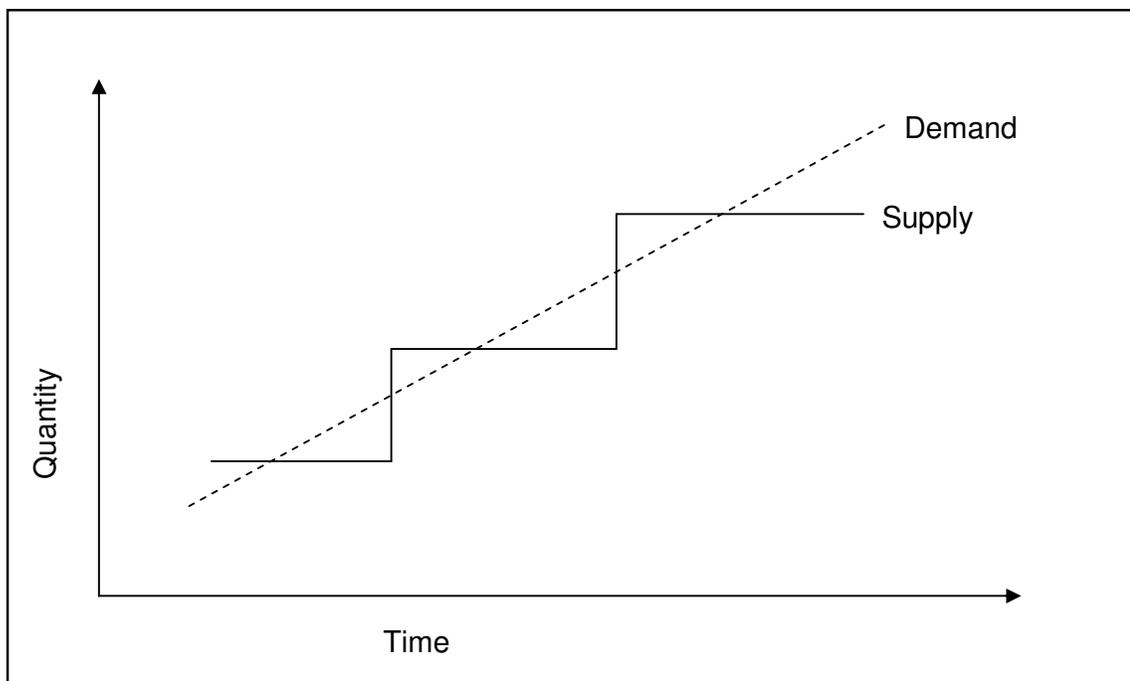
2.3.3 Cyclical components making up the primary real estate cycle

With reference to the primary real estate cycle from Phyr, *et al.* (1989) discussed in section 2.2.1, several sub-component cycles can be identified. According to Phyr, *et al.* (1989) and McKenzie and Betts (2006) these are the construction cycle, the mortgage money cycle, urban and city cycles, neighbourhood cycles, property specific cycles, seasonal cycles, property, ownership and investor life cycles, popularity cycles and social change cycles. The sub cycles of the primary real estate cycles are discussed below:

Construction cycles

Construction of new real estate follows cycles as shown in figure 2.4 below.

Figure 2.4 Construction supply and demand relationships



Source: Phyr, *et al.* (1989)

Thus the construction cycle is a step up type cycle as shown in figure 2.4 above. During stages 1&2 of the primary real estate cycle, there is pent up demand and favourable economic conditions for new construction. This is reflected by the flat portion of the step up curve of supply in figure 2.4 above. According to Phyr, *et al.* (1989) builders independently start new construction and do not consider the effects of supply and demand in the future and the construction being done by other firms. At some point in the future the new construction that had been started before that time is completed and enters the market resulting in an oversupply for the existing market. This reflected by the vertical or step up shown in figure 2.4 above. In figure 2.4 above when the supply curve is below the demand curve there is an undersupply of housing. The difficulties encountered by builders in selling these new houses causes new construction to slow. Then starts the next flat part of the supply curve shown in figure 2.4 above.

Mortgage money cycle

According to Phyr, *et al.* (1989) the mortgage money cycle is related to the business cycle and the construction cycle. Phyr, *et al.* (1989) state that as the business cycle expands and contracts, inflation increases and decreases. This results in government tightening or easing fiscal and monetary policy. A tightening of government economic policy through fiscal or monetary mechanisms directly increases the interest rate and thus the mortgage lending rate. The reverse is true for an easing of government policy – this in turn creates the mortgage money cycle as mortgage lending rates vary over time.

Urban area and city cycles

Cities and urban areas grow in a series of cycles that are determined by the local economic conditions and their relationship to national and regional conditions. Increases in business activities in a particular city may increase business vitality and thus stimulate the real estate market. (Phyr, *et al.*, 1989)

Neighbourhood cycles

Within cities, neighbourhoods also experience growth and development on a cyclical basis. Neighbourhoods are established, grow and develop until vacant land becomes scarce. After this point the nature of the neighbourhood may change as it is identified as a potential business area, as occupants move to more suburban areas and

commute or as other factors determine the change in how the land is used. (Pyhrr, *et al.*, 1989)

Property specific cycles

Different types of properties experience different cycles. Residential differs from industrial or commercial, and different types of residential may also differ – single family houses may experience a different cycle to apartments or townhouses. (Pyhrr, *et al.*, 1989)

Popularity cycles

This cycle is a result of an attractive opportunity being identified, which is then popularised by the media. Individuals and firms then jump on the bandwagon and at some point the market becomes oversaturated. The result is then a substantial bust in that type of real estate market, and the next popular opportunity is touted by the media. (Pyhrr, *et al.*, 1989)

Social change cycles

A society changes, the housing needs of the population also change. A growth in retired residents may create a demand for low maintenance, secure housing. A growth in the birth rate may result in the need for larger single family homes (Pyhrr, *et al.*, 1989). In the African context the emergence of middle class blacks creates special demands on the existing housing markets in Namibia.

2.4 Conclusion

From the review of theory above it is apparent that although interest rates are of significant importance in housing markets many other factors need to be considered.

According to the theory review above, prices in housing markets are influenced by the economic laws of supply and demand. For perfectly competitive markets, supply and demand tend towards a state of equilibrium, however as by McKenzie and Betts (2006) significant differences exist between perfectly competitive markets and real estate markets. These include difference in the number of buyers and sellers, product knowledge and market exchange, non-standardised products, fixed location,

low frequency of real estate purchases, government intervention and non-smooth interaction between supply and demand.

An important point from the theory review above is that only effective demand is relevant for real estate pricing – potential buyers must exist that have the purchasing power to acquire the desired property. In addition supply is fixed in the short term for property markets. This is due to the fact that the total amount of land is fixed - the intensity of land use can change which in turn increases or decreases the supply of real estate. However the time required for changing land use intensity is considerable as it involves developers acquiring land and then permits and financing and finally construction. The implication of this is that over the short term changes in market prices are determined by changes in demand for housing. As demand for housing increases, supply cannot respond in the short term and the housing market response is reflected by rising prices as buyers compete for a fixed level of supply.

The review of theory above includes a study of the cyclical nature of markets. This is essential to enable the understanding of the changes in the housing market over time. Some portion of the changes that will be explored may be considered to be part of a natural business or economic cycle. This needs to be taken into account when assessing the impact of the various macroeconomic factors to ensure that changes are not ascribed to other causes, when the real cause may be a change in the overall economic environment due to cyclical change.

Exploration of the primary real estate cycle shows that the imbalance of supply and demand plays a significant role in the cycle. In the initial stages, when demand is high and profitability is high, builders begin increasing amounts of new construction which at a point in the future results in oversupply and a decrease in prices and profitability. From the primary real estate cycle several sub-component cycles can be identified. These are the construction cycle, the mortgage money cycle, urban and city cycles, neighbourhood cycles, property specific cycles, seasonal cycles, property, ownership and investor life cycles, popularity cycles and social change cycles.

In the next section the current literature surrounding the interactions between housing and macroeconomic factors including interest rates is reviewed.

Chapter 3: Literature review

3.1 Introduction

This literature review starts by considering past studies of property values in other parts of the world. Factors such as tax reform, inflation, GDP growth, supply and demand as well as the economic climate that influence property values in other studies are identified, and their effects summarised. Following this a more in depth look into studies that have included property values and interest rates are reviewed including the methods used to analyse the data and draw conclusions.

3.2 Property and housing values

Liang and McLemore (2004) in their study they note three periods of significant housing appreciation that have occurred in the US since 1970. They also point out that on an annual basis the median national home price in the US has never fallen. They note that peak price appreciation during the housing boom from 1999 to 2004 is not any stronger than during the previous booms, but that in real terms the current boom has lasted longer. This they ascribe to the continuing fall in interest rates in the US during 1999 to 2004. Housing affordability resulting from the decreasing interest rates has been the primary driver of the rapid rise in housing demand. Within the five years before 2004, mortgage rates dropped to historic lows, prompting a home purchase and refinancing boom.

In the study of housing prices in Australia between 1970 and 2003, Abelson, Joyeux, Milunovich & Chung (2005) use quarterly housing index data to track the growth in housing values. They find a compound growth of approximately 3.3% per annum during this period, which they subsequently correct to 2.3% after taking into account quality changes in housing such as improvements, alterations and additions. They notice during their analysis a pattern of boom and stagnation periods, with four periods of boom over the 33 years. Of these booms, the longest and most significant was the period starting 1996 and continuing to past the time the study ended.

Over the past decade prices of homes have increased significantly throughout the world. The rising house prices have been accompanied by fears that a price bubble

exists and that a market correction may occur (Housing in trouble, 2004). Despite these fears, prices continue to rise beyond expectations without any periods of significant decline. This led to house prices being at record levels in relation to income as early as 2004 (The sun also sets, 2004), a position that has not changed subsequently.

In a recent study of the UK housing market, Sampter (2007) points out several aspects of the importance of home ownership and the effects of the rapid growth in house prices in that country. Sampter (2007) notes that in the UK the price of houses has increased by 180% over the past ten years. Coupled with this is the trend for more households to own their own homes. This has led to increased household wealth, but also a corresponding increase in debt levels as houses become more expensive. In the UK, government programs were implemented in the '80's to encourage private home ownership. However, according to Sampter (2007) in recent years the emergence and rapid growth of the 'buy to let market' has been a counter balancing factor that has put the owner occupancy rate in the UK at 70% as the number of properties rented privately has increased. Since most home purchases are financed by variable interest rate loans for close to the full amount of the buying price, any change in interest rate has a significant implication for homeowners.

This global trend is replicated in Namibia where property prices have been experiencing rapid growth. Property prices more than doubled in Windhoek between 2001 and 2006 (Property market – the investment way to go, 2006). This increase in prices has had significant effects on the accessibility of housing, particularly for the middle class, and the feeling is that prices are well above value (Bringing sense back into the property market, 2007).

The value of property is often related through the capitalisation rate (cap rate) of real estate used predominantly for real estate investment (Frew and Jud, 2003). The cap rate refers to the ratio of net operating income (NOI) to property value. A large body of empirical work has been done on cap rates and their relationship to macroeconomic factors. Ambrose and Nourse (1993) formulated a model that negatively relates cap rates to stock earnings/price ratios and a positive relationship with expected inflation. Using cap rates as an indicator of property value has allowed

assessment of the impact on property value of other macroeconomic factors that is reviewed in the following section.

Summary of property and housing values:

From the review of literature relating to property and housing values above it becomes clear that there is an increase in the value of property in many parts of the world. This increase in property prices is also being experienced in Namibia. These property price increases are accompanied by fears that prices may drop at some time during the future. It is also pointed out above that property markets experience cyclical variations. The results from Abelson, *et al.* (2005) supports the theory reviewed in the previous chapter relating to cyclical variations in housing prices.

3.3 The influence of macroeconomics on housing prices

In their investigation of the relationship between the price of property, McKenzie and Betts (2006) find that interest rates can not be solely used to predict changes in prices. Other studies (McKenzie and Betts, 2006, Mueller and Pauley, 1995, Conner and Liang, 2005, Abraham and Hendershott, 1996) point out those factors such as tax reform, inflation, GDP growth, supply and demand as well as a favourable economic climate can all have significant effects. Jud and Winkler (2002) in their analysis find that for metropolitan areas in the US, real housing appreciation is strongly influenced by real growth of the population, income, construction costs and interest rates. In addition macroeconomic variables also have a complex relationship with interest rates as the central banks use interest rate adjustment to slow inflation or boost a sluggish economy. According to McKenzie and Betts (2006) inflation may affect housing prices indirectly through the higher interest rates needed by lenders to compensate for inflation resulting in a reduced demand for real estate.

Mueller and Pauley (1995) believe that factors such as GDP, employment growth and inflation may affect real estate significantly. During periods of higher inflation construction costs rise, discretionary income falls and increased uncertainty exists about the future, all of these factors lead to a decrease in demand for housing. Likewise, Giussani and Hadjimatheou (1992) showed that fiscal and monetary policy have a direct impact on house prices both in the short and long run through changes

in personal disposable income, interest rates and the tax allowance on mortgage interest payments.

Apartment cap rates were found by Conner and Liang (2005) to react fairly quickly to a collapse in tenant demand brought about by significant job losses and rising home ownership. In addition they propose that an increase in the cost of capital and more attractive yields in other asset classes could adversely affect all types of real estate investments.

Sampter (2007) finds major driver of the growth in housing prices has been a strong economy and positive expectations for the future. Another significant contributor has been historically low interest rates and also an increase in the financing options available to purchasers. The more competitive home mortgage market has reduced the costs of debt and made loans available to potential buyers who previously would have not met with the requirements of the financial institution. In his study Sampter points to a strong correlation existing between changes in house prices and household spending when they are driven by changes in income growth and future economic expectations. However during periods of extremely high house price growth he finds that the relationship no longer holds as during these periods the growth in house prices may be driven by different forces. Similarly for periods where there is a drop in house prices, consumption tends to be dramatically affected, this is ascribed to the response of those with uncertain income or whose mortgage equity ends up being lower than their debt as the value of their house drops below the outstanding mortgage amount. Sampter (2007) goes on to point out that although house prices have increased at a faster rate than income this is balanced against lower interest rates and lower mortgage margins the result of which is to reduce the cost of servicing the higher debt levels that are needed.

In their study of Australian housing prices between 1970 and 2003, Ableson, *et al.* (2005) find that real house prices are determined significantly and positively in the long term by increased real disposable income, and the consumer price index. They also find that negative factors include increasing unemployment, real mortgage rates, equity prices and the stock of housing. The costs of new construction are not included in their study although they note the models of Bourassa and Hendershott (1995) and Bodman and Crosby (2003) both take new construction costs into their

models. The reasoning given is that the prices of new houses is actually driven by the price of existing house prices, and the cost of new houses only becomes a factor when new construction makes up a substantial portion of the housing supply.

Abelson, *et al.* (2005) then go on to model their long-run and short-run models of house prices. They assume that house prices adapt to economic fundamentals for the long run model, but in the short term the change is too quick for equilibrium to be maintained and house prices continually adapt in a non-linear response through an asymmetric error correction term. The asymmetry is due to the behaviour of buyers and seller in markets where prices are increasing versus decreasing. According to Abelson, *et al.* (2005), in increasing markets, buyers are eager to get into the market and pay more as they feel that prices are just going to be more expensive the longer they wait. Conversely in a decreasing market, sellers are reluctant to reduce their price and are more willing to wait a little longer in order to sell at or near their asking price. The long run model of housing prices is then presented as a function of the real mortgage rate, the real household disposable income, the trade weighted foreign exchange rate (to capture the influence of overseas demand for Australian housing), the effect of the stock market, the consumer price index, the unemployment rate, the housing stock per capita and a stationary error term. Since the variables are integrated to order 1, the Johansen (1988, 1991) co-integration test could be used, which reveals 5 co-integrating variables for the period which is 1975 to 2003. Over the same period the authors then use a method proposed by Stock and Watson (1993) to determine the relationships between the variables. This reveals statistically significant results for the effects of all variables except exchange rate on housing prices. The table 3.1 below summarises the results in terms of a 1% change in some of the relevant variables:

Table 3.1 Impact of variables on housing prices

Variable	Effect on housing price of a 1% increase in the variable
Real disposable income	Real housing price increases by 1.71%
Consumer Price Index	Real housing price increases by 0.76%
Real Mortgage Rate	Real housing price decreases by 5.4%
Housing stock per capita	Real housing price decreases by 3.6%

Source: Abelson, *et al.* (2005)

So from the table above it is apparent that the real mortgage rate is the most important driver of the housing price for Australian homes during the period reviewed. The change in housing stock per capita is also considered to have a large effect on house prices; however it is important to note that a 1% change in the number of houses per capita represents an extremely large amount of new construction, especially given that most houses are occupied by more than one person. As far as the timing of market response, their results indicated a lag of approximately 4 quarters for rising markets and 6 quarters for flat or falling markets due to asymmetry in buyer/seller response discussed above.

Phyrr, *et al.* (1989) indicate that rising inflation has a negative effect on new construction due to increasing costs, but that existing properties may increase substantially in value during periods of higher inflation. Storms (2001) points to a study by Abraham and Hendershott (1996) that reveals real housing appreciation is directly related to increases in real construction costs, employment and real income, and decreases in real interest rates.

Liang and McLemore (2004) outline three fundamental forces that drive housing appreciation: (1) income growth, (2) interest rates, and (3) the propensity of households to spend on housing. They use a model which is based on the formula:

Price appreciation = Income growth + Interest effect + Consumption effect

They note that house prices have always been affected by growth in household incomes, which is in turn partly affected by inflation effects. They also noted that as interest rates decline, homes become more affordable due to an increased number of buyers, which increases demand for housing. Housing consumption is given as a measure of the household's willingness to spend income on housing expenditures predominantly mortgage payments thus when mortgage rates rise; consumption effects counteract the negative impact of higher payments. According to Liang and McLemore (2004), this ensures that prices do not overreact to the interest rate change.

Liang and McLemore (2004) go on to analyse the effects of income growth, interest effects and consumption effects and use these to project future price variations for

the following 5 years. For income growth they note that in the US income growth has always been positive and that inflation has always been the most significant cause of income growth. They also note that the income for the top 20% of households has historically grown faster than the average and that this trend can be expected to continue into the future. They found that a one-to-one relationship exists between income growth and housing appreciation, thus a one percent growth in income is expected to increase home prices by one percent, with other factors held constant.

They further note that interest rates have been the most volatile driver of housing appreciation as well as the most important factor in the recent housing boom. There has been a long term secular decline in the mortgage rates in the US since 1981. According to Conner and Liang (2005) the decline in interest rates in recent years has offset the negative effects of a prolonged labor market recession. They estimate the effect of changes in interest rates on housing values as illustrated by the table 3.1 below.

Table 3.2 Potential interest effects on home price

	30 Year Mortgage rate	% Change in Value	15 Year mortgage rate	% Change in value
Base rate	6.0		5.0	
New rate	6.5	-5%	5.5	-3%
	7.0	-10%	6.0	-6%
	7.5	-14%	6.5	-9%
	8.0	-18%	7.0	-12%
	8.5	-22%	7.5	-15%
	9.0	-25%	8.0	-17%

Source: Prudential Real Estate Investors, from Liang and McLemore (2004)

As can be seen in table 3.2 above, a 1% change in mortgage rate from 6% to 7% decreases the house values with a 30 year mortgage by 10%. A change in interest rate for a 30 Year mortgage from 6% to 9% results in a 25% decrease in housing value. A similar analysis for a 15 year mortgage from a base of 5% reveals a 1% change from 5% to 6% resulting on a 6% drop in housing value. From table 3.2 above a 1% increase in interest rates has a larger effect on houses financed over 30

years than over 15 years. This can be ascribed to the longer period over which interest is collected.

For the consumption effect, Liang and McLemore (2004) determine the ratio of mortgage payment to median household income, assuming a loan to payment ratio of 80%. The higher the ratio the more households are spending, by choice or necessity on housing, with a rise of 3% from the existing 22% expected to increase housing prices by approximately 14%.

Hu and Pennington-Cross (2001) found that in terms of annual flows, the share of GDP attributed to real estate is quite stable over time. Their study found that in the US real estate contributed approximately 11% to GDP each year.

Stone and Ziemba (1993) review models that predict a combination of low interest rates and low property taxes would tend to have a higher land values relative to GNP. They also found a very close, positive relationship between land and stock prices in Japan. Their analysis begins by examining rational explanations for the high price of land in Japan. The large population and small land area are found to be a primary contributing factor that clearly increases demand for land. This is offset by tax considerations where land is heavily taxed when it is sold. Coupled with this is over regulation on zoning and height restrictions that lead to underutilisation. Stone and Ziemba (1993) found that in Tokyo particularly, but also in the rest of Japan local government places significant restrictions on the use of land through limitations based on zoning of land for use and limiting the height to which buildings may be constructed. Existing law on eviction reduces the attractiveness of rental property, which contributes to the underutilisation of land. Stone and Ziemba (1993) go on to perform an analysis of the relationship between land and stock prices and found a correlation of 99% between commercial land prices and the stock market level between 1955 and 1988. However stocks were found to be more volatile than land and land was found to lag the stock market. In addition, Japanese land prices were found to be based on rationality as intensity of land use in Japan is 20-30 times higher than in the US, and the required rate of return on rents is about a quarter to a third of that in the US. They further explain that the boom and bust cycle of the 1980's and 1990's can be rationally explained primarily by the movements in the short and long term interest rates. The 1980's were characterised by the availability

of cheap and easy money, which changed in the 1990's when it became difficult to arrange financing, and interest rates did not reflect the true cost of borrowing.

Storms (2001) finds that the strong factors influencing real housing appreciation are the growth of the population, real changes in income, construction costs and interest rates. In his study of 130 metropolitan areas within the United States he also finds that stock market appreciation is a driver of current and lagged wealth effects in housing prices. This is supported by the work of Muellbauer and Murphy (1997) who identify demographic trends, high debt levels and high interest rates as the three primary forces that have historically led to declines in housing prices.

However, according to McKenzie and Betts (2006), the most significant influence on real estate markets comes from the availability and cost of mortgage money and the current state of the local and national economy.

Summary of the influence of macroeconomic factors on housing prices:

In this section literature concerning the impact of various macroeconomic factors was reviewed. Results indicate that the relationship between housing prices and macroeconomic factors is extremely complex and requires consideration of a multitude of variables. These include:

- Interest rates in Muellbauer and Murphy (1997), Storms (2001), Stone and Ziemba (1993), Liang and McLemore (2004), Jud and Winkler (2002), Abraham and Hendershott (1996), Abelson, *et al.* (2005), Sampter (2007), Conner and Liang (2005), Mueller and Pauley (1995), and Giussani and Hadjimatheou (1992).
- GDP and income levels in Storms (2001), Hu and Pennington-Cross (2001), Liang and McLemore (2004), Abelson, *et al.* (2005), Jud and Winkler (2002), Sampter (2007), Conner and Liang (2005), and Mueller and Pauley (1995).
- Construction costs in Storms (2001), Abraham and Hendershott (1996), Bourassa and Hendershott (1995), Jud and Winkler (2002) and Bodman and Crosby (2003).
- Population and employment levels in Muellbauer and Murphy (1997), Storms (2001), Abraham and Hendershott (1996), Jud and Winkler (2002) and Abelson, *et al.* (2005).

- Inflation in Mueller and Pauley (1995), Jud and Winkler (2002) and Abelson, *et al.* (2005).

Other factors considered in the studies above were taxes, legal and zoning restrictions, and consumer spending habits and their relationship to housing prices.

3.4 The effect of supply and demand on housing prices

In this section literature relating to supply and demand for housing and property is reviewed.

Jud and Winkler (2002) developed a model for demand as a function of real housing price, real income, and real wealth, real after tax mortgage interest rates, population as well as a random error term. Similarly they found that market supply was a function of real housing price, real after tax mortgage rate, real construction costs and metropolitan area specific cost factors as well as a random error term. Combining these, their analysis yields that for metropolitan areas in the US, real housing appreciation is strongly influenced by real growth of the population, income, construction costs and interest rates. Wealth effects were found to be tied to current and lagged stock market appreciation.

Stern (1992) indicates that the level of demand has been more extensively analysed, and that variations in demand can be brought about by changes in real personal disposable income, real mortgage interest rates, household formations, buying by old people and divorcees trading down, population movements, wealth and level of house prices.

The study by Abelson, *et al.* (2005) ascribes real house price changes to disequilibrium between supply and demand, where demand is broken into consumption and investment demand. They further view demand as a function of income, user cost and demographic factors such as population growth or household formation. User cost is described as a function of the price of the house, rate of interest and any applicable tax costs or subsidies. They go on to discuss housing investment, returns in the form of capital growth and tax effects on the demand for housing. They note that taxation of nominal income and no tax on capital gains combined with high inflation increases demand for housing.

Abelson, *et al.* (2005) also note new construction averages 2% of existing stock per annum, but growth in supply is less due to demolitions. In their discussion of housing supply they note that the inelastic nature of housing supply means that it is rarely included in models of short term housing prices. They also point out the difficulty of obtaining housing stock estimates on a quarterly basis, but are concerned that excluding housing stock from models may be a major error if the long term and short term interactions are considered.

Sampter (2007) stresses the importance that supply matches demand and thus constrains a rapidly increasing property market in the UK. In recent years in the UK the growth in the number of households, driven by immigration, single parent families, population growth and other demographics, has exceeded the supply of new homes by a wide margin. This dis-equilibrium is a large part of the reason for the rapid growth in house prices in the UK in recent years. However he notes that despite government interest in slowing the growth in house prices, local authorities have historically made it extremely difficult for developers to bring new houses to market as they protect green belts, are reluctant to allow construction on countryside and implement planning systems that lead to applications becoming beyond onerous and lengthy with severe restrictions.

The relationship between interest rates and supply and demand has been discussed in a number of studies such as Sampter (2007), Conner and Liang (2005), Kau and Keenan (1980) and Mueller and Pauley (1995). Several studies point to the fact that decreasing interest rates have an effect on increasing both the demand and supply sides of the housing market (Kau and Keenan (1980), Sampter (2007), Abelson, *et al.* (2005)). However the studies mostly agree that the magnitude of any increase (decrease) in supply brought about by a decrease (increase) in interest rates is lower than the same effect on demand. Thus the dominant mechanism through which the interest rate affects the housing market is through its interaction with housing demand. This is effected in the following manner: an increase in interest rates results in the monthly costs of servicing a mortgage increasing, which in turn reduces the affordability of houses – the drop in affordability leads to a lowering in demand for houses. This drop in demand drives down house prices as supply is relatively inelastic and a drop in prices does not immediately mean that supply is curtailed.

Summary of the effect of supply and demand on housing prices

Demand for housing can be seen from the literature review above to be a function of housing prices, homeowner incomes, homeowners wealth, interest rates and population levels. In addition demand was found to be affected by population demographics such as household formations, buying by old people and divorcees trading down and population movements.

Similarly market supply was a function of housing prices, interest rates, construction costs and metropolitan area specific cost factors. An important point regarding housing supply is the inelastic nature of housing supply, as supported by theory. The effect on recent research is that supply is rarely included in models of short term housing prices.

House price changes can be ascribed to disequilibrium between supply and demand for housing. The relationship between interest rates and supply and demand has been discussed in a number of studies which point to the fact that decreasing interest rates have an effect on increasing both the demand and supply sides of the housing market. However the studies mostly agree that the magnitude of any increase (decrease) in supply brought about by a decrease (increase) in interest rates is lower than the same effect on demand. Thus the dominant mechanism through which the interest rate affects the housing market is through it's interaction with housing demand.

3.5 The relationship between interest rates and housing values

“The market sentiment attributes a rapid rise in prices to historically low interest rates that make higher borrowing possible for more households” (Housing in trouble, 2004). This is well supported by academic literature. A study by Conner and Liang (2005) that investigated the relationship between cap rates and interest rates found a 1% rise in interest rates resulted in a 0.5% increase in cap rates. They proposed that cap rates rise to give higher yield from real estate to compensate for the increase in interest rate.

In their study using a microeconomic approach to assess the relationship between real interest rates and housing, Kau and Keenan (1980) find that the primary impact of interest rates is on the demand side of the housing market. They develop a comparative static model of demand behaviour in terms of real prices and interest rates that operates in discrete time. They maintain that due to its durability housing is unique among consumer goods, and that the impact of interest rates may play a role in housing prices. They develop a model for liquid consumer durables that demonstrates an inverse relationship between interest rates and immediate demand for consumer durables. This is followed by a model for rental housing's relationship to interest rates that is also found to be inversely related. A model for the relationship between housing investment and interest rates was then developed where the effects of interest rate changes were found to only affect the levels of investment for rental housing and not for owner-occupied housing. However this study is based on utility maximisation and the model looks only at the supply side for this model and assumes that construction of owner occupied houses are immediately occupied.

Storms (2001) performs an analysis of the differences between leveraged and cash transactions for real estate investment and concludes that "Even if an investor buys property with cash hidden under a mattress, the value of the property still depends on interest rates, since subsequent purchasers will be willing to pay more in a low leverage environment than one with higher costs" (Storms, 2001:45).

Mueller and Pauley (1995) however found in their study of real estate investment trusts and interest rates found that rising interest rates may have little effect on property values and that any affect could be as a result of general economic and real estate fundamentals such as supply and demand. Thus it may be that interest rates have a secondary influence on housing price growth through the vehicle of stimulating demand in periods of low interest rates and reducing demand in periods of high interest rates. In their study they perform correlation analysis on changes in interest rates with various indices including the S&P 500¹, S&P 40² Utilities Index, NAREIT Price Index³ and the Wilshire Real Estate Index⁴. They find that in periods of rising interest rates, REITS had a negative correlation to interest rates, but that

¹ S&P 500 – An index compiled by Standard and Poor based on the top 500 companies on the New York Stock Exchange (NYSE).

² S&P 40 – An index compiled by Standard and Poor based on the top 40 utilities on the NYSE.

³ NAREIT – A Real Estate Investment Trust (REIT) index that includes healthcare REITs).

⁴ Wilshire Index – This index includes equity REITs and publicly traded real estate operating companies.

this correlation was weak – plus REIT prices increased in time of falling interest rates. They concluded that REIT's could be considered a better hedge against falling interest rates than the S&P 500, and thus the stock market in general. However, the analysis is perhaps flawed in that Mueller and Pauley focus on assessing the performance of REIT's that comprise a variety of different types of investment; although all are property related their profit basis differs considerably. This makes the obtaining of coherent results less likely than using a more focused sample group.

In another study of the fundamental drivers of housing appreciation, Liang and McLemore (2004) found that improved housing affordability due to decreasing interest rates had been the primary driver of the rapid rise in housing demand. In the five years before 1994, mortgage rates dropped to historic lows, prompting a home purchase and refinancing boom, the degree of which had never been seen before. Liang and McLemore (2004) found in their study that the interest rate is the most volatile driver of housing appreciation, thus significantly responsible for volatility in the housing market. They also noted that as interest rates decline, homes become more affordable to an increased number of buyers, which increases demand for housing. Table 3.1 in section 3.2 above outline the significant effects of interest rates on housing values according to their analysis.

In their study, McGinay and Nourzad (2004) point to the large body of literature that shows the significant influence of movements in mortgage rates on the housing market. They explore the different methodologies and conclude that since mortgage rates and housing prices are likely to be non-stationary an analysis using advanced co-integration testing procedures and vector error-corrected modelling techniques is warranted. In their analysis they find that the variables are indeed non-stationary, and further that the short-term relationship between housing prices and mortgage rates is virtually non-existent. They do however find a significant relationship between the housing prices and mortgage on the longer term, where an increase in mortgage rates results in a decrease in housing price and visa versa.

Cho and Ma (2006) used co-integration testing and spectral analysis to examine the effects of interest rates on housing prices in Korea. These tests confirmed a relationship between the two variables with housing price growth responding to interest rate changes. In addition they tested for causality and found a one way

causality between changes in interest rates and housing prices. They go on to suggest that interest rates can be used to effectively forecast the growth of future housing values. They argue that the rapid increase in housing prices could be attributed to the historically low interest rates or may actually result from the increased demand for housing resulting from a recovering economy that coincided with the low interest rates as the government used fiscal and monetary policies to stimulate growth. The data used for the analysis is a monthly housing index for a 12 year period plus a substitute variable for the interest rate. The paper then adopts the co-integration test to identify the long term equilibrium relationship between housing values and interest rates where they found that a negative relationship exists. Spectral analysis is utilised to model the cyclic component of the relationship which revealed that the growth rate of housing values reaches a peak or trough 8 months after the interest rate has reached a peak or trough. Causality is then tested using Granger's test of causality between the two variables. They found uni-directional causality from interest rates to the growth rate in housing values in both the short term and the long term. This was confirmed using a transfer function that confirmed that the estimated model used is a good fit to the relationship.

Summary of the relationship of interest rates with housing values

As mentioned in the supply and demand section previously, the relationship between real interest rates and housing, the primary impact of interest rates is on the demand side of the housing market. The effect of interest rates on housing values is no different if the purchase is financed by a loan or purchased cash, since future buyers would be able to afford more in a low interest environment even if the current purchaser pays cash.

Most studies agree that interest rates have a significant effect on housing process, with some studies ascribing rapid price escalations to favourable interest rates. However the findings for real estates investment funds yield inclusive results.

3.6 Conclusions of the literature review

In looking at recent research into the housing markets several points are worth highlighting.

Firstly research substantiates theory regarding the cyclical nature of real estate markets. For this study the implication is that any analysis must include a component to assess any cyclical interactions present in the housing market for Windhoek, Namibia.

Secondly the articles reviewed give important guidance as to what should be considered in an analysis of interactions between macroeconomic factors and housing prices. The results of the research concur with the established theory on these factors, but add valuable insight into the interaction between the factors and the housing price. Research results give an indication of the timing and magnitude of response in other areas of the world, which can be used as a baseline for comparison with the results of this research. Factors highlighted as important by the literature reviewed included:

- Interest rates
- GDP and income levels
- Construction costs
- Population and employment levels
- Inflation

Thirdly recent research extends the understanding of the interactions of supply and demand in housing markets. Several studies investigate these interactions and propose factors that drive changes in supply and demand. Although the importance of the different factors driving supply and demand differ between the studies, all relate the level of housing prices to the interaction between supply and demand. Consistent with theory, population demographics and economic factors such as real housing price, homeowner income, homeowner wealth, interest rates and population levels are viewed as determinants of housing demand. Similarly market supply was a function of housing prices, interest rates, construction costs and metropolitan area specific cost factors.

In previous chapters the study has been introduced and relevant theory and recent literature reviewed. In the chapter that follows theory and literature will be used to determine the research methodology for this study.

Chapter 4: Research Methodology

4.1 Introduction

In this section the methods used for the collection and analysis of data are outlined. The first section deals with the data required to successfully study relationships between housing values and the macroeconomic factors under consideration. Following this, methods and the sources used to collect data are outlined. Due to the lack of published data within Namibia for the housing market much of the data collected is unpublished. In addition a preliminary exploration has shown that data may be available either in the incorrect format for analysis, or may not be available in a frequency favourable for analysis (annual data versus monthly data).

Once the data has been collected it is placed into a format that facilitates analysis. Data collected for time periods less frequent than monthly are structured based on that frequency, either quarterly or annually. Having acquired and structured the data appropriately it can then be used for analysis.

Analysis of the data depends on the nature of the data available. For variables where data is only available on annual intervals limited analysis is possible. For monthly or quarterly data, analysis takes the form of tests for relationships between variables.

4.2 Data requirements

In this section the data requirements for the study are outlined. This looks at the period under consideration, appropriateness and frequency of variables used and descriptions of variables used.

Housing and macroeconomic data is required over the period from beginning January 1997 to end December 2006. This allows for a ten year analysis of relationships within the housing market in Windhoek.

In considering the data requirements for this study two aspects are important. Firstly appropriate variables must be selected. These variables must enable analysis of the factors identified in the theory and literature reviews as possibly having an effect on

housing values. Secondly the frequency that data is available is critical. In order to test for relationships between variables, enough data must be available. Over a ten year period the ideal is to obtain data on a monthly frequency. This is done wherever possible, but in some instances only quarterly or annual data is available. In these cases the ability to perform meaningful tests for relationships will not be possible.

The primary data requirements for this study are monthly housing prices for the Windhoek area and macroeconomic variables that could have an effect on housing prices. For the purposes of this study data on macroeconomic factors includes:

- Monthly interest rates for Namibia
- Income factors, measured by GDP of Namibia
- Inflation within Namibia, reflected by the Consumer Price Index (CPI)
- Housing supply in Windhoek, measured by the number of houses built
- Population data for Windhoek

This data allows exploration of the relationships between the macroeconomic variables and housing values.

Ideally the above data will be accessible in the preferred form using the data collection methods described in the next section.

4.3 Data collection

As mentioned above, the most important variable required is sufficient data to formulate a monthly measure of housing values. As described in a later section the final form is a monthly relative value housing index. Data required for the monthly relative value housing index was collected with the assistance from FNB Namibia. FNB Namibia is the largest supplier of home loans in Namibia with an estimated 53% market share. Since 2005 FNB Namibia has published a quarterly housing report for the Windhoek area. The raw data source for these reports, as well as information for the period 1997-2005 was accessed in order to compile a monthly measure of housing values. The raw data includes monthly records of housing valuations, and is presented by neighbourhood for all neighbourhoods in Windhoek. Some neighbourhoods may not have sufficient data to be useful. If these neighbourhoods

have similar characteristics to the adjacent area where more data is available these are combined to increase the amount of data available for analysis.

Monthly interest rates are published by and obtained from the Bank of Namibia for the period from January 1997 to December 2006. The prime lending rate is used as a measure of the interest rate. Although the prime lending rate may not be the actual rate offered to all mortgage holders, changes in the prime rate are an accurate reflection of changes in mortgage rates. Mortgage rates are not widely accessible over the period under review. In addition financial institutions build into the mortgage rate that is offered in any particular month their assessment of where they believe property values and economic conditions are headed. As such this may skew data by using values for which corrections for economic conditions or outlook have been made.

GDP for Namibia is published on an annual basis for Namibia by the Central Bureau of Statistics, National Planning Commission. The National Planning Commission has been approached in order to secure data with a higher frequency, either monthly or quarterly if available.

Inflation for Namibia is published on a monthly basis for Namibia by the Central Bureau of Statistics in the form of changes in the Consumer Price Index (CPI). The CPI historically has two different formats. For December 1992 to January 2001 the index was published as the Interim Consumer Price Index: Windhoek. The base period of December 1992 was set to equal 100. From February 2005 the Interim Consumer price Index: Windhoek was replaced by the Namibian Consumer Price Index (NCPI). The base period for the new NCPI is December 2001, taken as equal to 100.

Housing supply data is not published by any state or private entity. However the Central Bureau of Statistics maintains a record of housing plans submitted and housing completed. In the review of theory and literature, changes in housing supply has been seen to be affected by new housing, additions and alterations completed, changes in zoning and demolitions. No data are available to determine the increase in housing due to additions or alterations, or for changes due to re-zoning or

demolitions. Thus changes in housing supply are approximated by the completion of new housing figures that are available.

For population data in Windhoek, information is available in the form of census statistics taken in 1991 and 2001. Unfortunately intermediate data is unavailable and relies on population size and growth rate measured by the census.

4.4 Data analysis

In considering the data analysis portion of this report, two main sections exist. First the housing index for Windhoek must be created and assessed. Secondly relationships between housing prices and macroeconomic variables need to be explored. The interrelationship between housing prices and macroeconomic variables will be looked at in two parts. The first part considers the relationship between housing prices and factors relating to housing supply, and the second part to the relationship with housing demand factors.

4.4.1 The Windhoek Housing Index (WHI)

The primary data source for compiling the Windhoek Housing Index (WHI) is FNB Namibia. Over the period under review, FNB has approximately 4750 property valuations in their database. These valuations have been corrected by applying weighted multipliers to correct for different property sizes and improvement values. The result is a standardised housing value that takes into consideration the size of the property and the value of the improvements to the property.

The data of housing values by month obtained from FNB Namibia is first treated to create an index of housing values on a monthly basis. The value of the index is calculated by first determining the average housing values by neighbourhood for each month. This is done by dividing the total monthly value of housing (total monthly value) by the number of valuations recorded in that particular month (total monthly volume). This yields the average value of a house for that particular month as shown in the equation below:

$$\text{Average monthly housing value for month XX of year YY} = \frac{\text{Sum of all values for month XX of year YY}}{\text{Number of valuations for month XX of year YY}}$$

These neighbourhood housing values (NHV's) are then standardized for each neighbourhood. The standardisation is done by dividing each NHV by the sum of all 120 NHV data points (monthly over 10years). These standardised neighbourhood results were then combined to produce an overall value for Windhoek for each month in the period.

These overall values are then indexed to the value of housing for the month of Jan, 1997 to give the relative value of housing for a particular month. This is calculated by dividing the average housing value for month XX, year YY by the average value of housing for January 1997 as shown in the equation below:

$$\text{Index value for month XX of year YY} = \frac{\text{Average housing value for month XX of year YY}}{\text{Average housing value for January of 1997}}$$

Thus Jan 1997 will be the base month and subsequent values will be relative to the base month. This index can then be plotted against time to show the increase in housing values over the ten year period.

In addition the difference between the index values of any two consecutive months is calculated by subtracting the value of the preceding month. This reflects the change in the housing index and thus the change in housing value for the month. These results are plotted to show the variation in the housing index on a monthly basis.

The above results in two data tables: The first contains the index values on a monthly basis for the period January 1997 to December 2006. The second contains the monthly index variation for the period January 1997 to December 2006.

Once the values for the monthly housing index and its variation have been calculated as above some analysis can be performed. Firstly the results are assessed to detect the presence of any seasonal and cyclical variations. Secondly the data is assessed by neighbourhood to determine if there are any noticeable neighbourhood effects.

Having formulated and examined the properties of the Windhoek Housing Index, the next step is to determine if relationships exist between the housing values

represented by the index and macroeconomic factors as represented by the variables outlined in section 4.1 above.

4.4.2 Determining the influence of housing supply

The influence of housing supply is analysed on two levels in this study. Firstly annual trends are assessed by plotting the number of housing completions annually against the annual average housing index values. Due to there being only ten years under consideration, the annual data is used only to highlight any noticeable trends on an annual basis over the ten years. No formal analysis techniques are employed for the annual trends.

Secondly the change in available housing is analysed against changes in the housing index on a monthly basis. The monthly analysis includes testing the relationship between housing availability against housing values using the Pearson correlation. Diamantopoulos and Schlegelmilch (2000) as well as Leedy and Omrod (2005) caution that the presence of a relationship determined using a Pearson correlation must not be used solely to determine causality. However, as is described in the next section, the relationship tested is between a macroeconomic factor and some future housing value. Thus although causality is not explicitly defined by the Pearson Correlation Test, inferences may be made as to the direction of the relationship since housing value changes follow some period after the change in macroeconomic factor. Despite not explicitly being able to define causality, it is enough to say of the relationship that a change in the macroeconomic variable is followed a specified period later by a specified change in housing values.

As described in the review of literature and theory, any relationship that may exist may only be evident several months after the change in housing supply occurred. According to the theory and literature, it may take over 16 months between the change in a macroeconomic factor and a subsequent change in housing prices. In this analysis a period of 18 months following an event is examined to determine if a relationship exists between variables. In order to accomplish this, the percentage change in housing supply is tabulated against the percentage changes in the housing index for successive months. In table 4.1 below results are displayed for months starting with the current month to 18 months after the houses were built. The

percentage change in housing available is reflected as a percentage of the total housing available as described in the following formula:

$$\frac{\text{Percentage change in Housing availability in month X}}{\text{Housing availability in month X}} = \frac{\text{Housing completed in month X}}{\text{Total housing available in month X}}$$

The percentage change in a future level of the housing values is measured using the percentage change in the housing index calculated as follows:

$$\frac{\text{Percentage change in housing index}}{\text{Housing index for month X}} = \frac{\text{Housing index for month X} - \text{Housing index for month X-1}}{\text{Housing index for month X}}$$

The significance level is chosen as 2% to give a 98% confidence in results where the null hypothesis is rejected. In essence the tests check for a relationship between the percentage change in housing available in month X and a percentage change in housing index in month X+Y, where Y is between 0 and 18 months after the change in housing built occurred. This is demonstrated in table 4.1 below:

Table 4.1 Changes in housing supply to consecutive housing index months

Change in housing supply	Housing index for the same month	Housing index for month + 1 month	Housing index for month + 2 months	Housing index for month + 3 months	Housing index for Month	Housing index for Month	Housing index for Month + 18 Months
January supply	January index	February index	March Index	April index	..... Index	..... Index	Following year July index
February supply	February index	March Index	April index	.....	Index	.....	Following year August index
March supply	March Index	April index	..... Index	.....	Index	Index	Following September index
April supply	April index	..... Index	..... Index	.....	Index	.....	Following October index

In table 4.1, column 1 is first tested for a relationship with the housing index values in column 2. Next column 1 is tested for a relationship with column 3, and so on to 18 months. Results of the correlation test for the months up to 18 months after the event will determine if there is a significant relationship within this period.

If any relationship between housing supply and a subsequent change in housing values is determined, the nature of the relationship can be further explored using linear regression. This test is performed at a significance level of 2% to define the magnitude of the relationship between housing completions and housing value. This test is done for the relationship at the period defined by the Pearson Correlation after the change in the housing supply.

These tests are used to test for relationships with other monthly variables relating to demand in the next section.

As housing availability increases this has the direct effect of increasing housing supply. If housing demand were held constant, theory indicates that growth in housing values would decrease as a situation of oversupply occurs. Thus it may be expected that for housing supply the relationship to the housing index will be negative.

4.4.3 Determining the influence of housing demand

A similar approach to that taken for housing supply is taken in the analysis of housing demand factors. The amount of analysis possible depends to a large extent on the availability of data. For some factors affecting demand there may not be data available at any level aside from annual. For these factors analysis is unfortunately limited by this constraint.

An important point from theory regarding the macroeconomic factors affecting demand as compared to supply needs to be reiterated: For housing supply, any increase in the number of houses available increases the housing supply by that many units. For housing demand, the factors under consideration increase the population's propensity to purchase housing. For example, population changes may not affect the number of potential buyers. If the population increases, but the new inhabitants are not in a position to purchase housing there is no significant change in

the demand for housing. Thus demand is a result of the interaction of the different macroeconomic elements. Also important to consider from the theory is that housing values are determined by the interaction of supply and demand. Thus a change in demand may have no effect on housing values if there is a corresponding change in supply that matches the effect of the change in supply.

In the sections that follow methodology for each of the macroeconomic factors under consideration is discussed.

4.4.4 Changes in income as measured by changes in GDP

As indicated in the data collection section, data relating to income is only available in the form of the Namibian GDP. In addition this data is available only at the annual level, and as such the ability to perform analysis is limited. Annual trends are assessed by plotting the GDP annually against the annual average housing index values. Due to there being only ten years under consideration, the annual data can only highlight any noticeable trends on an annual basis over the ten years. No formal analysis techniques are employed for the annual trends.

On an annual basis the combination of changes in income and changes in housing index can be discussed in terms of the affordability of housing. If income increases faster than housing prices, houses become more affordable. Thus people earn a higher income and have to spend proportionately less of this income for housing. Similarly income that increases less than housing prices results in housing becoming less affordable.

Should monthly data be made available, this would be assessed in the same manner as for the changes in housing supply. GDP would be plotted monthly against the housing index to highlight any noticeable changes for the period January 1997 to December 2006. Following this the Pearson correlation test would be applied to compare GDP changes against 18 successive months of housing index changes. This would identify the nature and timing of any relationship between GDP changes and changes in the housing index.

4.4.5 Changes in population as measured by census statistics

The limited availability of data on population levels for Windhoek is a serious limitation in any study of the effects of changes in population. At best the census results enable a rough estimate of the impact of population changes. This is because the census was only conducted in 1991 and 2001, with data consisting of population level and growth rate for Windhoek.

As for GDP, annual trends are assessed by plotting the population annually using the census figures against the annual average housing index values. Due to there being only ten years under consideration, the annual data is used to only to highlight any noticeable trends on an annual basis over the ten years. No formal analysis techniques are employed for the annual trends.

Other ways exist where population interacts through other variables on housing prices. Income per capita is determined by dividing GDP by the population. Thus the more people sharing the GDP pie, the smaller each person's piece is. However this may not increase the relevance of using a national measure on a local scale. GDP had been considered isolated from national population due to differences in national and local population growth rates. Population combined with the number of housing units available gives an idea of how densely housing is being utilised – increases in number of inhabitants per house can be an indicator that supply of housing is not sufficient to meet the needs of the community. Thus included in the analysis is a tabulation of the change in inhabitants per house over the ten year period.

4.4.6 Changes in inflation as measured by the Consumer Price Index (CPI)⁵

Data for the CPI¹ is available at a monthly level. Thus a full exploration of the relationship between the CPI and the housing index is possible. This is conducted in a similar fashion to the analysis for housing complete in section 4.3.2 above. Firstly annual data is considered to outline any long term trends and relationships between the CPI and the housing index. Monthly trends are then plotted to show changes in the CPI and housing index on a monthly basis. This is followed by monthly analysis in the form of a Pearson correlation to test for relationships between the variables for

⁵ Consumer Price Index (CPI): The CPI change over a month, quarter or year is commonly used as a measure of the rate of inflation.

the 18 months following the change in the CPI. If a relationship is found, a linear regression is then performed at a significance level of 2% to define the magnitude of the relationship between inflation and housing values.

If housing prices increase at a higher rate than inflation, housing can be said to be becoming relatively less affordable as the increase in housing expenses is higher than the overall price increase reflected by the inflation rate. Thus home owners would need to spend relatively more on housing. The results of the study can be evaluated to determine changes in the relative affordability of housing over the period under review.

4.4.7 Changes in interest rates as measured by the Prime Interest Rate

Data for the prime interest rate is available on a monthly basis from the Bank of Namibia for the period under review. Thus a full exploration of the relationship between interest rates and the housing index is possible, as in section 4.3.2 above. Firstly annual data is considered to outline any long term trends and relationships between the prime rate and the housing index. Monthly trends are plotted to show changes in the prime rate and housing index on a monthly basis. This is followed by monthly analysis in the form of a Pearson correlation to test for relationships between the prime interest rate and the housing index. The relationship between the prime interest rate and the housing index will be tested for the period up to 18 successive months after the change in prime interest rate occurred. If a relationship is found, a linear regression is then performed at a significance level of 2% to define the magnitude of the relationship between interest rates and housing values.

4.5 Conclusions

The above describes the process for obtaining and analysing the data required for this research. This enables assessment of the existence of relationships within the housing market. In the chapter that follows, the results of data and analysis are presented.

Chapter 5: Research results

5.1 Introduction

In this chapter the results of the research process are reported. This chapter is divided into three main sections. Section 5.2 deals with the development of the housing index for Windhoek. Included in this section are results relating to different aspects of the final housing index. Section 5.3 presents the results of comparisons between the housing index and housing supply. And finally, section 5.4 presents the results of comparisons between the housing index and factors affecting housing demand. The factors affecting demand that are considered in section 5.4 are: Income (approximated by Gross Domestic Product (GDP) growth for Namibia), population growth within Windhoek, inflation (as reflected by changes in the National Consumer Price Index (CPI)) and the prime interest rate.

5.2 The Windhoek Housing Index (WHI)

In this section we start by describing the results of the development of the Windhoek Housing Index (WHI). This is followed by the housing index results. The section ends by considering the different attributes relating to the housing index for Windhoek. The attributes considered are seasonal variation and neighbourhood differences.

5.2.1 Formulation of the index

In developing the index for housing in Windhoek approximately 4,750 data points across 14 neighbourhoods were supplied by First National Bank Namibia. Using this data, monthly average housing values are determined for each neighbourhood. These neighbourhood housing values (NHV's) are then standardized for each neighbourhood. These standardised neighbourhood results are then combined to produce an overall value for Windhoek for each month in the period. These overall values were then indexed to the data point for January 1997 to produce the Windhoek Housing Index presented below in Figure 5.1 Windhoek Overall Housing Index.

Figure 5.1 Windhoek Overall Housing Index

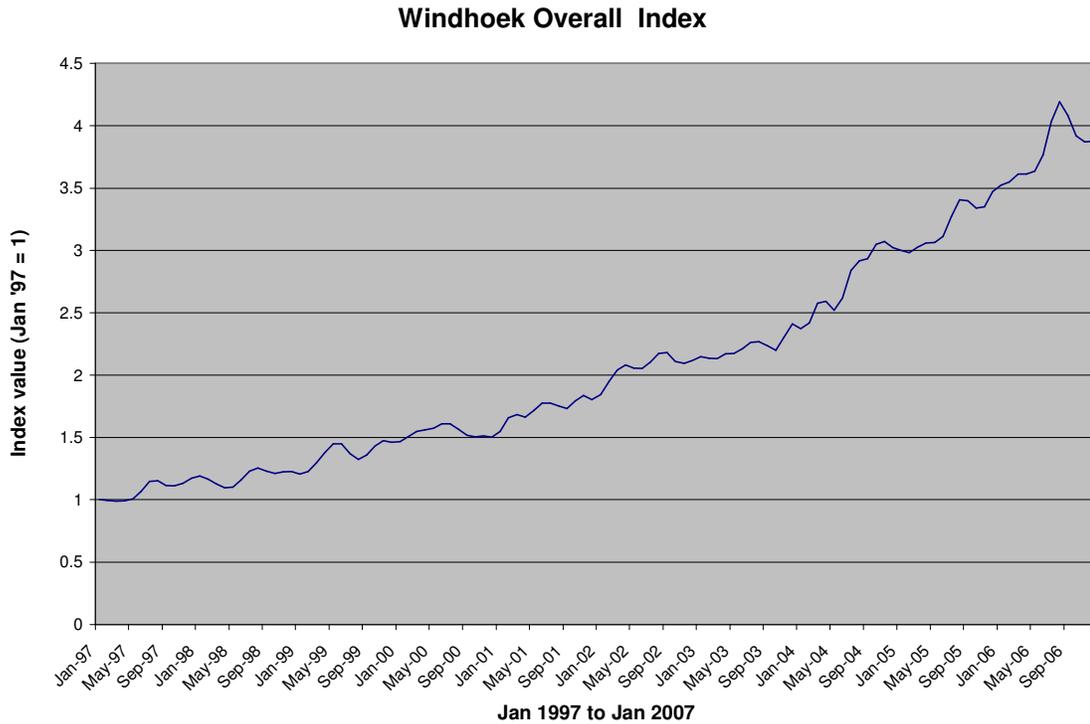
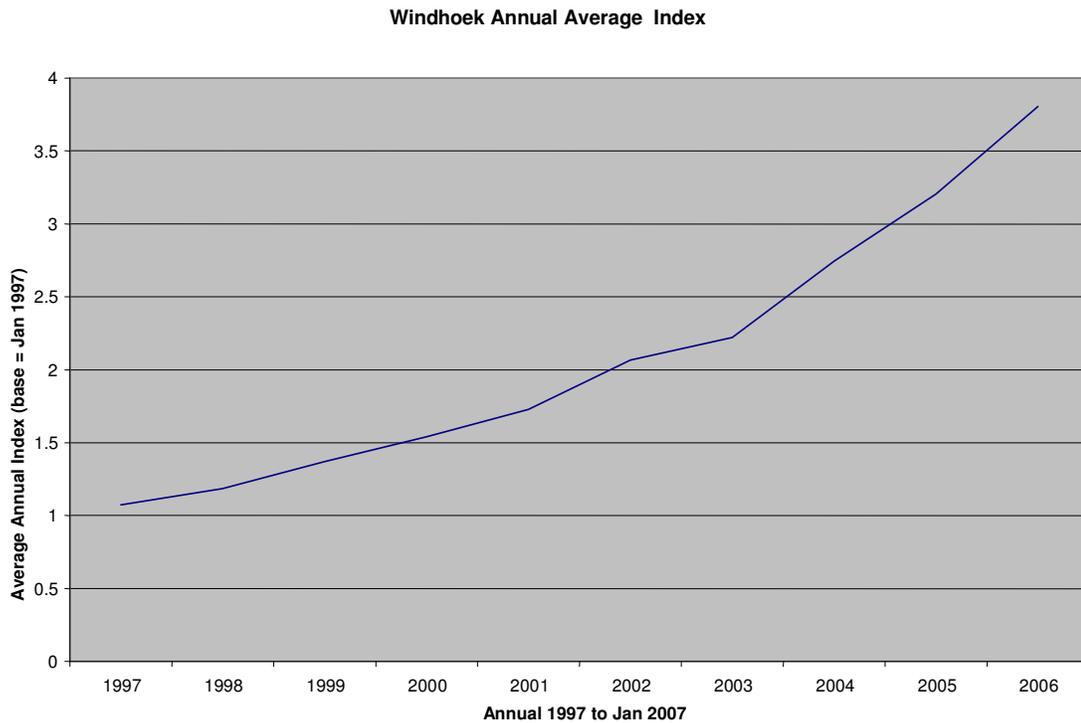


Figure 5.1 graphically illustrates the changes in housing values for Windhoek as compared to the base period of January 1997. Housing values had doubled by March 2002. By October 2005 housing values were three times those in January 1997, and by May 2006 they are seen to be 4 times the base value (however they later fell back to below this level). In Figure 5.1 above, the cyclical nature of the growth in housing value reflected by the index is clearly apparent. The short term variations seen over a period of two to three months may be partly due to the lack of data available. The raw data comprised 4746 points, distributed throughout 120 months. This is an average of 39.55 data points per month, although some months have less and some more. Increasing the number of data points included in the sample will greatly improve confidence in the index. The availability of sufficient data is a problem encountered throughout this research. Indeed the Windhoek Housing Index had to be constructed from scratch due to there being no published or unpublished index available within Windhoek.

The monthly values within the Windhoek Housing Index (WHI) are then averaged over each year to produce annual average housing index values. These are presented in Figure 5.2 Windhoek Annual Housing Index below.

Figure 5.2 Windhoek Annual Housing Index



In the figure 5.2 above we see that the high degree of fluctuation experienced on a month by month basis in figure 5.1 no longer exists. Figure 5.2 shows a growth in housing values throughout the period under consideration.

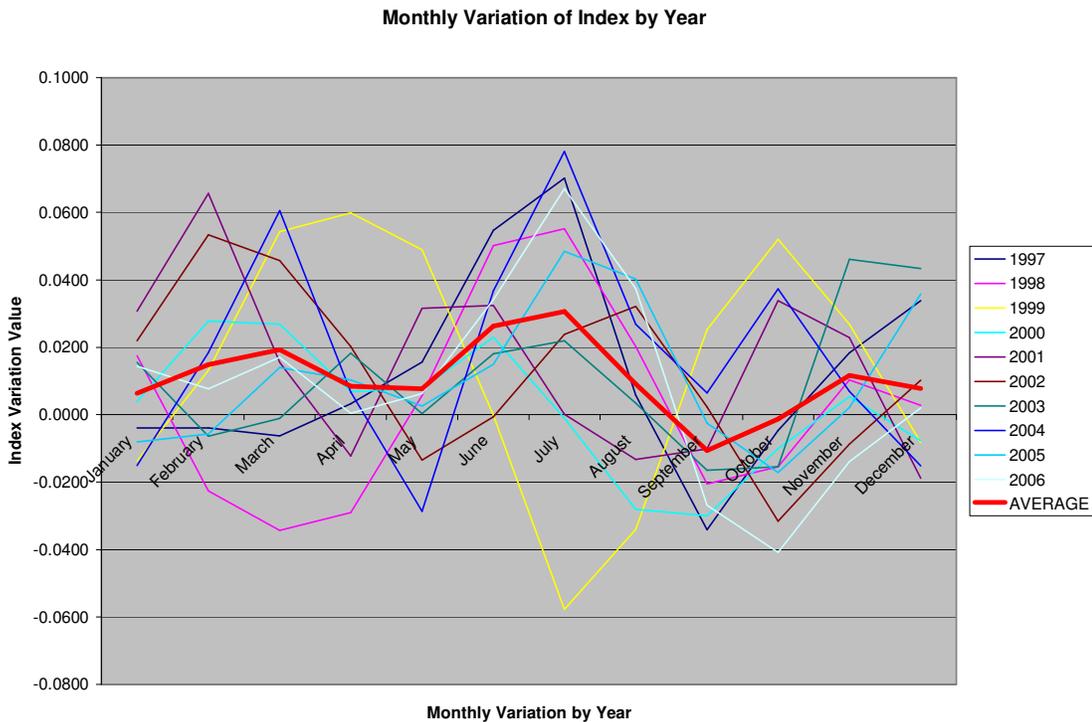
In figure 5.2 an approximately linear growth is evidenced between 1997 and 2002. Between 2002 and 2003 growth slowed slightly as shown by the flatter gradient in the figure between these two years. From 2003 to 2006 growth in housing values is again approximately linear. During 2003 to 2006 the slope of the curve in figure 5.2 is steeper than during the period 1997 to 2002. This indicates that growth in value occurs at a higher rate during 2003 to 2006.

This section describes the formulation and results of the Windhoek Housing Index. We see fluctuations on a month to month basis, but a steady growth on an annual basis. In the next section the index is assessed to determine if there are any significant seasonal variations.

5.2.2 Seasonal variation

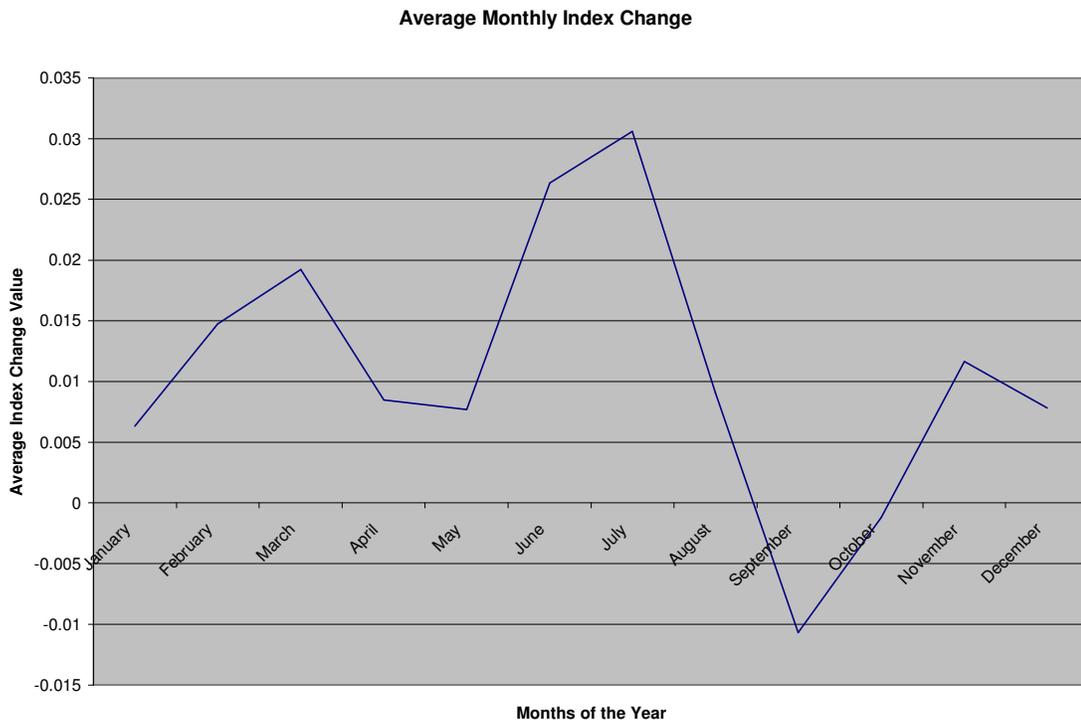
To find seasonal variations, the monthly change in the Windhoek Housing Index is calculated for each month between January 1997 and December 2006. This is done by taking the difference between two successive months. These values reflecting the monthly change are then split into ten individual years. This allows the monthly change in the housing index to be plotted against successive years as shown in figure 5.3 below.

Figure 5.3 Monthly changes in index for each year



In figure 5.3 above the pattern of variation in the index is equivalent to the pattern of monthly change in housing value. Thus figure 5.3 allows an assessment of how housing values change throughout the year in question. For all years excluding 1999, the most noticeable feature is an increase in housing value in the middle of the year. In order to produce the average value curve shown in bold in figure 5.3 above the value for each year is summed and averaged. This average monthly index change is also plotted in figure 5.4 below.

Figure 5.4 Monthly index change average for ten year period



In figure 5.4 above two peaks and one trough are evident. Average housing values are seen to be highest in June and July and reach their lowest average value in September. March exhibits a lesser peak, and from figure 5.3 we see that it is not a high value period in the years 1997, 1998, 2003 and 2005.

From the above we see that there is a seasonal variation in housing values through the course of the year. In the next section we compare the housing indices for each of the 8 neighbourhoods within Windhoek.

5.2.3 Neighbourhood variation

In order to determine if there are any neighbourhood effects on housing value growth the Windhoek Housing Index is broken down into 8 neighbourhoods. These neighbourhoods are:

Academia and Pioneerspark – This is a suburb located on the Southern side of Windhoek. Pioneerspark and Academia is an old and well established suburb. Residents are typically middle income families. Residents are a mixture of races, but largest percentage white.

Suiderhof – This suburb is located on the southern side of Windhoek, with Pioneerspark and Academia to the south and the business district to the north. A

large military base is located in Suiderhof and many residents are military families. Historically Suiderhof was a predominantly white suburb, when the military was mostly white. This has changed and the racial balance is an equal mix of white and black as the military families are now predominantly black. Residents are typically low to middle income families. Increasingly business are purchasing properties in this area as the business district encroaches from the north.

Dorado Park – This suburb is located west of the city. Residents in the area are mostly coloured and black, with a few low income whites. Residents are typically low income families.

Ludwigsdorp and Klein Windhoek – This suburb is located east of the city. It is the most affluent suburb in Windhoek with high income residents. Increasing numbers of newly rich blacks are locating in the area, but the area remains largely white. Areas of Klein Windhoek have been earmarked by Windhoek Municipality as favourable for business zoning.

Cimbebasia – This suburb is located south of the city, beyond and removed from Academia and Pioneerspark. This is a relatively new suburb, just starting in the mid 1980's. Residents are an equal mix of whites and blacks and consist of a large number of first time buyers. Residents are typically low income individuals and families.

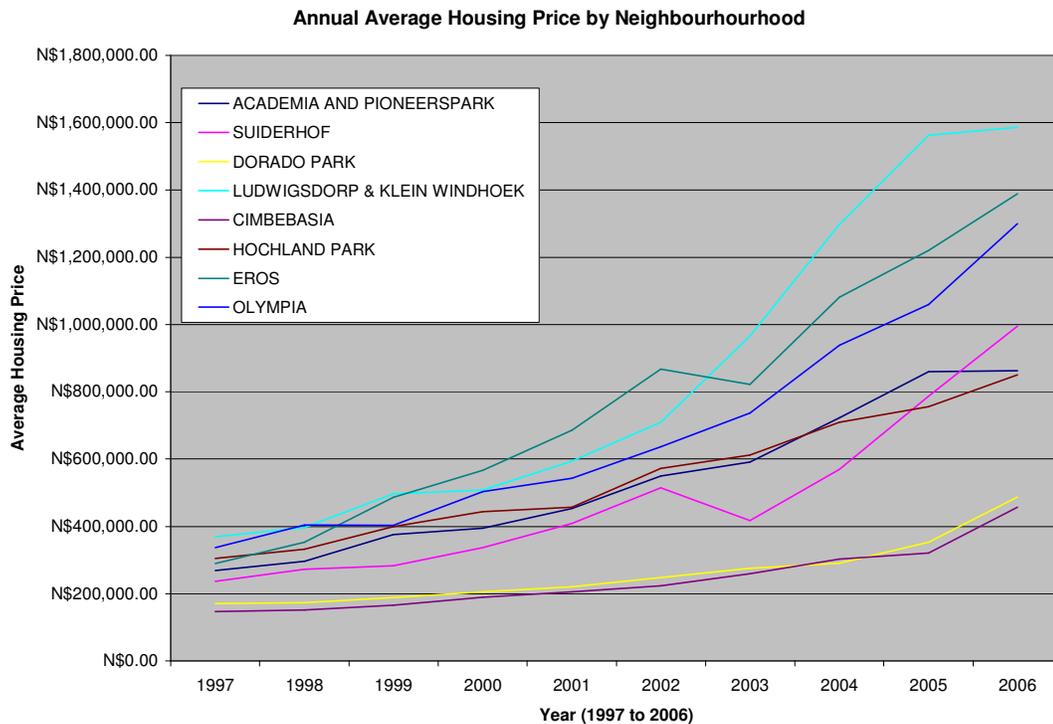
Hochland Park – Hochland Park is located west of the city and south of Dorado Park. Residents are a mixture of black and white low to middle income families. This neighbourhood used to be considered more white middle income. Its location near other black and coloured areas has led to a drop in housing values as whites left the area and it became more diversely populated.

Eros – Eros is located north-east of the city and north of Ludwigsdorp and Klein Windhoek. Residents are a mix of black and white families, but predominantly white families. Residents are middle to high income earners.

Olympia – Located south-east of the city, Olympia is a predominantly white area that has seen an influx of middle to high income black families in the last three to five years. Residents are typically middle to high income families.

The average housing values for each of these neighbourhoods is plotted annually in figure 5.5 below.

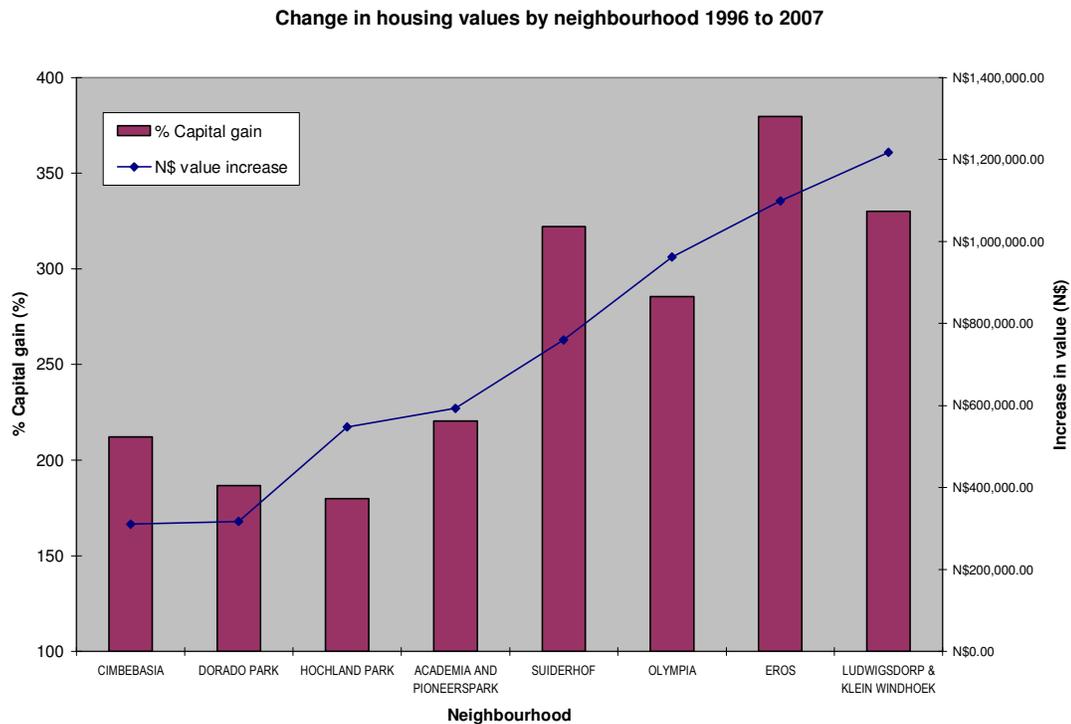
Figure 5.5 Average neighbourhood housing values



In figure 5.5 above we see that annually housing prices increase proportionately more for neighbourhoods with higher incomes. In 2003 both Suiderhof and Eros experienced a drop in housing value. This drop in value caused the slowdown in the overall annual index shown in figure 5.2 above. However, both these neighbourhoods then experienced the most rapid growth in the Windhoek area. Causes for these similarities would be interesting to determine.

The growth in value can be expressed either in Namibian Dollar terms or in percentage capital gains over the period 1996 to 2007 as shown in figure 5.6 below:

Figure 5.6 Changes in housing values by neighbourhood



In figure 5.6 we see that Hochland Park had a lower percentage capital gain than both Cimbebasia and Dorado Park. This can be attributed to its decline from a middle income neighbourhood to a low to middle income neighbourhood. Also Eros and Suiderhof neighbourhoods show impressive returns in terms of % capital gains rather than in Namibian Dollar (N\$) terms.

Dorado Park and Cimbebasia increased the least in Namibian Dollar terms over the period and are the lowest income neighbourhoods. Eros, Ludwigsdorp and Klein Windhoek increased the most and are the neighbourhoods with the highest income residents.

Thus we see three distinct bands:

- High or Middle to high income neighbourhoods. This is made up of Olympia, Eros, Ludwigsdorp and Klein Windhoek. Housing in these areas increased more than anywhere else in Windhoek, with the highest increases in the highest income areas. Municipal initiatives to favour business zoning within an area of Klein Windhoek and Eros may have resulted in the increased growth between 2002 and 2005.

- Middle income neighbourhoods. Hochland Park, Suiderhof, Academia and Pioneerspark. These neighbourhoods experienced growth in housing values somewhere between the high and low income areas. The recent rapid increase in values in Suiderhof may be a result of increases in value due to sales to businesses.
- Lower income neighbourhoods. Cimbebasia and Dorado Park. These neighbourhoods experienced the lowest levels of value growth in Namibian Dollars over the period analysed.

Summary of housing index formulation and analysis

The sections above considered the formulation of the index, seasonal variations and neighbourhood differences. The following important results should be emphasised:

1. There is a noticeable fluctuation in the monthly index for Windhoek.
2. On an annual basis housing prices increased steadily during the period from beginning 1997 to end 2006.
3. A distinct seasonal variation is apparent. Relatively higher values were recorded in March and July, with the lowest values in September.
4. Higher income neighbourhoods had higher rates of growth than lower income neighbourhoods.
5. Influx of businesses into neighbourhoods may result in higher growth comparable to other neighbourhoods.

Having examined the nature of the housing index, the sections that follow explore relationships between the housing index and macro-economic variables. Firstly housing supply is examined, followed by variables that may have an effect on housing demand.

5.3 Influence of housing supply

In order to investigate the effects of the supply side of the housing market this report will use the information regarding number of housing plans completed for a specific period. This will first be explored on an annual level, followed by on a monthly level.

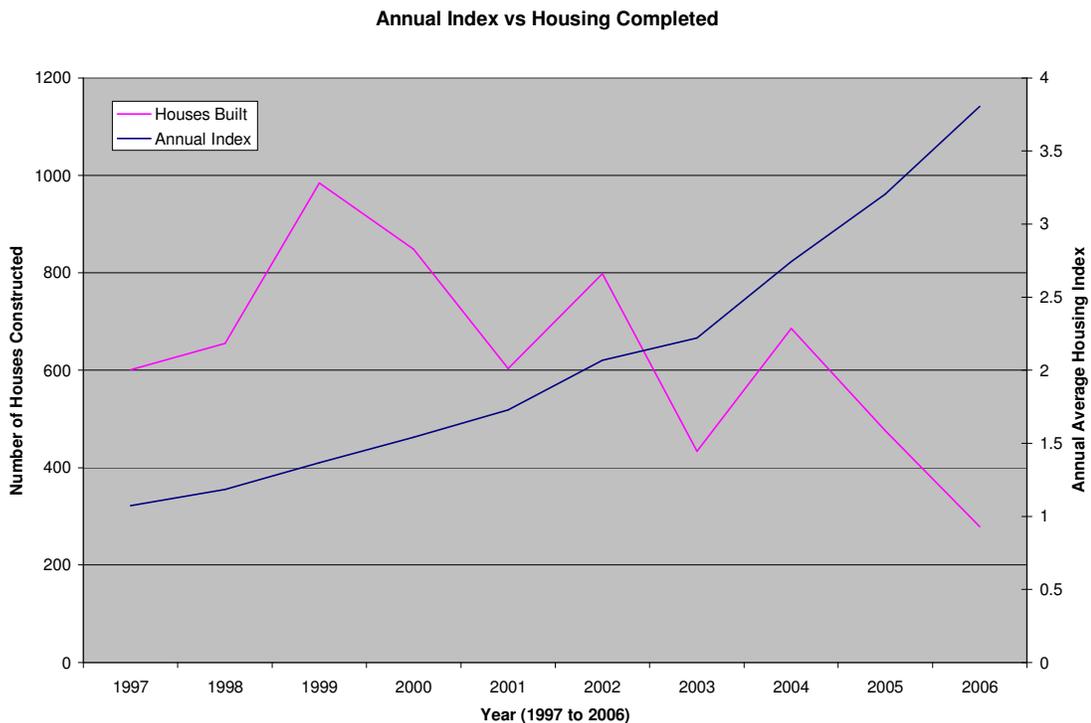
New housing can be considered to be only part of the full picture relating to changes in housing supply. Other factors that increase or decrease supply include:

- Demolitions of existing housing – This has not been a major occurrence in Windhoek.
- Rezoning of housing for other uses, such as business or commercial - Areas such as Suiderhof and Klein Windhoek were identified above as neighbourhoods where this is occurring.
- Alterations and additions to existing structures – Due to the increase in housing prices many households are opting to improve their existing homes rather than moving into a larger home as their family grows.

Although housing completed in a period reflects only new houses entering the market no other data are available for analysis.

In figure 5.7 below the number of houses completed annually is plotted against the Windhoek Housing Index. This shows the total number of newly built houses entering the market on an annual basis.

Figure 5.7 Annual housing index vs houses completed

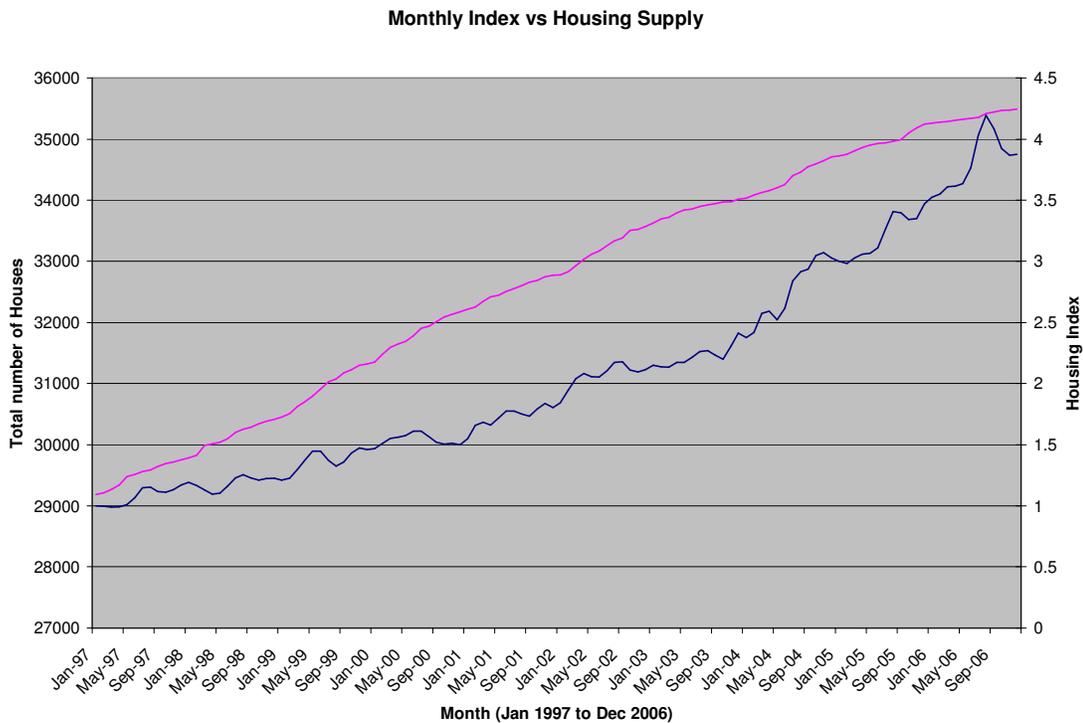


In figure 5.7 above the number of newly built houses increases to 1999 and then decreases. The years 1999 – 2001, 2003, and 2004 to 2006 all exhibit large decreases in the number of houses completed. In 2002 and 2004 had a higher number of houses completed than the respective preceding year. Overall however new housing completed has been decreasing since 1999.

The housing index over the entire period 1997 to 2006 has been on the increase. However there is limited ability to effectively determine if the two are related on an annual level since the data only reflects a ten year period. At this level it is only possible to observe that there has been a decline in new housing and a concurrent increase in the price of houses. In order to explore the relationship in more detail the monthly values for new houses is compared to the monthly housing index.

In figure 5.8 below the cumulative total of housing available is plotted against the Windhoek Housing Index on a monthly basis.

Figure 5.8 Monthly housing index vs total number of houses available

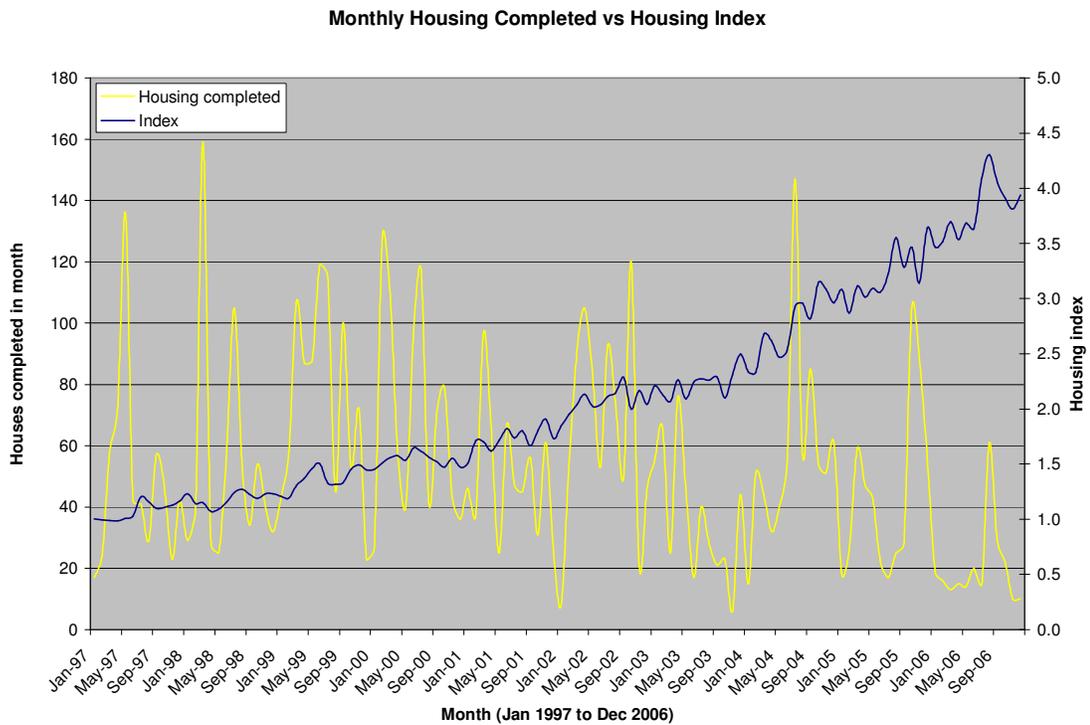


In figure 5.8 we see that there has been a steady rise in the amount of housing available. The decline in the number of new houses built can be seen in the decrease in the slope of the curve for the total number of houses. There are

fluctuations in the curve reflecting the total number of houses, but they are relatively small. Since the initial total number of houses is over 29000, a 1% change would be reflected by 290 houses. Since from figure 5.7 we see that the highest number of new houses built on an annual basis was 894, on a monthly basis this averages 82 houses built. In terms of analysis there is more relevance in examining the relationship between the changes in housing available with the changes in the housing prices. Although it is more relevant to consider the changes in housing values and availability, figure 5.8 makes it clear that changes in houses built actually has a low impact on the change in houses available. Any effect of changes in the number of new houses built is diluted by the fact that this is a small portion of the total housing stock available.

In figure 5.9 below the number of houses constructed per month is plotted against the Windhoek Housing Index. This makes the change in number of houses available more obvious than the total housing available shown in figure 5.8.

Figure 5.9 Monthly housing index vs. number of houses built per month



In figure 5.9 we see that there is actually a very high variation in the number of houses built in different months. This was not observable in figure 5.8 where the total housing stock was considered. The trend of diminishing annual number of houses

built observed in figure 5.7 can be seen from 1999 onwards. However it is not possible to determine if any relationship exists between the index and the house built each month.

In order to explore the relationship, analysis using the Pearson Correlation is performed. The analysis checks for a linear relationship between housing complete and future successive months of changes in the housing index. The results are shown in table 5.1 on the next page.

In table 5.1 below results are displayed for months starting with the current month to 9 months after the houses were built. In essence the tests check for a relationship between the percentage change in housing available in month X and a percentage change in housing index in month X+Y, where Y is between 0 and 9 months after the change in housing built occurred. The percentage change in housing available is reflected as a percentage of the total housing available as described in the following formula:

$$\frac{\text{Percentage change in Housing availability in month X}}{\text{Housing availability in month X}} = \frac{\text{Housing completed in month X}}{\text{Total housing available in month X}}$$

The percentage change in a future level of the housing values is measured using the percentage change in the housing index calculated as follows:

$$\frac{\text{Percentage change in housing index}}{\text{housing index}} = \frac{\text{Housing index for month X} - \text{Housing index for month X-1}}{\text{Housing index for month X}}$$

The significance level was chosen as 2% to give a 98% confidence in results where the null hypothesis is rejected. The relationship was tested to a point 18 months following the change in housing supply, but yielded no other significant results.

Table 5.1 Correlation between houses built and housing values

Correlation Coefficients Matrix for percentage change in housing available			
Sample size	111	Critical Value(2%)	2.361
		Percent change in supply	
Same Month	Pearson Correlation Coefficient		0.020071923
	R Standard Error		0.009170616
	t		0.20959926
	Significance Level		0.834371709
	Ho (2%)	accepted	
1 Month	Pearson Correlation Coefficient		-0.111607657
	R Standard Error		0.009060034
	t		-1.172543796
	Significance Level		0.243535037
	Ho (2%)	accepted	
2 Months	Pearson Correlation Coefficient		-0.132553391
	R Standard Error		0.009013116
	t		-1.396218448
	Significance Level		0.165485752
	Ho (2%)	accepted	
3 Months	Pearson Correlation Coefficient		-0.070033465
	R Standard Error		0.009129315
	t		-0.732970541
	Significance Level		0.465149785
	Ho (2%)	accepted	
4 Months	Pearson Correlation Coefficient		-0.122974431
	R Standard Error		0.009035571
	t		-1.293710222
	Significance Level		0.198500246
	Ho (2%)	accepted	
5 Months	Pearson Correlation Coefficient		-0.3165276
	R Standard Error		0.00825514
	t		-3.483769069
	Significance Level		0.00071299
	Ho (2%)	rejected	
6 Months	Pearson Correlation Coefficient		-0.324087313
	R Standard Error		0.00821071
	t		-3.576610665
	Significance Level		0.000520524
	Ho (2%)	rejected	
7 Months	Pearson Correlation Coefficient		-0.026543864
	R Standard Error		0.009167848
	t		-0.277223756
	Significance Level		0.782133371
	Ho (2%)	accepted	
8 Months	Pearson Correlation Coefficient		0.14349422
	R Standard Error		0.008985407
	t		1.513789617
	Significance Level		0.132973516
	Ho (2%)	accepted	
9 Months	Pearson Correlation Coefficient		0.029735198
	R Standard Error		0.0091662
	t		0.310581916
	Significance Level		0.756711586
	Ho (2%)	accepted	

In table 5.1 the null hypothesis is rejected in months 5 and 6 after the change in housing built. The Pearson correlation coefficient is negative for both these results, indicating a negative relationship between houses built and the housing index. Thus a decrease in houses built corresponds to an increase in the value of housing, and visa versa. The significance level for 5 months is 0.0007, and for 6 months is 0.0005 – this shows a slightly stronger relationship in the six month difference than the five month difference. Using the square of the Pearson Correlation coefficient gives a result of the number of houses completed in a month explaining 10% of the change in housing values 5 months later and 10.5% of the change in housing values 6 months after the month when the housing was completed.

Thus the results of the Pearson correlation test tell us that as the number of houses built in a month changes, a change will occur in the housing values in 5 or 6 months after this change. If there were fewer houses built housing values will increase. If more houses were built the growth in housing value will decrease and may become negative - in which case housing values will decrease.

A linear regression was then performed at a significance level of 2% to define the magnitude of the relationship between housing completions and housing value. This was done for 5 months and 6 months after the houses were completed. The results are shown in table 5.2 and 5.3 below:

Table 5.2 Linear regression between housing complete and housing value after 5 months

Linear Regression	
Regression Statistics	
R	0.214580971
R Square	0.046044993
Adjusted R Square	0.037602914
Standard Error	0.060993316
Total Number Of Cases	115
5 Months = 0.0464 - 12.8333 * Percent change in supply	

Table 5.3 Linear regression between housing complete and housing value after 6 months

Linear Regression	
Regression Statistics	
R	0.253172878
R Square	0.064096506
Adjusted R Square	0.055740225
Standard Error	0.060604804
Total Number Of Cases	114
6 Months = 0.0502 - 15.2190 * Percent change in supply	

The formulas express the magnitude of the effect of the percentage change in housing availability in a month on the change in the housing index for 5 and 6 months after completion respectively. In both formulas as the number of houses completed in a month increases, the growth in value of housing is reduced. No other data relating to demolitions, rezoning, additions or alterations is readily available to indicate other influences on housing supply. However based on the above we see that new construction does have a significant negative effect on housing values 5 to 6 months after the construction is completed. In the next section we will consider factors affecting housing demand.

5.4 Influence of housing demand factors

From the review of theory and literature, factors affecting demand include income, population, inflation and interest rates. In this study, changes in Gross Domestic Product (GDP) will be used to approximate changes in income. Population growth numbers will be used for the Windhoek area, but the data available is census data from 1991 and 2001, with growth averaged between these points. Inflation will be considered in this report by using the Consumer Price Index (CPI), the change in which is used for determining monthly inflation levels.

Whereas supply is a measurable number of housing units available, demand is not directly measurable and is subject to change based on factors such as residents' tastes or lifestyles. As mentioned earlier in the report, the factors such as GDP, inflation, interest rates and population all have an effect on demand, but none of these can be used as a direct measure of the level of demand for housing. Thus all the factors considered in this section can be expected to have a non-direct effect on housing values through changing the demand for housing. This is different to

building new houses, demolitions, or other ways of directly changing the supply of housing.

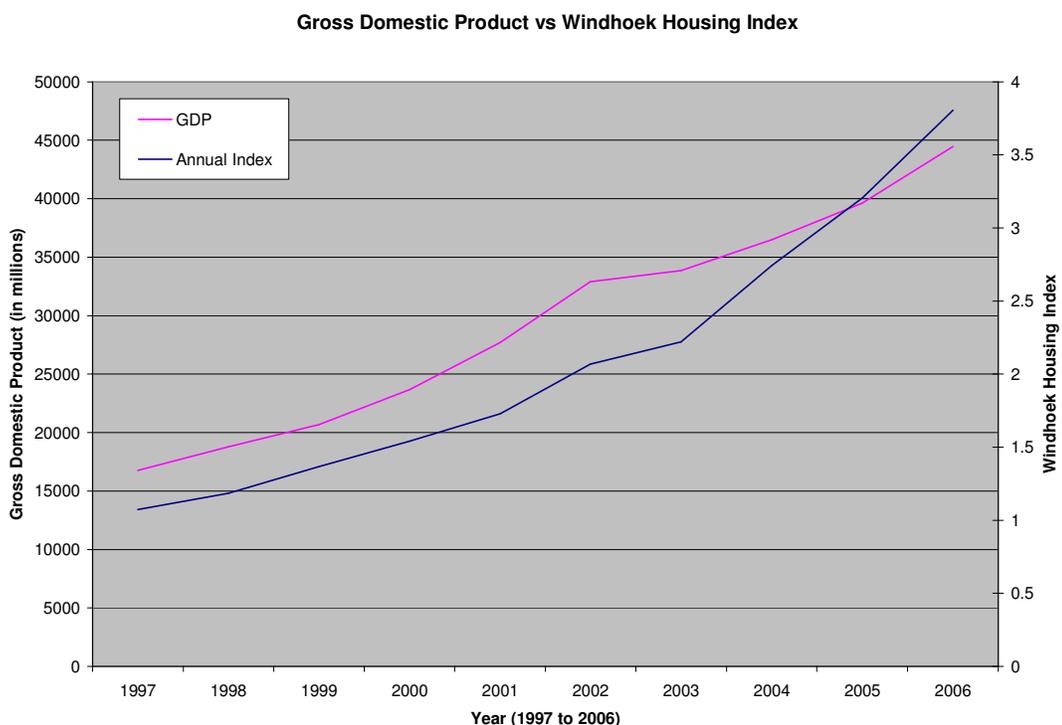
The next section investigates relationship between GDP and the housing index. This is followed by an examination of population effects on the housing values in Windhoek. Consideration of the effect of inflation is then considered and finally interest rates effects are explored.

5.4.1 The effect of changes in income

Changes in income can be approximated by the change in Gross Domestic Product (GDP). Alternative measures of income on a more local basis, for example within the city of Windhoek, or the Khomas region of Namibia are unfortunately not available. Data on GDP has until recently only been supplied on an annual basis by the Central Bureau of Statistics in Namibia. Future studies may be able to improve on this study if data to approximate income can be obtained on a quarterly or monthly basis.

Plotting annual GDP against the annual housing index is presented in Figure 5.10 below.

Figure 5.10 Annual Gross Domestic Product vs annual housing index



In considering figure 5.10, the following observations can be made:

- 1997 to 2002: GDP and housing index increasing steadily and there is a noticeable similarity between the two curves. GDP is increasing at a slightly higher rate than the housing index, so housing is becoming marginally more accessible during this period. This is because income is increasing at a faster rate than housing prices.
- 2002 to 2003: Both GDP and housing experience a substantial slow down in growth. The striking resemblance between the curves during this period points to either a common cause affecting the economy at large or a direct causal relationship between GDP and housing values.
- 2003 to 2006: Both GDP and housing values increase compared to the previous period from 2002 to 2003. However housing increases at a far higher rate than GDP. This implies that housing is becoming less affordable as prices increase at a faster rate than incomes.

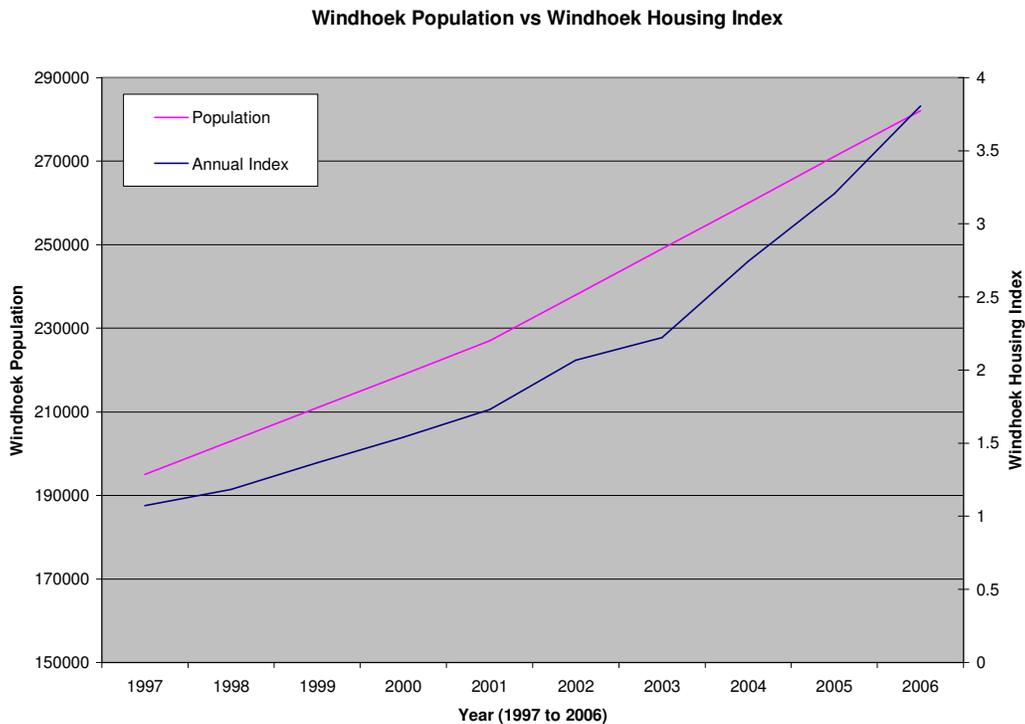
Thus we see that there is a strong similarity between GDP and housing values. Unfortunately it is not clear if this is due to common reaction to other influences or to a causal relationship between the two. In the next section population effects are considered.

5.4.2 The effect of changes in population

Population has been shown to be a primary driver of demand for housing on its own. The more people there are, the more houses are needed for the people to live in and the higher the demand for housing. Local population for Windhoek is plotted against the housing index in figure 5.11 on the following page.

Population figures for Windhoek are not available on a monthly, quarterly or annual basis. Rather they are reported by census taken in 1991 and 2001 with average growth rates between periods. As such, due to the low quality of the data it allows very little intelligent comment on the relationship between overall population and housing values.

Figure 5.11 Annual population vs housing index for Windhoek



A lower growth rate was experienced in the period prior to the 2001 census; this is illustrated in figure 5.11 above. Other than this observation, no other observations can be made regarding population effects due to the constraints outlined in detail in the preceding paragraph.

Other ways exist where population interacts through other variables on housing prices. Income per capita is determined by dividing GDP by the population. Thus the more people sharing the GDP pie, the smaller each person's piece is. However this may not increase the relevance of using a national measure on a local scale. GDP had been considered isolated from national population due to differences in national and local population growth rates. Population combined with the number of housing units available gives an idea of how densely housing is being utilised – increases in occupancy rates can be an indicator that supply of housing is not sufficient to meet the needs of the community. Table 5.2 below shows the annual value for average number of people per housing in Windhoek.

Table 5.4 Average number of people per house, 1997 to 2007

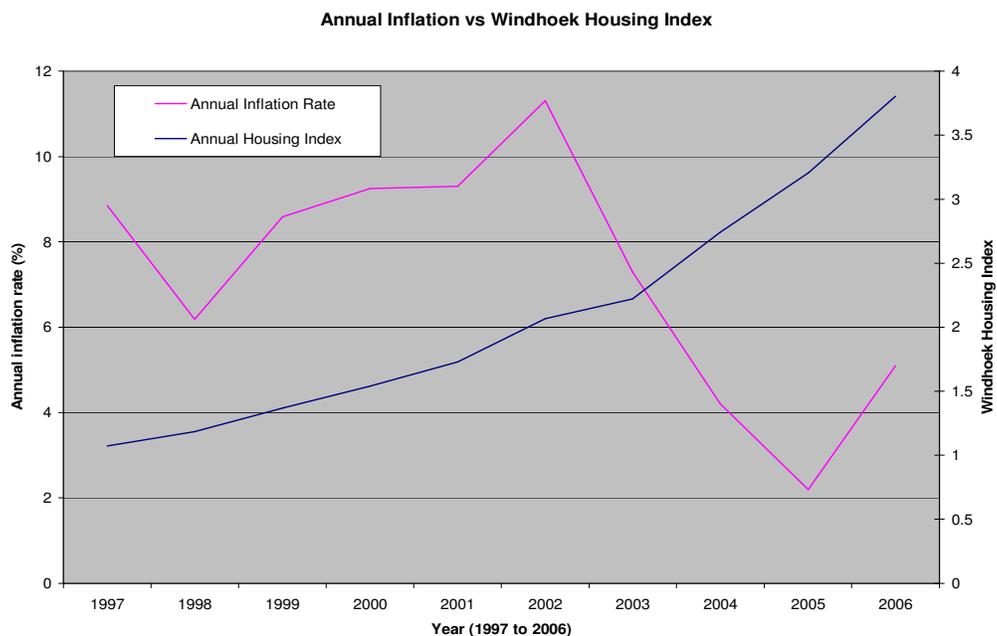
YEAR	Population	Total Number of houses	Average number of people per house
1997	195000	29770	6.55
1998	203000	30425	6.67
1999	211000	31409	6.72
2000	219000	32257	6.79
2001	227000	32860	6.91
2002	238014	33658	7.07
2003	249029	34092	7.30
2004	260043	34778	7.48
2005	271058	35254	7.69
2006	282072	35533	7.94

From table 5.4 above it can be seen that average number of people per house has increased steadily between 1997 and 2006. This shows that an insufficient number of houses are being built to satisfy the needs of the increasing population of the city.

5.4.3 The effect of inflation

In this study inflation is determined using the change in the Consumer Price Index. This is consistent with the method used by the Namibian Central Bureau of Statistics in determining the level of inflation for the country. Figure 5.12 below represents the annual trends for inflation plotted against the annual housing index.

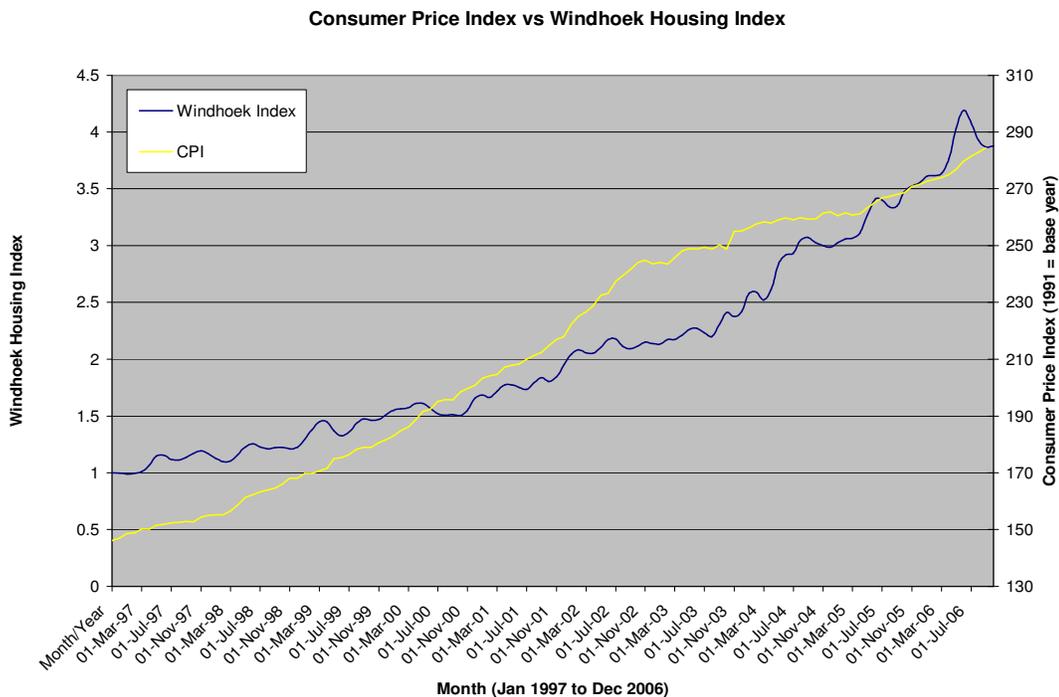
Figure 5.12 Annual inflation vs Annual housing index



In figure 5.12 we see that inflation rates were increasing on average up until 2002. Following 2002, inflation steadily decreased to the end of 2005, followed by an increase in 2006. This pattern of change has been noted for the 2002/2003 period in the trends for income in section 5.3.1 of this report. The decline in the inflation rate should offset some of the consequences on the lower growth in income levels noted in that section.

Data is available for the CPI and thus for inflation rates on a monthly basis, this allows further more detailed analysis to determine if a relationship exists between inflation and increases in housing values. Monthly values for the CPI versus the housing index are displayed in figure 5.13 below. In figure 5.13 we can observe that the CPI increased at a higher rate before the end of 2002 than the period after 2002. This is evidenced by the steeper slope of the curve from January 1997 to the end of 2002. The figure also shows small fluctuations on a monthly basis throughout the curve. There is a lack of significant changes in the form of short term fluctuations relative to the overall price level. A longer term trend as discussed at the annual level above may make it possible however to determine if any relationship between the inflation rate and the housing index exists.

Figure 5.13 Monthly consumer prices vs housing prices



In order to test for the existence of a relationship between the inflation rate and the housing index, a Pearson Correlation test is performed for a period covering 18 months after a change in the CPI. This checks for any relationship between the variables during that period. The results for the 9 month period following a change in the CPI are shown in table 5.5 below.

In table 5.5 below results are displayed for months starting with the current month to 9 months after the houses were built. The percentage change in the CPI is reflected as a percentage of the total CPI value as described in the following formula:

$$\text{Percentage change in CPI in month X} = \frac{\text{Change in CPI from month X-1 to month X}}{\text{Total CPI value in month X}}$$

The percentage change in a future level of the housing values is measured using the percentage change in the housing index calculated as follows:

$$\text{Percentage change in housing index} = \frac{\text{Housing index for month X} - \text{Housing index for month X-1}}{\text{Housing index for month X}}$$

The significance level was chosen as 2% to give a 98% confidence in results where the null hypothesis is rejected. The relationship was tested to a point 18 months following the change in housing supply, but yielded no other significant results.

Table 5.5 Correlation between the CPI and the housing index

Correlation Coefficients Matrix Consumer Price Index		
Sample size	111	Critical Value(2%) 2.3610
		Change in CPI
Same Month	Pearson Correlation Coefficient	0.005141514
	R Standard Error	0.009174069
	t	0.053679691
	Significance Level	0.957288625
	Ho (2%)	accepted
1 Month	Pearson Correlation Coefficient	-0.059614562
	R Standard Error	0.009141707
	t	-0.623503224
	Significance Level	0.534256451
	Ho (2%)	accepted
2 Months	Pearson Correlation Coefficient	-0.031496727
	R Standard Error	0.009165211
	t	-0.328998711
	Significance Level	0.742787954
	Ho (2%)	accepted
3 Months	Pearson Correlation Coefficient	-0.122850117
	R Standard Error	0.009035852
	t	-1.29238237
	Significance Level	0.198957841
	Ho (2%)	accepted
4 Months	Pearson Correlation Coefficient	-0.077689992
	R Standard Error	0.009118938
	t	-0.813566283
	Significance Level	0.41766711
	Ho (2%)	accepted
5 Months	Pearson Correlation Coefficient	0.040035835
	R Standard Error	0.009159607
	t	0.418321786
	Significance Level	0.6765349
	Ho (2%)	accepted
6 Months	Pearson Correlation Coefficient	-0.014770557
	R Standard Error	0.00917231
	t	-0.154225972
	Significance Level	0.87771676
	Ho (2%)	accepted
7 Months	Pearson Correlation Coefficient	-0.072069681
	R Standard Error	0.00912666
	t	-0.754391276
	Significance Level	0.452241051
	Ho (2%)	accepted
8 Months	Pearson Correlation Coefficient	-0.006580883
	R Standard Error	0.009173915
	t	-0.068707919
	Significance Level	0.945348
	Ho (2%)	accepted
9 Months	Pearson Correlation Coefficient	0.051537024
	R Standard Error	0.009149944
	t	0.538778323
	Significance Level	0.5911385
	Ho (2%)	accepted

The analysis shown in figure 5.5 was conducted for a period 18 months from the month of the change in CPI under consideration. No significant correlations were

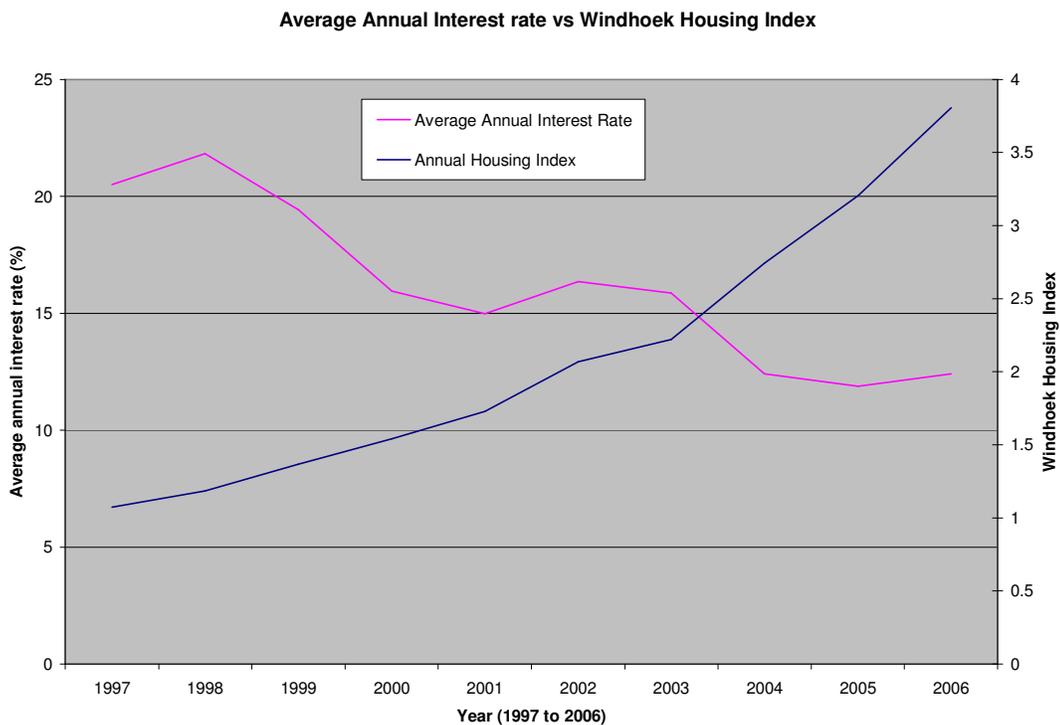
found. In each case the null hypothesis was accepted indicating that no significant relationship exists between changes in inflation (reflected by changes in the CPI) and housing values.

5.4.4 The effect of interest rates

As discussed in the theory and literature review interest rates affect demand by changing the cost of credit to home owners. Increasing interest rates increase the monthly payment for a home mortgage. This in turn can reduce demand as house become less affordable due to the higher monthly payment.

First we begin by looking at the relationship between annual average interest rates and the annual housing index values for the period 1997 to end 2006. These are plotted in figure 5.14 below:

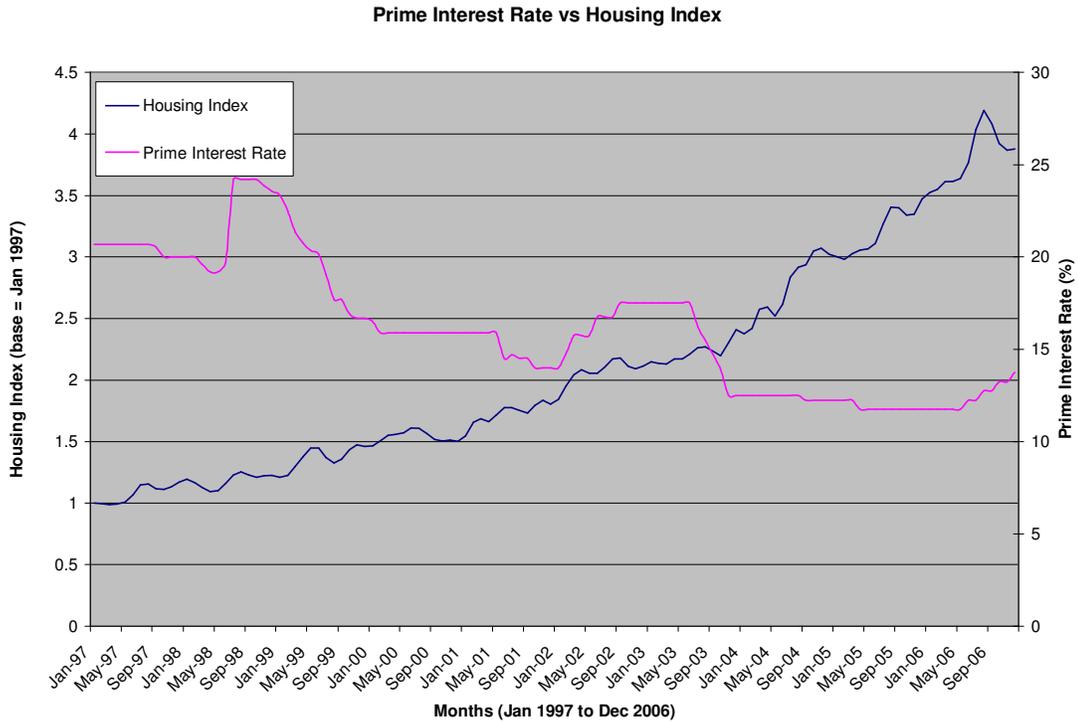
Figure 5.14 Average annual interest rates vs Annual housing index



In figure 5.14 above we see that interest rates have been declining overall since 1998. A slight increase is noted in 2002 from 2001, followed by subsequent decreases until 2006. Here again as in previous assessments of annual variations, the period 2002 – 2003 are different to the majority trend over the period.

Data is available at a monthly level for interest rates which allows further detailed exploration of the relationship between interest rates and housing values. In figure 5.15 below, the prime lending rate is plotted against the Windhoek Housing Index.

Figure 5.15 Monthly interest rates vs housing values



In figure 5.15 we see that there have been large variations in the prime interest rate in Namibia. The interest rate in 1997 was 20.7%, this decreased slightly to 19.2% in April 1998. In June 1998 the interest rate increased sharply to 24.2%. Interest rates then declined consistently until October 2001, when they reached a low of 14%. In March 2003 interest rates began increasing and reached a high of 17.5% in September 2002. July 2003 to November 2003 saw a rapid decline in the interest rate from 17.5% to a new low of 12.5%. Interest rates then declined more slowly until reaching 11.75% in April 2006. Between May 2006 and the end of 2006 interest rates increased to 13.75%.

These large variations in the interest rate do not appear to be reflected in corresponding changes in the housing index. In order to explore if any relationship exists, analysis was to determine the relationship, if any, between interest rate changes to subsequent housing index changes. The results are shown in table 5.6 below:

Table 5.6 Correlation between interest rates and housing index

Correlation Coefficients Matrix for change in interest rate			
Sample size	102	Critical Value(2%)	2.364
		Percentage change in interest rates	
Same Month	Pearson Correlation Coefficient		0.081225096
	R Standard Error		0.009934025
	t		0.814943711
	Significance Level		0.417041173
	Ho (2%)	accepted	
1 Month	Pearson Correlation Coefficient		-0.020748492
	R Standard Error		0.009995695
	t		-0.207529596
	Significance Level		0.836018322
	Ho (2%)	accepted	
2 Months	Pearson Correlation Coefficient		-0.030148167
	R Standard Error		0.009990911
	t		-0.30161877
	Significance Level		0.763569036
	Ho (2%)	accepted	
3 Months	Pearson Correlation Coefficient		-0.118102711
	R Standard Error		0.009860517
	t		-1.18935092
	Significance Level		0.237117975
	Ho (2%)	accepted	
4 Months	Pearson Correlation Coefficient		-0.196799253
	R Standard Error		0.009612701
	t		-2.007246634
	Significance Level		0.047421954
	Ho (2%)	accepted	
5 Months	Pearson Correlation Coefficient		-0.04316182
	R Standard Error		0.009981371
	t		-0.4320208
	Significance Level		0.666656408
	Ho (2%)	accepted	
6 Months	Pearson Correlation Coefficient		0.084061763
	R Standard Error		0.009929336
	t		0.843603529
	Significance Level		0.400904453
	Ho (2%)	accepted	
7 Months	Pearson Correlation Coefficient		-0.084216586
	R Standard Error		0.009929076
	t		-0.845168343
	Significance Level		0.400034491
	Ho (2%)	accepted	
8 Months	Pearson Correlation Coefficient		-0.235253668
	R Standard Error		0.009446557
	t		-2.420469569
	Significance Level		0.017304609
	Ho (2%)	rejected	
9 Months	Pearson Correlation Coefficient		-0.051771998
	R Standard Error		0.009973197
	t		-0.518415211
	Significance Level		0.605313819
	Ho (2%)	accepted	

In table 5.6 we see that only one point in time shows a relationship between the interest rate and the housing index. At 8 months after a change in the interest rate a

linear relationship exists with the housing index. At this time the null hypothesis is rejected lending support for the alternative hypothesis. The nature of the relationship is negative, implying that an increase in interest rate results in a decrease in the housing index, and visa versa. The square of the Pearson Correlation Coefficient indicates that the interest rate change explains 5.5% of the change in the housing index 8 months after the interest rate change.

The relationship between interest rates and housing values is explored further by performing a linear regression for housing values 9 months after the change in interest rates. The results are reflected in table 5.7 below:

Table 5.7 Linear regression results for the relationship between interest rates and the housing index after 8 months

Linear Regression	
Regression Statistics	
R	0.18806538
R Square	0.035368587
Adjusted R Square	0.026599211
Standard Error	0.06184013
Total Number Of Cases	112
8 Months = 0.0222 - 0.3834 * Percentage change in interest rates	

The equation in table 5.7 above indicates that the housing index will grow at a lower rate if there is an increase in the interest rate and at a higher rate if there is a decrease in the interest rate.

5.5 Conclusions

The most significant result above is the effect of housing availability on housing values. Changes in the total supply of housing as estimated by the number of houses built in a month affect changes in housing values after 5 and 6 months. A total of 20.5% of the change in housing values can be explained by the change in total housing supply. Interest rates were found to explain 5.5% of the change in housing values 8 months after the change in interest rates. No significant effects were noted for changes in inflation. For population and income changes there was insufficient data to perform more than a high level look at possible interactions with the level of housing prices. In the next section these results are discussed in more detail followed by conclusions and recommendations for future research.

Chapter 6: Discussion, conclusions and recommendations

6.1 Introduction

This chapter starts by discussing the results of the research presented in the previous chapter. The results are compared to those of previous research and deviations and similarities to theory are indicated. This is followed by recommendations for future research before finishing with the significant conclusions that are drawn from the research results.

6.2 Discussion of results

6.2.1 Trends in the overall index

The overall housing index displayed two main trends during the period under evaluation. The monthly housing values exhibited short term fluctuations over 2-3 month periods. On an annual basis the housing values increased in a relatively consistent manner year on year. This is consistent with the results of Liang and McLemore (2004) who noted that the median national home price in the US has never fallen on an annual basis since 1970.

The short term fluctuations were examined on an annual basis and were partly found to be due to seasonal variations. The most significant features were a highest peak in housing prices in June/July. This was reflected in a high for each year around June or July for most years except for 1999 which appeared to move counter-cyclically to most other years. A low was evident for September, where on average growth in housing prices was actually negative. March also experienced a peak in housing price growth, although this was lower than in June/July due in part to the values for this period in the years 1997, 1998, 2003 and 2005. This supports theory from Phyr, *et al.* (1989) and McKenzie and Betts (2006) where a seasonal effect on housing prices is outlined, and that this forms part of the overall real estate cycle. They go on to suggest climate, builders holidays, or tax considerations as being some of the more important factors that can have an influence on seasonal variation.

Climate may in part explain the high values in June/July each year. As winter settles in, moving around Windhoek becomes more comfortable as daily temperatures

move downwards. June/July are ideal months to go shopping for property, the summer months being hotter and less comfortable. Climate may also partly explain the dip in values for September. September is known as suicide month in Windhoek due to the warmer, dry, dusty and windy conditions that make the local population irritable and depressed. Thus the opposite of June/July is true – September and October would be the most uncomfortable months to go around looking at properties. Tax considerations may play a part in the lesser peak in values around February and March each year. The end of February is the end of one tax year and the start of the next in Namibia. Demand may be increased in February as individuals attempt to gain a last minute tax benefit through property investment before the end of the tax year. For March demand may increase due to individuals purchasing property in that month to maximise the tax benefits over the full tax year ahead.

Holidays in Namibia are held over December/January and to a lesser extent over Easter in April/May. Both these time periods have very similar levels exhibited for housing prices shown in figure 5.4 of this report. During these times demand may be lower as people take holidays away from home and may thus suspend their plans to move house until they return.

Differences in housing value growth were found to exist between neighbourhoods in this report. Although there does not appear to be any support noted in theory or current literature, more affluent neighbourhoods increased in dollar value at a higher rate than lower income neighbourhoods. This increased dollar value growth is consistent through the entire range from low income to high income neighbourhoods. This was to a lesser extent observed in increases in percentage capital growth in value for different income neighbourhoods. Part of the difference may be explained by some neighbourhoods, specifically Suiderhof becoming identified as potential areas. This is part of the neighbourhood variation outlined by Phyr, *et al.* (1989) in the review of theory, where neighbourhood cycles are attributed to changes in the availability and use of land.

The cause for the higher growth for affluent neighbourhoods may be linked to the importance of housing supply as found in this study. These neighbourhoods are well established and limited in their ability to accommodate additional demand due to the lack of additional land available for development. Since supply was found to be a

major determinant of housing prices, this constraint could be driving the increased growth in housing prices in these areas.

6.2.2 Influence of housing supply

This study utilised the completion of new housing in order to approximate changes in the level of housing supply in Windhoek. This was necessitated by a lack of data on the demolitions, re-zonings, and alterations and additions to properties. On average the number of new houses completed annually has been in decline since 1999, and on an annual level there is a step down pattern to new houses available. This corresponds well to the discussion in theory where Phyr, *et al.* (1989) describe the tendency of builders to begin new construction simultaneously when an imbalance in demand is noted. According to Phyr, *et al.* (1989) this results in a noticeable step pattern evident in new construction. This may in part be explained by the results of Abelson, *et al.* (2005) who found that housing supply is relatively inelastic over the short term.

The results of this report show that there is actually a very high variation in the number of houses built in different months. Thus not only does the number of new houses vary significantly from year to year, but also from month to month. The changes in houses completed was used as an approximation of changes in housing supply in order to test for a relationship between changes in housing supply and changes in housing values. This test was performed for a period 18 months following the change in housing supply. The results found a significant relationship between a change in housing completed and a change occurring in housing values 5 and 6 months after the change in housing completed. This was stronger and more significant for the 6 month result. The combined effect of a change in housing supply explains 20.5% of the change in the housing index after 6 months, 10% in the month 5 months after the change and 10.5% in the following month. The nature of the relationship was further explored using linear regression. Here again the 6 month effect was found to be larger than the 5 month effect.

Abelson, *et al.* (2005) in their long-run and short-run models of house prices, and find a 1% increase in housing stock per capita is responsible for a 3.6% decrease in housing price. Calculations using the data for Windhoek are shown in Appendix A: The result is that a 1% change in housing per capita for Windhoek will result in a

3.54% decrease in housing price in the year 2006. However this result must not be considered as supporting or being supported by the results of Abelson, *et al.* (2005). The calculation in Appendix A gives an approximate relationship between the variables, and this result may be considered to be valid only for Windhoek. We would not expect the same factors to affect housing in Namibia as they do in the UK, Australia, or other parts of the world. Each region or even cities within a region will have their own unique relationships between the macroeconomic factors and housing values. This is due to local conditions resulting in varying importance for the different factors under consideration. Low availability of land or zoning restrictions as outlined in Stone and Ziemba (1993) for Japan create a very different dynamic for the use of land in that country than would be experienced in Namibia. Thus the similarity between the results of this report and those of other reports must be used as a more general validation of the magnitude of response. A finding of large differences in results may lead to questions on the underlying factors that drive the difference, rather than showing a lack of support from one study to another. In addition, we can see that for Windhoek, the effect of housing supply per capita must have been changing as the number of occupants per house has increased during the period under review.

The results reported and discussed define the relationship and timing between changes in housing availability and housing prices in Windhoek. The underlying drivers of the level of housing supply were not explored in this study. The effect of construction costs, availability and cost of mortgage credit, existing house prices and government actions were all identified by McKenzie and Betts (2006) in the review of theory as having an effect on housing supply.

6.2.3 Influence of changes in income

Changes in income were approximated in this report by the change in Gross Domestic Product (GDP). Data was only available on an annual basis, and this combined with the National rather than local measure of income mean that only a very high level and approximate analysis is possible. GDP and housing values matched each other fairly well until after 2003. This included a marked decrease in growth in both for 2003. However after 2003 housing values increased at a higher rate than GDP, which may be an indication that housing was becoming less affordable. Relating this to the theory of supply and demand as expressed by

McKenzie and Betts (2006) it may be that after 2003 demand increased at a higher rate than supply, resulting in the increased slope in the housing index curve after this point. The decreasing affordability of housing leads to a conclusion that either housing was underpriced relative to income in the early period under analysis, or some other factor has a larger and overriding effect that has led to housing becoming more expensive. Local data on income levels during the period under review would increase confidence in analysis of the income effect.

6.2.4 Influence of changes in population

Again only high level analysis was possible due to the nature of the data available. However, it is possible to see that the combination of increasing population and a decline in the production of new housing have led to higher number of people per house in Windhoek since 1999. The effect of the decline in housing built is cumulative – previous years of low construction decrease the total housing available relative to an ever increasing population. This might be the factor that has led to the decreasing affordability of housing noted in the previous section. Since 20.5% of changes in the housing index were explained by the correlation with changes in the housing available this seems possible. The declining availability of housing per capita as evidenced in higher occupancy rates as shown in figure 5.4, combined with the high impact of availability on the housing index add credence to this argument. More data on population and income levels in the Windhoek area would allow statistical analysis of the nature of these relationships.

6.2.5 Influence of changes in inflation

In the results for inflation changes above we see that inflation rates were increasing on average up until 2002. Following 2002, inflation steadily decreased to the end of 2005. The change in pattern for inflation was noted to coincide with changes in the trend for income on an annual basis. The decline in the inflation rate may offset some of the consequences on the lower growth in income levels noted after 2002. Inflation reflects the change in the Consumer Price Index and thus the changes in prices overall that consumer pay for goods and services. Thus the reduced inflation rate following 2002 means that consumers may actually experience an increase in their level of disposable income. This occurs if income increases faster than the rate at which the cost of goods and services purchased by consumers increases. Thus despite an income growth slowdown in the period following 2002 consumers may

have had more income available to spend on housing. This is due to a lower percentage of their income being used to pay for other goods and services.

The more detailed monthly analysis using the Pearson Correlation failed to determine any significant relationship between changes in inflation rates in a particular month and subsequent changes in housing values up to 18 months into the future. This does not mean that housing values are independent of the level of inflation. Rather it means that no consistent response in terms of a change in housing values to a change in inflation was detected. Mueller and Pauley (1995) proposed that higher inflation causes construction costs to rise, discretionary income to fall and increases uncertainty, and that these factors lead to a decrease in demand for housing. It may be that since inflation has more than one effect on demand, this results in different responses to changes in inflation as different effects may have more impact at one time than another. If inflation increases this does not mean that the cost of building materials is necessarily also increasing during that increase in inflation. In addition construction costs could rise at a higher level than inflation due to some local effect. An example would be a recent entry and exit of an alternative supplier for cement in Namibia. When this supplier entered the market, construction costs fell sharply as the cost of cement went to half of its previous price. Strong lobbying by competitors turned government against the new supplier who was forced to exit the market. Cement prices then returned to a level higher than their pre-price war level. These dramatic changes in cement had significant effects on construction costs, but very little effect on the inflation rate.

6.2.5 Influence on changes in interest rates

On an annual level, interest rates have been seen to be declining overall since 1998. Interest rates in 2002 and 2003 were however higher than their 2001 level. This again highlights difference between these two years and the overall trend for the period exhibited by other macroeconomic factors considered previously. It may be significant that interest rates started to increase from their previously low level of 14% in January of 2002. Relative to this low level in January 2002, interest rates grew or remained at a higher level until starting to fall from 17.5% in July 2003. By the end of 2003 interest rates had fallen to 12.5%. Comparing this to the changes in the other macroeconomic factors during 2002 to 2003 may indicate some sequential link between events. In late 2002 the inflation rate had started to slow, and for 2003

the rate of income growth as measured by GDP had also slowed. As outlined in theory (Case and Fair, 2004) interest rates are one of the primary tools used by government in their monetary policy. Economic theory states that governments may use increases in interest rates to slow inflation.

This period from 2002 to 2003 was also characterised by the slowest growth in housing values for any time during the ten years under consideration. From the results of the Pearson correlation test performed for the relationship between interest rate changes and the change in housing values this could be explained as follows: The rise in interest rates from the January 2002 level of 14% to the September 2002 level of 17.5% would affect housing values 8 months after this period. Thus we would expect to see a corresponding slower than normal growth in housing values between August 2002 and April 2003. The plot of the housing index is presented in figure 6.1 below to take a closer look at that period.

Figure 6.1 Interest rate effect for August 2002 to April 2003



In figure 6.1 above we see not only slower than normal growth, but negative growth during the period August 2002 to April 2003.

Overall the relationship between interest rates changes and housing values was defined by the Pearson correlation test as negative in nature with a difference of 8 months between a change in interest rates and a change in housing prices. The magnitude of the response by housing prices was found to be lower than that for changes in housing supply, with only 5.5% of subsequent changes in housing values being explained by a change in interest rates.

Considering that the majority of research (Stone and Ziemba (1993), Jud and Winkler (2002), Stern (1992), Sterns (2001), Mueller and Pauley (1995) and Liang and McLemore (2004) among others reviewed in this report) as well as theory highlight the importance of interest rates in determining the level of house prices, the results of this report are surprising. Based on the review of theory and literature a stronger response was expected to be found between interest rates and housing values. It is possible that interest rates play a lesser role in Windhoek due to some other factor dominating the level of housing prices. From other results in this report, we see that the combination of a decreasing supply of new houses and an increasing population has led to higher number of people per house. Since the effect of fewer new constructions and increases in population are cumulative this may increase the individual effects of each. In previous analysis we see that 20.5% of change in future housing values can be explained by changes in the number of new houses built. This is approximately 4 times more than for the effect of interest rates. It is possible that the constraints on the supply side are driving a large portion of housing price increases and that this is lessening the effect that interest rates can exert.

6.3 Recommendations for future research

Several areas of future research have been identified by this research. Firstly alternative methods can be used to expand on the understanding of the effect of macroeconomic factors on housing values. Secondly some of the results of this research could be examined to obtain a better understanding of the nature of the relationships found.

Limitations of this study highlighted in the section above include the inability to adequately account for the effect of the level of interest rates and other

macroeconomic factors on the level of housing prices. A study to test the relationship between the levels of macroeconomic factors and the levels of housing values would be valuable as it would enhance the accuracy of predicting the effect on future housing values of future levels of these factors. The effects of cumulative changes and the direction of changes in macroeconomic factors can also add value in future studies.

In addition, as Namibia becomes more aware of the importance of compiling data on economic and demographic factors, future research could include the effects of population and income to enhance the understanding of their relationships with housing values.

Several relationships were found that could benefit from further investigation and analysis. Variation annually, with growth higher in July was noted in this study, however a similar trend had been noted in Northern hemisphere studies where it is ascribed to summer. Further investigation may reveal a link between this annual pattern and other factors, rather than the climate effects proposed by this and other studies.

Variation in dollar value growth depending on the neighbourhood has not been noted in any of the theory or literature reviewed in this study. Other studies of the relationship between value growth differences between high versus low income neighbourhoods in other parts of the world would validate if this is a universal phenomenon or limited to Windhoek.

The causes for the drop in growth in income and housing in 2003, and the subsequent decrease in the affordability of housing following 2003 also bear further investigation. If a causal link between an event or a combination of macroeconomic factors can be determined for this period this may enhance the understanding of the changes that occur in the affordability of housing over time.

6.4 Conclusions

A significant limitation of this research is that it fails to account for effects in the level of the factors on the level of growth in housing index. Percentage changes were used in this report in order to weight the magnitude of the change by the level at which the change occurred to reduce the level effect. This report also fails to allow for the cumulative, increasing effect of a number of changes in a factor within a short space of time, versus a small change over a longer duration. For example - one or two increases in interest rates over a short time period may not have a big effect on housing prices. A third or fourth successive increase could have a far larger impact due to pessimism of future outlook or increased foreclosures as people can no longer afford the higher interest rate. Another limitation of this study is that it fails to consider that the response of housing values is assumed to be the same for an increase as for a decrease in the variable under consideration. It may be that for some of the macroeconomic factors considered the response of housing values may be different if the factor is increasing compared to if it is decreasing. This may affect both the timing and the magnitude of the response by housing values. For example the same magnitude of change in interest rates may have a different effect on housing prices depending on whether the interest rate increased or decreased.

However in considering the above it should be noted that only considering the impact of changes in factors on future changes in housing values simplifies the analysis to a point where the results become more useful (if less accurate) than a more complex model incorporating level considerations, cumulative effects of changes and the direction of the change. Improving the levels at which data is collected for income and population will go a lot further to improving the accuracy of the results than increasing the complexity of the analysis.

The most significant result of this study is the effect of housing availability on housing values. Changes in the total supply of housing as estimated by the number of houses built in a month affect changes in housing values after 5 and 6 months. A total of 20.5% of the change in housing values can be explained by the change in total housing supply.

The magnitude of the change in housing values can be calculated using the two formulae below:

% change in the housing index after 5 Months = $0.0464 - 12.8333 * \% \text{ change in supply}$

% change in the housing index after 6 Months = $0.0502 - 15.2190 * \% \text{ change in supply}$

The effect of interest rates found by this study was lower than the theory and literature reviews would have led us to expect. The results of the Pearson correlation test for the relationship between percentage changes in interest rates and percentage changes in future housing values found that a relationship exists 8 months after the change in interest rates occurred.

Interest rates were found to explain 5.5% of the change in housing values 8 months later as defined by the following equation:

% change in the housing index after 8 Months = $0.0222 - 0.3834 * \% \text{ change in interest rates}$

In summary, this study found significant results relating changes in future housing prices to changes in the availability of housing and interest rates. No significant effects were noted for changes in inflation. For population and income changes there was insufficient data to perform more than a high level look at possible interactions with the level of housing prices.

List of References

- Abelson, P., Joyeux, R., Milunovich, G. & Chung, D. 2005. 'Explaining house prices in Australia: 1970-2003', *The Economic Record*, 81(255): S96-S103.
- Ambrose, B.W. and Norse, H.O. 1993. 'Factors influencing capitalisation rates', *Journal of Real Estate Research*, 8(2): 221-239.
- Bringing sense back into the property market. 2007. *The Namibian*, 20 February: 18.
- Bodman, P.M. and Crosby, M. (2003), *How Far to Fall? Bubbles in Major City House Prices in Australia*, Working Paper, Melbourne Business School.
- Bourassa, S.C. and Hendershott, P.H. (1995), 'Australian Capital City Real House Prices, 1979-93', *Australian Economic Review*, 3rd quarter, 16-26.
- Cho, D. and Ma, S. 2006. 'Dynamic relationship between housing values and interest rates in the Korean Housing market', *Journal of Real Estate Financial Economics*, 32:169-184.
- Conner, P. and Liang, Y. 2005. 'The complex interaction between real estate cap rates and interest rates', *Briefings in Real Estate Finance*, 4(3): 185-197.
- Case, K.E. and Fair, R.C. 2004. *Principles of Economics*. 7th Edition. New Jersey: Pearson Education.
- Diamantopoulos, A. and Schlegelmilch, B.B. 2000. *Taking the fear out of Data Analysis*. London: Thompson Learning.
- Frew, J. and Jud, G.D. 2003. 'Estimating the value of apartment buildings', *Journal of Real Estate Research*, 25(1): 77-85.
- Giussani, B. and Hadjimatheou, G. 1992. 'House prices: an econometric model for the UK', *Netherlands Journal of Housing and the Built Environment*, 7(1): 31-58.

Housing in trouble; Property Prices. 2004. *The Economist, London*, 13 March: 88.

Hu, D. and Pennington-Cross, A. 2001. 'The evolution of real estate in the economy', *Journal of Real Estate Portfolio Management*, 7(2): 169-177.

Johansen, S.J. 1988. 'Statistical Analysis of Co-integration Vectors', *Journal of Economic Dynamics and Control*, 12: 231–254.

Johansen, S.J. 1991, 'Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregression Models', *Econometrica*, 59: 1551–1580.

Jud, G.D. and Winkler, D.T. 2002. 'The dynamics of metropolitan housing prices', *Journal of Real Estate*, 23(1): 29-45.

Kau, J.B. and Keenan, D. 1980. 'The theory of housing and interest rates', *Journal of Financial and Quantitative Analysis*, 15(4) 833-847.

Leedy, P.D. and Omrod, J.E. 2005. *Practical Research: Planning and Design*. 8th Edition. New Jersey: Pearson Prentice Hall.

Liang Y. and McLemore, R.A. 2004. 'Housing appreciation – The three fundamental drivers', *Real Estate Finance*, 6(2): 3-11.

McGibany, J.M. and Nourzad, F. 2004. 'Do lower mortgage rates mean higher housing prices?', *Applied Economics*, 36: 305-313.

McKenzie, D.J. and Betts, R.M. 2006. *Essentials of Real Estate Economics*. 5th Edition. Ohio: Thompson South Western.

Muellbauer, J. and Murphy, A. 1997. 'Booms and busts in the UK housing market', *The Economic Journal*, 107: 1701-1727.

Mueller, G.R. and Pauley, K.R. 1995. 'The effect of interest rate movements on real estate investment trusts', *Journal of Real Estate Research*, 10(3): 319-326.

Haworth Final.doc

Property market – the investment way to go. 2006. *The Namibian*, 6 March: 12.

Phyrr, S.A, Cooper, J.R, Wofford, L.E, Kapplin S.D & Lapidés P.D. 1989. *Real estate investment*. 2nd Edition. New York: John Wiley and Sons.

Samter, P. 2007. 'UK Housing and the Economy', *Housing Finance International*, 21(3): 3-8.

Stern, D. 1992. 'Explaining the UK house price inflation 1971-89', *Applied Economics*, 24: 1327-1333.

Stock, J.H. and Watson, M. 1993. 'Testing for Common Trends', *Journal of the American Statistical Association*, 83: 1097–1107.

Stone, D. and Ziemba, W.T. 1993. 'Land and stock prices in Japan', *Journal of Economic Perspectives*, 7(3): 149-165.

Storms, P. 2001. 'Real estate fundamentals: The importance of interest rates and leverage', *Journal of Financial Planning*, February: 45-49.

The sun also sets; Global house prices. 2004. *The Economist*, London, September 11: 85.

Wurtzebach, C.H. and Miles, M.E. 1995. *Modern Real estate*. 5th Edition. New York John Wiley & Sons.

Appendix A: Calculating effect of 1% change in housing per capita

The value for housing per capita in Windhoek can be seen to be the inverse of 7.94 people per house in 2006 from Table 5.4, or 0.1259 houses per capita.

A 1% change is equivalent to 0.001259. Holding population as constant for the period, this change would be ascribed to the percentage change in housing availability. This could be used to test the comparable effect in Windhoek.

Using the equations derived using linear regression with a 1% change in housing supply, and considering only the variable term as we are looking for the difference between a 0% change and a 1% change in housing per capita:

$$\begin{aligned} \mathbf{5\ Months} &= \mathbf{-12.8333 * Percent\ change\ in\ supply} \\ &= \mathbf{-12.8333 * 0.001259} \\ &= \mathbf{-1.62\%} \end{aligned}$$

$$\begin{aligned} \mathbf{6\ Months} &= \mathbf{-15.2190 * Percent\ change\ in\ supply} \\ &= \mathbf{-15.2190 * 0.001259} \\ &= \mathbf{-1.92\%} \end{aligned}$$

Thus a total of decrease of 3.54% in the housing index (and thus in housing values) will result from a 1% increase in housing per capita.