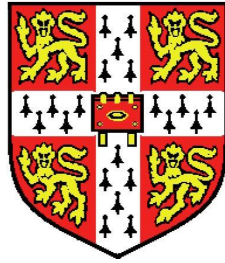# An Analysis of Judgemental Bias in Housing Choice

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A thesis submitted for the degree of

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FOR MY PARENTS

# Author's Declaration

This thesis is submitted according to the requirements of the Degree Committee of the Department of Land Economy. It does not exceed the regulation length of 80,000 words including footnotes, references and appendices.

It is the result of my own work and includes nothing that is the outcome of work done in collaboration except where specifically indicated in the text.

Peter J. Scott

1 November 2011

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Friends and loved ones have played a significant part in this thesis too. Foremost among them is Isabelle Kaufeler, to whom I owe a great deal for giving me her love and kindness during the last three years. Also my housemates, Rob Wells, Matt Richardson and Chris Kelly provided friendship on many occasions for which I am deeply grateful. I would also like to thank James Blackburn and Patrick Wyatt for various pieces of help and advice over the years.

Finally, I would like to thank my family. My brothers David and Andrew have always been there when I needed them. I am excited to try and explain this thesis to my young nieces and nephew, Erin, Ella, and Alex, in the coming years! Above all I owe this thesis to my parents, Ann and Arthur, for their continued love and support. I dedicate it to them.

# Abstract

Buying a home is among the most important choices that any individual is likely to make in their lifetime. It has lasting consequences for happiness, well-being and personal finances. Yet, given the infrequency with which such decisions are made; the difficulty getting information from an opaque and decentralised marketplace; and the high transactions costs involved, there is a significant risk that decision making may depart from the high standard imposed by the normative economic concept of *rational choice*.

This thesis uses the insights of the economic theory of choice – from behavioural economics in particular – to examine housing choice from a new perspective. It considers the potential for estate agents, knowingly or otherwise, to exploit behavioural biases in decision making to influence preference and, ultimately, choices over housing. This naturally is of interest to estate agents and policy makers involved in housing markets; but most importantly to individuals as decision makers: making better decisions relies on understanding when and where vulnerability to manipulation may lie.

Using evidence from a series of classroom experiments with 280 student volunteers and from two online surveys with over 4,000 adult respondents, significant areas where individuals may be consistently vulnerable to manipulation of judgement are found and recorded. In particular, both student and adult respondents are susceptible to biases involving manipulation of the decision making context, known as the choice frame. Students also tend to rely on arbitrary 'anchor' points to make value estimates, which results in significantly impaired judgements, even in the presence of incentives for accuracy. Finally, evidence of a significant new form of behavioural bias is found, in which elements of the choice frame have an unexpectedly negative impact on perceptions. This new bias is persistent across several experimental scenarios and is labelled the *choice pollution effect*.

# Contents

# List of Figures

# List of Tables

# Part I

# Chapter 1

# Introduction

Making choices is part of being human. It is also one of the central
concerns of economic theory. But choice goes beyond abstract theory.
Choices ultimately determine individual happiness and there can be
few more important single choices than buying a house. This chapter
introduces the thesis and motivates the research by describing why
the study of choice in the context of housing decisions is important in
three areas: for the theory of choice; for our understanding of housing
markets and the economic actors who are a vital part of them; and
for each individual ultimately to make better choices and improve
their happiness. It then considers the methods used to make this
contribution before setting out the structure of the following chapters.

## 1.1   The Importance of Choice

Making choices is a fundamental human activity. It is synonymous with con-
sciousness. Choices confront all individuals in every aspect of everything they
do. Humans are so experienced at making choices that many are made without
even thinking about them. Of course, some choices are more important, and have
more lasting effects, than others. What to wear; what to have for breakfast; how
to get to work – these choices will, in most cases, have little lasting impact. In
contrast, some choices are far more important. A choice which falls into this

category is the choice of where and how to live. Housing decisions are among the most important individuals make during a lifetime. They have lasting consequences for happiness, well-being and personal finances. They have even been enshrined as a fundamental human right[1].

This thesis uses the insights of the economic theory of choice – of behavioural economics in particular – to examine housing choice from a new perspective. It considers the potential for the estate agent to exploit behavioural biases in decision making to influence preference and, ultimately, choices over housing.

The engagement of behavioural biases to influence preference is irrational in the neoclassical paradigm of choice (led by von Neumann and Morgenstern, 1944) because it violates basic rules of that theory. This is important because the model is normative, that is, it is a model of how individuals *should* make choices. Existing evidence of violations of the theory has already led to a dramatic re-evaluation of the meaning of rationality among economists, and this thesis takes that literature further still. It is important for housing economists because traditional accounts of housing markets largely ignore these influences by assuming that the individuals who make choices are rational. While this has intuitive appeal and allows for tractable analysis at the market level, it obscures a great deal about the psychology of decision making processes and so fails to capture the true dynamics of housing markets. It is also important for policy makers. Although they have typically been more willing to adopt a less strictly neoclassical approach, little policy research has adopted an approach that incorporates the insights of behavioural economics.

Finally, the thesis acknowledges the increasingly important role that the internet is having in our decision making lives, especially in consumer purchasing. It presents a significant contribution to this nascent body of research by considering explicitly how online consumer environments – in this case online property search websites – can influence property choice.

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[1]  Article 12, United Nations Universal Declaration of Human Rights (UN, 1948).

For economists, a model that describes human choice has been a major preoccupation since the early 20$^{\text{th}}$ century. The fundamental economic problem is itself a choice: how to satisfy infinite wants with scarce resources. Choice theory is the cornerstone of microeconomics. Its dominating paradigm, that of rational choice, is generally traced back to the work of John von Neumann and Oskar Morgenstern (von Neumann and Morgenstern, 1944). Their *Behavioral Decision Theory* set out a series of axioms which should govern the rational decision maker, ensuring that choices have some basic element of coherence and consistency and that choices made maximise individual happiness.

However since the 1970s a critique of the theory has grown in importance and impact, challenging the neoclassical account of choice. The body of work, which is known collectively as behavioural economics, is led by the work of psychologists Daniel Kahneman and Amos Tversky and their seminal work *Prospect Theory* (Kahneman and Tversky, 1979). This *behavioural critique* has demonstrated significant areas in which human decision making departs quite severely from traditional rationality, with important consequences for the theory itself and for individuals as decision makers. Understanding these consequences further in the context of housing choice is the ultimate goal of this thesis.

## 1.2   Why Study Housing Choice?

This study of housing choices, most particularly those made when buying a house, has several distinct lines of motivation which are considered in the following three sections. They are: to make a contribution to the economic theory of choice; to understand more about the dynamics of housing markets; and to help each of us as individuals to make better choices through understanding how the use of decision making rules of thumb (known as heuristics) can lead to biased choices.

All of these motivations share a common observation: housing choices are among the most important decisions made by households or individuals during their lifetime. Among all consumer choices they possess the power to have a fundamental and lasting impact on welfare. Thus the unifying theme of the discussion

in this section is that, although the motivation may incorporate wider aspects, understanding housing choices better is a worthy goal in its own right.

## 1.2.1 Choice Theory and Housing

A theoretical model of choice behaviour is at the heart of economics and the study of choice has been an important part of economic inquiry from its earliest beginnings. Adam Smith considered decision making and in particular the role of emotions in his work *The Theory of Moral Sentiments* in 1759 well before his more famous 1776 volume. Several important contributions from utilitarian Jeremy Bentham explored decision making, explicitly focusing on psychological aspects. However the coalescence of ideas into a model of choice was not forthcoming until the mid-20$^{\text{th}}$ century with the work of John von Neumann and Oskar Morgenstern (von Neumann and Morgenstern, 1944) who gave the theory of rational choice axiomatic foundations, bringing to the fore the idea that in making choices humans acted as self-interested utility maximisers.

The important aspect of this theory is that it gained widespread acceptance as *the* solution to the choice problem. The theoretical decision maker even gained a name: *homo economicus*. Significant theoretical developments across microeconomics were built upon its foundation. Areas of economics as wide as environmental resource valuation and inflation targeting policy; and as unrelated as crime modelling[2] and stock market valuation use assumptions about the rationality of individuals as the starting point for that which follows. Rational choice theory is normative: it prescribes the ways in which a decision maker *ought* to make choices, but guarantees that the choices made will reveal preferences and will, in turn, maximise individual happiness.

However, although elegant and widely applicable, the rational choice model has come under serious pressure since the 1970s. A growing *behavioural critique* of the rational model's descriptive account of choice struck at the heart of the axioms and assumptions on which the theory is built. This body of work, known

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[2] Thanks largely to Gary Becker (Becker, 1968).

today as behavioural economics, is led by the work of psychologists Daniel Kahneman and Amos Tversky and their foundational contribution: *Prospect Theory* (Kahneman and Tversky, 1979).

Beginning as a series of isolated paradoxes showing situations in which violations of standard rationality seem to occur, the work of these behavioural economists has gained credence and acceptance by demonstrating that the underpinnings of rational choice theory are assumptions about behaviour that are psychologically flawed. Chapter 2 considers in more detail both the neoclassical model of choice and the opening of this new paradigm in the theory.

This thesis picks up the story by considering choices in the context of a relatively under-researched and yet vitally important area of decision making: housing. Housing choices share many of the characteristics of other types of consumer and quasi-consumer choices, but are also very different. These differences allow significant inferences to be made which go beyond those that exist in current research.

In the first instance, the factor which makes housing choices stand out from other consumer decisions is that the stakes are high. Buying a house is not a small-scale purchase like buying a chocolate bar, or a consumer durable such as a TV. It can be a lifetime-defining decision. Research into choice theory, particularly from the behavioural perspective, has largely used as test objects such consumer goods as cars (Huber, Payne and Puto, 1982), beer (Huber and Puto, 1983), TVs (Ratneshwar, Shocker and Stewart, 1987), baked beans (Doyle, Reynolds and Bottomley, 1999) and chocolate (Ariely, Loewenstein and Prelec, 2003).

Housing choices are significantly more important than any of these choices, yet have not been the subject of nearly as much research (although there have been exceptions, such as Northcraft and Neale, 1987, and Genesove and Mayer, 2001, which are considered further in Chapter 3). The high stakes involved are vital from the perspective of choice theory because a common criticism of behavioural economists who have attempted to demonstrate anomalies in choice behaviour is that their experiments, largely done on smaller consumer purchases as above,

are not applicable to those which decision makers consider more important. The reasoning is that when the decision really matters, the decision maker will take the time and cognitive effort to make a 'good', by which we mean rational, choice (see Kachelmeier and Shehata, 1992, for a further discussion on this point). Housing presents a choice scenario when a direct assessment of this claim can be made.

Another aspect which divides housing choices from other consumer decisions is that they are not made very frequently. According to the Council of Mortgage Lenders, in the UK home-owners move only once every 15 years on average (CML, 2004). This is important because it is unlike most consumer purchases which are made regularly (such as buying food or consumer durables). Thus it renders unimportant another prominent defence of rational choice theory: that individuals are less likely to make 'mistakes' in decisions they are experienced at making, and that greater experience will result in learning and less errors. The reasoning is thus that, although consumers may make errors in their choices once or even twice, they will soon learn from their mistakes and so are not likely to deviate from rational decision making in the long run.

Several articles have supported the idea that greater experience in making a choice can lead to less 'mistakes' in choices (for example Knez, Smith and Williams, 1985; List, 2004). This reasserts the supremacy of the rational model of choice theory, in effect suggesting a kind of economic Darwinism – those who continue to make irrational choices will be 'competed away' by repeated market forces. This situation does not apply to housing choices. They are made extremely infrequently meaning that few making them could be described as 'experienced'. It is an observation which suggests that the risk of errors is significantly higher than for other consumer purchases.

Related to this is the observation that when choices are made over housing, feedback on how good a choice has been made is not forthcoming in the same way as with other types of consumer purchases. If an individual makes a mistake[3]

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[3]  For clarity: by 'mistake' this analysis means some departure from rational choice rather than a simple error.

and buys a chocolate bar they do not actually like, this will become clear upon eating the item, for example. Or if a consumer chooses a brand of washing machine but it turns out to break frequently then this becomes obvious reasonably quickly and the consumer will realise a poor choice has been made. Housing is a very long term consumer purchase with many aspects of the choice hidden from immediate feedback. The consequences of a poor choice – for example the third bedroom being too small for an expanding family – might not become clear for a considerable period.

Although not impossible, it is very difficult to amend decisions over housing once they are made because of the transaction costs involved compared with other consumer goods. Transaction costs buying and selling houses run to many thousands of pounds, including legal and other professional fees, as well as property taxation. Poor choices cannot be corrected easily in this environment.

Another aspect to housing decisions is that houses are not merely a consumer purchase. They are an investment, certainly the single biggest such investment in the lives of most of the over 15 million households who own their own home in the UK[4]. This thesis does not focus on the investment side of house purchase, specifically excluding this element in many of the tests reported. There are two reasons for taking this approach. The first is theoretical: the investment potential of a property does not ultimately determine housing choices in the majority of cases. Individuals may believe *a priori* that housing is a good investment, but when it comes down to the choice between individual houses, which is the focus of the research here, the potential for capital appreciation is but one of a series of factors which come into the decision makers' calculations. There are models which consider house purchase from the investment perspective (Shiller, 2005, 2007) but this is largely achieved through emasculating the consumer elements of the decision process rather than incorporating them into a complete model. The second reason is practical: including time-dependent investment concerns into the choice scenarios considered here would entail an infeasible level of complexity without aiding the analysis significantly although, as Chapter 9 explains,

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[4]  Source: Census 2001. Available at www.statistics.gov.uk.

such a complete model should be the ultimate goal of research into housing choice.

Returning to the choice theory which this thesis contributes to, behavioural economists have shown that our psychological composition may prevent us from making decisions in the way prescribed by the classical rational choice model (Tversky and Kahneman, 1974; Thaler, 1980). Their research suggests instead that a series of regularities in their thought processes might cause individuals to depart from this normative standard of choice, thus compromising decisions.

Behavioural economists have gone further however, suggesting that these psychological regularities might be exploited by economic actors who have a reason to intercede in individual choice processes (Huber et al., 1982; Simonson, 1989; Ariely et al., 2003). In effect, the suggestion is that we as consumers might be vulnerable to choice *manipulation* in certain circumstances. The precise ways in which this can be accomplished are considered in Chapter 4. In that chapter it is further demonstrated that estate agents are economic actors with a significant motivation to intercede in exactly this way. They are *choice architects* (Thaler and Sunstein, 2008) who are, given the significant asymmetry of information, in a position to construct the scenario in which the choice takes place and so significantly influence decision making.

As discussed above, neoclassical economists have typically sought to undermine evidence of behavioural anomalies, and so of the alternative formulations of choice theory, by suggesting that anomalies exist either only when the choices are not that important or the stakes are low. Housing is a good scenario to test this claim. The stakes are unambiguously high: the decisions are likely to be the most important that are made from a personal finance perspective in a lifetime, with vital and long lasting effects on household welfare. Of all choice situations, housing decisions – particularly house purchase – are surely ones which individuals will take the time and effort to make an appropriate choice?

Moreover what makes housing even more interesting as a scenario to understand decision making is that it possesses several unique features which ensure the po-

tential for the manipulation of choices is far greater than elsewhere. Choices are made infrequently by decision makers with limited experience, so it hard to learn from mistakes; there is limited feedback so that errors may only become clear after a significant period; and transaction costs are high making it difficult to correct mistakes when they are made. Finally, marketplaces for residential property are decentralised and relatively opaque; information is limited and difficult to obtain[5]; and estate agents must be relied on for direction. These conditions are a breeding ground for behavioural phenomena to occur.

By providing a unique scenario in which choices are made, housing presents an opportunity to provide evidence which contributes to the theory of choice and in particular the growing behavioural paradigm that has already done so much to change the way economists think about rationality.

The next section considers the contribution that this approach makes to our understanding of housing markets.

## 1.2.2 Understanding Housing Market Dynamics

Away from the theoretical contribution to our understanding of choice processes, an important reason for this research is to provide greater understanding of the dynamics of housing markets. This is already the subject of a lively debate in academic literature. Housing market economics looks at topics such as inequality of accessibility and affordability (Aoki, Prudman and Vlieghe, 2001; Barker, 2004); wealth implications of uneven house price appreciation (Smith, 2005; Thomas and Dorling, 2004); and the transmission of mortgage market dynamics into the macro economy (Attanasio et al., 2006; Maxwell, 2005).

Housing market dynamics are typically analysed with reference to economic variables employing models predicated on individuals' more or less rational behaviour according to Munro and Smith (2008). Adopting a microeconomic perspective

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[5] Although it is becoming easier due to the internet, which is discussed further later in this chapter.

and focusing on individual behaviour is one way to gain greater understanding of the dynamics of housing markets. A strand of urban economics research does adopt this more pluralistic approach[6]. It suggests that in analysing sub-markets for housing we must go beyond the single-model framework for market clearing and price determination favoured by neoclassical approaches which rely on rational actors. This thesis complements that research by incorporating the insights of behavioural economics into the microeconomics of housing markets. Through understanding individual action at the level of choices, important implications can be drawn for policy makers and real estate practitioners.

There are have been some promising attempts to broaden the theoretical underpinnings of this market dynamics perspective by incorporating aspects of bias or non-rationality. For example, Lin and Vandell (2007), who focus on pricing biases due to illiquidity at a local level. Genesove and Mayer (2001) examine whether individuals are prone to a behavioural bias known as *loss aversion* when selling their houses[7]. This psychological regularity implies that individuals will be more reluctant to sell for a given price when that sale price represents a 'loss' as against when it is a 'gain' compared to their purchase price. They find strong evidence to support this suggestion. Individuals selling houses for amounts which would results in 'loss' tend to set higher asking prices and keep houses on the market far longer than those who sell corresponding houses for prices which to them represent a 'gain'. This result holds even controlling for all relevant characteristics of the house and seller.

Most recently Levitt and Syverson (2008) consider whether estate agents manipulate individuals in their decision over when and at what price to sell their property. They find evidence that supports this assertion. When estate agents sell their own homes they sell for significantly higher prices after leaving their property on the market for longer than if selling on behalf of others.

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[6]  A good summary of this early literature is Bourne (1976).
[7]  Loss aversion is a key part of the *Prospect Theory* of Kahneman and Tversky (1979). It is explored in Chapter 2.

This thesis builds on the current research, using a behavioural approach to consider housing market dynamics from the individual level. In this regard, it offers further evidence in the spirit of Genesove and Mayer (2001) and Levitt and Syverson (2008). However it goes beyond their work, considering home buyers and not home sellers as their research does. It also focuses explicitly on the *active* manipulation of behavioural regularities by estate agents rather than justifying error-making by reference solely to information asymmetry (as Levitt and Syverson do).

The resulting evidence on the extent and efficacy of behavioural manipulation strategies in house purchase decisions will be of interest to policy makers, practitioners and real estate academics.

## 1.2.3 Making Better Decisions

A final motivation for the work in this thesis lies with the decision maker himself or herself. The work of behavioural economists has shown conclusively that there are situations in which human decision makers make 'mistakes'. Whatever the source and importance of these lapses, significant amounts of research show that we frequently fall below the standard required in von Neumann and Morgenstern's original theory of choice.

Tversky (1977) has suggested that the errors discussed are often like optical illusions. Figure 1.1 is a classic example. It is based on an illusion in Shepard (1990)[8]. When asked about the dimensions of the tables in the image, most people's intuitive opinion is that the one on the left is much longer and thinner than the one on the right. However, if a ruler is used to physically measure the long side of both tables it can be seen that they are the same. In this case perspective has been used to alter our perception of the tables' dimensions.

This result and others like it are generally are regarded as being little more than 'quirks' in our overall sensory apparatus, yet the principle of optical illusions has important lessons for the biases that affect our decision making lives. A primary

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[8]  Although the idea to use it in this case lies with Thaler and Sunstein (2008).
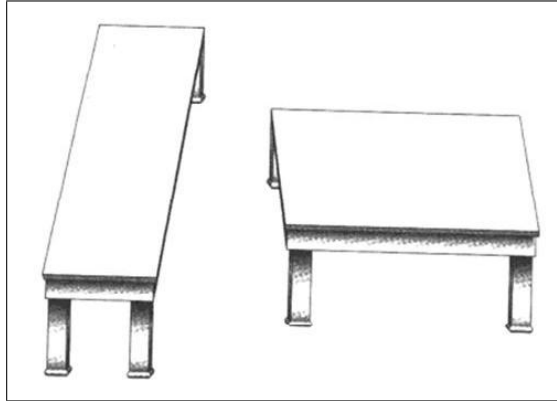
**Figure 1.1:** Illustation of an optical illusion with two tables. Based on Shepard (1990).

observation is that they are powerful; very few individuals can resist the obvious conclusion that the tables are different. This means that, if the biases which behavioural economists hypothesise about are truly based on psychological flaws, as they suggest, then we are likely to be highly vulnerable to them.

Thus a final motivation for this thesis is to help us, as decision makers, better understand when and in what ways we might be vulnerable to choice and judgemental biases. Understanding them is the first step to making 'better' choices and improving happiness.

Moreover, as has already been noted, there can be few more important decisions for the individual than buying a house. This choice is likely to have significant and long lasting implications for wealth and happiness. Thus making a 'good' choice, and understanding our vulnerabilities to making 'bad' choices, is likely to be more vital than elsewhere, even ignoring the idea that housing choices are ones in which we might be more vulnerable than others to error and manipulation owing to the nature of the decision making scenario.

## 1.2.4 Summary

Housing choice is a high-stakes, one-shot game which is likely to have a significant and long lasting impact on our happiness. Getting the decision right is clearly

more important than for most of the other choices which have been the subject of study in the past 30 years.

This thesis investigates choice biases and manipulation in housing choices with three primary motivations. The first is to contribute to the economic theory of choice. Choice theory has been an important area of study for economists for at least 100 years, particularly so in the latter part of the 20<sup>th</sup> century. It is also important because large parts of economic theory use assumptions about human behaviour and rationality at their heart. Choice theory has undergone a dramatic change in the past 30 years with the opening of a new paradigm in the theory, that of behavioural economics. This study of housing choices contributes to the theory because housing choices are different in several ways to those which have formed the basis of most studies. The stakes are high, yet because the decision to buy a house is made extremely infrequently it is rare that the decision maker is experienced when making the choice. Feedback on the choice is limited and transactions costs are high. Finally, owing to the opaque nature of the market-place, individuals must frequently rely on the advice of an economic actor who has significantly more information than them: the estate agent. These conditions suggest that individuals might be more vulnerable to choice manipulation than in other scenarios which have been considered by the literature.

A second motivation is to understand the dynamics of markets from a different perspective. The workings of housing markets are a prominent concern of the real estate literature, yet many papers implicitly adopt a 'rational' approach to individual action. Those which do incorporate non-rational elements either do not consider home buyers – focusing instead on sellers – or do not incorporate the idea that there is an economic agent who might find it in their interest to *actively* manipulate decision making processes and thus influence market outcomes. This thesis addresses that gap in the literature adding further to our understanding of what is really going on in housing markets.

The final motivation for the thesis is to help individuals to make better choices. By understanding decision making weaknesses, points of vulnerability to the sub-

tle influence of others, individuals can hope to make 'better' choices and thus improve their happiness for the long run.

With these motivations in mind the following section considers how the thesis investigates the issues at hand.

## 1.3 Methods

The primary methodology used to study the nature of biases and manipulations affecting housing choice is economic experiments on students and controlled surveys on adults in the tradition of the field of experimental economics.

Although some economists have questioned the suitability of experimental methods in economics, from its beginnings in the 1950s, experimental economics has established itself as an important part of mainstream economic research. It is an established methodology in its own right offering significant insights into a variety of economic questions, including those posed here.

Two key principles run throughout the experimental work that economists have undertaken, which ensure its validity for studying judgemental and choice bias in housing. The first of these is experimental control: experiments give significant control and so allow more powerful inferences to be made than from more natural sources of data. Such methodological control can be more powerful than the econometric techniques used to make inferences from this natural, or *happenstance* data (Freidman and Sunder, 1994). The second principle is the use of careful design to isolate and leave unchanged the essential underlying conditions of the natural environment to allow researchers to *induce* how the results would likely be played out in a real world scenario.

This latter argument directly addresses the external validity of experimental results, undoubtedly a concern for economists not familiar with experimental methods. Freidman and Sunder (1994) note that scepticism about the generalisability of experimental results has existed since at least the time of Gallileo when critics

did not believe the motions from his now-famous pendulum experiment could be applied to planetary motions. For Gallileo, as for experimental economists, this abstraction from the full complexity of the real world, that is the essence of performing an experiment, does not *automatically* destroy the external validity of the work.

This principle is known as *induction*. It provides is that regularities observed in systems – such as behaviour in economic experiments – will persist in new situations provided the relevant underlying conditions remain largely unchanged. What counts as 'relevant', and to what extent conditions are 'largely' unchanged is a matter for debate, but the principle of induction itself is an axiom of experimental work, not a deductible proposition.

Vernon Smith calls this the *parallelism precept* (Smith, 1982, page 936). According to this axiom it must be presumed that results *will* carry over to the real world. Thus the sceptic has the burden of stating what is different about the real world that might change the results observed in the experimental situation. The goal of the researcher is to design and re-design the experiment to counter these points of scepticism. Chapter 5 considers the nature of the designs to ensure the external validity of the work in detail. Two key points stand out: the use of incentives and the replication of decision frames.

For all economic experiments, incentives are necessary to gain control over subjects' motivations. A simple reward structure is constructed within the confines of the experimental scenarios such that all participants understand the way to ensure they earn more of the reward. Usually paid in money at the end of the experiment, it is assumed that subjects always want to earn more reward. As Chapter 5 discusses, the experiments exploring judgemental bias in housing use incentives extensively to provide a motivator for 'good' judgement. Such a structure replicates the real world situation in which better judgement when buying a house is rewarded financially, often considerably.

For those situations where incentives are not possible and so the work is more

accurately a controlled survey, the scenario – or *decision frame* (Tversky and Kahneman, 1981) – in which decisions are taken is designed to replicate closely the real world situation. In this vein, this thesis reports a large-scale survey of over 4,000 users of the property search website www.rightmove.co.uk (hereafter referred to as "Rightmove") where choices are presented in a manner almost identical to how houses are viewed in real situations on their site. This design presents a compelling case for the external validity of the results.

This thesis reports results from three separate experiments which employ two distinct methods. They are summarised in Table 1.1. The Student Experiments involved the use of classroom experimental techniques on over 280 volunteer participants. They were all members of the University of Cambridge recruited on campus through advertising and online. A number of choice and judgement experiments involving housing were used, with a variety of treatment effects considered. Incentives were paid where appropriate and were designed to replicate the binary, high-stakes nature of housing decisions. This first method was complemented by a second which forms the bulk of the remaining research work: online controlled surveys. Two separate controlled surveys were conducted. The first, completed with the help of the website Rightmove, used over 4,000 participants of their site.

| Name | Description |
| --- | --- |
| Student Group Experiments | Series of experiments of choice and judgement in classroom settings with over 280 student volunteers. Incentives paid for judgement experiments. |
| Rightmove Survey | Large-scale controlled survey of over 4,000 users of website Rightmove. Used online design to closely resemble the real choice scenario in which house preference decisions are made |
| Stamford Adult Group Survey | Controlled survey of 600 residents of the town of Stamford, South Lincolnshire. Replicated the Rightmove survey but using different online delivery methodology. |

**Table 1.1:** Summary of experiments reported in this thesis.

The research creates a choice scenario involving a selection of homes, from which the participant is asked to pick their preferred option. Fourteen treatments were used to control the context in which the decision is taken (the "choice frame") including the composition of the choices seen (the "choice set") and the order of viewing. Finally the Stamford Adult Group Survey is an online controlled experiment of over 600 residents of the town of Stamford, South Lincolnshire. This survey replicated the scenarios and treatments of the Rightmove Survey but used a different online delivery methodology which altered the emphasis of some aspects of the property choice (including the prominence of location).

Thus the three experiments encompass two distinct participant groups: university students and adults. The former are more available for research and have lower recruitment costs, which is a significant benefit for research purposes. Perhaps for this reason, the use of students is entirely standard in experimental economics. However, it is incumbent upon the researcher to design the experiments so that they are generalisable to as broad a context as possible. Although representative of a sophisticated group of potential renters, the student group are not, in all likelihood, representative of home buyers as a whole. In contrast the adult volunteers recruited from the website Rightmove are representative of home buyers in the UK, and more: the vast majority are currently searching for homes (hence their being on the website) so represent an ideally suited subject group. This dual approach lends far greater weight to the results reported than if they were presented in isolation.

A survey of the origins of experimental economics and the key techniques used, as well as a detailed description of the methodology used in this thesis is presented in Chapter 5. The following section considers the contribution that the research makes to the literature given the motivations expressed in Section 1.2.

# 1.4 Contribution

This thesis makes three primary contributions. The first is to choice theory. Through three experiments which examine choice and judgement manipulation in real estate, significant new evidence about the nature of these biases is uncovered. This is important because housing is a very different type of choice scenario to those considered by current research. The stakes are large and the decision is typically a one-off, with little chance to learn from mistakes. The results confirm that high stakes do not significantly reduce decision making errors. Even when offered the opportunity to earn a one-off bonus of £100 for accurate judgement (Student Group Experiments, Chapter 8) participants' estimates of value were significantly influenced by arbitrary anchors.

Evidence of biases resulting from choice set composition including *asymmetric dominance* (Huber et al., 1982) and *compromise effects* (Simonson, 1989) are confirmed in written tests (Student Group, Chapter 6) backing up existing research in this new choice scenario. The results go beyond this, however. In complex choice set scenarios where participants are presented with real descriptions of houses including photos there is evidence that judgements are biased both according to the precise composition of the set (Student Group Experiments, Chapter 6) and the order in which properties are shown (Student Group Experiments, Chapter 7). When the testing is carried out on adult users of a property search website using a design which matches almost exactly the way in which properties are actually viewed, these biases persist (Rightmove Survey, Chapters 6 and 7). These errors apply across a very large sample set – over 4,000 people – representing a broad demographic of home buyers in the UK. An online survey of over 600 residents of a medium-sized town, which presents house choices using a delivery mechanism that places less emphasis on photographic data and more on textual descriptions of properties, largely repeats these findings (Stamford Adult Group Survey, Chapters 6 and 7). In general those less experienced with property are more vulnerable to choice manipulation.

Furthermore the findings are confirmed using simple difference in proportions

tests and logit analysis which controls for variables of interest including age, gender, location and experience buying property.

Most significantly these tests show evidence of a new form of behavioural bias. The bias occurs when one of the options in the choice set acts as a *negative* influence on another choice, causing a change in aggregate preference away from the other choice when the 'bad' choice is added. I label this finding the *choice pollution effect* to reflect the idea that it results from one option 'polluting' individual perceptions of an alternative choice. Choice pollution effects are found among students (Student Group Experiments, Chapter 6) and adults (Rightmove Survey and Stamford Adult Group Survey, Chapter 6).

Another source of contribution is to our understanding of the dynamics of housing markets. Traditional theories which consider housing markets have frequently used at their heart a rationality assumption about the behaviour of individuals. Such an assumption results in easier modelling at the macro level, but obscures significant detail at the micro level about what is really going on in housing markets. Although promising moves have been made in this direction (such as Munro and Smith, 2008; Levitt and Syverson, 2008; Levy and Frethey-Bentham, 2010) little considers the role of home buyers, or adopts the non-rationality perspective which arises from the behavioural economics literature (Simonsohn and Loewenstein, 2006, is perhaps the closest to follow this path).

Furthermore, research into housing markets has not largely considered the role of the estate agent *actively* manipulating individual home buyer behaviour. This thesis brings these strands of the literature together. There is significant evidence that home buyers are highly vulnerable to behavioural manipulation. The results show it is reliably possible to influence preference over housing options through altering the choices which are shown and even the order in which they are shown. Judgements over value are particularly liable to manipulation also. These are influenced in a predictable direction by the use of an arbitrary anchor.

The research therefore gives new importance to the role of the estate agent in

housing decisions on an individual level. This is likely to be of interest to estate agents themselves, but also policy makers and finally individual home buyers.

The final contribution is methodological. As Chapter 5 explains, experimental economics has evolved into being a significant part of today's economists' toolkit. Experiments today are used in fields as wide as industrial organization, finance theory and environmental economics. A significant part of the experimental work in this thesis uses an online research design for delivering experiments which has rarely been used in published research into consumer choices. The online experiment has significant advantages in terms of volunteer recruitment. However the *contribution* arises from using this method to replicate an actual decision frame of interest. Online property search has revolutionised the way individuals buy property in the UK in the last 10 years. It is now a vital platform for advertising properties for sale. Over 90% of UK agents are registered with the market leader, Rightmove[9].

A growing research body considers online consumer behaviour. Kumar, Lang and Peng (2005) and Rose and Samouel (2009) examine how consumers search for information on the internet. The latter present a model of online consumer information search, concluding that cognitive processing and motivation are important impacts on the amount of time spent searching, more so than factors such as cost.

Wu, Cheng and Lin (2008) is, to the best of my knowledge, the only paper which uses online experimentation to investigate the role of behavioural biases in e-commerce. They find evidence that anchoring is important in online value judgements. This thesis also directly addresses how consumers might be manipulated in online environments, but is the first to use this method to consider how individuals might be manipulated in the online decision frame by altering their preference *between* products. Chapter 5 considers in detail the design of the online experimental work. With online consumer markets growing rapidly this contribution is likely to become even more significant in the coming years.

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[9]  Source: Rightmove figures.

# 1.5 Conclusion

Behavioural economics provides a new perspective on choice theory, a subject of great concern to economists, by placing our models of human decision making on a firmer psychological footing. Leading behaviouralists Colin Camerer and George Loewenstein echo this sentiment: *"behavioural economics increases the explanatory power of economics by providing it with more realistic psychological foundations."* (Camerer and Loewenstein, 2004, page 3).

This thesis makes an important contribution both to choice theory and to our understanding of the dynamics of housing markets by answering the following question: to what extent, and by what means, can housing choice be manipulated in non-rational ways by a willing economic agent?

The thesis proceeds as follows. Chapter 2 concludes Part I by considering why economists are so interested in choices and what they mean by rationality. Through reviewing the literature in choice theory, it shows how the dominant paradigm, that of rational choice according to the von Neumann and Morgenstern analysis (von Neumann and Morgenstern, 1944), was compromised by a series of papers which cast doubt on the fundamental axioms of that theory. The *behavioural critique*, led by Kahneman and Tversky (Kahneman and Tversky, 1979), and for which Kahneman won the Nobel Prize in 2002, has fundamentally altered they way economists think about choice.

Having set the background to the research, Part II considers non-rational choice manipulation and how it may apply to housing choice. Chapter 3 considers the non-rational approaches that have been used in real estate markets already. The review highlights a clear gap in the literature to explore non-rational decision making by home buyers who are being manipulated by a willing economic agent. It also reviews the core literature into behavioural bias in consumer choice scenarios, highlighting three areas of bias which form the basis of the research in this thesis.

Chapter 4 applies the theory of choice manipulation into specific predictions about how choice manipulation might take place in housing scenarios. These are considered under three headings: biases arising from choice set manipulation; biases due to viewing order; and biases in value judgements. It makes hypotheses which form the basis of the experiments reported later. Estate agents are an important part of the story of choice manipulation being presented in this thesis. The second part of Chapter 4 considers conceptual models which confirm that estate agents are economic agents who are motivated to manipulate home buyers' behaviour. Manipulations are expected to be particularly important – and potentially valuable – in the growing market for online property listings where agents compete with each other for sales across a common platform.

Finally in Part II, Chapter 5 reviews the methodology and data collected. Experimental techniques are employed throughout the research so considerable attention is devoted to the evolution of this method, illustrating its coming to prominence as well as its validity today. The three specific experiments which form the results: the Student Group Experiments; the Rightmove Survey; and the Stamford Adult Group Survey are considered in detail.

Part III presents the results. It is split into three chapters. These match the definitions of the behavioural biases that are presented in Chapter 4. Thus Chapter 6 reports the results from experiments investigating the effect of choice set manipulations on decision making. Chapter 7 shows that ordering effects are potentially important in preference construction and therefore choices. Finally Chapter 8 finds that it is possible to manipulate value judgements through the use of arbitrary anchors placed before decision makers when making judgements. This suggests that more subtle forms of value judgement manipulation, which could allow an agent to increase property sales values, thus increasing his commission, is not only possible but a source of significant vulnerability for consumers.

The thesis is concluded by Chapter 9. This chapter considers the importance the findings have for three groups in particular: estate agents for whom it presents clear ways in which they might influence home buyers for their own ends; policy

makers, for whom consumer protection is an important aspect of their regulatory scope; and finally for decision makers themselves. By understanding our own limitations and vulnerabilities we can hopefully make better, more informed choices. When the choice is as important as buying a home, this is a significantly positive outcome.

Chapter 9 also considers the limitations in the research, a feature of all academic endeavours. Finally future directions for research are suggested, both in terms of improving and building on the work contained here and more generally considering alternative applications for behavioural insights into real estate markets.

There is no doubt that the behavioural paradigm and the field of behavioural economics has revolutionised research into large parts of economics today. There is significant potential for a similar effect in real estate economics.

# Chapter 2

# Decision Making Under Risk

This chapter considers the models that explain how humans make choices. Models of decision making typically have at their heart the normative concept of *rationality*, which demands that choice patterns display a certain level of consistency and coherence. The leading neoclassical model of rational choice, *Behavioral Decision Theory*, is examined as the solution to the choice problem. Although elegant, widely applicable and very tractable, this model has come under serious pressure since the 1970s. The growing *behavioural critique* of some of rational choice theory's central predictions culminated in the publishing, in 1979, of an alternative model of choice, *Prospect Theory*. This perspective represents a different paradigm in the way economists think about choice.

## 2.1 Choice, Reason and Rationality

Desire is at the heart of choice and so of the theory of choice. Humans are driven to make choices by their individual desires, a process that is as natural to being human as speaking, talking, even breathing. Yet there is more to choice than desire alone. Reason must form a central part of any story of choice. Moreover, these two concepts, desire and reason, are fundamentally linked. As Allingham (2002) notes, choices using reason but lacking desire are vacuous. But desire with-

out reason is self-defeating: it is the crying child who both wants to go home and not go home. Our earliest philosophers also identified the connection; Aristotle said: *"The origin of action... is choice and that of choice is desire and reasoning with a view to an end. This is why choice cannot exist without... reason."* (Aristotle, 1980, Book VI, Line 32).

So it is a central part of the concept of choice that actual choices will be based on some element of reason or reasonableness. A synonymous term for this idea is *rationality*. But what does it mean for choice to display reason, or for actions to be rational? The answer to this question often depends on who is asking the question, there is by no means agreement over a unique definition.

A good starting point might be to consider actions or choices which are clearly not rational[1]. Actions which clearly result in self-harm such as smoking or excess drinking would seem to fall into the category of 'irrational' behaviour on that basis. A more general definition of rationality in this spirit might be that it includes only those actions and choices which are made in self-interest. In an everyday sense when we refer to people acting rationally this usually means that they are using reason rather than being under the influence of visceral or instinctive pressures. For example, emotion is recognised by most people as being a powerful force that may interfere with their powers of reason.

Ludwig von Mises (1949) takes a different tack, arguing that by definition any action must be rational. This method essentially defines rationality in terms of revealed preference. If we make a choice or take an action then it must be because we have a preference for doing so. Such an approach is echoed in Berridge who says *"individual tastes are not a matter for dispute, nor can they be deemed rational or irrational."* (Berridge, 2001, page 17). This view, while clearly coherent, obscures all the factors that are involved in the determination of revealed preference, essentially putting them into a black box. Thus it is not particularly useful in aiding our analysis and understanding of choice or, therefore, making

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[1] This section is based on the arguments in Chapter 9 of Wilkinson (2008) titled "The Nature of Rationality".

policy decisions, which are the goals of this thesis.

Baumeister suggests that "*a rational being should... pursue enlightened self-interest.*" (Baumeister, 2001, page 3). This may be a good starting point, but runs into problems when the terms are defined in detail. For example, does 'enlightened' imply that an individual has perfect knowledge, surely a highly restrictive requirement? What is in the 'self interest'? What happens if we misjudge what is in our self interest, or factors in our self interest come into conflict? Self interest could mean 'happiness' or it could mean 'pleasure', two related, but distinct, ideas which frequently come into conflict, for example when choosing a dessert in a restaurant which causes pleasure in the short term, but reduces happiness in the long run through its effects on health.

For economists, the definitions considered in this discussion, while useful, are too imprecise as building blocks for a theory of choice. They have tended to use a rather narrower definition, incorporating the idea that rational choices are ones which maximise individual happiness or utility. To ensure that decision making does maximise individual utility most economists agree that certain irrefutable features of choice construction are necessary. In their analysis these irrefutable conditions become the criteria for rationality. Among other things they include a specific condition that choices should display some element of consistency and coherence, for example that a choice pattern should not contradict itself. This requirement in turn involves most essentially the concept of *transitive* preferences which is discussed below.

In other words, for neoclassical economists rationality is an important part of choice theory because it lends normative status to decision making which uses it. That is, it allows a prescriptive model of choice to be developed that equates pursuing desire with maximising individual happiness, or utility, which is the goal of making choices. The leading neoclassical model in this vein is the *Behavioral Decision Theory* of von Neumann and Morgenstern (1944). As will be explored in Section 2.2, in the decades after its publication this classic work was widely adopted as the solution to the fundamental economic choice problem expressed

in Chapter 1.

Significant theoretical developments across economics were made using this model of choice and utility maximisation at their heart (for example Sharpe, 1964). It was taken as a self evident truth that revealed preferences expressed through actual choices maximise individual happiness which in turn implies that they are generated by a rational preference structure; and more: that a rational preference structure implies that choices *will* maximise individual happiness. Thus to say that a choice or action is irrational means that that individual's decision making apparatus is in some way compromised and so the resulting choice is not optimal[2].

For this reason the critiques of the neoclassical choice model, which emerged from the early 1950s (Allais, 1953) and gathered pace in the 1970s (Slovic and Lichtenstein, 1971; Tversky and Kahneman, 1974; Grether and Plott, 1979), presented a fundamental challenge to choice theory and so to one of the cornerstones of microeconomic theory. They showed prominent and important situations in which choices were clearly not rational in the neoclassical sense. Initially dismissed as demonstrating only isolated paradoxes, this *behavioural critique* gathered pace and gained influence. It showed that the assumptions which underpinned the rational model were psychologically implausible at best, casting doubt on the relevance of the model as a whole. This set the scene for a dramatic re-thinking of economists' concepts of rationality, choice and reason.

This critique is considered in Section 2.3. It begins with the Allais Paradox (Allais, 1953) which demonstrates a simple situation in which individuals violate a key axiom of the rational model. Further paradoxes and anomalies followed, each pointing to problems with the assumptions of the rational model or areas where its applicability seems limited (such as Slovic and Lichtenstein, 1971; Grether and Plott, 1979). An important finding of this early literature arises from analysis of these papers: that context – also known as *framing* – matters in decision making. This concept is vital in creating the possibility of the choice manipulation that is

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[2] Wilkinson (2008) considers a particularly stark case of failures in decision making apparatus at page 460.

the subject of this thesis.

By the late-1970s the collection of problems and paradoxes of the rational model were unfortunately still just that: a collection. They were without a unifying intellectual framework; a complete alternative model of choice which could challenge the rational model in its own terms. This was remedied by the publishing in leading economic journal *Econometrica* of Daniel Kahneman and Amos Tversky's *Prospect Theory* (Kahneman and Tversky, 1979).

This alternative account of decision making under uncertainty unified many of the themes of the behavioural approach to choice theory. It presents an alternative account of choice to challenge the von Neumann and Morgenstern model based on what Kahneman and Tversky call *psychological regularities*. These include: *reference point effects*, the idea that utility is assessed by considering gains or losses from a reference point rather than absolute amounts; *loss aversion*, the concept that perceived losses from the reference point are viewed far more negatively than gains of a corresponding magnitude; and *decision weighting*, an alternative non-Bayesian probability estimation framework by which outcomes are weighted. Representing the high watermark of this paradigm in economic thought, it is examined in Section 2.4.

Before considering *Prospect Theory* though, we must begin by returning to the economic concept of rationality. The discussion thus far has noted how a precise definition of rationality is central to choice theory. Next I explore in more detail why normative models of choice, which invoke rationality, are important and how one such model became the dominant school of thought in microeconomics.

## 2.2 Behavioral Decision Theory

A theoretical model of choice behaviour is at the heart of microeconomics. Economists need a model of choice that describes the way in which humans make decisions because it is a vital part of economics' usefulness as an academic subject. The theory of choice has implications that are fundamental to concepts as ab-

stract as human happiness; to issues as important as government policy; and to problems as intractable as global environmental protection. Without a suitable model of choice economists are unable to offer individuals guidance on the ways in which they might improve their own welfare; or governments on the effects of policies; or supra-national bodies on how they might effectively tackle the issues that confront us.

Moreover, economists generally see their own discipline as scientific in philosopher Karl Popper's sense of the word, meaning that it is the job of economic theory to make predictions of how systems work in the world around us and confirm – or refute – these predictions, with the aim of building better models. Working towards this 'ideal' model is the ongoing concern of economic research.

Also as we have seen, creating a model that has normative as well as positive implications is desirable. A model that describes that which *is* is a useful starting point, but for most economists having something to say about that which *ought* to be is also at the centre of their world-view.

## 2.2.1   Formal Model of Choice under Uncertainty

The vast majority of choice involves at least some uncertainty. In their book, *Theory of Games and Economic Behavior*, John von Neumann and Oskar Morgenstern present four axioms which formalise the theory of choice under uncertainty which they call *Behavioral Decision Theory*. The result is an elegant, tractable and highly general model of human decision making which was quickly adopted as *the* solution to the choice problem. It is normative as well as descriptive, prescribing a way that individuals *should* make decisions to maximise their happiness.

Under the assumption of uncertainty, decision making is considered as a process of choosing between different gambles, or prospects. Each prospect consists of a number of outcomes with associated probabilities for each occurring. So for example, a gamble which will gain the decision maker an apple with probability

0.3 and a banana with probability 0.7 is written as:

$$\mathbf{g} = (\text{apple}, 0.3; \text{banana}, 0.7)$$

or, in more general terms:

$$\mathbf{g} = (x_i, p_i; \dots ; x_n, p_n)$$

where $x_i$ represents outcomes, and $p_i$ represents probabilities.

The formal axioms of preference under uncertainty are presented below.

1. *Completeness.* This requires that individuals can compare any two gambles, $\mathbf{x}$ and $\mathbf{y}$. The comparison leads to one of three mutually exclusive outcomes: either $\mathbf{x}$ is better than $\mathbf{y}$; $\mathbf{y}$ is better than $\mathbf{x}$; or both in which case you are indifferent between the gambles. This is expressed as follows:

   **A1.** For all $\mathbf{x}$ and $\mathbf{y}$: either $\mathbf{x} \succ \mathbf{y}$, $\mathbf{y} \succ \mathbf{x}$ or $\mathbf{x} \sim \mathbf{y}$

   This requirement has a similar formulation in a model of choice under certainty. It establishes that for all prospects a preference relation can always be made.

2. *Transitivity.* A decision maker considers three different gambles, $\mathbf{x}$, $\mathbf{y}$ and $\mathbf{z}$. If he prefers $\mathbf{x}$ to $\mathbf{y}$ and $\mathbf{y}$ to $\mathbf{z}$ then he must prefer $\mathbf{x}$ to $\mathbf{z}$. This is expressed as follows:

   **A2.** $\mathbf{x} \succ \mathbf{y}$ and $\mathbf{y} \succ \mathbf{z} \implies \mathbf{x} \succ \mathbf{z}$

   This condition is an essential building block of the normative theory because it ensures that choices do not contradict themselves. But it is not restrictive – it is a condition that most people would express that they want to follow since it is clear that choices which do not follow it do not make sense.

3. *Continuity.* This principle ensures that choices can be represented by a preference function that attaches real value to every prospect. It says that

for all prospects $\mathbf{x}$, $\mathbf{y}$ and $\mathbf{z}$ where $\mathbf{x} \succ \mathbf{y} \succ \mathbf{z}$ there is a probability, $p$, which will make the decision maker indifferent between the middle-ranked prospect, $\mathbf{y}$ and a gamble consisting of the other two prospects weighted by $p$ and $(1 - p)$ respectively. It is expressed in formal terms below:

**A3.** For all $\mathbf{x} \succ \mathbf{y} \succ \mathbf{z}$, there exists a unique $p$ such that $p\mathbf{x} + (1 - p)\mathbf{z} \sim \mathbf{y}$

This axiom ensures that there are not jumps in preference[3].

4. *Independence.* This axiom is the most restrictive building block of the theory of choice under uncertainty. It has also been called the cancellation principle, and is known as the substitution axiom in the most important critique of the theory (Kahneman and Tversky, 1979). Broadly it suggests that preference between two options cannot be altered by the presence of a third option. Wilkinson (2008) explains the axiom by saying it says that any state of the world which results in the same outcome regardless of the choice made should be ignored. It is presented in formal terms as follows:

**A4.** If $\mathbf{x} \succ \mathbf{y}$, then $p\mathbf{x} + (1 - p)\mathbf{z} \succ p\mathbf{y} + (1 - p)\mathbf{z}$ for all $\mathbf{z}$ and $p \in (0, 1)$

The axiom makes it clear that if $\mathbf{x}$ is preferred to $\mathbf{y}$ then the presence of prospect $\mathbf{z}$, which will happen with probability $(1 - p)$ in both cases, makes no difference to that preference. It can be 'cancelled' in the decision maker's thoughts.

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[3] To see why this is important consider the following example. The decision maker has a choice of snack. The options are apples, biscuits and chocolate. He prefers apples to biscuits and biscuits to chocolate. He also prefers apples to chocolate which ensures that the transitivity axiom is met. However, he will prefer biscuits to every gamble which gives either apples or chocolates, however low the probability of getting chocolates. This set of preferences seems reasonable if we imagine that the decision maker detests chocolate. But it means there is a jump in preferences. The decision maker will choose biscuits rather than face the gamble (apples, $p$; chocolate, $1 - p$). for all values of $p$ which are less than 1. But when $p = 1$, in other words when the gamble becomes just a choice of apples or biscuits, the decision maker's preference will jump without him ever being indifferent between the two. This may not seem unsatisfactory in this case, but Allingham (2002) provides an example which illustrates a situation where it may be. Imagine that the choice of apples is replaced by £1m; biscuits becomes nothing; and chocolates becomes instant death. Without the continuity axiom the implication would be that there is no probability that would ever make the decision maker cross the road, incurring a minute probability of death, to pick up £1m on the other side.

Together these axioms prescribe the restrictions which must be placed on the preference function. In addition the theory adds a method for relating preference to utility (remembering that the goal of choice is to maximise utility). This is known as the *expectation principle* and states that the overall utility of a prospect is the expected utility of its outcomes. Formally:

$$U(x_1, p_1; \ldots ; x_n, p_n) = p_1 u(x_1) + \ldots + p_n u(x_n) \tag{2.1}$$

Thus the method is that each outcome in the prospect is evaluated using the utility function then weighted according to its probability of occurring. These can then be summed in the traditional way to generate an overall utility for the prospect. Thus the decision maker's task when making choice using the four axioms and the expectation principle is to maximise the following objective function:

$$V(\mathbf{g}) = \sum p_i u(x_i) \tag{2.2}$$

where $\mathbf{g}$ is a prospect and $u(\cdot)$ is a utility function defined on the set of outcomes $(x_1, x_2, \ldots, x_n)$ with probabilities $(p_1, p_2, \ldots, p_n)$. A final aspect of the model is four assumptions which usually accompany the formal axioms. These are desribed below[4].

1. *Asset Integration*. This says that a prospect is acceptable if and only if the utility from integrating the prospect with one's own current assets exceeds the utility from one's assets alone. In mathematical form we may write that we would only accept gamble $(x_1, p_1; \ldots ; x_n, p_n)$ from our current asset position $\omega$ if:

$$U(\omega + x_1, p_1; \ldots ; \omega + x_n, p_n) > u(\omega) \tag{2.3}$$

   This condition is fairly simple, just requiring that all prospects are considered in the round, including our current wealth. They should not be considered in isolation. This rule is the basis of the capital budgeting concept of *Net Present Value* (Fisher, 1907). As we will see, there is significant evidence that this requirement is not met in many scenarios.

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[4] The are presented in this form in Wilkinson (2008).

2. *Risk Aversion.* This is an objective description of choice behaviour which it is assumed all individuals adhere to. Risk aversion is the preference for a certain prospect ($a$) over a risky prospect with expected value $a$. A numerical example makes this clear: for a gamble which pays £10 with probability 0.5 and £20 with probability 0.5 the expected value is £15 using the procedure in Equation 2.1. If offered the choice between the gamble and a certain £15, risk aversion says that the certain amount will always be preferable. To not prefer the certain prospect makes the individual a risk lover. Investment theory uses this concept in building the *Capital Asset Pricing Model* (Sharpe, 1964) which expresses the relationship between the risk and return of securities.

3. *Dominance.* This condition says that if $\mathbf{x}$ is preferred to $\mathbf{y}$ in one state and at least as good in all other states then $\mathbf{x}$ is dominant over $\mathbf{y}$ and so should be chosen. In situations of uncertainty this is known as *stochastic dominance* and essentially describes the minimum conditions for decision makers to find one option better than another.

4. *Invariance.* This assumption states that different representations of the same choice problem result in the same preference. Preference relations should not depend on the description of the options (description invariance) or the method of elicitation (procedure invariance). Although it is essentially implied by the completeness and transitivity axioms, it is important to restate it because it is fundamental to the theory. Without stability of preference across descriptions and elicitation procedures it becomes impossible to represent a person's choices as utility maximising. Rational preference as a normative concept is lost.

## 2.2.2 Summary

For a significant period of the 20th century the rational choice paradigm was the dominant school of thought in microeconomics. Together the collection of conditions that form the model of choice under certainty and the more general von Neumann and Morgenstern model present an elegant and tractable solution to

the choice problem. The latter in particular is extremely general, allowing it to be applied far and wide in microeconomic theory (and beyond). The status of the theory is confirmed by the widespread practice of using individuals with 'von Neumann-Morgenstern preferences' and that being synonymous with rational action itself.

Not only that but it is intuitively compelling, prescribing only the simplest of rules for choice determination which most individuals would want to follow. Kahneman and Tversky noted the theory's position in economics theory:

> "*It is accorded all the methodological privileges of a self-evident truth, a reasonable idealisation, a tautology and a null hypothesis.*"

> (Tversky and Kahneman, 1986, page S273).

However, even as the theory was meeting widespread acclaim after its first publication in 1944, some economists were asking questions about aspects of its formulation and its descriptive accuracy. Existing at first as little more than isolated paradoxes, these coalesced into a powerful critique that ultimately created a new paradigm in the theory of choice.

## 2.3 The Behavioural Critique

Today behavioural economics is a mainstream field of economic enquiry. Behavioural theories are used widely to explain phenomena from stock market returns (Benartzi and Thaler, 1995) to why it is impossible to get a taxi on a rainy day (Camerer et al., 1997); from the way environmental resources are valued (Hanley, Kristrom and Shogren, 2009) to betting patterns at racetracks (McGlothlin, 1956). Its founding fathers, psychologists Daniel Kahneman and Amos Tversky have been widely acclaimed for their groundbreaking work, the former being awarded the Nobel Prize for his contribution in 2002[5]. They have successfully challenged the status of the once-dominant rational choice paradigm, forcing a dramatic re-thinking by economists of the nature of choice and rationality. This

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[5] Amos Tversky died in 1996.

body of work presents a new way to think about choice problems which this thesis aims to use and make further contributions towards.

This change was not immediate, however. It began as a simple critique of the dominant theory of the day, the neoclassical *Behavioral Decision Theory*. Several isolated studies published in the 1950s cast doubt on the rational model's descriptive account of choice, striking at the heart of the axioms and assumptions on which it is built.

## 2.3.1 The Allais Paradox

Among the first critiques of the von Neumann-Morgenstern model is Allais (1953) which presents the now-eponymous paradox. It shows a simple violation of the independence axiom. The description of it here is taken from Kahneman and Tversky (1979) exploiting what they call the *certainty effect*. In the paradox the decision maker is faced with two problems in which he has to make choices:

**Problem 1**: Choose between winning

| | | | |
|---|---|---|---|
| **A**: | 2,500 with probability 0.33, | **B**: | 2,400 with certainty. |
| | 2,400 with probability 0.66, | | |
| | 0 with probability 0.01. | | |

n=72            [18]                         [82]*

**Problem 2**: Choose between winning

| | | | |
|---|---|---|---|
| **C**: | 2,500 with probability 0.33, | **D**: | 2,400 with probability 0.34, |
| | 0 with probability 0.67. | | 0 with probability 0.66. |

n=72            [83]*                      [17]

where n = the number of respondents. The figures in parentheses indicate the

proportion of respondents who made each choice and * indicates a significant preference at the 0.01 level. The modal choice of the two was BC, chosen by 61% of respondents. This pattern violates expected utility theory. To see how, it is first noted that $u(0) = 0$. The first preference of B over A implies:

$$u(2, 400) > 0.33u(2, 500) + 0.66u(2, 400)$$

or:

$$0.34u(2, 400) > 0.33u(2, 500)$$

The second preference of C over D implies the reverse, however. This violates the independence axiom considered in the previous section because Problem 2 is obtained from Problem 1 by removing a 0.66 chance of winning 2,400 from both prospects. Thus it should not affect the preference between the options.

## 2.3.2 Further Paradoxes

The Allais Paradox presents a challenge to the neoclassical theory because the violation of one of its central axioms is stark as well as being predictable (ie. not a random variation). However, far from being an isolated paradox, significant further evidence of judgemental errors in decision making was presented in published work from the early 1970s. Slovic and Lichtenstein (1971) and Grether and Plott (1979) document a series of major inconsistencies in choice behaviour; there are elementary errors in probabilistic reasoning in Tversky and Kahneman (1983) casting doubt on the Bayesian operation that is enshrined in the expectation principle; and Kahneman and Tversky (1984) report violations of the dominance assumption. Another violation of independence is reported in Kahneman and Tversky (1979) with the following problem set:

**Problem 3**: Choose between winning

**A**:    6,000 with probability 0.45.          **B**:    3,000 with probability 0.90.

n=66                    [14]                                        [86]*

**Problem 4**: Choose between winning

**C**:     6,000 with probability 0.001.     **D**:     3,000 with probability 0.002.

n=66                    [73]*                                    [27]

Problems 3 and 4 have the same payoffs, with the same relative probabilities of success (Problem 4 is obtained from Problem 3 by reducing the probability of success by a factor of 450). Thus an individual who chooses A should also choose C, while one who chooses B should also choose D. However the choices do not reflect this. The modal choice is BC which is a violation of independence.

At this stage it is important to emphasize again that these are elementary violations of the axioms of a model which aims to be the normative solution to the choice problem - a model of action which individuals do follow and that they should want to follow to maximise their utility. Kahneman and Tversky conclude from the example that common attitudes towards risk and probability are not being adequately captured by the expected utility model. Grether and Plott (1979) go further, saying the following of their findings:

> "*Taken at face value the data are simply inconsistent with preference theory and have broad implications about research priorities within economics. The inconsistency is deeper than the mere lack of transitivity or even stochastic transitivity. It suggests that no optimization principles of any sort lie behind even the simplest of human choices and that the uniformities in human choice behavior which lie behind market behavior may result from principles which are of a completely different sort from those generally accepted.*"

(Grether and Plott, 1979, page 623).

### 2.3.3 Framing and Choice

As well as these direct violations of individual axioms, Tversky and Kahneman published other studies showing that individuals may fail to make entirely rational choices in a variety of situations through the use of rules of thumb to aid decision making. These *heuristics* can seriously impair judgement, particularly with respect to estimates of probability (Tversky and Kahneman, 1974).

Decision makers are also shown to be particularly vulnerable to errors associated with the way in which problems are presented. This is known as *framing*. The assumption of invariance states that choices should be invariant to the method of description and of preference elicitation. Yet a series of studies showed that framing effects can be vital in altering the pattern of choice made. In Tversky and Kahneman (1981) the psychologists introduce the following problem to illustrate their concept of framing. It has become a classic example of behavioural processes at work in direction violation of the rational choice model.

***Problem 5****: Imagine that the US is preparing for the outbreak of an unusual Asian disease which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimate of the consequences of the programs are as follows:*

*If Program A is adopted, 200 people will be saved*

*If Program B is adopted, there is a 1/3 probability that 600 people will be saved, and a 2/3 probability that no one will be saved*

*Which of the two programs would you favour?*

In response to this problem the vast majority, 72%, opt for the risk-averse choice: the prospect of certainly saving 200 lives is preferable to a gamble with an equal expected value. A second group of participants were given the same cover story as Problem 5 but with the following outcomes:

*Problem 6*:

*If Program A is adopted, 400 people will die*

*If Program B is adopted there is a 1/3 probability that no one will die, and a 2/3 chance that 600 people will die*

*Which of the two programs would you favour?*

It is clear that the options given in Problem 6 are identical to those in Problem 5; the only difference is the way they are expressed. Problem 6 has a 'negative frame' which talks about patients being killed whereas Problem 5 talks in positive terms of lives saved. Seventy-eight per cent of the respondents to Problem 6 opted for choice B in Tversky and Kahneman's (1981) study. This demonstrates risk loving: respondents do not prefer the certain death of 400 patients over a gamble which has an equal expected value of deaths. The combination of the two sets of responses is incompatible with rational choice theory and illustrates vividly the possibility of framing to manipulate choice.

Other framing problems are presented in Tversky and Kahneman (1986), Thaler (1985) and Johnson et al. (1993). In *Towards a Positive Theory of Consumer Choice* (1980) leading behavioural economist Richard Thaler illustrates framing effects in a consumer environment. Credit card companies lobbied the United States Congress to ensure that a new law on credit card charges at store check outs was expressed as a cash *discount* rather than a credit card *surcharge*. Why this difference given that the two situations are equivalent[6]? Thaler argues that the different framing significantly impacts customer attitudes to the charge. People are far happier to forgo a saving (an opportunity cost) than pay a direct charge (an out of pocket expense), a fact appreciated by credit card companies who did not want people discouraged from paying by credit card.

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[6] It will cost more to pay by credit card in both situations.

The failure of decision making due to violations of invariance on account of framing are described by Kahneman and Tversky as disturbing: *"Invariance is normatively essential, intuitively compelling, and psychologically infeasible."* (Kahneman and Tversky, 1984, page 344). As Chapter 4 will describe, the importance of the decision frame, which can also be called the context in which the decision is made, lies in the fact that is leaves the decision maker open to being manipulated by an economic agent who can alter the decision frame and has the motivation to do so.

By the 1980s the behavioural critique had gained significant momentum, showing that, although many of the assumptions of the neoclassical rational choice model were simple and intuitively compelling, they were untenable from a psychological point of view – that is, people simply did not abide by them in real world situations involving economic choices. Suddenly alarming variations from the standard story were uncovered and increasingly validated in experimental and real world settings, including in consumer budgeting (Thaler, 1980, 1985); labour markets (Camerer et al., 1997); consumer goods (Huber et al., 1982; Simonson, 1989); stock market investment (Benartzi and Thaler, 1995; Odean, 1998); betting (McGlothlin, 1956); and insurance (Cicchetti and Dubin, 1994)[7]. Several of these form the basis of this thesis and are explored in greater detail in Chapters 3 and 4.

### 2.3.4   Bounded Rationality and Other Approaches

A natural response to the violations discussed is to reformulate or relax some of the axioms of the original theory and several papers follow this reasoning. Friedman and Sunder (1948) propose that the utility function which arises from the von Neumann and Morgenstern (1944) analysis does not fully account for readily observable human choices. Most particularly they point to the *simultaneous* purchase of both insurance – to protect against the small risk of a significant loss – and lottery tickets – to earn the small chance of a significant gain – as

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[7]   Camerer (2000) presents a useful synopsis and summary of behavioural anomalies in real world choice situations.

being incompatible with their *Behavioral Decision Theory*. These actions imply that individuals cannot have a concave-shaped utility function, as they must to satisfy risk aversion, over all wealth levels. Instead they argue that the utility function must have several turning points, yielding areas of risk aversion *and* risk loving. Markowitz (1952) points out this formulation of the utility function has several significant problems of its own and proposes an alternative shape albeit one which is based on the idea that the utility function might have several turning points. Also Markowitz's function is centred around current wealth[8] [9]. This means abandoning the assumption of *asset integration* which is a key part of the von Neumann and Morgenstern analysis. This observation forms the heart of *Prospect Theory* (Kahneman and Tversky, 1979) which is reviewed in the next section.

Some attention focuses specifically on the independence axiom, the source of many of the violations. Chew and MacCrimmon (1979) introduce *weighted utility theory*. It is axiomatised in Chew (1983). Essentially the theory says that people become more risk-averse as the prospects they are faced with improve[10]. This modification solves the violations of independence reported by Kahneman and Tversky (1979) but represents simply an ad hoc solution to these problems. It is not a comprehensive alternative model based on psychological observation.

Bell (1985) proposes *disappointment theory* as an extension to expected utility theory. It augmented the objective function expressed in Equation 2.2, including a term relating to the prior expected utility of the prospect. If this were to be higher than the evaluated utility then the decision maker would feel disappointment. Individuals are assumed to be disappointment averse, which accords more closely with psychological intuition and is able to explain several of the preference switching violations of the traditional theory.

The most radical changes from neoclassical rational choice models invoke a con-

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[8] This interpretation is drawn from Levy and Levy (2002).
[9] Levy and Levy (2002) present a good analysis of these suggested modifications to the utility function.
[10] This interpretation is drawn from Wilkinson (2008).

cept known as decision weighting. These functions transform objective probabilities (associated with each outcome of the prospect) into subjective decision weights. These decision weighting functions often incorporate non-linear transformations of probabilities and thus give scope for many of the psychological biases observed in the earlier critiques of the basic models. Once such is the *subjective expected value* model of Edwards (1955, 1962).

While such models have intuitive appeal for they explicitly account for the large bulk of evidence reporting that human subjective assessments of probability are subject to significant biases (most notably Tversky and Kahneman, 1974), many allow for violations of dominance which is a significant problem for their status as normative theories. Quiggin (1982) develops a form of these models which solves this problem. His *rank-dependent expected utility theory* uses a decision weighting function, but ensures that it is sophisticated enough to ensure dominance (also known as monotonicity). It does this by specifying that the weighting attached to an outcome depends not only on the objective probability of an event but also its ranking relative to other outcomes in the prospect. These models generally offer a better fit to empirical reality than the expected utility theory. However there remains a significant class of problems which they cannot explain, including the widely reported violations of invariance and transitivity. None of these models have become widely accepted as alternative solutions to the choice problem.

Another approach is adopted by Simon (1957). He emphasises that decision makers can depart quite significantly from the optimal behaviour imposed by the neoclassical model, but that this may simply reflect their own cognitive limitations. He terms this approach *bounded rationality*. It acknowledges that human decision makers have a finite ability to acquire and process information. This may be due to intellect, but might also stem from other quite reasonable constraints such as time. In this framework the individual has limited time to make a decision and so may not devote his entire cognitive energy to making an absolutely optimal decision when a near-optimal one will do in most cases. Rationality is then bounded by limitations of cognitive capacity and conscious necessity.

### 2.3.5 Summary

The neoclassical model came under attack in the years after its formulation from a variety of sources. Early papers represented isolated studies casting doubt on individual axioms of the theory. But these criticisms grew in number and importance as violations of independence, dominance and even transitivity – accepted by most as essential for a normative theory – were seen and validated in experimental and empirical work.

Attempts have been made to relax or reformulate some of the axioms. Simon's model of bounded rationality has become a key defence of neoclassical economists who seek to maintain rational choice theory as a normative model in the face of these criticisms.

The majority of the criticisms have one thing in common: they note the psychological implausibility of the central tenets of the von Neumann-Morgenstern analysis. Friedman's (1953) 'as if' principle is frequently cited as a justification for models which make unrealistic assumptions: providing individuals behave *as if* they were following the axioms then its status as a descriptive model is not compromised. The behavioural critique successfully challenged the descriptive accuracy of the model. By providing further evidence of a choice scenario where decision making may be compromised this thesis aims, among other things, to contribute to that body of literature.

A fortunate aspect of the behavioural critique is that it provides an obvious place to start formulating an alternative model of choice: by looking towards the mental processes underlying the violations observed and formulating more psychologically plausible assumptions on which to build a theory.

## 2.4 Prospect Theory

The central plank around which this paradigm has coalesced is an alternative model of choice. Kahneman and Tversky's *Prospect Theory* was published in

leading journal *Econometrica* in 1979. It has become one of the most influential papers in economics. A recent survey found that it was the second most-frequently cited work in the subject in the last thirty years[11].

As with the burgeoning field of behavioural economics as a whole, the aim of the model they propose is to improve economists' theory of choice. Arguing that the neoclassical rational choice model is based on flawed psychological reasoning about the way human decision processes occur, they aim to use psychological observations to place the theory on a firmer footing. This, they argue, results in a model with greater explanatory power. Importantly Kahneman and Tversky do not propose that their model is normative, merely that it provides an accurate descriptive account of choice. In other words their model makes no claims as to how humans *should* make choice; it recounts simply how they *do* make choice.

The basis of the model is the observation of four regularities in human choice, all at odds with the neoclassical theories of choice and all incorporating aspects of psychology that are not captured by the von Neumann-Morgenstern analysis.

## 2.4.1 Psychological Regularities

The first psychological regularity which forms the backbone of *Prospect Theory* (henceforth, PT) is that outcomes are defined relative to some *reference point* which acts as the zero point on the value scale. In other words, outcomes are all seen as gains and losses to this reference point. This is in contrast to the principle of rational choice theory, which suggests that individuals will consider outcomes in terms of final states integrated with their current wealth position (as in Equation 2.3). The determination of the reference point depends on the context, although it is expected that the current position, or status quo, will naturally form the reference point.

This is not always the case though. Aspirations may come into play, so that

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[11] The most cited paper, according to Kim, Morse and Zingales (2006) is White's "A Heteroskedasticity-Consistent Covariance Matrix and a Direct Test for Heteroskedasticity" *Econometrica* (1980).

if an individual is told they are receiving a pay rise of £5,000 they would be happy, but when they learn that a colleague has got £6,000 this acts the natural reference point. In this situation joy at a gain would quickly turn into anger at a perceived 'loss'. Such a reaction is essentially inadmissible in the plainest reading of rational choice theory[12].

Kahneman and Tversky (1979) suggest that the reason for this regularity is that our perceptual apparatus are more attuned to recording changes than absolute magnitudes. They argue that this is the case for human responses to attributes such as brightness, loudness and temperature. Wilkinson (2008) points out that this regularity is not an innovation of the PT model however. Its history in economic thought lies at least as far back with the work of Markowitz (1952) and Helson (1964).

Reference point effects are a widespread finding in many of the studies of behaviour already discussed, particularly among stock market investors (Shefrin and Statman, 1985; Odean, 1998) and gamblers (McGlothlin, 1956). Odean finds a marked reluctance to sell stock investments in which the investor is currently making a loss compared to those in which the investor is making a gain compared to the purchase price. Investors seem to hang on to their losers and sell their winners to avoid the psychological pain of crystallising a 'loss' from the reference point. This observation is not a direct proof of irrationality however. Such a regularity *could* be the result of individuals' rational belief that the fortunes of their loss-making investments will improve and revert to their mean performance, but if that is the case the beliefs are certainly misplaced: Odean shows that the decisions turn out to be sub-optimal far more frequently than not.

The second regularity, which combines with reference point effects is summarised succinctly by Kahneman and Tversky (1979):

> "*A salient characteristic of attitudes to changes in welfare is that losses loom larger than gains. The aggravation that one experiences*

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[12] Although it clearly accords more closely with *disappointment theory* of Bell (1985).

> *in losing a sum of money appears to be greater than the pleasure associated with gaining the same amount.*"

(Kahneman and Tversky, 1979, page 279).

Kahneman and Tversky dub this finding *loss aversion*. Once again there is no place for this psychological intuition in the von Neumann-Morgenstern theory[13]. However studies have found consistent evidence of it. The findings relating to stock market investments of Shefrin and Statman (1985) and Odean (1998) incorporate elements of both reference point effects and loss aversion. In housing markets too Genesove and Mayer (2001) find evidence that the price paid for a property forms a significant reference point, below which owners are significantly more reluctant to sell[14].

A third aspect vital to the alternative model of choice proposed by Kahneman and Tversky is *diminishing marginal sensitivity*. This suggests that the importance of both gains and losses decreases with their magnitude. From a technical perspective this property is desirable because it ensures that the preference/ value function is concave, as it is in the rational choice theory. In that theory it is known as the *law of diminishing returns*. A discussion on the precise way in which this observation influences the PT value function is deferred until the next section.

A final psychological regularity in the Kahneman and Tversky analysis is *decision weighting*. This aspect has been incorporated into other alternative theories of choice and says, in its broadest form, that humans are not Bayesian probability operators in the manner that the expected utility theory suggests they will be. In this analysis, risky outcomes are multiplied by a decision weight in a manner similar to the weighting of outcomes by their Bayesian probability (whether subjective or objective) in the expectation principle, but that these decision weights

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[13] The previous section discussed changes to the utility function which might accommodate observations such as this, including Friedman and Sunder (1948) and Markowitz (1952). *Prospect Theory* builds on this observation but takes it further by incorporating it into a comprehensive alternative model.

[14] Behavioural aspects of real estate markets will be considered further in Chapter 3.

are not probabilities and are not measures of belief of likelihood.

The decision weighting function is denoted $\pi(p)$. According to Kahneman and Tversky: "*decision weights measures the impact of events on the desirability of prospects, and not merely the perceived likelihood of these events.*" (Kahneman and Tversky, 1979, page 280). If the expectation principle holds then $\pi(p) = p$ but not otherwise. As expected, $\pi$ is an increasing function of $p$, and it is bounded so that $\pi(0) = 0$ and $\pi(1) = 1$ meaning impossible events are ignored and certain events are weighted in full. Otherwise the key properties of the weighting function are below:

1. *The weighting function is a subadditive function of p.* In other words $\pi(rp) > r\pi(p)$ for $0 < r < 1$. This is seen in Problem 4 (Section 2.3.2). In that problem $(6,000, 0.001)$ is preferred to $(3,000, 0.002)$. Hence:

$$\frac{\pi(0.001)}{\pi(0.002)} > \frac{v(3,000)}{v(6,000)} > \frac{1}{2}$$

where $v(\cdot)$ is a value function. The relation is maintained by the concavity of $v$ which is guaranteed by the diminishing marginal sensitivity property. Subadditivity does not necessarily hold for larger values of $p$.

2. *Overweighting of low probabilities.* The following problems illustrate[15]:

**Problem 7**: Choose between winning

**A**:    5,000 with probability 0.001.        **B**:    5 with certainty.

n=72                [72]*                                    [28]

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[15] Reproduced from Kahneman and Tversky (1979), page 281.

**Problem 7\***: Choose between winning

**C:**    -5,000 with probability 0.001.        **D:**    -5 with certainty.

n=72              [17]                                              [83]\*

In Problem 7 people prefer what is in effect a lottery ticket over the expected value of that ticket, whereas in Problem 7\* they prefer a small loss, which can been seen as the payment of an insurance premium, over the small probability of a large loss. The preference for the lottery in Problem 7 implies:

$$\pi(0.001)v(5,000) > v(5)$$

hence:

$$\pi(0.001) > \frac{v(5)}{v(5,000)}.$$

Since the concavity of the value function implies that:

$$\frac{v(5)}{v(5,000)} > 0.001$$

we can write:

$$\pi(0.001) > 0.001$$

3. *Subcertainty.* It is suggested for all $0 < p < 1$, $\pi(p) + \pi(1-p) < 1$. This property can be seen from the Allais-type violations. Thus the slope of $\pi$ in the interval $(0,1)$ can be viewed as a measure of the sensitivity of preferences to changes in probability. Subcertainty ensures that $\pi$ is regressive with respect to $p$, in other words preferences are generally less sensitive to changes in probability than the expectation principle would suggest.

4. *Subproportionality.* This property is implied by the violations of the substitution axiom. These violations conform to the rule that if $(x,p) \sim (y,pq)$ then $(x,pr)$ is not preferred to $(y,pqr)$ for $0 < p,q,r \leq 1$. If this is applied

49

to a value function, $v(\cdot)$:

$$\pi(p)v(x) \sim \pi(pq)v(y)$$

implies:

$$\pi(pr)v(x) \leq \pi(pqr)v(y);$$

hence:

$$\frac{\pi(pq)}{\pi(p)} \leq \frac{\pi(pqr)}{\pi(pr)}$$

This means that for a fixed ratio of probabilities the ratio of corresponding decision weights is closer to 1 with low probabilities than with higher probabilities.

A weighting function which satisfies these properties is illustrated in Figure 2.2 in the next section (page 54).

There is a significant amount of evidence that humans are bad at probability judgements. These are most comprehensively discussed in Tversky and Kahneman (1974) which shows that individuals frequently use rules of thumb to help them make probability judgements. These are often biased by such factors as the ease with which events can be recalled, or the extent to which the assessment matches pre-existing probability estimations. As a result judgement is seriously compromised. But beyond that there is evidence pointing towards the properties of the weighting function that Tversky and Kahneman suggest including Tversky and Kahneman (1992) and Kachelmeier and Shehata (1992). Prelec (1998) also discusses the nature of the decision weighting function extensively.

Having put these regularities in mind, we can proceed towards Kahneman and Tversky's full model of choice under uncertainty.

## 2.4.2   Formal Model

*Prospect Theory* distinguishes two phases of the decision making process: an initial phase known as *editing* which consists of an initial analysis of the offered prospects and often includes simplifications of them; and a second phase of *evaluation* in which the prospects are evaluated and the one offering the highest value is chosen. In this latter sense Kahneman and Tversky's conception of choice is of an optimisation exercise that is similar to von Neumann and Morgenstern's, only using a starkly different method for doing so. The editing phase is also vital since it is not expected to be independent of the frame or method of presentation of the prospects. This means that the invariance assumption is likely to be violated consistently, as well as suggesting that the order in which prospects are considered is likely to be important. In the choice scenarios that are the focus of this thesis, the presentation frame makes the editing phase especially critical, so a discussion of the nature and importance of it is left until the next section.

All prospects are gambles of the form $(x, p; y, q)$ which pay $x$ with probability $p$ and $y$ with probability $q$. If $q = 0$ then that outcome is omitted. Following the editing phase, as mentioned above, the decision maker evaluates the prospects and is assumed to select the prospect with the highest value.

The overall value of an edited prospect, denoted $V$, is expressed in terms of two scales $\pi$ and $v$. The former associates with each probability, $p$, a decision weight, $\pi(p)$, which reflects the impact of $p$ on the overall value of the prospect. The latter scale, $v$, is a value function, assigning to each outcome, $x$, a number, $v(x)$, which reflects the subjective value of the outcome. All outcomes are defined relative to the reference point, which serves as the zero value of the scale. Thus, $v$ measures the value of deviations from the reference point (gains and losses).

The basic version of the theory includes simple prospects with a maximum of two non-zero outcomes. In the prospect above one receives $x$ with a probability of $p$, $y$ with a probability $q$, and 0 with a probability $1 - p - q$, where $p + q \leq 1$. An offered prospect is said to be strictly positive if its outcomes are all positive,

ie. if $x, y > 0$ and $p + q = 1$; it is strictly negative if its outcomes are all negative. Any prospect not satisfying these restrictions is regular.

Kahneman and Tversky (1979) form the basic equation of the theory which describes the manner in which $p$ and $v$ are combined to determine the overall value of a regular prospect. If $(x, p; y, q)$ is a regular prospect such that either $p + q < 1$, or $x \geq 0 \geq y$, or $x \leq 0 \leq y$, then:

$$V(x, p; y, q) = \pi(p)v(x) + \pi(q)v(y) \qquad (2.4)$$

where $v(0) = 0$, $\pi(0) = 0$ and $\pi(1) = 1$[16].

For strictly positive or negative prospects the rule is slightly different. For these types of prospects, in the editing phase there is segregation into two components: the riskless gain or loss which is certain to be obtained; and the risky component which is dependent on the outcome of the gamble. The evaluation of these prospects is as follows. If $p + q = 1$ and either $x > y > 0$ or $x < y < 0$, then:

$$V(x, p; y, q) = v(y) + \pi(p)[v(x) - v(y)] \qquad (2.5)$$

So the value of a strictly positive or negative prospect equals the value of the riskless component plus the value-difference between the two outcomes multiplied by the decision weight associated with the more extreme outcome[17]. Thus the critical feature of Equation 2.5 is that the decision weight is not applied to the certain component, $y$.

The value function incorporates several of the features discussed in the previous section. These include that the carriers of wealth are changes in wealth rather than final states; that gain and loss functions display diminishing sensitivity; and

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[16] See the Appendix of Kahneman and Tversky (1979) for an axiomatic analysis of the theory including the conditions needed to ensure the existence of a unique $\pi$ and a ratio-scale $v$ satisfying Equation 2.4.

[17] This equation has echoes in the *Capital Asset Pricing Model* of Sharpe (1964). There is no evidence that Kahneman and Tversky intended the link however, especially given the particular features of the functions $v(\cdot)$ and $\pi(\cdot)$ which have already been discussed.
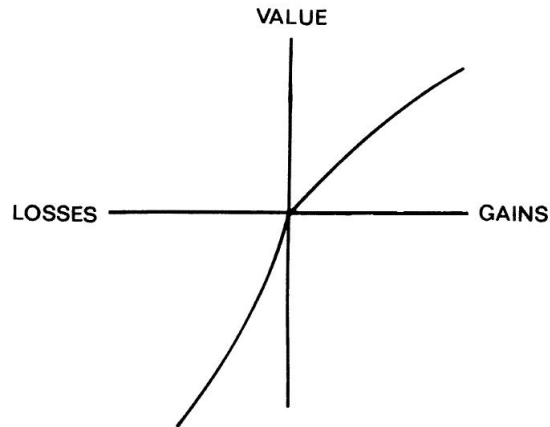
**Figure 2.1:** The value function. Source: Kahneman and Tversky (1979), page 279.

that losses loom larger than gains so that the pain associated with losing an amount of money is greater than the pleasure associated with winning an equal amount. The result is an S-shaped function which depicted in Figure 2.1.

The key characteristics are clear: the function is defined relative to the reference point and is kinked around it to reflect that. Losses are worse than gains of corresponding magnitude by the fact that the function is steeper for losses than gains. The diminishing sensitivity property is seen by the concavity of the function in the region of gains and convexity in the region of losses. As a result there will be risk aversion in the domain of gains, and risk seeking in the domain of losses (an observation evident in the stock market behaviour reported earlier in this chapter).

The weighting function has been discussed in the previous section and is reported in Figure 2.2. It is relatively shallow in the middle and changes abruptly near the end-points. It has discontinuities, especially at very low probabilities indicating that there is a limit to how small a decision weight can be attached to an event (otherwise it is disregarded).

Equations 2.4 and 2.5 show that the attitude towards a risky prospect is not
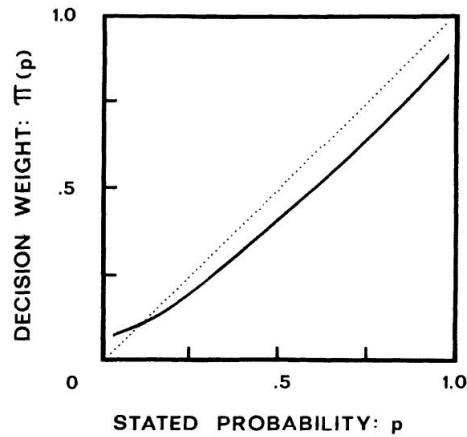
**Figure 2.2:** Decision weighting function. Source: Kahneman and Tversky (1979), page 283.

solely determined by the utility function, but by the combination of $v$ and $\pi$. It is possible to analyse when risk seeking and risk aversion is expected to occur using this functional form. Kahneman and Tversky illustrate with the choice between the gamble $(x, p)$ and its expected value $(px)$. If we are in the domain of gains (ie. $x > 0$) risk seeking is implied whenever $\pi(p) > v(px)/v(x)$ which is greater than $p$ if the value function for gains is concave. Hence overweighting $(\pi(p) > p)$ is a necessary but not sufficient condition for risk seeking in the domain of gains, contrary to what is usually seen. The opposite is true for losses (ie. when $x \leq 0$). This means that risk seeking for gains and risk aversion for losses is expected to occur only at small probabilities where the overweighting condition is expected to hold. It is the overweighting of small probabilities that favours both gambling and insurance, whereas the S-shaped value function acts against both types of behaviour. These are the typical conditions under which lottery tickets and insurance policies are sold, behaviour contrary to the expected utility model.

Responding to criticisms of the initial form of the model, particularly with respect to the decision weighting function, an updated version of the theory was developed and is reported in Tversky and Kahneman (1992). Known as *Cumulative*

*Prospect Theory* it modifies the decision-weighting function to ensure that certain properties, such as dominance, are assured[18]. But the underlying psychological observations have remained unmodified in the 30 years hence.

## 2.4.3   The Importance of the Editing Phase

Kahneman and Tversky reserve some of their discussion for an analysis of the editing phase of the theory. To summarise again: in this part of the decision process it is argued that prospects are considered in their initial form and perhaps simplified before evaluation. These operations can have an important impact on the ultimate decision if choice frames are manipulated to exploit the way prospects are perceived in this phase. Searching for property – particularly online as discussed in Chapter 4 – involves significant amounts of 'Kahneman and Tversky editing': making quick judgements based on salient characteristics, discarding certain prospects (properties) and so on. Thus editing is likely to be an important part of the behavioural manipulation strategies that are the focus of this thesis.

Kahneman and Tversky (1979) consider six operations that may be part of the editing phase. These are considered below.

1. *Coding.* In this operation the prospects are assumed to be categorised into 'gain' or 'loss' according to the psychological regularity discussed earlier in relation to reference points.

2. *Combination.* Here prospects can be simplified by combining probabilities associated with identical outcomes, for example the prospect $(50, 0.2; 50, 0.3)$ will be reduced to $(50, 0.5)$ and evaluated in this form.

3. *Segregation.* Some prospects contain riskless elements which are segregated from the risky components and evaluated separately. For example, the prospect $(200, 0.60; 300, 0.2)$ is more naturally separated into a sure gain of 200 and the prospect $(100, 0.2)$ and evaluated as such.

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[18] In the 1979 version of the model this is not guaranteed, something that is widely regarded as unacceptable in a theory of choice.

4. *Cancellation.* This operation was described earlier in respect of reported violations of the independence axiom. If prospects share certain identical components these may be discarded or ignored. The following problems, reported in the 1979 paper, illustrate:

**Problem 8**: Choose between winning

**A**:    4,000 with probability 0.20.    **B**:    3,000 with probability 0.25.

n=95                [65]*                                    [35]

**Problem 9**: Consider the following two stage game. In the first stage there is a probability of 0.75 to end the game without winning anything, and a probability of 0.25 to move into the second stage. If you reach the second stage you have a choice between:

**C**:    4,000 with probability 0.80.    **D**:    3,000 with certainty.

n=141            [12]                                    [78]*

In Problem 9 the decision maker has a choice between a $0.25 \times 0.80 = 0.20$ chance to win 4,000 and a $0.25 \times 1.0 = 0.25$ chance to win 3,000. So in terms of final states Problems 8 and 9 are identical. Yet the majority choice is different in the two problems. Kahneman and Tversky say that the reason for this violation of invariance is that when faced with Problem 9 individuals ignore (cognitively 'cancel') stage one of the game *because it is common to both prospects*. They also term this an *isolation effect* because stage two is isolated from stage one in the decision maker's mind.

This pair of problems demonstrates clearly how an operation in the editing phase can have an important – and non-rational – impact on the decision maker.

5. *Simplification.* This operation is on some levels a description of the entire editing process. But it also refers to certain rounding operations associated with outcomes and probabilities. For example the prospect $(199, 0.51)$ is likely to be coded as an even chance to win 200. Or extremely unlikely events may be discarded. This contributes to Allais-type violations, among other things.

6. *Detection of Dominance.* In this operation the prospects are scanned to detect dominated options, which are discarded without further evaluation.

The editing phase is not expected to be independent of the presentation frame of the decision, or the order in which editing operations occur, so they have the potential to exert a powerful influence on ultimate choices.

Moreover, as discussed above, for certain choices this element of the process is propelled to the fore. In particular, where there are many choices one could expect that the initial phase of simplifying and narrowing down the options to engage this function heavily. Chapter 1 discussed the housing choice scenario that is the basis of this thesis, one which, while vital for overall welfare and hence a choice over which considerable deliberation is made, nonetheless involves a great deal of simplification. There may be hundreds of options which must be narrowed down to make the choice process feasible[19]. Important simplifications in the editing phase seem inevitable. For example a house may be labelled according to just a few salient characteristics, such as "big garden" or "good period features" or it may be discarded because it does not have a certain feature (eg. "no parking space"). All this before the options are evaluated.

Adding to this, Chapter 5 discusses the methodology for completing the experiments and reports how one of the studies incorporates a design which replicates a choice frame that has grown explosively in the last 10 years: online. Estate agents and others marketing houses have embraced the online forum for this

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[19] Note that at this stage no assumption on the form of the utility optimisation that is part of the choice itself is strictly necessary. It could be an optimisation in the spirit of the von Neumann-Morgenstern model, or incorporate elements of Kahneman and Tversky's behavioural theory.

choice perhaps more than any other, with the leading websites boasting property listings in the millions in the UK alone, and billions of individual page views. The way online listings are set up provides a more natural role for *editing* in the Kahneman and Tversky sense than ever before. It is easy to imagine that where housing choice begins with an online search, initial preferences, which are so powerful in conditioning ultimate choices made, are likely to be powerfully influenced by the initial phase of searching and editing. Although discussed by Kahneman and Tversky in their original analysis, the majority of research into choices that utilises the behavioural paradigm does not attempt to focus explicitly on the editing phase. This thesis provides evidence which fills this gap in a choice scenario where it is expected to be vital.

### 2.4.4   Criticisms

In the years after its publication, *Prospect Theory* became the leading theoretical work in the new field of behavioural economics, in turn influencing vast swathes of the economics discipline. But it has been subject to criticism.

Some of the criticisms relate to the editing phase discussed in the previous section. As Wilkinson (2008) discusses, they are not defined precisely or incorporated in a comprehensive sense into the model. Rather they sit outside the main framework of the model as a collection of decision making operations which may influence decision making in certain situations. This is somewhat unsatisfactory because it makes the model less parsimonious. It is also undesirable from a more technical point of view because one implication of the editing phase is that violations of dominance and transitivity are possible[20]. Quiggin (1982) calls this an undesirable result and other economists have doubted that it is possible to have a model of preference that incorporates such a violation.

To a certain extent this criticism is remedied with the publication of *Cumulative Prospect Theory* (Tversky and Kahneman, 1992) which incorporates aspects

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[20] It is typically regarded as a minimum pre-requisite of all models of choice that they satisfy the basic property that dominated alternatives should never be chosen. The 1979 version of *Prospect Theory* does not guarantee this.

of editing into the main model, ensuring in particular that violations of dominance are not possible.

Technical criticism also comes from Levy and Levy (2002) who dispute the accuracy of the S-shaped value function. Instead they argue that a reverse S-shape, as originally proposed by Markowitz (1952) is more applicable in most situations involving *mixed* prospects, that is, prospects with both positive and negative outcomes. This interpretation is disputed by Wakker (2003) though, who counters that the Levy and Levy interpretation is incorrect because it entirely neglects the *weighting function*, the second key pillar of PT. In respect of the weighting function Prelec (1998) offers some criticism and proposed modification of its functional form, though does not dispute the underlying rationale of the theory.

Section 2.3.4 (page 41) discussed that one response to the behavioural critique and the behavioural regularities observed in experimental data is to reformulate aspects of the rational choice theory to render the alternative model unnecessary. Altering the shape of the utility function, as Markowitz (1952) does, or relaxing specific axioms, such as independence in Chew and MacCrimmon (1979) are partial fixes for the problems uncovered in the theory. However no reformulation of the original theory has managed to fully repair the breach caused by Kahneman and Tversky's fundamental observation: that the process of decision making which is implied by the axioms of rational choice are not *psychologically plausible*.

Another line of criticism is to limit the scope of the violations of rational choice. For example there is some evidence that individuals do make improved – by which we mean more rational – decisions when they are more experienced at making a particular decision (List, 2003, 2004). Furthermore the *bounded rationality* approach of Simon (1957) acknowledges that individuals will not always make strictly rational decisions, but says that this is driven not by a fundamental flaw in the rational choice model. Rather, the time and effort spent making a rational choice will be conditioned by the importance of the decision. For minor decisions, such as buying household items like food, the observation of judgemental errors should not therefore be regarded as particularly significant. This approach

argues that where the choice is important the decision maker will take the time and effort to make a good (rational) choice.

This criticism naturally extends to the methodology used to uncover many of the purported biases in choice. Much of the initial research work, in particular that by Kahneman and Tversky (1979), is based on experimental choice data with low stakes and arguably unimportant decisions. Chapter 5 discusses these criticisms of experimental techniques in economics. Here it should suffice to say that experimental economics is today a widely accepted methodology for which one of the founders, Vernon Smith, earned a Nobel Prize. Moreover there is a considerable body of *empirical* evidence which also points to consistent violations of rational choice (for example McGlothlin, 1956; Thaler, 1980; Camerer et al., 1997; Odean, 1998). Also, as discussed in Chapter 1, this criticism provides a natural motivation for the research in this thesis because buying a house is among the most important ever made by an individual. If there is one situation where an individual should take time and effort to make a rational choice it is this.

An important criticism of the theory and of the behavioural paradigm in general is its non-normative status. The neoclassical rational choice theory prescribed a method of choice that would maximise individual utility. In other words it prescribed the way individuals should make choices. In contrast to *Behavioral Decision Theory*, PT attempts only to provide a descriptive account of choice. It offers no norms of behaviour that individuals should follow.

This criticism can be addressed in two distinct, but related, ways. Earlier in this chapter it was argued that economists generally see their discipline as being scientific in the sense that its aim is to formulate theories to explain naturally occurring phenomena and use evidence to confirm or reject them, with a view to developing more accurate theories. Thus it seems odd to reject a model which can offer better predictions because it does not have certain normatively appealing characteristics, as Starmer (2000) suggests:

> "*There should be no prior supposition that the best models will be the ones based on the principles of rational choice, no matter how*

*appealing those may seem from a normative point of view."*

(Starmer, 2000, page 363).

Whether it offers normative prescriptions or not, the behavioural approach offers a new perspective on choice, and a different way forward in the quest to produce better models. This alone makes it a worthy area of inquiry.

Moreover, even if this criticism of PT is accepted, it may be irrelevant in respect of the purpose of this thesis: to investigate the extent to which, and by what means, housing choice can be manipulated in non-rational ways by a willing economic agent. In this sense the behavioural approach offers a method of analysis for the problem, with the different insights into human decision making informing the models of choice manipulation used.

Camerer and Loewenstein (2004) agree, saying that behavioural economics is a collection of tools and ideas. They suggest that the field should be conceived of as a power drill: using a wide variety of drill bits to perform different jobs. While such an approach does reduce its parsimony, it is clear that generality is the beneficiary.

### 2.4.5   Summary

Kahneman and Tversky's *Prospect Theory* is intended to be an alternative descriptive account of human decision making. It aims to put choice theory on a firmer footing by using more psychologically plausible assumptions on which to build the theory. Four principle psychological regularities form this foundation: reference points, loss aversion, diminishing marginal sensitivity and decision weighting. Kahneman and Tversky were not the first to use any of these insights, but they were the first to place them together in a unified theory that could be a better predictor of behaviour than the neoclassical model based around the von Neumann and Morgenstern analysis.

The theory has become one of the most influential papers of the past 30 years in

economics and sits, with its successor *Cumulative Prospect Theory* (Tversky and Kahneman, 1992), at the heart of the paradigm of behavioural economics.

This alternative paradigm has so far tended to steer clear of normative prescriptions. Although this has resulted in some criticism, it does not blunt its usefulness as a method of analysis for the phenomena that are the focus of this thesis: choice manipulation in housing choice scenarios.

## 2.5   Conclusion

Having a satisfactory model of choice is important because making choices goes to the heart of the economic problem: how to get the most utility from our unlimited desires but with scarce resources. Understanding how to make good choices is, therefore, vital in securing human happiness. It is also important for policy making, for if we are to make good policies it is critical that we know how individuals are likely to alter their behaviour in reaction to them. It is for this reason that formulating and improving our models of choice has pre-occupied microeconomists for the best part of the 20th century and there is evidence that desire, reason and choice were important considerations for our earliest philosophers too.

Having been accepted as the normative solution to the choice problem with its dénouement in von Neumann and Morgenstern (1944), the rational choice model has come under significant pressure. At first the gaps in its applicability and accuracy were seen as little more than isolated paradoxes, but these doubts grew, particularly in research published from the early 1970s (for example Slovic and Lichtenstein, 1971; Tversky and Kahneman, 1974; Grether and Plott, 1979; Kahneman and Tversky, 1979).

Attempts have been made to improve neoclassical models of choice by relaxing and reformulating assumptions (such as Quiggin, 1982; Chew, 1983; Bell, 1985) or by suggesting natural limitations of the theory such as *bounded rationality* (Simon, 1957). However the weaknesses exposed by the behavioural critique – that the underpinnings of rational choice theory are assumptions about behaviour that

are psychologically flawed – set the stage for a re-evaluation of choice theory. Led by Kahneman and Tversky's *Prospect Theory* (1979) a new paradigm in choice theory was opened. It is a process that continues so that in its simplest form, as discussed in Chapter 1, the primary motivation for this thesis is to provide further evidence to this end: understand decision making in an important area of decision making to contribute to improved models of choice.

However in a more specific sense the motivation behind this thesis lies in the insights the behavioural paradigm explored in this chapter can give us into our field of interest. Even if it is accepted that the rational choice model is the normative solution to choice and that it does provide an adequate description of choice behaviour in the majority of cases, it is clear that there are significant areas where decision making falls short of the standard required. Whatever the underlying cause, it is clear that lapses of judgement are possible and even likely in certain situations. Thus, in the very least, it is important to explore when, and in what situations, we are vulnerable to these lapses *and* the situations when others might look the exploit this weakness.

As will be seen in Chapter 3, some areas of consumer decision making have been subject to behavioural analysis and many important results already achieved. This thesis will, in first instance, build upon these results. But, as discussed in Chapter 1, among consumer choices, house purchase stands out as among the most significant. Yet that research which does look at decision making in this area rarely uses behavioural insights. Significant advances in our understanding of the dynamics of housing markets are possible using this perspective.

The thesis proceeds as follows. Chapter 3 will review the research that has been undertaken in both real estate markets and consumer choice theory. Chapter 4 considers the ways in which choice and judgement may be vulnerable to manipulation and consider why it may be in the estate agent's interest to do so. It makes several hypotheses in this regard. Chapter 5 concludes Part II by exploring the methodology that will be employed to investigate the hypotheses before the results are reported in Part III and conclusions drawn in Part IV.

# Part II

# Chapter 3

# Review of the Literature

This chapter surveys two literatures which form the background to the work in this thesis. First it considers the varied research which has examined behaviour in real estate scenarios. It finds that, although a behavioural perspective has been used in some studies of real estate markets, such as professional valuation, our understanding of the microeconomics of housing choices would benefit greatly from a behavioural perspective. In particular there is scope for a new focus on the role of an agent capable of manipulating preference construction and so influencing choice. Secondly it considers the studies into consumer decision making which have highlighted the precise ways in which choices can be manipulated in non-rational ways. These can be thought of under three headings: biases arising from choice set manipulation; biases due to option viewing order; and biases in value judgements.

## 3.1 Introduction

In the years since its publication in 1944, many papers have shown that human decision making and choice can fall well short of the standard required in the *Behavioral Decision Theory* of von Neumann and Morgenstern (1944). But just how important are these failings? This question is the subject of significant con-

troversy that has gone to the heart of microeconomics, for the doubt its answer may cast on the normative theory of rational choice.

It has certainly had a spectacular impact on the theoretical underpinnings of the field. Chapter 2 considered the theory of choice and its evolution from these neoclassical foundations, which claimed to offer a normative solution to the choice problem, to the behavioural insights of the 1970s and the dramatic re-thinking of our concept of rationality. In the very least it is clear that limitations in information processing and short term memory (Newell and Simon, 1972; Simon, 1978) can lead to systematic errors of judgement which must be termed 'irrational' under the neoclassical formulation. The work of behavioural economists has taken the theory a great deal further, most particularly showing how the use of cognitive short-cuts, or heuristics, can lead to systematic errors of judgement (Tversky and Kahneman, 1974; Slovic and Lichtenstein, 1971).

The work contained in this thesis will make a contribution to the theory of choice directly, but it has a further source of motivation. The general aim, expressed in Chapter 1, is to consider the extent to which, and by what means, housing choice can be manipulated in non-rational ways by a willing economic agent. In this sense, the evolving field of behavioural economics offers a new perspective to consider housing choice and the dynamics of housing markets.

There is a varied body of research which considers behaviour in real estate scenarios. It is considered in the next section of this chapter. The existing research that could be included under the heading of "behaviour and real estate" has tended to fall into two camps. Firstly there is research examining behavioural anomalies in a real estate context, particularly in value judgements. However this typically focuses on commercial real estate or the decisions of professional valuers and agents. Secondly there is a literature considering the microeconomic dynamics of *housing* markets which has gone beyond neoclassical approaches. However it does not employ a behavioural approach in the sense now recognised by economists and largely ignores the role of market participants in producing

outcomes by manipulating decision making[1]. Our understanding of the microeconomics of housing choices would benefit greatly from this behavioural perspective.

The second part of this literature review, which begins in Section 3.2, considers the studies into consumer decision making which have highlighted the precise ways in which choices can be manipulated in non-rational ways. Prior research has considered both the psychological aspects which contribute to judgemental errors and more specifically how and when manipulations in choice can occur. These are best considered using three headings, as in the following sections in this literature review.

Firstly there are biases arising from manipulating choice sets, that is, the options seen by decision makers. The independence assumption of rational choice theory ensures that the choice between two options cannot be affected by the presence, or lack thereof, of other options. This also implies that the context, also known as the *decision frame* (Tversky and Kahneman, 1981), is not important in determining choice. However there is significant evidence contradicting this theoretical proposition which suggests how decision frames may be used reliably to influence choice.

Another way in which decision making can be manipulated is through the order in which options are viewed. As previously discussed, traditional rational choice models do not admit this part of the decision frame to influence decision making, but, through a psychological process known as *anchoring* (Tversky and Kahneman, 1974), there is some evidence that viewing order is important in determining choice patterns. This is potentially an important finding in the context of housing choice because here options are naturally viewed in a sequential way.

Finally we consider biases in value judgements. Given the importance of house purchase from a personal finance perspective, judging value correctly is likely to be vital and the consequences of errors significant. Yet a review of the literature

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[1] An exception is the literature on *redlining* by credit bodies (such as Munnell et al., 1996; Jones and Maclennan, 1987). Also, Pearce (1979) considers racial steering by estate agents.

suggests that psychological processes underlying numerical judgement can be seriously flawed and open to manipulation.

As Chapter 1 made clear, by presenting evidence of non-rational decision making in a new, and arguably more important, scenario than has been done before, this thesis makes a contribution to the economic theory of choice. But, perhaps most importantly, the research offers a clear path to deepening our understanding of how housing choices come to be made, and therefore to the dynamics of housing markets themselves. The review that follows establishes this as a powerful motivation for the work at hand.

## 3.2   Real Estate, Housing and Behaviour

As was argued in Chapter 1, real estate and housing are a vital part of our modern economy. For consumers, house purchase decisions are among the most important for personal finance and individual happiness made during a lifetime. Thus it is an important area for economic research. The insights of the field of behavioural economics have not gone unnoticed by academics interested in the field of real estate economics. A significant body of behavioural research exists in the real estate context, although the majority focuses on valuation by 'experts' in a commercial setting. It is considered in the next sub-section.

Providing further understanding of the microeconomic dynamics of housing markets is a significant concern of the real estate literature. The implications of this understanding are useful for consumers, practitioners and policy makers. It forms one of the motivations for the work in this thesis. Current research is examined in Section 3.2.2. The literature in this area does not, however, typically use a behavioural approach in the spirit of the literature covered in Chapter 2, ie. considering deviations from rational action due to psychological regularities; and little focuses on the role of estate agents in manipulating decision making.

A reading of these two strands of literature presents a clear opportunity for research to consider the dynamics of housing markets using the insights of be-

havioural economics. Can the manipulation of non-rational aspects of behaviour by estate agents have a significant role in explaining individuals' choices and therefore housing market outcomes?

## 3.2.1 Behaviour and Real Estate

The literature which considers behavioural anomalies in real estate can be broken up into three areas: modelling the valuation process; biases in valuation; and the role of feedback.

Diaz (1990) is among the first studies to document the behavioural processes that take place during real estate appraisals. Studying the behaviour of 12 experts conducting a hypothetical appraisal case, he concludes that experts deviate significantly from the prescribed appraisal process. This is the case in both familiar and unfamiliar settings. This finding is confirmed in a more in-depth paper studying residential valuation behaviour in three countries (Diaz, Gallimore and Levy, 2002). Gallimore and Wolverton (1997) conclude that price knowledge causes distortion in valuation behaviour, reflected both in the choice of less than "best" comparables and in the actual value estimate.

The finding that experts use non-normative cues as part of their valuation process leads to the possibility of systematic biases in valuation behaviour. Citing the foundational work of Tversky and Kahneman (1974) and Slovic and Lichtenstein (1971), much of the work seeks to examine whether anchoring and reference point-type effects are commonly present. Gallimore (1994) uses a large sample questionnaire to uncover evidence of an anchoring effect. Respondents were asked what they thought was the typical percentage variability of property prices, either side of the average price. Manipulating the suggested point above or below which variability was estimated to occur was a reliable way to influence responses.

Several studies examine the types of reference points or anchors which might bias appraisal valuations. Diaz and Hansz (1997) and Diaz (1997) ask whether valuers are influenced by previous expert judgemental in their own appraisals.

Such effects are significant compared with control groups who received no such cues, although only in areas of geographic unfamiliarity to the participants. In a follow up study, Diaz and Hansz (2001) conclude that, among experts in unfamiliar locations, there are a variety of reference point effects. In order of significance these are: the uncompleted contract price of a comparable property; the uncompleted contract price of the subject property; and the value opinion of other experts.

Feedback may be an important part of the appraisal process, and another source of behavioural bias. Survey evidence points towards a belief among respondents that feedback is a significant conditioning factor in both appraisal goals (Wolverton and Gallimore, 1999) and final estimates (Levy and Schuck, 1999). Hansz and Diaz (2001) examine the issue experimentally, finding an important asymmetry in responses to feedback, finding clear evidence of an upwards-only bias in valuations in response to feedback. Havard reports conflicting evidence of a similar phenomenon among student volunteers (Havard, 1999, 2001). Returning to the issue of negotiation, Diaz, Zhao and Black (1999) find that the use of contingent rewards, a form a feedback, does reduce anchoring biases.

More recently the *Journal of Property Research* has devoted a special edition to the issue of behavioural real estate research[2]. In it guest editor, Julian Diaz, notes the growing importance of behavioural research in real estate economics (Diaz, 2010). Sah, Gallimore and Sherwood Clements (2010) offer further evidence on the impact of experience on real estate valuation processes. Similarly Levy and Frethey-Bentham (2010) find that perceptions of probable sale prices of houses can be influenced by the experience in property of the decision maker, although their subjects were all students who were not incentivised. They also find that manipulation of the context in which the decision is made, namely by altering the comparable properties shown to participants, has an effect on decision making. Jin and Gallimore (2010) also focus on the effect of choice frames on perception in the real estate market, finding that they were able to influence perceptions of even sophisticated market participants. Finally, illustrating the

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[2]  *Journal of Property Research*, volume 27, issue 3, September 2010.

wide applicability of behavioural research, in the same issue Gibler and Taltavull (2010) use a behavioural perspective to examine how preferences for retiree housing segments markets, based on a survey of the retirement housing market in Alicante, Spain.

A small group of papers focus more explicitly on behavioural anomalies in real estate by *consumers*. Northcraft and Neale (1987) examine judgemental bias among non-experts who were given the opportunity to visit the property before estimating its fair market value in an attempt to recreate the information-rich, real world environment in which decisions are commonly taken. Knowledge of the list price of the property proved a reliable anchor in final estimates, although participants were not incentivised for accurate judgement.

Simonsohn and Loewenstein (2006) hypothesise that when making decisions over how much to spend on housing, households are prone to draw upon salient cues to help them. This occurs even though in many cases these cues have no obvious information content. Simonsohn and Loewenstein argue that this mechanism is important in housing choices because people experience significant uncertainty over how much to spend, in particular when they move to a new location. Furthermore, they do not have much opportunity to learn from experience. They hypothesise that when households move from more expensive locations they tend to spend more in their destination city, *ceteris paribus*, because previously they were exposed to high prices. They expect a similar trend for households moving from cheap to expensive locations.

Using a sample of 928 household moves drawn from the Panel Study of Income Dynamics they confirm their hypothesis. In other words, households moving from an expensive city to a cheaper one initially spend more on housing than would be expected of a similar household and vice versa. Such effects are not explained by wealth or taxes or imperfect information.

Behavioural anomalies in seller behaviour are examined by Genesove and Mayer (2001). They note several puzzling features in the residential housing markets,

including a strong positive correlation between prices and sales volume and a negative correlation between prices and time on the market. In good times houses seem to sell quickly at, or above, asking prices. In a downturn however, houses stay on the market for long periods with asking prices set well above the prevailing market price. The obvious implication, as Genesove and Mayer point out, is that sellers' reservation prices may be less downwardly flexible than buyers' offers.

They propose a model in which *loss aversion* (Kahneman and Tversky, 1979) helps to explain sellers' choice of list price and whether to accept an offer or not[3]. When house prices fall after a boom period, many homes have a value below the price the current owner paid (ie. they are facing a 'paper' loss). Owners who are averse to these losses are incentivised to attenuate that loss by setting a reservation price that exceeds the one they would have set in the absence of a loss, so set a higher asking price, spend longer on the market, and receive a higher transaction price when the property does sell.

Using data from the downtown Boston apartment market in the 1990s, they find significant evidence in support of nominal loss aversion explaining seller behaviour. Both owner-occupiers and investor-owners are susceptible to loss aversion, though investor-owners less so. Although liquidity constraints play a role in determining list and selling prices (Genesove and Mayer, 1997) these appear much less important than loss aversion.

## 3.2.2 Housing Market Dynamics

The dynamics of housing markets are a significant concern for researchers and policy makers (for example Aoki et al., 2001; Barker, 2004)[4]. Areas of particular interest include: inequalities in housing accessibility and affordability (Bramley and Karley, 2005; Havard, 2001); the wealth implications of uneven house price appreciation (Smith, 2005; Thomas and Dorling, 2004); and the transmission of mortgage market dynamics into the macro economy (Attanasio et al., 2006;

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[3] See Chapter 2 for an explanation of the behavioural phenomenon of loss aversion.
[4] This section of the literature review is drawn from Munro and Smith (2008).

Maxwell, 2005).

These dynamics are traditionally explored with models which have at their heart individual actors who are rational in the normative sense envisioned by von Neumann and Morgenstern. Together this work has been called *urban consumer theory* (Turnbull, 1995). This research ultimately uses utility maximisation arguments which are based on rational decision processes of economic agents. Current work examining housing market dynamics, on topics such as optimal waiting time for sellers (Inaltekin et al., 2009) and structural change (Andrew and Mean, 2003), still frequently employs rational actor arguments to support the analysis.

However, housing market dynamics have not proved entirely amenable to this type of precise analysis. This is partly because of the complexity of the issues involved. It is clear that market dynamics – particularly cycles – are heavily segmented into local markets which have varying degrees of interconnectedness. Adopting a microeconomic perspective and focusing on the heterogeneous nature of individual behaviour is one way to gain greater understanding of the dynamics of housing markets. A strand of urban economics research does adopt this more pluralistic approach. It includes topics such as behavioural aspects of housing supply (Kaiser, 1972); the process of neighbourhood status change (Grigsby, 1963); the role of aspirations (Canter and Thorne, 1972); and discrimination including racial steering (Munnell et al., 1996)[5]. Several papers consider the role of emotions in decisions over housing, including Khoo-Lattimore, Thyne and Robertson (2009), which takes a qualitative approach to motivations for housing decisions; and Levy and Lee (2004) and Levy, Murphy and Lee (2008), which both use the same method to consider housing decisions at a family level. Together, this litertaure suggests that in analysing sub-markets for housing we must go beyond the single-model framework for market clearing and price determination favoured by neoclassical approaches which rely on rational actors.

There are some promising attempts to broaden the theoretical underpinnings of this market dynamics perspective by incorporating aspects of bias or non-

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[5] A good summary of this early literature is Bourne (1976).

rationality. Lin and Vandell (2007) focus on pricing biases due to market illiquidity on a local level. Munro and Smith (2008) shed light on the microstructural nature of the property market of a city through 90 qualitative interviews. They characterise housing markets as "*collective calculating devices*" in which multiple inter-relationships generate pricing outcomes. They argue that "*price is an affective as well as economic affair, whose volatility is... an expression of sociality and emotional intelligence...*" (Munro and Smith, 2008, page 349).

Levitt and Syverson (2008) consider whether estate agents manipulate individuals in their decision over when and at what price to sell their property. They find evidence that supports this assertion. When estate agents sell their *own* homes they sell for significantly higher prices after leaving their property on the market for longer than if selling on behalf of others. In their discussion the source of this bias is the information asymmetries which are important in the seller-agent relationship.

Most promisingly among attempts to consider biases in real estate market dynamics is the attempt to incorporate psychological aspects of human behaviour into the research agenda. In the vanguard of this approach is Robert Shiller (Shiller, 2003, 2005, 2007). He argues that rational expectations models, although elegant and simple, do not capture everything about market dynamics, however much researchers wish they could:

> "*One could easily wish that these models were true descriptions of the world around us, for then it would be a wonderful advance for our profession... Wishful thinking can dominate much of the work of a profession for a decade, but not indefinitely.*"

> (Shiller, 2003, page 84).

In place of models of rational expectations should be a psychological theory which explicitly models housing dynamics (particularly pricing dynamics) in terms of feedback mechanisms or social epidemics. Kishore (2006) also argues that significant insights into property markets can be gained through the use of the

behavioural economics paradigm.

There is significant scope for further work into housing market dynamics to adopt a behavioural approach. This would be complementary to – and in the spirit of – Shiller's work: put to one side the idea that individuals acting in housing markets are always rational and seek to understand the dynamics accordingly. One step along this road is to consider the extent to which it is possible to *induce* non-rational decision making, especially given an economic agent with the ability to do so. This is considered further in Chapter 4.

### 3.2.3 Summary

There are two strands to the literature into housing markets which are of interest here: a body of work which examines behavioural and judgemental biases in professional real estate valuation in the spirit of Chapter 2; and a body which explores housing market dynamics. The latter is a particularly important concern for practitioners and policy makers. However, current research in this area does not, in the main, use a behavioural approach, considering deviations from rational action due to psychological regularities, and little focuses on the role of estate agents in manipulating decision making.

Thus there is a clear opportunity for research to consider the dynamics of housing markets using the insights of behavioural economics. Can individual housing choice be reliably manipulated using non-rational aspects of behaviour and thus play a significant role in housing market outcomes?

The section which follows explores the second body of literature referred to in the introductory paragraphs of this chapter. A large body of experimental and empirical work has studied consumer decision making to highlight the precise ways in which choices can be manipulated in non-rational ways. These three sources of bias will form the basis of the research presented in Part III.

# 3.3 Choice Set Manipulation

The insights of psychologists studying cognitive anomalies in the 1970s were a revelation to economists because they undermined much that was taken as given about human decision processes. Humans were meant to be ruthless utility maximisers, considering all relevant evidence in making choices, and acting at all times in a thoroughly predictable and consistent manner. On the contrary, the work of Tversky, Kahneman and others suggested that humans might be *"wired differently than economic rationality in the sense of the standard model requires"* (McFadden, 1999, page 75). As Chapter 2 reported, suddenly alarming variations from the standard story were uncovered and increasingly validated in experimental and real world settings.

One area where these counter-intuitive results first came to prominence was in studies which showed the possibility of choice set manipulation to affect consumer decisions. The neoclassical view is expressed in the independence axiom considered in Chapter 2, which can be summarised as saying that the preference between two options cannot be altered by the presence, or lack thereof, of alternatives. Preference must be *independent* in this way in the rational choice model because of the way the theory implies that choice occurs, ie. that each option available is evaluated, a 'utility' assigned, then the option with the highest utility among the choice set picked. If it is the case that a decision maker chooses A from a choice set of {A, B} but changes his mind and chooses B when the choice set becomes {A, B, C} then this concept is undermined. However, as already emphasised, restricting *rational* choice to avoid such preference structures seems entirely reasonable. After all, to change one's mind in this way does seem somewhat odd.

In consumer studies, an early model in this spirit is that by Luce (1959) which assumed *proportionality*, that is, when a new offering is added to a choice set it will take market share from others in proportion to their original shares. However this was quickly contradicted by Debreu (1960) and latterly by McFadden (1972). Instead it seemed as though when new products were added to a choice set the

new product took market share most from the choices most similar to it. This is labelled the *similarity hypothesis* by Tversky (1972).

Huber et al. (1982) point out that both proportionality and the latter contradictions make an implicit assumption, which is that the addition of a new option cannot increase the proportion choosing a member of the original set. This they call *regularity*. However their evidence contradicts this assumption: choice patterns could be manipulated in this way. They call this effect *asymmetric dominance*.

### 3.3.1 Asymmetric Dominance

In the simplest case Huber et al. (1982) consider a choice set with two 'core' options, *Competitor* and *Target*. For simplicity these are considered on only two scales of value, allowing them to be represented by a graph as in Figure 3.1. Neither of these two options is dominant over the other – *Competitor* offers more in Dimension 1, but less in Dimension 2 than *Target*. Thus an individual's choice will depend on their relative preference for the two dimensions. However, the addition of a third option can significantly alter the situation. This option, known as *Decoy*, can be added so that it is anywhere within the shaded box in Figure 3.1. This positioning means that *Decoy* is dominated by the *Target* option because it offers less in both dimensions of value; but is not dominated by the *Competitor* option. In this sense the dominance is asymmetric. Furthermore the manipulation is made most effective when *Decoy* is placed so that, as well as being asymmetrically dominated by *Target* alone, it is actually similar to *Target*, ie. it lies within the shaded box, but very close to the option labelled *Target*.

In their experiment 153 student volunteers were asked to pick from choice sets across a range of consumer products such as cars, restaurants, beers and TVs. They found that the effect of adding the asymmetrically dominated alternative was to significantly increase the popularity – measured by participants choosing that option – of the dominant alternative (*Target*) at the expense of the non-dominant original (*Competitor*). Using a variety of different placement strategies,
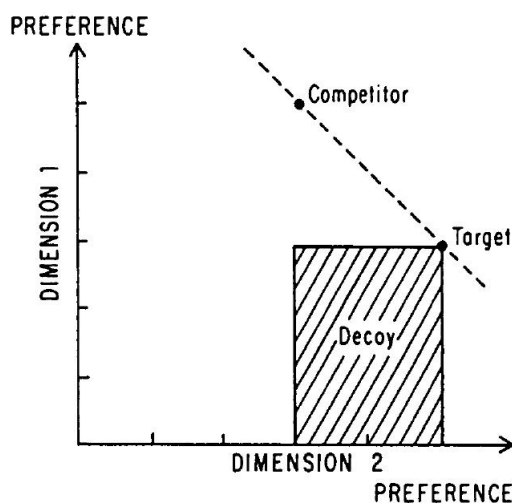
**Figure 3.1:** Asymmetric dominance in consumer choices. Reproduced from Huber et al. (1982).

Huber et al. (1982) show that the magnitude of this effect is an average increase of popularity of over 9%[6].

The regularity implied by both Luce's (1959) proportionality model and Tversky's (1972) similarity hypothesis cannot accommodate this change in preferences. That is, it is irrational to choose *Competitor* when the choice set is {*Competitor, Target*} but choose *Target* when the choice set is expanded to {*Competitor, Target, Decoy*}. Those models predict that the dominated alternative is not chosen by any decision maker – which was confirmed in the study – and thus that its inclusion can have no effect on the relative popularity of the original options. For the dominated alternative to have an effect on the relative proportion choosing between original options is a violation of regularity and the independence axiom of rational choice which underlies it.

Their findings are supported by studies using a range of consumer-based products including: batteries and beer (Huber and Puto, 1983); orange juice, light bulbs,

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[6] In other words if *Target* were chosen 50% of the time from the choice set {*Target, Competitor*} then it would be chosen on average 59% of the time from the choice set {*Target, Competitor, Decoy*}.

BBQ sets and TVs (Ratneshwar et al., 1987); and branded pens (Simonson and Tversky, 1992). More recently it has been confirmed using a real supermarket test of branded baked beans (Doyle et al., 1999) and among couples making joint decisions (Munro and Popov, 2009). A more general discussion of the importance of decoys can be found in (Wedell and Pettibone, 1996).

What is the psychological mechanism that provides for this significant violation of rational choice? An important part of the story is uncertainty. All choice involves uncertainty. In the context of buying decisions there is uncertainty about the true values of certain attributes by which alternatives are considered (a measurement error problem). Additionally, however, a consumer may be uncertain about the weights of the attributes and about their preferences for different combinations of attribute values (Simonson, 1989). In this case the choice set itself can provide the answer to some of this uncertainty in the consumer's mind, acting as a kind of cue to aid decision making when the consumer is not certain of their own preferences. The cost of this psychological mechanism is the kind of regularity illustrated above.

Choosing between *Target* and *Competitor* is difficult because they are quite different in both attributes of value. The addition of *Decoy* changes the situation. Now the choice set contains two options which are similar to each other (*Target* and *Decoy*). Thus they are easier to compare and contrast with each other in a pairwise way. *Target* will, by design, offer more in both dimensions of value and so emerge 'victorious' from the comparison. The positive perception of *Target* as a result has an important impact when the decision maker then considers between *Target* and *Competitor*. This impact, which has been called the *halo effect* in this stand of the literature (Nisbett and Wilson, 1977), ensures that *Target's* popularity is greater than when it was considered alone.

A similar analysis comes from Simonson (1989). He argues that in situations of uncertainty, particularly where the uncertainty is in respect of our own preferences for attribute weightings, consumers appear to make decisions according to a psychological mechanism where they look for available reasons or justifica-

tions *against* each alternative. Thus in a situation where decision makers find it difficult to assess which alternative would provide them with the highest utility, they tend to make a choice which is supported by the best overall reasons. In the current situation, this interpretation says that the addition of *Decoy* changes the perception of *Target* because it manipulates the context in which that perception is constructed allowing a cognitively easier way of justifying choosing *Target*. Simonson's study finds even greater evidence of asymmetric dominance effects when decision makers know they are going to be made to justify their decision afterwards, which he concludes is further evidence of this psychological mechanism.

Simonson and Tversky (1992) hypothesise that asymmetric dominance is part of a wider phenomenon of choice in context which they call *trade-off contrast*. This states that the tendency to prefer an alternative is enhanced, or hindered, depending on whether the trade-offs within the set are favourable or unfavourable to that option. This is an extension to pure asymmetric dominance because it suggests that the addition of a decoy to the analysis in Figure 3.1 to the lower right of the current shaded area will also increase the attractiveness of the target, even though the decoy option is not strictly dominated. This perception change is affected by making *Target* the centre of two trade-offs – that between *Competitor* and *Target* and that between *Target* and *Decoy*. The rate at which the attributes must be traded off is more advantageous to *Target* in the first comparison than the second; and in the second the option *Decoy* is not attractive to most. Thus the presence of *Decoy* serves only to enhance *Target* in the 'main' comparison between *Target* and *Competitor*. Using experiments in which the subject was the choice over types of camera and computer memory, they find strong evidence in support of their ideas.

The implication of this research is clear, as stated in Huber et al. (1982): it may be possible to increase the profitability of a product line by adding a dominated (relatively inferior) alternative that hardly anyone chooses. The implications of this will be addressed further, and will be the subject of a hypothesis for the current study, in Chapter 4.

A related effect incorporating the same psychological intuition is considered in the next section.

## 3.3.2   Compromise Effect

Decision makers find it easier to choose a particular option when they have more available reasons to justify that choice (Simonson, 1989). The choice set itself can be used to provide subtle, but effective, cues to the decision maker, steering his decision towards a target choice by providing these reasons and thus disrupting the thought process that the neoclassical rational man will complete. This insight helps contribute to the *compromise effect*.

Simonson (1989) highlights the finding in Huber and Puto (1983) that in de-briefing sessions following a dominance study *"subjects expressed the feeling that [the relatively superior option] was the 'safe,' 'compromise' alternative."* (Huber and Puto, 1983, page 38). He points out that this suggests a second justification for choosing the target above and beyond its relative superiority. This second reason is that the addition of the relatively inferior option (the decoy) means that the relatively superior option (the target) can be seen as a compromise alternative in terms of its attribute values between the original competitor and the newly added decoy. In Simonson's reasoning, if the decision maker is not sure which of the two attributes is more important the selection of an alternative that is seen to combine both attributes is much easier to justify (and hence more likely to actually be chosen). This suggests that an alternative's popularity increases when it is made a compromise through the addition of other options, even in the absence of dominance relationships.

This is illustrated in Figure 3.2. With an original choice set of B and C the addition of A – to make B a compromise – or D – to make C a compromise – is expected to increase the popularity of B and C respectively.

Simonson and Tversky (1992) extend the analysis, labelling it *extremeness aversion*. This analysis incorporates the concept of loss aversion (discussed earlier

**Figure 3.2:** Compromise effect in consumer choices. Reproduced from Simonson (1989).

in this chapter and in Chapter 2). In choice situations this concept is modified slightly in the sense that gains and losses – or advantages and disadvantages – will be evaluated relative to other options. Nevertheless it is expected that disadvantages will loom larger than advantages.

Consider Figure 3.3 which illustrates. There are three options which vary according to two attributes. The option $y$ is placed such that it is in the middle for both attributes, ie. $x > y > z$ for Attribute 2 and $x < y < z$ for Attribute 1. Each of the extreme options ($x$ and $z$) has a large advantage and a large disadvantage relative to the other. Each of the extreme options also has a small advantage and a small disadvantage relative to the middle option ($y$). The middle option has small advantages and small disadvantages relative to both extreme options. Thus if (pairwise) disadvantages loom larger than the corresponding advantages the middle option will perform better when the choice set is $\{x, y, z\}$ than when it is either $\{x, y\}$ or $\{y, z\}$.

Both Simonson (1989) and Simonson and Tversky (1992) find significant evidence in support of the compromise effect, the former on a wide range of products including beer, cars, TVs, apartments, calculators and mouthwash. In the latter
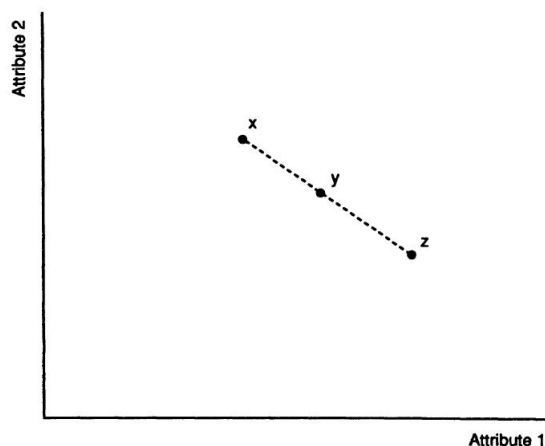
**Figure 3.3:** Extremeness aversion in consumer choices. Reproduced from Simonson and Tversky (1992).

the popularity of a brand of camera was increased from being as popular as the competitor (ie. its relative popularity was 50%) to being 72% more popular than that competitor, a significant increase.

Studies of the compromise effect have proliferated. Bettman, Luce and Payne (1998) provide a useful review of much of the outstanding literature. Dhar, Nowlis and Sherman (2000) use time pressure as a variable to analyse in more detail the source of compromise effect-type biases. Their results show that time pressure on choices reduces the impact of compromise effects. Reducing time available for making a choice would be expected to minimise one source of error – an excessive focus on the relational characteristics of the alternatives offered – whereas it would be expected to increase another source of error – effort minimisation. Thus they interpret their findings as supporting the former idea, that the source of error is an excessive focus on the relational characteristics of the alternatives offered, the kind of psychological regularity discussed in Huber et al. (1982) and Simonson (1989).

Drolet, Simonson and Tversky (2000) provide further evidence that preferences are largely not determined by absolute attribute values, instead being mainly the

result of the relative positioning of alternatives in choice sets. In this sense they conclude that indifference curves can be said to be relative and 'travel' with the choice set. Drolet (2002) provides further analysis of context effects in preference construction.

Despite the clear importance of these psychological insights and their potentially wide application, little research has to-date focused on larger-scale decisions such as over housing. Does the presence of estate agents with the power to construct the choice set provide an implicit way to construct preferences and bias choices in a similar manner to that found in the consumer choice literature? This will be the subject of consideration and hypothesis in Chapter 4.

### 3.3.3 Summary

Behavioural literature into choice set manipulations has uncovered two types of bias which stand out, especially in the field of consumer choice. The first of these is *asymmetric dominance*, which suggests that, by adding an option to the choice set that is dominated in an asymmetric way (that is, by one of the original options but not by the other), it is possible to influence preference between the two original options. Specifically it has been found that the option which dominates the new choice, and so is the target of the manipulation, gains a psychological 'halo' which is enough to sway decision makers.

Second is a bias known as *compromise effect* which suggests that, if a decoy option is added to a choice set so that it makes one of the existing options seem like a compromise, the effect will be to significantly increase its popularity. This is by taking advantage of a psychological regularity uncovered by Simonson (1989): individuals find it easier to make choices which can be easily justified.

Both biases are significant to choice theory because they are both significant departures from the neoclassical theory of rational choice. Its axiom of independence cannot allow the preference between two mutually exclusive options to be influenced by the presence of an alternative.

# 3.4 Ordering Bias and Choice

The receipt of information to inform choice is an important part of the decision making process. But it is undoubtedly a complex and multi-faceted mechanism. A precise investigation of the nature of information receipt is beyond the scope of this thesis; however one aspect of it is of interest for our current purposes: its sequential nature. According to Anderson (1981): "*In everyday life, information integration is a sequential process. Information is received a piece at a time and integrated into a continuously evolving process.*" (Anderson, 1981, page 144)[7]. Thus in its simplest form the natural question to ask is whether the order in which information is received has an impact on choice.

Chapter 2 explored the neoclassical rational choice model, one of whose central assumptions was invariance. Simply put, this assumption states that preference, embodied by choice, cannot be influenced by the alterations in the description of options providing the descriptions impart the same information. Naturally included in the word 'description' is the order in which information is received. According to this assumption then, preference should be invariant to the order in which choices are considered or information about them received. However, as with the behavioural critique of other aspects of neoclassical choice theory, there may be more to the story.

Cognitive psychology has led the research into the role of ordering in opinion formation and belief revision, although the importance of the work goes much wider than that field alone. In their comprehensive summary of the literature, Hogarth and Einhorn (1992) note its importance in areas as broad as probabilistic inference (Slovic and Lichtenstein, 1971); decision theory (Raiffa and Schlaifer, 1961); social cognition (Nisbett and Ross, 1980); jury decision making (Davis, 1984); attitude change (Cooper and Croyle, 1984); and causal inference (Einhorn and Hogarth, 1986). It should be noted from the beginning however that relatively little research has directly examined the extent to which ordering impacts choice and particularly consumer choice.

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[7]  Drawn from Hogarth and Einhorn (1992).

Broadly speaking, there are two schools of thought competing with the assertion of the rational choice model that ordering has no effect on choices. These are that information received first will have a special significance, or *primacy*; and that information received last will hold sway, known as *recency*. Nisbett and Ross (1980) espouse the former view stating that "*several decades of psychological research have shown that primacy effects are overwhelmingly more probable.*" (Nisbett and Ross, 1980, page 172)[8]. However this conclusion is questioned by Davis (1984). His review finds more evidence of recency in studies of jury decision making. Anderson (1981) finds evidence supporting both theories.

The psychological intuition which supports primacy goes by another name: *anchoring*. In their classic study of judgement under uncertainty, Tversky and Kahneman (1974) explain anchoring as one of a series of cognitive rules of thumb, known as heuristics, which are used to aid decision making and judgement. These rules of thumb reduce the complexity of judgement but their use can lead to systematic and serious errors, many of which were discussed in Chapter 2.

Anchoring occurs when an individual, faced with making a judgement, uses some initial value as their starting point before making adjustments to that to yield a final answer. Significantly, the adjustment will typically not be sufficient (Slovic and Lichtenstein, 1971), which means the final judgement will not be independent of the initial value. In its purest form, anchoring relates most specifically to value and probability judgements, and will be examined in more detail in the following section. For our present purposes however it is sufficient to draw from the theory that anchoring means that in decision making information received initially will take on a special significance in final outcomes. Thus for choice theory it provides a basis for hypothesising that first-viewed options may prove more popular than those options viewed later, *ceteris paribus*.

In contrast, the concept of recency invokes the kind of *bounded rationality* explanation of Simon (1956). Faced with limited time and cognitive capacity in

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[8]  Drawn from Hogarth and Einhorn (1992).

which to make decisions, under this theory information received most recently achieves a special significance, so in choice situations it would be expected that more recently-viewed options would be more popular.

Hogarth and Einhorn (1992) present a model of belief updating suggesting key variables for the determination of ordering effects. These include the complexity of the information, its length and the nature of the information (whether it confirms or contradicts earlier information). Broadly they find evidence that ordering effects are not important for simple tasks in which information receipt is consistent. When the tasks become longer and the information contradictory (or 'mixed' in their terminology) there is evidence of recency.

Two papers examine ordering effects in a professional setting. Ashton and Ashton (1988) is one of a series of papers examining belief revision in auditing (Koch, Pei and Reed, 1989; Butt and Campbell, 1989). They find evidence that belief updating does depend on the order in which it is received. And Gallimore (1994) examines commercial real estate appraisals, finding that greater weight is typically applied to more recently-received information. These results were largely not statistically significant, however.

There is little evidence directly studying whether ordering effects are significant in choice. Houses are naturally viewed in a sequential way, creating an information receipt mode which might be conducive to the behavioural phenomena discussed. This is discussed further in Chapter 4.

## 3.5 Biases in Value Judgements

The use of rules of thumb in decision making, which can lead to serious judgemental biases, has become one of the most important areas of psychology to reach into economics. It has particularly important implications for choice theory as discussed in Chapter 2.

The classic work of Tversky and Kahneman (1974) reports some of the most sig-

nificant including: *representativeness*, where assessment of probabilities is biased according to the extent to which an event is representative of another; *availability*, where probability estimates of the likelihood of a event are affected by the ease with which examples can be recalled; and *anchoring*. Significant areas of literature which can be included as additions to this list of psychological biases in judgement include: *loss aversion* which results in a reluctance to part with owned assets known as the *endowment effect* (Thaler, 1980; Kahneman, Knetsch and Thaler, 1990) and is one of the bases of *Prospect Theory*; and *framing effects* which result in phenomena such as *preference reversal*, where altering the description frame reverses preferences (Slovic and Lichtenstein, 1983; Tversky, Slovic and Kahneman, 1990).

The current interest is largely confined to the bias of anchoring which was alluded to in the previous section. It is one of the purest forms of behavioural phenomena which Daniel Kahneman has said is among the most robust observations in the psychological literature (Kahneman, Ritov and Schkade, 1999). Anchoring is, as discussed, a form of heuristic which individuals use to aid their decision making process. It is best summed up in the authors' own words:

> "*In many situations, people make estimates by starting from an initial value that is adjusted to yield the final answer. The initial value, or starting point, may be suggested by the formulation of the problem, or it may be the result of a partial computation. In either case, adjustments are typically insufficient. That is, different starting points yield different estimates, which are biased toward initial values.*"

> (Tversky and Kahneman, 1974, page 1128).

The use of a mechanism where an initial value is selected and adjustments made to yield a final answer is not a serious flaw in judgement making *per se*. It is the fact that the selection of the initial value is not independent of the problem's framing and that the adjustments made are typically not sufficient which lead to bias.

In their illustrative experiment, participants were asked to estimate quantities, such as the number of African countries in the United Nations, expressed in percentages. Prior to this a number between 0 and 100 was determined by spinning a wheel in the presence of the participants. Having been asked whether they thought the percentage they were being asked to estimate was above or below the number they had just seen, subjects were then asked what they thought the correct number was. Despite the initial number – the anchor – being demonstrably random, judgements were significantly correlated with it. The effect was not reduced by increasing payoffs for accurate judgement.

The implications of this for choice, particularly in the context of value judgement, are clear and a significant amount of research has followed. Anchoring is found to be significant in a simulated economy setting (Sterman, 1989); in choices over lotteries (Johnson and Schkade, 1989); in answering factual questions (Jacowitz and Kahneman, 1995) and over the valuation of public goods (Green et al., 1998). A useful review, which suggests reasons for the phenomenon, is Chapman and Johnson (2002).

Ariely et al. (2003) move the literature on from its predominant concern of how anchoring corrupts subjective judgement to the impact it can have on valuation or preference[9]. They focus explicitly on consumers' valuation of goods. Utilising a procedure first adopted by Wilson et al. (1996) they asked subjects to write down the last two digits of their social security number (SSN) as a price. Thus, someone whose digits were -23 would have written $23. They then showed subjects a series of consumer products such as computer equipment, wine and chocolates, and asked them whether they would be willing to accept each in turn for the price they had written down using the SSN. Finally, subjects were asked the maximum dollar price they would be willing to pay for each product[10]. The social security number – patently an arbitrary anchor – proved a reliable indicator of willingness to pay in each case.

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[9] Although they say that Johnson and Schkade (1989) was the first to do so.

[10] Note that the procedure uses the Becker-DeGroot-Marschak procedure (1964) for eliciting willingness-to-pay and guarantees that some of the transactions – determined randomly – will be carried out, thus ensuring the reality of the situation to participants.

Their results are hugely significant. Subjects with above median SSNs stated values between 57% to 107% greater than subjects with below median SSNs. The gap between the bottom and top quintiles was up to a multiple of 3. For the cordless keyboard the bottom quintile estimated a value of $16 on average. The value for those with the highest quintile SSN was $56.

The authors present further evidence in support of the proposition that subjective valuation of goods can be influenced by anchoring. They term the effect *arbitrary coherence*. It encompasses the idea that values in a subject's mind can, relatively easily, be established arbitrarily using anchoring. After that they can shape decision making significantly. They become coherent and form the basis of future judgements.

More recently research has examined anchoring in consumer judgements in more depth (Simonson and Drolet, 2004); in field experiments (Alevy, Landry and List, 2008; Mazar, Koszegi and Ariely, 2009); and in fields far removed from consumer economics including medicine (Brewer et al., 2007) and the valuation of environmental goods (Hanley et al., 2009).

House purchase is among the most important personal finance decisions made during an individual's lifetime so it is natural to ask whether anchoring can be used to influence judgements in this area too. Hypotheses related to this are considered in Chapter 4.

## 3.6   Conclusion

House purchase is among the most important consumer choices, yet little work has considered how behavioural biases might be important in decision making in respect of housing. As discussed in Chapter 1, a reason for this might be that neoclassical researchers tend to respond to criticisms of their model by arguing that two factors will minimise the extent of errors: stakes and experience. It has already been noted that the stakes could hardly be higher. Individuals should,

and do, take great care over their choice given the profound incentives to get the choice right. However, they make the choice with necessarily little experience, meaning that for only the minority could it be true that their preferences are strongly formed prior to initiating the choice process. Thus study of housing choices presents an excellent test bed for these claims in first instance.

However the study of the dynamics of housing markets is a significant concern of research in its own right. One strand of this work goes beyond modelling outcomes built on models with rational man-type assumptions. It adopts a microeconomic perspective and focuses on the heterogeneous nature of individual behaviour to gain greater understanding of the dynamics of housing markets. The incorporation of non-rational insights is also a promising area of development in the study of housing markets. Examining the ways in which housing choice can be influenced through *actively* engaging individual behavioural biases may prove a fruitful way to go beyond the existing literature and Shiller's *irrational exuberance* approach; deepening further our understanding of housing markets.

Three sources of behavioural bias in particular stand out from the literature into consumer choice and they have been reviewed in this chapter. First are what have been labelled choice set biases. These are biases which arise from the make-up of the choice set itself. Rational choice models have at their heart a principle known variously as regularity, invariance and independence which says that the preference between two options cannot be affected by other, mutually exclusive, choices. A rational set of preferences cannot accommodate a decision maker who prefers A to B, but will change his mind and choose B if he is choosing from A, B and C rather than A and B alone. Yet prior research suggests there is significant scope for manipulating choice sets in this way to affect choice.

A second source of bias lies in the order in which information is processed when individuals make decisions. More specifically, this research asks whether the order in which options are shown – and considered – has an effect on the ultimate choice. The von Neumann and Morgenstern rational model of choice does not allow such an effect to be important in preference formation. There is limited

empirical work considering this avenue of choice bias.

A final significant area of choice bias lies in numerical judgement. Evidence shows that humans are not always good at making these types of judgements because of the use of psychological rules of thumb known as heuristics. These help simplify decision processes, but can result in significant errors. A particularly important bias is known as anchoring, which can result in value judgements which are biased according to a (possibly arbitrary) value in the decision maker's mind. The possibility of placing these arbitrary values into consumers' minds and affecting their judgement has been specifically confirmed in an important study by Ariely et al. (2003), though the scope of the bias in consumer choices has not been otherwise widely considered.

There is a significant opportunity to bring these strands of the literature together, using behavioural theory, particularly with respect to choice and decision making, to shed light on the dynamics of housing markets. This will contribute both directly to choice theory and to our understanding of what is really going on when we make the decision to buy a home.

Thus the main focus of the work which follows in this thesis is choice manipulation in house purchase decisions. Chapter 4 considers in more detail the methods which could be used to alter choice patterns in non-rational ways, building on the research reported in this chapter. It makes hypotheses in this regard which will be the basis of the experiments reported later. An important part of the story is the economic agent who it is hypothesised could *use* the insights to affect preference construction and alter choice. The second part of Chapter 4 considers the motivation of the estate agent who is assumed to be that economic agent, presenting conceptual models to show how it could be in the agent's interest to manipulate home buyers' choices in this way.

Chapter 5 concludes Part II by reporting the methodology used to investigate the issues at hand. Part III reports the results before Part IV concludes and suggests avenues for further research.

# Chapter 4

# Choice Manipulation: Methods and Motivation

This chapter considers specific ways in which house purchase behaviour can be biased using the behavioural insights considered in Chapter 3. These are considered under three headings: biases arising from the choice set; biases due to viewing order; and biases in value judgements. It makes hypotheses in this regard, which will be the basis of the experiments reported later. The biases are important because of the possibility an economic agent may *use* them to predictably manipulate choice. The second part of the chapter explores *why* the estate agent is motivated to use the manipulations, with several conceptual scenarios suggested. Manipulations are expected to be particularly important – and potentially valuable – in the growing market for online property listings where agents compete with each other for sales across a common sales platform.

## 4.1 Introduction

As the literature review in Chapter 3 established, making good decisions can be difficult. There is a significant body of evidence which has shown that a variety of psychological regularities can lead to non-rational decision making. Incomplete

information is an important catalyst for these psychological regularities. For example, Chapter 3 illustrated that where the decision maker is uncertain about his own preferences in trading off two attributes of value, a *choice architect* (Thaler and Sunstein, 2008) may place decoy options in the choice set to manipulate the perception of these attributes, thus favouring one of the options (Huber et al., 1982). Similarly, when asked to make a value judgement in a situation where they have relatively little experience, individuals frequently rely on an *anchoring-and-adjustment* heuristic which can lead to bias (Tversky and Kahneman, 1974).

Regularities in the way individuals react to uncertainties like this leads, as discussed in Chapter 1, to the possibility of manipulation by an external economic agent with the motivation to do so. This chapter explores both these concepts in respect of housing choice. First it considers the precise ways in which behavioural bias can impact decision making in a housing context. In aggregate these effects – which are split into three sections: biases due to the choice set, biases due to viewing order, and biases in value judgements – may cancel each other out or simply add a certain unpredictable element to choice. However it is proposed that it is possible for an external agent, in this case the estate agent, to manipulate these biases to produce regularities in decision making to suit their own purposes. This is the second strand to the analysis in this chapter[1]. Having considered the manipulations in the following section, the primary motivations for them by estate agents is examined in Section 4.3.

## 4.2 Methods of Manipulation

The foundational work of Daniel Kahneman and Amos Tversky (Kahneman and Tversky, 1979) caused a dramatic re-evaluation of the theory of choice, in which the model of rational action of von Neumann and Morgenstern (1944) had previously been accepted as the solution to the choice problem. Since then a significant body of research has established that there are a series of ways in which human psychological processes may result in choices that are not rational from the neoclassical perspective, and more, that it is possible to use these processes

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[1] I am grateful to Professor Colin Lizieri for pointing out this explicit division.

to manipulate choices and judgements.

A literature review has found that decision making over housing is one area where these behavioural biases may have a particularly important impact, but that has been largely neglected by current research.

In the course of this literature review several specific areas of bias have been considered, including: biases arising from the choice set, biases due to viewing order and biases in value judgements. In the sections that follow, the methods by which these biases could be used to influence choice in housing scenarios are considered and hypotheses made. These hypotheses will form the basis of the experiments in Part III of this thesis.

## 4.2.1   Biases Arising from the Choice Set

There are two manipulations of choice sets which prior literature has found can have an impact on decision making in consumer choices, in violation of the independence principle of rational choice.

The first of these, after the work of Huber et al. (1982) discussed in Chapter 3, is known as *asymmetric dominance*. It is depicted in graphical form in Figure 4.1. Decision makers are faced with evaluating choices based on two scales of value, which they must trade-off. In the initial situation the choice set is {A, B}. In this scenario neither option dominates the other so that the choice will depend on the relative value placed on each attribute by a decision maker. In a latter scenario a third option, C, is added. This changes the situation significantly because option C is dominated by B. That is option B offers more of both attributes. A rational decision maker should never choose option C.

The purpose of the addition of C is not, however, to check this proposition, but to take advantage of a *halo effect* (Nisbett and Wilson, 1977) which benefits option B for 'beating' option C in a direct comparison of the two. Options B and C are naturally compared because the dominance is asymmetric – option C is similar
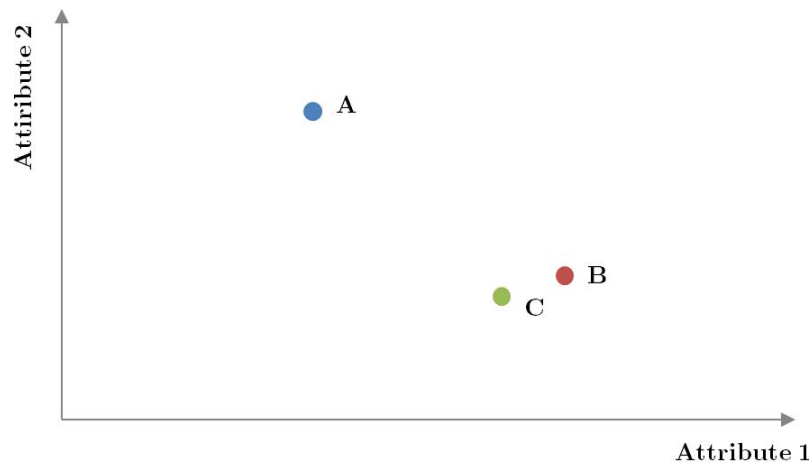
**Figure 4.1:** Asymmetric dominance manipulation of preference between two options.

to option B, but not particularly like option A. In Huber et al.'s (1982) analysis, option B is known as *Target* and option C as *Decoy*. Option A is known as *Competitor*. A change in preference from *Competitor* to *Target* as a result of the addition of the addition of the decoy option would be a significant violation of the independence axiom of rational choice considered in Chapter 2. To re-state, this says that the preference between two options cannot be affected by the presence – or lack – of other options.

It is suggested that in housing choice scenarios the economic actor who sets the conditions under which the choice is made – the choice architect – is able to show particular properties to a potential buyer, creating a choice set that uses the decoy option to manipulate preferences between a target option and a competitor. The implication is that such a manipulation would be used to sway decision makers towards options that the choice architect desires they favour. This leads to our first hypothesis:

> **H1.** *Asymmetric dominance: the proportion choosing a particular property increases when a decoy property is added that is asymmetrically dominated.*

The second choice set manipulation which is proposed can be used to influence housing choices is known as the *compromise effect*. Simonson (1989) argues that

individuals find it easier to make choices when there are available reasons to justify their choices. The compromise effect takes advantage of this by inserting a decoy option into the choice set which makes another of the options appear like a compromise. This provides a powerful justification for selecting it and is enough to persuade individuals to choose it in greater numbers than if the decoy option was not present.

This is depicted in Figure 4.2. The original choice set is as previously, {A, B}. To take advantage of the manipulation a third choice is added, option E[2]. This is not dominated by either of the original options, but it does offer an extreme amount of Attribute 1 and less of Attribute 2. In this light, option B becomes a natural compromise between the two original options. This provides a powerful reason for choosing option B, which is enough to manipulate decision makers into choosing it to a greater extent than they did when the options were {A, B}. This leads to the following, related, hypotheses:

> **H2a.** *Strong compromise effect: the proportion choosing a particular target property increases when it is made a compromise choice by the addition of a decoy property to the choice set.*

> **H2b.** *Weak compromise effect: the proportion choosing a competitor property decreases when the addition of a decoy property to the choice set makes the other original property the compromise.*

Since option E is not dominated by option B (or option A) a decision maker whose preferences are such that Attribute 1 is very important to him could choose that option. This is the source of Hypothesis 4.2.1b: the addition of option E could, reasonably, induce significant numbers who would have chosen B from a choice set of {A, B} to choose E. But it should not take market share from option A.

As will be explored in Chapter 5 several economic experiments are used to test these hypotheses in housing choice scenarios. Some of the experiments involve simple trade-offs in a manner directly analogous to the above analysis. Other

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[2] This labelling scheme is used to provide consistency with the numbering used in Chapter 5.
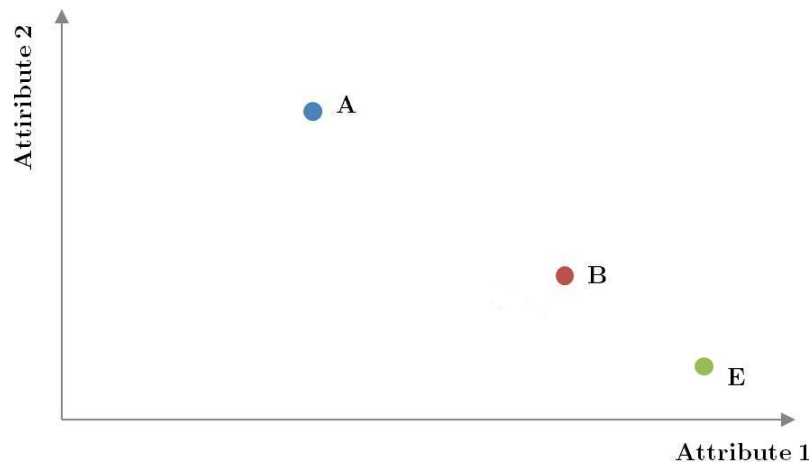
**Figure 4.2:** Compromise effect manipulation of preference between two options.

experiments use more complex information environments which closely replicate actual choice situations.

## 4.2.2   Biases due to Viewing Order

Research has suggested that the order in which information is received is important in decision making and judgement (Anderson, 1981; Hogarth and Einhorn, 1992), although little focuses directly on the role it has in preference formation in buying decisions. Houses are naturally viewed in an ordered way and so is an important part of the choice process in housing to consider.

There are competing hypotheses on the effect of viewing order:

> **H3a.** *Primacy: information received first will have excessive weight in judgements over housing, thus houses seen first will be preferred more, ceteris paribus.*

> **H3b.** *Recency: information received last will have excessive weight in judgements over housing, thus houses seen last will be preferred more, ceteris paribus.*

The first of these hypotheses comes from the work of Tversky and Kahneman (1974) who suggest that a psychological process called *anchoring* means that initially-viewed information will be given excessive weight because adjustments made from it will not be sufficient. In the case of housing this is expected to take root in the following way. A consumer would like to purchase a two-bedroom house. The first of these he views becomes his 'anchor' representing in his mind what a two-bedroom house is like. All subsequent houses are viewed in reference to this one, being compared and contrasted with it. This process, also known as *imprinting* (Ariely et al., 2003) is enough to give the first-viewed property an advantage and means it is likely to be chosen more frequently than if viewed in other positions.

In contrast recency suggests that, faced with limited time and information complexity, boundedly rational individuals (Simon, 1956) place an excessive weight on information which is more recently received and so is easier to recall. The hypothesis suggests that, when viewing a series of houses, individuals will be more likely to choose a property if it is show last, *ceteris paribus*.

It should be noted here that the process of imprinting is a complex one, and housing is a highly complex good, far more so than the goods considered in the majority of the consumer choice literature. Thus it is difficult to say with precision what the effect will be. Subjects may use an anchoring process, but the anchor may not have a reliably positive effect. For example the first-viewed property may be highly undesirable resulting in a *negative* effect which lasts to subsequent viewings. Nevertheless, experiments which examine this proposition are considered in Chapter 5. The results, which explore all these issues, are reported in Chapter 7.

### 4.2.3 Biases in Value Judgements

Humans often use short-cuts, or heuristics, to help make judgements. These can serve a useful role simplifying decision-making; however significant research has shown that it can also lead to serious errors in judgement. The psychological pro-

cess of anchoring, first explored by Tversky and Kahneman (1974) suggests that value judgements may be biased according to some initial value in the decision maker's mind which they use as a basis for making estimation. These anchors can be entirely arbitrary, having serious implications for purchasing decisions (Ariely et al., 2003).

When faced with buying a house, establishing a 'fair' value is among the most important decisions. As discussed in Chapter 1, given the large stakes, any error is likely to cost the decision maker thousands of pounds. Yet housing markets are generally decentralised and opaque. Information is difficult to obtain with most being held by those experienced in the market – estate agents. For purchasers who may only enter the market once or twice during their lifetime it is difficult to know what the fair price for a given property is given current market conditions and other factors.

In these circumstances the risk of being manipulated as a home buyer is high. Decision makers are expected to sub-consciously use salient (available) valuations to influence their estimations of value. These can be reasonable, for example by looking at the prices of other, comparable, properties. However, it is hypothesised that it is possible to establish arbitrary anchors in individuals' minds too:

> **H4.** *Anchoring: individuals' valuation judgements over housing are biased by the presence of an arbitrary anchor.*

Even with a strong incentive to judge accurately, if this hypothesis is correct individuals' estimations contain a detectable element that is arbitrary. If arbitrary valuations are possible then it remains open for a willing economic actor – in this case most likely an estate agent – to influence valuations according to his preferences, presumably inducing consumers to believe that houses are worth more than is fair value to maximise their own profitability.

Carefully structured experiments which assess the nature of these biases, as well as their duration, are presented in Chapter 5 and results in Chapter 8.

### 4.2.4 Summary

With the motivations of this thesis expressed in Chapter 1 in mind, a series of hypotheses on the nature and extent of choice and judgemental manipulations in individual housing decisions have been proposed. These include: biases arising from the choice set itself; biases from the order in which options are presented; and biases in value judgements. If proved, these provide a significant insight into the vulnerability of consumers in housing markets, as well as presenting ways in which an estate agent may bias housing choice to their own ends.

## 4.3 Why Manipulate Choices?

The first part of this chapter suggests several hypotheses which involve a willing economic agent – the estate agent – engaging in actions which manipulate the choices of home buyers. The primary focus of this thesis is to investigate the nature and extent of these biases, but it is important to establish *why* they might wish to engage in this behaviour.

Principal-agent problems have been a focus of research in economics since at least the early 1970s (for example Ross, 1973). The aim of this section is not to provide a theoretical model of estate agent action[3] but consider the circumstances in which the agent may engage in the kind of manipulative behaviour that has been hypothesised. Three conceptual scenarios are presented in the following sections which illustrate entirely plausible justifications for agents to act in this way.

Before discussing these conceptual scenarios, it is worth giving some background about the role of estate agents in the UK housing market. Estate agents are employed by vendors to manage all aspects of the process of buying a property. They are responsible for marketing the property to potential buyers, including advice about the most appropriate asking price to achieve a sale. Once an offer has been made they represent the vendor in any negotiations and frequently play

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[3] For an example of that see Geltner, Kluger and Miller (1991), for example.

a co-ordinating role in the legal aspects of the conveyancing process. Agents earn fees paid out of the sale price. As discussed above, this results in significant principal-agent issues between vendor and agent which have been the subject of research. However, for present purposes, the aspect of this structure that is most relevant is that agents do not have a legal or contractual obligation towards *buyers*. The sections below consider how, given this, agents may be incentivised to manipulate buyers in the ways hypothesised.

### 4.3.1 Manipulation and Value Judgements

Taking the latter area of manipulation – judgemental biases – first, it is clear that there is a significant rationale for agents to engage in this behaviour if it is possible. Getting a buyer to value houses, or a particular house, more highly than its market-determined 'worth' is likely to lead to higher sales commission, the earning of which is the aim of the agent as discussed above.

The process of establishing a property's worth is complex because of the decentralised marketplace and heterogeneity of the good being purchased. Nevertheless, it remains true that, holding other factors constant, to increase a buyer's subjective valuation of a property would be a profitable thing for an agent to do to increase their sales commission.

Although they focus on home sellers and use information asymmetry as the source of decision making errors, Levitt and Syverson (2008) present evidence which supports the claim that agents are motivated to manipulate their clients' decisions to their own ends. In their investigation of 100,000 property sales in the US state of Illinois, they find that where a registered estate agent is the owner (rather than an 'uninformed' client) the property is held on the market for longer and achieves a statistically significant higher price upon completion. This finding suggests that agents are able to – and do – manipulate their clients into making non-optimal decisions in their own interests.

It has already been argued that in property markets uncertainty presents an op-

portunity to intercede in the buyers' decision making process, something that is confirmed by Levitt and Syverson's work albeit from a different perspective. Anchoring is a subtle psychological mechanism which most decision makers are not aware of and this makes it a powerful way of influencing perceptions. Moreover Tversky (1977) has said that many manipulations of this type are reminiscent of optical illusions: even after the 'deception' is uncovered it is difficult to reconcile what our brain continues to tell us about what we see before us. Through the use of arbitrary numerical anchors or, more likely, by showing 'representative' comparable properties which over-inflate a buyer's sense of value, an agent could increase their profitability from each transaction.

Conceptually the use of these strategies can be bundled as part of the agent's 'effort' function, which has been explored extensively in earlier work (Yinger, 1981; Zorn and Larsen, 1986). Providing this extra effort produces more revenue via sales commission the agent will find it profitable to do it. Clearly the payoff from the strategies is itself a function of the difficulty and efficacy of putting them into place. This is addressed by the hypothesis in the previous section and is the primary focus of the research in this thesis.

## 4.3.2  Choice Bias and Property Turnover

The use of choice set biases is more complex. In the simple situation where an agent has a portfolio of properties on his books with a brief to sell them, it is not immediately clear why he might use one as a decoy. This would benefit a particular alternative property, but leaves the agent with a property that probably won't sell. To show how an agent might be motivated to take this action it is necessary to think of the effect of the manipulative action in terms of another variable: preference intensity.

It is reasonable to propose that the effect of using choice set biases – asymmetric dominance and compromise effect – might go beyond swaying a buyer towards a particular property. It is also expected to increase the strength of preference for that property. Following this reasoning, if individuals feel more strongly about a

property then it is likely that they would make the decision to buy the property more quickly, *ceteris paribus*.

This being the case the manipulation of preference using choice set biases serves two purposes: i) it matches buyers to sellers more quickly, increasing the property turnover of the estate agent thus earning them more commission during a given amount of time; and ii) it makes buyers more likely to cut short their search and make the decision to go ahead and purchase the property that is subject of the manipulation. This latter effect is valuable to the agent in a competitive marketplace where buyers could use other estate agents to find their property.

To re-state this proposition for clarity: in a competitive marketplace for estate agents a particular agent has the attention of a buyer for a limited time and so would clearly benefit from showing them the 'perfect property' – or helping them believe they have found the perfect property – ensuring they transact with them quickly over another agent. Thus even if it means designating several properties as decoys which probably won't sell there is a clear motivation if it increases the preference intensity of buyers inducing faster property searches and greater sales volumes.

This reasoning depends on the manipulations hypothesised having the effect of increasing the intensity of preference towards the target property. It is worthwhile making another hypothesis in this regard:

> **H5.** *Preference intensity: the strength of preference for a particular target property increases when it is the subject of a choice set manipulation.*

Evidence to test this hypothesis is reported in Chapters 6 and 7 as part of the analysis of the choice set biases.

The motivation to use choice set biases in this conceptual scenario is clearly somewhat indirect. It suggests that an agent might not care *which* property he has as a target or a decoy, simply that he will be motivated to use this approach

in general terms to strengthen buyers' preferences, increasing the number who buy the property from him and the speed with which they do so. In the following section a more direct way is considered in which, as the search and sale of residential property moves to online platforms, an agent may be strongly motivated to use choice set effects to further their own interests.

### 4.3.3 Online Property Sales and Preference Manipulation

In recent years there have been many significant changes in the UK housing market. Few, however, have been more dramatic than the migration of the market to the online sphere. From almost nothing in the year 2000, property search websites have revolutionised the way people search for property in the UK. In the six months to June 2010, the market leading website – Rightmove – reported over 3.2 billion page impressions. Ninety per cent of estate agents in the UK list properties on the website[4]. For this reason a significant portion of the research in this thesis is devoted to the online property search environment, a very different *decision frame* (Tversky and Kahneman, 1981) to that previously studied.

A particular feature of online search websites is that competing estate agents come together to list their properties on a common platform, paying a fee to the website for doing so. This situation mirrors an invention of an earlier age: the Multiple Listing Service (MLS). These are centralised bodies which allow real estate brokers to co-operate with each other by sharing listings in exchange for splitting commission between the finding agent and the listing agent. Their origins are in the early 20th century in the United States, although they appear in different forms in housing markets across the world today. A significant amount has been written about MLSs, for example on their effectiveness and the optimal contract design to appropriately incentivise agent behaviour (Frew, 1987; Geltner et al., 1991; Miceli, 1991).

While the arguments in this section about the motivation for agent behaviour

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4 Source: Rightmove figures. Page impression statistics audited by Audit Bureau of Circulation.

share some parallels with the MLS literature conceptually, there is a subtle difference between the role of the MLS and the property search website. The MLS is effectively a forum for co-operative contracts to be designed between agents (standardised to reduce information and administrative costs). In contrast, online search websites are themselves businesses whose customers are estate agents paying fees for listings. This changes the position of the agent somewhat and provides a natural role for the choice set manipulations that are the subject of this thesis to come to the fore.

By using the property search website, agents are pooling information about houses (the market supply) across a common platform to reduce information costs among buyers (the market demand) and promote increased activity. However they remain in competition with other agents, competing for the buyer to choose the property *they* list. Given this competition it is clear there would be some gain to a particular agent in using another's property listing(s) to bias users towards his own. If a particular agent could structure search results in a way that made his property the target and another agent's property a decoy, he would be motivated to do so.

The ability to structure search results in this way lies with the websites, such as Rightmove. They have no *a priori* reason for doing so, but, given the competition among agents, we could expect them to be willing to pay Rightmove to alter search results in this way. To re-cap: this conceptual reasoning suggests that in the online environment there is a clear rationale – and potential market – for the listing provider to manipulate search results in favour of fee-paying agents.

Academic research has yet to catch up with the changes that online decision making environments have made to consumer decision making. Stibel (2005) acknowledges that the presentation of information on the internet is important and that understanding the mental processes of users is important in their online experience, although his focus is primarily on designing websites to make them as intuitive and compelling as possible.

Several papers do examine online consumer behaviour. For example Kumar et al. (2005) and Rose and Samouel (2009) examine how consumers search for information on the internet. Wu et al. (2008) examine whether anchoring has a role in e-commerce. They argue that typical designs in experiments, involving a comparative judgement followed by an absolute estimate, are not practical or realistic in online situations. They go on to suggest an alternative design to assess the impact of anchoring biases, hypothesising that even without comparative judgements there will be strong anchoring by participants. They find support for this hypothesis especially when anchor points are shown on multiple occasions. This has implications for website design – and consumer welfare.

Wu et al.'s study is important because it directly addresses how consumers might be manipulated in online environments, on this occasion in respect of value judgements. Although Wu et al. do focus on consumer judgements, there is nothing in their study or elsewhere considering how online decision frames could impact preferences *between* different products. Grant, Clarke and Kyriazis (2007) call for further research into online consumer behaviour. The research presented in this thesis contributes significantly to this area of enquiry, building on Wu et al.'s work by providing important evidence of online consumer decision making in one of the online sphere's most high profile markets.

### 4.3.4 Summary

In this section three conceptual scenarios have been described which explain why estate agents could be motivated to engage in the behavioural manipulations that have been the subject of hypotheses earlier in this chapter. Agents have a clear rationale for engaging in actions which increase buyers' subjective valuations of property, *ceteris paribus*, since this is likely to lead to higher sales commissions.

If choice set manipulations are considered, it is plausible that if the manipulation can increase the preference intensity of buyers, making them more willing to go ahead and put an offer in on the property shown, thus cutting short their search and removing the possibility of losing sales commission to a competing

estate agent, the agent will do so. This could easily outweigh the cost of keeping a decoy property on their books which is unlikely to sell. A further hypothesis was made in this regard, which will be examined in Part III.

Finally, it seems reasonable to expect agents to find the use of choice set biases in a common listing platform, such as online property search websites, particularly valuable. This may be even to the extent that they would pay the listing company to manipulate search results if it were possible.

## 4.4 Conclusion

Despite it being a fundamental part of everyday life, decision making in certain situations and markets can be difficult, particularly when information is hard to obtain. Housing markets are one such situation. They are decentralised and opaque with significant information asymmetries. Location is a vital factor. Transaction costs are high and buyers must frequently rely on the services of an estate agent with interests which may not be entirely aligned with his or her own.

Given this, and the arguments advanced at greater length in Chapter 1, there is significant scope for buyers to be vulnerable to judgemental bias in their perception, preference and choice. This chapter considered the precise form this manipulation might take, drawing inspiration from the review of the theory of choice and behavioural economics literature that was considered in Chapters 2 and 3. These fall under three headings.

Biases may result from choice set manipulation if the decision maker (the buyer) sub-consciously uses the choice set itself as context when deciding between options. Rational choice models imply that options can always be considered in isolation, with a 'utility' ascribed to each. Having completed this process all the decision maker needs to do is pick the option which gives him the highest utility to maximise his own happiness and make a 'good' choice. However, the work of behavioural economists has shown that decision making with this kind of isolation is very difficult to achieve and that it is possible to use the choice set itself, by

introducing decoy choices, to manipulate perceptions of other options and so bias choice outcomes. It has been hypothesised that two manipulations in particular stand out as being possible in housing markets: asymmetric dominance, where an inferior decoy option is introduced to provide a positive 'halo' (Simonson, 1989) to a target option though dominating it; and compromise effect, where a decoy is added to make a target option a compromise, the choosing of which has a powerful psychological draw.

Biases may also result from the order in which properties are shown to buyers. There are competing hypotheses on the effect of choice ordering. The first suggests that initially-viewed properties will gain a special place in decision making because of a process known as *anchoring* (Tversky and Kahneman, 1974); whereas another suggests that given limited time and cognitive constraints, the most recently-viewed property will gain an advantage. Either effect would be a violation of rational decision making.

Finally biases in value judgement are also hypothesised, which are possible because of psychological flaws in our estimating and judgement apparatus. The earlier-mentioned process of anchoring suggests that certain numerical values, if they take root in our mind, can influence our estimation of values, even if these numerical values are patently arbitrary. This has the potential to cost home buyers significant amounts of money if it can be used by estate agents to influence judgement, in a similar way to that which has been shown in other consumer studies (Ariely et al., 2003).

In the light of these hypotheses, the second part of the chapter considered why estate agents could find it in their interest to manipulate consumer behaviour in this way. Three conceptual scenarios were reported. In first instance it was argued that estate agents would always find it in their interests to influence the subjective valuations of housing. Increasing home buyers' perceptions of value would be expected to lead to greater sales commissions, conditional of the efficacy and difficulty of undertaking the manipulations.

A further hypothesis was made about the effect of choice set manipulations. This said that, as well as swaying participants towards a particular option (which was **H1** and **H2**) choice set manipulations also increased the intensity of preference for a particular decision maker. That is, it guided them towards a particular option *and* made them more certain of their choice. This is expected to increase the speed with which choices are made, giving estate agents a way to increase the turnover of their property stock and induce potential buyers to cut short their searches, thus lessening the possibility of the buyer going to a competitor agent. If the manipulation is powerful enough it is likely to outweigh the cost of maintaining decoy properties which are unlikely to sell.

Finally the role of property search websites was also considered. These are important because of the explosive growth they have enjoyed in recent years, which has affected a dramatic change in the way property searches take place. Here, on sites such as Rightmove, agents list their properties across a common platform but remain in competition for business. This situation is similar, but decisively different to, a much older invention from the United States: the Multiple Listing Service. The common, but competitive, environment means that any agent would be strongly motivated to use another's properties as decoys to the benefit of his own stock. The ability to do this via search results lies not with the agents themselves, but with the independent company which runs the website. However, given the value that could potentially gained from it there is a clear rationale for agents to pay the website operator for manipulation of this sort in their favour.

Having set out the motivation for the study and the hypotheses that are to be investigated, the thesis proceeds as follows: Chapter 5 completes Part II by considering the methodology to be used. It explores the discipline of experimental economics, finding that it offers the potential for significant insights into the issues at hand. Part III reports the results of the experimental work split into three distinct areas which match the hypotheses made here: choice set effects in housing decisions (Chapter 6); ordering biases and housing choice (Chapter 7); and judgemental biases and housing value (Chapter 8). Chapter 9 concludes the thesis and makes suggestions for future work.

# Chapter 5

# Empirical Methodology and Data

This chapter describes the experimental studies which form the data for the results in Part III. It begins by examining the field of experimental economics, discussing how this methodological approach has grown to become a valuable tool for economic enquiry, in particular in the study of choice theory. It then describes the three experimental studies themselves, considering what insights they can provide into housing choice.

## 5.1   Experimental Economics: A Valuable Tool

To some, economics does not appear to be a subject suitable for experiments. The word experiment suggests a specifically *scientific* method of inquiry involving laboratories, controlled conditions and careful manipulations of complex systems. Some economists have questioned whether this is a feasible (or even desirable) approach for economists to take. Samuelson and Nordhaus (1985) exemplify this view, saying instead that *"[economists] generally must be content largely to observe."* (Samuelson and Nordhaus, 1985, page 8). Yet today experimental economics thrives as an important part of mainstream economic research. It is an established methodology in its own right which offers a way to gain significant insights into a variety of economic questions, including the existence and persistence of judgemental biases in housing choice which are the focus of this thesis.

Such a change in perception is not without precedent in science. According to Freidman and Sunder (1994) biology is one such that was for a long time considered inherently non-experimental because the subject matter was living organisms. But the 19th century saw the likes of Mendel and Pasteur introduce new techniques that turned it into the experimental science it is today. The same is true for psychology which has grown organically to include a significant experimental tradition.

This section will explore how this change occurred and how we can benefit from it in examining the hypotheses posed in Chapter 4. We will see how, starting from a few isolated studies in the inter-war years of the 20th century, a distinct tradition of experiments has evolved in economics with several fundamental principles; principles which today help justify why the data gathered from using this method can be used to further our knowledge of economic phenomena at hand.

## 5.1.1  Early History

Among the earliest economic experiments was carried out by Thurstone (1931)[1]. He sought to determine experimentally individual indifference curves, being interested in how practical it was to obtain consistent choice data to estimate the curves. In his experiment subjects were asked to make a number of hypothetical choices over certain commodities such as hats and coats or shoes and coats. He concluded that it was possible to estimate a curve which fitted actual data for these choices fairly closely and as such that it was a suitable way to go about doing so. However, the work was latterly subject to critique by Wallis and Friedman (1942). They questioned the whole basis of the study, saying that the experimental situation was artificial, rendering the choices made meaningless. They argued, among other things, that for an experiment to be satisfactory it would need to include "*reactions to actual stimuli*" (Wallis and Friedman, 1942, page 180).

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[1]  Perhaps the very earliest recorded is Bernoulli (1738) according to Kagel and Roth (1995). It achieved widespread attention when it was translated into English and published in *Econometrica* in 1954 (Bernoulli, 1954).

Rousseas and Hart (1951) used the criticism to help design their own experiments on indifference curves. Their article, intended as a follow up to Thurstone according to Kagel and Roth (1995), constructed a more realistic choice situation. Participants were asked to choose from several different breakfast menus with each containing different amounts of eggs and bacon. Importantly once the choices were made subjects were asked to eat what they had chosen there and then. This added realism to the choice environment and so removed some of the artificiality of the initial experiment.

Although there were still methodological concerns with the work[2] the exchange succeeded in providing the burgeoning field with several important themes which remain relevant today, including the importance of stimuli and of careful design in experimentation if the results are to be regarded as valid.

However, these isolated studies aside, there was as yet little interest among the wider body of economists in developing experimental economics as a discipline. Freidman and Sunder (1994) suggest that meaningful experiments in a discipline are only possible when some of the key variables recognised by the discipline are amenable to experimental control. In the 1930s and 1940s the prevailing view in economics was that the variables of interest were not amenable to this type of control. At the time economics was sub-divided into its micro- and macro-forms. Macroeconomic systems were so large in scale that experiments seemed impractical. They might also be somewhat immoral, given the weighty topics under consideration.

Microeconomics seemed to be heading in a different direction too, but for different reasons. By the 1950s it was coming to full power among social sciences by pursuing theoretical approaches. These abstract from reality and use mathematics to create important concepts such as optimization and equilibrium. As such mainstream microeconomists were not interested in whether humans actually do maximise utility or whether markets clear; rather they were interested in testing the consequences of assuming these things, for example by investigating what will

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[2]  See, for example, MacCrimmon and Toda (1969).

happen to security prices in equilibrium if there are changes in the underlying risk preferences of the market participants. Experiments in a laboratory situation are not necessarily useful for testing the *internal* validity of these models. Thus, according to Freidman and Sunder (1994), microeconomists were naturally quick to reject the idea that experimentation could make a useful contribution. Far better to judge the model according to whether its predictions meet with reality than on its assumptions as per Milton Friedman's famous *"as if"* principle (Friedman, 1953).

But things were changing. John von Neumann and Oskar Morgenstern published their *Theory of Games and Economic Behavior* in 1944 to instant impact. It was, according to Kagel and Roth (1995), both a more powerful theory of individual choice and a new theory of interactive behaviour. It had a profound influence on microeconomics, making series of predictions about individual choice behaviour which were ripe to be tested in exactly the kind of controlled situation that experiments could offer.

Individual choice experiments began to appear more widely. One article that followed the spirit of Thurstone was Mosteller and Nogee (1951) who examined von Neumann and Morgenstern's expected utility theory. Their method used initial tests to estimate each individual's utility curve with respect to certain risky gambles. These were used to make predictions about the individual's preferences over other, more complex, risks and compared to choices made by the individuals when assessing those same risks. They concluded, cautiously perhaps[3], that it was possible to construct the curves experimentally and use these to make predictions about attitudes to other risky propositions.

Implicitly this paper's important contribution was to recognise that the laboratory, and the controlled conditions it provided, was a useful setting to examine the von Neumann-Morgenstern choice model which, after all, was derived from assumptions about individual choice behaviour.

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[3] Mosteller and Nogee noted that the results were: "*[N]ot so good as might be hoped, but their general direction is correct.*" (Mosteller and Nogee, 1951, page 399).

Freidman and Sunder (1994) see this as a change in what they call the ruling paradigms of microeconomics. New topics were growing rapidly, presenting an opportunity for experimentation:

> "*General equilibrium theory, social choice theory, industrial organization theory, game theory, and voting theory matured to the point that they could provide serious alternatives to one another as a foundation for understanding economic phenomena... At this point the need for a method of choosing among competing economic principles became recognised.*"
>
> (Freidman and Sunder, 1994, page 123).

By the mid 1950s a growing band of economists were coming to the same conclusion. Experiments could be very useful in determining which, among competing models, was the best predictor of behaviour. Experimental studies began to proliferate in many of these new fields in microeconomics including: game theory (Flood, 1985, 1958); industrial organization (Chamberlain, 1948; Hogatt, 1959); competitive bargaining (Siegel and Fouraker, 1960); and choice theory (Allais, 1953). Siegel and Fouraker's work was perhaps the most comprehensive experimental paper of its day including a lengthy discussion reflecting on their work.

In the 1960s the field began to grow significantly, gaining ground symbiotically with the new topics in microeconomics that had come to the fore a decade earlier. Kagel and Roth (1995) document over 100 papers using experiments in the 1960s. Increasing thought was given over to the subject of experimental methodology: Becker et al. (1964) outlined a procedure for establishing subjects' true reservation prices for certain risky gambles, a procedure still in widespread use today. A paper by Hogatt, Esherich and Wheeler (1969) was the first to use computers in an economic experiment.

The 1970s and 1980s saw experimental economics being adopted more widely in economics faculties across the United States in particular. The field also expanded into new areas including, most significantly, social and public choice the-

ory (Fiorina and Plott, 1978; Pearce, 1979). An important source of growth was the new field of behavioural economics and the work of psychologists Daniel Kahneman and Amos Tversky. As noted in Chapter 2, in the 1970s researchers began to notice, and document, increasingly prominent situations when human decision making under risk did not seem to adhere to the axioms of rational choice theory. For the first time the von Neumann-Morgenstern preferences model could be comprehensively attacked on the basis of its predictions and a competing model advanced.

Kagel and Roth (1995) say that by the 1990s the growth was explosive and experimental economics began to display many of the hallmarks of a mainstream discipline including the *Journal of Economic Literature* establishing a separate bibliographic category for "Experimental Economics Methods" in the mid-1990s and experimental methods being adopted as part of standard undergraduate economics courses. Maurice Allais, a pioneer in choice experiments, was awarded a Nobel Prize in Economics 1988[4].

Today experimental economics is an accepted tool used in a variety of economic fields from industrial organization to finance theory and from public choice models to environmental economics. But what are the key principles that make this approach valid for studying such issues as judgemental bias in housing choice? The following sections examine this question, showing that two of the key principles from the earliest work in experimental economics hold the answer: experiments give significant control and so allow more powerful inferences to be made than from natural sources of data; and careful design to isolate and leave unchanged the underlying conditions allows researchers to induce how the results would likely be played out in real world scenarios.

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[4]   Also, in 2002 Daniel Kahneman and Vernon Smith were awarded the Nobel Prize, the latter: *"for having established laboratory experiments as a tool in empirical economic analysis..."*

## 5.1.2   Experimental Control

In Section 5.1.1 we saw that in one of the first true economic experiments Thurstone used the control of a laboratory experiment to investigate indifference curves of subjects with respect to certain consumption bundles. The data produced is clearly experimental data compared with the happenstance data he might have obtained from recording transactions for these goods in real settings[5]. The latter data would have arisen as an outcome of what are fundamentally uncontrolled processes, rather than the controlled conditions in an experiment.

Experimental data is valuable – and has been accepted as so across the scientific world – because it is easy to interpret. As we will see in later sections of this chapter, if option A is chosen more frequently when it is shown to participants first among several choices, than when it is shown last, we can be sure that it is this change in the order of viewing that is *causing* the change in preference. Why? Because in a well-designed experiment this is only this variable that is being manipulated, satisfying economists' desire for *ceteris paribus* conditions. If the data is happenstance we cannot be so confident in making causal conclusions.

The field of econometrics exists to pick through and minimise many of these difficulties and has developed powerful tools for doing so. But many of these tools rest on assumptions the veracity of which is difficult to gauge. Furthermore in many cases happenstance data is definitely inadequate. It may be impaired by omission of useful variables, which necessitates using proxies (thus introducing a further dilution in control), or by measurement error of unknown magnitude.

Experiments of increasing sophistication and application have removed many of these considerable obstacles to analysis. Often utilising a careful process of random allocation of subjects to treatments, one can be sure that in an experimental environment the only variable being altered is the one varied according to the treatment. The results are also replicable, an important way of establishing

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[5]   This typology replicates that used by Freidman and Sunder (1994), pages 3-4.

their validity[6].

What about external validity? Is it generally possible to generalise inferences from the laboratory into the real world? This is an issue which is often difficult for those not familiar with experimental work. It remains an important task of each experimental economist to explain how his work offers insights into real world situations and behaviours. However, in doing so he can rely on some simple but powerful inductive reasoning.

### 5.1.3 External Validity

Freidman and Sunder's (1994) primer for experimental economists tackles the issue of external validity in experiments. Unless you are an experienced experimentalist, they note, the obvious instinct when designing a laboratory experiment is to pursue what they call *realism*. That is to design the laboratory environment in a way that resembles as closely as possible the real world environment. Alternatively the instinct might be to design the experimental along theoretical lines, replicating as closely as possible the theories of interest. Freidman and Sunder argue that neither of these approaches is correct. The goal of the researcher should be to develop a design which balances both goals, for external validity and theoretical exactitude. Their point is that the experimental situation will inevitably not replicate the infinite complexities of the real world. It would be futile to try since infinite amounts of detail will always be left out. Moreover, complexity may dilute the control that is at the heart of the experimental method or even introduce confusion to the participants and thus introduce a confounding variable to the analysis.

That being the case, many economists have, quite reasonably, asked: how can the data gathered in experiments really be representative of the real world[7]? Scep-

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[6] Some of the most famous problems in game theory and choice theory have been repeated many hundreds of times, largely surviving unmodified, thus galvanising their validity. Examples include the *Prisoner's Dilemma* formulated by Flood and Dresher (Flood, 1985, 1958) and formalized by Tucker (Tucker, 1950).

[7] Note this analysis closely follows the reasoning of Freidman and Sunder (1994) pages 15-16.

ticism in the generalisability of experimental results has been present since at least the time of Gallileo when his critics did not believe that the motions he described in his pendulum experiments could be applied to the planetary motion of celestial bodies. However, the compromising of real world complexity does not automatically destroy the external validity of experimental work. The fact that you have observed the sun rise every morning for twenty years does not logically allow the deduction that it will rise again tomorrow. However people do make this leap of faith. Why? This is the principle of *induction*.

The principle that induction provides is that regularities observed in systems – such as behaviour in economic experiments – will persist in new situations provided the relevant underlying conditions remain largely unchanged. What counts as 'relevant', and to what extent conditions are 'largely' unchanged is a matter for theory and debate, but the principle of induction itself is an axiom of experimental work, not a deductible proposition.

Vernon Smith calls this the *parallelism precept* (Smith, 1982). According to this axiom it must be *presumed* that results *will* carry over to the real world. Thus the sceptic has the burden of stating what is different about the real world that might change the results observed in the experimental situation. The goal of the researcher is to design and re-design the experiment to counter these points of scepticism. As the following sections of this chapter discuss, significant effort was made developing and evolving the experiments in this thesis with precisely this in mind. Consequently the experiments described do allow for conclusions which have applicability in real world housing choice scenarios.

Are there any principles which experimental economists have evolved to deal with the most common criticisms of their method? Three important areas of design are considered in the paragraphs that follow: incentives, randomization, and subjects.

Incentives are an important part of any economic experiment. Whereas for psychologists these are less of an issue, with participants usually asked simply 'to do

your best', in economic experiments they are important in motivating subjects and gaining control over the experimental outcomes. Vernon Smith calls this *induced-value theory* (Smith, 1976). The idea is that by using a reward correctly, the experimenter can gain control over the motives of the participant, so that certain innate and heterogeneous aspects of individual behaviour become irrelevant.

Several of the experiments reported later in this chapter clearly demonstrate these characteristics. In one experiment subjects making judgements on the value of houses would earn more money through guessing accurately. In the choice set research subjects did earn a fee for participating, or could win a prize for taking part, but this was not strictly related to their *performance* in decision making. Thus, although conducted using the controls associated with economic experiments, these parts of the study are therefore not strictly experiments. They are controlled surveys. The methodology for these surveys will be discussed extensively in Sections 5.3 and 5.4 that follow. Furthermore in the case of the online surveys the choice scenario was designed to replicate a particularly delicate part of the choice process where prospects are initially weighed up and impressions established. The decision frame was virtually an exact replica of the frame in which decisions are actually taken, which lends the results a considerable external validity, even given the lack of incentives.

Another important principle for experiments is randomisation. With human subjects this is a vital ingredient in establishing external validity because it removes significant and uncontrollable nuisance variables which can seriously damage the results. Nuisance variables are a problem if they are correlated with the treatment variable. Experiments must be designed very carefully with this in mind. A big problem known to experimenters is the alertness and interest of subjects, for example. It is likely a significant nuisance variable would be introduced to the analysis if all the complex choice set experiments took place during the late afternoon, when subjects might be tired after a long day, whereas the simple ones took place in the morning, when they were bright and alert. A finding that subjects performed worse in the complex experiments than the simple ones would

be compromised by such a variable because the researcher cannot be sure that it is the treatment variation causing the differential performance.

Similarly individual subjects can have many different characteristics which are unobservable and uncontrollable by the experimenter. In this case randomisation of subjects to treatments – and even positions within the experimental environment – has evolved as standard practice in experimental economics.

The nature of the human subjects chosen is, of course, a big part of the practice of experimental economics. Freidman and Sunder (1994) discuss this topic at some length, pointing out that the nature of the subjects chosen will depend ultimately on the aims of the experiment at hand.

Student subjects are a very common part of the subjects, partly because of their ready availability to academic researchers and the relatively low cost to motivate them. There is a lengthy debate about the generalizability of results obtained from using students subjects (Calder, Phillips and Tybout, 1981; Cunningham, Anderson and Murphy, 1974; Shuptrine, 1975). A reasonable conclusion of this literature is that student subjects can be used if they represent a good model of a particular group under consideration, or if they point to behaviours which can be corroborated by other experiments. For the research here students are useful because they represent a cadre of individuals who are likely to be active in the rental market in the coming years. Another reason that undergraduate students may be a good subject pool is that they represent the sophisticated end of the renter market. This presents an even stiffer challenge for the behavioural biases hypothesised. In other words, it is possible to use the non-representativeness of the subject group to strengthen the validity of the results obtained. If even sophisticated decision makers are vulnerable to simple behavioural manipulations, what hope for the rest of us?

Experimental methodologies often build in repetitions that use different subjects to extend the external validity. The research reported here does this too, by including extensive testing on adult subjects who own homes and are, therefore,

likely to have as much experience as is possible in choosing houses.

## 5.1.4 A New Platform for Experiments

Two of the research projects examining choice biases in housing scenarios were undertaken using an online experiment[8]. Section 5.3 will discuss the methodology itself in detail, but it is important to consider here the contribution this makes both to the external validity of the work and experimental economics itself.

Completing experiments into housing choice online is a vital part of the external validity of the work because of the explosive growth of this medium for making housing choices. The leading website, Rightmove, has over 20,000 estate agents listing properties on their site, which is over 90% of the total. There are over one million properties on that website alone. Today perhaps the majority of housing searches begin with online searches. Mimicking this frame when conducting controlled surveys is, therefore, an important part of the parallelism precept discussed by Smith (1982). Significant attention was paid to designing and conducting the survey so that it replicated closely how choices like this are made. This approach enhances the validity of the results considerably.

It also represents a contribution to experimental economics and choice theory more generally because little work currently exists to examine the importance of choice biases in online settings, despite its increasing importance as a choice frame. In many ways it is the perfect breeding ground for many of the behavioural heuristics discussed in Chapters 2 and 3 to take effect.

Finally the key strength of the online methodology is that it replicates what Kahneman and Tversky (1979) have called the *editing* phase of decision making, where the preliminary analysis of offered prospects occurs and simplifications take place to allow cognitively easier decision making (see Chapter 2, page 55). The exponential rise of online buying outlets has made biases in this phase of decision

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[8] The term "experiments" is used extensively in the text although, as discussed in Section 5.1.3, it is acknowledged that strictly these are controlled surveys.

making more important than ever. This is particularly true with housing choice. It is easy to imagine a process of housing selection where initial preferences – so powerful in conditioning ultimate choices – are influenced by the initial phase of searching and browsing online. The research in this thesis contributes by placing this part of the decision making process under a greater spotlight than has previously been the case.

## 5.1.5 Summary

Experimental methods have followed, within the wider subject of economics, a similar evolutionary path to that which experimentation has followed in other areas of scientific inquiry. It found a role in microeconomics and particularly choice theory from the 1950s as the subject evolved and grew in sophistication, allowing for competing hypotheses on a diverse range of topics which experiments could be useful in modelling and testing. As in other experimental subjects, a body of standard practices has emerged which help build upon the experiment's ultimate strength – the control it provides to allow firm causal conclusions to be drawn – while also ensuring that as far as possible, the results have external validity and can tell us something about the world outside of the laboratory.

The methodological approach in this thesis to investigate the hypotheses and answer the fundamental question posed in Chapter 1 – to what extent, and by what means, can housing choices be manipulated in non-rational ways by a willing economic agent? – employs economic experiments and controlled surveys in the tradition of experimental economics. They are carefully designed to replicate essential features of housing choices, while abstracting somewhat from the rich tapestry that is real world decision making. This is the best approach to provide the control necessary to allow firm conclusions to be drawn, allow for maximum generalisability and show a way forward for future research in the topic.

# 5.2 Student Group Experiments

The experiments involving student participants were carried out at the University of Cambridge between November 2009 and March 2010. They were all in a classroom setting in groups of between 10 and 40 students. A total of 283 students took part. Great care was taken with the recruitment and experimental procedure for conducting the experiments to ensure the fidelity of the results, following current best practices in experimental economics. This is discussed in the following sections.

## 5.2.1 Recruitment

Volunteers were recruited using a variety of student-specific media throughout the University. This included advertisements in local student newspapers, emails to students groups and posters. Following guidance in Freidman and Sunder (1994) all advertisements made only general references to the context of the experiments. Volunteers were called for an "experiment in the economics of decision making", that would take around 45 minutes and for which they would earn £5 for participating, and would have the opportunity to earn £10 or £20 more depending on their performance[9].

## 5.2.2 Pilot Study

As part of the development process for the experimental procedure, pilot experiments were arranged in November and December 2009. Involving around 40 participants, these experiments were conducted as dry-runs of the full experiments later. After the pilot studies subjects were asked to stay behind for 5-10 minutes and more in-depth feedback was solicited on an informal basis.

Several important alterations to the experimental design were made as part of this process. Modifications were made to way certain properties were described to ensure that all terms would be understood by all participants. For example

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[9] Incentives are discussed in Section 5.2.7.

several subjects had not understood what a "maisonette" was. This is potentially an important source of bias therefore presentation scripts were re-examined modified to explain all these terms and more emphasis was placed on participants being able to ask questions during the experiment itself to clarify matters.

The pilot study also allowed timings to be tested and modified so the whole experiment ran more smoothly, without significant gaps or waiting periods. The entire procedure for all classroom experiments lasted a maximum of 45 minutes from beginning to end, which is important in retaining subject involvement and ensuring their fatigue was kept to a minimum.

As part of the pilot study, consultations were completed with a local estate agent, including advice about suitable properties to ensure the validity of the intended manipulations.

### 5.2.3   Experimental Procedure

Experiments were designed to best practice in the field of experimental economics. Much of the procedural design was taken from Freidman and Sunder (1994) and Kagel and Roth (1995) whose texts remain the leading authorities on experimental methods.

The experiments were all conducted in a classroom setting which is illustrated in Figure 5.1. Desks were lettered and clearly marked. Spacing was such that it would be difficult – although not impossible – to see another's answers. In light of this subjects were reminded that it was important they did not look at others' answers and that being caught doing so would result in them forfeiting all payments and being excluded from the experiment. At each desk was a pen, answer sheet (which was turned over) and a consent form.

In common with standard experimental procedure, consent was sought from all subjects before taking part. The consent form was designed from a template suggested in Freidman and Sunder (1994). A copy is provided in Appendix A. During

<div align="center">(a)            (b)</div>
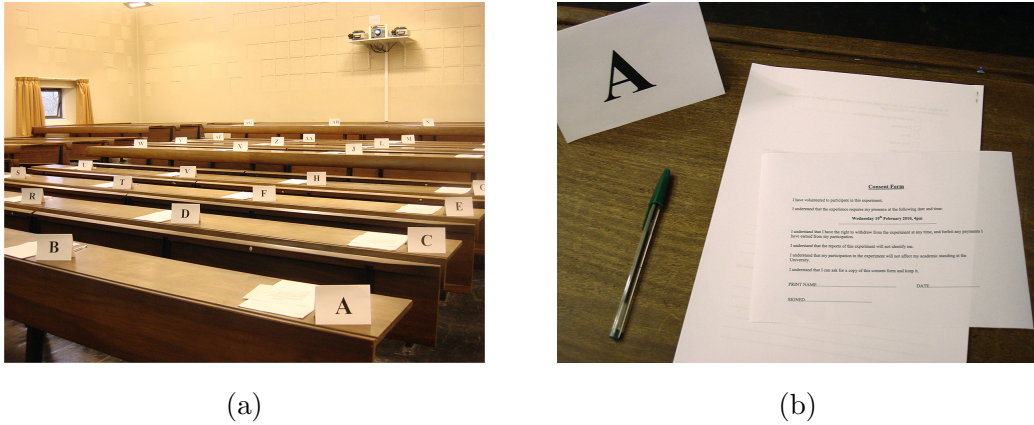
**Figure 5.1:** Experimental environment for Student Group Experiments.

some experiments information would be received using a presentation therefore all experimental environments had large overhead projectors which were in clear sight from all desks.

Desk allocation was conducted using a randomisation procedure which ensured the anonymity of the respondent. That the responses are anonymous – and seen to be so by participants – is an important part of minimising experimenter-induced biases where participants subconsciously give answers which they expect the experimenter wants to hear. When everyone was ready, subjects were asked to turn over their answer booklets and read the instructions. These were also read aloud at the same time.

This initial procedure was governed by an experimental protocol which detailed to the experimenter how to conduct the experiment[10]. Part of this guidance is reproduced in Appendix A. Throughout the experiments information was read to them in this way to ensure that each experiment was identical, except for the experimental treatment in each case.

Having completed the initial instructions, experimental treatments were carried out. The procedure for these is contained in Section 5.2.4. Having completed

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[10] Note: the experimenter was the author of this thesis throughout.

experiments students were asked to fill in a questionnaire with personal details and other information, for example about the strength of their preference(s) for their choice(s). The questionnaire was designed based on standard templates in Freidman and Sunder (1994) and is reproduced in Appendix A.

At the end of the experiment payments were made to students. This was done in cash (in envelopes). When the payments were all completed, subjects were asked to leave, thus completing the experimental procedure.

The following two sections cover the precise nature of the experiments which the student group took part in.

### 5.2.4   Written Choice Set Experiments

The simplest experiments that students took part in involved the written receipt of information only. Students were asked to trade-off two features that they value in a hypothetical scenario involving renting a property. This experimental set-up matches the experiments pioneered by Huber et al. (1982) and Simonson (1989). There were two main experiments conducted using this procedure: testing for asymmetric dominance and compromise effects. Thus, these experiments were intended to test hypotheses **H1** and **H2**, which were discussed in Chapter 4 (page 96 and 97) and are reproduced below:

> **H1.** *Asymmetric dominance: the proportion choosing a particular property increases when a decoy property is added that is asymmetrically dominated.*

> **H2a.** *Strong compromise effect: the proportion choosing a particular target property increases when it is made a compromise choice by the addition of a decoy property to the choice set.*

> **H2b.** *Weak compromise effect: the proportion choosing a competitor property decreases when the addition of a decoy property to the choice set makes the other original property the compromise.*

An example of one of the experimental scenarios that students were faced with is presented in Appendix A. Participants were asked to trade-off commuting time with the state of repair of the property.

Ordering effects are also tested in this example by varying the order in which the options are listed. These were the subject of hypothesis **H3**, which was discussed on page 98. It is reproduced below:

> **H3a.** *Primacy: information received first will have excessive weight in judgements over housing, thus houses seen <u>first</u> will be preferred more, ceteris paribus.*

> **H3b.** *Recency: information received last will have excessive weight in judgements over housing, thus houses seen <u>last</u> will be preferred more, ceteris paribus.*

Figure 5.2 represents the different choice treatments in the experiments on a graph. As can be seen from this information, the options are set up so that in the asymmetric dominance experiments Option C is dominated by Option B; and Option D is dominated by Option A. In those examining compromise effect
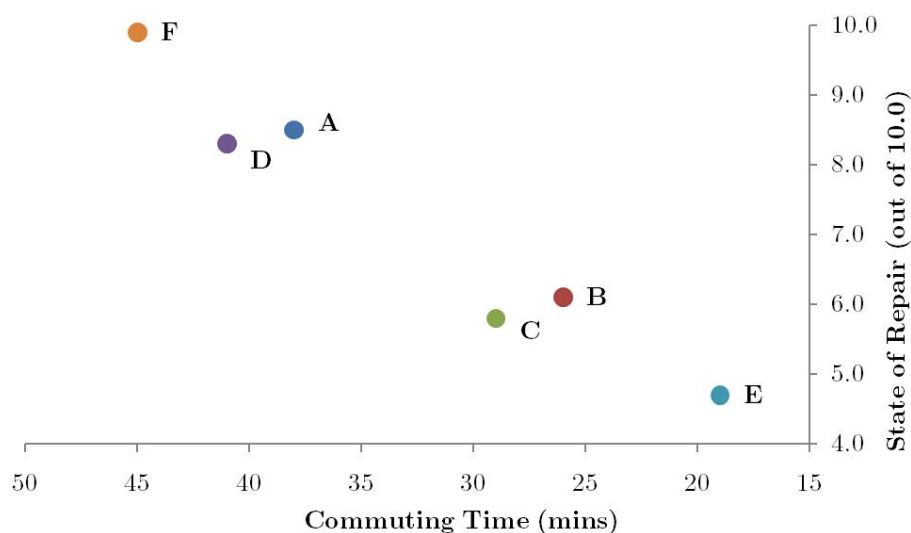


**Figure 5.2:** Choice options for students participating in written experiments.

128

| Treatment | Set and Order | n |
|:---:|:---:|:---:|
| a:1 | {A, B} | 21 |
| a:2 | {B, A} | 21 |
| b:1 | {A, B, C} | 24 |
| b:2 | {C, B, A} | 25 |
| c:1 | {A, B, D} | 25 |
| c:2 | {D, B, A} | 25 |
| d:1 | {A, B, E} | 22 |
| d:2 | {E, B, A} | 20 |
| e:1 | {A, B, F} | 22 |
| e:2 | {F, B, A} | 20 |

**Table 5.1:** Treatment classification for written student experiments.

Option E makes Option B a compromise; while Option F makes Option A a compromise. The final numbers used were calibrated using feedback from the pilot study to ensure that those who saw the simple choice set containing only Options A and B were divided evenly between the two. As can be seen from Table 5.1, the experimental treatments consisted of manipulating both the choice set and the choice ordering. For clarity, those who were part of treatment a:1 saw the options {A, B} in that order; whereas those part of treatment c:2 saw the options {D, B, A} in that order.

## 5.2.5 Visual Choice Set Experiments

As discussed in Chapter 3, the majority of papers which have examined choice set manipulations have used very simple 'dummy' options to manipulate choices. These were typically transparently dominated, or participants found it easy to weigh up the simplified characteristics on show. The experiments described in the previous section replicate this method to some extent. However, housing is a highly complex choice scenario with many decision variables. To capture this complexity and bring the choice frame into a more realistic setting, while still testing hypotheses **H1** and **H3**, a set of more realistic 'visual' choice set experiments were also designed.

Subjects were told that they were going to receive a presentation, which would be a 'virtual tour', of several properties and afterwards asked which they liked the most. The scenario was constructed in a similar manner to the written experiments considered in Section 5.2.4: students were told to imagine they had got a job in Cambridge and were looking at houses to rent for a couple of years. To remove any income effects subjects were told throughout that the houses would cost the same to rent and that they could afford to live in any of the properties shown to them.

Three properties were chosen based on discussions with a local estate agent and after considering the results of the pilot study. Apartment X was a two-bedroom city-centre flat in a smart and modern complex. The fit out was clearly new and it was obviously well equipped with modern technology. House Y was a two-bedroom city-centre terraced property. It offered what are called 'character features' in British housing markets that were not evident in the flat, given its age, including a fireplace and old floorboards in places. It was in an excellent state of repair also, with a new bathroom suite. This bathroom was, however, on the ground floor of the property, which is an inconvenience in modern British properties. References to location were non-specific. Both were said to be 0.7 miles from the city centre and close to amenities. Thus both properties offered the same rent, distance to city centre and number of bedrooms, but were different in terms of character features and facilities. Broadly Apartment X had less age and character features, but better facilities than House Y. An excerpt from the 'virtual tour' of Apartment X is reproduced in Figure 5.3. Full reproductions of the information for each property are presented in Appendix A.

In addition to Apartment X and House Y a third option, House Z, was added to some treatments. This property was also a terrace. Thus it also offered age and some period features. However, it was further away from the city centre than both X and Y and was in a noticeably poorer state of repair than House Y. It was therefore a decoy, placed so as to be similar in type and character to House Y but ultimately dominated by it. Table 5.2 reports the treatments that were used in this experiment. Thus for example, subjects who were exposed to
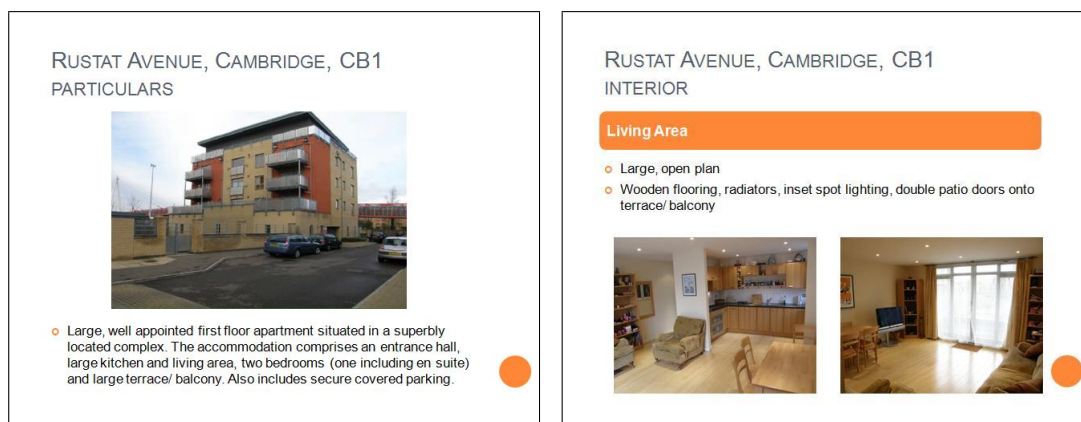
(a)                                         (b)

**Figure 5.3:** Example of the 'virtual tour' method.

treatment f:1 saw Apartment X followed by House Y, and subjects exposed to g:2 saw {Z, Y, X} in that order.

Clearly given the significantly greater amounts of information available it is not possible to control the experiment with the same precision as when there are only two dimensions of value. It is far harder to make predictions about the way these effects will run. Furthermore, significant experimental 'noise' compared with more typical – highly controlled – experimental situations is expected. For this reason the analysis which follows in Chapters 6 and 7 considers relationships at the 10% level of significance.

| Treatment | Set and Order | n |
|:---:|:---:|:---:|
| f:1 | {X, Y} | 39 |
| f:2 | {Y, X} | 44 |
| g:1 | {X, Y, Z} | 45 |
| g:2 | {Z, Y, X} | 67 |
| g:3 | {Y, Z, X} | 31 |

**Table 5.2:** Treatment classification for visual student experiments.

## 5.2.6   Judgement Experiments

As discussed in Chapter 4, manipulating judgements, particularly value judgements, is potentially an important part of consumer vulnerability when choosing housing. The experiment used examined anchoring by giving participants an arbitrary numerical value before asking them to estimate the sale price of a series of four properties. Thus it is intended to examine hypothesis **H4**. This was discussed on page 100. It is reproduced below:

> **H4.** *Anchoring: individuals' valuation judgements over housing are biased by the presence of an arbitrary anchor.*

Once preliminaries had been completed, subjects were given instructions[11]. As previously students received these instructions in written form and they were read aloud. In order to provide a minimum level playing field for all subjects, given their relative lack of experience in housing choice, all were given some background information about current conditions in the housing market both on a national and local level. This procedure also made the experiment more realistic because in real housing choice situations decision makers would be expected to spend at least some time familiarising themselves with their local market through research on the internet local press.

Thus subjects were given a 10-minute presentation on the UK and Cambridge housing markets which included facts and figures on the following:

- Commentary on current national house price trends
- Current average house prices as estimated by leading market researchers
- Regional market moves and average house prices
- Background on the Cambridge housing market
- Average house prices in Cambridge's five central post-code areas

This method also presents a significant challenge to the anchoring manipulation that was to follow because it presented subjects with many other potential and highly salient anchors from which they could base their estimate. All the information contained within the presentation was based on internet research

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[11] As with earlier instructions, these are reproduced in Appendix A.

readily available to any real home buyer on websites including rightmove.co.uk and primelocation.com.

Having listened to the market trends presentation the next phase of the experiment began. Its aim was to give subjects an arbitrary anchor which might bias their judgement. Subjects were told that before we viewed the first property they needed to write down a number. This was the anchoring procedure. The instructions for this procedure were exactly as below:

> *Before we view our first property I would like you to use the first space [on the answer sheet] to write down the last three digits of your mobile phone number. Write these down as a price in thousands of UK pounds. So, if my last three digits were two-zero-four, I would write down two-hundred and four thousand pounds.*

This procedure uses as its inspiration the anchoring procedure developed by Ariely et al. (2003) who used digits of US Social Security numbers to produce an anchor.

The exact procedure used is, in fact, somewhat more stringent their method, because it leaves less room for the arbitrary anchor to take hold. In their experiments, where student subjects were asked to value a series of household items such as bottles of wine and computing equipment, the anchor was given then subjects were asked to indicate whether they thought the item they were valuing was worth *more* or *less* than the number they had just written down. Having done this they were then asked what they thought the value was. In the housing choice experiments reported here no reference at all was made to the anchor once it was written down.

By asking participants specifically to appraise the item at hand in terms of the anchor, Ariely et al. clearly gave the arbitrary anchor much more prominence in the valuation process and so made it much easier for it to influence judgement. Thus, as well as providing evidence about biases in a different area of choice, the housing judgement experiments also provide a methodological test of Ariely et al..

Having received the arbitrary anchor, participants were presented 'virtual tours' of the properties using information from the agents' brochures as in the visual choice set experiments in Section 5.2.5. The presentations for all four properties are reproduced in Appendix A.

After each viewing, which lasted approximately 2-3 minutes, subjects were asked what they thought the sale price of the property was. They were reminded that, as per the instructions, the house was sold within the last four months and that their incentives would be paid according to how close they were to that value. The procedure was repeated. No price feedback of any kind was given in between each valuation. The actual values of these properties are reported in Table 5.3.

Having completed the experiment subjects were asked to complete a questionnaire before incentive payments were made. Incentives schemes are discussed specifically in Section 5.2.7 which follows.

In terms of experimental procedure, Freidman and Sunder (1994) suggest a procedure for efficiently incentivising subjects in multiple judgement scenarios. Students were told at the beginning that accurate judgement would be rewarded, but that payments would only be made on one of the properties. However the property on which the payments would be made would only be determined at the end of the experiments. Given these conditions participants' best course of action is to judge the value for all as accurately as they can since they do not know which will offer the chance of earning extra money. This mechanism was explained in full to participants at the beginning of the experiments as was their

| House | Sale Date | Price |
|:---:|:---:|:---:|
| A | 12 January 2010 | £240,000 |
| B | 13 January 2010 | £207,000 |
| C | 5 January 2010 | £215,000 |
| D | 6 November 2009 | £195,000 |

**Table 5.3:** Value of properties in anchoring experiment.

| Step | Action | Medium |
|------|--------|--------|
| 0 | Subjects welcomed | – |
| 1 | Experiment instructions | Written, read aloud |
| 2 | Presentation: UK and Cambridge market | Overhead projector |
| 3 | Anchor procedure | Read aloud |
| 4a | Presentation: House A | Overhead projector |
| 4b | *Valuation: House A* | Written |
| 5a | Presentation: House B | Overhead projector |
| 5b | *Valuation: House B* | Written |
| 6a | Presentation: House C | Overhead projector |
| 6b | *Valuation: House C* | Written |
| 7a | Presentation: House D | Overhead projector |
| 7b | *Valuation: House D* | Written |
| 8 | Questionnaire | Written |
| 9 | Incentives calculated and paid | Read aloud |
| 10 | Subjects dismissed | – |

**Table 5.4:** Summary of anchoring experiment procedure.

best course of action as a result. In full view of participants a house was selected at random by asking one of the participants to pick a lettered tile out of a bag. Based on the selection subjects were told the correct value and payments were made accordingly. Having received the money and signed receipts the experiment was over and subjects were invited to leave. Table 5.4 presents a summary of this procedure.

### 5.2.7 Incentives

Incentive payments are an important part of economic experimentation, as discussed in Section 5.1. The induced-value theory of Smith (1976) suggests that providing incentives correctly is a sufficient way to control the behaviour of respondents in the desired way, despite their heterogeneous preferences and attitudes. In the judgement experiments the intention was to induce participants to estimate the value of one or several properties as accurately as they could, given the information available to them. Incentives were thus designed for this purpose.

Housing choices are among the most important that can be made in a lifetime by any individual or household. As discussed in Chapter 1, this is part of the reason that it is a vital – and very interesting – area to examine behavioural biases. Many economic experiments employ incentive schemes which are graduated: participants earn increasing amounts as they perform better and better with some extra money almost guaranteed. Housing choice is like this, especially where judgement of value is concerned. Judging incorrectly means paying thousands of pounds too much, consigning the decision maker to years of paying above 'fair value' for his purchase. Or perhaps it means paying too little, therefore missing out on properties altogether and a stressful and extended search process. Both result in significant, binary, effects on welfare and utility.

As such a binary incentive scheme was designed for the judgement experiments. Subjects could earn one of two amounts, £10 or £20. They would earn £20 if they estimated to within £2,000 of the true sale price, and £10 if they estimated to within £10,000 and £2,000 of the correct price. Any judgements outside of this boundary would not be rewarded[12]. All subjects earned a fee of £5 for participating in experiments, which is standard practice in experimental economics.

Thus, for judging accurately, the student volunteers could earn up to 4x their show up fee as a reward. This effectively motivated the student subjects taking part, as well as contributing to the realism of the experiment itself. Smith's (1982) parallelism precept[13] says that inductive reasoning allows one to say that behavioural regularities from laboratory experiments will persist in real world situations as long as the relevant underlying conditions remain substantially unchanged. The incentive scheme was high-stakes[14] and it was binary, conditions which match those in real world housing choices.

The incentive structure is another feature which distinguishes the experiments

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[12] Note that in one experimental treatment there was the possibility of earning a top prize of £100 for the best overall estimate. This did not make a significant difference to the results.

[13] This is discussed in more detail in Section 5.1.

[14] The stakes were high both relative to typical practice in experimental economics and to the student participants involved in these tests.

here from the choice experiments of Ariely et al. (2003) who used a randomisation device to force some participants to actually transact in the goods they had valued at their stated prices. Such a methodology was clearly not feasible in the case of housing choice! Approximately 10% of all participants earned some extra money from this incentive scheme. The mean payout was £6, although naturally this had a significant variance (90% earned £5, while 10% earned some combination of £10 or £20).

### 5.2.8 Summary

In total 283 student volunteers took part in the experiments which examined choice set and ordering effects from several perspectives with increasing complexity, as well as judgemental biases in value estimation. Significant time and effort was put into designing and implementing an efficient and effective experimental methodology in accordance with current best practice in the field.

Some of the experiments broadly replicate methodologies developed in other papers including Huber et al. (1982), Simonson (1989) and Ariely et al. (2003). However in several cases the procedure used represents a more stringent test of the bias hypothesised than has been used previously. This adds to the credibility of the result as well as providing an implicit test of the previous method.

Thus the results reported from these experiments in the chapters that follow have credibility and can validly give us insights into real world housing decisions.

## 5.3 Rightmove Survey

The Rightmove Survey was generated from a large-scale online experimental survey of a self-selected group of 4,000 users of the property search website Rightmove. They survey was conducted over a period of one week in June 2010.

The student experiments described in Section 5.2 have many advantages, including the ability to control and manipulate information in a classroom setting

and conduct more lengthy sessions (up to 45 minutes). However there is a clear weakness in that group – most students are in their early 20s and are unlikely to have much experience in buying houses. Thus, while they represent a good proxy for behavioural in rental markets, as has already been argued, the conclusions might not apply to home buyers.

Thus, to investigate judgemental bias in housing choice more thoroughly it is important to try and extend the scope of the experiments to a wider group of participants in housing markets. This also allows for an implicit test of whether age and experience are important factors in determining the vulnerability to the behavioural biases hypothesised.

Another reason for conducting the survey in an online setting is that it provides a different platform – and hence methodology – for conducting experiments. This strengthens the findings and extends their validity still further so is good experimental practice for its own sake. However, getting beyond the classroom to conduct an experiment online has another important advantage when studying housing choices: it replicates the situation in which increasing amounts of housing choice takes place.

From almost nothing in the year 2000, property search websites have revolutionised the way people search for property in the UK. In March 2010 figures showed that the top four websites attracted over 7.5 million unique visitors[15]. The leading website, Rightmove, has over 20,000 estate agents listing their properties on its site, which is 90% of the total. There are over 1 million properties listed on that site alone. Today many property searches begin on these vast databases.

As discussed earlier in this chapter, this part of the search process resembles closely what Kahneman and Tversky called the *editing* phase of decision making, consisting of an initial analysis and simplification of the prospects at hand. Their foundational *Prospect Theory* discusses the violations of rational choice

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[15] http://www1.propertyportalwatch.com/2010/04/zoopla-co-uk-reports-more-growth/.

theory that may arise from *both* the editing and later *evaluation* phases of decision making, but much of the consumer choice literature which followed does not distinguish between the two. Such a distinction is vital in understanding choice biases and ultimately choice manipulation. So by creating an experiment where decision makers choose housing but are aware that they are not going to be actually completing any purchases the work focuses more explicitly on the editing phase of choice and preference construction.

Thus studying judgemental bias in housing choice by employing an online design brings far greater realism to the methodology by replicating the context and situation in which many of these choices are made. It is important to bear in mind though, as discussed previously, that predictions about the effects of manipulations are far more difficult in this information-rich design than for simpler experiments reported here and in existing literature.

## 5.3.1 Survey Design

The natural partner for administering the survey was an online property search website and agreement was reached with the Rightmove website to help design and administer the survey. Throughout the design phase the motivation was to create a choice frame which matched, as closely as possible, the way in which housing choices are made on the Rightmove website. With relatively few modifications this was possible.

Four houses were selected to form the experimental treatments and screen captures were taken to be used in the survey. One such is reproduced in Figure 5.4. Small modifications were made to this capture to remove certain confounding variables from the analysis. Firstly all references to specific locations were removed so that, even though all the houses were in Cambridge participants did not know this. Research in professional valuation has shown that familiarity with the local market can be an important determinant of *valuation* accuracy (Diaz, 1997; Diaz and Hansz, 2001). This was necessary to ensure a level playing field among respondents in a UK-wide study.
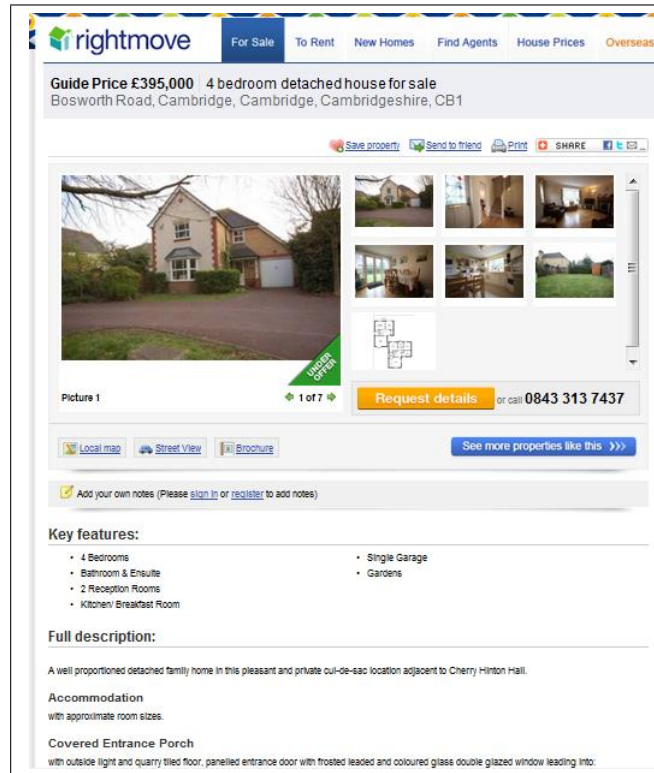
**Figure 5.4:** Screen capture of a property profile on Rightmove.

As with the classroom experiments discussed in Section 5.2, all price indications were also redacted. Participants were told they were going to view houses which were the same value (this was not true to the letter, but there was not much difference between each one). Doing this removes any income effects from the analysis which are also hard to control and may have a significant confounding influence on the analysis. Also certain minor changes were made to the "Full Description" section of the property profile so that there was more consistency between the properties. A final important result of this design is that some of the interactivity was lost. Most particularly participants could not toggle between different photographs of the property. They were only able to see one main shot in large size, with the others more thumb-nail sized as can be seen in Figure 5.4. This was a necessary part of the survey design software.

Overall the property profiles created for the survey very faithfully match the terms under which properties are viewed and chosen in this environment. As already discussed, this is a key strength of the methodology: survey participants were asked to choose which house they favoured from a series which looked the same as any other group of houses that might be returned from a casual search of the website.

## 5.3.2 Recruitment and Incentives

Email invitations were sent out to a randomly selected group of 7,000 of these users of the website who have previously indicated a willingness to take part in surveys. As is reported in Chapter 6 they represent a wide demographic of adults living in the UK[16] whose only common trait is that they use, or have used, property search websites. This is, if anything, a desirable feature of the sample group because it means that they are at least familiar with how property search websites work, giving them the best chance of avoiding the kind of choice biases which are being hypothesised. In turn this means they form a stringent test of those hypotheses.

There was no judgemental element to the experiments in this case, so incentives could not be paid according to how 'well' a person performed. Subjects were incentivised to take part however by being told that they could earn a prize for participating. Fifteen prizes of between £20 and £100 were available in the form of vouchers to a national department store. This conformed to standard practice used by Rightmove and was administered by them. In total £440 was paid out in prizes, which equates to a recruitment cost of just over 10 pence per respondent.

## 5.3.3 Experiments

The experiments were designed to examine choice biases in a similar manner to those considered by the classroom experiments in both written and visual form.

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[16] A very small minority currently live outside the UK.

Having clicked on a link to the survey, participants were greeted by an introductory screen which gave instructions. They were very simple and made no reference to the purpose of the study, just that they were asked to view a series of houses then make a decision about which they preferred. The text from the instructions page is reproduced in Appendix B.

Having clicked to enter the survey itself, subjects were shown either two or three houses picked from the four pre-selected to make a choice set. There were three choice sets: {A, B}, {A, B, C} and {A, B, D} where the letters correspond to properties A to D respectively. These choices were arranged in all possible ordering combinations, resulting in 14 treatments. These are reported in Table 5.5 along with the numbers taking each. A total of 4,087 took part in the survey, of which 3,786 were usable samples (with all necessary data). Having seen the choices, participants were asked which their preferred property was before completing a questionnaire which asked for demographic details as well as about their choices. A copy of the questions in the questionnaire is presented in Appendix A. Having completed the survey questions, a space was left to leave contact details for those who won prizes. This marked the end of the survey.

Full details of all the properties can be found in Appendix B. The main purpose of the survey was to investigate the choice biases which were considered in Chapter 4, in particular asymmetric dominance. Would it be possible to use a 'decoy' property to bias choices in favour of a 'target' property, in violation of rational choice theory's *independence of irrelevant alternatives* axiom? The specific hypothesis which this experiment aimed to investigate was expressed in Chapter 4:

> **H1.** *Asymmetric dominance: the proportion choosing a particular property increases when a decoy property is added that is asymmetrically dominated.*

To investigate four properties were chosen and labelled A, B, C and D. The aim was to create options which adhered to the graphical representation in Figure 5.5. Properties were chosen after discussions with a local agent and representa-

| Treatment | Choice Set and Order | n |
|:---:|:---:|:---:|
| 1 | {A, B} | 335 |
| 2 | {B, A} | 312 |
| 3 | {A, B, C} | 277 |
| 4 | {A, C, B} | 318 |
| 5 | {B, A, C} | 272 |
| 6 | {B, C, A} | 275 |
| 7 | {C, A, B} | 236 |
| 8 | {C, B, A} | 232 |
| 9 | {A, B, D} | 253 |
| 10 | {A, D, B} | 259 |
| 11 | {B, A, D} | 296 |
| 12 | {B, D, A} | 244 |
| 13 | {D, A, B} | 235 |
| 14 | {D, B, A} | 242 |

**Table 5.5:** Treatments in the Rightmove Survey.

tives from Rightmove to ensure that the properties did adhere to the intended manipulations.

Properties A and B were chosen so that they offered different combinations of two key characteristics: state of repair and age/ character. Property A was a modern four-bedroom property. It was in an excellent state of repair and offered many modern conveniences associated with family life today including a large kitchen diner. It was in a better state of repair than Property B, which had clear evidence of a lack of repair. Property B was, however, older looking and definitely offered a greater quantity of features which, in British housing markets, might be referred to as 'character features', including a mature garden and some internal features. Thus neither property dominated the other, and a straight choice between them involved trading off the relative merits of these two features.

Properties C and D were decoys. They were dominated by Properties B and A, respectively. Property C was also an older property, solidly built with some pleasant features, but it did not have as many as Property B, and was also in a worse state of repair. The units and fittings were older, as was some of the decoration.
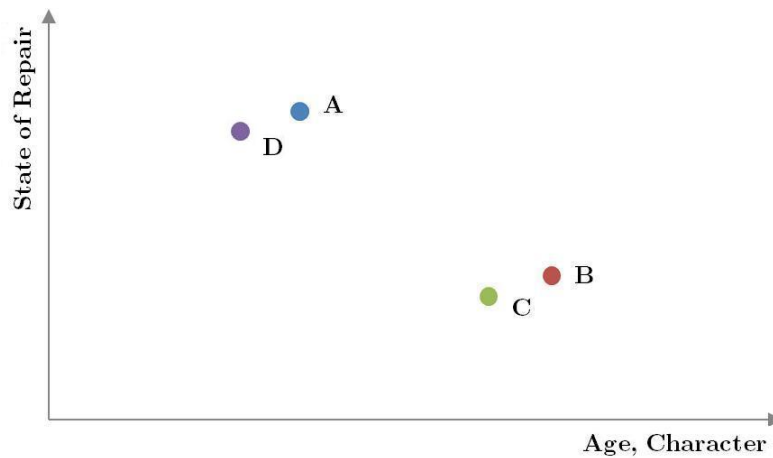
143

**Figure 5.5:** Choice options for participants in the Rightmove Study.

Property D was also modern, and so similar in this respect to Property A. Many of the fixtures and fittings looked new, as did the bright red painted door. But it did not offer the features and character of Property A. Both decoys were also smaller than their associated targets (although all had at least four bedrooms). An illustration of how the properties looked is presented in Appendix B.

## 5.3.4 Summary

The Rightmove Survey has several important methodological advantages over and above the classroom experiments conducted with student volunteers, aside from the significantly larger scale of the study.

Firstly it uses a wider demographic more representative of those likely to have made, and be making, housing choices. Indeed, the use of a self-selected group of users of the property search website Rightmove brings a demographic which is more likely than the general population to have looked, or be looking, for property and so is a good test of the hypotheses at hand. The use of the online survey design replicating almost exactly the conditions under which many housing choices are at least started today adds realism to the choice scenario. And it allows research to focus on a new platform for consumer choices: online. This is interesting because little has currently been done to focus on how such platforms

may alter choice dynamics; and because it allows us to shed more light on the vital initial phase of decision making where prospects are simplified before being evaluated more fully, a process first identified in Kahneman and Tversky's classic 1979 paper.

## 5.4 Stamford Adult Group Survey

This section describes a survey of 600 residents of the town of Stamford, Lincolnshire examining further the biases in housing choice that have been advanced in this thesis. The survey was also conducted online, using specialist software.

### 5.4.1 Survey Design

The Stamford Adult Group Survey tests the same behavioural biases as the Rightmove Survey using the same information set. In other words it was designed the test hypothesis **H1** which was first expressed in Chapter 4 (page 96). The properties used, and the manipulations attempted, are the same as those described in Section 5.3. As well as providing supplementary evidence on the existence and persistence of choice bias in a housing scenario designing the study this way offered a natural way to test the methodology of the Rightmove study itself.

The survey was conducted online using specialist survey software provided by www.questionpro.com (hereafter referred to as "Question Pro"). This allows the user to specify the layout and content of the internet pages which form the experiment. The broad structure of the survey was the same as that described in the previous section: participants were first greeted by an information screen telling them about the experiment, then showed a series of properties before being asked to state which they preferred and why. Finally there was a questionnaire to complete the survey.

The text used to describe Properties A, B, C and D was the same as with the Rightmove study as were the photographs. However there were subtle differences in the layout and 'look' of the pages. In the Rightmove survey subjects were only

145

able to see one photo in large size, with the others being thumb-nail size only. This was a necessary part of the way the Rightmove-designed software worked. Question Pro's software on the other hand allowed for all the photos to be shown in large size, thus naturally giving a more equal weight to each one. Also, the placing of the "Next" button was altered so that participants in the Stamford study were forced to scroll down through all the written information before going on to the next viewing. Of course participants could not be forced to actually read and take in all the information in detail, but this subtle alteration in the design did mean that Stamford survey participants were encouraged more strongly to consider all the information available and not make snap judgements.

If the Rightmove design had the advantage of replicating faithfully how real people view properties and form judgements about them, the Stamford design offered the chance to investigate choice patterns among an adult volunteer group who were very likely to have taken more time and considered each property more carefully. This allows for a comparison to be made between the two sets of results and implicit conclusions drawn about the overall importance of the method of presentation. Would biases persist among this group? Or would they be reduced when people took more time over their choices?

A final difference between the Stamford and Rightmove Surveys is that the Stamford Survey included some location information about each property. Participants were told that the properties were all located in Cambridge and were shown zoomed-out maps of each property's location. Stamford is located about 45 miles from Cambridge itself so, while the majority of the respondents would have heard of Cambridge and maybe visited at least once, most would not be expected to be knowledgeable about its property market. Data about participants' familiarity with the Cambridge market was taken in the questionnaire and is examined in Chapter 6. We believe this is a further strength of the design here because it adds realism to the experimental scenario. It effectively made the choice frame more concrete by making reference to a location known to most participants, without compromising the overall aim, of conducting the experiment so that location was largely removed from the choice scenario.
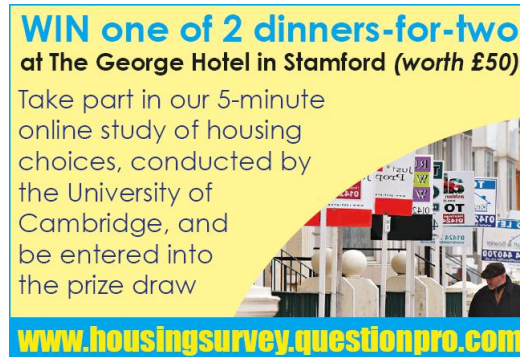
**Figure 5.6:** Advertisment for participants in the Stamford Adult Group Survey.

### 5.4.2   Recruitment and Incentives

As discussed at the beginning of this section, the Stamford survey also used adult volunteers, largely experienced in property. Some were recruited using advertising in local media. The advertisement used is reproduced in Figure 5.6. Volunteers were also sought by emailing local schools and asking if they would be willing to advertise to their parent body. Several schools agreed, giving access to large numbers of local residents many of whom would be home-owners and 'experienced' in property. In total 617 people started the survey, which resulted in 388 usable responses. As in the Rightmove case there was no judgement element within the survey therefore no way to pay incentives according to how well a person performed. However to encourage people to take part a prize was offered, with a value of £50.

### 5.4.3   Experimental Treatments

Because the survey was somewhat smaller than the Rightmove Survey only six treatments were used. Table 5.6 reports these and shows that they allowed for both choice set effects to be examined by including all three choice sets {A, B}; {A, B, C}; and {A, B, D}. Ordering biases could also be considered because all three choice sets had their orders reversed completely (treatments 2, 4 and 6).

| Treatment | Choice Set and Order | n |
|:---:|:---:|:---:|
| 1 | {A, B} | 69 |
| 2 | {B, A} | 61 |
| 3 | {A, B, C} | 72 |
| 4 | {C, B, A} | 59 |
| 5 | {A, B, D} | 76 |
| 6 | {D, B, A} | 51 |

**Table 5.6:** Treatments in the Stamford Adult Group Survey.

## 5.4.4   Summary

The Stamford Adult Group Survey has an important role beyond providing further evidence of judgemental bias in real estate choice from a different sample set. Although still conducted online, the different software platform allowed subtle variations in the way the information was presented.

Specifically, it gave more equal weight to visual material by reproducing all photographs in equal size and implicitly forced participants to take more time considering each choice by giving more prominence to all the information. The choice frame was also made more real by telling participants that the houses were in a specific city they were aware of, although not familiar with, in most cases.

This allows interesting conclusions to be drawn from the treatments about the strength of the biases hypothesised and, by implication, the importance of the information platform in producing judgemental biases and conditioning vulnerability to manipulation.

## 5.5   Conclusion

This chapter began by exploring the growth and development of experimental economics. This methodology has grown to become an incredibly useful for tool for many types of problems in modern economics, particularly choice theory. As was discussed, a tradition has evolved which pays particular attention to harness-

ing the control that experimental environments provide while also maintaining the essential features of the situation under examination to ensure the external validity of the results. Two Nobel Prizes in Economics have now been awarded for the establishment of this field, firmly placing it in the modern economist's tool kit.

For studies in choice theory, such as those proposed here, experiments are particularly useful because the control they afford is so vital in establishing causal relationships. In addition they are considerably more feasible than comparable empirical work would be, especially in terms of cost. Furthermore the online research design for the controlled surveys offers a particularly valuable way of completing research with experimental control in an environment that is virtually identical to the real choice frame. A strong case has been made that the method is the most appropriate for the questions at hand, and can make a significant contribution to our understanding of both the dynamics of housing markets and consumer choice theory.

The methodology for the experiments and controlled surveys in this thesis was discussed in detail in the latter parts of the chapter. The design of the economic experiments adheres to best practice in the field and was implemented after careful development. There are two main platforms used: classroom experiments involving student volunteers and online controlled surveys of adult participants. The student volunteers taking part in the classroom experiments represent a specific demographic, young renters, which is an important segment of the housing market, although not necessarily representative of the owner-occupier market.

The online studies were split into two: the Rightmove Survey which was a survey of 4,000 users of the property search website; and the Stamford Adult Group Survey which was a survey of 600 residents of the town of Stamford, Lincolnshire. Completing the surveys using an online choice frame is an important methodological contribution to choice theory and the consumer choice literature in its own right because of the exponential growth in this form of consumer choice, especially in property markets. It is possible realistically to claim that the experiments described are as close to an empirical study as possible, while also allowing

for the significant control that economic experiments provide.

Moreover, subtle variations in the presentation of information between the two online studies provide important points of comparison and form an implicit test of the strength of this methodology. Finally adult volunteers who own homes and are experienced in housing choices are also clearly more representative of housing choice at large.

Part III, which follows this chapter, reports the results of these experiments. It is split into three chapters. Chapter 6 considers choice set effects from the three studies described in this chapter: the Student Group Experiments; Rightmove Survey; and Stamford Adult Group Survey. Chapter 7 explores the ordering biases that were present in the same studies. Finally Chapter 8 investigates judgement biases in housing value estimates that were tested for in the Student Group Survey. Part IV ends the thesis in Chapter 9 by providing conclusions as well as considering the limitations of the work and how future research may build upon it.

# Part III

# Chapter 6

# Choice Set Effects in Housing Decisions

This chapter reports the results from several experiments examining biases in choice patterns that can be induced by the use and placing of 'decoy' options as explained in Chapter 4. These are broadly termed *choice set effects*. It finds significant evidence of these choice set effects in housing choice scenarios including a new bias labelled the *choice pollution effect*. The biases exist among both inexperienced and more seasoned decision makers.

## 6.1 Student Group Experiments

This section presents the results from a series of economic experiments conducted on student volunteers which investigate whether housing decisions can be reliably influenced by a willing economic agent who is able to manipulate the selection of properties shown to the decision maker, known as the choice set. The experiments had two methodologies. In one, information about the choices was presented in a highly simplified written form. Participants were given only two dimensions on which to judge the houses – distance from a place of work and state of repair. This method largely replicates methodologies used widely in experimental choice theory literature and provides significant precision – by isolating effects clearly –

|                                     | Exp. 1a | Exp. 1b | Exp. 2 |
|-------------------------------------|---------|---------|--------|
| n                                   | 171     | 149     | 225    |
| Male (%)                            | 50      | 44      | 46     |
| Aged (18-25) (%)                    | 82      | 87      | 81     |
| Own property (%)                    | 6       | 5       | 6      |
| Knowledgeable in property[1] (%)    | 15      | 15      | 14     |

**Table 6.1:** Summary statistics for choice set experiment participation.

albeit at the expense of realism. In the second set of experiments house choices were presented in visual form by means of a 'virtual tour' of each property using photographs and descriptions from the real property profiles of a local estate agent. This significantly increases the complexity and realism of the choice frame, although makes predicting the results more difficult. The hypotheses for these tests were discussed in Chapter 4 and the experimental procedure is presented in further detail in Chapter 5.

Summary statistics on the participants for each experiment are presented in Table 6.1. The figures show little variability between experiments. Although not reported here, tests conducted on these variables indicate no systematic difference in answers according to age, ownership of property or among those particularly knowledgeable about property (as indicated by non-significant p-values).

The figures clearly illustrate that the typical student participant was young and inexperienced in making decisions over property. Subjects were classed as 'knowledgeable' if they identified themselves that way (with a reason) or if they admitted to participating in three or more activities chosen as indicators of a particular interest in property[1]. Just 15% fulfilled these criteria. As already argued in Chapter 5, this group represents well at least one important set of participants in the housing market – young renters. Many of the participants in this experiment will make their first independent steps into the housing market via renting a property in the next few years, so the insights gained here have a ready application.

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[1]  To see these criteria used to determine if a subject was 'knowledgeable', see Appendix A.

## 6.1.1 Asymmetric Dominance

Asymmetric dominance is a choice bias where the addition of an alternative to the choice set which is dominated by one of the options, but not the other, leads to a change in preferences in favour of the 'dominant' option (Huber et al., 1982). This is irrational according to the von Neumann and Morgenstern (1944) rational choice axioms because it means in aggregate that individuals are choosing A from a choice set of {A, B} but choosing B from a choice set of {A, B, C}. The hypothesis describing this effect was expressed in Chapter 4. It is reproduced below:

> **H1.** *Asymmetric dominance: the proportion choosing a particular property increases when a decoy property is added that is asymmetrically dominated.*

The experiment to test whether asymmetric dominance manipulations can be effective in housing choices asked participants to trade-off two features of value in a hypothetical decision over renting a house. The two features were: i) the distance from the town centre; and ii) the state of repair of the property[2].

In the first treatment, subjects faced the simple choice set of {A, B} where neither option was dominant. In other words, Option A was located a shorter distance from the town centre (variable 1) but was in a worse state of repair (variable 2), than Option B. In treatment 2 the choice set was expanded to include a dominated alternative, C, making the choice set {A, B, C}. Option C was placed so that its domination was asymmetric. That is, it was inferior to B (being further from the town centre *and* in a worse state of repair) but not A (although much further from the town centre than A, it is still in a better state of repair). This makes Option C fundamentally similar to, and so naturally comparable with, B. It thus makes that option the 'target' of the manipulation. Finally treatment 3 contained the choice set {A, B, D} where Option D was dominated by Option A, making A the target[3].

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[2] Note that income effects were removed by telling subjects that all houses would cost the same amount which they should consider affordable.

[3] This methodology is discussed further in Chapter 5 (Section 5.2.4, page 127).

**Table 6.2:** Asymmetric dominance among student subjects – simple form.

| Row | Choice Set | A | B | C | D | p-value | n |
|-----|-----------|-----|-------|-----|-----|---------|-----|
| 1 | {A, B} | 58 | 42 | | | | 57 |
| 2 | {A, B, C} | 41 | 59** | 0 | | 0.029 | 64 |
| 3 | {A, B, D} | 67 | 33 | | 0 | 0.141 | 49 |

*Notes:* The figures indicate the percentage making the relevant choice.
p-values are based on a one-tailed z-test of proportions.
** indicates significance at the 5% level.

Table 6.2 presents the results[4]. Rows are numbered for ease of reference in the left-hand column. There is evidence of asymmetric dominance. The introduction of Option C increases the proportion choosing the target option, B (row 2). The increase is significant at the 5% level. When Option D is added instead, to make A the target of the manipulation there is an increase in the proportion choosing A – from 58% to 67% – however this is not strong enough to be significant at the 10% level (p-value: 0.141), a result indicative of the relatively small sample size.

This result is powerful because, as detailed in Chapters 4 and 5, this experiment included an extremely simple choice problem, expressed in words with no other cues, visual or otherwise. In aggregate it is a direct violation of the independence of irrelevant alternatives axiom, a central pillar of von Neumann and Morgenstern's (1944) rational choice theory.

## 6.1.2 Compromise Effect

Compromise effects are a similar type of choice set bias to asymmetric dominance. First suggested by Simonson (1989), they describe how preference can be influenced by placing alternative options which make certain 'target' choices appear as compromises. Individuals tend to show *extremeness aversion* according to Simonson and Tversky (1992) meaning that these compromise options are chosen with greater frequency than when they are presented in isolation. This gives rise

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[4] Note that tests which illustrate the effect of altering the order of presentation are reported in Chapter 7.

to the possibility of placing alternatives to artificially create compromise options which will be more preferred by decision makers, *ceteris paribus*.

In this experiment subjects were faced with an identical choice situation to previously but with the choices placed differently. Options A and B remained the same, but Options E and F were added to treatments 2 and 3 respectively which made the original options a compromise[5]. In the choice set {A, B, E} Option B is the compromise target; in the choice set {A, B, F} Option A is the compromise. The hypotheses tested in this experiment, discussed in Chapter 4 is reproduced below:

> **H2a.** *Strong compromise effect: the proportion choosing a particular target property increases when it is made a compromise choice by the addition of a decoy property to the choice set.*

> **H2b.** *Weak compromise effect: the proportion choosing a competitor property decreases when the addition of a decoy property to the choice set makes the other original property the compromise.*

Table 6.3 reports tests of these hypotheses[6]. There is no evidence of a strong compromise effect. The addition of Option E to the choice set increases the proportion choosing B from 42% to 46% but this is not significant. The introduction of Option F to the choice set actually decreases the proportion choosing A from 57% to 50% (p-value: >0.50).

The weak-form compromise effect requires the proportion choosing the option that is not the target to decrease when the other option is made a compromise by the introduction of the third alternative. There is significant evidence of weak-form compromise effect (the p-values in the table are from weak-form tests). When the choice set is {A, B} the proportion choosing Option A is 57%. The introduction of Option E makes B the compromise choice. Its introduction causes

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[5] The precise nature of the choice placing is reported in Chapter 5 (Section 5.2.4, page 127).
[6] Note that tests which illustrate the effect of altering the *order* of presentation are reported in Chapter 7.

**Table 6.3:** Compromise effect among student subjects.

| Row | Choice Set | A | B | E | F | p-value | n |
|-----|-----------|------|------|----|----|---------|----|
| 1 | {A, B} | 58 | 42 | | | | 57 |
| 2 | {A, B, E} | 38** | 46 | 16 | | 0.020 | 50 |
| 3 | {A, B, F} | 50 | 21** | | 29 | 0.016 | 42 |

*Notes:* The figures indicate the percentage making the relevant choice.
p-values are based on a one-tailed z-test of proportions.
** indicates significance at the 5% level.

the percentage choosing A to fall to 21%, a highly significant decrease (row 2). Similarly, in row 3 of Table 6.3 the addition to the choice set of Option F causes a decrease in the proportion choosing B from 43% to 21% compared to the base case where the choice set was {A, B}.

The implication of these results is that compromise effect manipulations can have significant applications in housing choices. Specifically it appears that introducing an extreme option to make another a compromise induces a shift along the preference spectrum. The choices in this experiment were set up so that Option A was preferable for those who preferred a better state of repair relative to commuting time; and Option B was preferable for those who preferred a shorter commute relative to the state of repair. The introduction of the third option significantly changed the proportion making these choices. When Option E was added offering an even shorter commute (but at the expense of a worse state of repair) significant numbers were induced away from the "good repair-long commute" option (A) to one of the two "short commute-bad repair" options (B and E). When Option F was added in an equal and opposite way (that is, it offered an even better state of repair at the expense of a longer commute) the effect was in the opposite direction. This further illustrates the power of the manipulation.

## 6.1.3 Complex Choice Set Effects

As emphasised earlier in this thesis, housing choices are very complex, with many factors being traded off in the decision making process. In this section an experiment is reported which introduces significant complexity into the decision making

process and gets far closer to real housing choices.

As discussed in detail in Chapter 5 (page 129), in this experiment participants were asked to choose between properties having been shown photographs and received information about them by way of a 'virtual tour' based on real properties supplied by a local estate agent. Despite this added complexity, the idea was the same as for the previous sections: induce a tendency towards a particular target property by adding a dominated alternative to the choice set.

The original choice set of {X, Y} contained the choice between a city-centre apartment (X) and a similarly well located terraced house (Y). The third option added to some treatments (Z) was another terraced property, but with an inferior location and state of repair to House Y. Thus House Z was the 'decoy', used with the intention of enhancing the prospects of House Y (which is the target).

The results are reported in Table 6.4[7]. The addition of House Z has the effect of *decreasing* the attractiveness of the target. The percentage choosing House Y drops from 58% to just 35%, a highly significant fall. Although some chose the 'new' choice, House Z, a significant number are driven towards favouring the other original choice, Apartment X. The proportion who choose X rises from 42% to 59% (the p-value for this change, not reported in Table 6.4, is 0.012).

This result has not been seen before in previously published literature and is totally contrary to the theory of asymmetric dominance discussed previously (led by Huber et al., 1982). It suggests that the addition of the dominated option, House Z, to the choice set had a perverse effect on the target. In this case the addition of a poorer terraced house (Z) made the other terraced house (Y) look worse, causing a movement in preference away from it. This is labelled the *choice pollution effect*.

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[7] Note that tests which illustrate the effect of altering the *order* of presentation are reported in Chapter 7.

**Table 6.4:** Asymmetric dominance among student subjects – complex form.

| Row | Choice Set | X | Y | Z | p-value | n |
|-----|-----------|-----|--------|---|---------|-----|
| 1 | {X, Y} | 42 | 58 | | | 83 |
| 2 | {X, Y, Z} | 59 | 38*** | 4 | 0.003 | 111 |

*Notes:* Figures indicate the percentage making the relevant choice.
p-values are based on a one-tailed z-test of proportions.
*** indicates significance at the 1% level.

The explanation may lie in information asymmetry[8]. Akerlof (1970) was the first to theorise that in market situations characterised by significant information asymmetry, those on the wrong end of the asymmetry would take preventative action to avoid being taken advantage of (sold a 'lemon' when paying for a good quality car). This can have seriously distortive effects on markets, as his analysis shows.

Housing choice is also characterised by significant information asymmetry. In the typical scenario the home buyer will be aware that the seller, represented by the agent, is in possession of far more information about the property than he is and thus that he is vulnerable. In this scenario it is possible that information from other choices in the set are used implicitly to send a signal about missing information on the choice at hand. That is, the inferior terraced house presented alongside the nicer terraced property sent a negative signal about the latter. Perhaps it gave the signal that terraced houses may look superficially spacious (as the target did), but really are quite small (as the inferior house was), or that although they can be renovated to look good (again, as the target did), they can also depreciate quickly and become run-down (as the inferior house was, relatively).

Another explanation may be that the added complexity of this choice scenario introduces significant uncertainty into the decision process and so adds significant 'noise' to the effects seen. It is clearly true that many economic experiments, by

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[8]  I would like to thank Professor Colin Lizieri for pointing out this interpretation to me.

simplifying decision making in laboratory scenarios, underemphasizes the complication of real world choices. Thus in the very least this experiment suggests that we may uncover more useful information by experimenting with scenarios as realistic as possible.

### 6.1.4 Summary

The Student Group Experiments show evidence of several important choice biases. In housing choice scenarios involving only simple trade-off decisions there is evidence of the effectiveness of asymmetric dominance effects, confirming and extending the findings of Huber et al. (1982) and Simonson (1989) and of hypothesis **H1** (Chapter 4, page 96). Placing choices to create compromise options and thus influence choice patterns is also possible in weak form (hypothesis **H2b**, Chapter 4, page 97).

The most significant results come from the investigation of more complex choice set effects in an information-rich environment. When shown profiles of real properties selected to produce the same choice set biases seen in the simple written-information case the effect is significant, but runs in the opposite direction to the existing theory. Participants display a phenomenon labelled the *choice pollution effect*: the presence of an inferior decoy in fact confers a negative signal about the quality of all similar properties and biases choices *away* from the target. This is the first time that such an effect has been seen in experimental studies of choice behaviour so represents a contribution worthy of further investigation. It may be that the results of such investigation is that it is difficult to tell which effect – asymmetric dominance or choice pollution – will dominate, limiting the effectiveness of such strategies in real world situations. The next section will investigate further by utilising a choice frame which replicates real world choice situations even more closely.

The experimental group – largely undergraduate students with little experience in property – is clearly not fully representative of all those who participate in the rental market. Students living in Cambridge and studying at the University are in

a unique position in some respects because accommodation is typically provided by their colleges on site, and so they will, in most cases, not be using the private rental market. Many will have never rented property independently before. Thus the decision making of these subjects may not completely represent that of more seasoned decision makers when renting property. However, young first-time renters are a significant part of the market, so the conclusions are still useful.

In addition, the results thus far point to one further conclusion: that experience may be important in housing choices. Is the vulnerability of decision makers to choice set effects reduced when they are more seasoned in these markets and these kinds of decisions? The next section attempts to answer this question through a large-scale survey of a very different demographic.

## 6.2 Rightmove Survey

This section reports the results from the controlled survey of 4,000 users of the property search website Rightmove. This large-scale study allows an extension of some of the experiments of the Student Group Experiments in Section 6.1. The size of the study is clearly important, allowing more treatments to be investigated and a clearer picture sought. However the important aspect of this part of the study is the nature of the participant group and the choice frame used.

As the statistics in Table 6.5 illustrate, respondents were typically much older than their student counterparts: they have a mean age of 44. The majority own their own houses and have done so for a reasonable period. Thus the results described in this section apply more directly to the owner-occupier market. Furthermore, many regard themselves as being interested in property generally, as the responses to the questionnaire show. Thus the subject group provides a sterner test for the behavioural manipulations that have been hypothesised. Although it has been claimed that housing choices are unique among consumer or quasi-consumer decisions, because they are always made with limited experience, this group represents the typical consumer of housing, who is likely to have at least some experience with the process of searching for and choosing property.

| Age | % |
|-----|---|
| 18-24 | 5 |
| 25-34 | 25 |
| 35-44 | 24 |
| 45-54 | 23 |
| 55+ | 23 |

(a)

| Length of Occupation | % |
|----------------------|---|
| <1 year | 21 |
| 1-5 years | 39 |
| 6-10 years | 18 |
| 11-20 years | 13 |
| 20+ years | 9 |

(b)

| Type of Occupation | % |
|--------------------|---|
| Owner Occupied | 71 |
| Rented | 20 |
| Other | 9 |

(c)

| Which of the following apply to you? | % |
|--------------------------------------|---|
| I watch property shows on TV | 76 |
| I read property supplements | 52 |
| I own properties as investments | 13 |
| I work in the property industry | 6 |
| Other | 5 |
| None of the above | 11 |

(d)

**Table 6.5:** Summary statistics for the Rightmove Survey group.

The survey was completed by respondents viewing properties online through the Rightmove website with properties presented in an almost identical manner to how they are actually viewed in real choices[9]. Participants were asked to view two (or three) houses and choose which they preferred, before completing a questionnaire. By replicating closely the actual choice frame in which decisions are made – or at least initial preferences are formed – this experiment offers a significant insight into the nature of biases in housing choice. Although the significant complexity that comes with the information-rich design makes it difficult to make firm predictions about the effects we will see.

Four properties were used, all based on real profiles on the Rightmove website. The set-up was similar to the experiment of complex choice set effects in the Student Group Experiments, although the actual properties were different. It is reported in full in Chapter 5. As previously, the aim was to place a 'decoy' property with the intention of altering preference in favour of a 'target' property.

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[9]  Location information was removed. For full details see Chapter 5.

Property A was a smart, modern family home, which offered less character, but perhaps a better state of repair, than its comparison, Property B, which was older and more solid in appearance. It had character and several features not present in the modern house, but was in a more traditional state of repair than Property A. Thus respondents were asked to trade-off age and character against the state of repair of the property in an information-rich environment where properties were viewed in an almost identical manner to how they would be on Rightmove.

Properties C and D were decoys. Property C was also a 'character' property like B, but clearly offered less of the charm of B and was in a noticeably worse state of repair. Property D was like Property A – modern and well maintained, but without the overall impressiveness of A in terms of state of repair. As with the earlier experiments, price was excluded from the analysis by telling participants that all the houses cost the same[10]. This removes significant complications relating to income effects. The experiment had 14 treatments, allowing for each combination of the choice sets and orders.

## 6.2.1 Full Sample Results

Table 6.6 reports the results from the full sample in aggregated form[11]. The aim of this experiment is to test hypothesis **H1**, which was discussed in Chapter 4. It is reproduced below:

> **H1.** *Asymmetric dominance: the proportion choosing a particular property increases when a decoy property is added that is asymmetrically dominated.*

It is clear that Property A was significantly preferred in the simple choice set consisting of {A, B}. The introduction of C to the choice set, intended to make B a target, does not increase the proportion who choose B. It falls from 28% to 26%, a significant decrease at the 10% level (p-value: 0.078). This is not met

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[10] This statement was true to within £10,000. All four houses were definitely in the same 'price bracket'.

[11] Note that tests which investigate the effects of altering the order of presentation are reported in Chapter 7.

**Table 6.6:** Choice set effects among the Rightmove Survey group.

| Row | Choice Set | A | B | C | D | p-value | n |
|-----|-----------|-----|-----|-----|-----|---------|-------|
| 1 | {A, B} | 72 | 28 | | | | 647 |
| 2 | {A, B, C} | 69 | 26 | 5 | | NM | 1,610 |
| 3 | {A, B, D} | 63 | 24 | | 14 | NM | 1,529 |

*Notes:* Figures indicate the percentage making the relevant choice.
p-values are based on a one-tailed z-test of proportions.

by an increase in the proportion choosing A, which might be suggestive of the *choice pollution effect* as described previously. Similarly the introduction of D to the choice set, intended to make A the target, does not cause an increase in the proportion choosing A. The percentage who choose it falls from 72% to 63%. This is a significant decrease (p-value: <0.001). Once again though this is not met by an increase in the proportion choosing B, which would point towards the choice pollution effect.

If the decoy properties (C and D) were transparently dominated by the target properties (A and B) this would suggest a significant irrationality: in the choice set {A, B, C} 5% of respondents choose a dominated alternative by choosing C; and in the choice set {A, B, D} 14% make an irrational choice by choosing D. However given the complexity of the decision variables involved in this information-rich scenario, it is possible that some uncontrolled variable does favour Properties C and D respectively. Thus the conclusion that individuals' choosing C and D illustrates irrationality can only be a tentative one.

## 6.2.2 Logit Estimation of the Determinants of Choice

As part of the controlled survey, all respondents completed a questionnaire giving demographic information such as age and gender, and various other variables which indicate their knowledge and experience of property. Given the significant noise present in the aggregated sample, and thus the difficulty in identifying significant tendencies, another approach is to assess whether any of these other variables have any power in explaining choice, and so whether bias is more present

among one group of participants than another. Such a finding may contribute to the work of economists who have sought to show that experience in choices can reduce errors (such as List, 2004).

The dependent variable in this case is binary: whether the respondent chose the target property. As such, logistic regression using maximum likelihood estimation is an effective way to assess which variables have an important impact on choice. The variables of interest are reported in Table 6.7. The first, *complexset* indicates whether a decoy was present in the choice set when the choice was made. When this is set to 1 the decoy – either Property C or Property D depending on the suffix – was present, otherwise it is set to 0. The testing above suggests that its impact might be significant, although not as intended in the manipulation. This variable captures that effect and allows us to interpret within the model.

The variable *prefstrength* is based on the respondents' own report of his strength of feeling towards the choice made. It is rated on a scale of 0-5 where 0 is a "Don't Know" response. The strongest feelings are indicated by a rating of 5. Standard variables for gender and age are included. The latter has six categories. The variable *ownprop* indicates whether the respondent owns property, or has done so in the past. This is intended as a possible proxy for experience with buying property, since prior literature has suggested that experience might be an important variable in determining whether individuals make 'mistakes' in choice, or are vulnerable to manipulation. The penultimate variable, *duration* indicates the length of time that respondents have been in their current property. It is a categorical variable split into five categories ranging from under 1 year to over 20 years. This may also be a proxy for experience with housing, albeit in reverse. Those living in their current property the longest are perhaps likely to be the least knowledgeable about current property trends. The final variable, *know*, indicates whether the respondent is particularly knowledgeable about property. It is comprised of those who declared themselves as being knowledgeable for a particular reason (such as working in the property industry) and those who answered yes to at least three of a series of statements reflecting their interest in property. These can be found in Table 6.5 (page 162).

| Variable | Description |
|----------|-------------|
| *choose* | The dependent variable indicating whether the subject chose the target property |
| *complexset-c* | A dummy variable indicating whether the choice set was 'simple' (ie. contained only A and B) or 'complex' (ie. contained A and B and a decoy). The '-*c*' indicates that the decoy present was C. |
| *complexset-d* | A similar variable to that above except for the '-*d*' which indicates the decoy present was D. |
| *prefstrength* | The respondents' strength of preference towards their choice, on a scale of 0-5 (where 0 is the response "Don't Know"). |
| *gender* | The gender of the participant. A dummy variable where 1=male and 0=female. |
| *age* | The age of the participant. A categorical variable with six variables: 18-24, 25-34, 35-44, 45-54, 55-64, 65+. |
| *ownprop* | Whether the respondent owned their own home. A dummy variable where 1=owner occupier, 0=not owner occupier. |
| *duration* | The duration the respondent had lived in his current property. A categorical variable with five values: under 1 year, 1-5 years, 6-10 years, 11-20 years, 20 years+. |
| *know* | Whether the participants are especially knowledgeable about property. A dummy variable where 1=knowledgeable and 0=not knowledgeable. |

**Table 6.7:** Variables for logit regression of choice.

The logit regressions are reported in Table 6.8. Rows refer to the variables discussed above, while each column represents a different specification for the regression. Column (1) is based on the effect of adding Property C to the set, whereas columns (3) and (4) report regressions where the effect of the addition of Property D is compared with the 'simple' choice set of {A, B}.

Referring to Column (1) first, this shows that in the full model with all the variables, the effect of adding Property C to the choice set – the decoy intended to increase the proportion choosing the target – is not significant.

The model finds that the variables *prefstrength* has a strongly significant effect

**Table 6.8:** Logistic regression on the likelihood of choosing the target property.

|  | Prob. respondent chooses target | | |
|---|---|---|---|
|  | (1) | (2) | (3) |
| Intercept, $\alpha$ | -0.200 | 0.053 | 0.001 |
|  | (0.259) | (0.240) | (0.235) |
| *complexset-c* | -0.118 |  |  |
|  | (0.106) |  |  |
| *complexset-d* |  | -0.404*** | -0.396*** |
|  |  | (0.041) | (0.103) |
| *prefstrength* | -0.215*** | 0.157*** | 0.157*** |
|  | (0.043) | (0.041) | (0.041) |
| *gender* | -0.194* | 0.255** | 0.254** |
|  | (0.103) | (0.099) | (0.099) |
| *age* | 0.000 | 0.078** | 0.061* |
|  | (0.043) | (0.039) | (0.035) |
| *ownprop* | 0.009 | 0.000 |  |
|  | (0.121) | (0.112) |  |
| *duration* | 0.016 | -0.044 |  |
|  | (0.046) | (0.041) |  |
| *know* | 0.331** | -0.140 |  |
|  | (0.145) | (0.151) |  |
| n | 2,257 | 2,176 | 2,176 |
| Pseudo $r^2$ | 0.014 | 0.014 | 0.014 |
| Log-likelihood, $\chi^2$ | 35.89 | 43.05 | 40.96 |
| Significance | <0.001 | <0.001 | <0.001 |

*Notes:* Standard errors are in parentheses.
        *, **, *** indicates significance at the 10%, 5% and 1% levels respectively.

on the likelihood of choosing the target. The odds ratio associated with this coefficient is 0.807 implying that an increase of 1 unit in preference strength reduces the likelihood of an individual choosing the target property by nearly 20%. The variables *gender* and *know* indicate significance at the 5% and 10% levels respectively. Being male reduced by 0.194 the log-likelihood of choosing the target property, a nearly 18% decrease in the odds ratio. Individuals who are classified as being particularly knowledgeable about property are almost 40% more likely to choose the target property than those who are not.

Columns (3) and (4) report a similar procedure for the introduction of Property D to the choice set. Here the inclusion of D does have a significant effect on the likelihood of choosing the target property. Raising the coefficient to the exponential yields an odds ratio of 0.667: the likelihood of an individual choosing the target property falls by 33% when the choice set is expanded to include D. The variable *prefstrength* is also significant here – a one unit increase in the strength of preference towards the choice increases the likelihood an individual will choose the target property by nearly 17%. Both gender and age are significant determinants of the choice of the target property, although the latter is only significant at the 10% level. Male respondents are more likely to choose the target property which in this case is A. A one unit change in the category of age makes a participant nearly 2% more likely to choose the target. Column (4) reports a more refined version of this model dropping the insignificant variables. It models the log-likelihood of choosing the target property with the variables *prefstrength*, *gender*, and *age*.

These results help understand which variables are significant in explaining the preference for the target property. The effect of the manipulation does not appear to be significant in the case of Property C, but the introduction of D does have a significant effect, although perhaps not as expected. Men appear to make a different choice to women; there is some evidence older participants make different choices to younger ones; and when the target is B those with strong preferences are far *less* likely to choose that target, whereas when the target is A those with strong preferences are significantly *more* likely to choose it. But these conclusions do not tell the full story about the susceptibility to behavioural manipulations. To investigate this, the following sections take some of these significant variables and split them out further.

### 6.2.3 Strength of Preference

Strength of preference has a significant influence on the likelihood of choosing the target property upon the introduction of both decoys (C and D). But is

**Table 6.9:** Rightmove Survey group results split by strength of preference.

| Row | Preference | Choice Set | A | B | C | D | p-value | n |
|-----|-----------|-----------|-----|-----|-----|-----|---------|-------|
| 1 | Weak | {A, B} | 67 | 33 | | | | 240 |
| 2 | | {A, B, C} | 60** | 32 | 8 | | 0.042 | 535 |
| 3 | | {A, B, D} | 59 | 26** | | 15 | 0.021 | 621 |
| 4 | Strong | {A, B} | 75 | 25 | | | | 405 |
| 5 | | {A, B, C} | 74 | 22 | 4 | | 0.424 | 1,071 |
| 6 | | {A, B, D} | 66 | 22 | | 12 | 0.368 | 903 |

*Notes:* Figures indicate the percentage making the relevant choice.
p-values are based on a one-tailed z-test of proportions.
** indicates significance at the 5% level.

this indicative of choice *bias*? Preference uncertainty has been suggested as a significant factor in the efficacy of strategies to manipulate preference construction in prior literature (Simonson, 1989), even in housing markets (Simonsohn and Loewenstein, 2006). Table 6.9 presents the choice data split by preference strength. Preferences were classed as strong – where the rating was 4 or 5 – or weak – where the preference rating was 1, 2 or 3.

There is evidence that those with weak preferences were more strongly influenced than those who were more certain. Among those with weak preferences the introduction of Property C causes a fall from 67% to 60% the proportion choosing the non-target, Property A (rows 1 and 2). This is a significant decrease (p-value: 0.042). However for those with strong preferences the effect was negligible: the proportion choosing A only fell from 75% to 74% (rows 4 and 5).

Upon the introduction of Property D as a decoy in the choice set the proportion choosing the non-target (B) falls from 33% to 26% among those with weak preferences (p-value: 0.021), but only from 25% to 22% among those with strong preferences (p-value: 0.368).

The susceptibility to the effects of the decoy is further corroborated by examining the decoys themselves. Those with weak preferences were much more likely

to pick them. Those with weak preferences chose Property C 8% of the time compared to 4% for those with strong preferences (row 2 and row 5). This is significantly more (p-value: <0.001). And the same is true for D, which was chosen 15% by those with weak preferences against 12% by those with strong preferences (p-value: 0.035).

This analysis suggests that those with less well formed preferences – those whose choices were more uncertain – were significantly more likely to abandon the non-target upon the introduction of the decoy and choose either that decoy or the target property. This is a strong result, suggesting clearly to the estate agent that his ability to manipulate choice is far greater when the buyer is not certain of their preferences. This has a clear corresponding implication for buyers too.

## 6.2.4 Other Factors

The logistic regression indicated that age (variable: *age*) was a significant factor in explaining the likelihood of choosing the target property (A) when the decoy property (D) was added. Also, it suggested that gender (variable: *gender*) was an important determinant of the likelihood of choosing the target upon the introduction of either decoy (C or D). Finally the property-specific knowledge of the participants (variable: *know*) was also important for when the choice set was expanded upon the inclusion of Property C.

Analysis by splitting these variables out in the same manner as the previous section indicates no clear patterns as to the susceptibility to bias. In other words, although the probability of men choosing the target was significantly different to the corresponding probability for women, it is not clear that men were significantly more biased – in other words manipulated by the introduction of the decoy choice into making an irrational choice – than women. Thus these results are not reported here. The results seem instead to be part of the extra 'noise' that would be expected from making the experimental scenario significantly more realistic and information-rich, as the Rightmove Survey does.

### 6.2.5   Effect of the Decoy on Strength of Preference

One of the important impacts from the choice set manipulations that was hypothesised in Chapter 4 was that the introduction of the decoy would not only increase the popularity of the target option, as measured by the aggregate proportion who chose it, but that it would increase the *strength* of their preference too. This hypothesis is reproduced below:

> **H5.** *Preference intensity: the strength of preference for a particular target property increases when it is the subject of a choice set manipulation.*

Table 6.10 reports data which tests it. The first column shows the distribution of preference strength for Property A among those who saw the choice set {A, B}. This is compared to the distribution among those who also chose A, but saw the choice set {A, B, D}, in other words with the decoy property present. There is little evidence that the introduction of the decoy property increased the strength of preference. Sixty-two percent of participants who chose Property A having seen {A, B, D} rated their preference as 'strong'[12] which is less than the proportion who felt as strongly in making the same choice having seen the simple choice set of {A, B}, which was 65%. There is evidence that the *distribution* of preference is altered though. A chi-squared test of goodness of fit is rejected at the 1% significance level. This is tentative evidence that the more complex choice set induced greater *uncertainty* in preferences.

When Property C is added, Property B is made the target. The strength of preference for those choosing B is reported in columns 3 and 4 of Table 6.10. The introduction of C increases the proportion who rate their preference as strong from 56% to 58%, although this is not a significant increase. There is no evidence that the distribution of preferences as a whole is altered by the introduction of D. On the whole it is difficult to say that this evidence confirms the hypothesis made in Chapter 4 (**H5**, page 104).

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[12] As in previous sections, an individual is classed as having a 'strong' preference if he rates his preference as 4 or 5. Those with a preference strength of 1, 2 or 3 are classed as having a 'weak' preference.

**Table 6.10:** The effect of the decoy on strength of preference.

| Strength of Preference | Choice Set | | | |
|:---:|:---:|:---:|:---:|:---:|
| | {A, B} | {A, B, D} | {A, B} | {A, B, C} |
| 1 | 7 | 6 | 8 | 8 |
| 2 | 8 | 8 | 8 | 8 |
| 3 | 19 | 24 | 28 | 26 |
| 4 | 47 | 41 | 42 | 43 |
| 5 | 19 | 21 | 14 | 15 |
| $\chi^2$ | | 21.59*** | | 0.98 |

*Notes:* Figures are all percentages.
Chi-squared tests of goodness of fit are completed with four degrees of freedom.
\*\*\* indicates significance at the 1% level.

## 6.2.6   Summary

The Rightmove Survey of 4,000 users of a property search website vastly increases both the realism and complexity of the choice scenario in which this experimental study takes place. Thus it is expected that the results obtained will be subject to significantly more 'noise' than those seen in simpler experiments from the previous section. As such statistical conclusions are more tentative, notwithstanding the increased sample size.

There is evidence that the introduction of decoy choices has an effect on the likelihood of choosing the target property. When Property D is added to the choice set the estimated likelihood of the participant choosing A (the target) falls by 33%. Aggregate choices do not swing in favour of the non-target choice (Property B) though, which would be a confirmation of the *choice pollution effect* seen earlier in the chapter. This result is indicative of a weak form of irrationality because it suggests that significant numbers of participants are drawn to choose the decoy option which is at least weakly dominated by the already-rejected property, A. However this conclusion is clearly limited by the decreased precision with which extraneous variables can be controlled in an information-rich scenario[13].

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[13] In other words it is not possible to conclude that the intended decoy is *definitely* dominated by the target because there could be a variable of value to participants in which the decoy is better than the target, but which has not been anticipated/ controlled for by the experiment.

Splitting the results by strength of preference yields an important result – that those with weak preferences are significantly more like to be influenced by the decoy, and make *irrational* choices (in aggregate) than those with stronger preferences. The conclusion of this chapter discusses the significance of this finding further.

The logistic regression suggests that the age, gender and prior knowledge of property of the participant are all variables which can influence the likelihood of choosing the target property, but there is little evidence that any of these variables can help explain the susceptibility to choice *bias*. Finally, there is limited evidence to prove the hypothesis that the introduction of the decoy property has the added effect of increasing the strength of preference for the target.

As will be discussed further in the conclusion to this chapter, together these results reflect the difficulty introduced by increasing the complexity of the choice scenario, which, it must be fairly concluded, suggests that the real world application of the hypothesised manipulations may be more difficult than simple classroom experiments imply.

## 6.3 Stamford Adult Group Survey

This section reports the results of a survey of 600 adult residents of the town of Stamford, Lincolnshire located around 50 miles north-west of Cambridge. The survey used a similar design and explored the same choice set effects as the Rightmove Survey. However, the design allowed participants to explore the properties in greater detail than the Rightmove Survey[14]. Furthermore the choice situation was less hypothetical because respondents were told that the properties they were viewing were located in Cambridge, a city all were aware of, but the vast majority did not know in detail. This fixed the choice scenario more firmly in the minds

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[14] The survey was still conducted online but participants were able to see more photos of the properties in large form and were forced to scroll through the written information on each property before moving on to the next one. See Chapter 5 for further explanation.

of participants, giving a more realistic edge to the results.

Descriptive statistics are presented in Table 6.11. Respondents generally were similar to those who took part in the Rightmove Experiments. A large proportion, 84%, were 40 or older and had lived in their current properties for a significant period (64% over 5 years). Thus, once again, the results in this section are focused on the owner-occupier market. Questions designed to elicit their interest in – and knowledge of – property show that the majority are knowledgeable. Thus, as with the Rightmove Survey, the survey group represents a firm test for the behavioural manipulations hypothesised by trying to influence a set of people experienced as one can be in making exactly these kinds of judgements. Thirteen percent even reported that they are currently looking to move house, so could be expected to have extremely current knowledge of the making housing choices.

Finally, Panel (f) of Table 6.11 shows that the vast majority do not know Cambridge well. Only 10% declare a significant knowledge of the city itself. As reported in Chapter 5 those taking part were told (truthfully) that the properties they were about to view were in the city of Cambridge. This puts the choice scenario on a more realistic – less hypothetical – footing while not biasing the results because of a significantly differential knowledge base of the target city.

## 6.3.1 Full Sample Results

Table 6.12 reports the results from the six treatments in the survey. The experiments are testing hypothesis **H1**. This was discussed in Chapter 4 and is reproduced below:

> **H1.** *Asymmetric dominance: the proportion choosing a particular property increases when a decoy property is added that is asymmetrically dominated.*

Note that the property choices and resulting labels all correspond exactly to the Rightmove Survey. Because the smaller sample size did not allow all combinations of viewing orders – and so the ability to cancel out ordering effects – unlike

| Age | % |
|-----|---|
| 18-29 | 1 |
| 30-39 | 15 |
| 40-49 | 60 |
| 50-59 | 21 |
| 60+ | 3 |

(a)

| Length of Occupation | % |
|----------------------|---|
| <1 year | 8 |
| 1-5 years | 28 |
| 6-10 years | 27 |
| 11-20 years | 30 |
| 20+ years | 7 |

(b)

| Type of Occupation | % |
|--------------------|---|
| Owner Occupied | 90 |
| Rented | 10 |
| Other | 0 |

(c)

| Which of the following apply to you? | % |
|--------------------------------------|---|
| I watch property shows on TV | 72 |
| I read property supplements | 55 |
| I own properties as investments | 7 |
| I work in the property industry | 20 |
| I am currently looking to move | 13 |
| Other | 13 |

(d)

| Interest in property | % |
|----------------------|---|
| 1 = low interest | 5 |
| 2 | 11 |
| 3 | 27 |
| 4 | 33 |
| 5 = high interest | 24 |

(e)

| How well do you know Cambridge? | % |
|---------------------------------|---|
| 1 = not very well | 34 |
| 2 | 29 |
| 3 | 24 |
| 4 | 8 |
| 5 = very well | 2 |
| Don't Know | 2 |

(f)

**Table 6.11:** Summary statistics for the Stamford Adult Group Survey.

the Rightmove Survey, the results are presented separately. In rows 4-6 the viewing order is reversed compared with rows 1-3[15]. There is clear evidence of choice set effects among the respondents to the survey. The introduction of Property C to the choice set (comparing rows 1 and 2), which makes Property B the target, should cause an increase the proportion choosing that target.

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[15] Thus there are two tests of the effect of introducing the decoy, Property, C to the choice set: i) comparing what happens when the decoy was placed last as in the comparison between rows 1 and 2; and ii) comparing what happens when the decoy is placed first as in the comparison between rows 4 and 5.

**Table 6.12:** Choice set effects in the Stamford Adult Group Survey.

| Row | Set and Order | A | B | C | D | p-value | n |
|-----|---------------|-----|-------|---|----|---------|-----|
| 1 | {A, B} | 46 | 54 | | | | 69 |
| 2 | {A, B, C} | 68 | 29*** | 3 | | 0.002 | 72 |
| 3 | {A, B, D} | 57 | 41 | | 2 | 0.110 | 76 |
| | | | | | | | |
| 4 | {B, A} | 51 | 49 | | | | 61 |
| 5 | {C, B, A} | 54 | 41 | 5 | | 0.354 | 59 |
| 6 | {D, B, A} | 29** | 55 | | 16 | 0.011 | 51 |

*Notes:* Figures indicate the percentage making the relevant choice.
p-values are based on a one-tailed z-test of proportions.
**, *** indicates significance at the 5% and 1% levels respectively.

However here it causes a move *away* from the target towards the non-target. The proportion choosing Property B falls from 54% to 29% when C is added. This is a significant fall (p-value: 0.002). These people instead choose the non-target, A, which sees its proportion rise from 46% to 68%, another significant increase (p-value: 0.005). This appears to be clear evidence of the *choice pollution effect* as discussed in earlier sections. The effect of increasing the complexity of the choice set by including a decoy option gave a negative signal about the quality of the target biasing respondents away from choosing it.

However, when the order is reversed (comparing rows 4 and 5) the effect of the introduction of C is much more muted – it only causes a rise in the proportion choosing Property A from 51% to 54%, which is not significant, given the relatively small sample size. This suggests that ordering effects might be important and perhaps accounting for a large proportion of the effect seen. This is investigated explicitly in Chapter 7.

When Property D is added to the choice set, making it {A, B, D} (comparing rows 1 and 3) the choice set effect displays evidence of strong-form irrationality. The proportion choosing the target, A, rises from 46% to 57% although this is not quite a significant increase given the sample size (p-value: 0.110). This is driven by a decrease in the support for the non-target, B, which falls from 54%

to 41%. When Property D is added but placed first (comparing rows 4 and 6) there is a *decline* in the proportion choosing the target – Property A goes down from 51% to 29% – however this does not, in the main, flow to the non-target, B (which would suggest the choice pollution effect), but the decoy, D, which gains 16% of the choices. The decline in Property A is significant but together these pieces of evidence are suggestive of ordering effecting being important in the choice patterns so are taken up in Chapter 7.

## 6.3.2 Comparison with Rightmove Survey

An important feature of the Stamford Adult Group Survey was that the design allowed greater exploration of the properties featured by looking at photos in greater detail and by forcing respondents to scroll through the description of the properties at hand. Comparing the results of the Rightmove and Stamford Surveys, where they coincide, allows some estimation of the importance of these effects given the demographic similarity of the response groups.

The relevant tests are reported in Table 6.13. The results suggest strongly that Property A enjoyed a significant advantage in the Rightmove study, *ceteris paribus*. This is particularly true in the case where respondents saw the simple choice set, either {A, B} or {B, A}. Among the Rightmove group who saw {A, B} 70% chose A. Among those who saw this same choice set in the Stamford survey that percentage was just 46%. This effect is repeated when among those who saw {B, A} too. The information available to participants was identical in these cases. The only difference was that in the latter participants were able to see all photos in large size and were forced to scroll through the written information before going on to the next property.

When the choice set was more complicated, {A, B, C} or {A, B, D}, the effects are slightly modified. For those who saw {A, B, C} there was no significant difference between the Rightmove and Stamford groups. For the order {C, B, A} there was a significant effect on Property A at the 5% level: it dropped from 68% among the Rightmove group to 54% among the Stamford group. This dif-

**Table 6.13:** Rightmove and Stamford survey results compared.

| Row | Choice Set | Group | A | B | C | D | p-value | n |
|---|---|---|---|---|---|---|---|---|
| 1 | {A, B} | Rightmove | 70 | 30 | | | | 335 |
| 2 | | Stamford | 46*** | 54 | | | <0.001 | 69 |
| | | | | | | | | |
| 3 | {B, A} | Rightmove | 73 | 27 | | | | 312 |
| 4 | | Stamford | 51*** | 49 | | | <0.001 | 61 |
| | | | | | | | | |
| 5 | {A, B, C} | Rightmove | 72 | 25 | 3 | | | 277 |
| 6 | | Stamford | 68 | 29 | 3 | | 0.269 | 72 |
| | | | | | | | | |
| 7 | {C, B, A} | Rightmove | 68 | 26 | 6 | | | 232 |
| 8 | | Stamford | 54** | 41 | 5 | | 0.023 | 59 |
| | | | | | | | | |
| 9 | {A, B, D} | Rightmove | 60 | 22 | | 18 | | 253 |
| 10 | | Stamford | 57 | 41 | | 2 | 0.272 | 76 |
| | | | | | | | | |
| 11 | {D, B, A} | Rightmove | 58 | 26 | | 16 | | 242 |
| 12 | | Stamford | 29*** | 55 | | 16 | <0.001 | 51 |

*Notes:* Figures indicate the percentage making the relevant choice.

p-values are based on a one-tailed z-test of proportions.

**, *** indicates significance at the 5% and 1% levels respectively.

ference was largely absorbed by an increase in the proportion choosing Property B. This suggests that the ordering effect is also different between the Rightmove and Stamford studies, which will be taken up in Chapter 7.

Similarly, while there was no significant difference between the proportion choosing A out of the choice set {A, B, D}, there was a stark difference in the rate of choosing of Properties B and D. Property B was far more attractive in the Stamford study – and Property D correspondingly less so – which implies that views of Property D were also affected by the method of presentation.

This result is an important part of interpreting the overall results. It makes the evidence from the Rightmove study even more powerful because the manipulations seen there survived the bias towards Property A evident simply from the

**Table 6.14:** The effect of the decoy on strength of preference.

| Strength of Preference | Choice Set | | | |
|---|---|---|---|---|
| | {A, B} | {A, B, D} | {A, B} | {A, B, C} |
| 1 | 7 | 7 | 25 | 2 |
| 2 | 15 | 11 | 12 | 19 |
| 3 | 26 | 33 | 23 | 23 |
| 4 | 33 | 31 | 34 | 40 |
| 5 | 19 | 18 | 6 | 16 |
| $\chi^2$ | | 1.84 | | 17.64*** |

*Notes:* Figures are all percentages.

Chi-squared tests of goodness of fit are completed with four degrees of freedom.

\*\*\* indicates significance at the 1% level.

method of presentation. This also clearly reinforces the power of the method of presentation to affect choice patterns.

### 6.3.3 Effect of the Decoy on Strength of Preference

In Chapter 4, it was hypothesised (**H5**, page 104) that, as well as increasing the proportion who chose the target property, the effect of the decoy would be to increase the *strength* of preference on average among those who chose the target. Table 6.14 reports the results of this analysis for the participants in the Stamford Adult Group Survey. When Property D is added to the choice set there is little evidence that this alters the strength of preference towards the target. A chi-squared test of goodness of fit is not rejected.

However, the addition of Property C does have a significant impact on preferences towards the target property (B). When the choice set is {A, B} 40% of participants who choose B rate the strength of their preference as being 'strong'[16]. This rises to 56% when Property C is added as a decoy. This difference is not quite significant at the 10% level (p-value: 0.132) owing to the small sample size. A chi-squared test of goodness of fit is rejected at the 1% level though, providing

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[16] As in previous sections, an individual is classed as having a 'strong' preference if he rates his preference as 4 or 5. Those with a preference strength of 1, 2 or 3 are classed as having a 'weak' preference.

further evidence of the effect of the addition of the decoy. Together this evidence is strongly suggestive that participants find it hard to make a good comparison when there are only two choices in the set, but when the choice set is expanded to include a choice which gives context to one of the options (which is what the decoy does to the target) the decision becomes more clear cut: participants are more certain of their choices.

### 6.3.4 Summary

The Stamford Adult Group Survey presents further evidence that choice set effects are important in decision making over housing. As with the Rightmove Survey, the participants were all adults generally in middle age and living in their own properties. The results showed significant evidence of the *choice pollution effect* seen in the Student Group Experiments which is contrary to earlier hypotheses (**H1**, Chapter 4, page 96). Ordering effects also appear significant, although an examination of them is left to Chapter 7. Importantly the survey design allowed greater exploration of the properties at hand and analysis showed that this did have an important impact on choice patterns, confirming the general theme that presentation is vitally important in property choice.

## 6.4 Conclusion

This chapter has reported experiments which examine whether a series of prominent biases in choice can be used to manipulate housing decisions. Buying a house is likely to be among the most important choices made during a lifetime, so understanding the ways in which these biases have application is important to individuals, policy makers and the estate agents who may seek to use them.

Having asked participants to choose their most preferred houses from a series of options, attempts to manipulate individuals' preferences were made through the inclusion of 'decoy' options. These properties were intended to give context to other 'target' properties in specific ways and thus increase the popularity of these options. The precise ways in which this manipulation might take effect in

choices and the motivation for doing so is considered in Chapters 3 and 4. Several different experimental methodologies were used which altered both the method of presentation and the characteristics of the participants.

The significant results can be summarised as follows:

- When the choices are presented in highly simplified written form to student participants who represent a good model for educated first-time renters, there is significant evidence of the *asymmetric dominance* first proposed by Huber et al. (1982). The proportion choosing the target option increases from 42% to 59% upon the introduction of a decoy to the choice set (Table 6.2), this is a conformation of hypothesis **H1**;

- When the choice scenario is made significantly more complex by the use of real property profiles including photos and text description based on real estate agent information a significant, previously unobserved, effect is seen among student participants. In this situation the proportion choosing the target house *falls* and significantly more choose the non-target apartment instead. Upon the introduction of the decoy the proportion choosing the target falls from 58% to 38% and the proportion choosing the target rises from 42% to 59% (Table 6.4). This is labelled the *choice pollution effect*;

- There is significantly more noise and identifying the effect of manipulations is more difficult when the sample set is expanded to over 4,000 users of the Rightmove property search website and the property profiles are viewed in a near-identical manner to how they would be in real choice situations, in another test of hypothesis **H1**. Factors which influence the likelihood of choosing the target property are identified (Table 6.8) and include the age and gender of the participant, but firm conclusions on the effect of the decoy properties are difficult to discern;

- There is significant evidence that the certainty participants have over their choices is a determinant of the efficacy of manipulation strategies. Participants who rated their own preferences as being 'weak' were far more likely to change their preferences in response to the addition of the decoy. Eight

percent of those with weak preferences choose the inferior decoy, Property C, double the number who do if their preferences are strong (Table 6.9). However there is limited evidence that the presence of the decoy increases the strength of preference, which would be a confirmation of hypothesis **H5**; and

- When the method of delivery is altered slightly to emphasise *all* the features of properties (rather than just focusing on one 'main' photo) on a group of 600 residents of the town of Stamford, Lincolnshire there is significant evidence of the ability to manipulate choice even in an information-rich environment. Choice pollution effects appear to dominate. The proportion choosing the target falls from 54% to 29% upon the introduction of a decoy, with participants instead favouring the non-target, which increases from 46% to 68% (Table 6.12).

Together the experiments reported in this chapter have found significant evidence of important biases in housing choice scenarios. Effects were persistent across inexperienced student respondents and those far more seasoned in housing choices – mature adults who own their own properties and take an interest in property and property markets. In this way the findings confirm and extend the results first obtained by Huber et al. (1982) and Simonson (1989).

The analysis in the survey of 4,000 users of the property search website Rightmove showed that when the realism of the choice scenario is increased, in this case to a situation which almost exactly replicates the actual frame in which property searches are made, a significant amount of noise is added which makes discerning the effect of the manipulation far more difficult. Picking decoy properties to influence choice patterns is complicated and the *choice architect*[17] will not know with precision the effect of his manipulations. This is an important result because it illustrates the difficulty of putting the biases found in the laboratory into practice in real choice scenarios. However, as described in Chapter 4, estate agents are exactly the sort of economic agent with the expertise (more accurately the

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[17] Recall that this is the name Thaler and Sunstein (2008) give to anyone who sets the conditions under which a choice is made. Estate agents are perhaps the definitive choice architect.

information advantage) and motivation to attempt such manipulations if shown the broad direction. Further work is clearly needed in real choice scenarios to understand in more detail how and when manipulation strategies will be effective.

An interesting result from the comparison of the Rightmove and Stamford Adult Group Survey concerns the method of presentation of properties. This is possible because the properties used were identical in both surveys, only the method of delivery was different. In the Rightmove Survey preferences were formed and choices made as they would be when browsing online, that is, very quickly and based little more than a glance at the relevant information. The importance of the photographs – in particular the 'main' photograph – was strongly emphasised. Contrary to what might be expected this did not prove conducive to choice bias. In the Stamford Adult Group Survey, although completed online, the information was presented far more evenly. This means that all aspects of the properties were emphasised, not just key features. Participants had to scroll through written and photographic information before continuing on to the next profile. This slight change in delivery method resulted in preferences which were far more considered. The effect was to produce more significant biases in all cases.

This finding is important for agents and individuals because it suggests that they may become more susceptible to biases the *more* they consider their choices in the case of housing. This is similar to the reasoning of Ariely et al. (2003) who say, in the case of valuation anchoring[18], that for an anchor to take hold, an individual has to actually consider making the purchase at that price (a psychological phenomenon known as *imprinting*). It also runs counter to the assumed wisdom of the defenders of neoclassical choice theory (such as Simon, 1957) who say that greater consideration and thought over a particular choice problem will tend to reduce decision making errors.

The most significant result concerns the finding of a new, previously unobserved choice bias. This regularity has been labelled the *choice pollution effect*. It describes a choice pattern where the introduction of a decoy choice has a perversely

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[18] Note that this thesis will consider value anchoring in Chapter 8.

*negative* effect on the intended target choice, decreasing the popularity of the said target, in favour of an unspecified competitor option. This effect was seen in both the Student Group Experiments and among older, experienced participants in the Stamford Adults Group Survey. The explanation for this observation may lie in information asymmetry. When making choices over housing, individuals know they have significantly less information than the agent helping with their search. Such an observation is true in many choice situations, but the nature of housing choices suggests it may be more significant here than for most other decisions. In this scenario participants may use other choices in the set as a signal about the desirability of similar properties. In the student experiments the decoy property was an inferior terraced house. However, instead of making the target terraced house look good (the traditional *halo effect* explanation for the efficacy of the strategy after Simonson, 1989) it appears to have sent a negative signal to decision makers about all similar properties, emphasising their negative aspects. Further study is clearly needed to explore this finding further.

Overall this chapter shows choice set biases are evident in choices involving housing, providing further evidence to support the behavioural paradigm of choice theory. This evidence is significant in that debate because housing choices are among the most important decisions made during a lifetime. This blunts a common criticism of behavioural work, which says that the choices considered are usually unimportant, with investigations being largely confined to decisions over simple consumer durables.

The findings are also important on a practical level for housing market participants and academics. Estate agents are motivated to use manipulation strategies to increase their own profitability as discussed in Chapter 4. The results in this chapter confirm the possibility of such actions although they do suggest they may be technically difficult to put into practice and control effectively. Regulators have shown concern with preventing the manipulation of consumers (OFT, 2010a). The results in this chapter suggest that a closer look at housing markets may be useful. Finally, for individuals the results lay bare their vulnerability to choice manipulation, an important contribution in its own right.

# Chapter 7

# Analysis of Ordering Biases

This chapter presents the results from several experiments examining biases in choice patterns that can be induced by varying the order of choice presentation as explained in Chapter 4. It finds significant evidence of these ordering biases in housing choice scenarios. When the choice set consists of more than two options, a property gains significantly from being shown first, *ceteris paribus*. The results are particularly strong in an online choice frame which forced participants to spend time reading the information about each property in turn.

## 7.1   Student Group Experiments

This section presents the results from a series of experiments which investigate whether preferences over housing can be reliably influenced by a willing economic actor – the estate agent – who is able to alter the *order* in which properties are shown to the decision maker. In this section, and throughout this chapter, the hypotheses being tested is as follows:

> **H3a.** *Primacy: information received first will have excessive weight in judgements over housing, thus houses seen <u>first</u> will be preferred more, ceteris paribus.*

> **H3b.** *Recency: information received last will have excessive weight in*

185

> *judgements over housing, thus houses seen <u>last</u> will be preferred more,*
> *ceteris paribus.*

These hypotheses are discussed in greater length in Chapter 4. The subjects in the experiments in this section were students attending the University of Cambridge. As discussed in the previous chapter, the majority of the subjects live in rented accommodation provided by their colleges. Thus most will have never experienced renting independently in the private rented sector before. The summary statistics for the participants, reported in Table 6.1 (page 153), bear this observation out. The statistics show that the participants were aged 18-23 and generally inexperienced in dealing with property. While this observation limits the generalisability of the results, it has already been argued that the student group does represent a good model of first-time renters who are a significant part of housing markets in their own right. Moreover, by comparison with the results from the other experimental groups, may allow us to uncover more about the role of market experience in determining vulnerability to preference manipulation.

The analysis of ordering biases is completed using data gathered as part of the set of experiments on housing choice which were reported in Chapter 6. Thus the methodologies match those reported in Chapter 6[1]. To recap, there were two main experimental designs. In the first information about property choices was presented in a highly simplified written form. Participants were able to judge between houses on only two dimensions of value – distance from a place of work and state of repair. This method replicates that commonly utilised in experimental choice theory literature (as surveyed in Chapter 3) and has the advantage of precision – treatment effects can be isolated easily – with the disadvantage being a lack of realism. Experiments 1a and 1b use this methodology to test primarily for *asymmetric dominance* and *compromise effects*[2]. In the analysis below the choice set effects reported in the previous chapter are held constant and the order of presentation of the choices is varied. In this way it is possible to examine whether ordering is an important part of the choice process.

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[1]  The exact form and procedure for each experiment is reported in Chapter 5.
[2]  The results of these tests are reported in Chapter 6.

In the second set of experiments (Experiment 2 in Table 6.1, page 153) house choices were presented in a visual form by means of a 'virtual tour' of each property using photographs and information drawn from the real property profiles of a local estate agent. This significantly increases the realism of the choice frame and the complexity of the information set. The result is an experiment which more closely matches real decision making environments. The cost of this is precision. As Chapter 6 illustrated, the greater complexity makes is harder to isolate treatment effects and introduces a lot of 'noise' to the results.

Behavioural literature has suggested two contradictory non-rational ordering effects. These are discussed in detail in Chapter 3. The first derives from the concept of *anchoring* first introduced by Tversky and Kahneman (1974). It suggests that properties which are viewed first gain a special significance in the mind of the decision maker because he will use this first property as a cognitive 'measuring stick' against which all other options are naturally compared and contrasted. As such it is suggested that first-viewed options will be chosen more frequently *ceteris paribus*. This bias has also been called *primacy* (Nisbett and Ross, 1980).

In contrast the alternative hypothesis is simpler. Known as *recency* it suggests that cognitive limitations on the part of the decision maker will ensure that more recently-received information will be over-weighted. Thus this hypothesis suggests that the property viewed *last* will tend to be chosen more frequently on average.

Both of these ideas, which were the subject of discussion and hypotheses in Chapter 4 (page 98), run counter to the classical model of choice of von Neumann and Morgenstern (1944). That accords no special place for ordering effects. This is a necessary part of the theory's central concept of invariance[3]. Thus our null hypothesis, expressed by the assumption of invariance, is that the ordering of choices will make no difference to the pattern of preferences.

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[3] For a detailed description of the axioms of the classical choice model, including the assumption of invariance, see Chapter 2, page 30.

**Table 7.1:** Ordering effect among student subjects in asymmetric dominance experiments.

| Row | Set and Order | A | B | C | D | p-value | n |
|-----|---------------|------|----|---|---|---------|----|
| 1 | {B, A} | 59 | 41 | | | | 22 |
| 2 | {A, B} | 57 | 43 | | | 0.471 | 35 |
| | | | | | | | |
| 3 | {C, B, A} | 32 | 68 | 0 | | | 25 |
| 4 | {A, B, C} | 46** | 54 | 0 | | 0.045 | 39 |
| | | | | | | | |
| 5 | {D, B, A} | 60 | 40 | | 0 | | 25 |
| 6 | {A, B, D} | 75 | 25 | | 0 | 0.096 | 24 |

*Notes:* Figures indicate the percentage making the relevant choice.
p-values are based on a one-tailed z-test of proportions.
** indicates significance at the 5% level.

## 7.1.1 Ordering in Asymmetric Dominance Experiments

Table 7.1 reports the results from the first set of tests which explored asymmetric dominance. By holding the choice set constant it is possible to complete tests on the effect of varying the order of choice presentation. There is evidence of ordering effects even though the method of choice presentation was extremely simple which was expected to minimise these effects[4].

There is no evidence of ordering for the 'short' two-choice case: when participants saw {B, A} they chose Option A with a frequency of 59% (row 1) which was only slightly above the 57% of the time it was chosen when shown in the form {A, B} (row 2). However, when the choice set becomes 'long', ie. including a third option, ordering becomes important. The results clearly suggest that the first-viewed option gains from being in that position which is suggestive of primacy. The percentage choosing Option A when the choice set was {C, B, A} was 32%, however when the presentation was {A, B, C} this rose to 46%, a significant increase. A similar magnitude rise occurs when the choice set is {A, B, D} versus {D, B, A}, Option A rises from 60% to 75%.

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[4] The presentation was simple in the sense that the choices were presented next to each other on the answer sheet.

**Table 7.2:** Ordering effect among student subjects in compromise effect experiments.

| Row | Set and Order | A | B | E | F | p-value | n |
|-----|---------------|-----|-----|-----|-----|---------|-----|
| 1 | {E, B, A} | 33 | 53 | 14 | | | 21 |
| 2 | {A, B, E} | 42 | 41 | 17 | | 0.232 | 29 |
| | | | | | | | |
| 3 | {F, B, A} | 40 | 30 | | 30 | | 20 |
| 4 | {A, B, F} | 59* | 14 | | 27 | 0.055 | 22 |

*Notes:* Figures indicate the percentage making the relevant choice.
p-values are based on a one-tailed z-test of proportions.
* indicates significance at the 10% level.

It is also clear the ordering and choice set factors interact. Option A is chosen the most when it is the 'target' and it is shown first (75%). It is chosen the least when it is not the target and it is shown last (32%). This difference is highly significant.

## 7.1.2 Ordering in Compromise Effect Experiments

The ordering effects associated with the experiments into the compromise effect are examined in Table 7.2. When the viewing order was {E, B, A} Option A was chosen 33% of the time. When the order was revered and Option A was shown first it was chosen 42% of the time. This increase is not significant due to the relatively small sample size but is suggestive of primacy.

There is a significant effect in the choice set containing Options A, B and F. Here when Option A is shown last, ie. in the form {F, B, A}, it is chosen 40% of the time. This rises nearly 20 percentage points to 59% when it is shown first, ie. {A, B, F}.

As with earlier results, the effects clearly interact. Option A is chosen the most when it is the compromise and is shown first (59%). It is chosen the least when it is not the compromise and is shown last (33%). This is a significant difference.

The same is true of Option B: it is chosen most when it is the compromise and is shown before the other original choice (53%). When it is not the compromise, and is shown after the compromise choice is it chosen dramatically less (14%).

These results are particularly interesting because of the simplicity of the experiments. All information was conveyed in written form on a single sheet of paper, with options listed alongside boxes to indicate preference. The only treatment variation to create these biases was altering the listing order of the options. That they persisted gives further credence to the general finding that ordering effects are generated by a psychological bias which takes shape when an option comes under consideration in the decision maker's mind. It is natural to ask whether such manipulations can be used in a more complex information-rich scenario, which the following section considers.

### 7.1.3 Ordering in Complex Choice Set Scenarios

Table 7.3 reports the results from ordering tests in the more complex information-rich choice environment that was created by making visual presentations to decision makers. In the short two-choice case there appears to be a tendency towards primacy: Apartment X is chosen 46% when shown first (row 2) and only 39% when shown last (row 1). This difference is not statistically significant, however.

It is not possible to discern significant results when the choice set is made longer through the addition of a third, dominated option. As rows 3 and 4 of Table 7.3 illustrate, the percentages are not materially altered by reversing the order of presentation.

This result continues a theme from Chapter 6, namely that when significant complexity is introduced into the experimental design, reliable manipulation effects are more difficult to discern. This is disappointing for the doubt it casts upon the ability to put the manipulations into practice into real choice scenarios.

**Table 7.3:** Ordering effect among student subjects in complex choice set scenario.

| Row | Choice Set | X | Y | Z | p-value | n |
|-----|-----------|----|----|---|---------|----|
| 1 | {Y, X} | 39 | 61 | | | 44 |
| 2 | {X, Y} | 46 | 54 | | 0.245 | 39 |
| | | | | | | |
| 3 | {X, Y, Z} | 57 | 39 | 4 | | 44 |
| 4 | {Z, Y, X} | 60 | 37 | 3 | 0.382 | 67 |

*Notes:* Figures indicate the percentage making the relevant choice.
p-values are based on a one-tailed z-test of proportions.

### 7.1.4  Summary

The Student Group Experiments provide some evidence of ordering effects. The simple written-form methodology produces statistically significant results indicating most reliably a tendency towards primacy, which would be a confirmation of hypothesis **H3a** (page 98). This result is strongest when the choice set is 'long' in the sense that it contains three choices rather than two.

When the choice frame is made more complex through the use of detailed profiles of real properties, including visual information, there is no clear effect. However the next sections change the participant group significantly. The mature adults in these surveys are a significant test for the manipulations hypothesised because they represent the typical consumer of housing, who is likely to have at least some experience with the process of searching for and choosing property.

## 7.2  Rightmove Survey

This section examines ordering effects from the results of the survey of 4,000 users of the property search website Rightmove that was reported in Chapter 6. By holding constant the choice set and varying the order of presentation, it is possible to use the same data set to examine the hypotheses at hand.

As explained in that section, the large-scale study of a self-selected group of adult volunteers interested in property or at least experienced with property market dealings presents a significant opportunity and challenge for the biases being examined. Table 6.5 on page 162 reports descriptive statistics for that data set. Seventy-one percent own their own homes, and the average age of the respondents is 44. Over three-quarters have lived in their homes for over one year.

The survey was completed by respondents viewing properties online through the Rightmove website with properties presented in an almost identical manner to how they are actually viewed in real choices[5]. Participants were asked to view two (or three) houses and choose which they preferred, before completing a questionnaire. By replicating closely the actual choice frame in which decisions are made – or at least initial preferences are formed – this experiment offers a significant insight into the nature of biases in housing choice. Although, as noted in Chapter 6, the significant complexity that comes with the information-rich design makes it difficult to make firm predictions about the effects we will see.

The experiment had 14 treatments allowing for all combinations of choice sets and orders. A total of four properties were used, all real properties being advertised on the Rightmove website. To summarise the properties again: Property A was a modern, well-appointed family home which, which offered less character but perhaps a better state of repair than its comparison, Property B, which was generally older and more solid in appearance. It had character and several features not present in the modern house, but was in a more traditional state of repair than Property A. Thus respondents were asked to trade-off age/ character against the state of repair of the property based on a profile page viewed in exactly the same manner as they would be on Rightmove.

Properties C and D were 'decoys'. Property C was also a 'character' property like Property B, but clearly offered less of the charm of Property B and was in a noticeably worse state of repair. Property D was like Property A, modern and well maintained, but without the overall impressiveness in terms of state of repair.

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[5] Location information was removed. For full details see Chapter 5.

## 7.2.1 Logit Estimation of the Importance of Order

One method for examining the importance of ordering effects in this large sample is a logistic regression using maximum likelihood estimation. The broad hypothesis on the importance of ordering effects can be split into three specific questions:

- Are ordering effects present when the choice set is 'short' ie. contains only Properties A and B?

- Are ordering effects important in explaining the likelihood of choosing the target when the choice set is expanded to include three options?

- Is there evidence of ordering effects when the likelihood of choosing the decoy is examined in a set containing three options?

Table 7.4 presents evidence to answer the first question. The dependent variable is whether the participant chose Property A[6]. The single independent variable is binary, taking a value of 1 if the participant saw Property A first, and taking a value of 0 otherwise. Thus the model estimates whether the order of presentation – {A, B} versus {B, A} – alters the likelihood of choosing Property A. There is no evidence that ordering effects are important in the short choice set case.

**Table 7.4:** Logistic regression on the probability of choosing Property A.

| | Respondent chooses Property A |
|---|---|
| Intercept, $\alpha$ | 0.982 |
| | (0.127) |
| *prop-a-first* | -0.114 |
| | (0.175) |
| n | 647 |
| Pseudo $r^2$ | <0.001 |
| Log-likelihood, $\chi^2$ | -386.1 |
| Significance | 0.515 |

*Note:* Standard errors are in parentheses.

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[6] The dataset is filtered to only include those participants who saw the choice set {A, B}.

**Table 7.5:** Logistic regression on the likelihood of choosing the target property.

|  | Probability respondent chooses target | | | | | |
|---|---|---|---|---|---|---|
|  | (1) | (2) | (3) | (4) | (5) | (6) |
| Intercept, $\alpha$ | -1.035 | -1.077 | -1.074 | -0.460 | 0.526 | 0.524 |
|  | (0.191) | (0.070) | (0.071) | (0.363) | (0.058) | (0.064) |
| *treatment-abc* | -0.007 |  |  |  |  |  |
|  | (0.034) |  |  |  |  |  |
| *treatment-abd* |  |  |  | 0.004 |  |  |
|  |  |  |  | (0.031) |  |  |
| *target-is-first* |  | 0.020 |  |  | -0.101 |  |
|  |  | (0.120) |  |  | (0.141) |  |
| *target-is-last* |  |  | 0.008 |  |  | -0.046 |
|  |  |  | (0.120) |  |  | (0.113) |
| n | 1,610 | 1,610 | 1,610 | 1,529 | 1,529 | 1,529 |
| Pseudo $r^2$ | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Log-likelihood, $\chi^2$ | -914.6 | -914.6 | -914.6 | -1,012 | -1,012 | -1,012 |
| Significance | 0.844 | 0.870 | 0.945 | 0.890 | 0.477 | 0.687 |

*Note:* Standard errors are in parentheses.

Table 7.5 reports regressions analysing whether there is evidence of ordering effects in the likelihood of choosing the target property when the choice set is expanded to three choices[7]. As discussed in Chapter 5 this was done in two different ways: either through the addition of Property C to make the choice set {A, B, C} or through the addition of Property D to make the choice set {A, B, D}. In Table 7.5 columns (1) – (3) report tests of ordering effects when the choice set was {A, B, C} and columns (4) – (6) report similar tests when the choice was set {A, B, D}.

The dependent variable is always whether the respondent chose the target property. When the choice set was {A, B, C} this is Property B; and when the choice set was {A, B, D} this is Property A. There are several ways in which the order of presentation could be taking effect. These are tested separately using three dif-

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[7] The dataset is filtered to include only those participants who saw choice sets containing three choices.

ferent independent variables. The first, *treatment-abc* and *treatment-abd* – where the former is applicable when the choice set is {A, B, C} and the latter when the choice set is {A, B, D} – is the simplest. It is a categorical variable which assigns a number to each ordering. There are six combinations of orders of the three properties, so it ranges from 1 to 6.

Alternatively the ordering bias could be specifically only applicable when the choice is viewed first. This is tested by the variable *target-is-first* which is given a value of 1 when the target property is seen first (irrespective of the ordering of the other two choices) and 0 otherwise. Similarly to test for a bias based on the chosen property being shown last the variable *target-is-last* is given a value of 1 when the target property is seen last and 0 otherwise.

The results from Table 7.5 suggest there are no relationships of statistical significance. Thus it is not possible to conclude that respondents are more likely to choose the target property when it is shown first, or when it is shown last. This is the case when the choice set is {A, B, C} and {A, B, D} – thus encompassing two different target properties[8].

The final question posed above relating to ordering effects was whether they apply to the decoy. In the theoretical exposition of choice set effects considered in Chapter 4 the decoy is strictly dominated by one other property – the target – and so should not be chosen by any respondents. When the experimental testing is simplified and all variables of value can be controlled, as they are in the Student Group Experiments, this expectation was met. No one chose a dominated alternative. However, when the information set is significantly expanded, as it is in the Rightmove Survey through the use of real property profiles including photos, it is far harder to control all variables which determine the ultimate choice made. Thus the decoy cannot be regarded as strictly dominated. A minority of respondents are thus expected to choose the decoy property and useful information can be gained by examining their choices.

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[8]  In other words ruling out the possibility that it was something particular to *one* of the properties.

**Table 7.6:** Logistic regression on the likelihood of choosing the decoy property.

|  | Probability respondent chooses target | |
|---|---|---|
|  | (1) | (2) |
| Intercept, $\alpha$ | -1.295 | -1.861 |
|  | (0.088) | (0.088) |
| *decoy-is-c* | -1.098*** | -1.102*** |
|  | (0.137) | (0.137) |
| *decoy-is-first* | 0.298** |  |
|  | (0.131) |  |
| *decoy-is-last* |  | 0.035 |
|  |  | (0.130) |
| n | 3,139 | 3,139 |
| Pseudo $r^2$ | 0.004 | 0.038 |
| Log-likelihood, $\chi^2$ | -923.7 | -925.7 |
| Significance | <0.001 | <0.001 |

*Notes:* Standard errors are in parentheses.
**, *** indicates significance at the 5% and 1% levels respectively.

Table 7.6 reports regressions which consider ordering effects on the decision to choose the decoy. The dependent variable is whether the decoy is chosen, taking a value of 1 when it is and 0 when it is not. The actual property that is the decoy varies. When the choice set is {A, B, C} the decoy is C; and when the choice set is {A, B, D} the decoy is D. There is a significant difference in the likelihood of choosing Property C compared to D[9] thus a control variable is included in all the regressions in Table 7.6. This variable, labelled *decoy-is-c*, takes a value of 1 when the decoy is Property C and 0 otherwise (ie. when it is Property D).

Two different independent variables test whether ordering effects are important. The first, labelled *decoy-is-first*, is a binary variable activated when the decoy is shown first. As with the testing of ordering effects in relation to the target, if this variable is significant it will show that the likelihood of the decoy being chosen is influenced by it being viewed first versus being viewed in another position. Simi-

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[9]  Based on unreported testing.

larly the variable *decoy-is-last* considers the opposite case: whether being shown last influences the likelihood of the decoy being chosen.

Considering column (1) of Table 7.6 first, the estimated regression suggests that the likelihood of the decoy being chosen is increased by it being shown first. Taking the coefficient and raising it to the exponential gives the odds ratio associated with that variable. Doing this for the variable *decoy-is-first* indicates that the likelihood of the decoy being chosen is increased by over 34% when it is placed first as opposed other positions. Remember, this controls for the difference between the popularity of decoys C and D. This is evidence of primacy: a way to significantly increase the popularity of the decoy is to place it first in any set.

Column (2) adds to this conclusion because the variable *decoy-is-last* is not significant. This means that being placed last does not significantly increase the likelihood of choosing the decoy.

To summarise the preceding results: there is no evidence of ordering effects in the short choice set, or in the likelihood of choosing the target in the long set. There is, however, significant evidence of primacy when we consider the decoy. It is far more likely to be chosen when viewed first than when viewed in other positions.

In Chapter 6 we saw that the vulnerability to choice set effects were partly determined by the strength of preference of the decision maker. It seems reasonable to ask whether such factors also influence the vulnerability to ordering biases. This is analysed in the following section.

## 7.2.2 Strength of Preference

Evidence in Chapter 6 suggested that the respondents' reported strength of preference, believed to be a simple measure of the certainty of their decision making, was important in determining the susceptibility to choice set bias. It is worth considering whether the same may be true in respect of the ordering biases that are the subject of this chapter. As in Chapter 6, strength of preference is split in

197

**Table 7.7:** Ordering effects from the Rightmove Survey split by strength of preference.

| | | | Weak Preferences | | | Strong Preferences | | |
| | | | | Position | | | Position | |
| Row | Set | Choice | First | Not First | p-value | First | Not First | p-value |
|---|---|---|---|---|---|---|---|---|
| 1 | {A, B} | A | 65 | 69 | 0.291 | 75 | 75 | - |
| 2 | | B | 31 | 35 | 0.291 | 25 | 25 | - |
| | | | | | | | | |
| 3 | {A, B, C} | A | 60 | 61 | 0.415 | 75 | 74 | 0.261 |
| 4 | | B | 32 | 32 | 0.426 | 23 | 22 | 0.297 |
| 5 | | C | 12*** | 6 | 0.004 | 3 | 4 | 0.260 |
| | | | | | | | | |
| 6 | {A, B, D} | A | 59 | 58 | 0.399 | 64 | 66 | 0.270 |
| 7 | | B | 26 | 27 | 0.409 | 25* | 21 | 0.059 |
| 8 | | D | 21*** | 13 | 0.004 | 12 | 12 | - |

*Notes:* Figures indicate the percentage making the relevant choice.
p-values are based on a one-tailed z-test of proportions.
*, *** indicates significance at the 10% and 1% levels respectively.

two. Having been asked to state the strength of their preference on a scale of 1-5 respondents were labelled as having a 'strong' preference if they indicated a 4 or a 5. A 'weak' preference was recorded if they rated their preference as a 1, 2 or 3. The results are presented in this way in Table 7.7.

There is evidence that ordering effects are more significant for those with weak preferences than among those whose preferences are more certain. The majority of the differences in the table are not significant. However for the decoys there is a significant ordering effect. When the decoy property C is shown first it is chosen 12% of the time by those with weak preferences. When it is not shown first to those with weak preferences it is only chosen 6% of the time – significantly less. The same is true of decoy property D. Its popularity, measured by the proportion choosing it, rises from 13% to 21% when it is shown first to those with weak preferences.

No such relationship is evident among those with strong preferences. When the

choice set is short, containing only properties A and B those with strong preferences make an identical choice whichever order they view the properties in. The popularity of options appear invariant to their being shown first when the choice set is made more complicated too. All are non-significant coefficients aside from a fall in the proportion choosing Property B when it is not shown first in the choice set {A, B, D}, which is significant at the 10% level.

These observations seem to confirm the conclusions from Chapter 6, that there is some difference between the susceptibility to choice biases according to strength of preference. Those with stronger preferences are less likely to be affected by the order of presentation than those who report greater uncertainty. As the analysis earlier in this chapter suggested, ordering effects seem most powerful on the decoy. It is chosen by relatively few people total, but its popularity can be significantly improved through being shown first.

It is important to note that the self reported measure of strength of preference used in this analysis is clearly not an entirely objective and error-free variable. Different respondents may have interpreted that question in the questionnaire differently, for example[10]. Or some may have paid little attention to filling it in, thus increasing the observation error. Thus it is not possible to say for certain that the measure reported here exactly represents 'uncertainty' in decision making. This is notwithstanding the difficulty an agent may have in identifying 'uncertain' decision makers in advance in real world situations (with a view to manipulating them). However the results do suggest that further investigation into the influence of subject uncertainty in vulnerability to manipulation might prove fruitful.

### 7.2.3 Other Factors

Demographic information about the respondents – such as their age, gender and tenure history – was taken through the use of a questionnaire. Analysis in Chapter

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[10] Note that the questionnaire respondents filled in at the end of the Rightmove Survey is discussed in Chapter 5. A copy of it is reproduced in Appendix B.

6 considered whether these variables might have an impact on the susceptibility to the choice set biases that were the focus of that chapter. For example it might be the case that respondents who have never owned a property previously, and so have never gone through the process of selecting a house, making an offer, completing the transaction and so on, are more susceptible to manipulation because of their inexperience.

Logistic regressions were performed to test these variables in respect of ordering biases which are under consideration here. For example: are men more likely to choose the first-viewed property than women? Do older respondents prefer the most-recently viewed choice? However, the analysis indicates no significant patterns in the data. There is no clear evidence that any of these variables exert a consistent influence on the decisions of respondents. Thus these results are not reported here. As was concluded in Chapter 6, the effects of these variables seem instead to be part of the extra 'noise' which is expected from making the experimental scenario significantly more information-rich, as the Rightmove Survey does.

## 7.2.4 Summary

The Rightmove Survey reveals several important ordering biases. Logistic regressions showed that some ordering effects are present in the choice patterns of the 4,000 respondents to the survey.

There was no evidence of biases when the choice set was short and contained only two choices. Similarly it was not possible to conclude that it is possible to manipulate perceptions of the target property through the order in which it is viewed.

The ordering effects that are observed in the Rightmove Survey group are seen most strongly on the decoy properties. This is an interesting result partly because it is unique: published research into choice set manipulations rarely pauses to consider the decoy at all. As was discussed earlier in this chapter, in simple

experimental situations it is possible to ensure the decoy is *strictly* dominated and so is chosen by no one. However in the information-rich scenario used in the Rightmove Survey it is difficult to produce strict dominance, thus a small proportion (always under 20%) of respondents chose the decoy probably because they felt it was superior on some unidentified (and uncontrolled) scale of value. An effective way to increase this proportion is to show that property first. Being shown first versus any other position more than doubled the popularity of the decoy option in some cases. This is interpreted as evidence in support of the *primacy* hypothesis derived from the *anchoring* concept of Tversky and Kahneman (1974) and hypothesised in Chapter 4 (**H3a**, page 98).

Using this ordering bias may prove an effective strategy for agents looking to shift particularly 'difficult' properties from their books. If an agent has a property which is ostensibly inferior to many in its class he may be able to improve its popularity simply by showing it first in all his viewings of similar properties. Buyers might also want to be made aware of this possibility.

Strength of preference was found to partially condition the ordering effects displayed, once again most particularly on the decoy property. In general those with less fully-formed preferences were more likely to be influenced by ordering effects, although the evidence cannot be said to be as firm as with the choice set effects examined in Chapter 6. Finally there was no evidence that other factors such as the age, gender or tenure status of the respondent have an impact on the vulnerability to ordering effect manipulations.

The Rightmove Survey was designed so that it replicated almost exactly the conditions in which properties are viewed on property search websites. This is quite different to the decision making process used when physically viewing properties. When browsing online search results judgements are made, and preferences formed, among many options very quickly based on readily visible features, probably with little in the way of detailed analysis. As discussed in Chapter 2, these conditions match the *editing* phase which Daniel Kahneman and Amos Tversky discussed in their seminal *Prospect Theory* (1979). The results suggest that it is

not easy to produce consistent and controllable biases in preferences in this forum. As Chapter 6 concluded, such a result is perhaps counter to the interpretation of human decision making (largely after Simon, 1957) which says that when decision makers form preferences quickly, with little consideration and using rules of thumb, they are *more* vulnerable to biases than if they take time over the decision.

The controlled survey in following section uses the same properties as the Rightmove Survey, but its design forces respondents to spend more time considering the properties in greater detail. As well as providing another test of the ordering biases hypothesised, the results will provide interesting evidence as to the importance of time spent making the decision in moderating the vulnerability of that decision to behavioural biases.

## 7.3   Stamford Adult Group Survey

The Stamford Adult Group Survey comprises an online survey of 600 residents of the town of Stamford, Lincolnshire. As explained in Chapter 5, the survey design was similar to the Rightmove Survey. However the method of administration was slightly different, allowing participants to view *all* the photographs of the property in larger size as well as forcing them to scroll through all the written information before they went onto the next property. This is a subtle change in methodology, but important because it encourages respondents to consider each option in more detail, focusing on a wider range of features of value. Ariely et al. (2003) state that in their experiment biases – they were looking at valuation biases which are the subject of Chapter 8 – took effect only when the decision maker actually contemplated making a particular purchase. Psychological literature calls this process *imprinting*. The design of the Stamford Adult Group Survey resulted in a far greater possibility of imprinting on the part of the decision maker.

Thus, as well as providing further evidence of ordering biases in a housing choice context from a demographic seasoned in housing choice, the design allows an implicit test of the different methodologies. If the ordering biases found in the

**Table 7.8:** Ordering effects in the Stamford Adult Group Survey.

| Row | Choice Set | A | B | C | D | p-value | n |
|-----|-----------|------|------|----|----|---------|----|
| 1 | {B, A} | 51 | 49 | | | | 61 |
| 2 | {A, B} | 46 | 54 | | | 0.306 | 69 |
| | | | | | | | |
| 3 | {C, B, A} | 54 | 41 | 5 | | | 59 |
| 4 | {A, B, C} | 68* | 29 | 3 | | 0.053 | 72 |
| | | | | | | | |
| 5 | {D, B, A} | 29 | 55 | | 16 | | 51 |
| 6 | {A, B, D} | 57*** | 41 | | 2 | <0.001 | 76 |

*Notes:* Figures indicate the percentage making the relevant choice.
p-values are based on a one-tailed z-test of proportions.
*, *** indicates significance at the 10% and 1% levels respectively.

Rightmove Survey persist in this set of experiments, or are even stronger, it will add to our knowledge not only of the *nature* of the biases themselves, but also the *conditions* under which they can be created and sustained.

## 7.3.1 Full Sample Results

Table 7.8 reports the results of the Stamford survey so that it is possible to examine ordering biases. As discussed previously these tests are examining hypothesis **H3**, which was outlined in Chapter 4 (page 98). There is no large ordering effect on the 'short' choice set containing Properties A and B only. The proportion choosing Property A rises from 46% to 51% when it is placed last, but this is not a significant increase given the sample size. However, when the choice set is expanded to its 'long' form containing three choices ordering effects become important. When the choice set is {A, B, C} the proportion choosing A rises from 54% to 68% by placing it first compared to last. This is a significant increase at the 10% level.

When the choice set is {A, B, D} the effect is even more obvious. The proportion choosing A is 29% when respondents see the choice set in the order {D, B, A}, in other words with A placed last. When this ordering is reversed and it is shown

first this figure rises to 57%, a highly significant result. That this is an ordering effect is corroborated by looking at the effect on the decoy, D, which is swapped with Property A in the treatment manipulation. Those who saw the choice set {D, B, A} chose D with a frequency of 16%. When this was reversed and D was placed last – {A, B, D} – the proportion choosing D fell to just 2%, a significant fall.

This is an important result. As in the previous section the effect of ordering is seen most strongly on the decoy. Simply by showing the inferior option first (holding all other factors constant), it was possible to increase its popularity eightfold from 2% to 16%. Once again it suggests an obvious strategy for increasing the sales of difficult to sell properties, although it is clearly worthy of further investigation given its novelty. Together these results constitute strong evidence that *primacy* dominates in the choice set containing three choices, which is a confirmation of hypothesis **H3a** (Chapter 4, page 98).

The choice set and ordering effects combine to produce significant variations in choice patterns. Property A is chosen the most (68%) when it is not the target and it is shown first (a combination of *choice pollution effect* and primacy). It is chosen least (29%) when it is the target and it is shown last. This is a highly significant difference (p-value: <0.001).

## 7.3.2   Other Factors

In Chapter 6 the data was split according to key demographic variables which were taken from respondents through the use of a questionnaire. A similar analysis is possible when considering ordering biases. Ultimately the aim of this procedure is to answer the following question: is there a sub-group of respondents who are more vulnerable to behavioural biases than the population as a whole? The Student Group Experiments go some way to answering this question by focusing on young adults who are inexperienced participants in housing markets. Using the demographic data from the Stamford Adult Group Survey (as with the Rightmove Survey) is a way of building on this.

**Table 7.9:** Stamford Adult Group Survey results split by strength of preference.

| Row | Preference | Choice Set | A | B | C | D | p-value | n |
|-----|-----------|-----------|------|----|----|----|---------|----|
| 1 | Weak | {C, B, A} | 50 | 39 | 11 | | | 18 |
| 2 | | {A, B, C} | 61 | 33 | 6 | | 0.218 | 36 |
| 3 | Strong | {C, B, A} | 59 | 38 | 3 | | | 39 |
| 4 | | {A, B, C} | 73 | 27 | 0 | | 0.111 | 33 |
| 5 | Weak | {D, B, A} | 33 | 40 | | 27 | | 27 |
| 6 | | {A, B, D} | 48 | 50 | | 2 | 0.124 | 40 |
| 7 | Strong | {D, B, A} | 22 | 74 | | 4 | | 23 |
| 8 | | {A, B, D} | 67*** | 30 | | 3 | <0.001 | 33 |

*Notes:* Figures indicate the percentage making the relevant choice.
p-values are based on a one-tailed z-test of proportions.
*** indicates significance at the 1% level.

Analysis of the data according to the age, gender, tenure and experience with property of the respondents does not yield any significant insights into choice behaviour. Variation can be observed – as would be expected – between different sub-groups, but nothing strongly indicating a systematic weakness in one group over another to *bias*. Thus these results are not reported.

A strong result from previous sections and the previous chapter was that self-reported strength of preference is important in determining the vulnerability to manipulation. Individuals who reported greater uncertainty were far more likely to be affected by the decoy property, and to make less consistent choices in general, than those who described their preference as 'strong'. Table 7.9 considers whether ordering biases are also conditioned by this uncertainty. It only reports treatments involving long choice sets of three options because there is no significant evidence of ordering effects in short two-choice sets.

To re-cap: the presumed direction of the effect is that ordering effects are stronger among those with weak preferences and than those with strong preferences. How-

ever, examining Table 7.9 does not produce conclusive evidence on this point. Ordering effects seem to be important for both groups. When the choice set is {A, B, C} in rows 1-4, being shown first helps increase Property A's popularity from 50% to 61% among those with weak preferences (comparing rows 1 and 2); and from 59% to 73% among those with strong preferences (rows 3 and 4). These movements are similar and neither statistically significant.

Moreover the most significant result comes from those with strong preferences. The proportion who chose Property A is 22% when they view the properties in the order D, B, A. When this is reversed and A is shown first this triples to 67% a highly significant result. It is difficult to interpret this result in isolation, with no *a priori* reason to expect such a strong change in preference.

Strength of preference does appear to be a moderating influence on the ordering effect seen on the decoys. Among those with strong preferences the decoy is chosen by a small minority of respondents; a proportion that does not change significantly whether the decoy is placed first or last (comparing the rate of choosing of C in rows 3 and 4; and of D in rows 7 and 8). For those with weak preferences however, the ordering effect on the decoy is strong, particularly for decoy D. Being shown first rather than last increases the proportion choosing Property D from 2% to 27% among those with weak preferences, a highly significant increase, which reinforces the dominance of primacy effects.

### 7.3.3    Summary

The Stamford Adult Group Survey strengthens the findings of part of the Rightmove Survey by providing further evidence that ordering biases are important in housing choice scenarios. In the long choice set containing three options *primacy* dominates. As previously, this result is most strongly seen on the decoy properties. They gain most from being shown first. The magnitude of the increase is striking. Decoy properties can have their popularity increased by as much as eightfold by being shown first in some cases.

In general the ordering biases are stronger than those in the Rightmove Survey, even given the smaller sample size. This suggests that the more in-depth survey design, meaning respondents were able to view more information on the properties – and for longer – contributed to the creation of ordering effects.

## 7.4 Conclusion

This chapter has reported experiments which examine whether, in decisions over housing, preferences can be influenced by the order in which properties are viewed. Ordering effects have not been a significant concern of the literature in behavioural economics or consumer economics, although isolated papers exist (such as Einhorn and Hogarth, 1985, see Chapter 3 for a review). However there are reasons to believe that housing choices may be an important scenario in which they might flourish. The first reason for this expectation is that when making housing choices in the 'traditional' sense, by which we mean travelling to and viewing properties physically, the sequential nature of the viewing of the options is strongly emphasised. It takes time and effort to view each option and a lot of information must be taken in at each one because of the complexity of the choice. When making the choice between two brands of dishwasher for example, a consumer is able to easily switch his thoughts between them. They might even be next to each other in the shop. This would tend to limit the extent to which the order in which they are viewed matters. For housing choices this is not generally the case. The buyer must consider one property, and form an impression of it, before moving to another and another and so on[11].

Another reason that housing choices are different is that housing searches have, in recent years, migrated online. The growth of online search websites, such as Rightmove, has been discussed extensively (in Chapter 5). Searching for property online involves quickly forming impressions about properties to narrow down the initial search result to a more focused group for greater consideration. In this way it represents quite closely what Kahneman and Tversky have called the *editing*

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[11] Although of course in some cases a property search may cover a very restricted location so the properties are more easily viewed inter-changeably.

phase of decision making. Many researchers (led by Simon, 1957) have argued that decision making based on quickly formed impressions using the most salient information is the most vulnerable to bias. When narrowing down a search result in this way it is plausible to hypothesise that the process is not invariant to the order in which it is completed.

There are two competing hypotheses as to the nature of any ordering bias. The first is known as *primacy* and says that first-viewed options will gain a special significance in the mind of a decision maker, being the 'yardstick' against which other options are compared. This results in it being favoured more frequently, *ceteris paribus*. The alternative bias, *recency*, comes from cognitive limitations on the part of the decision maker. It suggests the most recently-viewed choice will be chosen more frequently simply because of the ease with which it can be recalled. The theory of rational choice has no place for ordering effects. It says that individuals will consider each option on its merits, ascribe a utility to each, then pick the option which offers the highest utility.

The experiments reported in this chapter have found evidence of ordering biases in housing scenarios. The important results can be summarised as follows:

- Ordering effects do not appear significant when the choice set is 'short' containing only two options. This result applies across all experiments examined;

- When choices are presented in a highly simplified written form to student volunteers who are a good proxy for inexperienced users of property markets, there is significant evidence of primacy in 'long' (three option) choice sets. Property A is chosen 32% of the time when the set is viewed as {C, B, A}, but 46% when it is viewed as {A, B, C} (Table 7.1). This result does not carry over to the information-rich experimental design involving real property profiles however;

- In a controlled survey of 4,000 users of the property search website Rightmove there is limited evidence of ordering biases having an impact on the

popularity of the *target* option (Table 7.5). However 'decoy' options do benefit significantly from ordering manipulations. The likelihood of choosing some decoys rises by as much as 34% when the option is viewed first (Table 7.6) a confirmation of the primacy hypothesis. There is evidence that strength of preference also plays a role in ordering biases. Respondents are more affected by ordering manipulations – especially on the decoy – if they rate their own preference as 'weak' versus 'strong'; and

- There is significant evidence of ordering biases in the Stamford Adult Group Survey which questioned 600 adults residents of a Lincolnshire town. Property A increased its share of preferences from 29% to 57% by being placed first versus last in the choice set {A, B, D} (Table 7.8). Decoy properties also strongly benefit from being viewed first.

Taken together the findings support hypothesis **H3a** from Chapter 4 (page 98) which suggested primacy would dominate choice patterns. It also confirms the theoretical work of Einhorn and Hogarth (1985) and extends the work of Gallimore (1994) from professional real estate settings to the consumer marketplace.

For estate agents and home buyers there are two significant findings. The general finding is that first-viewed options are given a boost by being in that position. Agents should think carefully about which property they show to their clients first because this is likely to set the tone for the whole search. However it is important this result be tempered by the limitations that were also part of the results. Primacy was not possible in all cases, especially in the Rightmove Survey where the effects were more faint. As with the choice set manipulations in Chapter 6 it is clear that controlling preferences is inexact and cannot be done with precision, although greater levels of research may refine our knowledge of the conditions under which it is most effective.

A second important result concerns decoys. These inferior properties do exist and it is not difficult to imagine a situation where the agent may hold such properties on his books for a considerable period unable to effectively market them. The results in both the Rightmove and Stamford Adult Group Surveys showed

that the popularity of these options can be dramatically increased by having decision makers view them *first*. The result is a powerful illustration of a useful way in which decision making biases can be utilised by an economic agent with a motive to do so.

As in Chapter 6, the results from the Rightmove Survey show how difficult it is to select properties in real situations to maximise manipulations. The best characterisation of the biases uncovered in this survey is that they are fragile. Further work is clearly needed to understand more about how to effectively produce and sustain behavioural bias in the online choice environment. Moreover, the Stamford Adult Group Survey shows that the method of presentation is a vital component in establishing effective manipulation strategies. In that survey the information was identical to the Rightmove case, but the online design emphasised the features of the properties more evenly (rather than focusing on one main photograph) forcing participants to spend longer on each property by making them scroll through all the information before moving on. This produced far greater evidence of ordering effects, once again particularly on decoy properties.

The results are interesting to estate agents for the insights they give into home buyer decision making processes. They are relevant to real estate academics studying housing markets because they shed a new light onto the dynamics of housing markets using a framework which stands apart from the rational model typically employed. Finally they are of interest to the most important group of all: home buyers themselves. Buying a home is among the most important decisions an individual can make. The results in this chapter are important because they point the way towards home buyers being better consumers, making better decisions.

# Chapter 8

# Judgement Bias and Housing Value

This chapter reports the results from experiments examining biases in value judgements that can be created by placing arbitrary *anchors* in respondents' minds before value judgements are made, as discussed in Chapter 4. Arbitrary anchors are a reliable determinant of ultimate value judgements, even in the presence of significant incentives for accurate judgement, in a group of student volunteers.

## 8.1   Anchoring in Value Judgements

Psychologists Amos Tversky and Daniel Kahneman (Tversky and Kahneman, 1974) were the first to systematically examine deficiencies in human judgements caused by the use of computational rules of thumb, known as *heuristics*. They hypothesised that when making a value judgement individuals typically start with an initial value then make adjustments based on receipt of new information to yield a final answer. However this process, which they called *anchoring-and-adjustment*, can lead to seriously flawed judgements because of deficiencies in both the formulation of the initial estimate and the adjustments made to it.

The experiments at hand are concerned with the first part of this decision making

process: the formulation of the initial estimate. More particularly they examine whether judgements over housing value can be reliably influenced by the placing of arbitrary *anchors* in the minds of decision makers.

As was argued in Chapter 1, housing choice represents perhaps the ultimate test for consumer judgement and decision making, given the singular importance it has for household finances. Paying too much based on flawed decision making is likely to have significant implications for wealth and ultimately household happiness.

The methodology used broadly replicates that of Ariely et al. (2003) who examine anchoring in value judgements over everyday household goods. It is reported in detail in Chapter 5. Subjects were asked to make a value judgement over four houses having been given a 'virtual tour' using photos and information from an estate agent's brochure. They were told (truthfully) that the houses had sold within the past few months and they were estimating what they thought each had sold for. Participants made their judgements sequentially having been given an entirely arbitrary 'anchor' value based on their mobile telephone number. This was implemented by asking participants to write down the last three digits of their mobile telephone number as a price in thousands of UK pounds. The example given to students to ensure their understanding noted that if someone's last three digits were -204 then they should write £204,000 on their answer sheet. As with Ariely et al. (2003), an arbitrary anchor, rather than something more relevant to property decision making, is used to illustrate the power of the bias.

It is important to note at this stage that the procedure employed was in one important respect somewhat more stringent than that used by Ariely et al. (2003). Their procedure delivered the anchor in a similar way by asking candidates to write down the last two digits of their US Social Security Number as a price. However when the valuation was to be made, subjects were asked first whether they thought the value of the item under consideration (it was chocolates, bottles of wine and computer equipment in their case) was worth more or less than the number they had just written down. They were then asked what they thought

that value was. This reference specifically to the anchor gives significantly more opportunity for it to take effect in the subjects' minds. In the procedure employed here no further reference was made to the anchor after it was written down. In other words the procedure employed here builds in an even sterner test of anchoring processes than that used in Ariely et al. (2003). This should be borne in mind when reading the results.

Returning to the aim of the experiments reported here, this was discussed, and was the subject of a hypothesis, in Chapter 4. It is reproduced below:

> **H4.** *Anchoring: individuals' valuation judgements over housing are biased by the presence of an arbitrary anchor.*

In other words the question which this chapter seeks to answer is: would arbitrary values, written on the answer sheet, but otherwise entirely unreferenced, influence the value judgements made?

## 8.1.1 Mean Valuation Judgements

Table 8.1 reports the raw results from the estimation of House A. The responses are split according to the arbitrary anchor each participant wrote down. Anchors are placed into 'anchor buckets' according to their first digit. Thus if the arbitrary anchor that a subject wrote down was £125,000 they would be placed in bucket 1. If it was £576,000 they would be placed in bucket 5. Buckets 0 and 9 are excluded for the entire analysis because they do not provide reasonable anchors.

**Table 8.1:** Value judgements amount students.

| Anchor Bucket | 1-2 | 3-4 | 5-6 | 7-8 |
|---|---|---|---|---|
| Mean, $\mu$ | 246,100 | 251,800 | 257,800 | 268,200 |
| Standard Deviation, $\sigma$ | 35,600 | 41,500 | 48,500 | 44,500 |
| n | 21 | 32 | 22 | 24 |
| F | | 1.142 | | |
| Significance F | | 0.336 | | |

*Notes:* Figures are in pounds sterling and are rounded to the nearest £100.
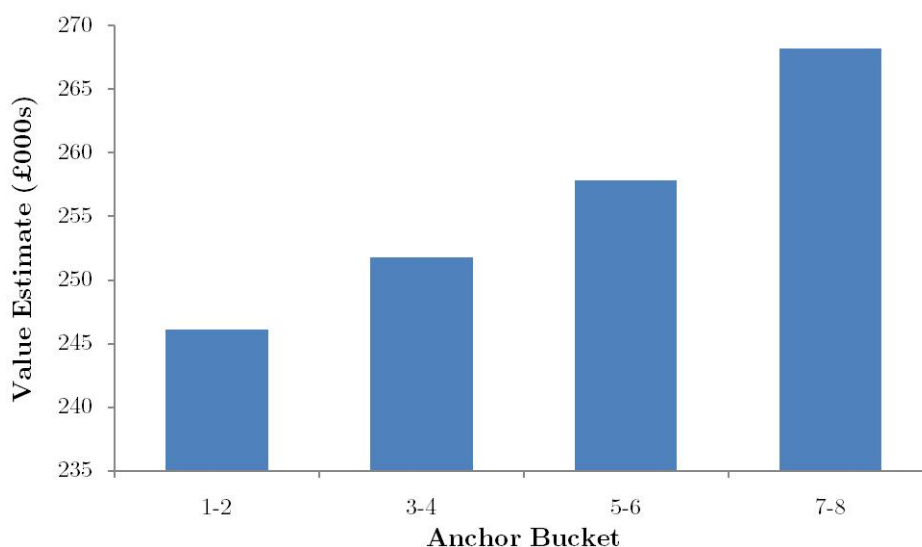
**Figure 8.1:** Illustration of value judgement bias.

Finally buckets are grouped so that the data is effectively split into quartiles by anchor[1]. Different methods are used to truncate the data and exclude extremely inaccurate answers. In Table 8.1 the top and bottom 5% of observations listed by error margin are truncated. This reduces the sample size to 99.

There is evidence that arbitrary anchors had an influence on value judgements of houses. For example, those with an anchor of £100,000 to £299,900 on average estimated the property to be worth £246,100. While those with an anchor of £700,000 to £899,900 estimated on average that the property was worth £268,200. However, there is a significant amount of noise in the data and an F-test of the joint equality of means does not allow a rejection of the hypothesis that they are equal (F=1.142, p-value: 0.336).

The results in Table 8.1 are presented in graphical form in Figure 8.1. On average a person who saw an anchor of between £100,000 and £299,900 thought the property was worth over £22,000 less than an average person who saw an anchor of £700,000 to £899,900. Figure 8.1 also shows that the effect of anchor

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[1] Ariely et al. (2003) split their data into quintiles, so this analysis is similar.

on valuation was strictly increasing across the distribution of joint anchor buckets.

It is important to emphasise two points at this stage: i) the experiment's procedure randomly allocated subjects to anchors, and therefore anchor buckets; and ii) participants were making their judgements in the presence of significant incentives for accuracy. The student volunteers could earn up to four times their show up fee for judging the sale price of the property accurately. The payment was binary: they either earned it, or they did not. There was no point in roughly guessing a ball-park figure; those taking part were incentivised to give their best efforts towards coming up with an estimate that would be as accurate as possible.

### 8.1.2 Regression of Sale Price Estimations

Another way to consider the relationship between the anchor and the valuation of House A, the first house to be valued after the anchor and so the one expected to be most susceptible to the behavioural bias of anchoring, is to use ordinary least squares regression. A least squares regression of the relationship is presented in Table 8.2. The regression estimated is of the following form:

$$Estimate = \alpha + \beta AnchorBucket + \epsilon \tag{8.1}$$

There may be non-linearity in the value estimates therefore these are taken as natural logarithms[2]. Three different specifications for the independent variable, *Anchor Bucket*, are reported. Each employs a different method for truncating wildly inaccurate estimates. In Column (1) the top and bottom 5% of observations listed by error margin are removed[3]. In Columns (2) and (3) the truncation is relative. Observations are removed if they are more than 50% (column (2)) or 60% (column (3)) above or below the true value. Two of the three specifications result in significant coefficients. When the top and bottom 5% of inaccurate estimates are truncated the model predicts that being in anchor bucket 1 will produce an estimate of £240,700, whereas being in anchor bucket 8 will result

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[2] A regression with untransformed valuation estimates as the dependent variable is too noisy to yield significant results. This is not unexpected (see Chapter 4).
[3] This method is used to generate the data in Table 8.1 and Figure 8.1.

**Table 8.2:** Regression of the relationship between anchor bucket and value judgement.

|  | Estimated Value of House | | |
|---|---|---|---|
|  | (1) | (2) | (3) |
| Intercept, $\alpha$ | 5.470 | 5.458 | 5.452 |
|  | (0.037) | (0.036) | (0.039) |
| *Anchor 1* | 0.014* | | |
|  | (0.007) | | |
| *Anchor 2* | | 0.009 | |
|  | | (0.007) | |
| *Anchor 3* | | | 0.013* |
|  | | | (0.008) |
| n | 99 | 101 | 105 |
| Adjusted $r^2$ | 0.025 | 0.004 | 0.018 |
| Significance F | 0.063 | 0.227 | 0.088 |

*Notes:* Standard errors are in parentheses.
  *Anchor 1*: top 5% of observations truncated.
  *Anchor 2*: errors +/- 50% truncated.
  *Anchor 3*: errors +/- 60% truncated.
  * indicates significance at the 10% level.

in an estimate of £264,800. The model is significant at the 10% level (p-value: 0.063).

Another way to analyze the data and remove a significant amount of the noise which is present is to use the simple average of the estimates in each anchor bucket as the dependent variable. This is reported in Table 8.3. Here there is stronger evidence of a relationship between the anchor seen and the estimate made. If the data is truncated as in Column (1), with the top and bottom 5% of observations being removed, the average estimate increases by £3,730 for each digit increase in the anchor with the coefficient significant at the 5% level. If all errors of greater than $+/- 60\%$ are removed from the data the independent variable exerts a highly significant effect on the ultimate value judgement made (Column (3)).

Thus for the student sample the simple arbitrary anchor proved a reliable way

**Table 8.3:** Regression of the relationship between anchor bucket and average value judgement.

|  | Average Estimated Value of House | | |
| --- | --- | --- | --- |
|  | (1) | (2) | (3) |
| Intercept, $\alpha$ | 239,218 | 237,810 | 236,276 |
|  | (3,398) | (3,893) | (2,769) |
| *Anchor 1* | 3,730** | | |
|  | (672.8) | | |
| *Anchor 2* | | 2,083** | |
|  | | (770.1) | |
| *Anchor 3* | | | 3,445*** |
|  | | | (548.3) |
| n | 8 | 8 | 8 |
| $r^2$ | 0.84 | 0.55 | 0.85 |
| Significance F | 0.014 | 0.035 | <0.001 |

*Notes:* Standard errors are in parentheses.
Anchor definitions match Table 8.2.
**, *** indicates significance at the 5% and 1% levels respectively.

to influence their judgement of House A's sale price. Judgements, it should be noted, that were far from being made in isolation. Students were not asked simply to pick out a value for the house randomly based on only their own knowledge. As detailed in Chapter 5, all received information about the UK and local housing market including average prices, recent trends and sales volumes immediately prior to viewing the house and being asked to estimate its value. This is the kind of information that might be obtained from basic research on the internet by an interested buyer, or from a local estate agent. Information that provides vital context (and other much more salient potential anchors) for decision making.

Finally it must not be forgotten that there were significant incentives for accurate judgement just as in the high-stakes world of real moves on the housing ladder. Yet these biases were clearly evident in the value judgements that subjects were asked to make.

### 8.1.3 The Determinants of Estimation Accuracy

As part of the student experiments, as detailed in Chapter 5, simple demographic information was taken from subjects including their gender, age, nationality, whether they own property and how knowledgeable they are about property markets. It is worth considering whether any of these variables exert a significant influence on the valuation judgement. If these variables are found to have influence it may help further our understanding of the susceptibility of certain individuals to biases such as value anchoring. In this regard this analysis is similar to the logit and other tests performed on choice set biases in Chapters 6 and 7.

The dependent variable in this analysis is the valuation error (*Error*) in the estimate for House A. It is expressed as a percentage for all 139 participants. The independent variables which make up the regression are presented in Table 8.4. Taking them in turn, the first, *Gender*, is included largely as a control. There is no *a priori* reason to expect either males or females to be more accurate in their estimations. The variable *Age* is split into five categories. Evidence in Chapter 6 suggested that younger participants were more susceptible to bias than older ones who may have more experience dealing in housing or may have developed their decision making ability more generally. It should be noted however that the bulk of participants in this experiment were aged 18-29, so this variable cannot provide as much information as it can in the Rightmove Survey.

The variable *Nation* is a dummy variable to separate those participants who were British against those of other nationalities. British participants might be expected, on average, to be significantly more experienced with UK property and housing markets generally simply through their residency in the UK for a longer period of time. This may significantly improve their valuation accuracy. The fourth independent variable *OwnProp* is another dummy which indicates whether the participant owns their own property. Those who have bought a house could be expected to be more experienced in making valuation judgements, which has been shown to be important in decision making (List, 2003, 2004).

| Variable | Description |
|----------|-------------|
| *Error* | The dependent variable expressing the error in the value estimation as a percentage. |
| *Gender* | The gender of the participant. A dummy variable where 1=male, and 0=female. |
| *Age* | The age of the participant. A categorical variable split into five categories: 18-30, 30-39, 40-49, 50-59, 60+. |
| *Nation* | The nationality of the participant. A dummy variable where 1=British, and 0=other nationalities. |
| *OwnProp* | Whether the participant owns their own property. A dummy variable where 1=owns property, and 0=does not own property. |
| *Know* | Whether the participants are especially knowledgeable about property. A dummy variable where 1=knowledgeable, and 0=not knowledgeable. |

**Table 8.4:** Variables for a regression of value accuracy.

Finally *Know* expresses whether the participant is especially knowledgeable about property. This is satisfied in one of two ways. Firstly participants could indicate whether they considered themselves to be particularly knowledgeable in property matters. Secondly they were asked to pick from a list of property-related activities which applied to them[4]. Those who ticked three or more were classed as knowledgeable.

The multiple ordinary least squared regression is run as follows:

$$Error = \alpha + \beta_1 Gender + \beta_2 Age + \beta_3 Nation + \beta_4 OwnProp + \beta_5 Know + \epsilon \quad (8.2)$$

The method of truncation used removes the top and bottom 5% of observations from the sample based on valuation accuracy[5]. The results are reported in Table 8.5. Two specifications of the model are produced. The first, reported in Column (1) includes all five regressors. The full model contains only one variable significant at the 5% level – *Gender*. However, *Age* is also close to being significant (p-value: 0.122) therefore it is included in a restricted version of the model which

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[4] These were: study property at University; work(ed) in property markets; considered buying a house; and interested in property in the media (TV and magazines).

[5] This is the same procedure used to generate Table 8.1.

**Table 8.5:** Regression of the relationship between valuation accuracy and other variables.

|  | Valuation Error | |
| --- | --- | --- |
|  | (1) | (2) |
| Intercept, $\alpha$ | -0.002 | -0.023 |
|  | (0.044) | (0.036) |
| *Gender* | 0.071** | 0.069** |
|  | (0.031) | (0.030) |
| *Age* | 0.046 | 0.052** |
|  | (0.029) | (0.025) |
| *Nation* | -0.031 | |
|  | (0.031) | |
| *OwnProp* | -0.005 | |
|  | (0.065) | |
| *Know* | 0.023 | |
|  | (0.048) | |
| n | 127 | 127 |
| $r^2$ | 0.045 | 0.059 |
| Significance F | 0.058 | 0.008 |

*Notes:* Standard errors are in parentheses.
** indicates significance at the 5% level.

is reported in Column (2). In the latter model both coefficients are significant, although it is clear there is a significant amount of noise in the data as evidenced by the extremely low value of $r^2$.

This is a surprise in two ways. Firstly *Gender* was included primarily as a control. It was not expected to be significant. However its coefficient suggests that male respondents estimate with larger errors than female participants. A male participant aged 18-29 would be expected to value the property 9.8% above its true value according to the model, whereas a similarly-aged female would estimate with a 2.9% error, on average. The sign of *Age* is also unexpected since it suggests that older participants value property less accurately, by 5.2 percentage points for each increase in age category. Because few of the respondents were in the higher age groups in this sample, this result in particular should be interpreted cautiously, however.

### 8.1.4 Summary

This section has sought to explore whether anchoring biases, first uncovered by Tversky and Kahneman (1974), have relevance in valuation judgements over property. These have been observed in professional real estate settings (Diaz et al., 2002) and in some real estate contexts (Simonsohn and Loewenstein, 2006; Levy and Frethey-Bentham, 2010)[6]. Student participants were given an arbitrary anchor using a similar – but ultimately more restrictive – procedure to Ariely et al. (2003). They were then asked to value a property having been given a 'virtual tour' using real estate agent information (including photos). There is powerful evidence that the anchor given does influence judgements, even in the presence of significant, binary incentives for accurate judgement. There is also evidence that male participants value property with greater inaccuracy than females, a result not anticipated and not previously discussed in choice theory research.

There is a significant amount of noise though, far more than in experiments over simple household items such as those considered by Ariely et al. (2003). This is expected and still presents compelling evidence that, in a choice scenario in which information is limited and decision makers typically have little experience, they are vulnerable to even the simplest forms of manipulation.

The following section examines the extent to which judgemental biases, once established, persist and continue to affect decision making, a cognitive effect known as *arbitrary coherence*.

## 8.2 Arbitrary Coherence

Ariely et al. (2003) argue that once established, arbitrary anchors may become *coherent* such that we continue to use them in our decision making. They dubbed this effect *arbitrary coherence*. The experimental design reported in Section 8.1 allowed a test of this effect in a housing choice scenario. Having been given an arbitrary anchor and asked to value a property (House A), subjects were shown

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[6] See Chapter 3 for a full review.

(a) House B
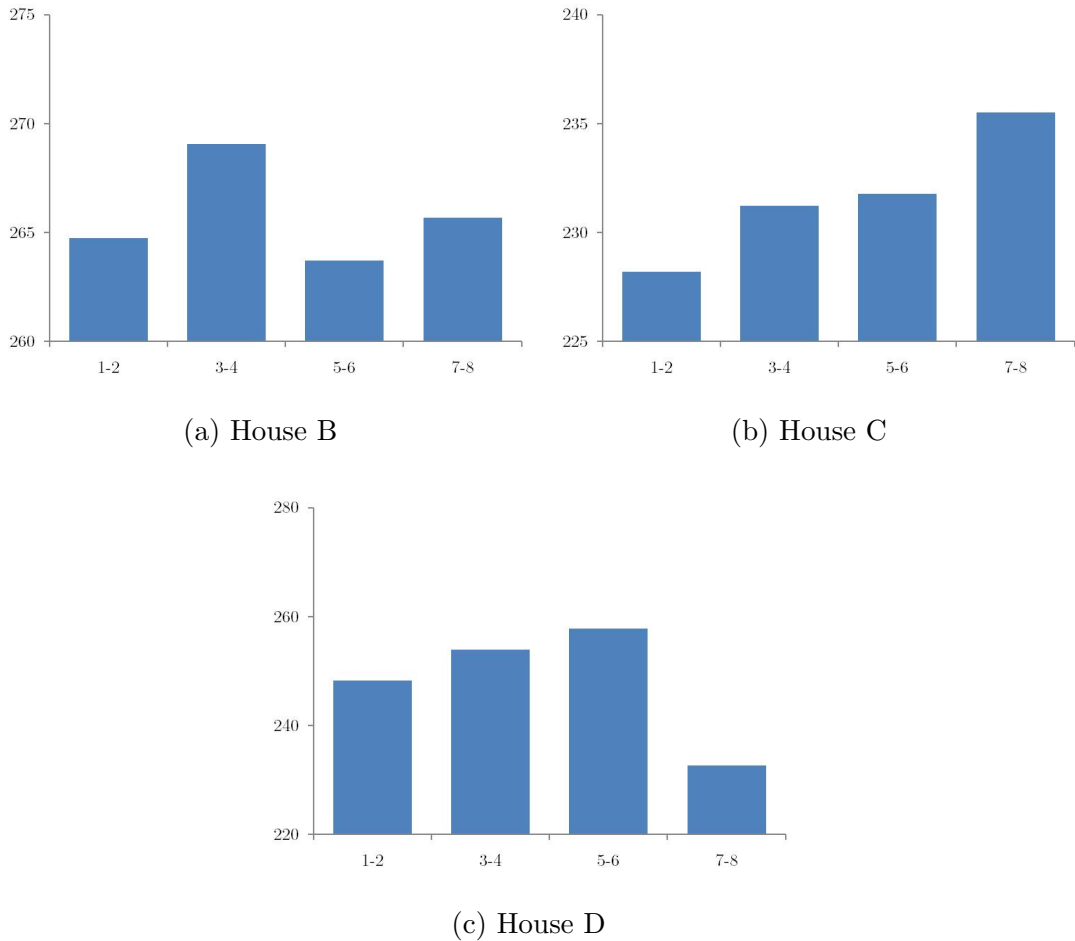
(b) House C



(c) House D

**Figure 8.2:** Illustration of arbitrary coherence.

three more similar properties and asked after each of them to make a similar judgement. Does the initially placed arbitrary anchor prove a reliable guide to the estimations of Houses B, C and D?

## 8.2.1 Persistence of the Anchor

Figure 8.2 reports the results from the analysis. The data is generated using the same truncation procedure as for Column (1) of Table 8.2, namely that the top and bottom 5% of observations listed by error margin are removed.

It is clear from Figure 8.2 that there is little evidence of arbitrary coherence in

this dataset. The estimates of House B (in Figure 8.2a) do not show the same kind of linear trend that is clearly evident in the estimation of House A. House C is more as expected, but House D is not. Ultimately it appears the effect of the arbitrary anchor decays quickly when it comes to making further estimation, or at least that the noise present in the estimations is too significant to strongly identify the effect of the anchor. Performing regressions on the data with similar specifications to those used in Section 8.1 does yield not significant results either and thus are not reported here.

## 8.2.2   Transitions Between Estimates

Another way to think about the effect of the arbitrary anchor is by considering the transitions between houses. In Section 8.1 evidence was presented showing that there was a relationship between the arbitrary anchor and the estimation of House A. It is natural to ask whether a relationship can be found between the valuation of House A and that of House B; between House B, and that of House C; and so on.

The literature on anchoring, led by Tversky and Kahneman (1974), suggests that in making judgements individuals will rely on the most salient anchor point. Thus it seems likely that the most recently estimated house may form a new anchor point for the estimation of the next property. In this scenario, having estimated the price of House A, it may become salient in the judgement over the value of House B, even in the absence of feedback about the accuracy of the first judgement (of which the was none in the experimental design).

This is examined by Table 8.6 which shows correlations between the estimates. There is evidence of a correlation between sequential estimates. Having estimated House A, the correlation with the resulting estimate of House B was 0.195 which is significant at the 5% level. There is some correlation between the estimates of House B and C, but it is not significant. The greatest significance occurs between the estimates of Houses C and D. The correlation coefficient of 0.397 is highly significant.

**Table 8.6:** Correlation between sequential house price estimates.

| House | A | B | C |
|---|---|---|---|
| B | 0.195** (0.021) | | |
| C | | 0.109 (0.202) | |
| D | | | 0.397*** (<0.001) |

*Notes:* Figures in parentheses indicate the p-value based on a two-tailed t-test.
**, *** indicates significance at the 5% and 1% levels respectively.

This result can be understood when we take a look at House C. This property was a 'wild card' property. House C was significantly different to others in the set in one critical factor – it was in noticeably shabby repair and would clearly need some work in order to bring it up to a modern standard. This introduced a significant source of uncertainty for the student participants: they knew that it would get a reasonably large discount as a result, but had no clear way of assessing how big that discount might be. In this scenario it seems reasonable that there would be a 'break' in the transition structure from House B to C. It is significant though that the use of the previous judgement as the most salient anchor for the following one is quickly re-established. Estimates of House D are highly correlated with House C.

An analysis of the transitions illustrates this point further. Table 8.7 reports two transition matrices. Examining the matrix on the left-hand side first (Table 8.7a), we see the rows split the estimates of House A into quartiles. The columns split the estimates of House B into quartiles. Thus the position in the matrix – expressed in the form {row, column} – illustrates the transition from House A to House B. The diagonals in the matrix represent individuals who stay in the same quartile in the transition, so a transition vector of {2, 2} illustrates someone

|  | House A | | | |
|---|---|---|---|---|
|  | Q1 | Q2 | Q3 | Q4 |
| Q1 | 29 | 38 | 18 | 15 |
| Q2 | 26 | 23 | 27 | 26 |
| Q3 | 26 | 23 | 26 | 26 |
| Q4 | 17 | 17 | 31 | 34 |

(a)

|  | House A | |
|---|---|---|
|  | H1 | H2 |
| H1 | 58 | 42 |
| H2 | 41 | 59 |

(b)

**Table 8.7:** Transition matrix for transition from House A to House B.

who was in the second quartile for House A and the second quartile for House B. Similarly {1, 4} – the top right-hand box – would be an individual who was in the first quartile for House A and the fourth for House B. In Table 8.7a and 8.7b the figures reported are percentages of the total. These sum by row. Thus the table indicates that 29% of respondents who were in the first quartile of estimates for House A remained in the first quartile for House B.

If the estimate for House B was unrelated to House A numbers would be distributed evenly across each row showing that a person, having being in Q1 of estimates for House A, was as likely to be in Q1 as Q4 in their estimate of House B. A test of this expectation using a chi-squared distribution with 9 degrees of freedom can be conducted[7]. Here there is not significant evidence of a relationship in the transition from House A to House B with a $\chi^2$ value of 8.45 (p-value: 0.489). Table 8.7b groups the quartiles so that the matrix shows whether participants were above or below the median estimate (ie. in Half 1 or Half 2). The interpretation is the same otherwise. Thus it shows along the diagonal that 58% of participants who estimated below the median for House A (H1) remained in that half of the distribution for House B. A chi-squared test of this matrix reveals a significant relationship in the estimations of House A and House B ($\chi^2 = 3.804$, p-value: 0.051): participants were significantly more likely to estimate below the

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[7] In a matrix such as this the degrees of freedom is given by $(rows - 1) * (columns - 1)$.

|         |    | House B |    |    |    |
|---------|----|---------|----|----|----|
|         |    | Q1 | Q2 | Q3 | Q4 |
| House C | Q1 | 32 | 21 | 21 | 26 |
|         | Q2 | 17 | 31 | 31 | 20 |
|         | Q3 | 29 | 20 | 29 | 21 |
|         | Q4 | 20 | 29 | 30 | 31 |

(a)

|         |    | House B |    |
|---------|----|---------|----|
|         |    | H1 | H2 |
| House C | H1 | 51 | 49 |
|         | H2 | 49 | 51 |

(b)

**Table 8.8:** Transition matrix for transition from House B to House C.

median for House B having done for House A; and vice versa.

Tables 8.8a and 8.8b complete the same analysis for the transition from House B to House C. Although the directionality is the same – Table 8.8b shows that participants who estimated below the median for House B were more likely to be below the median for House C also, this was not significant, whether the data was split by quartiles ($\chi^2 = 5.289$, p-value: 0.751) or halves ($\chi^2 = 0.064$, p-value: 0.780).

Finally Tables 8.9a and 8.9b report on the transition from House C to House D. The diagonals of the matrix show that participants tended to stay within the same quartile in the transition between House C and House D. Forty-seven percent of the participants who were in the first quartile of estimates for House C remained in that quartile for House D. Among those in the fourth quartile, 49% remained in the same quartile. There is a significant relationship when the data is divided by quartile ($\chi^2 = 31.576$, p-value: <0.001) and into halves ($\chi^2 = 10.940$, p-value: <0.001).

A final way to explore this data using transitions analysis is to consider the evolution of estimates across all four judgements. In other words do participants whose anchor is above the median tend to estimate above the median in each of

|  | House C | | | |
|---|---|---|---|---|
|  | Q1 | Q2 | Q3 | Q4 |
| Q1 | 47 | 18 | 12 | 24 |
| Q2 | 26 | 37 | 26 | 11 |
| Q3 | 14 | 29 | 40 | 17 |
| Q4 | 11 | 17 | 23 | 49 |

(House D on vertical axis)

(a)

|  | House C | |
|---|---|---|
|  | H1 | H2 |
| H1 | 64 | 36 |
| H2 | 36 | 64 |

(House D on vertical axis)

(b)

**Table 8.9:** Transition matrix for transition from House C to House D.

their judgements in the estimation phase (Houses A – D)?

Starting with the anchor, it is possible to produce a decision tree showing this evolution. At each node (ie. each new estimation) participants' estimates can either be above or below the median. A participant whose estimates were always below the median would have a route through the decision tree of H1-H1-H1-H1-H1. One who was in the first half for the first three, then switched to being above the median, before returning to being below the median for the final estimation, would have the following route: H1-H1-H1-H2-H1. The paths of all 139 participants through the decision tree are reported in Figure 8.3. For clarity this shows that seven participants (out of 139) were in H1 for all four estimations and the anchor, in other words these seven individuals consistently estimated below the median. At the opposite end of the distribution, 11 individuals estimated above the median for all estimates. Fourteen individuals were in H1 for all four estimates having been in H2 for the anchor.

Because the expectation is that the estimation of houses is independent, that is individuals do not use a previous estimate as an anchor for their next estimate, we can say a lot about how the decision tree should look. In particular if we take as a random variable the number of times a participant is in H1, given independence, we would expect this random variable to follow the binomial distribution
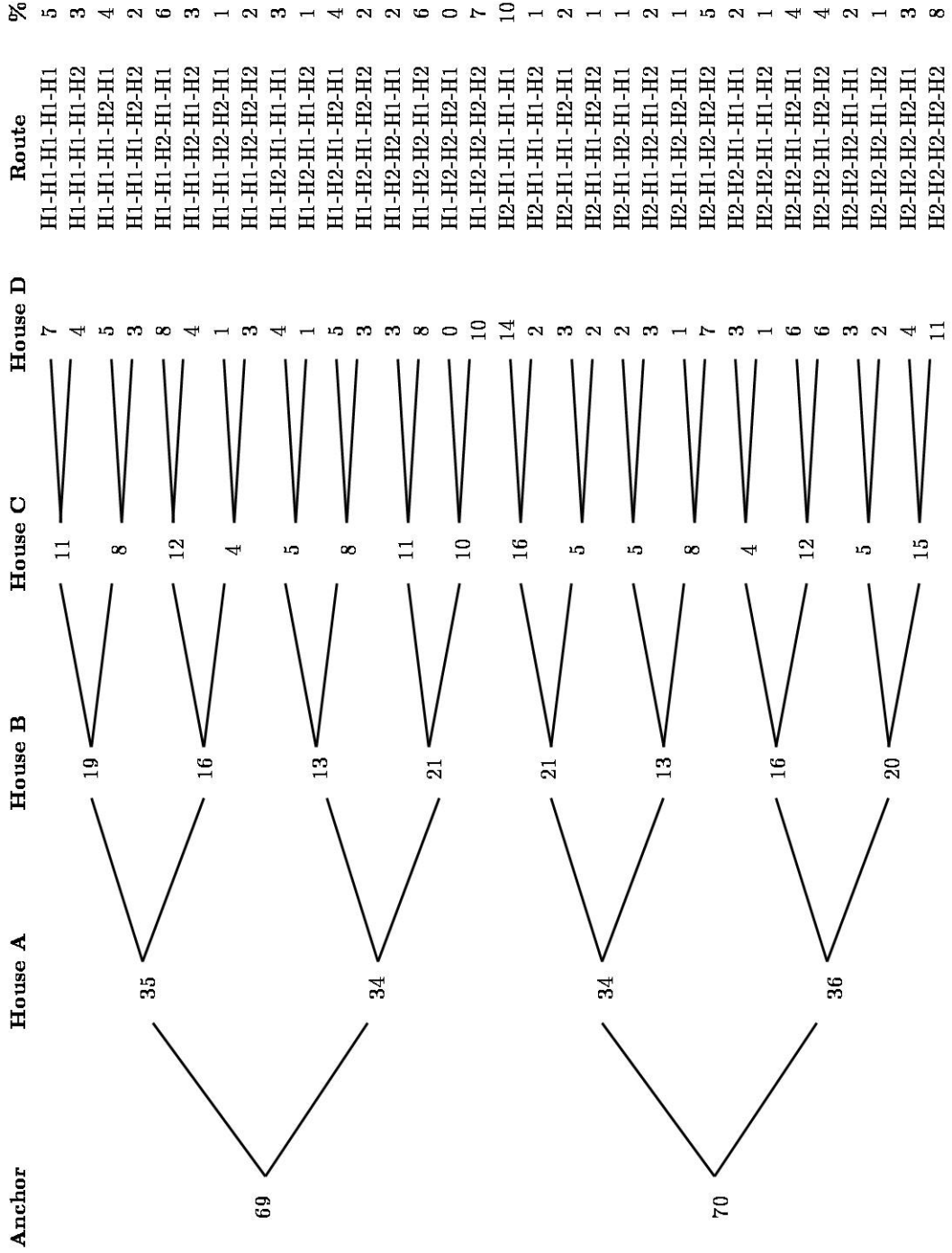
**Figure 8.3:** Decision tree showing the evolution of house price estimates.

| Frequency of H1s | Expected[8] | Observed |
|:---:|:---:|:---:|
| 0 | 3 | 8 |
| 1 | 16 | 21 |
| 2 | 31 | 22 |
| 3 | 31 | 19 |
| 4 | 16 | 25 |
| 5 | 3 | 5 |
| | 100% | 100% |

**Table 8.10:** Distribution of frequency of H1s as a test for independence in the evolution of house price estimates.

with $p = 0.5$ and $n = 5$. Using the binomial distribution we can extrapolate how many of the participants should be in each category of the random variable. Comparing this to what is actually seen will demonstrate whether there is a tendency for individuals to stay in the same half of the distribution. The results are reported in Table 8.10.

The distribution of frequencies of H1s appears to deviate from that expected. Table 8.10 shows that 13% of participants remained in the same half of the distribution for all estimations[9] far in excess of the 6% expected. Forty-six percent of participants were in the same half of the distribution for four out of the five estimations (anchor included), also well in excess of the 31% expected. A chi-squared test of goodness of fit is strongly rejected ($\chi^2 = 32.764$, p-value: <0.001). The distribution of H1s violates the assumption that estimates are independent because individuals do not use a previous estimate as a salient anchor for their next estimate. Far from it, there is significant evidence that the presence of an arbitrary anchor continues to influence the evolution of value judgements.

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[8] Using the binomial distribution $Pr(K = k) = \binom{n}{k}.p^k.(1 - p)^{n-k}$. Given $p = 0.5$ and $n = 5$, $Pr(2) = 0.3125$.

[9] Found by summing the percentage frequency of those with 0 H1s and those with 5 H1s.
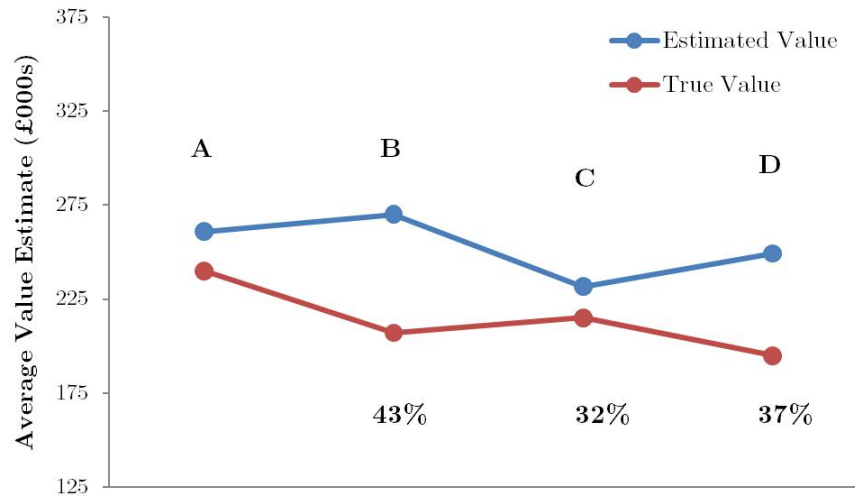
**Figure 8.4:** Internal consistency of house price estimates.

### 8.2.3 Internal Consistency

In analysing their experimental data, in which participants were asked to make value judgements over a series of consumer items, Ariely et al. (2003) asked whether there was internal consistency in the estimates. In other words, could participants tell whether House A was more expensive than House B (which it was), and whether House B was more expensive than House C (which it was not)? Figure 8.4 shows that, overall, subjects' estimates do not display a high degree of internal consistency in this sense. House B was around £30,000 cheaper than House A yet the average participant estimated it was slightly more expensive. On the other hand, House C was in actual fact slightly more expensive than House B, yet the average respondent thought it was cheaper than their estimate of House B. Finally, House D was the cheapest of all, yet the majority raised their estimates from what they judged House C as being worth. As indicated alongside the chart the percentage who correctly guessed the direction change from house-to-house was always below 50%.

### 8.2.4 Summary

This section has presented several important results from the value judgement experiments on the persistence of arbitrary anchors in decision making. Ariely et al. (2003) found significant evidence that, although the relevance of the anchor decayed over time, once established it could continue to influence estimations of value. The results presented here back up that finding.

A first direct comparison between the arbitrary anchor and the estimates for Houses B – D does not uncover much evidence of bias. This is probably because of the significant noise in the estimation function, which has been a feature of all the housing choice experiments. In turn this reflects the complexity of housing decisions compared with the kind of consumer goods over which much of the previous experimental work has been conducted.

An important method by which the arbitrary anchor might remain important is by being transmitted from estimate to estimate (Chapter 5 details how the estimates were made sequentially without feedback between estimates). There is a significant correlation between the estimates for Houses A and B and between Houses C and D. The latter is particularly strong. This latter finding is important because it further suggests that decision maker uncertainty is an important determinant of the extent to which choice and judgement biases can take effect. Transition matrices confirm that, particularly for the transition between House A and House B and House C and House D, individuals who were in the top half of the estimate distribution for the first house remained there for the latter house, and similarly for the bottom half.

Finally the evolution of price estimates across all four estimations was considered using a binomial decision tree which counted how times each individual was in the bottom half of the distribution. Individuals were far more likely to remain in the same half of the distribution across the estimates than would be expected if estimates were independent.

This is strong evidence that value anchors do affect sequential decision making and an initial anchor can have a powerful impact well beyond the next judgement. Ariely et al. (2003) only considered the binary correlations between each estimate in a sequence, so in this sense these results go beyond their findings.

## 8.3   Conclusion

This chapter has reported experiments which examine evidence of biases in judgement that can be created through the use of arbitrary anchors in housing scenarios. Buying a house is the most important purchase likely to be made in the household's lifetime, so getting valuations right is vitally important.

There is significant evidence that, even in the presence of significant incentives for accurate judgement, participants are vulnerable to their judgements being biased in estimates of housing value. In this way the results in this chapter confirm and extend the work of Ariely et al. (2003). The results are also a confirmation of hypothesis **H4** (page 100).

Although subjects do not appear to be directly influenced by their initial arbitrary anchor for subsequent judgements, there is evidence that they continue to use the estimate immediately prior to the one at hand for making their judgement, which gives support to the *anchoring-and-adjustment* mechanism proposed by Tversky and Kahneman (1974). Furthermore strong evidence has been presented showing the evolution of price estimates can be influenced by initial arbitrary anchors because estimates are clearly not independent. This is a potentially significant weakness in decision making if a first value can be established arbitrarily.

In interpreting the results of these experiments it is important to note that there is not expected to be a literal relationship between viewing an anchor and influence on value judgements, in other words it is not possible simply to place an arbitrary number in front of potential home buyers predictably to influence their judgement. Instead the experiments illustrate the ease with which arbitrary anchors can be established, and clung to, by buyers without extensive experience

in such matters. As emphasised in motivating this thesis (Chapter 1) housing is a novel choice setting in this regard because decisions are almost always made by decision makers who come to the market with little prior knowledge. The decision to buy a house may be made only once or twice in a lifetime making it difficult to gain the experience that it appears may be necessary to avoid biased judgements.

Chapter 4 illustrated that the estate agent has a powerful part to play in this story. They have a significant information advantage over home buyers and are able to set the conditions under which the choice is made by their choice of which houses to show, and in what order, among other things[10]. Thaler and Sunstein (2008) call this type of economic actor a *choice architect*. Although it is beyond the scope of this thesis to fully model the principle-agent problem faced by home buyers, Chapter 4 showed that, although it will be conditioned by how difficult it is to actually do it, it is clearly in the interests of estate agents to convince home buyers that a house – or a particular set of houses – are worth as much as possible.

The evidence in this chapter shows how to achieve this judgemental manipulation. Importantly it does not involve explicitly tricking home buyers, for example by lying about sale prices. Instead estate agents could use the flawed decision making processes of home buyers, in this case through the process of *anchoring* identified by Tversky and Kahneman (1974), to subtly influence estimations of value. Perhaps by showing a more valuable, top-of-class property first, or by sending a series of 'expensive' comparables to individuals prior to their viewings, it is likely that the home buyers' judgements can be compromised. This can have powerful influences on their choices.

The findings in this chapter are clearly of interest to policy makers who set the regulatory framework in which estate agents operate. However, it seems unlikely that, given the subtlety of the manipulation here and the significant noise that is inherent in value judgements, policy makers would be able to formulate a policy

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[10] Second order effects might include the time of day they show a house and the order in which they show the rooms.

response to this finding.

However, the party most interested in these results is surely us as decision makers. Behavioural economists have consistently stressed that one of the fundamental motivations of their work is to help us understand our decision making processes better. By understanding our weaknesses – and our strengths – in decision making we can hope to make better, more effective choices and improve our own happiness. There can be few more important spheres to make better decisions than in housing choice.

# Part IV

# Chapter 9

# Conclusions and Future Research

This chapter concludes the thesis. It brings together the results reported in Part III and discusses the relevance they have for the parties considered in Chapter 1. The primary contribution is to place a new emphasis on the role of estate agent behaviour in moderating housing market outcomes. The estate agent is a true *choice architect* with the power to influence decision makers in subtle ways, almost entirely outside of the dominant rational choice paradigm. All research has limitations and these are also discussed. Finally areas of future research are considered. Behavioural insights have a considerable amount still to offer in the search for greater understanding of housing markets and in the wider real estate economics discipline.

## 9.1   Summary of Results

The fundamental research question that this thesis has sought to answer is expressed in Chapter 1: to what extent, and by what means, can housing choice be manipulated in non-rational ways by a willing economic agent? The answer to this question is of interest to estate agents, policy makers, and of course to all individuals as decision makers. Not making errors of judgement in housing choices is important because they are among the most important decisions made during a lifetime.

Using the alternative paradigm of choice theory embodied in the field of behavioural economics, the research has examined - through five hypotheses - three specific ways in which this behavioural manipulation might be possible. These are: i) through the placing of alternative options in the choice set – 'decoy' properties – to influence the perception of certain 'target' properties; ii) by altering the order in which options are viewed to favour certain options; and iii) by placing value 'anchors' in the decision maker's mind to influence his perception of value.

Three different experimental studies have been used to investigate these effects. The first of these used classroom experiments on student volunteers at the University of Cambridge. Student volunteers are used widely in experimental economics, most obviously because of the ease of recruitment for academic researchers and the low marginal cost of their time (which makes recruitment significantly more affordable on limited research budgets). While there are clearly concerns with the generalisability of results gained from this sample set, it is held that they are a particularly useful group to focus on for this study. The primary advantage of students in this case is that they represent individuals in the rental market very well.

Two controlled surveys make up the remainder of the experimental work. The first, a survey of 4,000 users of the property search website Rightmove, was designed almost exactly to replicate the true conditions in which properties are actually viewed. The second was also completed online, but the design was slightly modified, forcing participants to spend more time considering the information about each property in more depth. It was conducted on 600 residents of the town of Stamford, Lincolnshire. Chapter 5 discusses in further detail the merits of experimental techniques to economics. Although slow to gain acceptance, experimental techniques are now widespread in the discipline. A body of research has standardised methodologies and great care is taken to guarantee the accuracy and applicability of the results. A key early proponent, Vernon Smith, was awarded the Nobel Prize in 2002. Experimental work will never substitute for empirical study from the field, but it can offer a different – and very valuable – perspective.

Before discussing the results obtained from the experimental work, it is useful to consider again the motivations for undertaking it.

Studying choices has been a preoccupation for economics for at least 100 years. The fundamental economic problem is itself a choice: how to satisfy our infinite wants with scare resources. The dominating paradigm of choice theory, the *Behavioral Decision Theory* of von Neumann and Morgenstern (1944), proposed formal axioms for the theory of choice and became synonymous with rationality. These axioms are considered in detail in Chapter 2. A review of the literature reveals that, not long after the publication of this seminal work, doubts were raised about its applicability and descriptive accuracy (the highest profile of which is Allais, 1953). The criticisms led to reformulations of the original theory, and attempts to relax or modify key assumptions (such as Markowitz, 1952; Chew, 1983). However the key insight of the criticism could not be patched over: the axioms require a method of decision making that is not psychologically plausible. A growing body of evidence concluded that individuals do not actually follow the rules of the theory in practice, leading to significant areas where the predictions of the theory do not match reality.

Psychologists Daniel Kahneman and Amos Tversky were in the vanguard of this *behavioural critique.* In a series of ground-breaking articles, they demonstrated some of the key areas in which the rational choice theory is not descriptively accurate (Tversky and Kahneman, 1974, 1981; Kahneman and Tversky, 1979). The work, coalescing around their alternative model of choice, *Prospect Theory*, opened an alternative paradigm in choice theory that has challenged the foundations of microeconomics in the past thirty years.

An overriding motivation for the work in this thesis, then, is to contribute to this debate. It does this by providing evidence as to the applicability of the rational choice model in an important and under-researched area of choice: housing. Chapter 1 discusses in detail why housing is a novel choice scenario for this research. In that chapter, housing choice was characterised as a high-stakes, one

shot game, which is rare among the consumer choices typically studied. The research in this thesis extends our knowledge of choice behaviour by focusing on the nature of this choice specifically.

A second motivation for the research is to contribute to our understanding of the dynamics of housing markets. Housing economics has been an interest of academics and policy makers for some time, with many different approaches used, as Chapter 3 makes clear. This research contributes to our understanding by focusing on the role of estate agents in moderating housing market outcomes.

The final primary motivation for the research is to help individuals make better choices. This thesis produces evidence that illustrates the vulnerability of decision makers. Particularly in housing markets, decisions are made at a significant information disadvantage (something discussed further in Chapter 4). Understanding the weaknesses in decision making apparatus which leave decision makers open to manipulation should contribute to more informed and hopefully better choices. This is a worthy aim.

Having considered the motivation for the work, let us look at the main results from the three chapters which report the experimental work.

### 9.1.1 Choice Set Effects

Three hypotheses were advanced in Chapter 4 to test choice set effects. These are reproduced below:

> **H1.** *Asymmetric dominance: the proportion choosing a particular property increases when a decoy property is added that is asymmetrically dominated.*

> **H2a.** *Strong compromise effect: the proportion choosing a particular target property increases when it is made a compromise choice by the addition of a decoy property to the choice set.*

> **H2b.** *Weak compromise effect: the proportion choosing a competitor property decreases when the addition of a decoy property to the choice set makes the other original property the compromise.*

> **H5.** *Preference intensity: the strength of preference for a particular target property increases when it is the subject of a choice set manipulation.*

The experimental results which relate to choice set effects are discussed in Chapter 6. The results are summarised in the conclusion to that chapter as follows:

- When property choices are presented in highly simplified written form to student participants there is significant evidence of *asymmetric dominance*, confirming hypothesis **H1**;

- In a similar test with student participants, there is evidence of a weak form of the *compromise effect*, which confirms hypothesis **H2b**

- When the choice scenario is made significantly more complex by the use of real property profiles including photos and text description based on real estate agent information, a significant, previously unobserved, effect is seen among student participants. In this situation the proportion choosing the target property *falls* and significantly more choose the non-target option instead. This is labelled the *choice pollution effect*;

- There is significantly more noise, and identifying the effect of manipulations is more difficult, when the sample set is expanded in the Rightmove Survey and hypothesis **H1** is tested again. Factors which influence the likelihood of choosing the target property include the age and gender of the participant, but firm conclusions on the effect of the decoy properties are difficult to discern;

- There is significant evidence that the certainty participants have over their choices is a determinant of the efficacy of manipulation strategies, although there is limited evidence that the presence of the decoy option increases their level of certainty as suggested in hypothesis **H5**; and

- When the method of delivery is altered slightly to emphasise *all* the features of properties as in the Stamford Adult Group Survey, there is significant evidence of the ability to manipulate choice even in an information-rich environment. Choice pollution effects appear to dominate.

Thus the evidence from the Student Group Experiments confirms and extends similar findings in other studies of consumer choice (led by Huber et al., 1982). The Stamford Adult Group Survey in particular illustrates that such biases are strong even among mature adult decision makers who largely own property. This is evidence that there is great potential for estate agents to have a significant role in the ultimate home buying decision, through manipulating the choice frame and so the process by which preference is constructed. However, the Rightmove Survey results are more uneven and suggest that using the biases to produce predictable (and quantifiable) outcomes in real choice situations is likely to be challenging.

The most significant finding is of a new form of behavioural bias that has been labelled the *choice pollution effect*. The 'polluting' of perceptions against the target by the decoy is contrary to any previously reported results. Chapter 6 discuss the belief that the effect may lie in information asymmetry and signalling. Further research should seek to understand the conditions under which choice pollution effects are produced in more detail.

## 9.1.2 Ordering Biases

Chapter 7 reported results from the same experiments as Chapter 6 but controlled for the choice set to isolate the effects which are solely down to the order in which options are viewed. This was, therefore, a test of hypothesis **H3**. It is reproduced below:

> **H3a.** *Primacy: information received first will have excessive weight in judgements over housing, thus houses seen <u>first</u> will be preferred more, ceteris paribus.*

> **H3b.** *Recency: information received last will have excessive weight in judgements over housing, thus houses seen <u>last</u> will be preferred more, ceteris paribus.*

The results are summarised as follows:

- Ordering effects do not appear significant when the choice set is 'short' containing only two options. This result applies across all experiments examined;

- When choices are presented in a highly simplified written form to student volunteers, there is significant evidence of *primacy* in 'long' choice sets containing three options. This result does not carry over to the information-rich experimental design involving real property profiles however;

- In the Rightmove Survey there is limited evidence of ordering biases having an impact on the popularity of the target option. However decoy options do benefit significantly from ordering manipulations. There is evidence that strength of preference also plays a role in ordering biases. Respondents are more affected by ordering manipulations – especially on the decoy – if they rate their own preference as 'weak' versus 'strong'; and

- There is significant evidence of ordering biases in the Stamford Adult Group Survey. Both target and decoy properties strongly benefit from being viewed first.

Taken together, the results reported in Chapter 7 support the hypothesis of primacy (**H3a**). First-viewed options, particularly decoys, consistently get a boost from being in that position, although the strength of the effect is often fairly faint.

There was a significant difference in the results between those who took the Rightmove and the Stamford Adult Group Surveys with ordering effects being far more prevalent in the latter. The difference between them was that the latter forced participants to spend longer considering each property in more detail (as detailed in Chapter 5). One of the arguments used to defend against evidence of judgemental errors is that they are made most frequently when individuals do

not take the time and effort to consider their decision. The results in Chapter 7 contradict that suggestion[1].

## 9.1.3 Judgement Bias and Value

Chapter 8 reported results from experiments on student volunteers who were asked to value a series of properties having been exposed to an arbitrary 'anchor' value, in this case based on their mobile telephone number. The procedure, which is detailed in Chapter 5, is similar to that used by Ariely et al. (2003). This was a test of hypothesis **H4**, which was discussed in Chapter 4. It is below:

> **H4.** *Anchoring: individuals' valuation judgements over housing are biased by the presence of an arbitrary anchor.*

The results are summarised as follows:

- There is direct evidence that even in the presence of significant incentives for accuracy, participants are vulnerable to their judgements being biased in estimates of housing value;

- There is evidence that successive valuations are not independent. Participants appear to use the previous estimate as the basis for their next judgement and are far more likely to remain in the same half of the distribution of value judgements throughout the valuation series. This is interpreted as evidence which supports the *anchoring-and-adjustment* mechanism proposed by Tversky and Kahneman (1974).

When the two findings are placed together they become a significant confirmation of hypothesis **H4**. Subjects, even in the presence of significant incentives for accuracy, do use an arbitrary anchor to inform their judgement. And subsequent judgements are not independent so that the judgements *all* contain a non-trivial arbitrary element. This implies that agents may be able to place anchors, such as high-value properties, to influence consumer judgements.

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[1] Note it is a suggestion made implicitly by Tversky and Kahneman too in their analysis of the use of rules of thumb in decision making (Tversky and Kahneman, 1974).

### 9.1.4 Summary

This thesis seeks to answer the following question: to what extent, and by what means, can housing choice be manipulated in non-rational ways by a willing economic agent? It presents evidence based on the insights of the field of behavioural economics which addresses this question in three key areas: choice set effects; ordering biases; and biases in value judgements. It employs experimental methodologies encompassing three different studies: Student Group Experiments based on classroom experiments of 250 student volunteers; the Rightmove Survey based on a controlled survey of over 4,000 users of a leading property search website; and the Stamford Adult Group Survey from an online survey of 600 residents of the town of Stamford, Lincolnshire recruited through local schools.

Significant results were found to confirm several of the hypotheses made in Chapter 4 especially **H1** (asymmetric dominance), **H3a** (primacy) and **H4** (anchoring). The results suggest that the process buying a home is clearly open to manipulation by the estate agent. As was made clear in Part III, in practice this manipulation is likely to be subtle. For example it means placing options to influence the perception of properties at the initial 'filtering' stage – where many choices are considered briefly before being narrowed down for greater scrutiny – or using anchors to influence the perception of value in a particular market. Nevertheless given the stakes involved, these are important findings.

In the following section these results are interpreted further and their relevance to the parties considered in Chapter 1 are discussed.

## 9.2 Relevance and Interpretation

Chapter 1 expressed the primary reasons for studying housing choice in terms of the parties for whom the research is relevant. This section discusses the results of the research and the conclusions that can be drawn for each of these parties in turn.

### 9.2.1  Estate Agents

For estate agents there is a clear interest because of the possibility of using the strategies to their own benefit. As admitted above, the results suggest that further study and refinement may be needed to understand how to control them and produce predictable results. The results do, however, illustrate the *nature* of decision making biases that may affect home buyers. There are two particularly interesting results which go beyond the general conclusion that estate agents have considerable power to influence property choices (which may not come as a surprise to many agents).

The first is the result from Chapter 7 that one of the most powerful ways in which ordering biases take effect is on inferior 'decoy' properties. These strongly benefitted from being shown *first* in choice sets. As discussed in that chapter, the psychological basis for such an effect is known as *anchoring*. It suggests that in making decisions individuals will tend to focus excessive attention on some initially received information (the anchor). Adjustments are made upon receipt of new information, but the anchor retains a powerful role in determining ultimate judgements and choices. Thus in the case of housing choice it seems likely that the first-viewed property becomes the psychological 'yardstick' against which all others are naturally measured. This is enough to produce a bias in favour of this option, an effect known as *primacy*.

Although primacy was observed across several types of properties, including superior target options, it is the effect on inferior decoy properties that was the most significant. In some cases being viewed first doubled their popularity. For agents this may prove an effective strategy for helping market their more 'difficult' properties without significantly lowering their price. Such properties may otherwise stay on the books of agents for a considerable time which is not in the interests of either the agent or the vendor.

The second relevant result for agents lies in the illustration of the importance of how properties are marketed in the online space. The difference in the results

between the Rightmove and Stamford Adult Group Surveys illustrates that the *design* of the choice frame is vital. In particular the results suggest that the more time individuals spend taking in information about a particular property, whether they are forced to by the design of the page or by making it more interesting, the easier it is for psychological phenomenon such as primacy to take effect. Finally the results show the key role the design of search algorithms may have in moderating housing choices. If these can be manipulated by an agent, there is significant scope for improving their own sales figures.

It seems likely that agents themselves would have an insight into consumer decision making processes and so have their own ideas as to how they might influence choices. In the course of this research several anecdotal reports of this have been received. The results contained here clearly inform that body of knowledge. The natural next step may be a formal qualitative study using agent case studies to shed more light on the topic. This possibility is discussed in Section 9.4.

## 9.2.2 Policy Makers

Regulators today have a significant hand in all markets in which consumers make decisions. The main arbiter of consumer protection in the UK is the Office of Fair Trading (OFT). Established by statute in 1972, the OFT today employs nearly 700 people and has a budget in excess of £70 million. Its scope is wide including aspects of market analysis, merger control and competition law. Its mission, broadly stated, includes: "...*the promotion and protection of consumer interests throughout the UK, while ensuring that businesses operate in a fair and competitive way.*" (OFT, 2010*b*, page 10).

The results in this thesis are of interest to policy makers and regulators like the OFT because they illustrate an important way in which consumers can be manipulated when they make purchases. In general the results show that the choice frame – the context in which the decision is taken – is important in determining the ultimate choice in non-rational ways.

The insight into the new and rapidly growing market for online property searches is particularly relevant because there is currently little regulation in this area. Given the possibility of choice manipulation to promote one agent over another through controlling the search results (discussed in Chapter 4) a future development may be the creation of a market in property search results. In other words search websites such as Rightmove could find it profitable to offer to control their search results for a fee paid by the advertising agent[2]. This could operate in a similar way to the auction system AdWords$^{TM}$ used with spectacular success by Google. Such a development would be of great interest to consumer protection bodies such as the OFT because unless implemented transparently – in other words so that consumers were aware how their search results were being determined – the possibility of market manipulation is considerable. The results in this thesis prove that such consumer manipulation is plausible if, as it must be admitted, the results do also show how difficult practicing the manipulations may be in real choice situations. It may be that such manipulations are not yet consistent or controllable enough to be economically viable, at least for the time being.

Finally professional regulatory bodies are also likely to be interested in the results since they relate directly to professional practice. The National Association of Estate Agents (NAEA) produces a professional Rules and Code of Practice document which sets out, in Rule 2(2) the rule that: *"No Member shall do any act... which: (a) involves dishonesty of deceitful behaviour; (b) involves professional practice that is unfair to members of the public..."* (NAEA Code of Practice, www.naea.co.uk, 2010). The manipulation strategies studied would seem to directly engage this rule. Of course this thesis does not provide any evidence that agents actually undertake these strategies, although it is suggested in Chapter 4 that there is a motivation for them to do so. Nevertheless, if evidence was forthcoming which did confirm this practice in addition to the research here, it would certainly suggest a need to modify codes of practice in the industry.

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[2]  Note that there is currently no evidence that property search websites have any intention of doing this.

### 9.2.3   Academic Study

The results of this study represent a contribution to choice theory and so are of interest to academics interested in this part of microeconomic theory. Chapter 2 charted the dominance of the rational choice paradigm followed by its gradual undermining by the emergence of the field of behavioural economics. Housing is a choice setting with several unique characteristics. It is to most people thought of as a consumer choice, yet it is vitally important for wealth and happiness in the long term. However, it is made very infrequently under conditions of significant uncertainty. Thus, as was argued in Chapter 1, we can extend the applicability of our ideas by studying choice in this different context.

The results support the belief, expressed in the hypotheses in Chapter 4, that behavioural effects are prevalent in housing markets, leading to the possibility of effective choice manipulation strategies. They also contradict several important arguments used by those who defend the rational choice paradigm. Firstly they suggest that, even when the choice is important and the decision maker may wish to take greater care over their choice, they may still be vulnerable to biases. The online controlled surveys reported in Chapters 6 and 7 show that the *editing* phase of decision making, when choice sets are slimmed down and initial preferences are formed, is likely to have a lasting influence on choices. Although the subject of the choice is vitally important, a fact appreciated by decision makers, this element of it occupies a central place in the process of decision making and is open to manipulation and bias. Furthermore in experiments of value judgement bias (reported in Chapter 8) the presence of large, binary incentives for accurate judgement does not alter the finding that individuals' judgement can be influenced by arbitrary anchors.

The results also cast doubt on the argument that judgement is more error-prone – in the sense of departing from von Neumann and Morgenstern rationality – when little time is taken over the choice as discussed above. A psychological process known as *imprinting* may help explain this finding.

The work in this thesis is important in contributing to our understanding of the economics of housing markets. As explained in Chapter 3, there has been an increased focus on understanding the non-rational micro-dynamics of markets in recent years (for example Levitt and Syverson, 2008; Lin and Vandell, 2007). This research takes the debate on further still by placing new importance on the role of agent behaviour in moderating market outcomes.

It has already been argued that housing choices are different in many respects to other consumer decisions. Another way in which they are different is the presence of the estate agent. He is an economic agent who has the ability to use his superior information to control the parameters under which the choice is made. Thaler and Sunstein (2008) call anyone with this ability a *choice architect*. This thesis has shed a new light on the role of choice architects in by showing the significant ways in which the agent may use his position to influence choice. Pearce (1979) produces stark evidence on the role of agents in moderating outcomes in his study of racial segregation in US neighbourhoods. More recently Levitt and Syverson (2008) show how seller behaviour can be distorted by the agent through his superior market knowledge. This thesis focuses on home buyers and produces a similar conclusion: there is considerable potential for the agent to manipulate the behaviour of home buyers. This is an important conclusion for real estate academics. One avenue for further research is to understand in more detail the economic outcomes of these manipulations. This is considered in Section 9.4.

## 9.2.4 Individuals

The ultimate aim of the research in this thesis is to help all individuals make better choices. Richard Thaler and Cass Sunstein, who discuss the concept of framing and choice architecture in their book, *Nudge* (Thaler and Sunstein, 2008), express a similar aim when they say: "*One of our main hopes is that an understanding of choice architecture... will lead others to think of creative ways to improve human lives in other domains.*" (Thaler and Sunstein, 2008, page 252).

For individuals this thesis is relevant because it illustrates some important ways

in which their choice might be manipulated by taking advantage of weaknesses in their decision making processes. First, the reasonable psychological desire to form preference by comparing and contrasting items, rather than considering each item in isolation, leads to the risk that choices will be placed to subtly influence this process in favour of certain options. These are the *choice set effects* examined in Chapter 6. Secondly, a similar process that affects the way information is processed through time means that information which is viewed first may gain an excessive weight in the decision maker's mind, resulting in a first-viewed item being favoured simply by virtue of being viewed there. These are the *ordering effects* seen in Chapter 7. Thirdly when individuals make value judgements they may also be too strongly influenced by the numerical information available at the time of the judgement. Even if this numerical information has no connection to the judgement at hand – and so is arbitrary – it can influence decisions, as was reported in Chapter 8.

Since this is among the most significant decisions an individual can make, it is important that the choice be as error-free as possible. The most effective way to achieve this is through knowledge. By being aware of decision making vulnerabilities, individuals can overcome the risk of manipulation and make better choices.

### 9.2.5 Summary

The research contained in this thesis is of interest to a wide body of parties from policy makers and estate agents to academics interested in choice theory. Finally the results are of interest to all decision makers. Knowledge about decision making weaknesses, those situations where individuals are most vulnerable to being manipulated, is ultimately the most effective way to make better decisions, a desirable outcome for all.

# 9.3 Limitations of the Work

As with all research, the work reported in this thesis has limitations and it is important that these are considered, in part so that future research can build and improve upon it. The limitations can broadly be split into two areas: i) limitations in methodology; and ii) limitations of interpretation. We will focus on these in order.

Chapter 5 considered the field of experimental economics in considerable detail, arguing that it has gained widespread acceptance in economics today. The majority of researchers accept the role that experiments can play in economic study, namely that it offers the ability to tightly control information and so isolate variables of interest with precision. The clear cost is realism. Experiments are by definition artificially constructed scenarios, usually held in classrooms. Although efforts are made to create incentive structures which match the payoffs in the real world, this is difficult to achieve precisely.

The choice set elements of the Student Group Experiments reported in Part III are clearly limited in this sense. They took place in classrooms and involved entirely hypothetical decisions. Participants were asked to imagine themselves buying or renting a house in Cambridge and take decisions on that basis. Economists are naturally suspicious of measuring the outcome of choice based on *stated* preference. They would much rather consider choices based on individuals' *revealed* preferences, that is, what they *do* rather than what they *say*. Since the choice experiments do not measure revealed preference because no individual actually takes a decision that he will have to live with, the Student Group Experiments are clearly limited in this sense.

Incentives were used in the experiments of judgement bias reported in Chapter 8. Subjects could earn up to four times their show up fee for accurate judgement (and 20 times in one experiment). This mitigates the realism limitation to a certain extent because the participants faced a real economic decision. However it is self-evident that this payoff structure still did not – and could never have –

completely replicated the real economic decision over buying a home.

The Rightmove Survey was designed very carefully to replicate almost exactly the conditions under which real housing choices are made in the online forum. Participants were asked to view several properties then pick the one they preferred the most. Thus the choice frame was clearly more realistic than for the classroom-based student experiments. As was argued in Chapter 2 (Section 2.4.3 page 55), the scenario also replicates fairly closely the initial search phase – known as *editing* in *Prospect Theory* – which characterises many property searches today. As Kahneman and Tversky argue, this phase is likely to be vital to the final decision. However despite this, the general criticism of the experimental methodology remains: in the Rightmove and Stamford Adult Group Surveys the decision is not real, it is hypothetical. Participants know they are taking part in a survey which has no bearing on the future lives, an important methodological limitation.

The natural next step to answer these criticisms is an empirical study of real housing choices based on survey work with estate agents in the field. This possibility was explored for this study although time and cost implications make it impractical for a PhD project. How such a project might be designed is considered in Section 9.4.

Another important methodological limitation is that some of the more important variables for determining housing choice were largely removed in most of the experiments. For the Rightmove Survey, participants were only told that the properties were in a city and for the Stamford Adult Group Survey respondents were told that the properties were located in Cambridge, but not where precisely. There is an obvious concern that if a Rightmove Survey participant from the South West, for example, sees that the properties they are viewing are located in Cambridge then they might give it less attention because they do not know anything about the Cambridge property market. By emasculating location in these instances, the survey design made the choice scenario more realistic for all participants in that it made it easy to imagine looking for property like that displayed in a location near to the scope of their experience.

Price was also removed entirely as a variable. Participants were simply told that all the properties had the same price. The removal of price as a variable was discussed in Chapter 5. It considerably simplifies the analysis by removing income effects which are complicated to model on a large sample of individuals[3].

Removing the variables price and location in this way is a limitation because they are clearly among the most important in the decision to buy a home. Trading off these two variables in particular is likely to be a key determinant in ultimate choices. This naturally limits our interpretation of the results. For example it may be that decision makers are more effective at trading off features against price, rather than against each other, for example, which is what the survey design forced.

A final methodological limitation lies with the treatments themselves. The Rightmove Survey consisted of 14 treatments based on four properties; the Stamford Adult Group Survey used only six treatments with the same four properties. No more than half a dozen properties were used in the Student Group Experiments. This is to a certain extent a rather limited scope. It may be that the choice biases seen are only applicable for the four-bedroom family homes that were the subject of the Rightmove and Stamford Adult Group Surveys, for example. The Student Group Experiments reported the phenomenon that was named the *choice pollution effect* in the comparison of small city-centre properties (terraced property versus a flat). It is difficult to say whether this result extends far beyond this context. It would have been preferable to illustrate the manipulation strategies on a wider range of properties partly to illustrate the generalisability and partly to understand more about whether the type of property also moderates the extent of behavioural bias.

Another problem with this limited scope of properties is that it leaves open the

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[3] For example, to include price as a variable would mean that significant amounts of wealth and income data would need to be taken from participants to use as control variables. Such information is personal and many participants may not have wanted to disclose it in a survey of this kind (or worse they may have consistently under- or over-stated it).

possibility of particular features of the properties under consideration having an impact which are not general to all properties. The results of the Rightmove Survey clearly show that the Bosworth Road property was heavily favoured over the St. Alban's Road property (see Table 6.6, page 164). This was because the main photograph used to represent the former was significantly more attractive than the latter. Evidence for this belief comes from the Stamford Adult Group Surveys, which used the same properties, but did not emphasise this single photograph as strongly. Initial preference was much more even in this survey (see Table 6.12, page 176). While this result illustrates how important the choice frame is in the formation of preference, in general the results would have been more robust had they been repeated across many property sets.

Another sense in which the Student Groups Experiments are limited is in the name itself: they use student volunteers. As discussed in Chapter 5, students are widely used in experimental economics because of their ease of recruitment for most researchers, as well as their low marginal cost of time, which allows for controllable motivation payments. Significant care was taken with the recruitment of the student volunteers in the experiments reported. As argued previously, this group does represent a good model of inexperienced renters who are an important part of housing markets. Also using University students is a good test because they represent the sophisticated end of this market, including some who may have knowledge of the formal terms of the rational choice model (and hence be more likely to act according to it). Nevertheless the use of student volunteers clearly limits the extent to which the results from these experiments can be generalised. It is possible the biases reported would not persist among a more experienced group. Such an extension will be left to future research.

Overall it is important to be realistic about the research presented in this thesis. Being based on experimental data it can never give a truly comprehensive picture of the nature of biases in housing choice. Indeed that was never the aim of the project. Instead the aim was to shed light on the nature of the biases which can afflict this important area of choice, providing a framework for our understanding of the important areas of bias and platform for further work. Interpreted with

this in mind the results give us plenty of useful conclusions and scope for further work. The former have been explored earlier in this chapter, the latter are explored in the next section.

## 9.4 Future Research

There are many avenues for future research, beginning with the areas of limitation discussed above. Behavioural insights have significant amounts still to offer to further our understanding of housing markets and real estate. It is a path of research that is only just beginning.

### 9.4.1 Formal Study of the Choice Pollution Effect

One of the most significant results reported in Part III is the finding of a new form of behavioural bias, labelled the *choice pollution effect*. This describes a choice pattern where the addition of a 'decoy' option to the choice set did not have the expected positive impact on the 'target' option. Instead the decoy appeared to 'pollute' the perception of the intended target, causing a significant decline in its popularity. Future work could include a formal experimental test of this bias. A suggested explanation for the bias lay in information asymmetry. It was suggested that the inferior decoy option may reveal negative information – or make it more vivid in the decision maker's mind as per the bias of *availability* (Tversky and Kahneman, 1974) – about the target. The experimental work may seek to understand this information signal in more detail: what are the main factors determining whether a decoy has a positive or negative effect? What are the limits of the effect? Does it exist in other choice scenarios or is it only relevant to choice scenarios characterised by information asymmetry? To my knowledge there is no published research in the housing choice or consumer economics literature which considers negative, rather than positive, decoys, so research in this vein would represent a significant contribution.

### 9.4.2 Empirical Study of Buyer Manipulation

Beyond further experimental study, the natural next step to extend the results in this thesis is an empirical study of home buyer manipulation. Attempts have been made to use existing datasets to tease out behavioural implications in housing situations (such as Genesove and Mayer, 2001; Simonsohn and Loewenstein, 2006). However a more effective way to extend our knowledge of manipulation strategies in a similar vein to those reported here would be an empirical study, but which nevertheless attempted to use broadly experimental control.

The study would gather data with the co-operation of local estate agents. The aim would be to follow a series of property searches from the beginning (when the agent was first contacted by a buyer) to end (upon completion or withdrawal of interest). To gain sufficient data perhaps hundreds of individual property searches would be needed over several months. Broadly the design would be to have home-buyers fill in a survey at the beginning of their search which asked demographic data as well as key wealth and income parameters. It would also need to consider the expectations and current living arrangements of the buyer(s). Perhaps the most effective method would be to focus on one group of buyers at a time, for example starting with first-time buyers, or those with young families looking to upsize. Data would be recorded on what homes were viewed, and in what order. At the end of the research a further questionnaire would be administered which would establish the result of the search – whether it resulted in a decision to buy – and why.

To take the research on further would require attempting some of the manipulations discussed in this thesis. An agent would randomly allocate particular choice sets to buyers. These would include different decoy properties to try and manipulate decision makers in favour of particular targets.

Being focused on real decision makers who are actually contemplating buying property, this study would be an effective way of taking the research in this thesis on further. It would be a particularly useful way to examine ordering effects.

It must be noted though that in practice it would be complex to design and complete. The risk of confounding variables is significant, and many hundreds of individual searches would be needed to give statistical power to the results. Clearly the gain of realism comes with a corresponding cost in terms of precision. Nevertheless an empirical result which matches the experimental work reported in this thesis would be of significant interest.

### 9.4.3 More on Housing Market Outcomes

A consideration of recent research in real estate (Chapter 3) found that the microeconomic dynamics of housing markets have become a significant focus in recent years. This research made a contribution to that body of research by focusing on the non-rational dynamics of housing choice. In particular the focus here was on the importance of the estate agent in moderating decision outcomes. Future research might build upon this platform. There are two broad paths. The first is to follow on to the next stage and ask in more detail: what are the housing market outcomes that result from home buyer manipulation? Pearce's (1979) study of the segregating effect of inadvertent racial biases in housing has already been mentioned as have others on the topic of 'redlining' (Munnell et al., 1996; Jones and Maclennan, 1987). Future research might consider in theoretic terms what the effect of these buyer manipulations is. Does it result in a broadly inefficient market for housing? Are there location-specific implications?

A second promising path for research is to consider *other* implications of non-rational behaviour terms of housing outcomes. One perspective comes from the insight that when making choices involving risk (a class of decision which buying a house clearly falls into) individuals are particularly concerned with what others think of them, especially how *skilful* they are seen to be. Failure in gambles – and investments – is embarrassing not just because of the effects on wealth, but also because of the embarrassment of being shown up for making poor choices. Several papers examine the effect that this might have on decision making. Harbaugh (2008) calls it *skills signalling*. Scharfstein and Stein (1990) show that individuals can be drawn to irrationally ignore their own private signals about

the success of a project and simply mimic the decision of a first-mover where they are concerned to maintain a reputation. They call this *embarrassment aversion* in the context of a body of research known as the career concerns literature which considers managerial decision making.

There is a natural application for this non-rational effect on behaviour in housing markets. The decision to *enter* the housing market as an owner occupier (buying a first home after renting) can be analysed in a similar framework. In the typical situation an individual is deciding whether to buy his first property. He has a private signal about the future direction of the housing market and is concerned about losing money (ie. he has a standard utility function over his wealth). But he is also concerned about his reputation among his friends and peers. They have all already bought properties and are apparently doing well 'on the ladder'. The social pressure imposed upon the prospective buyer by his concern over his reputation – that he will be thought of as having poor judgement because he is 'missing the boat' – is enough to tip him over the edge into buying.

This framework is similar in spirit to the kind of *irrational exuberance* models suggested by Case and Shiller (1989) and Shiller (2007) with respect to housing markets. Individuals are drawn to ignore their own private signals because of the presence of others who bias their choices. It differs from the Shiller model in a critical respect however. The driver of continued buying is not a belief that others will continue buying after you – the essence of irrational exuberance – but a specific concern over the reputational effect of *not* acting.

### 9.4.4   Other Applications of Behaviour in Real Estate

There is significant scope for further study of behaviour in real estate. A large body of literature already attempts to use the insights of behavioural economics in real estate (see Diaz and Hansz, 2007). There is a significant focus on the behaviour of professional valuers, which was discussed in Chapter 3. The future will undoubtedly bring further studies of this type.

Perhaps the most obvious area for continued work is commercial real estate investment. Non-rational aspects of behaviour, such as the Kahneman and Tversky concept of *loss aversion*, have been shown to affect investors in stock markets (Odean, 1998). But little evidence currently exists to consider these effects in commercial real estate markets. Do commercial real estate investors seek to attenuate their losses in the same way that private buyers do (according to Genesove and Mayer, 2001) for example?

### 9.4.5 Summary

Future research to take the results of this thesis further is just the beginning for behavioural research in real estate. The behavioural insights of Kahneman and Tversky radically altered economists' theories of choice and this shift has been felt across economics. Behavioural insights have a considerable amount still to offer in the search for greater understanding of housing markets and in the wider real estate economics discipline. It is an exciting research agenda.

# Appendix A

# Materials from Classroom Experiments

The figure below is a reproduction of the consent form used in all classroom experiments. Consent forms are available at the request of the author. Other materials associated with the Student Group Experiments are presented in the following pages.



**Figure A.1:** Consent form for participation in Student Group Experiments.

**Experimental Protocol**
**Experiments 1 or 2; 3a or 3b; and 4**

**OUTSIDE THE CLASSROOM**

Hello. Thank you for coming today. What the experiment is about, and what you will be doing you will learn in the classroom. Please take a token from this bag, and, when you enter the room, sit at the desk corresponding to the number in your hand. On your desk will be several sheets of paper. Please do not touch these until instructed to do so.

[Participants take a lettered token from a bag held by the experimenter/ assistant and then enter the classroom and sit, as instructed]

**INSIDE THE CLASSROOM**

[Stand at the front/ lectern]

Thank you for coming again. Before we begin please take a moment to fill out the consent form in front of you with the pen provided.

[Allow them to do this]

Okay, firstly I would like to note that from now on no communication is allowed throughout the experiment.

The data gathered in this experiment is only of scientific value if we can be sure that you made the decisions asked of you without outside interference or stimulus. If you communicate with somebody, or look at their answers, we cannot be sure that your decision is entirely your own, rendering the results meaningless. In this case we would not be able to pay you. Therefore it is in everyone's interest to follow this ban on communication strictly.

If, during the experiment, you have any questions please raise your hand. We will come to you and answer your question.

Now please turn over the left-hand sheet in front of you which has the instructions for today's experiment. We will read through them together. **Please do not turn over beyond the first page until instructed.**

[Pause while participants turn over their Instructions sheet]

1

**Figure A.2:** Example page of experimental protocol.

**Choosing a Property to Rent**

You are searching for a property to rent the new city where you have just got a new job. You have narrowed the choice down to two properties both of which have the same rent.

You <u>must</u> make a choice as soon as you can because your new job starts at the beginning of next month. You expect to live in the house for about 2 years, after which you may decide to buy a property rather than rent. Your estate agent has sent you further information about the properties to help you make your decision. As you need to commute by public transport to work the estate agent has calculated the times it will take, which you should assume are accurate. Also, the state of repair is assessed on a scale from 1-10 (where 10 is the best possible condition)

House A  commute: 38 minutes each way  state of repair: 8.5

House B  commute: 26 minutes each way  state of repair: 6.1

Which house would you choose (please indicate with a tick)?

☐ House A

☐ House B

**Figure A.3:** Example of written choice set experiment. This is treatment 1a.

**Choosing a Property to Rent**

You are searching for a property to rent the new city where you have just got a new job. You have narrowed the choice down to three properties all of which have the same rent.

You <u>must</u> make a choice as soon as you can because your new job starts at the beginning of next month. You expect to live in the house for about 2 years, after which you may decide to buy a property rather than rent. Your estate agent has sent you further information about the properties to help you make your decision. As you need to commute by public transport to work the estate agent has calculated the times it will take, which you should assume are accurate. Also, the state of repair is assessed on a scale from 1-10 (where 10 is the best possible condition)

House A  commute: 38 minutes each way  state of repair: 8.5

House B  commute: 26 minutes each way  state of repair: 6.1

House C  commute: 29 minutes each way  state of repair: 5.8

Which house would you choose (please indicate with a tick)?

☐ House A

☐ House B

☐ House C

**Figure A.4:** Example of written choice set experiment. This is treatment 1b.

(a)

(b)

(c)

(d)

(e)

(f)

**Figure A.5:** Information seen about Apartment X: Rustat Avenue.

(a)



(b)



(c)



(d)



(e)



(f)

**Figure A.6:** Information seen about House Y: York Street.

(a)



(b)



(c)



(d)



(e)

**Figure A.7:** Information seen about House Z: Cowper Road.

(a)



(b)



(c)



(d)



(e)
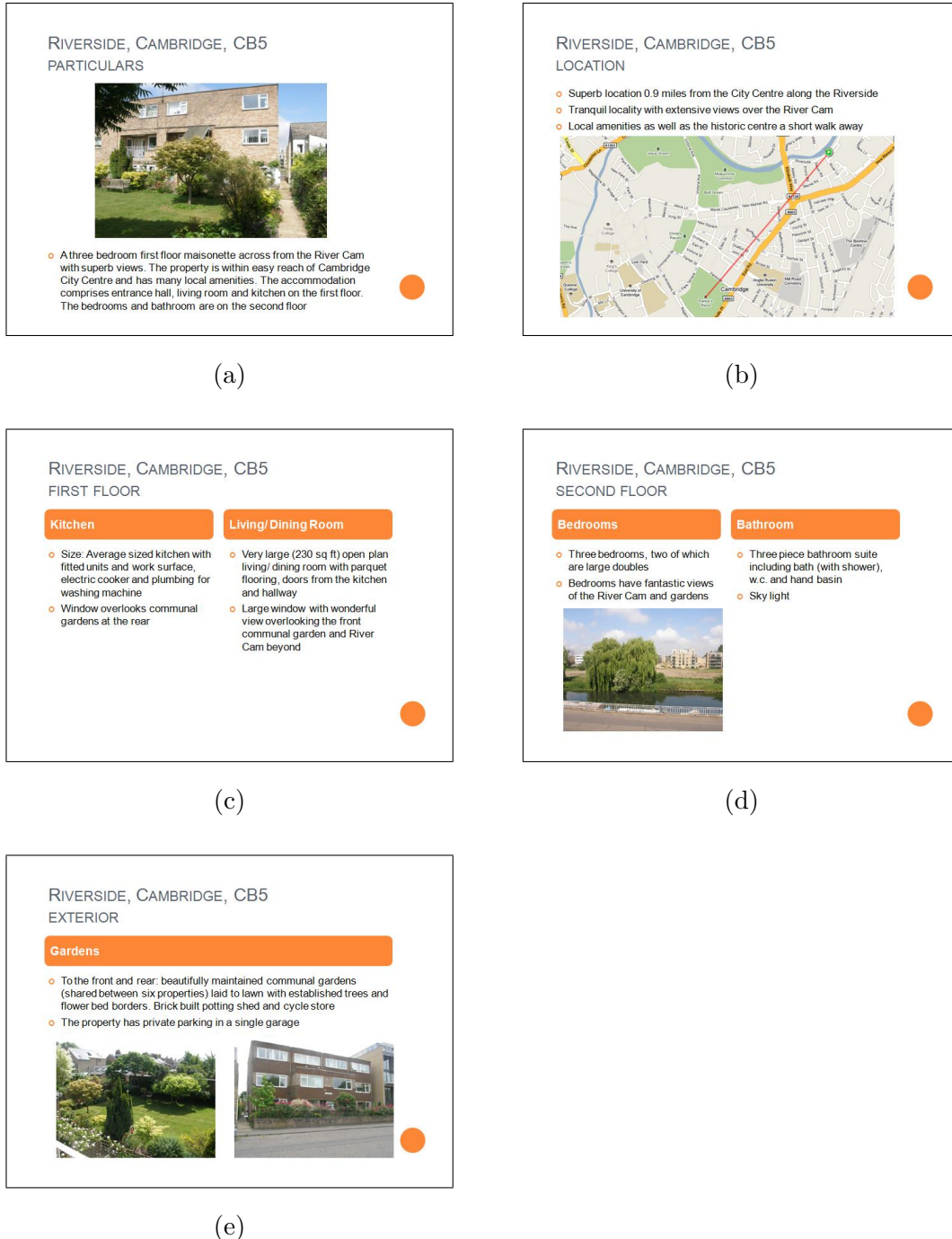
**Figure A.8:** Information seen about House A: Riverside.

(a)

(b)

(c)

(d)

(e)
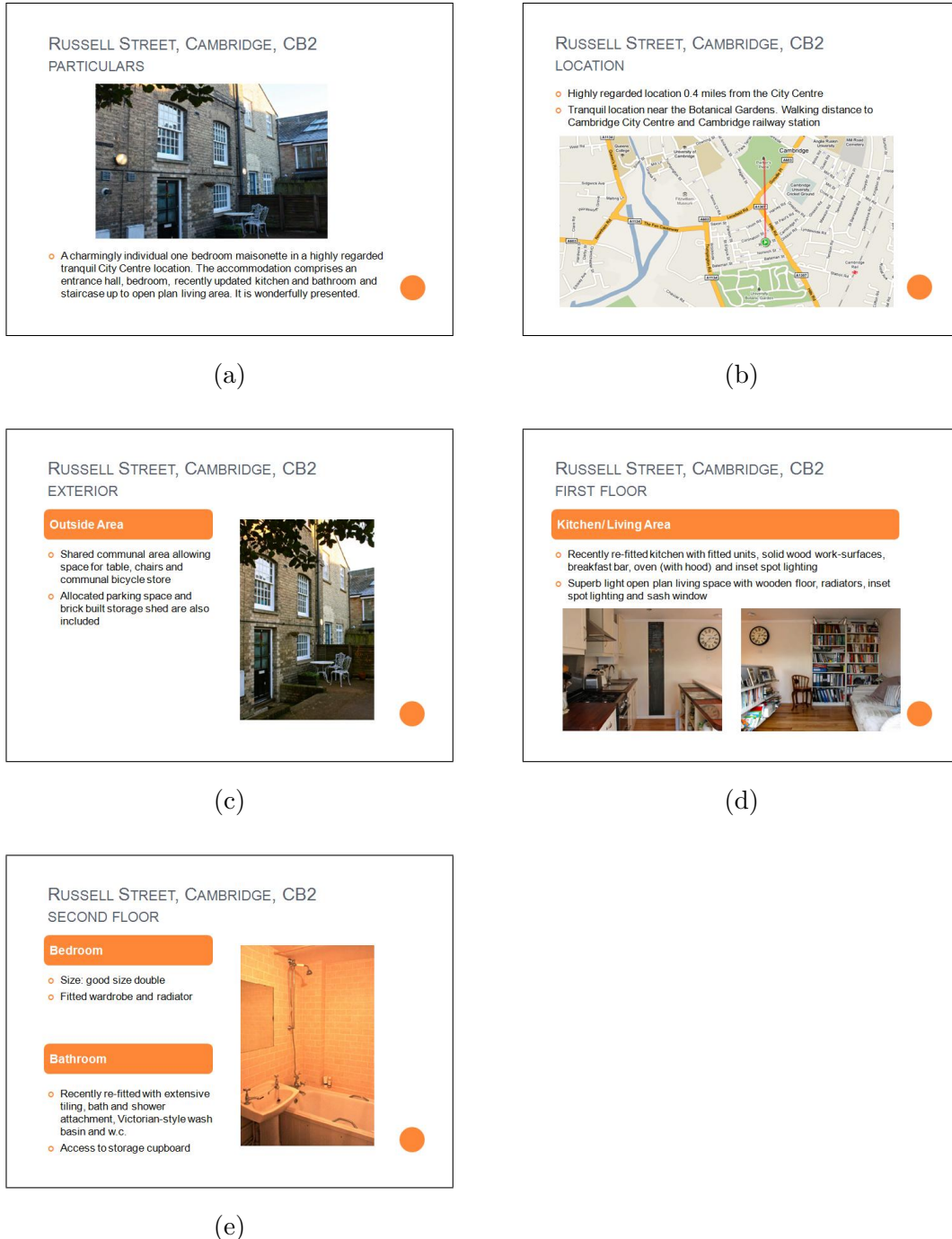
**Figure A.9:** Information seen about House B: Russell Street.

(a)



(b)



(c)



(d)



(e)
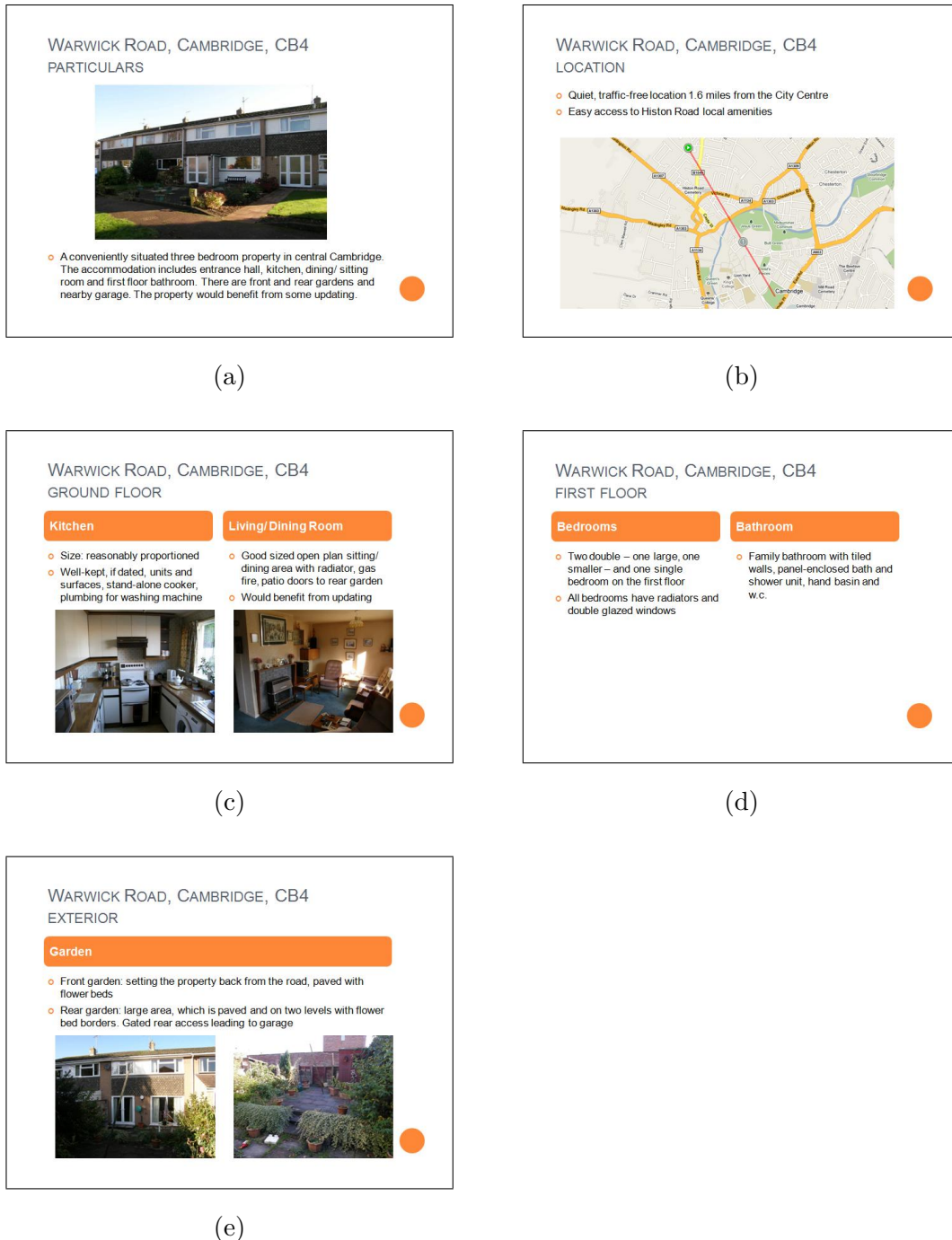
**Figure A.10:** Information seen about House C: Warwick Road.

(a)



(b)



(c)



(d)
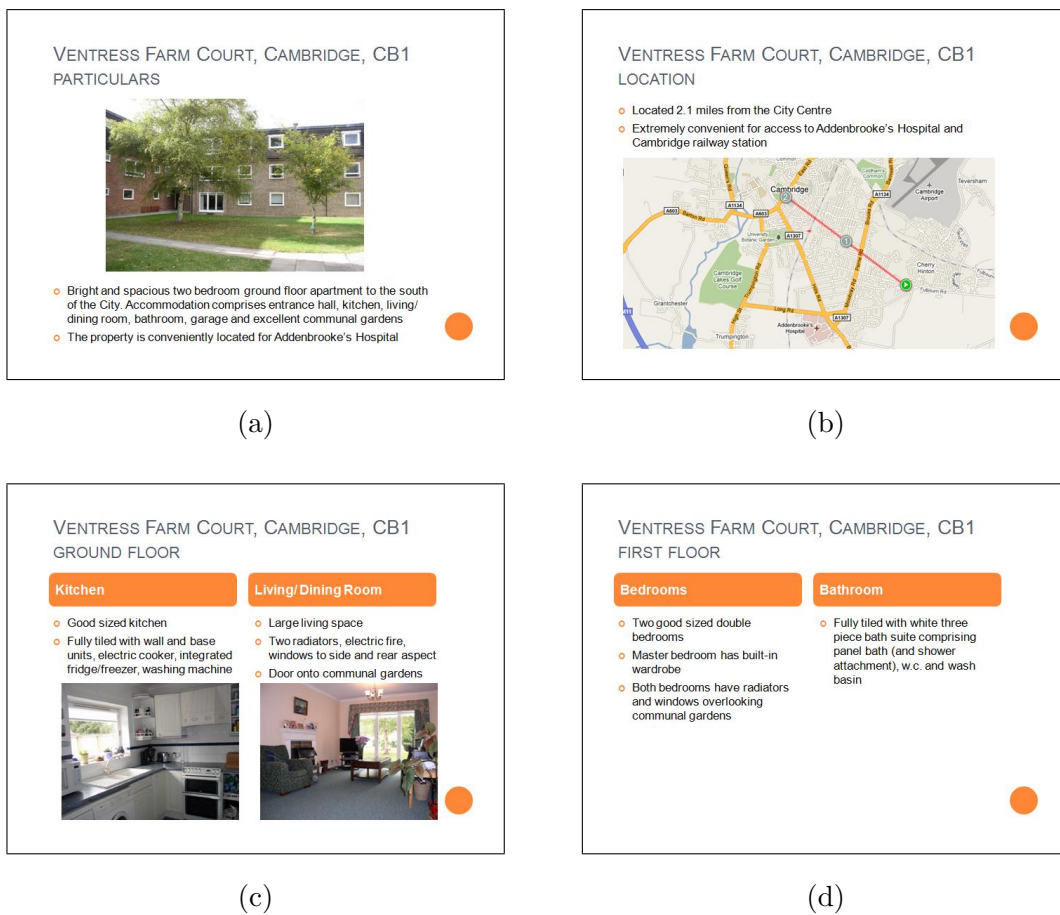
**Figure A.11:** Information seen about House D: Ventress Farm Court.

Date.....................
Desk ID..............

## Questionnaire

1) Please fill in the following details about yourself (please circle the appropriate response):

Sex:          Male          Female

Age:          18-25         26-30         31-35         36-40         40+

Nationality: .........................................

2) Do you own a property (please circle the appropriate response)?

Yes          No

3) If Yes, how long have you owned the property for?

..................................... years

4) How long have you lived in Cambridge in <u>total</u> whether as an owner-occupier or renting?

..................................... years

5) Aside from owning property, which of the following apply to you in respect of property, did/ do you (please tick all that are appropriate):

☐ Study it at University

☐ Work in the industry

☐ Ever considered buying a property

☐ Take an interest in property in the media

6) Is there some other reason why you might be particularly knowledgeable about property (please circle the appropriate response)?

Yes          No

7) If Yes, please use the space below to explain.

.................................................................................................................................

.................................................................................................................................

.................................................................................................................................

**Figure A.12:** Experimental Questionnaire Page 1.

8) Thinking about Part 1a of the experiment where you were choosing a house to rent, how strong was your preference for the choice you made?

☐ Not very strong/ virtually indifferent

☐ Quite strong

☐ Strong

☐ Very strong

☐ **Don't know**

9) Similarly for Part 1b of the experiment where you were choosing a house to rent in Cambridge, how strong was your preference for the choice you made?

☐ Not very strong/ virtually indifferent

☐ Quite strong

☐ Strong

☐ Very strong

☐ **Don't know**

10) Please use the space below to comment upon your answer to Questions 8 and 9.

.................................................................................................................................................
.................................................................................................................................................
.................................................................................................................................................
.................................................................................................................................................

11) Do you have any general comments about this experiment? Please use the space below to make any comments you wish.

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.................................................................................................................................................
.................................................................................................................................................

Thank you for completing the questionnaire.

**Figure A.13:** Experimental Questionnaire Page 2.

Question 5 of the Questionnaire asked participants to indicate whether they had any other engagement with matters to do with property. The items listed were:

- Study it at University

- Work in the insdustry

- Considered buying a property

- Take an interest in property in the media

Participants were marked as "knowledgeable" about property if they ticked three or more of the above criteria, or marked "Yes" in response to Question 6 which asked them to self-designate an interest in property.

# Appendix B

# Materials from Online Surveys

The figure below is a reproduction of the initial instructions shown to all participants in the Rightmove Survey. A similar one was used for the Stamford Adult Group Survey. Other materials associated with the Rightmove and Stamford Adult Group Surveys are presented in the following pages.
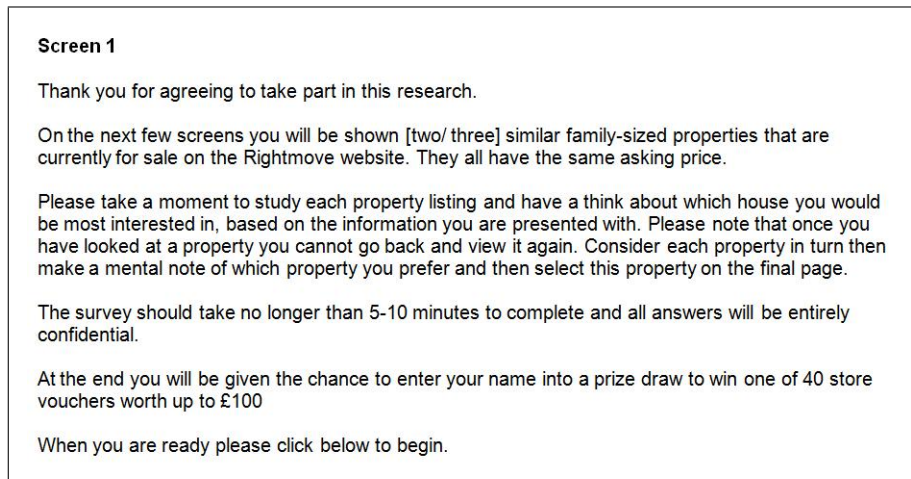
**Screen 1**

Thank you for agreeing to take part in this research.

On the next few screens you will be shown [two/ three] similar family-sized properties that are currently for sale on the Rightmove website. They all have the same asking price.

Please take a moment to study each property listing and have a think about which house you would be most interested in, based on the information you are presented with. Please note that once you have looked at a property you cannot go back and view it again. Consider each property in turn then make a mental note of which property you prefer and then select this property on the final page.

The survey should take no longer than 5-10 minutes to complete and all answers will be entirely confidential.

At the end you will be given the chance to enter your name into a prize draw to win one of 40 store vouchers worth up to £100

When you are ready please click below to begin.

**Figure B.1:** Instructions for the Rightmove Survey.

(a)

(b)

(c)

(d)

(e)

(f)

**Figure B.2:** Photographic information seen about Property A: Bosworth Road.

(a)



(b)



(c)



(d)



(e)



(f)



(g)



(h)

**Figure B.3:** Photographic information seen about Property B: St. Albans Road.

(a)

(b)

(c)

(d)

(e)

(f)

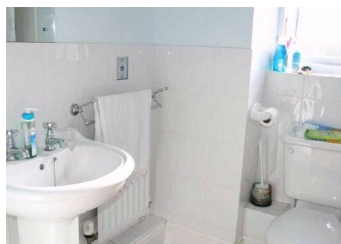**Figure B.4:** Photographic information seen about Property C: Bowers Croft.

(a)

(b)

(c)

(d)

(e)

(f)

(g)

(h)

**Figure B.5:** Photographic information seen about Property D: Moore Close.

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