

Judgemental Bias and Housing Choice*

Peter Scott[†]

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Abstract

It is firmly established that human judgement and decision making often falls short of the standard required in the *Behavioural Decision Theory* of von Neumann and Morgenstern (1947). Consumers in particular seem vulnerable to systematic errors of judgement which affect their choice behaviour (Thaler, 1980; Simonson and Tversky, 1992; Ariely, Loewenstein and Prelec, 2003). This paper uses an economic experiment to investigate the nature of biases in housing search and choice, considering in particular the role of estate agents as *choice architects*, influencing behaviour and resulting in predictable biases in outcomes. The study indicates that consumers are vulnerable to several areas of manipulation, in particular asymmetric dominance and ordering effects. These findings represent a contribution to – and extension of – the results of earlier research into consumer choice behaviour.

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[†] Corresponding author: Real Estate and Urban Analysis Group, Department of Land Economy, University of Cambridge, 19 Silver Street, Cambridge, CB3 9EP. Email: pjs56@cam.ac.uk.

1 Introduction

It is widely accepted that human judgement and decision making often falls short of the standard required in the *Behavioural Decision Theory* of von Neumann and Morgenstern (1947). Limitations in information processing and short term memory (Newell and Simon, 1972; Simon, 1978) and the use of cognitive short-cuts, or heuristics (Tversky and Kahneman, 1974; Slovic and Lichtenstein, 1971) can lead to systematic errors of judgement.

But how important are these errors and where can they be expected to occur? This question is the subject of significant controversy that has gone to the heart of microeconomics, for the doubt it casts on the normative theory of rational choice. What cannot be doubted is that economists care about it: the foundational work in Behavioural Economics, Kahneman and Tversky's *Prospect Theory* (Kahneman and Tversky, 1979) is the second-most cited paper in economics during the last 30 years.¹ What is certain is that, for economists, the importance of these biases is determined by exploring how and where they may exist in real choice scenarios, and in turn how economic agents have exploited – and may continue to exploit – them. It is with this in mind that this study provides evidence of judgemental bias in residential property choice.

Real estate has “*immense importance in human affairs*” according to Black et al. (2003)². Choices over housing are among the most significant personal finance decisions that are made during a lifetime. For critics who have sought to explain away the anomalies in choice behaviour this factor should serve to minimise the extent of error-making. In other words this argument suggests that where the stakes are sufficiently high consumers will take the required time and cognitive effort to make a rational decision (Reilly, 1982). Market experience is also held to minimise judgemental bias (List, 2003, 2004). Yet the decisions at hand are made infrequently and with little experience. Individuals may not be sure of their own preferences and have little context in which to form them. Information is limited and difficult to obtain while decentralised and opaque marketplaces for residential property and high transaction costs ensure that feedback is limited. It is hypothesised that such conditions are a breeding ground for behavioural phenomena to occur, possibly even to a greater extent than over more everyday consumer purchases.

¹ 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).

² at p.85.

This study explores a series of biases linked to several of the heuristics and cognitive shortcuts initially suggested by Kahneman and Tversky (1974) but from a new perspective: considering the role of the estate agent *using* judgemental bias to manipulate decisions.

There are studies which have looked at judgements in several real estate situations (Diaz and Hansz, 2001; Gallimore, 1994, 1996; Simonsohn and Loewenstein, 2006) and papers that illustrate more widely how decision frames can be manipulated to predictably influence choice (Tversky and Kahneman, 1981; Ariely, Loewenstein and Prelec, 2003). This study aims to bring these strands of the literature together, presenting evidence that housing decisions can be powerfully influenced by these non-normative cues, and that these effects can be easily controlled by the estate agent.

Thaler and Sunstein (2008) call anyone who organises the context in which people make decisions a *choice architect*. Estate agents are clearly choice architects in this sense. They have an information advantage over potential buyers in that they know the local market well and set the conditions under which properties are viewed (both *which* properties and in *what* order). In classroom experiments designed to replicate this choice scenario it is found that in several areas it is possible for an “estate agent” figure to use this position reliably to direct choice outcomes.

The rest of the paper is organised as follows: the next section describes the theoretical motivation for the work in more detail. Section 3 reports the experimental design and presents the hypotheses; and section 4 presents the results. Concluding remarks are given in section 5.

2 Theoretical Motivation

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 act quite differently:

*“[There is] accumulating behavioural evidence that the standard model fails under some market circumstances... Consumers may be wired differently than economic rationality in the sense of the standard model requires”*³

Tversky (1977) said that many of the biases uncovered were reminiscent of optical illusions: an original erroneous response didn't lose its appeal even *after* one learned the correct answer. Suddenly alarming variations from the standard story were uncovered and increasingly validated in experimental and real world settings (Thaler, 1980; Huber, Payne and Puto, 1982; Simonson and Tversky, 1992).

Three of these anomalies are examined in the experiments in this paper. Their theoretical background is considered below. All contribute towards an important finding: that context matters in decision-making. The way a problem is described, its *decision frame* (Tversky and Kahneman, 1981), is seen to be critical in influencing the final choice outcome.

2.1 Asymmetric Dominance

A fundamental axiom of the *Behavioural Decision Theory* of von Neumann and Morgenstern (1947) is the *independence of irrelevant alternatives* (IIA). This states that if X is preferred to Y in a choice set of {X, Y}, then introducing a third alternative, Z, thus expanding the choice set to be {X, Y, Z} must not make Y preferable to X. In other words, the preference between X and Y must be independent of the presence – or not – of another alternative. In that sense Z is irrelevant.

In individual choice modelling this axiom is fundamental yet it is consistently violated in consumer economics studies (Huber, Payne and Puto, 1982; Huber and Puto, 1983; Simonson and Tversky, 1992; Munro and Popov, 2009). These findings cast serious doubt on the rational choice model and its notion of *complete preferences*, that an individual can attribute an abstract value – utility – to each choice, and pick the choice with the highest utility from any choice set.

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 kind of measurement error problem). Additionally, however, a

³ McFadden, (1999), p.75.

consumer may be uncertain about the weights of the attributes and about their preferences for different combinations of attribute values (Simonson, 1989). 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 where the consumer is not certain of their own preferences. The cost to this psychological mechanism is the kind of irregularity illustrated above.

So what is going on? In certain situations consumers appear to make decisions according to a psychological mechanism where they look for available reasons or justifications *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 with is supported by the best overall reasons.

Huber, Payne and Puto (1982) were the first to note the counter-intuitive effects of adding an asymmetrically dominated product to the choice set. The new option will be asymmetrically dominated in the sense that is it dominated by at least one of the alternatives in the choice set, but not by at least one other. This is depicted in Figure 2.1. Here the core choice set is {A, B}. If the choice set is expanded to become {A, B, C} the effect ought to be negligible. Consumers should spot the dominated alternative, and then make the choice between A and B in the same manner as before. However, this was not what Huber, Payne and Puto (1982) found. The dominated asset appeared to provide a kind of 'help' to the nearby choice, which they called the *target*. The target is given context by the presence of the dominated alternative (the *decoy*), and gains a psychological advantage by 'winning' the comparison between it and the decoy. This is enough to sway consumers towards it.

[FIGURES 2.1 & 2.2]

In Simonson's (1989) framework, the target becomes more attractive in the presence of the decoy because it allows a cognitively easy way of justifying a choice of B. Both Simonson (1989) and Huber, Payne and Puto (1982) found significant evidence of asymmetric dominance across a range of products (beer, cars, restaurants, lotteries) in experiments conducted with student volunteers. Similarly Simonson and Tversky (1992) demonstrated strong asymmetric dominance in choices over branded pens. Doyle, Reynolds and Bottomley (1999) uncovered asymmetric dominance in a real supermarket test using baked beans brands and Munro and Popov (2009) found similar results among couples.

The implication of these violations is that it may be possible to increase the profitability of an item – and its saleability in the case of housing choice – by adding a dominated alternative that hardly anyone chooses. Does this effect persist when searching for houses? Can it be reliably manipulated?

2.2 Compromise Effect

In a similar manner to asymmetric dominance, the compromise effect occurs because manipulation of the choice set provides consumers with available reasons to make a particular choice. According to Simonson (1989) the introduction of an option which allows one of the choices to be seen as a compromise provides a highly salient reason for choosing the compromise option. The effect is illustrated in Figure 2.2. The core choice set consists of A and B. Adding a choice, E, which is not dominated by B, tends to increase the proportion of people choosing B, because it now represents a compromise choice. Such an effect would favour B if the choice set were {A, B, E}. There is a strong compromise effect when the probability B is chosen is higher when E is in the choice set; there is a weak compromise effect when the probability A is chosen falls when E is in the choice set.

Simonson (1989) found strong evidence of a compromise effect in simple consumer choices, and found support for his explanation that a need for reasonable justification of choice drives observed behaviour. Similarly Simonson and Tversky (1992) report a marked preference against extreme options in favour of intermediate ones. Studies of the effect have proliferated (see Bettman, Luce and Payne, 1998 for a review; also see Dhar, Nowlis and Sherman, 2000; Drolet, Simonson and Tversky, 2000; Drolet, 2002). However, research remains largely confined to simple consumer choices, little has focused on larger-scale decisions, such as over housing. Does the presence of estate agents with power to construct the choice set provide an implicit way to bias choices in a similar manner to that found in the consumer marketing literature?

2.3 Anchoring

In their examination of judgement under uncertainty Kahneman and Tversky (1974) note that in many cases people make estimates by starting from an initial value and then making adjustments to yield a final answer. This leads to two sources of bias: i) the initial value may be conditioned by the decision frame itself, or by some short-cut rule of thumb (“partial

computation”); and ii) in either case the adjustments are typically not sufficient, with the result that different starting points yield different final estimates, which will be biased towards the initial value. This is the phenomenon of anchoring.

The uncovering of this potentially significant bias in decision making spawned a great deal of research. Anchoring was found to be significant in a simulated economy setting (Sterman, 1989); in choices over lotteries (Johnson and Schkade, 1989); and over the valuation of public goods (Green et al., 1998). Anchoring has also been demonstrated among professionals: in accountancy (Joyce and Biddle, 1981); and commercial real estate valuation (Gallimore, 1994).

Consumers seem particularly affected by anchoring biases. These forces are particularly strong when they are not sure of their preferences or of what represents “true value”, which in turn is conditioned by their experience with the good of interest. Ariely, Loewenstein and Prelec (2003) offered a stark illustration of this effect, which they called *arbitrary coherence*. Their idea was that although the value of a certain goods may be established *arbitrarily*, once those values have been established in subjects’ minds they shape their decision-making significantly. They become *coherent* and form the basis of future judgements. In their experiment students were asked to make a series of choices over the value of certain goods (boxes of chocolates, bottles of wine and computer equipment) *after* writing down the last two digits of their social security number. The two digits form an entirely arbitrary anchor in the minds of participants and yet were a significant predictor of offered prices (in other words those with higher two-digit numbers were willing to pay more for the items than those with low two-digit numbers). These effects were robust and survived several specifications and participant groups.

The Ariely, Loewenstein and Prelec study is significant because it demonstrates how anchoring can affect not just perception, but also subjective valuation and preference. Subjects *valued* goods more highly having had a ‘high’ arbitrary anchor placed in their mind. Could such anchors have an important role in shaping the valuation judgements in housing choices, even when faced with large incentives not to be biased by such matters?

2.4 Ordering Effects

An implication of anchoring is that the order in which choices are viewed is likely to be significant in decision-making. It is suggested that this is particularly relevant in the case of housing choices where the sequential nature of the choice pattern is particularly emphasized. There is a literature examining ordering effects in cognitive psychology (Hogarth and Einhorn, 1992 provides a good summary), however, little has focused on how such effects might be important for consumer choices. Einhorn and Hogarth (1985, 1992) present a model in which the *order* and the *mode* (simultaneously or sequentially) in which new information is received is important determining how it is assimilated. According to their model the first-viewed choice is likely to be given an inappropriate weight in judgements because it will become the anchor, against which other choices are naturally compared. They name this phenomenon *primacy*. Alternatively decision-makers could give too much weight to the most salient option – that which they have most recently viewed (*recency*). Will preference be established in a manner that admits the order of sequentially-received information to matter to the final result?

Ashton and Ashton (1988) and Gallimore (1994) both examined ordering effects in professional settings. The former found evidence that auditors' belief revisions do depend on the order it is received. Investigating commercial real estate appraisals, Gallimore found limited evidence in support of a recency effect that was not statistically significant.

2.5 Behaviour and Real Estate

Research has been conducted that has focused on the role of behavioural anomalies in real estate, though most has focused on experts. This literature can be broken-up into three areas: modelling the valuation process; biases in valuation; and the role of feedback.

Diaz (1990) was among the first studies to document the behavioural processes that took place during real estate appraisals. Studying the behaviour of 12 experts conducting a hypothetical appraisal case, it was concluded that experts deviated significantly from the prescribed appraisal process. This was the case in both familiar and unfamiliar settings. This finding was 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.

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 has sought to examine whether anchoring and reference point-type effects are commonly present. Gallimore (1994) used a large sample questionnaire to uncover evidence of an anchoring effect. Building on this, several studies have examined the types of reference points or anchors which might bias appraisal valuations and concluded that there are a variety of important behaviour influencing cues, linked strongly to unfamiliarity with the location (Diaz and Hansz, 1997; Diaz, 1997; Diaz and Hansz, 2001)

A small group of papers focus more explicitly on behavioural anomalies in real estate by consumers. Northcraft and Neale (1987) examined 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.

Simonsohn and Loewenstein (2006) hypothesised that when making decisions over how much to spend on housing, households were prone to draw upon salient cues to help them, even if those cues were “*not normatively defensible*.”⁴ This reasoning mirrors the kind of theoretic background hypothesised in Ariely, Loewenstein and Prelec (2003) who called it arbitrary coherence. They argued that this mechanism would be important in housing choices because people experience significant uncertainty over how much to spend, in particular when they move to a new location, and furthermore they did not have much opportunity to learn from experience.

Specifically, they hypothesised 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 expected 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 (PSID) they confirmed their hypothesis, in addition finding that when people move again in their destination city they adjust their spending in a way that offsets the initial impact of

⁴ Simonsohn and Loewenstein (2006), p.175.

the previously-experienced prices. 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, but that they subsequently move to cheaper units, in keeping with the relative prices in the destination city to which they have become accustomed. Such effects were not explained by wealth or taxes or imperfect information.

Behavioural anomalies in seller behaviour were examined by Genesove and Mayer (2001). They propose a model in which *loss aversion* helps to explain sellers' choice of list price and whether to accept an offer or not⁵. 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.

That behavioural anomalies are present in real estate markets is well established by the literature, though a great deal of it has focused on the behavioural aspect of professional real estate valuation. Much less literature has looked at the generation of judgemental bias among consumers of real estate, and none on the role of estate agents as choice architects able to reliably influence estimates of value. Can, by their manipulation of *which* properties to show, and in what *order* to show them, estate agents produce significant biases in judgment and resulting choices?

3 Experimental Design and Hypotheses

Theoretical evidence from the field of Behavioural Economics and existing studies in the consumer behaviour literature suggest that consumers might be vulnerable to a series of judgemental biases in their choices over housing. Furthermore, it has been suggested that housing represents a particularly interesting choice scenario which has not been widely studied in this way before, not only because the choices are so important from a welfare perspective, but also because they are made with little experience relying heavily on an

⁵ See Kahneman and Tversky (1979) and Shefrin and Statman (1985) for an explanation of the behavioural phenomenon of loss aversion and the Disposition Effect.

external actor – the estate agent – to set the conditions under which the choice is made. Five classroom experiments are reported in this paper that explore the nature of these biases.

The experiments were carried out between January and March 2010 in Cambridge, UK in a classroom setting. In total 283 subjects took part. The majority were undergraduate students at the University of Cambridge⁶ selected randomly. Though a sizable minority were economists, the spread of disciplines was varied. Great care was taken with the experimental procedure, including a pilot study in November 2009. Every experimental session was carried out by the author using procedures contained in written materials in front of participants and read aloud. The experiments involved only the simplest of choices and actions and did not include any interaction with other subjects⁷ thus any anomalies resulting from subjects mis-understanding instructions are expected to be minimal.

Once seated subjects were presented with the relevant information and asked to make their choices. In total experimental sessions lasted no longer than 45 minutes, minimising biases due to boredom on the part of subjects. Subjects were given £5 for showing up and won an average amount of £1 in additional payments (though some earned much more – the structure of the incentive scheme is explained below) giving an average payout of £6 per participant. All experiments were administered with pen and paper

3.1 Experiment 1 – Asymmetric Dominance

This initial experiment asked candidates to make a choice over a hypothetical rental property. Information was presented in written-form, with no other visual clues. An example of what subjects saw is reported in Figure 3.1

[FIGURE 3.1]

Subjects were faced with a decision where they had to trade-off two characteristics of the choices under consideration: i) the distance from the town centre; and ii) the state of repair of the property⁸. In treatment 1 subjects faced a simple choice set of {A, B}. In treatment 2 the choice set was expanded to include a dominated alternative, C, making the choice set {A, B, C}. Choice C is inferior in both categories to B, thus is dominated by it in a way

⁶ a minority were postgraduate students, though this had no effect on outcomes.

⁷ a fact made clear at the beginning of each session.

⁸ Note: income effects were removed by telling subjects that all houses would cost the same amount that was affordable to them.

illustrated visually by Figure 2.1. This makes choice B the *target*. Finally treatment 3 contained a choice set {A, B, D} where D is dominated by A, making A the *target*.

This leads to the following hypothesis:

H1: *Asymmetric dominance: the proportion choosing the target increases when a decoy is added that it asymmetrically dominates*

Additionally a test of ordering effects was incorporated into the design – in different versions of the experiment the order of the choice presentation was varied, half of the subjects saw a choice set of {A, B} half saw {B, A}, and similarly with other treatments.

3.2 Experiment 2 – Compromise Effect

This experiment was administered in an identical manner to Experiment 1 – with written information in the same choice scenario without visual cues. There were three treatments: as before a choice set of {A, B} made up treatment 1; treatment 2 included the choice set {A, B, E} which has the effect of making B the compromise; and treatment 3 contained a choice set of {A, B, F} thus making A the compromise. This is illustrated in Figure 2.2. The experiment tests the following competing hypotheses:

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

H2b: *Weak compromise effect: the proportion choosing the non-target decreases when the addition of a decoy to the choice set makes the other original option the compromise*

The design of this experiment also incorporates a test of ordering by varying the order of choice presentation – half of the participants were exposed to a choice set of {A,B, E} and half to {E, A, B}, for example.

3.3 Experiment 3 – Complex Choice Set Effects

This experiment examined choice set biases in an information rich environment. Subjects were asked which of the houses in the choice set they preferred as in previous experiments, but were presented with significantly more information and visual cues. Subjects received a presentation on each house in turn featuring a virtual ‘tour’ of the property with photos and profiles of each room. Each presentation took 3-5 minutes and was scripted to prevent any differential information effects between treatments. An example page is presented in Figure 3.2. This method brings significantly more realism to a choice scenario where the decision-maker receives a set of property particulars (brochures) from which to make a choice or form initial impressions.

FIGURE 3.2

The houses were selected so there were two core choices: choice A, a modern two bedroom city-centre flat; and choice B, a picturesque two bedroom terraced property with garden and a city-centre location. The third choice was selected to be asymmetrically dominated by choice B. Thus choice C was also a city-centre terraced property, but in an inferior location and in noticeably poorer repair than target. Half of the subjects were presented with a choice set of {A, B} while half were shown {A, B, C} to detect choice set biases. This leads to the following hypothesis:

H3: *Information rich asymmetric dominance: the proportion choosing the target property increases when an asymmetrically dominated alternative is added*

As previously, tests of ordering effects were included by varying the order of the choice presentation.

3.4 Experiment 4 – Anchoring Bias

In choices over simple consumer goods, subjects frequently have their judgement of value biased through the placing of anchors (Ariely, Loewenstein and Prelec, 2003). Experiment 4 examines whether such estimation biases persist in choices over larger items, such as housing, by being asked to make sequential value judgements over a series of four properties *after* having received an anchor.

Presented initially with a blank piece of paper with space for five answers, subjects were asked to write down in the first space the last three digits of their mobile telephone numbers as a price in £000s⁹. This served as the arbitrary anchor. Subjects were then presented, in turn, with four properties and asked afterwards what they thought each was worth. The method of presentation was identical to that used in Experiment 3, ie. a virtual ‘tour’ using visual and text-based cues. Subjects were informed that all houses had sold to real buyers within the last four months.

Incentive payments were carefully structured to replicate the choice scenario under investigation. Housing choices are high-stakes, binary outcome decisions where decision-makers should be highly motivated to achieve accurate judgement. Thus subjects were offered the following incentive structure: i) earn £10 for estimating within £2,000 - £10,000 either side of the true price; and ii) earn £20 for estimating within £2,000 of the true price. Subjects were told they would earn no extra payments for inaccurate judgements. Payments were thus highly binary – to make a correct judgement would earn the subject a payment multiple times his show-up fee, while conversely inaccurate judgement would earn the subject nothing. Approximately 20% of participants earned extra money. Other binary incentive structures were tried, but did not alter the results significantly¹⁰.

A risk among the subject pool is the feeling among participants that they have a significant information deficit and hence guess randomly. To address this concern, all subjects were given a 10-minute presentation on the national and local housing market prior to the estimation procedure. The presentation included background information and recent market trends, aiming to give all participants a ‘base’ level of knowledge to work from. Such a method also stacked the deck against the arbitrary anchor, for it supplied a series of other reliable anchors in the minds of subjects.

In summary: firstly subjects were explained the experimental procedure, given the housing market presentation then asked to produce the anchor before receiving the presentation on the four houses sequentially. There are two related hypotheses:

⁹ In other words, those with the digits -204 would write: £204,000. This example was used for to explain to subjects who were uncertain.

¹⁰ In one treatment subjects were offered a single prize of £100 to the person with the most accurate judgement among the group (n=40).

H4a: Anchoring: subjects' initial valuation judgement is biased by the presence of the arbitrary anchor

H4b: Arbitrary coherence: subsequent valuation judgements are biased according to the arbitrarily established initial value judgement

3.5 Experiment 5 – Ordering Bias

It is hypothesised that in the consumer choice over housing, where viewings are sequential and determined by the estate agent, ordering effects might be an important determinant of preference. Three of the previous experiments have incorporated tests of ordering effects; however Experiment 5 uses a direct test of ordering biases in valuation judgement.

Subjects were asked to make a judgement over the value of a property having seen a series of four comparable properties. The subject property and the comparables were all presented using the same virtual 'tour' method as in Experiments 3 and 4. The comparables ranged in value from £191,995 to £295,995 and were presented *in value order*. The subject property was sold for £210,000. In treatment 1 the comparables were presented cheapest first; whereas in treatment 2 they were presented most expensive first. Thus subjects received identical information sets except for the order of presentation of the comparables, allowing a direct comparison and the following competing hypotheses:

H5a: Primacy: information received first will have excessive weight in judgements over housing

H5b: Recency: information received last will have excessive weight in judgements over housing

The methodology was similar to Experiment 4 – subjects were incentivised to accurate judgement using the same all-or-nothing payment structure as previously; and all subjects received a presentation with information about the housing market to give them a knowledge 'base' prior to the start of the experiment.

At the end of all experiments earnings were paid in cash after subjects had completed a questionnaire gathering demographic and other relevant control data.

4 Results

Summary statistics on the participants for each experiment are presented in Figure 4.1. The figures show little variability between experiments. Though not reported here, tests conducted on these variables indicate no systematic difference in answers according to age, nationality, ownership of property or among those particularly knowledgeable about property.

[FIGURE 4.1]

4.2 Experiment 1: Asymmetric Dominance

Figure 4.2 presents the results from Experiment 1. These have been split into two panels for ease of presentation. Panel A presents the tests of asymmetric dominance, in other words of a choice set composition effect. Panel B presents the related tests for ordering effects. Tests are numbered for ease of reference in the left-hand column. There is evidence of asymmetric dominance. The introduction of choice C increases the proportion choosing choice B (tests 1.1 and 1.3). In the latter case this is particularly strong: in the base case with a choice set of {B, A} the percentage choosing B was 41%. If choice C is added so the choice set is {C, B, A} the percentage choosing B rises to 68%, a highly significant result. Similarly the introduction of choice D increases the percentage choosing option A (tests 1.2 and 1.4) though this only has significance at the 10% level in the case of test 1.2.

[FIGURE 4.2]

There is also evidence of ordering effects, even though the method of choice presentation was extremely simple which was expected to minimise these effects¹¹. There is no evidence of ordering for the simple two-choice case (test 1.5) but when the choice set becomes more complicated, ie. including a third option, ordering becomes significant. The results clearly suggest anchoring: in test 1.6 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 similar magnitude rise occurs when the choice set is {A, B, D} vs. {D, B, A} in test 1.7.

¹¹ In the sense that the choices were presented next to each other on the answer sheet.

It is also clear the factors interact. Choice 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.

4.2 Experiment 2: Compromise Effect

The results from Experiment 2 are presented in Figure 4.3. They are split into three panels. Panel A reports tests of the strong-form compromise effect which requires the proportion choosing the target increases when it is made the compromise by the introduction of a third alternative. There is no evidence of strong compromise effect in this data.

[FIGURE 4.3]

Panel B reports tests of weak-form compromise effect, which 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. When the choice set is $\{A, B\}$ the proportion choosing B is 43%, however the introduction of choice F, which makes choice A the compromise, causes the percentage choosing B to fall to 14%, a highly significant decrease (test 2.6). Similarly in test 2.7 the addition to the choice set of option E, which makes B the compromise choice, causes a decrease in the proportion choosing A to 33% from 59% in the base case where the choice set was $\{B, A\}$.

The weak compromise effect appears to be strongest when the compromise choice is shown before the other original choice, which suggests anchoring. This is illustrated in panel C of Figure 4.3. Test 2.10 reports that when the choice set was $\{F, B, A\}$ the percentage choosing option A was 40%. This rises to 59% when the set is shown in the order $\{A, B, F\}$. As with Experiment 1 the effects clearly interact: 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 choice B: it is chosen most when it is the compromise and is shown before the other original choice (52%). When it is *not* the compromise, and is shown after the compromise choice is it chosen dramatically less (14%).

4.3 Experiment 3: Complex Choice Set Effects

Experiment 3 investigates choice set and ordering biases in an information-rich environment replicating many of the key features of modern house search. The results are reported in Figure 4.4. The original choice set of {R, Y}¹² contained the choice between a city-centre apartment and a similarly well located terraced property. The third option added to some treatments (C) was another terraced property, but with an inferior location and state of repair – that was clearly visible from the photographs – to choice Y. Thus C is the decoy, used with the intention of enhancing the prospects of choice Y (which is the target). The results are unexpected. The addition of choice C has the effect of *decreasing* the attractiveness of the target. In test 3.1 the percentage choosing Y drops to 39%, a significant change from the base case choosing rate (54%). This effect is also seen in tests 3.2 and 3.3¹³. The proportion choosing Y falls from 61% to 37% and 26% respectively, a highly significant result.

[FIGURE 4.4]

This result is suggestive of a **choice pollution effect**. The addition of the inferior option has a perverse effect on the target, acting as a negative signal about it, rather than enhancing its appeal. In this case the addition of a poorer terraced option (C) made the other terraced option (Y) look worse, causing a movement away from *both* choices Y and C. It is also possible that the other option (R) was enhanced by being merely *different* from the others, this difference being enough to alter perception in its favour.

Panel B presents evidence of ordering effects in the more complex information-rich choice scenario. There is consistent evidence of recency: for choice sets with more than two options, more recently seen options are always chosen more frequently compared with when shown earlier (tests 3.4 – 3.7) though none of the relationships is strong enough to be statistically significant.

4.4 Experiment 4: Anchoring Bias

Anchoring biases in valuation judgements were addressed by Experiment 4 where subjects were asked to estimate the value of a series of properties having had an anchor placed in their minds. The anchor was the last three digits of their mobile telephone numbers

¹² The letters used recall the names of the properties: Rustat Av., York St. and Cowper Rd.

¹³ Subjects undertaking test 3.3 were all Masters students specialising in Real Estate Finance.

expressed in £000s. For the purposes of presentation anchors are grouped into ‘anchor buckets’ based on the first digit of their anchor¹⁴ in a manner consistent with Ariely, Loewenstein and Prelec (2003). The results are reported in Figure 4.5 and 4.6. Several different methods of truncating the observations to remove serious outliers are reported for completeness. Column (1) of Figure 4.5 illustrates a significant relationship between the anchor and house price estimate – subjects with higher anchors estimated the value of houses to be higher than those with lower anchors. As illustrated in Panel B of Figure 4.6 subjects with an anchor of 1-2 estimated the price of House A at £246,000, significantly lower than the £268,000 estimated by those with an anchor of 7-8. This difference occurred even with strong, binary incentives for accurate judgement.

[FIGURE 4.5 & 4.6]

Subsequent to their estimation of House A, subjects were asked to estimate the prices of three other properties (B, C and D, respectively). The evolution of average estimates are presented in Figure 4.7. Collectively they illustrate that estimates were consistently above the true values. Furthermore, subjects consistently made errors in the direction of their estimates. Shown in Figure 4.7 is the proportion of subjects who guessed the *direction* of change from house to house. Thus it shows that having estimated their value for House A, only 43% of subjects correctly identified that House B was cheaper. Similar results applied to the estimates of Houses C and D.

[FIGURE 4.7]

4.5 Experiment 5: Ordering Effects

Ordering effects are tested specifically by Experiment 5 which asked subjects to make a judgement on the value of a property having seen comparables which were arranged in order of value. There were four comparables, whose prices were £191,995; £250,000; £250,000; and £259,995 respectively. The true price of the property to be valued was £210,000. The results are presented in Figure 4.8. Subjects exposed to the cheapest property first estimated the value on average lower than those exposed to the most expensive first, though this difference was not statistically significant. An F-test of variances also indicates no statistical difference

¹⁴ Note: if the anchor was £275,000 the observation would be placed in anchor bucket 2.

between treatments. Using other demographic variables such as age, nationality, experience with property or ownership of property does not alter this result.

[FIGURE 4.8]

Nevertheless there is clear evidence of bias among the subjects. The true value was £210,000 and the mean value estimated was significantly above that, even with a strong incentive for accurate judgement. It is suggested this may be caused by anchoring effects which overwhelm any ordering biases that exist. Specifically, the value £250,000 is a highly salient anchor given that it featured twice in the comparable properties shown to all subjects. Although subjects received significant amounts of relevant information about the local property market prior to the estimation procedure their experience in property markets was, in general, limited. This certainly increases the risk of confounding factors entering the judgement process. Here it is easy to hypothesise that subjects who felt totally unsure about their answer simply clung to the most available anchor available, which was £250,000. This has implications for housing choice among inexperienced decision-makers (for example first-time buyers) which is discussed in the next section.

5 Concluding Remarks

This study presents five experiments that examine the nature of biases in housing search and choice. Housing represents a particularly interesting area to examine consumer choice given its singular importance to individual welfare; but also because it presents a unique choice scenario: a high stakes choice which decision makers make infrequently and with little experience, relying heavily on an external actor – the estate agent. Critiques of behavioural studies in consumer economics have typically emphasised the importance of both the stakes and the decision maker’s experience in reducing error-making and bias. Thus this study presents a contribution to- and extension of – the existing literature in consumer choice behaviour.

The objective of the study was to explore the extent to which several commonly found biases in choice and judgement are seen in experimental housing choice scenarios. There was significant evidence of bias. Faced with simple choices over housing options, subjects were reliably influenced by the placing of an asymmetrically dominated choice. The placing of an

option to create an obvious compromise in the choice set was found to have important effects in choice patterns.

In information rich choice scenarios, which more faithfully replicated how initial housing selections are made there was found to be a significant *choice pollution effect*. Adding a dominated asset to the choice scenario induced a shift *away* from the target property that dominates it, suggesting that the dominated alternative communicated a negative signal about the quality of the said target. This result is counter to the typical finding that such a placement would induce a shift *towards* the target by creating a *halo effect* (Simonson, 1989).

Two experiments examined judgemental biases using a binary incentive structure that offered participants a strong incentive for accurate judgement. In the first subjects were found to be significantly influenced by an arbitrary anchor placed before the valuation task was undertaken. This was despite subjects being given significant amounts of information to aid their judgement (and provide other salient anchors) and the presence of the previously mentioned high stakes binary incentives.

Finally there was significant evidence of ordering effects throughout the study. The sequential nature of housing decisions – properties are naturally viewed in turn – adds to the importance of this aspect of judgemental bias here, in a way that other studies of consumer behaviour have typically neglected. Primacy seems to dominate – options were typically chosen more frequently when they were presented first than when presented later, *ceteris paribus*. Further study should aim to examine more explicitly how ordering effects can impact housing choices.

The experimental group in this study –University students – had fairly limited experience with property and housing choices. It remains a goal of future research to replicate these findings among more experienced groups, possibly of existing home-owners. Nevertheless, the students tested provide a good proxy for at least one important class of participants in the housing market – first time buyers. It is believed that providing insights into the behaviour of this segment of the housing market provides a valuable insight in its own right to consumers and policy makers.

In summary, the findings of this study have important implications for our understanding of consumer behaviour and for policy. The field of Behavioural Economics has consistently

challenged that notion that human decision making processes are rational in the axiomatic sense of von Neumann and Morgenstern's original analysis. This study adds to that body of literature, exploring another choice scenario in which decision makers are vulnerable to manipulation. The result is more powerful because this is not a choice scenario in which it is possible to explain away errors, as is typically done, by reference to either stakes or experience: the stakes are always extremely high, and for the vast majority experience is very limited: perhaps the ultimate one-shot game.

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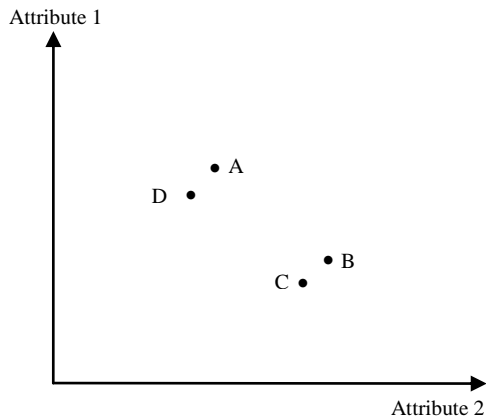


Figure 2.1: Illustration of Asymmetric Dominance
 With a core choice set of {A, B} asymmetric dominance is seen if the introduction of the dominated alternative, C – expanding the choice set to {A, B, C} – increases the proportion of people choosing B. Similarly if the choice set is {A, B, D} dominance is seen if the proportion choosing A increases.

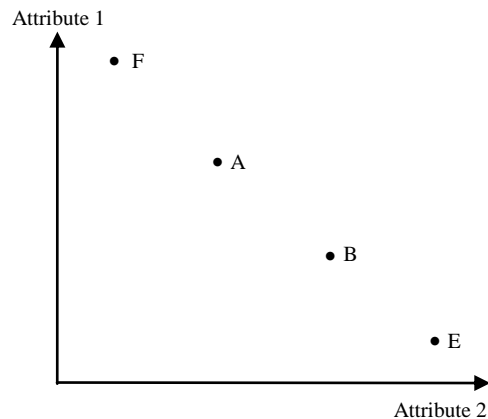


Figure 2.2: Illustration of the Compromise Effect
 With a core choice set of {A,B} a compromise effect occurs if the relative proportion of people choosing B increases when the choice set is expanded to become {A,B,E}. Similarly, if the choice set becomes {A, B, F} it is expected that the proportion choosing A will increase.

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 must 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 3.1: Choice problem in Experiment 1

Subjects were faced with a trade-off between two characteristics of value: distance to work and state of repair of the property. Three treatments varied the nature of the trade-off faced by introducing *decoy* choices (which choice C is here).

Figure 3.2: Example of virtual tour method

Subjects were presented with information about each property in a visual way, with images drawn from property particulars. Each presentation was scripted to ensure fidelity between treatments.



Variable	Exp. 1	Exp. 2	Exp. 3	Exp. 4	Exp. 5
n	171	149	225	139	114
Male	50%	44%	46%	49%	41%
Aged 18-25	82%	87%	81%	88%	76%
British	50%	55%	50%	57%	43%
Own property	6%	5%	6%	8%	4%
Knowledgeable in property	15%	15%	14%	15%	15%

Figure 4.1: Summary statistics for experiment participation

Rows show the percentage of subjects fulfilling the criteria in each case. Note that the final row presents the percentage who answered yes to the question: “Is there some reason why you might be particularly knowledgeable about property?” They were also classed as knowledgeable if they indicated yes to at least three of the following statements when asked whether it applied to them: study property at University; work in the property industry; considered buying a property; take an interest in property in the media.

Test	Choice Set and Order	A	B	C	D	p-value	n
Panel A: Set Composition							
	A, B	57	43				35
1.1	A, B, C	46	54	0		0.111	39
1.2	A, B, D	75*	25		0	0.056	24
	B, A	59	41				22
1.3	C, B, A	32	68***	0		<0.001	25
1.4	D, B, A	60	40		0	0.549	25
Panel B: Ordering Effects							
	B, A	59	41				22
1.5	A, B	57	43			0.471	35
	C, B, A	32	68	0			25
1.6	A, B, C	46**	54	0		0.045	39
	D, B, A	60	40		0		25
1.7	A, B, D	75*	25		0	0.096	24

Figure 4.2: Experiment 1 – Asymmetric Dominance

Subjects were faced with a choice over a house to rent and asked to trade off two attributes of value: commuting time and state of repair. Subjects saw one of three different choice sets: {A, B}; {A, B, C}; or {A, B, D}. Choice C was a decoy intended to bias subjects towards choice B, and choice D was a decoy intended to bias subjects towards choice A. The figures indicate the percentage making the relevant choice. * Indicates significance at the 10% level; ** indicates significance at the 5% level; *** indicates significance at the 1% level.

Test	Choice Set and Order	A	B	E	F	p-value	n
Panel A: Set Composition – Strong Compromise Effect							
	A, B	57	43				35
2.1	A, B, E	41	41	17		0.633	29
2.2	A, B, F	59	14		27	0.516	22
	B, A	59	41				22
2.3	E, B, A	33	52	14		0.198	21
2.4	F, B, A	40	30		30	0.974	20
Panel B: Set Composition – Weak Compromise Effect							
	A, B	57	43				35
2.5	A, B, E	41*	41	17		0.064	29
2.6	A, B, F	59	14***		27	0.004	22
	B, A	59	41				22
2.7	E, B, A	33**	52	14		0.015	21
2.8	F, B, A	40	30		30	0.224	20
Panel C: Ordering Effects							
	E, B, A	33	52	14			21
2.9	A, B, E	41	41	17		0.232	29
	F, B, A	40	30		30		20
2.10	A, B, F	59*	14		27	0.055	22

Figure 4.3: Experiment 2 – Compromise Effect

Subjects were faced with a choice over a house to rent and asked to trade off two attributes of value: commuting time and state of repair. Subjects saw one of three different choice sets: {A, B}; {A, B, E}; or {A, B, F}. Choice E was set so that it made choice B a compromise. Choice F was set to make choice A the compromise. The figures indicate the percentage making the relevant choice. * Indicates significance at the 10% level; ** indicates significance at the 5% level; *** indicates significance at the 1% level.

Test	Choice Set and Order	Rustat Av.	York St.	Cowper Rd.	p-value	n
Panel A: Choice Pollution Effect						
3.1	R, Y	46	54		0.031	39
	R, Y, C	57	39**	5		44
3.2	Y, R	39	61		<0.001	44
	C, Y, R	60	37***	3		67
3.3	Y, C, R	65	26***	10	<0.001	31
Panel B: Ordering Effects						
3.4	Y, R	39	61		0.211	44
	R, Y	46	54			39
3.5	R, Y, C	57	39	5	0.364	44
	C, Y, R	60	37	3		67
3.6	R, Y, C	57	39	5	0.249	44
	Y, C, R	65	26	10		31
3.7	C, Y, R	60	37	3	0.362	67
	Y, C, R	65	26	10		31

Figure 4.4: Experiment 3 – Complex Choice Set Effects

Subjects were faced with a choice over a house to rent and given information about each property in the form of a ‘virtual tour’ presentation including photos. Rustat Av. (R) was a two-bedroom city centre apartment; York St. (Y) was a two-bedroom city centre terraced house; and Copwer Rd. (C) was also a terraced house, but with inferior features to York St. and worse location. Thus choice C is a decoy, intended to enhance the target, Y. The figures indicate the percentage making the relevant choice. ** indicates significance at the 5% level; *** indicates significance at the 1% level.

	Estimated Value of House A		
	(1)	(2)	(3)
Intercept, α	239,218 (3.398)	237,810 (3.893)	236,276 (2.769)
Anchor 1 – top/ bottom 10% obs. truncated	3,730** (0.673)		
Anchor 2 – errors +/- 50% truncated		2,083** (0.771)	
Anchor 3 – errors +/- 60% truncated			3,445*** (0.548)
n	8	8	8
Significance F	0.014	0.035	<0.001
R ²	0.84	0.55	0.85

Figure 4.5: Experiment 4 – Anchoring Bias

Subjects were asked to estimate the value of a property (whose true value was £240,000) having been given an anchor associated with their mobile phone number. The regression uses the following equation: $House A = \alpha + \beta_x Anchor + \varepsilon$. The anchor variable used in each regression is the mean estimate of each ‘anchor bucket’ – these having been constructed by placing each observation into buckets 0-9 according to the first digit of the anchor. Buckets 0 and 9 are excluded from all regressions. There are three regression presented each with a different method of truncation. Column (1) truncates the top and bottom 5% of estimates; column (2) truncates errors of +/- 50% in terms of value; and column (3) truncates errors of +/- 60% in terms of value. ** indicates significance at the 5% level; *** indicates significance at the 1% level.

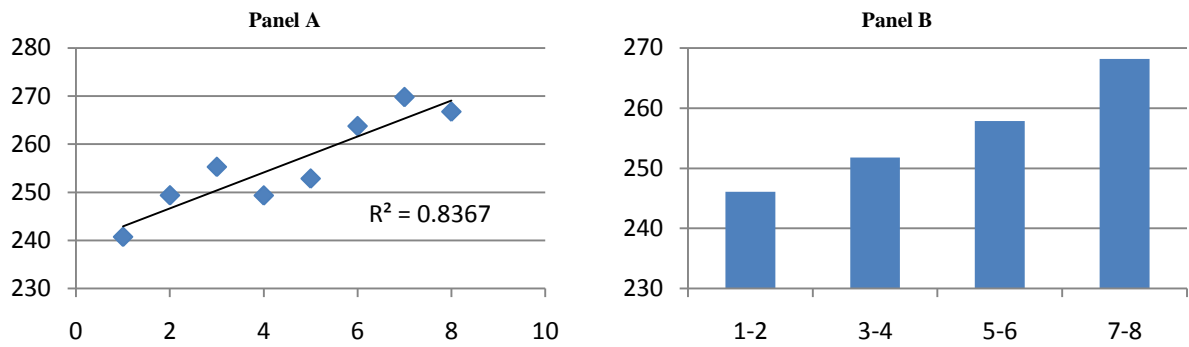


Figure 4.6: Experiment 4 – Relationship between anchor and House A estimate

Subjects are grouped into ‘anchor buckets’ according to the first digit of their anchor and the mean value for each bucket is taken. In Panel A, A line of best fit illustrates the relationship between the anchor bucket and the average estimate. It uses the same truncation method as column (1) of Figure 4.4. In Panel B the anchor buckets are grouped into twos with the same truncation method.

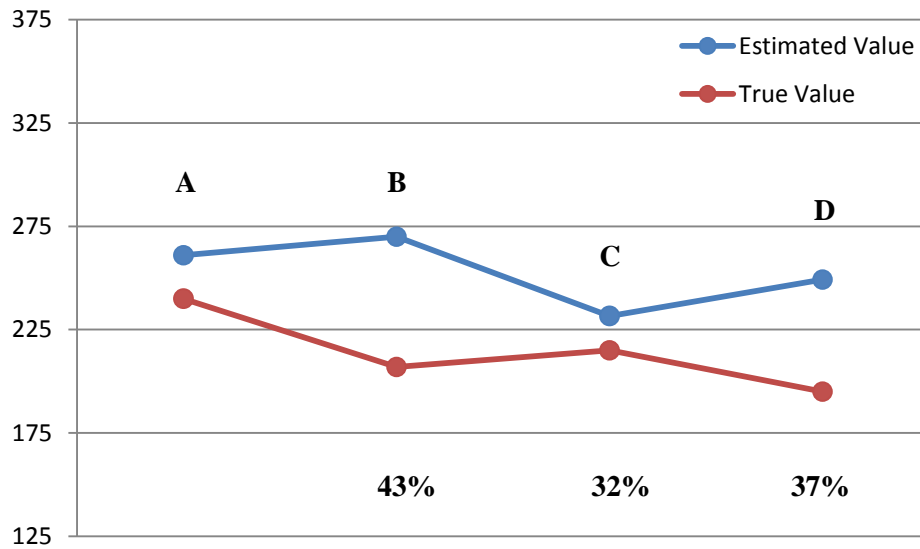


Figure 4.7: Experiment 4 - Evolution of average house price estimates

The mean estimate of all subjects for each of the four houses is presented along with the true values.

	Cheapest comparable property shown:	
	First	Last
n	54	60
True Value	£210,000	£210,000
Mean Estimate	£249,068	£251,273
<i>p-value</i>		0.284
Median	£251,500	£255,000
Mode	£255,000	£260,000
Std Dev	£20,761	£20,662
<i>F</i>		1.010

Figure 4.8: Experiment 5 – Ordering Effects

Subjects were asked to estimate the value of a property having seen four comparable properties. All properties were presented using a “virtual tour” with photographs. In treatment 1 (left-hand column) the cheapest property was presented first, with the most expensive last. In treatment 2 (right-hand column) this ordering was reversed, the most expensive property was first and the cheapest last. Descriptive statistics are presented above.