Mental Accounting and False Reference Points in Real Estate Investment Decision-Making

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This study examines a number of behavioral finance issues as they relate to real estate investments. We find a statistically significant degree of mental accounting at all points throughout the disposition effect curve when holding a real estate investment in isolation versus holding the asset as part of a mixed-asset portfolio. We also identify four distinct disposition curve shapes beyond the traditional "S-shaped" curve where investors are more willing to sell an asset that is in the gains domain. Further, we conclude that an investor's willingness to sell jumps by the greatest amount when going from zero return into profitable territory. Finally, this false reference point does take into consideration transaction costs.

Key words: mental accounting; false reference points; disposition effect; behavioral real estate.

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1. Introduction

Kahneman and Tversky's (1979) prospect theory describes how losses feel more painful to an investor than an equivalent gains feel good. Accordingly, the disposition effect describes how people are more willing to sell an investment at a gain than they are to sell investments at a loss, ceteris paribus. What results is a willingness to sell curve that is concave for returns above zero and convex below. Breaking even, or a zero return, is what is commonly referred to as a false reference point. If people were rational utility-maximizers, the decision to sell an asset would be independent of the price that was paid for the asset. The price paid in the past is a sunk cost, and should therefore be irrelevant to future buy/sell/hold decisions.

The literature is filled with transaction-based empirical evidence to suggest that investors regularly deviate from rationality in order to avoid experiencing regret – the pain associated with making a bad investment (Einio, Kaustia, and Puttonen, 2008; Genesove and Mayer, 2001; and Odean, 1998). The advantage to using transaction-based data is that researchers are able to observe how a person behaved in an actual investment situation. In this way, they can avoid the potential disconnect between how a person says they would behave in a hypothetical situation (stated preference) versus how they would actually behave in a real situation (revealed preference). The disadvantage to using transaction-based data is that researchers are only able to observe a single point along the "S-shaped" disposition effect curve. So, for a particular investor, we are able to know their (revealed) willingness to sell under only that exact set of specific circumstances.

In the current investigation, our purpose is to get an estimate at multiple points along the "S-shaped" disposition curve at the same point in time. To do this, it is not possible to use transaction-based data. Instead, we have devised an alternative framework where we present an investor with five scenarios. In all scenarios, there is a fixed expected future risk and return to holding the asset. What differs is the original purchase price in each case. The result is a return on the asset that covers the domain of both gains and losses, as well as a break-even point. Recall that for a rational decision-maker, the original purchase price should not matter because it is a sunk cost. That is, the investor's willingness to sell should be constant across all 5 scenarios.

Our results reveal that only 6.8% (36/533) of the sample exhibits complete rationality. In support of the extent literature, 74.9% (399/533) of the sample are more willing to sell as the return on the investment increases. Surprisingly, the "S-shaped" disposition curve does not hold for all investors. Specifically, 7.3% of the sample possesses a "U-shaped" curve. This means that their willingness to sell is higher or lower around their break-even point when compared to extreme gains and losses. We further consider demographics that might explain five uniquely independent disposition effect curves, but do not find significant explanatory power from these independent variables.

The second contribution of our study relates to false reference points. The inflection point along the disposition effect curve is hypothesized to occur at the origin. That is, investors have been found to behave differently while in the loss domain, than when they are in positive territory. We test for the identification of this false reference point in two ways. First, we consider the

inclusion of transaction costs. Because the transaction costs associated with owning common stock are trivial, we consider the holding of a real estate investment property. A typical real estate transaction involves a commission of 6-7% when all fees are considered. This gives us the rare opportunity to realistically consider transaction costs in the proper proportional context of the investment.

The second variable we utilize in examining false reference points is to consider the investment gain/loss, both in isolation and as part of an overall portfolio. Specifically, a second set of scenarios are presented to each investor where the value of their overall portfolio increased by $20,000 – the exact increment by which Scenarios 1 through 5 changes. Not coincidentally, $20,000 is also the exact sum off of all fees and commissions charged when selling the real estate investment. By having all these numbers be equal, we are able to use a triangulation technique to isolate the exact false reference point. We find that investor's willingness to sell jumps when moving into positive territory. Moreover, investors do consider transaction costs when (subconsciously) determining the shape of the disposition effect curve.

By presenting two sets of scenarios that differ by holding an asset in isolation versus holding the asset as part of a larger portfolio, we naturally create an opportunity to examine mental accounting. Mental accounting is said to be present when an investor's willingness to sell differs when considering the asset in isolation versus the willingness to sell as part of an overall portfolio. We demonstrate that investors within our sample do experience significant levels of mental accounting. Specifically, they are statistically significantly more willing to sell their real estate asset when it is held as part of a larger portfolio that has gone up in value. The aggregate

shape of the disposition curve is similar to the real estate in isolation case, but is significantly higher at all points along the curve when considered in a portfolio context.

2. Literature Review

2.1 Prospect Theory and the Disposition Effect

Prospect Theory holds that people's willingness to sell an asset is a function of whether or not that asset would currently sell at a loss or a gain. If the asset could be sold at a gain, an investor will be much more willing to sell. Conversely, if the asset resides in the loss domain, the investor would prefer to hold the asset until a time when the price increases enough for the investment to result in a profit. This is true even if the asset must be held for many years (Genesove and Mayer, 2001; and Shefrin and Statman, 1985). These tendencies are collectively referred to as the disposition effect.

Several studies have documented the disposition effect across a number of financial assets and contexts. Among the most well cited of these studies is Odean (1998) who showed that investors are twice as likely to sell stocks that have gone up in value over those that have gone down in value. The disposition effect has also been demonstrated in Kaustia (2010), Birru (2010), Einio, Kaustia, and Puttonen (2008), Grinblatt and Han (2005), Ivkovich, Poterba, and Weisbenner (2005), Grinblatt and Keloharju (2001), Shapira and Venezia (2001), Benartzi and Thaler (1995), and Heisler (1994).

2.2. False Reference Points

In studies of the disposition effect, the inflection point usually occurs at zero – or breaking even. In a behavioral context, this inflection point is known as a false reference point. But, inflection points do not always have to occur at zero. Baker, Pan, and Wurgler (2010) examine false reference points as they relate to mergers and acquisitions. When making successful bids, the authors identify as the false reference point the 52-week high stock price of the target firm. They find this arbitrary reference point to be relevant in the minds of both bidder and target shareholders.

In a real estate context, Einio, Kaustia, and Puttonen (2008) and Genesove and Mayer (2001) document people's tendency to sell their residence at a price not lower than their original purchase price. This result is not a function of holding period, which is a clear indication of a departure from rationality. Alternatively stated, homeowners are found to be willing to wait, say five years, for a home to increase by only $1,000, if that last $1,000 was needed to allow the home's selling price to exceed the original purchase price. Consider the meager rate of return associated with this decision and the irrationality of the lack of willingness to sell becomes clear. Einio, Kaustia, and Puttonen (2008) also suggest that having the purchase price as a false reference point can be detrimental even when the home is valued at slightly more than the false reference point. The reason is that homeowners are hypothesized to be willing to accept a lower than market bid as long as that lower than market bid even slightly exceeds the false reference point.

One explanation as to why the original purchase so often serves as the false reference point is that people are likely to recall the price they paid for an object. However, Seiler et al. (2008)

show false reference points can be introduced at any point throughout time. Consider a homeowner who strongly considered selling his home three years ago at a price that coincidentally is higher than the fair market value of that property today. Seiler et al. (2008) demonstrates that people will latch onto this new false reference point and experience the additional regret of having forgone the opportunity to sell at a higher than purchase price. It is reasonable to assume that the converse could be true as well. However, prospect theory would predict that the utility gained from not selling at a lower price in the past would be far outweighed by the utility loss from a failure to sell at a past higher price, all else constant.

2.3 Mental Accounting

Mental accounting refers to the inconsistent viewing of the value of money depending on where the money originated. A classic example involves the concept of "house money." Gamblers are risk averse when betting with the money they brought into the casino. However, if they are up $500, they consider the $500 to be "house money," and they are willing to take much riskier gambles with that money[1]. If $600 is lost on the next bet, the gambler will become more risk averse in his behavior because he is once again playing with his own money. Clearly, this is irrational behavior.

In a real estate context, Seiler and Seiler (2010) demonstrate how people who have experienced a loss within an asset class can mitigate regret aversion by instead thinking in terms of the return on their overall portfolio (which is higher in their study). By turning one's attention away from the losses experienced in one investment, the investor feels better about themselves, and

[1] They might well even become risk seeking in their betting patterns with "house money" (see Ali, 1977; and McGlothlin, 1956).

therefore derives more utility in the short-run. The authors recommend steering clear from this line of reasoning because avoiding regret through mental accounting will likely lead to greater biases in asset allocations which will likely lead to greater levels of unavoidable regret in the long-run.

3. Data

In order to test the extremely specific hypotheses set forth in this study, it was necessary to design our own experiment. The exact wording of the experiment and all included parameters are presented in the appendix. Briefly, we begin by presenting five scenarios to each investor. In all scenarios, the investor bought a home one year ago at a price that uniformly steps up by $20,000 in each scenario from $260,000 to $340,000. The current price of the property today is $300,000. This creates positions that include two losses, a zero return, and two gains. Additionally, a total cost to sell the investment property is provided as $20,000 – the exact distance between each scenario. As such, the investor's willingness to sell is captured relative to both gross and net returns. Willingness to sell is measured on a 9-point scale.

Looking forward, we hold constant all investor's expectation over the coming year both in terms of risk and return. Specifically, investors believe there is a 50% chance that the property will increase in value by $20,000 and a 50% probability it will decrease in value by $20,000. Given real-world alternative investment options, one might think that the expectation of a zero return with positive risk would render this a relatively unattractive investment to hold. However, because there is a significant cost to dispose of the asset (e.g. $20,000), we cannot state the number between 1 and 9 that would correspond to a rational person's current willingness to sell.

What rational utility maximization does predict, however, is that whatever value an investor selects between 1 and 9 should be the same amongst all five scenarios. Alternatively stated, the purchase price is a sunk cost, and should be irrelevant to an investment decision to be made today.

Question 2 involves the same five scenarios. The difference is that now the real estate investment is being held as part of a larger portfolio that has gone up in value by $20,000. This number corresponds to exactly a one scenario change. This allows us to compare reference points consistently throughout. By presenting the exact same material in isolation and in the context of an overall portfolio, we are able to examine mental accounting as well. If mental accounting is not present, we should observe the exact same willingness to sell values in question 2 as were observed in question 1.

One common drawback to experimental research is the frequent reliance on student samples. That is, students represent a convenient and inexpensive source of data for researchers. We avoid the temptation to take this short cut, and instead collect our data directly from actual real estate investors. We are in the fortunate position to have cultivated a national network of existing homeowners who have been previously identified as being willing to answer questions relating to many different aspects of real estate. In our current investigation, we pulled into our sample only those homeowners who do not occupy the property they own. Alternatively stated, we sampled only actual owners of investment real estate properties. The reason we are focused solely on investors in real estate, as opposed to owner occupants (those who live in the house they own) is because owner occupants have a number of additional reasons not to sell their

homes. To owner occupants, the choice to sell a home is a function of much more than future expected risk and return. Owner occupants might decline to sell because they view the home as both a consumption good as well as an investment. To avoid the contaminating effect of owner occupant's view of housing as a consumption good, we restrict our sample to pure real estate investors.

All experimental data are collected via an Internet-based survey of our existing homeowner pool from November 12, 2009, through January 4, 2010. As can be seen in the appendix, there are two questions inserted throughout the survey that ensure the survey was completed by a respondent who carefully read each question. We accomplish this safety check by periodically asking the investor to answer a certain number (say, 3) for the question. Later, we have them answer a question using a different number (say, 8). If respondents do not get these two answers correct, they clearly are not reading the questions carefully enough to provide us with meaningful data. All such respondents are jettisoned from the sample. Our final, clean sample consists of 533 usable responses.

4. Results

(Insert Table 1 here)

Part A of Table 1 shows the loss aversion scores associated with questions 1 (real estate in isolation) and 2 (real estate as part of an overall portfolio). Paired-Samples T-statistics are reported for each average score as we move from one scenario to the next. In all eight cases, willingness to sell scores increase significantly in both questions 1 and 2. At the bottom of Part

A, the difference between average answers to questions 1 and 2 is captured in the row titled "Degree of Mental Accounting." Differences greater than zero signify the extent to which the average investor possesses mental accounting. To identify statistical differences, Paired-Samples T-tests are again performed. In all four scenario changes, statistically significant differences are observed. The greatest difference in mental accounting occurs in scenario 4, which is associated with moving into the gain domain (gross) or reaching the zero return level (net commission and other selling expenses).

In Part B of Table 1, seven demographic characteristics of each investor are presented in dichotomous form. Numbers in bold indicate statistically significant differences at a minimum of the 10% level. All tests are based on Independent-Samples T-tests after conducting a Levene test for equality of variance. Part C contains metric representations of the demographic variables (where appropriate). Bold numbers signify which Pearson Product Moment correlation coefficients are significant at a minimum of the 10% level. The take away from Parts B and C is that, based on an initial, cursory glance at demographics, they appear to have little association with willingness to sell and degree of mental accounting.

(Insert Table 2 here)

Common discussions of the "S-shaped" disposition effect curve are in reference to the average investor and his willingness to sell over losses and gains. But, there is nothing to say that everyone will share the same "S-shape" preferences. Moreover, theory does not hold that everyone's curve will even be "S-shaped." In Table 2, we consider the possible distinct shapes of

those in our sample. The Shape 1 category includes those who indicated a greater likelihood of selling as the return on their investment increased. Shape 2 includes those who indicated a greater likelihood of selling as the return on their investment decreased. Shape 3 consists of those with a greater likelihood of selling at extreme losses and gains (what we refer to as a "U-shaped" preference function opening to the right). Shape 4 is composed of those with a greater likelihood of selling at nearer the investment's break-even point (what we refer to as a "U-shaped" preference function opening to the left). Shape 5 represents rational investors who ignore the purchase price, and are therefore characterized by a constant likelihood of selling across all scenarios. Finally, Shape 6 is a collection of all other shapes and indiscernible patterns.

Shape 1, which is consistent with the traditionally discussed disposition effect, is by far the most common shape (74.9%). This result was expected not only based on theory, but also because of the results already presented in Table 1. No doubt, they drive the overall observed pattern of preferences as is true in other studies. What is revealing from this table is that not everyone is characterized by the traditional "S-shape." Instead, a small percentage (less than 5%) experiences the exact opposite trend (Shape 2). Another 6.8% of the sample experience a "U-shaped" preference set opening either to the right or left. The results are remarkably independent of demographic characteristics whether measured as metric or non-metric data.

(Insert Table 3 here)

More formal tests are presented in Table 3. Here, the degree of mental accounting is used as the dependent variable, while all but one of the shape categories, as well as respondent demographic

data, compose the list of independent variables. In column (1), only the shapes are considered. Interestingly, four of the five shape dummies are significant. Only demographics are included in column (2). Consistent with the preceding tables, demographics do not explain our results. In column (3) shapes and demographics are included. Shapes remain significant, while demographics remain non-significant.

Since rationality is shown by those composing Shape 5, we isolate this group in column (4) to see who is responsible for aggregated changes in willingness to sell when going from question 1 to question 2. The only variable of significance is education, and even that only comes in at the 90% level. Column (5) shows a regression estimated on all remaining shape categories. No demographic data is significant here. The conclusion to be drawn from this table is that degree of mental accounting is explained not by standard demographic data, but instead by the shape of the disposition effect preference curve underlying each respondent.

(Insert Table 4 here)

In Table 4, the question of false reference points is examined. This table shows the number of people who experienced a unique (Part A) maximum increase in willingness to sell when moving from one scenario to the next in the real estate in isolation case. That is, we calculate the change in absolute value when moving from scenario 1 to scenario 2, and then compare that to the absolute value when moving from scenario 2 to 3, and so forth for all four changes[2]. If the highest number is observed only once, we consider that to be a unique maximum jump. Part B

[2] It is necessary to specify the maximization function as an absolute value because, as demonstrated in Table 2, the willingness to sell can decrease or increase as the return on the asset increases.

does the same, but allows for unique and shared maximum increases in willingness to sell. Finally, Parts C and D mimic Parts A and B, except movements are tracked for the overall portfolio, not just for real estate when held in isolation.

Parts A and B convey that it is moving from position 4 to 5 that results in the maximum jump in willingness to sell. This is true whether we consider unique or shared maximums. Matching this back to question 1, this corresponds with the investor going from breaking even in net terms to getting into positive territory. Turning to Parts C and D of Table 4, we observe that the maximum jump occurs exactly one scenario earlier (when moving from scenario 3 to 4). This is consistent with Parts A and B because in question 2, the investor started off exactly $20,000 (or one position) ahead of where they were in question 1. The conclusions to be drawn are that investor's preferences jump when moving into positive ground AND they consider transaction costs as well. This is a pure contribution to the overwhelming majority of studies in the area of false reference points that do not consider transaction costs.

5. Conclusions

In this study, we investigate the shape of the disposition effect curve at multiple points along the curve at the same point in time. We find that while roughly three quarters of our sample have the expected "S-shaped" disposition curve, the remainder does not. Instead, the S-shaped" curve is either inverted altogether or is a "U-shaped" curve opening in either direction characterizes investor willingness to sell preferences.

We also examine the degree of mental accounting when moving from holding a real estate investment in isolation versus holding the asset as part of a mixed-asset portfolio. Our results demonstrate that mental accounting is commonplace amongst participants in our sample. Finally, we examine false reference points. Past studies suggest that people focus on breaking-even as a false reference point. However, the extent literature is mostly silent on the inclusion of transaction costs and the role they play in willingness to sell. Due to our unique experimental design, we are able to consider commissions as part of our degree of mental accounting tests. We find that people do experience a greater willingness to sell when investments cross the break-even threshold and move into positive territory and that this preference set does in fact consider the total costs to dispose of the asset. That is, people consider their disposition decision in net, not gross, terms.

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Table 1. Willingness to Sell Scores, Degree of Mental Accounting by Demographic Characteristics and Scenario

This table shows loss aversion scores for each scenario when the real estate asset is held in isolation and when it is held as part of an overall portfolio (Part A). The difference measures the Degree of Mental Accounting. Part B shows loss aversion scores and tests for differences in mean scores between each demographic characteristic when represented as a dummy variable. Correlations for metric demographic characteristics are reported in Part C. Demographic variables include *gender, marital status, ethnicity, children, children under 18, net worth, education, age,* and *income*.

	Scenario				
	1	**2**	**3**	**4**	**5**
A: Willingness to Sell Scores					
Real Estate in Isolation	2.14	2.36	2.95	4.02	5.73
t-stats	5.89***	10.13***	13.85***	20.66***	
Overall Portfolio	2.27	2.53	3.42	4.73	5.86
t-stats	6.64***	12.76***	16.46***	16.91***	
Degree of Mental Accounting (difference)	.14**	.18***	.48***	.72***	.13*

B: Demographic Characteristics: By (a) Real Estate in Isolation and (b) Overall Portfolio

	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Women	2.05	2.18	2.26	2.46	2.91	2.33	3.96	4.75	5.79	5.92
Men	2.17	2.34	2.41	2.60	2.96	3.48	4.06	4.72	5.68	5.82
Single	2.22	2.30	2.49	2.59	**3.13**	3.47	4.09	4.83	**5.93**	5.99
Married	2.06	2.25	2.24	2.49	**2.79**	3.39	3.95	4.65	**5.56**	5.76
Caucasian	2.25	2.33	2.46	2.67	3.23	3.69	4.25	**5.09**	**6.10**	6.17
Non-Caucasian	2.11	2.26	2.33	2.50	2.88	3.36	3.95	**4.64**	**5.63**	5.79
Children	2.11	2.18	2.27	2.45	**2.80**	3.33	3.88	4.71	5.59	5.79
No Children	2.17	2.38	2.46	2.63	**3.11**	3.54	4.17	4.75	5.90	5.95
Children (<18)	2.12	2.22	2.28	2.49	2.81	3.35	3.87	4.67	**5.51**	5.72
No Children (<18)	2.14	2.31	2.42	2.57	3.05	3.48	4.13	4.78	**5.91**	5.98
Negative Net Worth	2.00	2.23	2.42	2.53	3.02	3.56	4.25	5.14	6.13	6.17
Positive Net Worth	2.15	2.28	2.35	2.54	2.94	3.41	3.98	4.68	5.68	5.82
No College Degree	2.20	2.37	2.37	2.65	2.87	3.44	3.87	4.89	5.82	5.82
College Degree	2.11	2.24	2.36	2.50	2.97	3.42	4.06	4.69	5.70	5.88

C: Demographic Characteristics: Correlations by (a) Real Estate in Isolation and (b) Overall Portfolio

Children	-.03	-.04	-.04	-.03	-.05	-.04	-.05	.02	-.03	-.01
Children (<18)	-.01	-.01	-.03	-.01	-.02	-.02	-.04	-.02	-.05	-.03
Age	-.02	-.05	-.04	-.05	**-.07**	-.07	-.07	-.07	**-.11**	**-.12**
Net Worth	.02	.01	-.03	.00	-.02	-.04	-.07	-.07	**-.09**	-.05
Income	-.02	-.03	-.01	-.05	-.02	-.02	-.03	-.03	-.06	.01

Notes:

1. The test statistics reported in Part A are from Paired Samples T-Tests. * indicates significance at the 10% level; ** indicates significance at the 5% level; *** indicates significance at the 1% level.
2. Independent Samples T-Tests were performed in Part B. Levene statistics were first computed in order to make the correct assumption regarding homogeneity of variance. Bold indicates significance at a minimum of the 10% level in Parts B and C.

Table 2. Disposition Effect Shapes and Degree of Mental Accounting by Demographic Characteristics for Real Estate in Isolation

This table parses the sample based on the shape of the Degree of Loss Aversion curve across all five scenarios when real estate is considered in isolation. Part A reports the relative frequencies with which each of the demographic characteristics (when represented as dummy variables) appear in each shape. Relative frequencies for metric demographic characteristics are shown in Part B. A relative frequency of 1.0 means the same percentage is observed within the sub-sample as is observed in the overall sample. Demographic variables include *gender, marital status, ethnicity, children, children under 18, net worth, education, age,* and *income*.

	Distribution Shape of Degree of Loss Aversion						
	1	**2**	**3**	**4**	**5**	**6**	**Total**
Sample Size	399	26	23	16	36	33	**533**
Average Degree of Mental Accounting	0.368	-0.600	0.304	1.225	0.494	-0.030	0.328
A: Demographic Characteristics (dummy): For Real Estate in Isolation							
Women	1.034	1.101	0.976	0.746	0.795	0.868	**223**
Men	0.975	0.927	1.017	1.184	1.148	1.096	**309**
Single	1.009	1.339	0.946	0.816	0.786	0.989	**245**
Married	0.993	0.712	1.046	1.157	1.182	1.009	**288**
Caucasian	1.013	1.009	0.978	0.781	1.041	0.909	**425**
Non-Caucasian	0.946	0.963	1.089	1.879	0.835	1.366	**106**
Children	1.000	0.717	1.134	1.165	1.087	0.960	**286**
No Children	1.001	1.328	0.844	0.809	0.899	1.046	**247**
Children (<18)	0.983	0.785	1.183	1.134	1.197	0.962	**235**
No Children (<18)	1.013	1.169	0.855	0.894	0.845	1.030	**298**
Negative Net Worth	1.002	0.961	0.000	1.562	1.388	1.009	**64**
Positive Net Worth	1.000	1.005	1.136	0.923	0.947	0.999	**469**
No College Degree	0.945	1.000	1.507	1.083	1.083	1.182	**123**
College Degree	1.017	1.000	0.848	0.975	0.975	0.945	**410**
B: Demographic Characteristics (metric): For Real Estate in Isolation							
Children	1.009	0.706	1.037	1.266	1.092	0.862	
Children (<18)	0.987	0.753	1.078	1.221	1.195	1.026	
Age	0.993	1.041	0.931	1.020	1.087	0.992	
Net Worth	0.992	1.093	1.060	0.881	1.020	1.020	
Income	1.000	0.925	0.930	1.017	1.100	1.000	

Notes:

1. The Shape 1 category includes those who indicated a greater likelihood of selling as the return on their investment increased. Shape 2 includes those who indicated a greater likelihood of selling as the return on their investment decreased. Shape 3 consists of those with a greater likelihood of selling at extreme losses and gains (what we refer to as a "U-shaped" preference function opening to the right). Shape 4 is composed of those with a greater likelihood of selling at nearer the investment's break-even point (what we refer to as a "U-shaped" preference function opening to the left). Shape 5 represents rational investors who ignore the purchase price and therefore are characterized by a constant likelihood of selling across all scenarios. Finally, Shape 6 is a collection of all other shapes and indiscernible patterns.

Table 3. OLS Estimates of Explaining Variations in the Degree of Mental Accounting: by Shape and Demographic Characteristics

This table shows the results from a series of regressions that attempt to identify the determinants of the Degree of Mental Accounting when considering real estate in isolation versus real estate as part of an overall portfolio. Column (1) includes dummy variables for all (but one) of the shapes. Column (2) considers only the demographic variables, while column (3) combines both shapes and demographics. Shape 5 is separately represented in column (4), while all others shapes are examined in column (5). Demographic variables include *gender, marital status, ethnicity, children under 18, education, age, net worth,* and *income*.

	(1) Shapes Only	**(2) Demographics Only**	**(3) Shapes and Demographics**	**(4) Shape 5 Only**	**(5) All other Shapes**
Constant	-.030(.184)	.530(.234)**	.138(.286)	2.691(1.257)**	.412(.241)*
Shape 1	.399(.191)**		.418(.191)**		
Shape 2	-.570(.277)**		-.549(.277)**		
Shape 3	.335(.286)		.419(.290)		
Shape 4	1.255(.321)***		1.273(.321)***		
Shape 5	.525(.254)**		.540(.254)**		
Gender		.016(.096)	-.009(.094)	-.092(.479)	.018(.099)
Marital Status		.196(.115)*	.153(.112)	.320(.542)	.167(.118)
Ethnicity		-.011(.119)	.001(.116)	.256(.554)	-.034(.122)
Children < 18		-.006(.051)	-.009(.049)	-.133(.238)	.009(.052)
College Degree		-.180(.116)	-.178(.113)	-.948(.520)*	-.121(.120)
Age		-.005(.005)	-.005(.005)	-.039(.026)	-.004(.005)
Net Worth		.006(.030)	.027(.030)	.107(.124)	.011(.032)
Income		-.004(.035)	-.021(.034)	-.170(.171)	.005(.036)
Sample Size	532	526	526	35	490
$\overline{R}^2$	.066	.011	.077	.230	.009
F-Test	7.40***	0.72	3.31***	1.01	0.52

Notes:
1. * indicates significance at the 10% level; ** indicates significance at the 5% level; *** indicates significance at the 1% level.
2. Standard errors are given in parentheses.
3. Standard errors were computed using White's heteroskedasticity robust covariance matrix. Null hypothesis: homoskedasticity.

Table 4. Reference Point Unique and Shared Maximums by Shape of the Disposition Effect Curve

This table shows the number of people who experienced a unique (Part A) maximum increase in willingness to sell when moving from one scenario to the next in the real estate in isolation case. Part B does the same, but allows for unique and shared maximum increases in willingness to sell. Parts C and D mimic Parts A and B, except movements are tracked for the overall portfolio.

	Changing to Scenario Number					
	2	**3**	**4**	**5**	**No Max**	**Total**
A: Real Estate in Isolation: Number of unique maximum Reference Points						
Shape 1	2	27	87	168	115	399
Shape 2	2	7	5	5	7	26
Shape 3	0	2	1	10	10	23
Shape 4	0	4	5	1	6	16
Shape 5	0	0	0	0	36	36
Shape 6	4	2	5	9	13	33
Total	**8**	**42**	**103**	**193**	**187**	533
B: Real Estate in Isolation: Number of unique or shared maximum Reference Points						
Shape 1	36	97	116	266	49	399
Shape 2	4	13	11	8	2	26
Shape 3	7	9	6	15	0	23
Shape 4	4	10	12	2	2	16
Shape 5	0	0	0	0	36	36
Shape 6	11	9	14	18	0	33
Total	**62**	**138**	**159**	**309**	**89**	533
C: Overall Portfolio: Number of unique maximum Reference Points						
Shape 1	4	69	108	79	139	399
Shape 2	2	9	5	3	7	26
Shape 3	0	5	5	4	9	23
Shape 4	0	2	5	0	9	16
Shape 5	1	1	4	1	29	36
Shape 6	1	6	10	4	12	33
Total	**7**	**92**	**134**	**94**	**206**	533
D: Overall Portfolio: Number of unique or shared maximum Reference Points						
Shape 1	50	159	198	170	50	399
Shape 2	6	15	12	5	1	26
Shape 3	7	11	9	10	1	23
Shape 4	4	10	13	5	2	16
Shape 5	1	3	3	4	28	36
Shape 6	9	13	18	10	2	33
Total	**77**	**211**	**253**	**204**	**84**	533

Notes:

1. The Shape 1 category includes those who indicated a greater likelihood of selling as the return on their investment increased. Shape 2 includes those who indicated a greater likelihood of selling as the return on their investment decreased. Shape 3 consists of those with a greater likelihood of selling at extreme losses and gains (what we refer to as a "U-shaped" preference function opening to the right). Shape 4 is composed of those with a greater likelihood of selling at nearer the investment's break-even point (what we refer to as a "U-shaped" preference function opening to the left). Shape 5 represents rational investors who ignore

the purchase price and therefore are characterized by a constant likelihood of selling across all scenarios. Finally, Shape 6 is a collection of all other shapes and indiscernible pattern.

APPENDIX

1. Assume you bought a home as an investment property (you do not live in the home) one year ago at a price associated with each of the following 5 scenarios. Today, the price of the home is exactly $300,000. If you were to sell the home today, you would have to pay a total of $20,000 in realtor fees, closing costs, etc.

Over the next 12 months, you believe there is a 50% chance of the home increasing in price by $20,000 and a 50% chance the price will decrease by $20,000. **How likely are you to sell this investment property today?** Please circle a number in each of the five rows in the last column where "1" = Definitely would NOT sell the home and "9" = Definitely would sell the home.

Scenario	Price you paid One year ago	Current Price of the home	Gross Gain/Loss associated with selling	Total cost to sell (Realtor fees, closing costs, etc.)	Net Gain/Loss associated with selling	Likelihood of you selling today (1 = Definitely will NOT sell; 9= Definitely will sell)
1	$340,000	$300,000	- $40,000	- $20,000	- $60,000	1 2 3 4 5 6 7 8 9
2	$320,000	$300,000	- $20,000	- $20,000	- $40,000	1 2 3 4 5 6 7 8 9
3	$300,000	$300,000	$ 0	- $20,000	- $20,000	1 2 3 4 5 6 7 8 9
4	$280,000	$300,000	+ $20,000	- $20,000	$ 0	1 2 3 4 5 6 7 8 9
5	$260,000	$300,000	+ $40,000	- $20,000	+ $20,000	1 2 3 4 5 6 7 8 9

Please answer number 3 for this question.

1 2 3 4 5 6 7 8 9

Now assume your investment in stocks increased in value by $20,000 over the same period of time as your real estate investment lost money (last year). Using the same information as before, please indicate on a scale from 1 (Definitely would NOT sell) to 9 (Definitely would sell) **how likely you are to sell your investment property today** by circling a number in each of the 5 rows in the last column.

Scenario	Price you paid One year ago	Current Price of the home	Gross Gain/Loss associated with selling	Total cost to sell (Realtor fees, closing costs, etc.)	Net Gain/Loss associated with selling	Profit made in the stock market over the same period	Combined Net Profit from all investments over the period	Likelihood of you selling today (1 = Definitely will NOT sell; 9= Definitely will sell)
1	$340,000	$300,000	- $40,000	- $20,000	- $60,000	+ $20,000	- $40,000	1 2 3 4 5 6 7 8 9
2	$320,000	$300,000	- $20,000	- $20,000	- $40,000	+ $20,000	- $20,000	1 2 3 4 5 6 7 8 9
3	$300,000	$300,000	$ 0	- $20,000	- $20,000	+ $20,000	$ 0	1 2 3 4 5 6 7 8 9
4	$280,000	$300,000	+ $20,000	- $20,000	$ 0	+ $20,000	+ $20,000	1 2 3 4 5 6 7 8 9
5	$260,000	$300,000	+ $40,000	- $20,000	+ $20,000	+ $20,000	+ $40,000	1 2 3 4 5 6 7 8 9

Please share the following demographic information about yourself:

Gender: Male _____ Female _____
Number of children: _____ children
Number of children below age 18: _____ children
What is your Age? _____

Please answer number 8 for this question.

1 2 3 4 5 6 7 8 9

Current Marital Status: Single ____ Married ____ Divorced ____ Widowed ____
Ethnicity: _____ African American ____ Asian
_____ Caucasian ____ Hispanic
_____ Other _____

Highest Education Attained
(Please check the appropriate box)
_____ Ph.D.
_____ Master's Degree
_____ Bachelor's Degree
_____ Some college
_____ High School Diploma
_____ Less than High School Diploma

Your Annual Income Level
(Please check the appropriate box)
_____ Under $20,000
_____ $20,001 - $40,000
_____ $40,001 - $60,000
_____ $60,001 - $80,000
_____ $80,001 - $100,000
_____ $100,001 - $120,000
_____ Over $120,000

What is your total Net Worth? Net Worth is defined as total assets (stocks, bonds, price of your home, retirement accounts, etc.) minus total liabilities (outstanding mortgage balance, credit card debt, student loans, auto loans, etc.)

_____ Less than -$400,000
_____ -$400,000 to -$200,001
_____ -$200,000 to $0
_____ $1 to $200,000
_____ $200,001 to $400,000
_____ $400,001 to $600,000
_____ $600,001 to $800,000
_____ $800,001 to $1,000,000
_____ Over $1,000,000