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An experimental examination of the house money effect in a multi-period setting

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Abstract There is evidence that risk-taking behavior is influenced by prior monetary gains and losses. When endowed with house money, people become more risk taking. This paper is the first to report a house money effect in a dynamic, financial setting. Using an experimental method, we compare market outcomes across sessions that differ in the level of cash endowment (low and high). Our experimental results provide support for a house money effect. Traders' bids, price predictions, and market prices are influenced by the amount of money that is provided prior to trading. However, dynamic behavior is difficult to interpret due to conflicting influences.

Keywords House money · Prospect theory

JEL Classification C91 · C92 · D80

Over the last two decades evidence from economics and psychology experiments has had a significant impact on financial models of asset pricing. Perhaps the most notable influence is Kahneman and Tversky's (1979, 1992) prospect theory, which provides a descriptive model of decision-making under risk. According to the model, people derive utility from

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gains and losses in wealth, rather than from the absolute level of wealth. For moderate and high probability gains (losses), people are risk averse (risk seeking).[1] Although aspects of prospect theory are increasingly applied in efforts to understand asset pricing,[2] Tversky and Kahneman (1981) themselves recognize that their theory was developed for one-shot gambles. Prospect theory is about individual decision-making, rather than asset pricing in dynamic financial markets. As Hirshleifer (2001, p. 1577) notes, translating evidence from psychology experiments to financial decision-making is not at all obvious. In this paper we provide experimental evidence on behavior in a market setting as a guide for future theoretical work.[3]

As financial markets are inherently dynamic, application of any theory of individual behavior to realistic financial settings requires further evidence concerning decision-making in sequential contexts. Thaler and Johnson (1990) provide some evidence in their experimental examination of how individual behavior is affected by prior gains and losses. Importantly, they conclude that prior outcomes influence real monetary decisions. An initial loss can cause an increase in risk aversion such that prior losses reduce risk-taking behavior.[4] In contrast, after a prior gain people are more risk seeking. This is referred to as a "house money" effect, in reference to casino gamblers who are more willing to risk money that was recently won.

At first consideration Thaler and Johnson's evidence may appear to contradict prospect theory because it suggests risk-seeking behavior after a windfall, whereas prospect theory suggests risk aversion in the domain of gains. However, a house money effect is not inconsistent with prospect theory because prospect theory was developed for one-shot gambles. Instead a house money effect can be taken as evidence that sequential gambles are segregated, rather than integrated. Integration implies that the outcomes of successive gambles are merged whereas with segregation the outcomes may be evaluated separately.

The evidence provided by Thaler and Johnson provides important insight into how individuals make sequential decisions. People do not necessarily merge the outcomes of distinct gambles. Others also document a house money effect on individual behavior (Battalio et al., 1990; Gertner, 1993). However, in public good experiments, Clark (2002) reports no evidence of house money effects on peoples' choices of voluntary contributions. Our paper is the first to empirically examine house money effects in a market setting. Our paper shares a similar goal with Clark (2002) in that we examine whether a reported individual behavior is observed in another important context. Though we do not test the implications of prospect theory per se, our results shed light on the appropriateness of translating this theory of individual behavior to a market setting.

We examine sequential behavior in a real financial setting in which traders' decisions affect their monetary earnings as well as the earnings of other participants. An experimental method affords control over extraneous factors and allows us to gain insight into the market outcomes that result from the complex interactions of individuals making financial decisions. In our experiment we examine the impact of the house money effect on asset pricing in a multi-period setting. The risky asset provides a monetary payout that is determined by the toss of a die. Each session includes several 3-period markets. The results indicate that the level of endowment affects market outcomes. Traders who are given a greater windfall of

[1] For low probability events (such as probabilities less than 0.10), prospect theory predicts risk seeking for gains and risk aversion for losses.

[2] Examples include Barberis and Huang (2001, 2001, 2002, 1997), and Benartzi and Thaler (1995).

[3] Vernon Smith (1994) argues that significant observation generally precedes well-formulated scientific theory.

[4] Thaler and Johnson (1990) find that in some cases, people are risk-seeking after a prior loss. A subject with a prior loss will take a gamble that offers the opportunity to break-even.

income at the start of a market session bid higher in order to acquire the asset, and thus, the resultant market prices are significantly higher. Moreover, prices remain higher over the entirety of the three-period markets.

Because of the sequential nature of our market experiment, we also examine how price dynamics evolve after changes in the wealth of the market. Aspects of prospect theory are embedded in financial models, yet our understanding of sequential behavior in a market setting is far from complete. For example, in the model put forth by Barberis et al. (2001) investors derive utility from consumption and changes in financial wealth. Investors are loss averse so that they are more sensitive to decreases than to increases in wealth and, thus, prior outcomes affect subsequent behavior. According to Barberis, Huang, and Santos's model, people are less risk averse after stock prices increase because the gains cushion subsequent losses, whereas after stock prices fall, people are concerned about further losses and become more risk averse. We empirically examine whether the behavior of traders in our markets is consistent with higher prices after increases in wealth and, conversely, lower prices after decreases in wealth.

Some recent experimental research has examined implications of prospect theory in market and individual environments.[5] In exchange economies in which only losses can occur, Myagkov and Plott (1997) document risk seeking behavior in losses for individuals and markets, consistent with prospect theory. However, when outcomes involve gains *and* losses, Battalio et al. (1990) report individual behavior that is inconsistent with prospect theory.[6] People can gain or lose when transacting in financial assets and strictly positive or negative outcomes are uncommon. Dynamic behavior in our experimental financial markets with mixed outcomes appears to be influenced by competing forces. In general, we find that changes in wealth have no consistent, significant effect on market pricing.

Our results suggest that applying aspects of prospect theory to model dynamic financial market behavior is problematic. Prospect theory was developed as an alternative to expected utility theory because psychology and economics experiments document violations of expected utility theory (Rabin and Thaler, 2001). Our results can be interpreted as evidence that risk aversion decreases with found money. We do not provide evidence on whether prospect theory or expected utility theory better describes behavior in our experiment. Rather, we document an observed individual behavior in a market setting. Individuals are more risk taking after a windfall gain. Insight into the house money effect is important for future asset pricing experiments as well as the theoretical literature.

The remainder of the paper is organized as follows. Section 1 describes the experimental method and predictions. Section 2 provides the experimental results. Section 3 contains a discussion and concluding remarks.

1. Experimental method and predictions

We conduct nine experimental sessions, each consisting of a series of markets. In each market eight participants compete via a sealed-bid auction to acquire an asset having a one-period life. The asset is referred to as a stock. The experimental design, to be described subsequently, is summarized in Table 1.

[5] See Edwards (1996) for a review of the empirical evidence on prospect theory.

[6] In a recent paper, Levy and Levy (2002) argue that their evidence violates prospect theory. However, the evidence they report is consistent with prospect theory when the importance of the theory's probability weighting function is recognized (Wakker, 2003).

Table 1 Experimental design

Treatment	Session	Number of traders	Number of markets	Number of periods	Endowment of cash ($)
Low endowment	1	8	6	3	60
	2	8	6	3	60
	3	8	6	3	60
	4	8	6	3	60
	5	8	6	3	60
High endowment	6	8	8	3	75
	7	8	8	3	75
	8	8	8	3	75
	9	8	8	3	75

This table summarizes the experimental design. Across the sessions we vary the initial endowment: low ($60) and high ($75). Each session includes eight participants who bid to acquire a stock whose life is limited to a single period. Sessions include six or eight markets with three trading periods.

1.1. The experimental environment

Across the sessions we vary the initial endowment: low versus high. Participants are endowed with $60 in sessions 1–5, referred to as the low endowment treatment. Participants' endowments are increased to $75 in sessions 6–9, referred to as the high endowment sessions. Across all sessions, the endowment is house money in that it is money participants keep and is not returned to the experimenter. The endowments are high relative to the opportunity cost of a student's time in order to ensure that the endowment is valued and viewed as significant "found money" by the participants.[7]

Each of the first five sessions includes six three-period markets, and the last four sessions include eight three-period markets. Otherwise, the markets in all sessions are both identical and simple. At the beginning of each market, participants are endowed with cash and then four single-period shares of a stock are allocated among the eight participants using a Vickrey (1961) auction. At period-end the stock pays a dividend of either $0 or $40, each with equal chance of occurrence. Hence, the expected payoff is $20 per period. The four highest bidders purchase the asset at the fifth highest bid. Clearly the wealth of those purchasing shares is affected. As long as the market price is between $0 and $40, trader wealth is negatively (positively) affected when the dividend is $0 ($40). By obvious extension, the wealth of a market as a whole is similarly affected because half of all traders (four out of eight) have their wealth affected (negatively *or* positively) and the other half experience no change.

1.2. Experimental predictions

The purpose of the experiment described above is to test for a house money effect in a dynamic market setting. According to the house money effect, people are more willing to take risk after prior gains. To examine the impact of prior gains, we compare behavior across our low endowment (1–5) and high endowment (6–9) sessions. In our experimental setting

[7] The opportunity cost of a student's time serving as a research assistant is approximately $10 per hour, or $25 per session as the sessions ran for about two and one half hours.

market valuations are revealed using an *n*th price or Vickrey auction. Vickrey (1961) argues that it is in the interest of bidders to bid their willingness to pay in this type of auction. With larger monetary endowments, or more house money, market valuations will reflect greater risk taking. Traders with larger endowments will be more willing to gamble to acquire the stock, which translates into a higher market price for the stock. On this basis market prices are expected to differ across the two treatments.

Hypothesis 1. The market price is higher when traders' endowments are larger.

In testing hypothesis 1 we compare market prices across the low and high endowment treatments.

Subsequent behavior is examined by looking at price changes in response to changes in market wealth. As a subset of the traders acquires the stock and the stock pays a positive dividend with a probability of 50%, incorporating the prior evolution of the market is important. Barberis et al. (2001) assert that people are less risk averse as their wealth rises because prior gains cushion subsequent losses.

Hypothesis 2. The average price is increasing in the wealth of the market.

In testing hypothesis 2, we focus on how market prices respond to prior changes in market wealth.

1.3. Experimental procedures

All participants are university students in their third or fourth year of study. All are business majors currently enrolled in or who have successfully completed an average of 8.3 finance and economics courses. The average age of participants is 21.9 years and none took part in more than one session. At the beginning of each session, participants receive a set of instructions and follow along as an experimenter reads aloud.[8] Sessions 1–5 (6–9) consist of six (eight) three-period markets.

Participants are given tickets on which to record their bids for the stock. Prior to the beginning of each market period, participants are also asked to predict the purchase price of the stock for the upcoming period. Participants record their predictions on the confidential bid tickets. Participants are instructed that the roll of a die determines the dividend paid to asset holders at period end. If the roll of the die results in 1, 2, or 3, the dividend is \$0, otherwise the dividend is \$40, so that each dividend is equally likely. Participants are invited to examine the die at any time.

The bidding procedure works as follows. All eight participants submit sealed bids for the stock by recording the amount of money they are willing to pay for one share of stock. The four shares are allocated to the four highest bidders at the fifth highest bid. After the shares are allocated, one of the traders is specifically asked to observe the experimenter toss the die to ensure confidence that the dividend payment is randomly determined.

At the conclusion of the first period, the second period commences and four shares of an identical single-period stock are auctioned off in the exact same fashion. A trader's cash balance is carried forward across periods within a market. As before, subsequent to allocation using a Vickrey auction, a die roll determines payout. A third period follows with identical

[8] The instructions are available upon request.

procedures. The advantage of this approach is that it is possible to generate a reasonable number of identical dividend evolutions.[9]

Six or eight markets are conducted in a similar manner bringing the session to a close. The traders' endowments are reinitialized at the beginning of each market. Subjects are told at the outset that they will be paid based on the results of only one of the markets, and this market is chosen by a die roll (or, in the case of sessions 6–9, by a card draw). Since *ex ante* the students have no way of knowing the identity of the payout market it is in their interest to treat all markets equally seriously.

Participants' experimental earnings include their cash endowment, less payments to acquire stock, plus dividends earned on stock held in the one randomly selected market. In addition, the participant with the lowest absolute prediction error in the randomly selected market receives a bonus of $20. At the beginning of each period, participants are informed that the participant with the lowest sum of the three absolute prediction errors in the selected market will receive the bonus. The incentive is provided to motivate participants to conscientiously report price predictions. The absolute prediction error for each participant is calculated as the absolute value of the difference between the observed price and the prediction.

At the conclusion of each session, participants compute the amount of cash they will receive and complete a post-experimental questionnaire. The purpose of the questionnaire is to collect general information about the participants and how they view the experiment. To assure anonymity and confidentiality, participants are called to the front of the room to collect their cash in an envelope.

The average compensation for participating approximately two and one half hours is $66.75 ($79.66) across sessions 1–5 (6–9). Participants' responses on a post-experiment questionnaire indicate that they found the experiment interesting and the monetary incentives motivating. Participants responded on an eleven-point scale as to how interesting they found the experiment, where 1 = not very interesting and 11 = very interesting. The mean response is 8.5. Participants also responded on an 11-point scale as to how they would characterize the amount of money earned for taking part in the experiment, where 1 = nominal amount and 11 = considerable amount. The mean response is 7.9.

2. Empirical results

2.1. Market pricing

Table 2 reports prices, bids, and predictions across treatments. Consistent with Hypothesis 1, the average initial price in the low endowment sessions is $17.10, while the average in the high-endowment sessions is $20.37. Further, the difference in means does not appear to dissipate over time, indicating that in our experiment the house money effect persists across trading periods. To test whether the difference across the low and high endowment sessions is statistically significant, we compute an average price per market for each group of sessions (i.e., within each market, price is averaged over periods 1–3). This results in

[9] At the outset no dividend has been paid. After one period passes there are two levels of wealth change: H and L (for a high and a low dividend). After two payouts, there are three (or four if order matters) levels of wealth change (HH, HL, LH and LL). The third-period dividend magnitude is immaterial because it can have no influence on decision-making for that market (there are no more decisions to be made), and it should not have an impact on subsequent markets as well.

Table 2 Prices, bids, and predictions across treatments

Period	Variable	Low endowment sessions				High endowment sessions				Difference in mean
		N	Mean	Min	Max	N	Mean	Min	Max	
1	Price	30	17.10	5.01	26.00	32	20.37	9.00	30.00	3.27
	Bid	240	19.70	0	60.00	256	24.95	0	75.00	5.25
	Prediction	240	17.69	1.00	60.00	256	20.17	2.00	70.00	2.48
2	Price	30	17.33	6.50	26.00	32	20.49	9.00	30.00	3.17
	Bid	240	19.97	0	87.25	256	22.10	0.01	92.00	2.13
	Prediction	240	17.53	4.75	50.00	256	20.61	8.00	35.00	3.07
3	Price	30	15.94	7.00	25.00	32	19.13	8.00	34.50	3.20
	Bid	240	19.13	0	99.01	256	22.13	0	100.00	3.00
	Prediction	240	16.97	5.50	28.00	256	20.56	8.50	34.50	3.59

This table reports information concerning the prices, bids, and price predictions for each period in the low and high endowment treatments. Along with the number of observations (N), the table reports the mean, minimum, and maximum observed value. The final columns report the difference in means across the treatments.

30 (32) observations for the low (high) endowment markets. We perform a non-parametric, Kolmogorov-Smirnov test, which detects differences in both the locations and the shapes of the distributions. We find a significant difference between the low and high endowment groups ($z = 1.935$, $p = 0.001$).[10] Our results are consistent with a house money effect in a financial setting. Market prices are higher when traders have more found money.

A concern with the preceding analysis is that price may not be independent across markets within a session. To assess the potential problem, we compute Spearman rank correlations for the low and high endowment groups. We find some evidence that price is correlated across markets in the low endowment group (most notably markets 1–3), but not in the high endowment group. Accordingly, we compute an average price per session, collapsed across markets. The average prices, reported in Table 3, indicate considerable variability between sessions. We conduct a non-parametric Kolmogorov-Smirnov test and fail to detect a statistically significant difference between the low and high endowment groups ($z = 1.118$, $p = 0.164$). The small number of observation ($n = 9$), though, limits the power of the test.

Next we examine bids across the three trading periods (refer to Table 2). The average bid in the first trading period in the low endowment sessions is \$19.70. For the high endowment sessions the average initial bid is \$24.95. As with the prices, higher bids in the high endowment sessions appear to persist across trading sessions. To examine whether the difference in bids is statistically significant across treatments, we compute the average bid per trader, averaged over all bids within a market. In the low endowment sessions, each trader makes 18 bids (3 periods $\times$ 6 markets) and there are 40 traders (5 sessions $\times$ 8 traders per session). In the high endowment sessions, each trader makes 24 bids (3 periods $\times$ 8 markets) and there are 32 traders (4 sessions $\times$ 8 traders per session). We perform a non-parametric, Mann-Whitney test and find that the bids of the high endowment exceed those of the low endowment ($z =$

[10] We repeat the analysis for each period separately and find that the result holds across periods at $p < 0.035$. That is, price is always significantly higher in the high versus low endowment group. In addition, we perform a non-parametric, Mann-Whitney test and reach a similar conclusion. With a z-statistic of –2.613 ($p = 0.009$) we find that the prices are lower in the low endowment treatment.

Table 3 *Average Price per Session.* The table reports the average price (standard deviation) per session, collapsed across periods and across markets. The sessions are presented separately for the low and high endowment groups as well as averaged across each endowment group

Treatment	Session	Average price (Std Dev)
Low endowment	1	19.22 (0.93)
	2	20.69 (1.09)
	3	12.71 (1.77)
	4	10.72 (2.41)
	5	20.58 (2.69)
	1–5	16.79 4.64
High endowment	6	20.75 (1.89)
	7	10.61 (1.48)
	8	23.99 (2.74)
	9	24.04 (3.10)
	6–9	19.85 (6.03)

−4.068, $p < 0.001$). These results suggest that participants are willing to pay more for the stock when given a larger initial endowment, which leads to a higher market price.

Table 2 reveals additional interesting insight into traders' behavior. Although Vickrey (1961) shows that there are incentives to bid true valuations in the nth price auction, our evidence indicates that this may not always be the case. According to Davis and Holt (1993), the discovery of an optimal bid by a trader requires substantial reasoning because the trader does not pay his bid to acquire the asset when the price is the highest bid for participants who do not acquire the asset. Whether a trader will report a bid that is not value revealing depends on his beliefs about others' bids. The minimum and maximum bids in both treatments suggest that some traders place very high (low) bids in order to make sure that they will get (not get) a share. Others have noted that while the Vickrey auction provides incentives to reveal demand, the auction mechanism may not adequately reveal individual valuations (Knetsch and Sinden, 1987). Extreme bids like $100 or $0 likely do not reflect a trader's actual evaluation of the worth of the stock but these bids serve the trader's intent to acquire or not acquire the asset.

Traders' price predictions for the first trading period provide insight into traders' expectations. Because participants are asked to predict the market price for the current period, these predictions reflect what traders believe others' bids will be. As Table 2 reports, the average predicted price in the low endowment sessions is lower than that in the high endowment sessions in all periods, indicating that traders expect higher bids when the endowment is higher. As described above for the analysis of bids, we compute the average prediction per trader, averaged over all predictions within a market. We perform a non-parametric, Mann-Whitney test and find that the predictions of the high endowment treatment exceed those of the low endowment treatment ($z = -4.998$, $p < 0.001$).

We perform additional tests to confirm the significant difference in bids. First, we modify very high or very low bids as follows. For any bid exceeding \$25, we truncate the bid at \$25 so that any bids above \$25 are assigned a value of \$25. For any bid below \$10, we truncate the bid at \$10 and set the bid to \$10.[11] This modification lowers the impact of extreme bids on the averages and adjusts for the likelihood that very low bids fall short of true valuations and very high bids exceed true valuations. We then compare the average bids between the low and high endowment treatments. Note that because we use the same modification for both treatments, if the house money effect indeed exists, this modification will bias the test results against finding the effect. We find that the average bid in the sessions with high endowment remains significantly higher than in the sessions with low endowment.

We next examine how changes in found wealth affect market outcomes.[12] Our results suggest that the absolute level of wealth dominates the effect of wealth changes. Although we document a significant house money effect in our market setting, we find that, in general, subsequent changes in wealth have no effect on market pricing. First we estimate a regression of changes in market prices on changes in the average wealth of all traders; i.e.,

$$\Delta\text{PRICE}_{t-1,t} = a + b\Delta\text{WEALTH}_{t-1,t} + \varepsilon_{t-1,t}$$

where $\Delta\text{PRICE}_{t-1,t}$ is the change in price across periods t and $t-1$, and $\Delta\text{WEALTH}_{t-1,t}$ is the change in traders' average *beginning* wealth across periods t and $t-1$, defined as $0.5^*(dividend_{t-1} - PRICE_{t-1})$.[13]

Table 4 reports the results of estimation of the regression equation. The regression is estimated for each treatment and again for all sessions together. In addition, the regression is estimated for changes from period 1 to period 2, changes from period 2 to period 3, and again for all changes. We estimate the regression separately based on movements across periods in order to examine how behavior evolves within a market. In all cases except one, the slope coefficient is not significantly different from zero. The exception occurs in low-endowment sessions for changes in wealth from period 2 to period 3. We find no evidence that changes in wealth after the initial cash windfall affect market outcomes in our experimental setting.

In order to examine whether changes in wealth have a persistent influence on behavior, we estimate an additional regression. We regress changes in prices for the final period of trading in each market on changes in market wealth over the two preceding periods. Accordingly, we estimate the following regression equation:

$$\Delta\text{PRICE}_{2,3} = a + b\Delta\text{WEALTH}_{2,3} + c\Delta\text{WEALTH}_{1,2} + \varepsilon_{2,3}.$$

[11] Truncation at other values (such as \$7 and \$27) lead to similar inferences.

[12] Of course, wealth here reflects only wealth accumulated during the experiment and does not account for wealth brought to the experiment by participants. Clearly participants' total wealth varies significantly even across our rather homogeneous subject pool. However, as we are focusing on changes in behavior resulting from changes in wealth position there is no requirement that total wealth be measured or controlled. In addition, it might be argued that a participant's experimental earnings are small in comparison to total wealth. While we agree that this is true, it only adds strength to our conclusion that found money has an important influence on behavior.

[13] Half the traders purchase the stock and each of these traders experiences a change in wealth equal to the dividend that is paid less the price paid to acquire the stock. The remaining traders experience no change in wealth.

Table 4 Prices and wealth change

	N	*a*	*b*
Low-endowment sessions			
Changes from Period 1 to Period 2	30	0.1907	−0.0611
		(0.60)	(−1.81)
Changes from Period 2 to Period 3	30	−1.7640	0.1406
		(−2.42)*	(2.20)*
Combined	60	−0.6265	0.0419
		(−1.48)	(1.04)
High-endowment sessions			
Changes from Period 1 to Period 2	32	0.0634	0.0530
		(0.13)	(1.13)
Changes from Period 2 to Period 3	32	−1.3867	−0.0310
		(−2.00)	(−0.47)
Combined	64	−0.6216	0.0165
		(−1.45)	(0.40)
Ass sessions			
Changes from Period 1 to Period 2	62	0.1699	0.0016
		(0.57)	(0.05)
Changes from Period 2 to Period 3	62	−1.4199	0.0549
		(−2.83)*	(1.20)
Combined	124	−0.6179	0.0288
		(−2.07)*	(1.01)

Note: *denotes significance at the 5% level (two-tailed).
This table reports the estimates of a regression of changes in market prices on changes in the average wealth of all traders; i.e., $\Delta\text{PRICE}_{t-1,t} = a + b\Delta\text{WEALTH}_{t-1,t} + \varepsilon_{t-1,t}$ where $\Delta\text{PRICE}_{t-1,t}$ is the change in price across periods t and $t-1$, and $\Delta\text{WEALTH}_{t-1,t}$ is the change in traders' average *beginning* wealth across periods t and period $t-1$, defined as $0.5^*(\textit{dividend}_{t-1} - \textit{PRICE}_{t-1})$. The regression is estimated separately for each treatment, for all sessions together, and for three sub-samples determined by period.

Table 5 Persistent effects of prior wealth change

	N	*a*	*b*	*c*
Low endowment sessions	30	−1.7062	0.1527	0.1639
		(−2.53)*	(2.56)*	(2.36)*
High endowment sessions	32	−1.4943	−0.0419	0.0922
		(−2.17)*	(−0.64)	(1.37)
Combined	62	−4.4512	0.0540	0.1133
		(−2.99)	(1.22)	(2.32)*

Note: * denotes significance at the 5% level (two-tailed).
This table reports the results of estimation of the regression equation: $\Delta\text{PRICE}_{2,3} = a + b\Delta\text{WEALTH}_{2,3} + c\Delta\text{WEALTH}_{1,2} + \varepsilon_{2,3}$ where $\Delta\text{wealth}'_{t-1,t}$ is the difference between the trader's *beginning* wealth position in periods t and $t-1$, $\Delta\text{PRICE}_{t-1,t}$ is the change in price across periods t and $t-1$, and $\Delta\text{WEALTH}_{t-1,t}$ is the change in traders' average *beginning* wealth across periods t and $t-1$, defined as $0.5^*(\textit{dividend}_{t-1} - \textit{PRICE}_{t-1})$. The regression is estimated separately for each treatment and for all sessions together.

The results reported in Table 5 indicate that changes in wealth have greater influence in the low endowment sessions. The effect on prices of changes in average wealth lasts for more than one period in the low endowment sessions. As with the earlier regressions reported in Table 4, we report no significant influence of wealth changes on market prices in the high endowment sessions.

2.2. Traders' bidding behavior

To provide insight into individual behavior in our markets, we extensively analyzed traders' bids. First we estimate regressions of changes in individual traders' bids on changes in wealth. As with the market price regressions reported in Table 4, in no case is the slope significantly different from zero in the high endowment sessions. However, in the low endowment sessions the effect of wealth changes on bids is significantly positive for all treatments and periods.

Nevertheless, further diagnostics signaled that this regression is misspecified. Examination of regression scatter plots indicated certain nonlinearities. Specifically, fitted values at changes in wealth levels (which means traders bid high enough to receive stock) reflect *negative* changes in bids, regardless of whether the dividend was received or not; whereas fitted values at zero wealth changes (which means traders did not bid high enough to receive stock) reflect *positive* changes in bids.

Knetsch et al. (2001) shed light on this puzzling behavior. They argue that in a Vickrey auction with repeated trials, intra-marginal traders may adjust their bids towards the margin. While it is not clear why this may occur, they suggest a kind of "peer pressure" effect whereby people lacking confidence in their own (initial) views on valuation move towards the consensus view. Unfortunately the end result is that such effects obscure the house money effect, rendering the examination of individual bidding behavior less fruitful than hoped.

3. Discussion and concluding remarks

This paper reports the results of an initial investigation of an important psychological finding in a financial market setting. People appear to be less risk averse after a windfall of money, perhaps because the earlier gain cushions subsequent losses. Our experimental results provide support for a house money effect in a new context. Traders' bids and price predictions are influenced by the amount of money they are provided with prior to trading. Market prices are consistent with a house money effect in all treatments. However, subsequent individual and market behavior does not indicate that traders will pay more to acquire the asset after an increase in wealth. Our data suggest that the absolute level of wealth has a dominating influence on subsequent behavior so that changes in wealth are inconsequential.

As financial models are increasingly incorporating psychological findings, significant future empirical research is called for.[14] As Myagkov and Plott (1997) argue, prospect theory pertains to individual decision making rather than market behavior, the substance of financial economics. The predictions of psychological theory for dynamic market behavior are not at all clear. Providing a basis for future theoretical modeling is a challenge for empirical investigation.

[14] Changes in wealth could impact behavior in a complicated fashion. For example, the effect of mood on behavior is unclear. See Isen and Patrick (1983) and Isen and Geva (1987) on the effects of mood on risk preferences.

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