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Earned Wealth, Engaged Bidders? Evidence from a second price auction *

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Abstract

Recent work in experimental economics has raised that observed behavior depends on whether wealth was windfall or earned. This paper extends this work by considering whether earned wealth affects bidding behavior in an induced-value second-price auction. We find people bid more sincerely in the auction with earned wealth given monetary incentives; earned wealth did not induce sincere bidding in hypothetical auctions.

Keywords: Auctions; Demand revelation; Experimental valuation; Hypothetical bias; Earned Money.

JEL Classification: C3, D1.

1 Introduction

There has been a push in experimental economics to replace windfall wealth with earned wealth. Legitimize wealth with effort has been shown to affect people's behavior in experiments, especially in games involving social preferences (i.e., self-interested people who also think about the payoffs and intentions of others). For example, people who earned their wealth were less generous in games that involve resource sharing, e.g., the dictator game.

Evidence suggests people are less generous and less prone to take risks when spending their own money (see Thaler and Johnson, 1990; Cherry, Frykblom, and Shogren, 2002; Cherry, Kroll, and Shogren,

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2005).[1] The open question is whether earned wealth helps concentrate the mind on "being more rational" or whether it simply reduces one's social preferences or both.

Herein we explore this question by examining whether earned wealth will affect bidding behavior in Vickrey (1961)'s classic demand-revealing second price auction. The second price auction is a good case study on the origins of wealth because earlier experiments have observed risk taking and insincere bidding behavior given windfall wealth (see the review by Kagel, 1995). Also the auction provides a cleaner environment since it involves only private values; there is no mechanism to share wealth, which eliminates social preferences from the story since a bidders' behavior is independent of the distribution and behavior of the other players.

Our results suggest earned money matters in the auction mechanism, and in a particular way. Bidding behavior was more demand-revealing and efficiency was significantly greater for earned wealth relative to windfall treatments. But this only held when monetary incentives also existed; earned wealth had the opposite effect on bidding behavior when the auction was non-binding.

2 The experiment

We use a 2×2 factorial design that focuses on two factors that affect the external validity of experimental decisions: earned versus windfall wealth and monetary versus hypothetical bidding in a second-price auction. Vickrey is the classic demand revealing auction to use in an experiment given it is straightforward to explain, the weakly dominant strategy is to bid one's value, and the price is endogenously determined by the bidders (Kagel, 1995). In all treatments in each period, one unit of an unspecified "good" is sold on the auction. Exchange rules of the second-price auction are: the highest bidder wins and pays the second-highest bidder's bid. An auction has 9 bidders each endowed with a unique induced value – *i.e.* the price at which the bidder can sell the good to the monitor after the auction.

The induced demand curve is identical in all auctions and is defined by: $\{84; 76; 71; 68; 65; 63; 53; 38; 24\}$. All monetary values are expressed in ECU (*Experimental Currency Unit*). The auction is repeated over 9 periods, implementing all possible permutations between individual private values. Each bidder experiences each private value once; and the entire demand curve is induced in every period.[2] Bidders do not know the other bidders' induced value or the induced demand curve. A bidding period ends when every bidder has chosen a bid between 0 and 100. At the end of the period, each bidder is privately informed about whether he or she won the auction (and the market clearing price if they won), their gain for the period and whether a new auction round is about to start.

All four treatments followed the same design except for the origin of the wealth and the consequences of bidding. First, the **windfall-hypothetical** treatment (labeled WH) is our baseline. The windfall wealth is a show-up fee of 10€. Second, in the **Monetary incentives only** treatment (WM), bidding is now binding: auction earnings are translated into Euros given a common knowledge exchange rate

[1] In contrast, some researchers find evidence that the origin of assets does not influence subject behavior in laboratory settings (e.g. Clark, 1998, 2002; Rutström and Williams, 2000). But see Harrison (2007) for an alternative interpretation of Clark's (2002) data.

[2] Although the repetition is deterministic, we avoid end-game effect by providing the subjects with no information on that point – except for the repetition itself.

(3 ECU for 1 €).[3] In each round, the winning bidder's profits equal the difference between his or her induced value and the market price he or she pays for the good (the second highest bid). Profits of the 8 non-winning bidders are zero. Only the winner sees the two highest bids at the end of the round. Overall earnings of the subjects are computed as the sum of the resulting amount and the 10€ show-up fee.

Third, we create the earned-wealth only treatment by adding an intermediate step to the baseline. Following Cherry, Frykblom, and Shogren (2002); Cherry, Kroll, and Shogren (2005), in **earned wealth-only** (EH) subjects earned their wealth by answering 20 questions of general interest. Each question is presented sequentially, and each question has four possible answers among which one is correct. Monetary earnings are proportional to correct answers. We selected the questions from the sheets used by the French government to select some of its civil servants. This seems well suited to discriminate between undergraduate students, since participation to the selection process is open only to holders of the French baccalaureate.[4] Subjects learn their score and total earnings in ECU at the end of this stage. The payment rate is 2 ECU *per* correct answer (the exchange rate is again 3 ECU for 1 €). Once all subjects answer all questions, the Vickrey auction begins.

The final treatment combines **Monetary incentives with earned wealth** (EM). Bidding behavior is now binding. The four experimental sessions were run in Paris, each involving 18 subjects.[5] In each session, subjects are separated into two distinct 9-bidder auctions, which provides two sessions for each treatment. Participants were first to third-year undergraduate students in law, economics or chemistry. The experiment was computerized using a software developed under REGATE (Zeiliger, 2000), recruitment made use of ORSEE (Greiner, 2004).

3 Results

We consider four indicators of sincere bidding behavior across the four treatments – aggregate bidding and demand, individual bidding behavior, allocative efficiency, and surplus extracted.

First, we consider aggregate bidding behavior. Table 1 illustrates bidding behavior at the aggregate level by induced value and treatment. We add up the bids and sort by induced value for each of the treatments.

Under windfall wealth, we observe similar bidding behavior with and without monetary incentives, e.g., no hypothetical bias in bidding. Strictly rational bidding in the monetary and hypothetical treatments would result in the elicitation of 9756 ECU $= 542 \times 18$. Adding up the bids for each induced value, we see people tend to overbid, both with and without monetary incentives, 10328 ECU(105.9% of the total demand) and 10134 ECU (103.9%). Unconditional mean test shows that bidding behavior with or without monetary incentives are not significantly different ($p = 0.645$).

[3] Negative total earnings would decrease the show up fee up to 5€. This lower bound stems from the way participants are recruited: we contractually commit ourselves to a minimum earning equal to 5€.

[4] The procedure is labeled *Concours de Catégorie B de la fonction publique*. Our source is `http://pagesperso-orange.fr/bac-es/qcm/annales_c02_r01.html`.

[5] The two windfall sessions are taken from the original experimental plan of Jacquemet, Joule, Luchini, and Shogren (2008a). The two earned money sessions are the first two parts of a longer experiment described in Jacquemet, Joule, Luchini, and Shogren (2008b).

Table 1: Aggregate bidding behavior by group and induced value

Induced value	24	38	53	63	65	68	71	76	84	All
Ag. Demand (AD)	432	684	954	1134	1170	1224	1278	1368	1512	9756
Winfall wealth & Hypothetical										
Revealed AD	626.0	808.0	1050.0	1193.0	1201.0	1192.0	1242.0	1290.0	1532.0	10134
Ratio RAD/AD	144.9%	118.1%	110.1%	105.2%	102.6%	97.4%	97.2%	94.3%	101.3%	103.9%
Monetary incentives only										
Revealed AD	687.0	735.0	1078.0	1045.0	1318.0	1259.0	1281.0	1334.0	1591.0	10328
Ratio RAD/AD	159.0%	107.5%	113.0%	92.2%	112.6%	102.9%	100.2%	97.5%	105.2%	105.9%
Earned wealth only										
Revealed AD	670.0	746.0	1045.0	1215.0	1205.0	1348.0	1334.0	1453.0	1479.0	10495
Ratio RAD/AD	155.1%	109.1%	109.5%	107.1%	103.0%	110.1%	104.4%	106.2%	97.8%	107.6%
Earned wealth & Monetary incentive										
Revealed AD	492.0	678.0	816.0	1145.0	1121.0	1229.0	1260.0	1406.0	1490.0	9637
Ratio RAD/AD	113.9%	99.1%	85.5%	101.0%	95.8%	100.4%	98.6%	102.8%	98.5%	98.8%

Note. The first row reports the induced values attributed to buyers. The second row reports the corresponding aggregate demand in each treatment, *i.e.* induced values × number of subjects. For each treatment (four remaining rows), the upper part of the row displays the aggregate revealed demand (*i.e.* the observed bids posted by buyers the induced value of whom are reported in column). The bottom part reports the ratio of this revealed demand to the aggregate induced demand, in %.

A different story emerges for the earned wealth treatments. Our results suggest significant difference in bidding behavior with and without monetary incentives. Elicited demand reveals underbidding, 9637 ECU (98.8%), with monetary incentives; and overbidding at 10495 (107.6%) without monetary incentives. The difference in demand is statistically significant, p-value $p = .046$ (unconditional mean test).

Consider now each induced value in Table 1: it suggests bidding behavior under earned wealth with monetary incentives performed relatively well at revealing demand in the aggregate. Results show elicited demand matched the induced demand for all the induced values. Sincere bidding on aggregate was similar for the other three treatments, except for the off-margin lowest induced value (24 ECU) in which bids were more likely to exceed induced demand.

Second, we now examine the rationality assumption of perfect demand revealing bids. If each bidder maximizes his or her private payoff, each bid should equal the induced value. In WH, 16.7% of bids are perfectly revealing; 46.9% of bids were within a 10 percent interval of the induced value. Insincere bidders both inflated and shave bids: 29.6% and 23.5%. Under WM, 5.5% of the bids are perfectly revealing and 52.5% are in the 10 percent interval. Bidders tended to inflate their bids (33.3%) rather than shaving them (14.2%).

Under EH, 8.7% of the bidders bid sincerely and 43.8% were bidding within the 10 percent interval. Here again, insincere bidders inflated their bids (38.9%) rather than shaved their bids (17.3%). Under EM, 20.4% of bidders gave their induced value and 63.6% bidded within the 10 percent interval. Bidders equally inflated and shaved their bids: 18.5% and 17.9%.

We test the assumption of perfect revealing bids by computing the ratio between the bid and the induced value for each bidder. Rational sincere bidding implies a ratio of one, which is tested by an

equality test on the estimated intercept of the regression on a constant. We cannot reject the null of rational bidding behavior for EM ($p = 0.812$); in all other treatments, we do reject the null: WH ($p = 0.034$), WM ($p = 0.039$), and EH ($p = 0.010$). On average, earned money increased the likelihood that a bidder would bid sincerely but only with monetary incentives in place; it had the opposite effect when bids were not binding.

Third, now consider allocative efficiency – a second criterion of a well functioning auction. The auction should allocate the good to the person who values it the most and he or she should pay the second highest bid. We see the highest value bidder (with induced value of 84 ECU) won the auction the most frequently in EM : 61.1% of the auctions. This was greater than the other three treatments: WH, 44.4% ($p = .504$); WM, 50.0% ($p = .774$); and EH, 22.2% ($p = .043$).

Strict efficiency implies the winner pays the second highest induced value. No treatment was particularly successful in this level of precision: 0% for both windfall wealth treatments ; 5.5% for earned wealth treatments. A weaker test is if the winner pays a price within the 10 percent interval around this value. Here, EM now performs significantly better than the other treatments: 72.2% of all exchanges. This compares to 27.8% for WH ($p = .020$), 33.3% for WM ($p = .045$) and 38.9% for EH ($p = .094$).

Finally, we examine average surplus extracted by bidders. A rational bidder would extract 8 ECU after 9 periods (84ECU - 76ECU). Again EM performed significantly better than the other treatments: the average bidders broke about even with a surplus of -0.3ECU. The other treatments all resulted in a substantial negative surplus significantly different from that in EM : -13.4ECU for WH ($p = .073$), -14.3ECU for WM ($p = 0.04$), and -23.4 for EH ($p = 0.004$).

Overall, based on our four indicators of sincere auction bidding, the most effective treatment was with earned wealth and monetary incentives – the auction environment closest to the wilds. Earning money and spending it for real seemed to concentrate the mind on the task at hand, which in our case was bidding one's induced value in the second-price auction.

4 Concluding remarks

As noted by Bellman nearly fifty years ago: "in the physical world, in connection with testing and experimentation, it is often useful to conceive of nature, in some vague anthropomorphic fashion, as an opponent attempting to conceal the truth from us. The design of experiments may be conceived of as a game in which we attempt to extract information from a stubborn, but fair, opponent" (Bellman, 1957, p.283). Herein we find that earned wealth matters in our experimental private value second-price auction. Earned wealth with monetary incentives induced more sincere bidding and greater efficiency relative to the classic windfall wealth treatment; and relative to the hypothetical bidding employed in stated preference valuation surveys. Since our design did not allow social preferences to play a role in behavior, earned wealth seemed to help concentrate the mind on the task at hand – rational bidding. In that sense, our results confirm previous findings that variations in incentives even out of the equilibrium path does in fact change behavior (Georganas, Levin, and McGee, 2009).

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