A pseudo-endowment effect in internet auctions

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Abstract

Although bidders in an internet auction do not obtain the actual ownership of the item during the auction, they still act according to an endowment effect. In a unique data set of 17,000 Danish furniture auctions I find that having the leading bid, both in terms of time and dollars, will affect the bidders probability to rebid if outbid. Thus, expectations to own, i.e. "*pseudo-endowment*", seem to affect bidders' willingness to pay in a relative fast and straightforward manor. Generally, these data therefore support that the reference point, from which we measure losses and gains, is closely related to expectations.

Keywords: Internet auctions, Reference-Dependent Preferences, Endowment Effect, bidding behavior, eBay, WTP, Reference Point.

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1 Introduction

Bidding behavior in real auctions can often from an economist's point of view look mysterious. The rational equilibrium strategy of game theory looks nothing like the strategy and behavior that is often observed. There are many examples of how bidders "get caught" in the game and end up paying too much. Especially in Internet auctions, like eBay, this has been documented (Ariely and Simonsen, 2003; Lee and Malmendier, 2006). At first glance you might simply conclude that bidders must have some kind of "auction fever". However, developments in Behavioral Economics could perhaps assists us when trying to understand some of this behavior.

One possible explanation is based on the *endowment effect* originally suggested by Thaler (1980). Once you own an item, selling it will feel like a loss whereas the money you receive in return is viewed as a gain. Thus, as people generally dislike losses considerably more than they like the same sized gains, the item will often be worth more to you when selling it as opposed to buying it. This was nicely demonstrated by Kahneman et al. (1990) where randomly distributed mugs had an average selling price of approx. $7 whereas the corresponding buying price was approximately $3.

Bidders do not obtain the actual ownership of the item during an auction. Still, they can get a feeling of ownership – especially if they have the leading bid. A feeling that could make them behave as if they were the actual owners. And if outbid a feeling of loss which could make them increase their bids. The question I ask in this article is therefore, if pseudo-endowment from having the leading bid will effect the bidders' probability to increase their bids if outbid?

This article presents evidence that bidders do in fact react according to such a *pseudo-endowment* effect. In a unique data set of 17,000 internet auctions for modern furniture the probability to increase a first max-bid when outbid depends positively on two measures of ownership; 1) the amount of *time* as the leading bidder and 2) the optimism measured as the *depth* from the bidder's max-bid to the current price in the auction. Moreover, these effects are marginally decreasing so that small amounts of time or/and depth are more important for the feeling of ownership. Theoretically, these results hint at the process of setting a reference point from which a decision maker measures losses and gains.

The paper is organized as follows. Section 2 presents the theoretical foundations of a pseudo-endowment. Section 3 describes the data and selects the relevant bids. Rebidding is analyzed in Section 4 and Section 5 discusses

and concludes.

2 Pseudo-Endowment

Reference-Dependent Preferences is the basic theory underlying a possible pseudo-endowment effect. As presented by Kahneman and Tversky (1979) in their famous paper of *Prospect Theory*, people do generally think in relative rather than absolute terms which, for economic decisions, mean that outcomes are usually compared to some reference – *The Reference Point*. This is in fact in many settings a very clever way to utilize our cognitive capacity very efficiently (Kahneman, 2003). However, since we dislike losses much more than we like the same sized gains the reference point can become very important for our decision making – not always in a positive way.. This has been demonstrated in a wide range of settings from small scale consumer decisions to large scale lifestyle decisions (See e.g. Tversky and Griffin (1991) and Frederick and Loewenstein (1999)).

Although the theory has proven its validity and relevance through a vast number of experiments in the last thirty years, a problem remains before the theory can become a reliable tool for market analysis and policy making. The exact reference point is in many settings ambiguous. In principle, you can therefore get almost any prediction if you set the reference point accordingly.

Early in the literature the reference point was either explicitly controlled or simply taken as the current endowment, hence the resulting "*endowment effect*". This is a very reasonable assumption in laboratory experiments were the endowment is the variable at stake and in focus of the subjects. Yet, actual endowments are not necessarily the reference point from which we measure losses and gains. Sen and Johnson (1997), for example, demonstrate how possessing a coupon for a product can increase the preference for that product. Another experiment by Carmon et al. (2003) shows how prior presentation of one choice alternative increases the preference for that alternative in a later choice. They both interpret this as a change in the reference point such that choosing something else would feel like a loss.

Later developments in the theory have emphasized the role of *Recent Expectations* as the reference point (Koszegi and Rabin, 2006). If you expect to receive a wage increase of $3,000 it is likely that you get disappointed and feel like you have incurred a loss if the actual wage increase ends up being $1,000 – even though it essentially is a gain to your current wage. Pseudo-endowment[1] is therefore when people *expect to get to own some-*

[1]Although Ariely, Heyman and Orhun (2004) use the term quasi-endowment for the

thing without actually owning it yet. However, expectations as such do not solve the problem of specifying the reference point as they too are often unknown.

One solution to this problem is the well-known method of assuming rational expectations. Applied to decision making it means that decision makers choose their expectations such that they will follow through on their plans and fulfil these expectations[2]. But like rational expectations in general, this assumption seems to be rather unrealistic. When bidders get involved in an auction and end up paying more than initially intended, this is indeed an example of how people do not follow through on their initial plans. From a theoretical point of view this article is therefore part of the effort to clarify how the reference point is constructed in real market settings.

3 The data

Lauritz.com is an auction house based primarily in Denmark, but with activities in Germany, Noway, and Sweden. All their auctions are internet auctions much like eBay.com, but there are some important differences. Lauritz.com is not only an internet site, but also a physical auction house with 18 locations (2007) where the goods are located and available for inspection during business hours. Potential bidders therefore have the opportunity to examine the goods thoroughly before bidding. Moreover, Lauritz.com was a traditional auction house before 2000 and has kept the tradition of making an expert estimate of the value of the items. Both of these features contribute to minimize the information about quality from other people's bidding. Thus theoretically there should be no reason for bidders to re-bid.

The particular data I have access to are from all the modern furniture auctions in 2005 which amounts to about 37,000 auctions[3]. More specifically, I have access to the complete bidding histories, i.e. exact time of bids and bidders' ID number etc., much like the available information on any eBay auction just after expiry[4]. From these histories I can backtrack the bidders' actual bids (as max-bids) and when they were submitted.

Furniture is one of the traditional goods for auction houses and especially

feeling of ownership in auctions, pseudo-endowment was used by Prelec (1990) to describe this general idea.

[2]This is the so-called Personal Equilibrium of Koszegi and Rabin (2006).

[3]In modern furniture there are two categories: 1) miscellaneous (29%) and 2) tables and chairs (71%).

[4]The data used for this article is therefore in principle publicly available. I did, however, receive the data directly from Lauritz.com with a few extras which is not used here.

Lauritz.com have branded themselves as reselling classic Scandinavian furniture designs. While Laurtiz.com was well established on the Danish market in 2005, this was a period of expansion in Germany and Sweden. I have therefore limited my analysis to the 27,000 Danish auctions. Since this is an analysis of rebidding, I need at least two bidders for one of them to face a question of rebidding. Excluding some extreme auctions brings the number of auctions down to 16,864[5].

The typical auction procedure is that the seller brings the item to the nearest auction house where an expert makes a valuation. If the seller is satisfied with the valuation and the probable sale Lauritz.com puts it on the internet site with auction expiration exactly one week later[6]. By policy none of the auctions have a reserve price, but the first available bid is $50 (2005) since this will cover the minimum fee to Lauritz.com for the seller. Generally the seller pays 10% of the reached auction price (if above $500), and the buyer must pay additionally 20% plus a fixed fee of $5[7].

During the auction bidders can either bid for the next available bid (the current price plus some predetermined increment of e.g. $10) or use the max-bid service (proxy bidder) and let the auction site bid for you. In economic terms bidders can therefore bid as if it was a normal first price ascending auction, or as if it was a sort of second price auction by putting in their maximum bid. This bidding procedure is very close to the proxy bidding system used on eBay, only the max-bids are also restricted to the increments. However, if a bid arrives within the last 3 minutes the auction is extended with 3 minutes. Thus, this is a so-called soft ending with always at least 3 minutes of time to react.

Once the auction is over the winner can pick up the item at the physical auction house. Due to the Danish Sale of Goods Act there is, however, the rather peculiar feature that buyers can regret and return the item within two weeks. Although this feature could potentially affect the bidding, it does not present a problem to this analysis[8].

[5]Only auctions with a valuation between $200 and $6,000 are included. Also there are a few auctions with an error in the time of start that subsequently have been altered by mistake, so they have been removed. These are the same auctions as used in Bramsen (2008) except for 212 auction. In these two bidders have enter a max-bid in the exact same second, which my procedure for backtracking bids cannot handle. These 212 auctions have therefore also been excluded

[6]To even out the load some are put for sale or set for expiration during the evening, but almost all the auctions have close to one week of duration, and the selected auctions all have a duration of 7 days +/- 6 hours.

[7]Since these are Danish auctions all prices are originally in DKK, but they have here been converted to USD where $1 = DKK 5 (2008).

[8]If there is uncertainty about WTP it can potentially make it less costly to bid too much if you can regret. However, bidders will still have incentive to bid what they believe is

The vast majority of the auctions are unique at the time of sale. Surely there are some repetitions and classic furniture that are sold in greater numbers, but it is rare to find competing items at a given time. With distinctive items that are professionally valuated and the soft ending Lauritz.com is a unique internet auction environment where almost all of the practical and game theoretic arguments for bidding late are absent. From a neoclassical point of view bidders who enter their willingness to pay (WTP) as a max-bid sometime during the auction should therefore have no reason to rebid.

4 Selecting the relevant bids

Bidders may have different strategies and not all bids are therefore relevant. Most bidders bid as if it was a normal English auction by simply bidding the next available bid. In fact, this practice seems to be the dominating behavior as 50.4% of all the bidders' first bid is simply the next available increment. Other bidders follow a sniping strategy bidding only during the last minutes. It is impossible to know when these bidders actually reveal their underlying WTP. Therefore it is also impossible to find out if and why they increase it. Hence, the only feasible approach is to exclude all the bids that are unlikely to reveal the true underlying WTP. Fortunately, the data set is large enough to enable a critically selection of only the relevant bids.

The first step in this selection process is to disregard winning bids. Only if the bidder is outbid there is reason to rebid. The next step is to select only the first bid by a bidder and thus analyze the probability for rebidding a second time. Surely, it could also be relevant to investigate factors which affect rebidding a third or a fourth time, but a comparison between e.g. a second and a third rebid will be problematic both to analyze and interpret. Thus, with the greater amount of first bids these are the most optimal to analyze.

Focusing on the first bid also have other advantages. If a bidder does not want to put in her real WTP, but something lower, this is easier to discover from the first bid compared to a second bid as the distance between the WTP and the current auction price will be greater for the first bid. For instance, if a bid is only 30% of the valuation made by Lauritz.com it is difficult to believe that it is a true representation of the bidder's WTP.

their WTP. It must therefore be the same underlying mechanisms that affect bidding with or without this option. Furthermore, there are transaction costs and only a very limited number does actually use the option (in this data, 6.5%). In comparison to eBay, where a bidder can ignore the purchase perhaps with a black listing as consequence, bidding on Lauritz.com seems to be more committing.

Following this logic, below is a list of restrictions which are designed to rule out any first bid which is unlikely to represent the true WTP of the bidder. The exact limits to these restriction are naturally rather arbitrary. On the one hand a very tough restriction is preferable in order to limit our attention only to the relevant bids, but on the other hand excluding too many observations might weaken the generality of the results. In appendix A I report a sensitivity analysis for the limits. Basically this shows that the restrictions are not simply data mining and that the results are generally valid for these data.

Too low a bid. If a bidder places a bid *below 60% of the final price* there are to possibilities. Either this is not a serious representation of the true WTP or this bidder does in fact have a very low valuation compared to other bidders. By excluding low bids the analysis will possibly be biased towards the behavior of bidders with high valuations. However these are usually the bidders who are important for the auction outcome and in some sense a possible bias is therefore beneficial.

Just the next increment. If bidders at entry simply take the next available bid there are again two possibilities.The next bid just happens to be the true WTP, or it is simply because this bidder is using the auction as a simple English auction (as around half the bidders do). The latter seems to be overwhelmingly likely. Still, excluding the few true WTP will possibly screen out more late first bids as the price is likely to be higher at the time. This will to some extend, however, be taken into account by controlling for the time of entry.

Excluding professionals. In the literature experience and professional motives are observed to diminish the endowment effect, see e.g. List (2003). Excluding bidders that bid at *more than 20 auctions* during 2005 will therefore get us closer to the underlying psychological processes that might happen for a "normal" individual.

Too high a second bid. If your second bid is *more than 20% higher than the first bid*, the first bid is not likely to be the true WTP. Although the endowment effect might be a powerful mechanism I do not believe that it will change the WTP dramatically from one bid to the other as the comparison effect of paying more will also kick in[9].

Too many bids. *More than 5 bids* from a bidder signals that the first bid was not a true representation of the WTP, but rather part of

[9]Bidders will not only be loss averse against loosing the item, but also towards paying more than expected. This was formulated as the comparison effect by Koszegi and Rabin (2006)

a strategy. It could of course happen that the bidder is provoked (outbid) to reevaluate the WTP a large number of times. Still, this would be a rare case and in my opinion it will not bias the outcome to leave these out.

Too fast a second bid. Changing the bid within a short period could be an indication of competition and pure "auction fever". Furthermore, as argued below rebidding within a short period is not likely to be response to a real change in underlying preferences. Bids which are *rebid within 4 hours*, will therefore be excluded[10]. However, as this turns out to be a key restriction, I will discuss this in more detail in the analysis.

It is of course impossible to ensure that all the remaining bids are representing the true underlying WTP. Still, in my opinion, these restrictions will facilitate that the dominating behavior behind rebidding are real changes in the preferences.

5 Analysis

Does pseudo-endowment from the first bid have an affect on a bidder's probability to bid a second time if outbid? That is the basic question in this article. My answer goes through a logit regression. More specifically, if y_i is a binary variable being 1 if the bidder rebids in observation i rebids and 0 if the bidder does not rebid, then y_i can be described by a binomial distribution where $y_i \sim B(1, p_i)$ for $i = 1, .., N$. I assume that p_i can be described using a logit model specified as:

$$\ln\left(\frac{p_i}{1-p_i}\right) = f(\text{pseudo-endowment}_i) + g(controls_i) + \epsilon_i$$

where ϵ_i is a random stochastic variable. In the analysis I will apply different specifications of pseudo-endowment indicated by $f()$, but there are also other factors which could explain the rebidding. In order to get unbiased results, and also to get the best possible fit, all such variables need to be part of the logistic regression. I will use these controls in the simplest possible model. Thus, $g()$ will be a linear function specifying all control variables. Below is a list of the controls[11]:

[10] The closer to finish the faster you may update your reference point. One idea could be to construct this restrictions in such a way that the closer to expiry the smaller break. However, bidding the last day and rebidding again soon after could also be an indication of auction fever. I will therefore not vary this restriction.

[11] Summary statistics of the controls can be found in Appendix A

Time of entry If a bidder is looking for some special item she is more likely to find it earlier in the auction period than bidders who are just randomly searching. Hence, early bidders might have higher WTP. This is in itself not a problem if the bidder really bids her maximum WTP. However, as the price is likely to be lower early in the auction this can act as an anchor depressing the first bid. The probability to rebid could for this reason be higher.

Experience Bidders on Lauritz.com do not have ratings like on eBay. In stead I can directly count how many times they participate in modern furniture auctions during 2005. Although I exclude the bidders which participate in more than 20 auctions ("The professionals"), some experience might also diminish the pseudo-endowment effect and the tendency to rebid.

Valuation As mentioned in section 3 Lauritz.com lists an estimate of the final price to guide both the sellers and the buyers. For expensive items (e.g. with a valuation of $4000) bidders might hesitate to put in their true WTP. As a consequence they might be more inclined to increase their bid later in the auction.

Price at entry A*relative* low price at entry compared to the actual value (the final price) might depress the bidders entry bid – just as a high valuation or early bids could do. Again this will make a rebid more likely.

5.1 Duration of ownership

Recall that pseudo-endowment was defined in section 2 as *expectations to buy*. Although "expectations" sounds simple it is a complex cognitive construction which is impossible to quantify directly. One simple approach is to ignore the expectations *per se* and focus on another necessary component: The amount of time used to form these expectations.

That time could be an important factor is exactly why internet auctions are of particular interest. During the typical auction that lasts a full week there is plenty of time for bidders to get used to the idea of buying and incorporate this into their expectations.

Empirical support for this idea can be found in Strahilevitz and Loewenstein (1998) where the endowment effect is significantly increased with longer periods of ownership. Even more related is the laboratory experiment by Ariely, Heyman and Orhun (2004). In a simulated auction they show how bidders bid significantly higher if they have pseudo-ownership, i.e. if they

have the leading bid for several bidding rounds as compared to a single bid with no ownership[12].

	Model 1a	**Model 1b**	**Model 1c**
Intercept	-0.43*** (0.13)	-0.73*** (0.14)	-0.49*** (0.09)
Time of entry	-0.087*** (0.019)	-0.071*** (0.020)	-0.056*** (0.016)
Experience	-0.023*** (0.006)	-0.022*** (0.006)	-0.022*** (0.006)
Valuation	0.00013* (0.00006)	0.00013* (0.00006)	0.00013* (0.00006)
Price at entry	-0.40** (0.13)	-0.36** (0.13)	-0.28* (0.13)
t	0.004 (0.026)	0.75*** (0.12)	
t^2		-0.30*** (0.05)	
t^3		0.03*** (0.01)	
$\ln(t)$			0.047*** (0.007)
-2Loglikelihood	6913.1	6865.7	6864.6
Significant codes: *** $\leq$0.001, ** $\leq$0.01, * $\leq$0.05			
Null deviance (-2$\mathfrak{L}$): 6997.5 on 6092 degrees of freedom			

Table 1: Logit regressions on the effect of the leading bid in days

The first proxy for pseudo-endowment I will deploy is therefore the duration in days as the leading bidder from the first bid. I denote this measure t. Table 1 shows the results for three different specifications of the logit regression. For all parameters in the specific model the estimates are shown with significance levels. Standard deviations are reported in brackets. As indicated by the Loglikelihood values the best fit is found with a formulation of $f(t) = \ln(t)$ in Model 1c.

From Table 1 it can be difficult to see the actual effect of being the leading bidder and in Figure 1 is the predicted effect of t (black solid line), and 95% confidence interval (dashed) for the median bidder. A median bidder participates in a furniture auction 5 times in 2005, enters at day 5.44, the

[12]A similar test on real auction data is performed by Wolf et al. (2005). They find a positive effect of duration as the leading bidder on the probability to re-bid, but the effect is not significant. However, eBay data is generally problematic as there are also other reasons (e.g. common value) for increasing the bid.

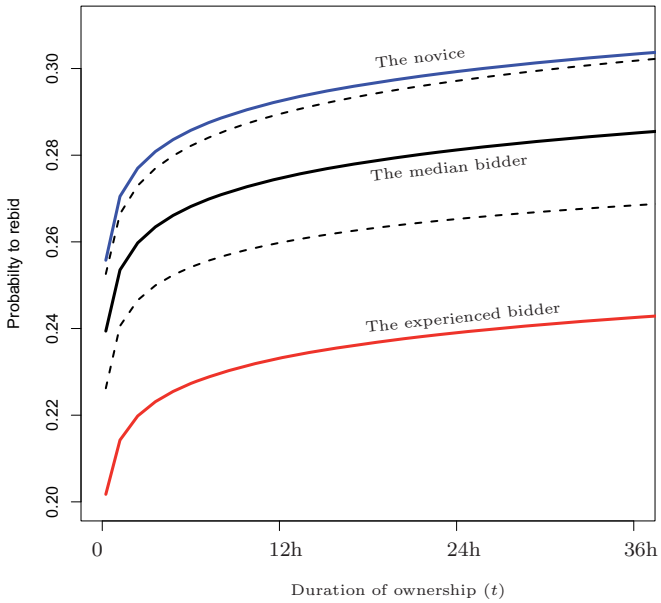


Figure 1: Predicted effect of having the leading bid

valuation of the item \$400, and the price at entry turned out to be 30% of the final price.

That $\ln(t)$ is the best fit compared to for instance a quadratic or cubic form suggests a high initial effect that will slowly fade[13]. In other words, these initial results suggest that most of the shift in reference point happens during the first 6 hours after the actual change in probabilities.

Both the level of probabilities and the magnitude of the pseudo-endowment effect depend on the controlling variables[14]. Figure 1 also shows the estimates for a bidder which only participated once (The novice) and for a bidder which participates 15 times this year (The experienced). Compared to the median bidder the data can therefore confirm the hypothesis that more experience diminish the probability to rebid and indirectly also the pseudo-endowment effect. Similarly, Table 1 shows that high valuation low price at entry, and early entry will increase the probability to rebid. All the controls therefore have the expected signs.

As mentioned in section 3 the result is rather dependent on the last selection criteria, i.e. excluding fast rebidding. In fact, if this selection criterion is ignored and more of the rebids are made within a few minutes the effect

[13]The results of other specifications can be obtained from the author upon request.

[14]With the simple functional form is it not possible to distinguish between direct effect on probabilities and an effect through t.

of t is reversed. Table 2 shows the coefficients of $\ln(t)$ in logit regressions with a less strict restriction. This reveals that if rebids within less than 6 minutes are allowed these fast rebids will dominate the sample and the effect of pseudo-ownership disappears. This illustrates a clear distinction between

Restriction	2 min	6 min	15 min	1 hour	**4 hours**
Coefficient	-0.026	0.000	0.015	0.030	**0.047**
N	7309	6984	6741	6462	**6093**

Table 2: Including fast rebidding

auction fever and the pseudo-endowment effect. I speculate that auction fever is when bidders get aroused and caught in a bidding competition. If bidders rebid within only a few minutes this must be an indication of auction fever as opposed to a real change in underlying preferences. That is exactly what the data shows. From this perspective, I think this finding supports the idea of pseudo-endowment.

5.2 Optimism

Although time is an important factor in changing the reference point I take this analysis one step further and focus directly on the expectations to buy. Expectations must be related to the bidders' beliefs about winning. Hence, from a logical point of view other factors to consider are the factors which could affects the bidders' subjective probability to win.

Imagine that bidders are rational in their beliefs about winning. What would then be a reasonable model of their subjective probability to win? This approach is taken by Bramsen (2007) where the bidding behavior of a Reference-Dependent bidder is modeled. Basically, the probability to win is based on some underlying probability distribution of prices which is updated during the auction. At a given time the probability to win can therefore be calculated as the cumulative probabilities to win below the bidders max-bid.

Naturally, we do not know the bidders' underlying beliefs about probabilities. Still, the perceived probability to win must be a function of the distance from the current price to the max-bid. If for instance the bidder places a max-bid of \$1000 she must be more optimistic about the chance to win if the current price in the auction is \$200 as compared to \$900. This distance or "*depth*" of pseudo-ownership is therefore a proxy for optimism and hence another measure of the amount of pseudo-endowment.

To illustrate this measure consider Figure 2. Here the bidder puts in a max-bid of \$1000 at a point where the current price is \$270. The leading

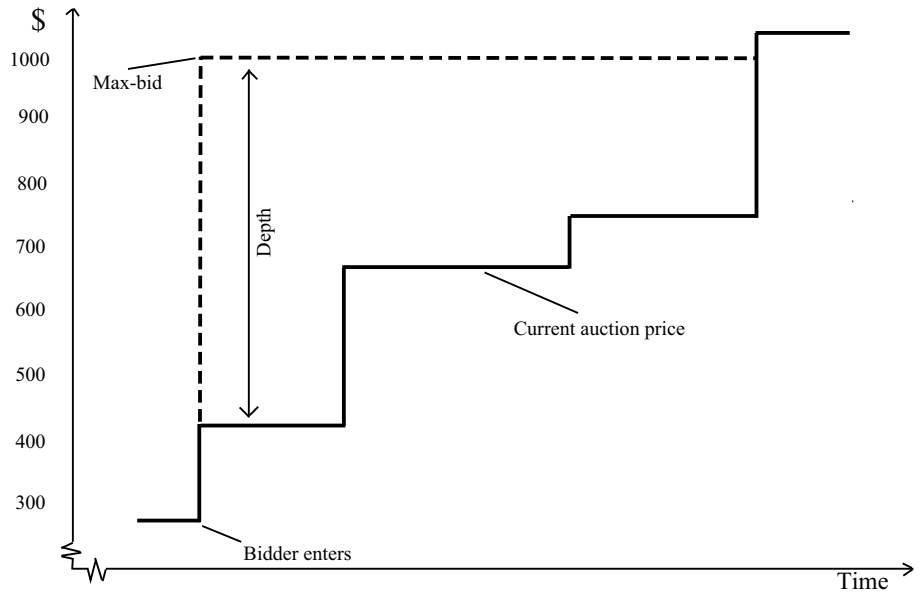


Figure 2: Measuring Pseudo-Endowment

bidder at this point has a max-bid of $400 which causes the current price to change immediately to $420 (the next increment). The initial depth can therefore be expressed as the distance between $1000 and $420. During the duration of ownership a couple of other bidders enter new bids which cause the current price to increase and the depth to decrease. At the point where a bidder bids $1040 (the increment above $1000) or more the leading bid is lost.

Figure 2 also illustrates that for many bidders the level of optimism will decrease during pseudo-ownership. Bidders will most likely observe the depth at some points in time during this period of pseudo-ownership, but it is impossible to know exactly when. As a general measure I will therefore use the expected depth at a random time. This corresponds to using a weighted average of the depth. I will denote this $\bar{d}$.

There is one problem with using depth as the proxy for optimism. When the depth is zero, i.e. the current price equals the max-bid of the bidder there is still a chance to win. Yet in a regression there is no difference between zero as in zero depth, and zero, as in outbid. To solve this problem I will therefore use a dummy if the bidders max-bid equals the current price. This dummy will be assigned a possible effect of ownership with zero depth.

In Table 3 the results of the four different logit regressions using $\ln(t)$ and $\bar{d}$

in various ways are reported. Again, a logistic transformation of $\bar{d}$ has the best fit as in model 2b[15]. In model 2c I also include an interaction effect, but this is not significant. Initially I therefore conclude that model 2b to be the best model.

	Model 2a	**Model 2b**	**Model 2c**	**Model 2d**
Intercept	-0.72*** (0.10)	-1.46*** (0.20)	-1.37*** (0.21)	-1.40*** (0.15)
Time of entry	-0.0036 (0.0185)	-0.0009 (0.0185)	-0.0039 (0.0186)	0.0006 (0.0183)
Experience	-0.022*** (0.006)	-0.022*** (0.006)	-0.022*** (0.006)	-0.022*** (0.006)
Valuation	0.000023 (0.000071)	0.000018 (0.000068)	0.000013 (0.000068)	0.000031 (0.000062)
Price at entry	-0.25 (0.13)	-0.29* (0.13)	-0.31* (0.13)	-0.29* (0.13)
$ln(t)$	0.14*** (0.02)	0.13*** (0.02)	0.25** (0.08)	
$\bar{d}$	0.00025*** (0.00007)			
$ln(\bar{d})$		0.16*** (0.03)	0.14*** (0.03)	
$ln(t)$*$ln(\bar{d})$			-0.02 (0.01)	
$ln(t \cdot \bar{d})$				0.14*** (0.02)
Dummy	1.36*** (0.28)	2.03*** (0.32)	3.49*** (0.98)	2.03*** (0.32)
-2Loglikelihood	6829.4	6820.5	6818.0	6820.8

Significant codes: *** ≤0.001, ** ≤0.01, * ≤0.05

Null deviance (-2Ł): 6997.5 on 6092 degrees of freedom

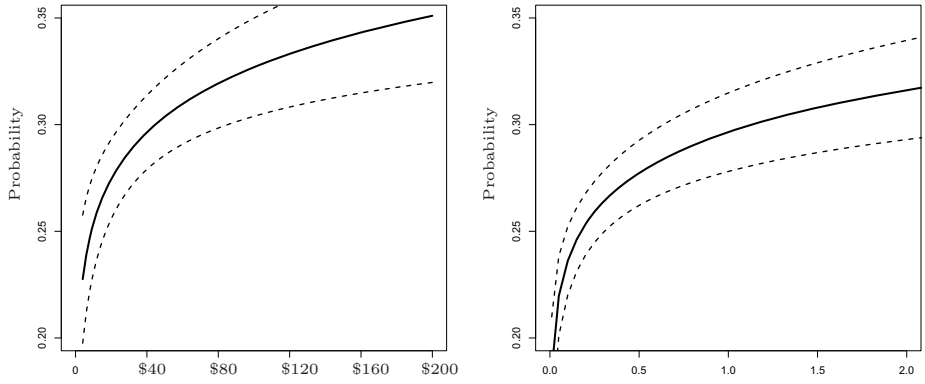
Table 3: Logit regressions on the effect of time and depth

Figure 3a illustrates the predicted values and 95% confidence intervals of model 2b for the median bidder with a duration of ownership of 19.5 hours. In addition to this effect there is often a link between low depth and short duration of ownership. Thus, the effect of low depth will often be enhanced by short ownership[16].

[15]If the average depth is zero I replace $\ln(\bar{d}) = -Inf$ with zero. Hence the effect of depth will be assigned to the dummy.

[16]Similarly will the dummy also be correlated to short duration of ownership. It is therefore difficult to interpret the exact effect of the dummy. What is important is the sign of the effect as this suggests that having no depth, but still ownership will have a

Adding depth to the regression, i.e. expand model 1c to 2b, increases the effect of duration substantially. Figure 3b illustrates the effect of having the leading bid for the median bidder with an average depth of $28. However, a little caution must be made because of the dummy, and a direct comparison is not possible. Still, the fact that the effect does not decrease must indicate that depth does not take any of the explanatory power away from duration. In other words, depth seems to be an entirely additional component of pseudo-endowment not explained by the duration.



(a) Effect of leading the bid in dollars ($\bar{d}$) (b) Effect from leading the bid in days (t)

Figure 3: Intentions at Entry and Pocket Money

Another observation for model 2b is that the estimated coefficient for $\ln(\bar{d})$, $\hat{\beta}_{\bar{d}} = 0.16$, is very close to that of $ln(t)$. This raises the question if $\beta_t = \beta_{\bar{d}}$ as in model 2d. A likelihood ratio test comparing model 2b and 2d shows that this hypothesis cannot be rejected (p=0.58). An alternative description of the pseudo-endowment effect is therefore $\beta ln(t) + \beta ln(\bar{d}) = \beta ln(t \cdot \bar{d})$. Hence, the change in reference point must be closely related to the area $t \cdot \bar{d}$, which is another way of describing the total area between the max-bid and the current auction price in Figure 2.

Although I use the weighted average of depth as the proxy for optimism, another reasonable hypothesis is that depth right after entry would have greater importance for the bidders' optimism than a random time. Yet, the estimated coefficient for an additional variable measuring initial depth is not significant. This hypothesis can therefore not be supported[17]. Another hypothesis is that a large depth late in the period of ownership will increase the loss of paying more and make the bidder less likely to rebid. But again

positive effect on the probability to rebid compared to no ownership at all.

[17]I measure the depth after 1 or 5 minutes after entry.

this cannot be supported by the data[18]. Thus, it seems as if the best possible proxy for optimism is the weighted average depth. In other word, the feeling of ownership is directly related to the logarithm of the total area between the current price and the max-bid *no matter the shape*.

This observation summarizes the results in a simple and illustrative model. First of all, optimism and duration can substitute each other in a straightforward manner. For instance, lower depth can be compensated with longer duration as the leading bidder. Also, a relative less optimistic start can be compensated if there is less decrease in optimism later in the period of pseudo-ownership.

Another intuitive aspect is the diminishing sensitivity on the reference point in both dimensions. More pseudo-ownership, both in dollars and in duration, will lead to an increase in the pseudo-endowment effect, but the effect is marginally decreasing.

6 Discussion

You do not get the actual ownership after a bid in internet auctions. Nevertheless, this analysis suggests that there is an endowment effect of being the leading bidder, i.e. a pseudo-endowment effect. For the subset of bids which is likely to represent WTP, both time as leading bidder and optimism about chances to win is facilitating that a bidder is getting attached to the item and thus willing to pay more when outbid. This study therefore confirms two hypotheses about the creation of a reference point; 1) that it takes some "getting used to" before people adjust to new beliefs and 2) that the reference point, at least to some extend, is based upon rational beliefs about future outcomes.

For those not impressed by the magnitude of the pseudo-endowment effect found in these data, this might only be the tip of the iceberg. Many people do not enter the auction until the last minute, perhaps as part of a strategy. But in my opinion they will still form expectation about their chance to win at a given bid which they are going to place. In fact, if they do not enter, the current price will be lower so they might even get more optimistic about their chance to win. Thus, some of the behavior I disregard as auction fever due to fast rebidding could in reality be caused by pseudo-endowment

[18]Nor a measure of depth five minutes before outbid or a measure of necessary increase in the payment from five minutes before outbid to five minutes after have significant coefficients in a logit regression. These analysis can be provided by the author upon request.

created before entering.

Naturally, the data is noisy and it might be a bit hastily to conclude in details how the reference point is created. In the time dimension the marginally decreasing speed of adjustment could simply be a result of the natural focus of the bidders. Just after placing the bid the bidder is likely to think a lot about the auction and therefore adjust the reference point relatively fast. However, the speed of adjustment will vary a lot between the bidders and depend on the specific situation[19]. Still, as a general model for the reference point the marginally decreasing speed of adjustment might not be a bad starting point. A reasonable model for this could e.g. be the lagged model of Frederick and Loewenstein (1999) where new beliefs partly replace the reference point of last period.

Pseudo-endowment might only be one of the factors affecting a change in preferences during the auction. For instance, if the bidders have price sensitive preferences as suggested in Ariely, Koszegi, Mazar and Shampan'er (2004), the rising price in itself will increase the WTP. Although this could raise some doubt about the pseudo-endowment effect, I think it mainly helps to explain some of the additional noise in the data and the reason why some of the bidders in the sample rebid more than once.

At a more general level the pseudo-endowment effect found here supports the fact that expectations play a major role for the reference point. Moreover, the relatively fast effect of entry suggests that a shift in reference point could be relevant in many other settings. For instance, if you go shopping and see something you fancy it is not at all unlikely that you will get attached to the item and change your reference point in time to make the purchase despite your initial objection to pay the price. Similarly, this could be the case in many other settings where a seller, your employer, or even your family is successful in affecting your expectations. Thus, the endowment effect can prove to be relevant far beyond the initial applications.

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[19]In auctions the speed of adjustment is therefore likely to be faster the closer to the end and that seems to be the case here. If the interaction of time of entry and duration is added to model 2b there is a positive and significant effect of this term. This analysis can be provided by the author upon request.

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APPENDIX

A Sensitivity Analysis

An important point in the analysis is to select the bids which are credible to be the bidders underlying WTP. In section 4 I present 5 restrictions which are designed to screen away bids that is unlikely to be WTP. Below are four tables which shows a sensitivity analysis for the first four restrictions (the last is treated in section 5.1). In my view they basically show that the result is relative insensitive to the exact limits of the restrictions. In fact, you could get larger coefficients from other limits. Thus with these restrictions I have tried to maximize the likelihood of observing WTP – not the coefficients.

Restriction 1: To low a first bid

$\geq$ pct. of final price	0	40%	**60%**	80%
Coefficient for $\ln(t)$	0.065	0.050	**0.047**	0.058
Number of obs	14886	9498	**6093**	2974

Restriction 2: First bid is just the next increment

Including increments	Yes	**No**
Coefficient for $\ln(t)$	0.031	**0.047**
Number of obs	9315	**6093**

Restriction 3: Excluding professionals

Participated in less than	10	**20**	50
Coefficient for $\ln(t)$	0.059	**0.047**	0.042
Number of obs	4605	**6093**	7780

Restriction 4: Maximum bid increase from first to second bid

Bid Increase $\leq$	10%	**20%**	None
Coefficient for $\ln(t)$	0.043	**0.047**	0.051
Number of obs	5438	**6093**	6447

B Summary statistics for controlling variables

In the logit regressions I apply some controlling variables in order to isolate the effects of duration and depth of ownership. For the sample used (N=6093) the summary statistics for these variables are:

	Entry at (days)	Participated	Valuation	P/V at entry
Min. :	0.0	1	200	0.00
1st Qu.:	3.3	2	300	0.18
Median :	5.5	5	400	0.30
3rd Qu.:	6.4	9	700	0.48
Max. :	7.2	19	4600	3.10
Mean :	4.8	6.3	559	0.35

More summary statistics on the data can be provide upon request.