

**WORKING PAPER** · NO. 2022-70

# The Endowment Effect and Collateralized Loans

*Kevin Carney, Michael Kremer, Xinyue Lin, and Gautam Rao*

MAY 2022



**Development  
Innovation  
Lab** at University  
of Chicago

An Affiliate of  
**BF** Becker  
Friedman  
Institute

5757 S. University Ave.  
Chicago, IL 60637  
Main: 773.702.5599  
[bfi.uchicago.edu](http://bfi.uchicago.edu)

## THE ENDOWMENT EFFECT AND COLLATERALIZED LOANS

Kevin Carney  
Michael Kremer  
Xinyue Lin  
Gautam Rao

May 2022

This project received generous funding from the Weiss Family Program Fund for Research in Development Economics, the Pershing Square Venture Fund for Research on the Foundations of Human Behavior, and an anonymous donor. This document is an output from the research initiative ‘Private Enterprise Development in Low-Income Countries’ (PEDL), a programme funded jointly by the by the Centre for Economic Policy Research (CEPR) and the Department for International Development (DFID), contract reference PEDL-LOA-4768-Rao. The views expressed are not necessarily those of CEPR, DFID or the NBER. We thank numerous colleagues and seminar audiences for helpful suggestions, and James Reisinger and Niharika Singh for excellent research assistance. We received IRB approval from Harvard University (protocol number IRB17-0944) and Maseno University (protocol number MUERC-00430-17. The experiment was pre-registered with a pre-analysis plan on the AEA registry, number AEARCTR-0002448.

At least one co-author has disclosed additional relationships of potential relevance for this research. Further information is available online at <http://www.nber.org/papers/w30073.ack>

© 2022 by Kevin Carney, Michael Kremer, Xinyue Lin, and Gautam Rao. All rights reserved. Short sections of text, not to exceed two paragraphs, may be quoted without explicit permission provided that full credit, including © notice, is given to the source.

The Endowment Effect and Collateralized Loans  
Kevin Carney, Michael Kremer, Xinyue Lin, and Gautam Rao  
May 2022  
JEL No. D14,D25,D9,D91,D92,O1,O16

### **ABSTRACT**

Collateral requirements play an important role in credit markets. This paper shows that the endowment effect—the phenomenon where owing a good increases one's valuation of it—inhibits demand for loans which use a borrower's existing assets as collateral. Using a field experiment in Kenya, we show that borrowers instead strongly prefer loans collateralized using the new durable assets being financed by the loans themselves. They are willing to pay 9% per month higher interest for such Same-Asset Collateralized Loans (SACLs) despite the endowed and new assets being randomized, and thus similarly valued before ownership. Our findings imply that assets which are difficult to use as collateral—which cannot be financed by SACLs—will be invested in less, even if the borrower has other collateral. We argue that borrowers' preference for SACLs is driven by naivete: they initially perceive that they have little to lose when offered a SACL, but subsequently come to develop an attachment to the new asset, resulting in high repayment effort. Consistent with this, borrowers underestimate their future attachment to an asset before owning it, and SACLs do not have higher default rates despite having higher demand. We derive the conditions under which offering consumers SACLs increases or conversely decreases borrower welfare.

Kevin Carney  
Harvard University  
carney@g.harvard.edu

Xinyue Lin  
Harvard University  
xinyue\_lin@g.harvard.edu

Michael Kremer  
University of Chicago  
Kenneth C. Griffin Department of Economics  
1126 E. 59th St.  
Chicago, IL 60637  
and NBER  
kremermr@uchicago.edu

Gautam Rao  
Department of Economics  
Harvard University  
Littauer M-30  
Cambridge, MA 02138  
and NBER  
grao@fas.harvard.edu

# 1 Introduction

Some loans are collateralized using the same durable assets whose purchase is financed by the loans themselves. Home loans, car loans and lease-to-own contracts are examples of such Same-Asset Collateralized Loans (SACLs). Such loans may be particularly helpful for borrowers who do not possess other assets to provide as collateral. Other loans involve the borrower pledging some other, already-owned asset as collateral. Providing land or jewelry as collateral, common in poor countries, and home-equity loans or pawn-shop loans in rich countries, are examples of such Other-Asset Collateralized Loans (OACLs). Such OACLs may be the only option to finance goods which cannot themselves serve as collateral. In this paper, we study how two psychological mechanisms—the endowment effect and naivete regarding it—affect borrowers’ demand for SACLs and OACLs, with implications for real investments and for borrower welfare.

The endowment effect is the phenomenon—well-studied in the lab—where owning a good increases one’s valuation of that good, and reduces one’s willingness to lose it.<sup>1</sup> We hypothesize that borrowers subject to the endowment effect will dislike placing assets they already own at risk of loss by pledging them as collateral. They may be more willing to take up loans collateralized instead by the new asset being financed, to which they may not (yet) be ‘attached’. If they subsequently do come to develop an endowment effect over the new asset, repayment incentives may still remain high while paying off the loan.<sup>2</sup> Thus, if borrowers under-estimate their own endowment effect, SACLs can allow lenders to achieve higher demand than OACLs (since borrowers ex-ante perceive that they will have little to lose) without lower repayment effort (since borrowers will come to perceive a sense of loss in case of default).<sup>3</sup>

We designed a field experiment ( $n=701$ ) with borrowers in Kenya to test how the endowment effect—and naivete about it—interacts with collateral requirements of loans, while holding constant the myriad of other reasons—such as information asymmetries and ownership of pledgeable assets—that might affect demand for SACLs and OACLs. We began by endowing participants with a randomly selected durable asset as compensation for their participation and then, one week later, offered them a loan to finance the purchase of a different randomly selected asset. We varied whether the loan offer was a SACL which used the asset being financed as collateral, or an OACL which required the randomly

---

<sup>1</sup>The endowment effect is often considered an example of loss aversion. However, numerous alternative psychological models also generate an endowment effect, such as motivated taste change (Beggan 1992), attachment (Carmon et al., 2003), attention to different aspects of the transaction (Carmon and Ariely, 2000), and salience (Bordalo et al., 2012). We do not distinguish between these underlying models, and instead focus on an implication of the endowment effect for collateralized loans.

<sup>2</sup>Note that this would require developing an endowment effect before paying off the loan, and thus before fully owning the new item. Some research suggests that physically possessing a good is enough to increase one’s valuation of it and generate an endowment effect (Reb and Connolly, 2007).

<sup>3</sup>In the language of reference dependence, the question is how quickly the reference point updates to include the new financed asset, and whether borrowers are naive and under-predict this adjustment.

endowed asset to be pledged as collateral. The assets used in the experiment were chosen from a list of common household and agricultural durable goods, with market prices of around 15 days of per capita daily income, and loan repayment terms of two months.

Borrowers have a substantial preference for loans that use the item being purchased as collateral rather than the already-owned item. The average willingness to pay for a new item is 13.3% (s.e. 2.1%;  $p=0$ ) higher—equivalent to an 8.8 percentage point higher monthly interest rate—when it is financed using a SACL rather than an OACL. This is despite borrowers valuing the financed goods and the collateral identically on average across the two types of loans, as ensured by the randomization and verified using baseline measures of valuation for each item. We find that realized default rates across OACLs and SACLs are nearly identical, consistent with the possibility that borrowers come to develop a similar endowment effect—and therefore repayment incentives—over the financed and already-owned assets.

We also directly measured whether borrowers are naive about (i.e. underestimate) the endowment effect. First, we elicited borrowers' predictions about their future take-up decisions for SACLs and OACLs before we endowed them with any item. We find that borrowers over-estimate their future willingness to pay for an OACL before owning the endowed asset by 13.9% ( $p=0.003$ ), while correctly predicting on average their future demand for a SACL ( $p=0.85$ ). Second, we elicited willingness to accept (WTA) to sell the endowed item after a week of ownership and compared this to predictions made prior to ownership, following Loewenstein and Adler (1995).<sup>4</sup> We find evidence of a strong endowment effect over the randomly endowed item, with WTA about four times higher than WTP.<sup>5</sup> Participants' predicted WTA lies roughly halfway between their initial WTP and their eventual WTA for the item and is significantly different from both ( $p=0$  for each). Both sets of results—for loans as well as for WTA—indicate that borrowers have a strong endowment effect, but are partially naive about it: they under-estimate it before owning the item. We randomize incentives for accurate predictions; naivete about the endowment effect does not diminish with incentives.

All our findings can be explained by a combination of the endowment effect and naivete about it. However, a number of alternative explanations are worth considering. First, participants may have learned about the value of the endowed good over the week of ownership. We used common durable goods that are familiar to participants, and allowed participants to examine them before making any decisions. Yet 96 percent of participants displayed  $WTA > WTP$ , and participants anticipated

---

<sup>4</sup>Naivete about the endowment effect has been documented by Loewenstein and Adler (1995) and Van Boven et al. (2003), and has been considered an illustrative example of projection bias (Loewenstein et al., 2003).

<sup>5</sup>At face value, this gap between WTA and WTP is within the range found in the literature, for instance among the less-experienced traders studied in List (2003). However, our estimate of WTA is an under-estimate, since a substantial share of participants are top-coded as they refused to sell the endowed good at all the prices we offered. Among those who are not top-coded WTA is still 2.2 times as high as WTP. This is discussed in more detail in Section 3.2.

having a higher WTA than WTP. This is difficult to reconcile under learning with unbiased priors, where valuations would be expected to increase for some while decreasing for others, and risk-neutral individuals should predict future valuation equal to current valuation.<sup>6</sup> The preference for SACLs over OACLs was similar across all four endowed goods, and among those who previously already owned items similar to the endowed good. It seems implausible that rational learning causes nearly all participants to systematically update positively, unrelated to their past experience with such goods, and similarly across all four goods despite differences in their technological complexity.<sup>7</sup> We also discuss other alternatives in Section 3, such as hedging motives, complementary investments or fixed costs related to the endowed good, or simply confusion regarding the experimental protocol. We argue that none of these can reconcile our full set of results.

To map these results to behavioral parameters and to better understand welfare implications, we estimate a structural model of loan take-up decisions. In our model, borrowers experience an endowment effect over goods they possess due to loss aversion relative to status-quo reference points.<sup>8</sup> Borrowers may also be naive, i.e. under-estimate how their reference point changes over time. Specifically, they act as if their future reference points are a convex combination of their current reference point and their true future reference point, similar to the projection bias model of Loewenstein et al. (2003). We designed the experiment with this model in mind, and the treatments provide transparent identification of the parameters. We estimate levels of loss aversion ( $\lambda = 4.6$ ) (s.e. 0.3) that are within the range of recent field estimates but higher than lab estimates. We estimate a sophistication parameter  $\alpha = 0.5$  (s.e. 0.03), indicating that borrowers underestimate their future endowment effect by half.

The welfare implications of SACLs relative to OACLs are ambiguous, and depend on both psychological and market / institutional factors. We develop a life-cycle consumption model with income risk and endogenous loan take-up and repayment decisions to clarify the conditions under which offering borrowers SACLs—holding interest rates and prices fixed—increases welfare. Taking up SACLs may expose borrowers to stronger-than-anticipated painful losses in the case of defaults, and borrowers may under-save in advance and go to greater lengths than they initially anticipated to avoid default. The naivete that makes SACLs attractive can thus make their take-up higher than optimal. But there are also countervailing reasons why take-up of collateralized loans—and particularly OACLs—may instead

---

<sup>6</sup>Risk-averse participants with unbiased priors could have  $WTA > WTP$  *on average* if the uncertainty resolves over the week of ownership. However, many individuals would need to end up with  $WTA < WTP$  to justify the large average gap between WTP and WTA, which does not occur. In addition, it would have to be the case that participants substantially under-estimate the resolution of uncertainty over a week.

<sup>7</sup>It could be that ownership of an asset itself affects attention and learning, as in Hartzmark et al. (2021). Positively biased learning could be a plausible alternative micro-foundation for the endowment effect in our experiment.

<sup>8</sup>While this is a classic theory for the endowment effect, the loss-aversion parameter,  $\lambda$ , in our model could be reinterpreted under alternative models as a measure of the strength of the endowment effect due to psychological factors such as emotional capital, attachment or attention.

be too low. Many low-income borrowers may desire loans but simply not possess assets suitable to be pledged as collateral, a problem which SACs solve. Even if borrowers have suitable assets, their take-up of OACs may be too low for a reason related to the naivete we document in this paper. Specifically, just as borrowers under-estimate how attached they will come to be to a new item, they may also under-estimate how quickly they will get over losing an owned item.<sup>9</sup> If these factors cause take-up of OACs to be too low relative to the optimum, then SACs could enhance welfare by increasing take-up of finance.

Our findings have implications for real investments. If the characteristics of a good make it difficult to use as collateral under local institutions, there may be less investment in that good. For example, suppose that land is good collateral, but that farm equipment is difficult to repossess. In the absence of the endowment effect, borrowers would simply finance their purchase of farm equipment by providing land as collateral. With the endowment effect, such a loan would be less attractive, and potential borrowers may not invest in farm equipment. This psychological mechanism is likely to interact with local institutions. The greater the cost of repossessing various new goods—due to legal restrictions, weaker contract enforcement, or lower costs to borrowers of hiding collateral—the more a lender is likely to insist on a few safe forms of collateral such as cash deposits or land. This may explain why SACs are rare in our study context of Kenya. A paucity of owned assets that can serve as collateral, and an endowment effect over them, in turn explains why take-up of the OACs that are offered is low relative to SACs (Jack et al. 2022).

This paper contributes to the finance literature on the role of collateral, an important element of many lending arrangements. Collateral can decrease lender risk and help overcome contracting problems related to asymmetric information (Bester 1985, Chan and Thakor 1987). The literature has focused on the features of assets that determine their suitability as collateral and, in turn, a borrower’s debt capacity. This includes the transferability of ownership (Hart and Moore 1994), redeployability (Williamson 1988, Benmelech et al. 2005, Benmelech and Bergman 2008), asset tangibility (Rampini and Viswanathan 2013) and the difference between personal and business collateral (Voordeckers and Steijvers 2006). To this literature, we add previously unconsidered psychological factors which might affect demand for, and repayment of, collateralized credit. Our paper provides one explanation for why collateralizing using the same asset being financed is so common, at least in developed economies where repossession of a wide range of assets is relatively feasible. It may also provide an explanation for the puzzlingly low demand for home-equity loans and reverse mortgages (Davidoff 2015).

---

<sup>9</sup>In the language of reference dependence, reference points may adjust quickly such that the loss of a durable asset ceases to ‘hurt’ after a short while, but borrowers may not anticipate this, thus over-reacting *ex ante* when faced with the possibility of the loss.

The second contribution of this paper is to provide new explanations and evidence on an important question in development economics. Evidence from multiple settings suggests that farmers, small-scale entrepreneurs, and households in developing countries sometimes leave high expected-return investments unexploited, a phenomenon which has been dubbed the *Euler Equation Puzzle* (Banerjee and Duflo 2007; 2011; Kremer et al. 2019). In theory, provision of credit should allow these investments to be made, but uptake of credit is often low (Banerjee et al. 2015; Jack et al. 2022). Our findings suggest that the endowment effect may partially explain this in the case of the collateralized credit often available in developing countries. More generally, investments which place owned assets at risk of loss may be perceived as much less attractive than standard models would imply.

A final contribution is to the behavioral economics literature on the endowment effect.<sup>10</sup> While the endowment effect is considered a foundational result of behavioral economics, we have relatively little evidence on its importance in markets and in the field. In their review of the literature, Ericson and Fuster (2014) conclude, “Although this is difficult to do, it would be very desirable to get more evidence from field settings with goods or entitlements of substantial value. Relatedly, more research is needed in the field that examines how decisions in important domains such as ... savings/investment ... are affected by changes in ownership.” This paper provides such evidence. In doing so, we build on List (2003; 2004; 2011), a series of papers which show that the endowment effect in trading goods reduces with market experience, but is prominently found in inexperienced traders and consumers. Anagol et al. (2018) also study the endowment effect in the field, showing that IPO lottery winners are more likely to later hold the endowed stock than losers, because winners ask for more than what losers are willing to pay. Closer to our context, Fehr, Fink, and Jack (2019) conduct an experiment in the field in Zambia allowing farmers to exchange household items, finding a large endowment effect that decreases in the presence of seasonal scarcity and other resource constraints. We identify a new application of the endowment effect—and naivete about it—to an important economic context.

Numerous open questions along these lines remain. First, our study considers relatively small loans (worth fifteen days of income) and is somewhat artificial, with the owned asset being randomly assigned. Jack et al. (2022) shows using a field experiment that offering SACs to finance large water tanks in the same setting led to much higher take-up than loans guaranteed with cash deposits. While that study did not separate the endowment-effect mechanism from liquidity constraints, it shows that SACs can increase take-up in a more natural setting with higher stakes. Second, more evidence is needed to determine whether the mechanism we identify in this paper is restricted to relatively naive borrowers such as consumers or the owner-operated businesses we consider, or also applies to managers

---

<sup>10</sup>Existing literature, going back to Knetsch (1989) and Kahneman et al. (1990), establishes the endowment effect in the lab. Ericson and Fuster (2014) describe it as “one of the most robust findings in the psychology of decision making”.

or to larger or more-frequent borrowers. Third, while we do not detect heterogeneity in treatment effects across the four endowed items we consider, heterogeneity across individuals and assets in the strength of the endowment effect could be important. For instance, it seems plausible that people feel much more strongly attached to assets such as land or jewelry, in which wealth is often tied up in developing countries, than to business equipment. This could make SACLs even more important to provide. Fourth, this paper does not directly establish that borrowers do indeed come to develop an endowment effect over the new financed asset, as suggested by the similar repayment rates we observe across the SACL and OACL. This could explain, for example, why borrowers often do not default on mortgages even when they have a strategic motive to do so (Ganong and Noel 2020).

The rest of the paper proceeds as follows. Section 2 describes the setting and lays out the experimental design. Section 3 presents our main reduced form results. In Section 4 we develop a theoretical model of loan take-up decisions. Section 5 presents structural estimates of the model’s key parameters. Section 6 discuss the welfare implications of SACLs. Section 7 concludes.

## 2 Setting and Experimental Design

### 2.1 Setting

Our study took place in Kenya’s Nyandarua and Laikipia counties, in the former Central Province. We partnered with one of several local savings and credit cooperative associations (SACCOs), the Nyala Vision SACCO. SACCOs are common financial institutions in Kenya; approximately five percent of Kenyans are members of a SACCO. The Nyala Vision SACCO has five branches and provides deposit accounts and loans. It primarily serves dairy farmers, and is associated with a dairy cooperative to which members can sell milk. The cooperative makes payments through the SACCO, and borrowers can have loan payments directly deducted from their milk revenues if they wish. The SACCO offers loans for a variety of purposes, including farm equipment, school fees, and emergency loans. Our partnership with the SACCO is crucial for the research design. The borrowers we work with have a valued relationship with the SACCO. This makes it possible for the SACCO to offer collateralized loans, with a high degree of confidence in being able to repossess collateral in case of borrower default.

We recruited 701 participants from the SACCO’s list of members. Our sample has a mean age of 51, and is approximately balanced on gender (Table 1). The average subject has 9.8 years of education and the mean household income in the month prior was KES 23,900 (USD 236). 62% of participants report dairy farming as their main source of income. Most participants are smallholder farmers: participants reported that on average they had 1.8 cows producing milk at the time they were surveyed.

Table 1: Sample Description

	Mean	Standard deviations	25th percentile	75th percentile
Age	51.0	12.6	42.0	60.0
Female respondent	0.5	0.5	0.0	1.0
Years of education	9.8	3.6	8.0	13.0
Number of HH members	4.2	1.8	3.0	5.0
Income last month (thousand KES)	23.9	18.7	10.0	33.0
Liquid household savings (thousand KES)	15.9	12.3	3.0	31.0
Outstanding loans (thousand KES)	13.4	13.1	1.0	31.0
Share primary income: dairy	0.6	0.5	0.0	1.0
Share primary income: farming land	0.2	0.4	0.0	0.0
Number of cows producing milk	1.8	1.1	1.0	2.0

Notes: Table 1 presents summary statistics for variables collected at the baseline. The first column shows the mean value of each variable. The second column shows the standard deviation. The third and fourth columns show the 25th percentile and the 75th percentile, respectively. The sample size is 701 individuals.

## 2.2 Identification Challenge

The key identification challenge is to offer loans that are identical but for one feature: whether their collateral is already owned by the borrower, and therefore a part of their endowment. To illustrate this challenge, suppose borrowers were randomly offered one of two loans to purchase a new asset: one loan that required the borrower to provide any existing asset as collateral (an OACL), and another loan that used the new asset itself as collateral (a SACL). Borrowers might prefer the SACL for many reasons. Perhaps the borrowers simply lack any assets to provide as collateral. Or perhaps the assets they could use as collateral are more valuable than the new asset, irrespective of an endowment effect. These confounds make it difficult to attribute a preference for SACLs to the endowment effect.

To overcome this challenge, we first endowed participants with a durable household or farm asset. One week later, once the asset was likely to have entered participants' reference point, we elicited each subject's willingness to pay for new assets using an OACL and a SACL. The OACL uses the initially endowed item as collateral, while the SACL uses the new item being purchased as collateral. By endowing each subject with the initial item for free, we overcome the challenge that borrowers with limited assets may not be able to take up an OACL. By randomly assigning which items serve as the endowed item and new items we ensure that the new items and items for sale have the same expected value in both loans. In this way, any difference in willingness to pay between OACL and SACL can be attributed to an endowment effect over their collateral.

Another goal of the experiment was to identify whether borrowers are naive about the endowment

effect, such that they fail to anticipate how unwilling they will be to lose an item once they possess it. This could explain borrowers being more willing to accept a SACL, but later exerting similar repayment effort to an OACL. Ideally, we would want to directly measure the predicted and actual endowment effect over the new item financed by the SACL while it was still being paid off. However, we would only be able to observe this for those who did take up a SACL, which would be a selected sub-sample with high WTP for SACLs. Instead, we measured beliefs about the *endowed* item before participants received it. Specifically, we elicited predicted willingness to later take up an OACL using the endowed good as collateral, as well as predicted WTA to directly sell the endowed good. In both cases, we compared this to actual willingness to take a loan or sell the endowed good a week later. For comparison, we also measured predicted future willingness to take a SACL for a new item, with that item itself as collateral.

### 2.3 Experimental Protocol

Figure 1 illustrates the experimental design. We invited members of the SACCO to participate in two sessions scheduled one week apart. 701 individuals participated in the study, unintentionally exceeding the pre-registered sample size by one.

**Items used.** Our experiment used four common household and agricultural items: a metal milk can, a cow sprayer, a set of cooking pots and a large thermos. Each of these items costs about KES 3,000 (USD 30), and was available in local markets. These particular items were identified based on pilot surveys as being durable, familiar and frequently used goods which were expensive enough that participants might require a loan to finance their purchase, and which the SACCO could repossess in case of default.

**Session 1.** During the participant’s first visit to the loan office, we elicited baseline valuations of the different items, asked them to make predictions about their future choices, and endowed the participant with one randomly selected item.

*Baseline valuations.* We began by eliciting participants’ willingness to pay for each item outright using a Becker-DeGroot-Marschak (BDM) multiple price list approach, implemented with a very low probability (Becker, DeGroot and Marschak, 1964). The purpose of this exercise was to (i) provide ex-ante valuations of the items, which were used to stratify the randomization and as control variables, and (ii) to introduce the BDM procedure which was also used in the loan offers that followed.<sup>11</sup> For each subject, we identified the three items that were the closest in valuation to each other. We then randomized—without yet revealing to the participant—which of these three items would be the endowed

---

<sup>11</sup>Note that we offered participants a collateral-free loan if they wanted one while eliciting the WTP. However, unlike in the collateralized loan take-up decisions which are our key outcome, this loan was not described in detail. It is possible that some participants missed this statement, and their elicited WTP may therefore be depressed due to liquidity constraints.

item, the item financed using an OACL, and the item financed using a SACL. This randomization ensured that, in expectation, the ex-ante valuation of the endowed item was the same as that of the items financed using the SACL and OACL respectively.

*Predictions.* We next elicited two sets of predictions from participants. First, we asked them to predict their future WTA to sell the soon-to-be-endowed item a week later, were they to receive it today. Second, we asked them to predict their future WTP for the two other items if they were offered with financing via a SACL or an OACL respectively. The OACL was required to be collateralized with the soon-to-be-endowed item. We will later compare these predictions to the actual WTA and loan WTP measured the following week.

We elicited the predicted WTA for the endowed item for all participants. Only a randomly selected one-third of participants were asked to make the loan take-up predictions.<sup>12</sup> We randomized half of all participants to receive small payments of up to KES 50 (USD 0.50) for correct predictions. We offered these payments to increase participants' incentives to think seriously about the predictions, but kept incentives small to avoid distorting later behavior. As it turns out, we find no evidence that the prediction incentives influenced participants' predictions or their later behaviors.<sup>13</sup>

*Endowed item.* At the end of the first session, we gave participants the randomly selected endowed item to take home with them. This was framed as their compensation for participation, and they were informed that the endowed item was now theirs to do with as they pleased. However, they knew that they would have the opportunity to purchase an additional item the following week, with financing, and that the OACL would require them to pledge the endowed item as collateral. They also knew that they might have the chance to sell back the endowed item a week later.

**Session 2.** Participants returned to the study site to complete a second session after a delay of approximately one week. We used a one-week delay to give sufficient time for the endowed item to enter into participants' reference points and to minimize attrition and scheduling conflicts. 95% of participants completed the second session within two days of the one-week target. Only 1% failed to return for the second session, leading to a final sample size of 691 individuals.

*WTA.* First, we elicited participants' WTA to sell back the endowed item to us. As in our other elicitations, we used a multiple-price list approach. We implemented participants' choices using a BDM procedure with a low probability.<sup>14</sup>

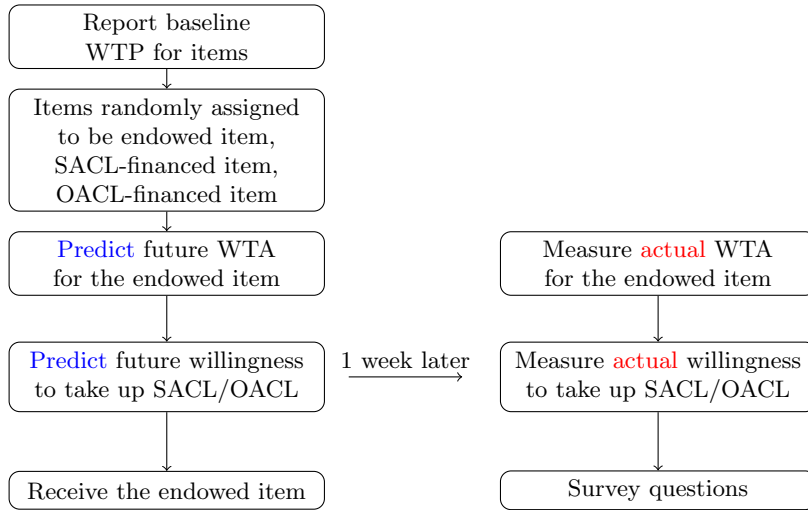
---

<sup>12</sup>We limited participation in these predictions out of concern that making predictions would induce anchoring of participants' actual loan take-up decisions to their previous take-up predictions. In practice, we find no evidence of differences in the eventual loan WTP of those who made or did not make loan predictions.

<sup>13</sup>See Appendix Table A.1.

<sup>14</sup>Either the WTA procedure (with low probability) or the loan take-up (with high probability) were randomly selected at the end of the session to be implemented. This ensures that participants had no reason to shade their WTA choices due to a concern that selling the endowed item would eliminate their ability to take up an OACL.

Figure 1: Flowchart of the Experimental Design



Notes: Figure 1 illustrates the experimental design. The order of different questions is randomized within sessions including baseline WTP elicitation, loan take-up prediction, and actual loan take-up decision. Only a randomly selected one third of subjects made loan take-up predictions.

*Loan WTP.* Next, we elicited participants’ WTP for a new item with an associated loan contract. To increase power, instead of offering only one item and loan type to each participant, we elicited WTP for two separate items and associated loan contracts from each participant, and then randomly implemented one of the two offers. For each participant, one of the items was randomly assigned to be financed using the endowed item as collateral (an OACL), while the other item would be financed using itself as collateral (a SACL).<sup>15</sup> The offers were presented in a randomized order, with some participants presented with the SACL offer first and others the OACL. Participants knew that only one of the two offers would be randomly selected to be implemented, and therefore each choice was independent. The loans were to be repaid in two monthly installments with one percent monthly interest.

We measured willingness to pay for each item with its associated loan, rather than take-up at a fixed price, to increase power. Again, we used a Becker-DeGroot-Marschak price list to elicit willingness to pay for each item. Participants had to correctly answer comprehension questions about the terms of the loan and its collateral before proceeding to willingness to pay questions. At this point, participants were very familiar with the procedure, typically passed all comprehension checks, and provided a single

<sup>15</sup>An alternative design would have been to elicit WTP using an OACL and a SACL for the same new financed item. In theory, this would provide a sharp within-person test of preferences for SACLs over OACLs. In practice, we were concerned about anchoring effects, which might drive the borrower to repeat the same WTP for the second loan-type they were offered. We therefore chose to offer the loans for different items.

crossing point to identify their WTP using the multiple price list. Alongside each price we displayed what the monthly installment payment would be for that price. After participants completed the price lists, the computer randomly selected one of the loans, and then randomly selected the price for that loan. If the subject had agreed to that price for that loan, they entered into a loan contract at the drawn price and went home with the new item. In case of default, the lender repossessed the collateral (in practice, the participant themselves returned the collateral to the lender in case of default). Participants were informed of this entire procedure in advance, and no participant reneged on their WTP choices.

*Survey.* The experiment concluded with a brief questionnaire measuring perceived probability of loan default, demographic information and information about farming practices.

### 3 Reduced-Form Results

#### Baseline valuations and balance checks

Appendix Table A.2 presents the baseline valuations from the initial BDM exercise for each of the four items used in the survey.<sup>16</sup> Participants exhibit substantial heterogeneity in their demand for each item, but the average WTP for the milk can, cow sprayer and cooking pots is comparable, with the thermos valued less on average. For all items, mean WTP was well below the market price, which was approximately KES 3,000 for each of the items.

More importantly, we use these baseline valuations to verify that the randomization was successful. Appendix Table A.3 shows that, as intended, the different loan types were balanced in terms of the baseline valuations of the financed items and the collateral. By chance, the thermos was slightly more likely to be offered for financing by a SACL and the cooking pots were correspondingly slightly less likely. While the baseline values are the relevant variables in our theory, these slight imbalances in the specific items financed by the different loans can be controlled for using item fixed effects.

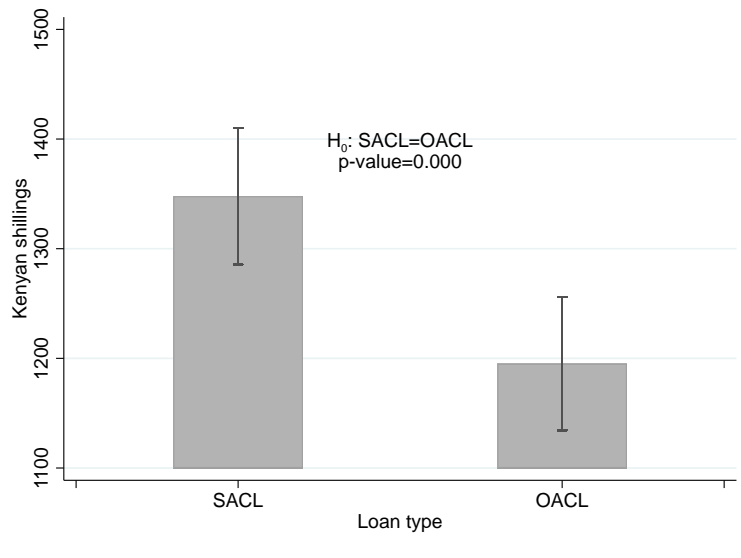
#### 3.1 Demand for Loans

A direct test of our hypothesis is to simply compare willingness to pay for items using a SACL versus an OACL. Figure 2 plots the raw means of willingness to pay for the two loan types, pooling across all the items. Participants are willing to pay KES 1,348 on average when an item is financed using a SACL, compared to KES 1,195 on average when financed with an OACL. A t-test for the difference of KES 153 is statistically significant at the 0.0001 level.

---

<sup>16</sup>Due to delays in procurement from the supplier, some participants completed the experiment without either the milk can or the cooking pot. This does not jeopardize our identification strategy.

Figure 2: Demand for SACL vs. OACL



Notes: Figure 2 presents the raw means (bars) and 95% confidence intervals (capped lines) of willingness to pay for new items financed by SACLs and OACLs, pooling across all the individuals and items. The p-value is calculated from a permutation test.

This result is robust to controlling for ex-ante differences in how participants valued the new items being financed by the loans and the associated collateral. Our main, pre-specified regression specification is as follows:

$$\Delta\text{Loan}_i = \beta_0 + \beta_1\Delta\text{New Item}_i + \beta_2\Delta\text{Collateral}_i + \varepsilon_i \quad (1)$$

Here, deltas represent differences between the SACL and OACL for individual  $i$ . On the left-hand side is the difference between individual  $i$ 's WTP for the two different randomly assigned items using a SACL versus an OACL respectively. For any given individual, this difference may differ substantially from zero depending on how much they value the particular items assigned to be financed using the SACL or the OACL. However, on average we would expect this difference to be zero if SACLs and OACLs are valued equally. On the right-hand side we include a constant, the difference between  $i$ 's baseline valuations of the new items financed using a SACL and an OACL ( $\Delta\text{New Item}_i$ ), the difference between  $i$ 's baseline valuations of the collateral items for the SACL and the OACL ( $\Delta\text{Collateral}_i$ ), and an individual-specific error term. The coefficient of interest is thus the constant, which represents the average difference between individuals' willingness to pay for a SACL and an OACL, controlling for differences in their baseline valuation of the new items as well as the collateral items for the two loans.

Table 2: Pre-Specified Regression Results

	WTP: SACL loan minus OACL loan	
	(1)	(2)
<b>Constant</b> <b>(treatment effect)</b>	158.7*** (25.26)	139.0*** (48.16)
New Item baseline valuation: SACL minus OACL	0.517*** (0.0595)	0.520*** (0.0601)
Collateral baseline valuation: SACL minus OACL	-0.0823* (0.0471)	-0.0884 (0.0570)
Endowed Item fixed effect		X
Average WTP for OACL	1195.2	1195.2
Equivalent monthly interest rate premium	8.8%	7.8%
Permute p-value for Constant	0.0000	0.0030
$R^2$	0.180	0.181
N	691	691

Notes: Column (1) of Table 2 reports estimates from the main, pre-specified regression. The dependent variable is the individual-level difference between willingness to pay for using a SACL versus an OACL. Note that the SACL and OACL finance different (randomly assigned) new items. The right-hand-side variables include a constant, the difference between baseline valuations of the new items financed using a SACL versus an OACL, and the difference between baseline valuations of the collateral for the SACL and the OACL. The coefficient of interest is the constant. The standard p-value and the p-value calculated from a permutation test both indicate that the constant is statistically significant at the 0.01 level. We also report what this treatment effect (measured in Kenyan shillings) corresponds to in terms of a monthly interest rate premium. Column (2) of Table 2 adds fixed effects for the endowed item to the regression specification of Column (1).

Standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Table 2 reports the estimates. In Column (1), the constant implies that borrowers are willing to pay KES 159 (s.e. 25) more on average for SACLs rather than OACLs. This represents a 13.3% increase in WTP over the mean WTP of KES 1195 for OACLs, and is equivalent to paying an 8.8% higher monthly interest rate in order to be able to collateralize using the item they are purchasing. As expected,  $\beta_1 > 0$  and  $\beta_2 < 0$ : participants are willing to pay more the more they value the new asset being financed and the less they value the collateral being placed at risk of loss. In Column (2), as a robustness check, we include fixed effects for each type of endowed item, and find very similar results.

In Table 3, we instead report alternative (not pre-specified) regressions where each observation is the WTP for a particular loan offer, the key treatment variable is an indicator for SACL, and standard errors are clustered at the individual level. The results are very similar, and robust to including new-item fixed effects, fixed effects for pairs of new and endowed items, and individual fixed effects. To

illustrate, this means that comparing SACLs versus OACLs among people who all received (say) a milk can as the endowed item and are offered a cow-sprayer as the new financed item or vice versa still reveals a preference for SACLs over OACLs. The table also reports no statistically significant order effects between the first and second loan each individual is asked about.

Table 3: Alternative (Non-Pre-Specified) Regression Results

	WTP for two types of loans					
	(1)	(2)	(3)	(4)	(5)	(6)
<b>I(SACL)</b> <b>(treatment effect)</b>	157.6*** (25.07)	157.5*** (35.58)	157.5*** (25.10)	165.7*** (25.24)	161.0*** (25.09)	169.7*** (35.12)
New Item valuation	0.526*** (0.0531)	0.520*** (0.0847)	0.510*** (0.0553)	0.491*** (0.0577)	0.519*** (0.0542)	0.404*** (0.0888)
Collateral valuation	-0.0357 (0.0501)	-0.0835 (0.0665)	-0.0227 (0.0502)	-0.0193 (0.0511)	-0.0349 (0.0500)	-0.0802 (0.0643)
Asked First	27.33 (25.19)	27.16 (35.74)	26.93 (25.25)	29.80 (24.59)	26.77 (25.08)	29.03 (34.43)
Individual fixed effects		X				X
Endowed item fixed effects			X			
New item fixed effects				X		
Item-pair fixed effects					X	X
Permute p-value for I(SACL)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
R <sup>2</sup>	0.174	0.841	0.176	0.181	0.177	0.851
N	1382	1382	1382	1382	1382	1382

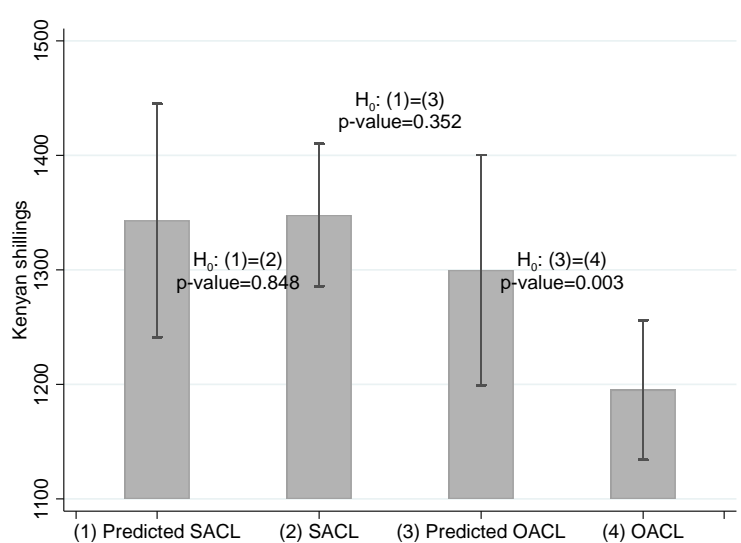
Notes: Table 3 reports an alternative specification of our main regression, estimated at the individual-loan level. The regression specification is  $\text{Loan}_{ij} = \beta_0 + \beta_1 \text{I(SACL)}_j + \beta_2 \text{New item valuation}_{ij} + \beta_3 \text{Collateral valuation}_{ij} + \beta_4 \text{Asked first}_{ij} + (\text{Controls}) + \varepsilon_{ij}$ . The dependent variable is individual  $i$ 's willingness to pay for loan  $j$ . I(SACL) is an indicator, equal to one if loan  $j$  is a SACL and zero if it is an OACL. New item valuation $_{ij}$  is individual  $i$ 's baseline valuation of the new item financed by loan  $j$ , and Collateral valuation $_{ij}$  is individual  $i$ 's baseline valuation of loan  $j$ 's collateral. Asked first $_{ij}$  is equal to one if individual  $i$  was asked about his or her willingness to pay for loan  $j$  first and zero otherwise. Column (1) includes no fixed effects. Columns (2)-(5), respectively, include fixed effects for individual respondents, each endowed item, each new item, and each possible pair of new items and endowed items (6 pairs in total). Column (6) includes individual and item-pair fixed effects. Standard errors are clustered at the individual level. Standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

### 3.2 Naivete about the Endowment Effect

*Naivete: Loan predictions.* The first way we measure naivete is by asking a randomly selected one-third of participants to predict their future demand for loans before they receive the endowed item. Figure 3 plots the predictions and compares them to the actual loan WTP a week later. On average, participants in the first session correctly predict their willingness to pay for the SACL in the second session (1343

KES vs. 1329 KES,  $p=0.85$ ). This is consistent with our theory—because the SACL does not involve the endowed item at all, there is no obvious reason that participants’ evaluations of this loan would change during the week between sessions. In contrast, participants substantially overestimate their future WTP for an OACL by 8.8% (1300 KES vs. 1116 KES,  $p=0.003$ ). This finding is consistent with naivete about the endowment effect: participants underestimate how attached they will get to the endowed item, and thus how unwilling they will be to promise it as collateral in an OACL. The point estimates suggest *some* sophistication, with the mean predicted OACL WTP being lower than the predicted SACL WTP (1300 KES vs. 1343 KES), but this difference is not statistically significant ( $p=0.35$ ). Elicited beliefs were similar with and without incentives of 50 KES for accurate predictions, suggesting that the questions were taken seriously even without the incentives (Table A.1).

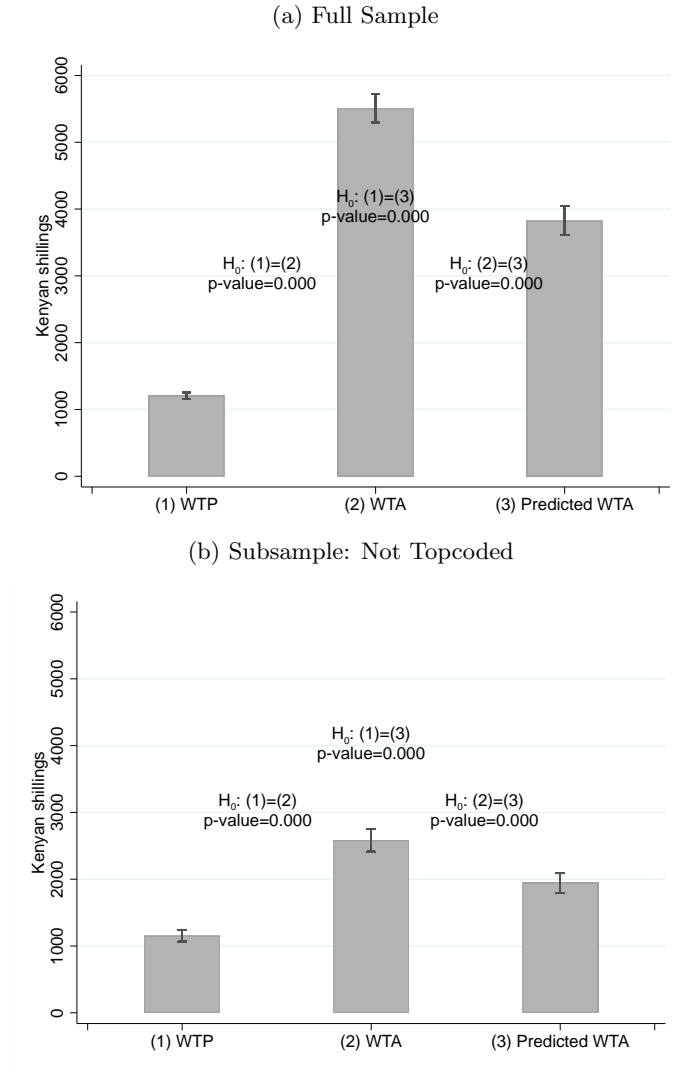
Figure 3: Predictions of Loan Take-up



Notes: Figure 3 shows the predicted and actual willingness to pay using SACLs and OACLs for the one third of subjects who were randomly selected to completed these predictions, pooling across items. Bars show the raw means and capped lines show the 95% confidence intervals. The p-values are calculated from permutation tests.

*Naivete: Underestimating WTA.* We additionally measure naivete by asking all participants to predict their future WTA for the endowed good. We compare their predictions to actual WTA and baseline WTP. Figure 4 panel (a) plots these three quantities for the full sample. Mean willingness to accept is much higher than willingness to pay—KES 5,508 vs. KES 1,205 (USD 55 vs. USD 12,  $p=0.000$ )—implying a strong endowment effect. Predicted WTA lies between actual WTP and WTA, at KES 3,825 (USD 38), and is significantly different from both ( $p=0.000$ ). This implies that participants are partially

Figure 4: Baseline WTP, WTA and Predictions



Notes: Figure 4 compares initial WTP for the endowed item, WTA for the endowed item after one week of ownership, and predicted future WTA for the item prior to its endowment. Bars show the raw means and capped lines show the 95% confidence intervals. Figure 4a shows the results from the full sample. Figure 4b shows the results from the subsample of individuals whose WTA and predicted WTA are not top coded. The p-values are calculated from permutation tests.

naive about the endowment effect, understanding that they will become attached to the endowed item over the course of a week but not recognizing the full strength of their attachment. Altogether, the two measures of naivete—predictions about WTA and loan take-up—both imply substantial naivete about the endowment effect, as in Loewenstein and Adler (1995) and Van Boven et al. (2003).

While our primary interest lies in comparing the demand for SACs and OACs, it is worth dis-

cussing the strength of the endowment effect implied by the WTA and WTP. The median ratio of WTA to WTP in our sample is 4.7. The mean at the individual level is even higher, at 6.5. In fact, this is likely an underestimate: our WTA data are top coded, as 62% of respondents said they would not accept any price on our price list (which went up to KES 8000) and declined to state a higher amount that they would (hypothetically) accept in exchange for the item.<sup>17</sup> Panel (b) instead restricts attention to participants whose choices were *not* top-coded. Even for this sub-sample, we find a substantial endowment effect, with a ratio of WTA to WTP of 2.2, and again find that participants under-predict the strength of their endowment effect.<sup>18</sup> Appendix Figure A.1 shows scatter plots of WTP, WTA, and predicted WTA. It shows that 96 percent of individuals have  $WTA > WTP$ , 81 percent predict that their WTA will be larger than their WTP, and most under-predict WTA.

Is such a large difference between WTA and WTP plausibly explained by the endowment effect? In the classic lab experiments on the endowment effect, WTA typically ranges from 2-3 times larger than WTP (e.g. Kahneman et al. 1990, Knetsch and Sinden 1984, Coursey et al. 1987). We observe a stronger endowment effect in our full sample, more in line with the ratio of 5.5 found among the less-experienced traders in a sports-card market in List (2003). Our findings are therefore broadly in the range found in the literature, but on the higher side. We discuss potential confounds below.

### 3.3 Caveats, confounds and alternative mechanisms

We have argued that the endowment effect causes borrowers to be willing to pay more for a SACL than an OACL. By the ‘endowment effect’ we refer to various psychological mechanisms through which ownership directly affects one’s valuation of and willingness to lose an item. This most prominently includes loss aversion, but could also incorporate motivated taste-change (Beggan 1992), attachment (Carmon et al., 2003), attention to different aspects of the transaction (Carmon and Ariely, 2000), or salience (Bordalo et al., 2012), all of which have been proposed as alternative psychological foundations for the endowment effect. Below, we instead consider alternative, standard explanations for why borrowers prefer SACLs over OACLs in our experiment while mispredicting their own future choices.

*Learning and uncertainty.* One plausible confound is that participants may have been uncertain about the value (e.g. the quality or usefulness) of the endowed good at first, and had a chance to learn over the course of the week. This seems unlikely to explain all our findings. First, we identified and used common durable goods that were familiar to participants, and asked them to carefully examine the items before making any decisions. By design, we thus tried to reduce the scope for learning or surprises.

---

<sup>17</sup>We code them as having a WTA equal to the maximum price on the list.

<sup>18</sup>Table 4 shows that that sub-sample whose WTA was not top-coded still displayed a substantial and statistically significant preference for SACLs over OACLs.

Table 4: Heterogeneity of Treatment Effects

	WTP: SACL loan minus OACL loan						
		X= 1[Endowed item owned]	X= Monthly inc. (1000 KES)	X= 1[Education above median]	X= 1[Female respondent]	X= 1[Gender norm match]	X= 1[WTA top coded]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>Constant (treatment effect)</b>	158.7*** (25.26)	173.0*** (36.35)	154.7*** (40.14)	173.2*** (34.72)	180.9*** (36.81)	122.2*** (37.42)	146.2*** (43.43)
New Item Baseline valuation: SACL minus OACL	0.517*** (0.0595)	0.519*** (0.0595)	0.517*** (0.0595)	0.518*** (0.0594)	0.519*** (0.0594)	0.522*** (0.0595)	0.517*** (0.0596)
Collateral Baseline valuation: SACL minus OACL	-0.0823* (0.0471)	-0.0849* (0.0470)	-0.0825* (0.0471)	-0.0819* (0.0471)	-0.0849* (0.0469)	-0.0861* (0.0471)	-0.0807* (0.0473)
X		-27.19 (50.49)	0.166 (1.379)	-35.12 (50.14)	-46.35 (49.90)	71.81 (50.89)	20.25 (53.42)
$R^2$	0.180	0.181	0.180	0.181	0.181	0.183	0.180
N	691	689	691	691	691	691	691

Notes: Table 4 reports estimates of regressions our main specification in Table 2 with additional control variables. Column (1) shows our preferred specification without controls, for comparison. Each consecutive column considers treatment effect heterogeneity along one dimension, designated by the control variable “X.” “Endowed items owned” is a dummy variable indicating whether the borrower owned the endowed item before. “Monthly income (thousand KES)” is the borrower’s income in the month prior to the experiment, in thousands of Kenya Shillings. “Education above mean” is a dummy variable indicating whether the borrower’s education level is above the median in the sample. “Female respondent” indicates that the respondent is a woman. “Gender norm match” indicates whether the endowed item is more likely to be used by the respondent than by their spouse according to local gender norms. “WTA top coded” indicates that the respondent was not willing to accept any price on our BDM list for the endowed item, and therefore has a WTA value that is top coded.

Standard errors in parentheses \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Second, under rational beliefs and learning, one would expect some people to update positively and others to update negatively from experience. Instead, 96 percent of participants displayed  $WTA > WTP$ , which is difficult to reconcile under rational learning.<sup>19</sup> Third, participants themselves predicted having a substantially higher WTA in the future than their current WTP. It is difficult to explain why people would predict systematic positive updating over time regarding the inherent quality of each item. Some sophistication about loss aversion or the endowment effect more broadly appears more plausible.<sup>20</sup> Fourth, Appendix Figure A.2 reports that we find similar degrees of preference for SACLs over OACLs across all four endowed goods, despite differences in technological complexity and therefore the likely scope for learning. Fifth, many participants already owned one or more of the endowed goods, or had owned them in the past, but had some use for an additional unit. We find a similar preference for SACLs among such participants, who would presumably have lower uncertainty and scope for learning (Table 4 Column 2).

We cannot rule out that learning plays some role in our findings. However, it seems implausible that learning causes nearly all participants to update positively, unrelated to their past experience with such goods, and similarly across all four goods despite differences in their complexity. One possibility is that people in our context generally systematically under-estimate the utility of goods before they own them. If so, we would argue that this comprises an alternative psychological foundation for the endowment effect.

*Fixed costs and complementary investments.* Another potential confound is a fixed cost associated with taking home and using the endowed good. Once such a cost has been sunk, borrowers will place greater value on holding on to the item. With this confound in mind, we chose items that should have little to no fixed costs associated with them. Importantly, by the time there is a chance for borrowers to default on the loan and have the collateral repossessed, one would expect any such fixed costs to also be sunk for the new asset financed using the loan. Therefore, this should not drive a difference in preference for SACLs and OACLs. A similar explanation applies to a possibility that people may have invested in goods complementary to the endowed item over the week.

*Hedging.* One reason to prefer SACLs, only relevant if there is greater uncertainty about the new financed item than the endowed item, is that if the new item turns out to be defective, a borrower

---

<sup>19</sup>It could be that ownership of an asset itself affects attention and learning, as in Hartzmark et al. (2021). Biased learning and thus over-valuation of owned goods could be a plausible alternative mechanism for the endowment effect in our experiment.

<sup>20</sup>Participants may correctly anticipate resolution of uncertainty over the week, and thus risk averse participants may anticipate higher WTA than WTP on average. But rationalizing such a large gap with WTA about 4 times higher than WTP would require large baseline uncertainty under reasonable risk preferences, which in turn is hard to square with over 95 percent of participants having WTA greater than WTP. High uncertainty should imply a substantial share of borrowers end up with negative learning shocks.

would prefer to default and give up the new item rather than the endowed item. We used durable items, so do not believe there was much scope for participants to believe the items might break, but we cannot entirely rule this out. However, this mechanism does not explain the misprediction of future WTA and OACL take-up. And note that there is also a force in the opposite direction: if the endowed good breaks, a borrower would prefer to default on an OACL and return the worthless endowed good.

Another way in which uncertainty and hedging motives could affect demand is if borrowers perceive a correlation between financial shocks (which affect the ease of repayment) and the returns to using the new item. For instance, in case a cow falls sick, farmers face a negative transitory income shock, and milk cans also become less useful. Once again, this argument should apply equally to both the new item and the endowed good, so it is not clear this would generate a preference for SACLs per se. Moreover, since the items we use are durable goods, short-run fluctuations should not matter very much.

*Complementarity or substitutability of items.* Whether the endowed item and the new financed item are complements or substitutes should also not bias our results. If the new item financed by the loan is a complement to the endowed item, borrowers' valuation of both items will increase symmetrically, which will not result in a gap in OACL and SACL valuation. A similar argument applies to the case when the items are substitutes. Empirically, controlling for fixed effects for pairs of endowed and new items does not change our results, as shown in Table 3 Columns (5) and (6).

*Social norms against selling gifts.* Recall that 62% of participants were unwilling to sell back the endowed item to us at the prices we offered. We asked qualitative debriefing questions to investigate why. One concern was that the item may have been seen as a gift from the researchers or the SACCO, and participants might have thought it inappropriate to sell a gift. We had emphasized that the endowed item was compensation for participation, and clearly specified that selling the item was fine and entirely their choice. Reassuringly, in debriefing questions, only 5% of those who refused to sell mentioned regarding the item as a gift or expressing that it would be rude to sell the item. A vast majority of participants (88%) instead explained their unwillingness to forfeit the item by describing the "importance" or "value" of the item to them. About 21% directly cited an "attachment" they had developed or an unwillingness to sell any item that was "already at home" or "already being used" as a reason not to sell the item back to us in the WTA exercise.<sup>21</sup> Of course, even if participants had been hesitant to directly sell the endowed item, they may have been comfortable using it as collateral.

*Already-sold endowed items.* Another possibility we probed was whether participants had already sold or bartered the item in between the first and the second session, and thus were simply unable to sell it or provide it as collateral. This turns out to be very uncommon. Resale markets for these items

---

<sup>21</sup>About 12% also cited a preference for illiquid assets in explaining their decision not to sell, for example by expressing fears of squandering the cash from selling the asset. Of course, this does not apply to promising the item as collateral.

appear to be thin or non-existent. And participants knew that they had the opportunity to use the endowed item as collateral, giving them incentives to hold on to the item. Only one person reported having bartered the item during the week between sessions.

*Intra-household frictions.* We also consider whether a preference for SACLs could be driven by intra-household frictions. For example, some items are more likely to be used by the borrower or instead by their spouse, given local gender norms. One could imagine that borrowers are more or less willing to pledge an asset used by their spouse. In Column (8) of Table 4, we add a control variable indicating whether the endowed item is more likely to be used by the respondent or their spouse. Our point estimate suggests that participants have a stronger preference for SACLs when they are likely to be using the endowed item themselves. This difference is not statistically significant, and a preference for SACLs over OACLs is seen in either case.

*Confusion.* Finally, it is unlikely that the result in Table 2 is driven by confusion about the experiment or the loans. Detailed comprehension checks showed that participants had an excellent grasp of the loans and the price elicitation method. Participants were required to correctly explain the terms of two loans back to the enumerator before stating their willingness to pay. Moreover, in Column (6) of Table 4, we show that the preference for SACLs over OACLs does not differ by education level.

## 4 Model

In this section, we present a simple model of borrowers' loan take-up decisions under the endowment effect and naivete. We model the endowment effect as being due to loss-aversion relative to reference points. We assume status-quo reference points: goods possessed by the borrower at the beginning of a period are in their reference point.<sup>22</sup> Naivete is modeled as an agent underestimating how their reference point will update over time when they come to possess (or lose) a good. We designed our experiment around this model, with a view to structurally estimating its key parameters.

### 4.1 Set-up

*Utility function.* Agents have the utility function  $U_t = U(c_t|r_t) + w_t$ , where  $c_t$  is consumption of the goods used in the experiment,  $r_t$  is the reference point to which this consumption is compared, and  $w_t$  is all other consumption (which is the numeraire good).  $U(c_t|r_t)$  captures reference-dependent

---

<sup>22</sup> Rational expectations-based reference points à la Köszegi and Rabin (2006) can also generate higher take-up of SACLs compared to OACLs. However, given their assumption of rational expectations, they cannot explain the mispredictions that we observe in the data. A model of reference points with non-rational expectations is likely to be able to explain the main results, at least qualitatively.

preferences, for which we adopt the formulation of Kőszegi and Rabin (2006). Specifically,  $U_t = U(c_t|r_t) = m(c_t) + n(c_t|r_t)$ : agents earn classical consumption utility  $m(c_t)$  from consuming the good, and also might feel a sense of gain or loss relative to the reference point,  $n(c_t|r_t)$ . As in Kőszegi and Rabin (2006), we assume that consumption utility is additively separable across dimensions  $m(c_t) \equiv \sum_{k=1}^K m(c_{tk}) \equiv \sum_{k=1}^K c_{tk}V_k$ ,  $k \in \{E, S, O\}$ <sup>23</sup> where  $c_{tk} = 1$  if agents own item  $k$ , zero otherwise. The gain-loss component of utility is tied directly to consumption utility and is also additively separable across dimensions:  $n(c_t|r_t) \equiv \sum_{k=1}^K \mu(m(c_{tk}) - m(r_{tk}))$ , where  $\mu$  has the properties of the Kahneman-Tversky (1979) value function. For simplicity, we follow Kőszegi and Rabin (2006) and assume  $\mu$  to be a piece-wise linear function. Because all of our results are driven by the sense of loss, to make the model's predictions easier to interpret, we make a further simplification by suppressing the sense of gain, so that  $\mu(x) = 0$  if  $x \geq 0$  and  $\mu(x) = \lambda x$  if  $x < 0$ .<sup>24</sup> The parameter  $\lambda > 0$  represents the additional weight the agent places on losses relative to gains (and consumption utility). The agent seeks to maximize her total expected (undiscounted) utility across the current period and future periods.

*Timing and reference points.* We consider status-quo reference points (Kahneman and Tversky, 1979; 1992). Our simplified model has three periods. The agent's reference point changes between each period as ownership of the endowed item and the loaned item changes. An agent's initial reference point in period zero, before they are endowed with any item, is  $r_0 = (0, 0)$ . Here, the first element indicates whether the agent owns the endowed item and the second element indicates whether the agent owns the item offered using a loan. After being endowed, her reference point becomes  $r_1 = (1, 0)$  in period 1. If she takes up a loan, then the reference point will be  $r_2 = (1, 1)$  in period 2. Figure 5 below presents the timeline of the model.

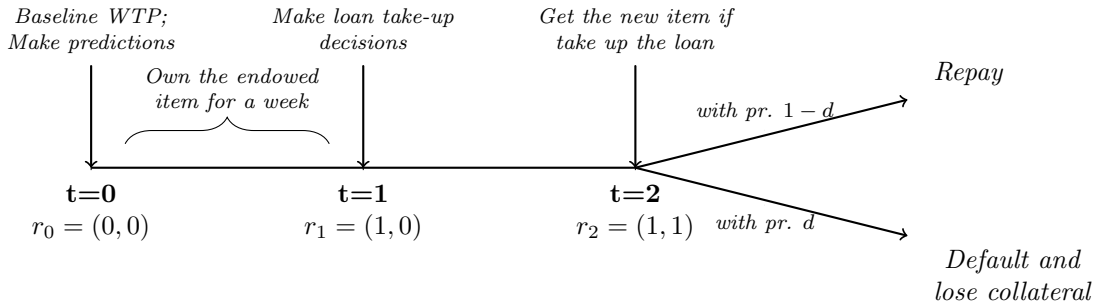


Figure 5: Timeline of the Model

<sup>23</sup>E denotes the endowed item, S the new item offered using a SACL, and O the new item offered using an OACL.

<sup>24</sup> Suppressing the sense of gain is essentially redefining the consumption utility. In Appendix B.1, we establish a mapping between parameters in our model with parameters in a standard Kőszegi and Rabin (2006) model.

When she is making the loan take-up decision, the agent may not fully anticipate that the new asset will enter her reference point fully once purchased. She may project her present preferences, including her present reference point, onto her future state. Let  $\hat{U}_t^\tau$  denote self  $t$ 's prediction of her future self  $\tau$ 's utility ( $t \in \{0, 1\}$ ,  $\tau > t$ ). Following Loewenstein et al. (2003), we incorporate projection bias into our model by assuming the utility function  $\hat{U}_t^\tau = (1 - \alpha)U(c_\tau|r_t) + \alpha U(c_\tau|r_\tau) + w_\tau$ . With this formulation,  $\alpha$  parameterizes the agent's degree of projection bias. If  $\alpha = 1$ , the person has no projection bias, predicting perfectly how her reference point will adjust when she acquires a new asset. In our setting, it can be shown that  $\hat{U}_t^\tau = U(c_\tau|(1 - \alpha)r_t + \alpha r_\tau) + w_\tau$ ,<sup>25</sup> so that an agent who suffers from projection bias expects her reference point to be  $r_t^\tau = (1 - \alpha)r_t + \alpha r_\tau$ , which is a convex combination of her current reference point ( $r_t$ ) and her actual future reference point ( $r_\tau$ ). This allows us to represent the agent's preferences using the simplified expression  $\hat{U}_t^\tau = U(c_\tau|r_t^\tau) + w_\tau$ .

The agent faces a probability of defaulting on the SACL and OACL of  $d_S$  and  $d_O$ , respectively. These parameters represent the individual's true ex-ante probability of default of each type of loan. However, at the stage of making loan take-up decisions, what matters is not the true default probability but rather the agent's *beliefs* about their probability of defaulting about, which we denote by  $\hat{d}_S$  for the SACL and  $\hat{d}_O$  for the OACL. These parameters can differ in value from  $d_S$  and  $d_O$ , as borrowers may underestimate or overestimate their likelihood of defaulting. For now, we leave the perceived default probability as exogenous (say, determined entirely by income shocks), and assume that  $\hat{d}_S = \hat{d}_O = \hat{d}$ . In Appendix D, we instead derive a life-cycle consumption model with income risk and endogenous default with OACLs and SACLs.

## 4.2 The Model's Predictions

The model allows us to derive expressions for each of the valuations and predictions we elicited in the experiment. Detailed derivations are included in Appendix B.

**WTP for four items.** We elicited the baseline willingness to pay for each item. This gives us the initial valuations for each of the endowed item, the SACL new item, and the OACL new item:

$$WTP_k^{item} = V_k - c, \quad k \in \{E, S, O\} \quad (2)$$

We add the parameter  $c \geq 0$  to account for the possibility that participants face liquidity constraints or are not yet familiar with the BDM procedure and therefore understate their valuation of the items.

<sup>25</sup> To verify this, we only need to check whether this holds when  $r_t \neq r_\tau$ . The conclusion is obvious when the reference point does not change. We also need to assume that  $m(c_{tk}) = c_{tk}V_k$  holds even when  $c_{tk} \in (0, 1)$ . Then it can be shown that when  $r_t = 0, r_\tau = 1, c_\tau = 0$ ,  $U(0|\alpha) = (1 - \alpha)U(0|0) + \alpha U(0|1)$ ; when  $r_t = 0, r_\tau = 1, c_\tau = 1$ ,  $U(1|\alpha) = (1 - \alpha)U(1|0) + \alpha U(1|1)$ . Similar results hold when  $r_t = 1, r_\tau = 0$ . Note that this expression is not universally true, but in our case, this equation holds because goods are discrete and  $c_t$  and  $r_t$  only take values of 0 and 1.

**Actual and predicted WTA for the endowed item.** We elicited the actual willingness to accept in period 1, when the endowed goods had fully entered the reference point. At this point, the agent’s valuation of the item includes their consumption value and the amount they would pay to avoid losses from losing the item, so that her willingness to accept is:

$$WTA = (1 + \lambda)V_E \quad (3)$$

We also elicit participants’ predicted *WTA* at period 0, before they are endowed with the item. This predicted *WTA* will depend on the agent’s perceived reference point, which under projection bias is  $r_0^1 = (1 - \alpha) \cdot 0 + \alpha \cdot 1 = \alpha$ .<sup>26</sup> So the agent’s predicted *WTA* prior to being endowed with the item is:

$$\widehat{WTA} = (1 + \alpha\lambda)V_E \quad (4)$$

Combining these two expressions, we write the difference between predicted and actual *WTA* as  $WTA - \widehat{WTA} = (1 - \alpha)\lambda V_E$ . This shows that if the agent is loss averse ( $\lambda > 0$ ) and subject to projection bias ( $\alpha < 1$ ), she will underpredict her future *WTA* for the endowed item.

**Demand for SACL and OACL.** A borrower who takes up a SACL will own both the endowed item and the new item if they repay the loan, but if they default, the new item is repossessed. In contrast, under OACLs, if borrowers fail to repay the loan, the endowed item is repossessed instead.

Borrowers who suffer from projection bias underestimate their future attachment to the new item, and therefore under-value the sense of loss upon losing the new item, which drives up their demand for SACLs. When a borrower considers taking up such a loan, their perceived equivalent reference point is  $r_1^2 = (1 - \alpha)(1, 0) + \alpha(1, 1) = (1, \alpha)$ . A greater  $\alpha$  implies that the borrower is more aware that the new item will enter their reference point. A borrower’s expected utility from taking up a loan is the sum of the expected utility if they do not default and if they do default, weighted by their perceived probability of each scenario. If the agent does not take up a loan, she still keeps the endowed item but does not receive a new item. As the loan price increases, taking up loans becomes less attractive. When the price reaches the agent’s willingness to pay, the utility from loan take-up is equal to the reservation utility, and she is indifferent between taking the loan and not.

Using the utility function described in Section 4.1, we can derive expressions for the agent’s WTP

---

<sup>26</sup> For simplicity, we assume the predicted utility is equal to the decision utility that agents maximize if they are asked to commit to their predictions. We also assume that people are naive about their projection bias.

for each loan in terms of the model's parameters:

$$WTP_S = \underbrace{-\frac{\hat{d}}{1-\hat{d}}(1+\alpha\lambda)V_S}_{\text{Utility penalty from losing collateral (new item)}} + \underbrace{\frac{1}{1-\hat{d}}V_S}_{\text{Utility gain from getting new item}} \quad (5)$$

$$WTP_O = \underbrace{-\frac{\hat{d}}{1-\hat{d}}(1+\lambda)V_E}_{\text{Utility penalty from losing collateral (endowed item)}} + \underbrace{\frac{1}{1-\hat{d}}V_O}_{\text{Utility gain from getting new item}} \quad (6)$$

Here, we can see the agent's willingness to pay for a SACL (i) is independent of  $V_E$ , the value placed on the endowed item; (ii) increases in  $V_S$ , the value placed on the new item financed by the SACL<sup>27</sup>; (iii) decreases in  $\lambda$ , loss aversion; and (iv) decreases in  $\alpha$ , the extent to which the agent understands how her reference point will update. The willingness to pay for an OACL (i) decreases in  $V_E$ , the value placed on the endowed goods; (ii) increases in  $V_O$ , the value placed on the new item financed by the OACL; (iii) decreases in  $\lambda$ , loss aversion; and (iv) decreases in  $\alpha$ , the extent to which the agent understands how her reference point will update (i.e. increases with projection bias).

The difference between willingness to pay for SACL and OACL, which is our primary object of interest, is due to the different utility penalties in the case of default. The agent prefers SACL to OACL because she believes it will feel less painful to lose the new item being purchased, which has not fully entered her reference point. Suppose, for simplicity, that her initial valuation of all three items is the same ( $V_E = V_O = V_S = V$ ). In this case, it is easy to see that  $WTP_S - WTP_O = \frac{\hat{d}}{1-\hat{d}}(1-\alpha)\lambda V > 0$ , meaning the agent will pay more for an item when she can finance it using a SACL rather than an OACL. This preference for SACL compared to OACL (i) increases in  $\lambda$ , loss aversion; (ii) decreases in  $\alpha$  (increases in projection bias); and (iii) increases in  $\hat{d}$ , perceived default rates.

**(Mis)prediction of Future Demand for SACL and OACL.** As described in Section 3.2, we elicited participants' predictions of their future willingness to take up loans at period 0, before they were given the endowed item to take home with them. As before, we model predicted utility as equal to decision utility and assume that the agent is naive about her projection bias. From the standpoint of period 0, the agent's perceived equivalent reference point is  $r_0^2 = (1-\alpha)(0,0) + \alpha(1,1) = (\alpha, \alpha)$  if she takes up either of the loans, and is  $r_0^2 = (1-\alpha)(0,0) + \alpha(1,0) = (\alpha, 0)$  if not. As previously, we can solve for the predicted SACL and OACL WTP by setting the expected utility from the loans equal to

<sup>27</sup> This holds when  $\lambda$  and  $\alpha$  are within reasonable ranges. If either parameter is relatively big, willingness to pay for a SACL may decrease in  $V_S$ .

the agent's reservation utility and solving for the price, which gives:

$$\widehat{WTP}_S = -\frac{\hat{d}}{1-\hat{d}}(1+\alpha\lambda)V_S + \frac{1}{1-\hat{d}}V_S \quad (7)$$

$$\widehat{WTP}_O = -\frac{\hat{d}}{1-\hat{d}}(1+\alpha\lambda)V_E + \frac{1}{1-\hat{d}}V_O \quad (8)$$

If the items are all valued equally ( $V_E = V_O = V_S$ ), these two terms are equivalent:  $\widehat{WTP}_S = \widehat{WTP}_O$ . That is, as long as the items for sale using the loans are of equal value to the agent, then she predicts that she will be willing to pay the same amount using each loan. At period 0, she has not been endowed with any item, so she underestimates her future attachment to both items equally. This makes the period-0 self indifferent between a SACL and an OACL.

Comparing an agent's predicted loan WTP with their actual WTP for that loan, we have  $\widehat{WTP}_S - WTP_S = 0$ ,  $\widehat{WTP}_O - WTP_O = \frac{\hat{d}}{1-\hat{d}}(1-\alpha)\lambda V_E > 0$ . Agents who are loss averse and projection biased will correctly predict their willingness to take up a SACL because the new item does not fully enter their reference point until after the loan take-up decision, so that their reference point is the same at the time of the prediction and the take-up decision. However, the agent will overpredict their willingness to pay for an OACL, because the period-0 self underestimates period-1 self's attachment to the endowed item. This is consistent with the reduced form results on projection bias presented in Section 4.

## 5 Structural Estimation

Our experimental design allows us to estimate structural parameters for loss aversion, projection bias, and the valuation of each item. This gives us estimates of behavioral parameters that have been the focus of research in laboratory settings. Our estimates are unusual in that they come from decisions participants made about actual financial products offered by a lender in a real-world setting.

### 5.1 Classical Minimum-Distance Estimation

We use classical minimum-distance estimation, where we identify a set of moments in the data and then find the parameter values that minimize the distance between the moments predicted by the model and the empirical moments. The optimization problem we solve is:

$$\min_{\theta} (\hat{m} - m(\theta))' W (\hat{m} - m(\theta))$$

where  $\theta = (\alpha, \lambda, \hat{d}, \mu_V, \sigma_V)$  is the vector of parameters we estimate in the benchmark case. As in the model in Section 5,  $\alpha$  characterizes the agent’s level of projection bias;  $\lambda$  is the loss aversion coefficient;  $\hat{d}$  is the perceived default rate; and the auxiliary parameters  $\mu_V$  and  $\sigma_V$  are the mean and standard deviation of item valuations, respectively, assumed to be drawn from a lognormal distribution.<sup>28</sup>  $\hat{m}$  is a vector of empirical moments from the data,  $m(\theta)$  is a vector of model-predicted moments, and  $W$  is a weighting matrix. In the benchmark case, the estimation moments include the means and standard deviations of the willingness to pay for SACL and OACL, the means of predicted willingness to pay for SACL and OACL, the mean of  $WTA$ , and the mean of  $\widehat{WTA}$ . We exclude means and standard deviations of the observed baseline WTP for each item to eliminate concerns that the measurement of the baseline WTP may be biased due to liquidity constraints or trust issues. We vary the moments we use and the parameters we estimate as robustness checks. Our choice of the weighting matrix is the inverse of the diagonal of the variance-covariance matrix of the moments. In Appendix Table A.4, as a robustness check, we present structural estimation results with the identity weighting matrix.

## 5.2 Identification and Results

To make our estimation process transparent, it is important to understand which moments identify which parameters. Here, we describe the intuition behind how each of the parameters of interest are identified, and present expressions for each in terms of the moments of our data.

*Projection bias.* The projection bias parameter,  $\alpha$ , is identified from the difference between participants’ willingness to accept for the endowed item after one week of ownership and their predicted willingness to accept prior to ownership. Because participants do not own the item at the baseline, they undervalue their future attachment to the it due to projection bias.<sup>29</sup> A caveat is that we are only able to measure projection bias over the endowed goods, which borrowers own at the time of our second session. We cannot identify projection bias from the new items because participants do not own these items until after our second (and final) study session, and participants’ reference points over these items should therefore not be expected to change during the study.

*Loss aversion.* Loss aversion is identified by the difference between WTA and WTP for the endowed item. Estimating loss aversion using the wedge between WTA and WTP is standard in the empirical

<sup>28</sup> Due to randomization, we can assume that the average valuations for three items are the same.

<sup>29</sup> We use the model from Section 5 to solve for the projection bias parameter in terms of the moments observed in our data to find that  $\alpha = (\widehat{WTA} - V_E)/(WTA - V_E)$ . If three items are valued equally ( $V_E = V_O = V_S = V$ ),  $\alpha$  is also identified as  $\alpha = (V - WTP_S)/(V - WTP_O)$ . One can also identify  $\alpha$  without knowing the baseline valuation of the items,  $\alpha = (\widehat{WTA} - WTP_S)/(WTA - WTP_O)$ .

literature (e.g. Kahneman et al. 1990).<sup>30</sup>

*Perceived default rates.* Mispredicting future reference points drives a wedge between WTP for SACL and OACL, but only in the case of default. In the most extreme case, if a borrower thinks that there is no chance of default, a loan’s collateral will be irrelevant, and even the most loss averse or projection biased borrowers will be indifferent between SACL and OACL. Conversely, a higher perceived likelihood of default makes the loan’s collateral more relevant and drives a wedge between SACL and OACL WTP for loss averse, projection biased borrowers. In this way, the perceived default rate can be identified from the difference in WTP between SACL and OACL, combined with the difference between WTA and predicted WTA for the endowed item.<sup>31</sup>

Table 5 displays the estimation results under different conditions. In addition to reporting parameters we directly estimate, we also report implied parameters (loss aversion  $\lambda$  and projection bias  $\alpha$ ) in the standard KR model and the implied mean and standard deviation of the item valuation. Column (1) displays the results of the benchmark case. People have projection bias over the endowment effect: they under-value their future attachment to the item they currently do not own by about 50%.  $\lambda$  equals to 2.8 (implied KR  $\lambda = 4.6$ ), indicating strong aversion to losses. The perceived default probability estimate is 5.5%. In Column (2), we include means and standard deviations of baseline WTP and estimate an additional parameter, the liquidity cost  $c$  in the baseline WTP. We can see that main parameter estimates do not change much. In Column (3), we exclude the loan prediction moments and find that the results do not change substantially. In Column (4), we restrict the sample to people who are not topcoded in either  $WTA$  or  $\widehat{WTA}$  and find a significantly lower loss aversion  $\lambda$  for this subsample. In Columns (5) and (6), we fix the perceived default rate to 10%, which is equal to the mean of participants’ self-reported default rates, and exclude  $WTA$  (Column (5)) or  $\widehat{WTA}$  (Column (6)) to see how topcoding affects our results.<sup>32</sup> The estimated loss aversion parameters are lower in these two columns than the benchmark case.

Our estimated loss aversion ( $\lambda = 4.6, s.e.0.3$ ) is higher than that typically found in laboratory experiments (e.g., 3.4 in Sprenger, 2015; 3 to 4 in Gächter et al., 2021; 3 in Abdellaoui et al., 2007; 2.6 in Pennings and Smidts, 2003; 2.4 in Booij et al., 2010), but within the range of recent field estimates. For example, in the job search setting, DellaVigna et al. (2017, 2020) find that the loss

---

<sup>30</sup> In terms of the empirical moments, the loss aversion parameter, can be expressed as  $\lambda = WTA/V_E - 1$ . If three items have the same valuation ( $V_E = V_O = V_S = V$ ),  $\lambda$  can also be expressed as  $\lambda = (1/\hat{d} - 1)(1 - WTP_O/V)$ . We can also identify  $\lambda$  without knowing  $V$ , as  $\lambda = (WTA - WTP_O)(WTA - \widehat{WTA})/(WTP_S \cdot WTA - WTP_O \cdot \widehat{WTA})$ .

<sup>31</sup>In terms of the moments observed in the data, the default rate can be expressed as  $\hat{d}/(1 - \hat{d}) = (WTP_S - WTP_O)/(WTA - \widehat{WTA})$ , given that three items are valued equally.

<sup>32</sup> For the model to be identified, when we exclude one of  $WTA$  and  $\widehat{WTA}$ , we need to fix the default rate. The model can not be identified if we exclude  $WTA$  and  $\widehat{WTA}$  at the same time.

Table 5: Structural Estimation Results

	(1)	(2)	(3)	(4)	(5)	(6)
	Benchmark	Include Baseline WTP	Not using loan prediction	Subsample Not topcoded	Fixed $d = 10\%$ no WTA	Fixed $d = 10\%$ no $\widehat{WTA}$
<b><i>Main Parameters</i></b>						
Loss aversion ( $\lambda$ )	2.778 (0.176)	2.602 (0.189)	2.779 (0.195)	0.801 (0.110)	1.993 (0.165)	2.335 (0.065)
Sophistication ( $\alpha$ )	0.585 (0.030)	0.577 (0.030)	0.585 (0.031)	0.444 (0.074)	0.720 (0.065)	0.772 (0.070)
Default rates ( $d\%$ )	5.476 (1.687)	7.743 (2.091)	5.467 (1.811)	10.461 (7.125)	10 NA	10 NA
<b><i>Auxiliary Parameters</i></b>						
Mean of the associated normal distribution ( $\mu$ )	7.110 (0.041)	7.244 (0.053)	7.109 (0.048)	7.116 (0.051)	7.184 (0.019)	7.234 (0.020)
Std. Dev. of the associated normal distribution ( $\sigma$ )	0.592 (0.012)	0.421 (0.019)	0.592 (0.013)	0.552 (0.020)	0.592 (0.012)	0.592 (0.012)
Liquidity cost ( $c$ )	NA NA	320.46 (70.87)	NA NA	NA NA	NA NA	NA NA
<b><i>Implied Standard Parameters</i></b>						
Loss aversion ( $\lambda^S$ )	4.577 (0.299)	4.358 (0.311)	4.579 (0.317)	2.075 (0.193)	3.087 (0.392)	3.323 (0.299)
Projection bias ( $\alpha^S$ )	0.524 (0.029)	0.513 (0.028)	0.524 (0.029)	0.292 (0.054)	0.635 (0.061)	0.704 (0.076)
Mean item valuation	1457.95 (57.184)	1529.08 (69.330)	1457.50 (65.882)	1434.87 (67.886)	1571.24 (22.934)	1651.77 (26.354)
Std. Dev. of item valuation	944.45 (41.177)	673.78 (12.215)	944.27 (43.105)	856.39 (48.870)	1017.83 (22.911)	1070.00 (23.882)
<b><i>Model Fit</i></b>						
Number of moments used	8	12	6	8	7	7
Number of estimated parameters	5	6	5	5	4	4
Goodness of Fit	3.797	4.123	3.443	1.834	3.797	3.797

Notes: Table 5 presents results of the minimum distance estimation. Moments used in Column (1), our benchmark estimation, include the means and standard deviations of the willingness to pay for SACL and OACL, the means of predicted WTP for SACL and OACL, the mean of  $WTA$ , and the mean of  $\widehat{WTA}$ . Moments used in Column (2) include the means and standard deviations of the baseline valuations of the endowed items and the new items for SACL and OACL, the means of the WTP for SACL and OACL, the means of predicted loan WTPs, the mean of  $WTA$ , and the mean of  $\widehat{WTA}$ . Column (3) excludes the means of predicted loan WTPs from the set of moments used in Column (1), the benchmark case. Column (4) uses the same set of moments as the benchmark case, but it restricts the sample to individuals who are not top coded in either  $WTA$  or  $\widehat{WTA}$ . Columns (5) and (6) exclude the mean of  $WTA$  and the mean of  $\widehat{WTA}$  from the set of moments in the benchmark case, respectively. The default rate is fixed at 10% in these two columns. The weighting matrix is the inverse of the diagonal of the variance-covariance matrix of the moments. We assume the baseline item valuation follows a log normal distribution. We directly estimate the mean and standard deviation of the associated normal distribution. The implied mean and standard deviation of baseline item valuation are also reported in the table. Goodness of fit is the distance between the theoretically implied moments and the empirical moments at estimated parameters that minimize the distance. Lower values of goodness of fit indicate better fit of the model.

aversion parameter of job seekers is in the range of 2.7 to 4.5. Anderson et al. (2021) model sellers’ listing decisions in the housing market and their  $\lambda$  estimate is around 1.5. The loss aversion level of cab drivers when they are making labor supply decisions is estimated to fall in the range of 1.2 to 5 (Thakral and Tô, 2021; Crawford and Meng, 2011). Engström et al. (2015) find that when filing tax returns, tax payers’ loss aversion level ranges from 3 to 5, depending on their gender.<sup>33</sup>

To test the goodness of fit and to show the significant roles loss aversion and projection bias play in the theory, we compute the theory-implied moments using parameter estimates of the full model (the benchmark case), the model without loss aversion ( $\lambda$  fixed at 0), and the model without projection bias ( $\alpha$  fixed at 1). We compare the moments under these conditions with their empirical counterparts. Figure 6 visualizes the results. The full model fits the empirical data well; the other two models do not.

An important caveat of our structural estimation is that we are unable to perform heterogeneity analysis because  $WTA$  and  $\widehat{WTA}$  are top-coded for a significant share of participants.

## 6 Discussion of Borrower Welfare and Policy Implications

The previous sections established that borrowers prefer SACs to OACs due to the endowment effect. We now turn to discussing the welfare implications of offering SACs to consumers who either (i) currently have access only to OACs (assuming they possess some collateralizable asset), or (ii) have no access to credit (e.g., because they do not possess any collateralizable assets). Our goal is not to reach definitive conclusions about welfare in our specific experiment, but instead to illustrate the underlying issues. We focus on borrower welfare, assuming lenders charge the same for SACs and OACs.<sup>34</sup> We work through the full lifecycle model for welfare analysis in Appendix D and discuss the insights from that analysis here.

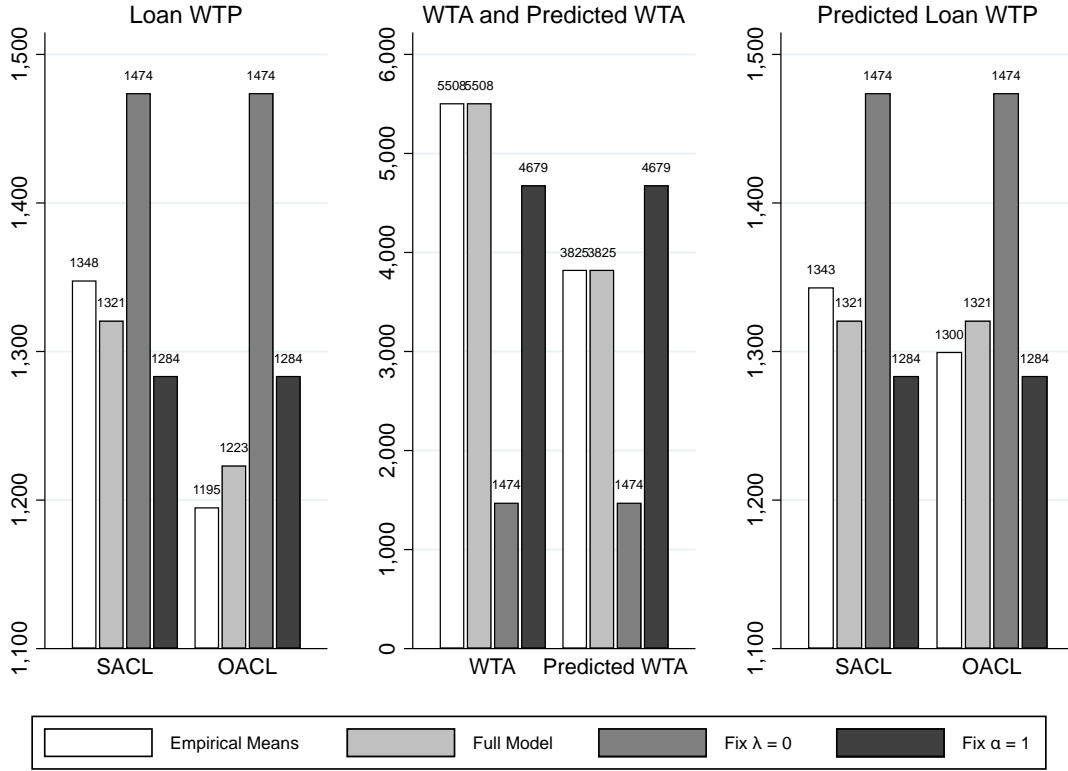
We begin by discussing welfare under our benchmark model, as set out in Section 4. In this model, default was exogenous, as would be case if income shocks were extreme. We also assumed that borrowers develop an endowment effect over the new financed item before paying it off—just as they did with the randomly-endowed item, and consistent with the similar repayment rates under SACs

---

<sup>33</sup> Note that we have transformed original  $\lambda$  estimates in the literature whenever necessary, so that they are comparable to our estimate. Specifically, Thakral and Tô (2017) and Crawford and Meng (2011) estimate loss aversion and weight of gain-loss utility jointly, so we impose the same weight on consumption utility and gain-loss utility and report the corresponding  $\lambda$  estimates. Gächter et al. (2010), Abdellaoui et al. (2007), Pennings and Smidts (2003), Booij and van de Kuilen (2006), Engström et al. (2015) assumes people only have gain-loss utility. A loss aversion of  $\lambda$  in their models translates into a loss aversion of about  $2\lambda - 1$  in our model, keeping the ratio between utility from losses and equivalent gains constant. Anderson et al. (2020) estimate  $\eta$  and  $\lambda$  separately, but their  $\eta$  estimate is close to 1, so we report their original  $\lambda$  estimate here. DellaVigna et al. (2017, 2020) set  $\eta$  to be 1, so their original estimates and ours are directly comparable.

<sup>34</sup>This would be the case in a competitive credit market, if SACs and OACs have the same default rates.

Figure 6: Goodness of Fit under Alternative Model Specifications



Notes: Figure 6 compares the empirical moments with theoretically predicted moments calculated from parameters that are estimated using three different models: the full model, the model with  $\lambda$  fixed at 0 (no endowment effect), and the model with  $\alpha$  fixed at 1 (full sophistication).

and OACLs. Introducing SACLs in this environment *reduces* borrower welfare compared to offering OACLs (Case 1 in Appendix D). The intuition is straightforward: borrowers prefer SACLs to OACLs under this model only because they underestimate their future endowment effect. Borrowers who would accept an OACL would weakly prefer a SACL because they incorrectly anticipate less pain from default, but ex-post will incur the same sense of loss as if they had used an OACL. Their welfare is unaffected by the introduction of SACLs. However, some borrowers (with lower values  $V$  of the new asset, more naivete, or higher loss-aversion) would decline an OACL but accept a SACL, and then face greater-than-anticipated loss utility upon defaulting on the loan. Assuming that the social planner values experienced utility—including the disutility from losing an item due to the endowment effect—such borrowers have sub-optimally high take-up of SACLs and suffer welfare losses. If, instead, OACLs are unavailable (for instance, because borrowers do not have appropriate collateralizable assets), SACLs reduce welfare only

if borrowers are sufficiently naive and loss averse; otherwise, SACLs increase welfare, because they make it possible for customers to borrow.

The benchmark model assumed that borrowers experience loss utility  $-\lambda V$  from losing an asset with baseline value  $V$ . Here,  $V$  can be thought of as the discounted stream of utility from using the durable item. Implicitly, the benchmark model assumed that borrowers feel a sense of loss in each period after they lose the collateral. Introspection suggests that this is an overly pessimistic assumption. Our experiment showed that reference points do adjust—people become attached to new assets within a week. It is plausible—although not established by our experiment—that they will similarly come to adjust to the loss of the collateral.<sup>35</sup> In Appendix D, we therefore extend the benchmark model by allowing experienced loss utility to be scaled by a parameter  $\gamma \in [0, 1]$ . This represents the ‘persistence’ of the reference point upon loss of a durable good.<sup>36</sup>

Incorporating this assumption changes our welfare analysis by capturing the intuition that take-up of OACLs may be sub-optimally low due to the endowment effect. A borrower who is naive about how their reference point adjusts will underestimate the extent to which they will “get over” the loss of endowed collateral, and will thus undervalue OACLs relative to their actual experienced utility.<sup>37</sup> Now, offering SACLs can actually increase welfare relative to OACLs. This is a case of “two wrongs making a right”: borrowers underestimate how attached they will get to the new financed asset, which counteracts their tendency to later overestimate how bad they will feel to lose the asset upon default. Case 2 in Appendix D works through this logic. Introducing SACLs leaves the welfare of borrowers who would have taken up an OACL unchanged but it affects the welfare of new borrowers who would only take up SACLs. The sign of the welfare effect depends upon the speed of adjustment of reference points in case of default. If reference points adjust slowly enough, SACLs reduce welfare compared to OACLs, just as in the benchmark model. If instead reference points adjust quickly enough, SACLs increase welfare.<sup>38</sup>

Finally, in Case 3 in Appendix D, we consider a full-fledged lifecycle consumption model with OACLs and SACLs, where consumers face income risk and make endogeneous loan repayment decisions. In this model, overestimating the duration of loss leads to an additional distortion in the case of OACLs:

---

<sup>35</sup>As the singer Grace Carter notes, *“It don’t hurt like it used to.”*

<sup>36</sup>As we demonstrate in Appendix D, in a model with multiple consumption periods, this parameter can be micro-founded as the speed with which the reference point updates upon losing an asset. If  $\gamma = 0$ , the reference point adjusts instantly and no loss is experienced. If  $\gamma = 1$ , a sense of loss is experienced in every period subsequent to the loss, and we return to the benchmark model.

<sup>37</sup>This provides a rationale for why a policy-maker may not want to respect loss aversion over durable goods in welfare calculations. People may act as if they are highly loss averse, but ex-post may not feel the sense of loss for as long as they anticipated.

<sup>38</sup>Specifically, if  $\gamma < \alpha$ , SACLs increase welfare. Otherwise, SACLs will increase the welfare of additional borrowers whose valuation is relatively high and decrease the welfare of additional borrowers whose valuation is relatively low.

borrowers default less than they optimally should. Since they overestimate how bad it will feel to lose the collateral, they save up more in advance and give up more consumption than is justified by their experienced utility. Their repayment plan is time consistent, but does not involve ‘enough’ default. This force is weakened in the case of SACLs, as above, since borrowers fail to anticipate fully how attached they will get to the new item. Even with SACLs, borrowers will sometimes—when income shocks are moderately negative—repay more than they anticipated at the time of loan take-up, since they become more attached to the new asset than they anticipated. Further, they would have failed to save enough for this state, and their time-inconsistent repayment induces substantial welfare losses.

Unlike Cases 1 and 2, in this environment, introducing SACLs changes the welfare of both new borrowers and of borrowers who would have taken up an OACL. Working through this case, we show that when  $\gamma$  is relatively small (reference points adjust quickly) or when income shocks are extreme (and therefore repayment under SACLs is as anticipated by borrowers), SACLs increase welfare compared to OACLs. Borrowers who would have taken up an OACL prefer a SACL, and ex-post are better off since they do not over-repay as much as with the OACL.<sup>39</sup> Some borrowers who would not take an OACL will take a SACL and will be better off than they would without a loan. In contrast, if  $\gamma$  is relatively large (reference points adjust slowly) or when income shocks are moderate (such that borrowers may repay more than anticipated under SACLs), welfare is reduced under SACLs compared to OACLs.

To summarize, in our model, while consumers prefer SACLs over OACLs due to the endowment effect and naivete, the welfare consequences of SACLs are ambiguous. How quickly reference points adjust upon losing an asset plays a crucial role. If this adjustment is fast—as was the case when we endowed subjects with the randomly assigned assets—then SACLs are more likely to increase welfare relative to OACLs. However, it is important for policymakers to be aware of the potential for SACLs to reduce borrower welfare, since consumers’ preference for SACLs is driven by a misprediction about their own future preferences.

## 7 Conclusion

In this paper, we provided experimental evidence that the endowment effect drives down demand for loans collateralized using a borrower’s existing assets. Instead, borrowers prefer loans collateralized by the same asset being financed, since they are not (yet) attached to the collateral. Once a borrower acquires the asset, however, they may come to be attached to it and work hard to repay the loan. Same-asset collateralized loans may thus increase demand for loans while still controlling moral hazard.

---

<sup>39</sup>Specifically, they will save less as they anticipate defaulting in bad states of the world, and will stick with this plan.

This might partly explain their ubiquity—in rich countries—even when borrowers own other assets.

Same-asset collateralized loans have the potential to increase real investment. They extend financing to individuals who need credit but do not possess collateral. But even when borrowers do possess existing assets which might serve as collateral, our results suggest they will dislike placing them at risk of loss. Thus, assets which require financing but which cannot themselves serve as collateral are less likely to be invested in, even when borrowers have other collateral.

This argument points to an important interaction between the psychology we study—which may be universal—and local market institutions. Lenders in developing economies often face barriers to repossession. In such environments, lenders might insist on a limited set of assets as collateral, such as land, jewelry, or cash deposits. This limits the scope for SACs. The endowment effect might thus drive down investment more in contexts with high barriers to repossession. More generally, the endowment effect could help explain the failure to take up high expected return, risky investments as documented in the development economics literature (Kremer et al. 2019). Potential investors may hesitate to take up investments that place their existing assets at risk, even if they have a high expected return.

While SACs have substantial potential to increase demand for credit and subsequent investment, their welfare effects are ambiguous. On the one hand, they may improve welfare by making credit available to those, especially the poor, who cannot accumulate assets to provide as collateral. Take-up of loans collateralized using existing assets may be sub-optimally low—even from the borrower’s private perspective—since borrowers may underestimate how quickly their reference point will adjust and they will ‘get over’ losing the collateral. In this case, the naivete which boosts demand for SACs may be a blessing, as it causes borrowers to foresee less of an endowment effect. However, it is important for policymakers to be aware that SACs may in some cases reduce welfare. Specifically, they may expose borrowers to a higher-than-anticipated sense of loss and might induce them to take excessively costly actions to repay loans when hit with negative income shocks.

Numerous open questions remain to be addressed in future work. We study relatively small loans, although Jack et al (2022) find SACs are also effective for much larger loans. It also remains to be conclusively established that borrowers do come to develop an endowment effect over the new financed asset while paying it off. While repayment rates are similar between SACs and OACs in our experiment, it will be important to evaluate default rates over a larger portfolio of loans where borrowers experience more realizations of income risk. Finally, institutional and technological innovations that make SACs easier to offer for a wider variety of goods in developing countries—beyond our context of a trusted lender with a strong relationship with borrowers—are another priority for research.

## References

- [1] Abdellaoui, Mohammed, Han Bleichrodt, and Corina Paraschiv. Loss aversion under prospect theory: A parameter-free measurement. *Management Science*, 53(10):1659–1674, 2007.
- [2] Anagol, Santosh, Vimal Balasubramaniam, and Tarun Ramadorai. Endowment effects in the field: Evidence from india’s ipo lotteries. *The Review of Economic Studies*, 85(4):1971–2004, 2018.
- [3] Andersen, Steffen, Cristian Badarinza, Lu Liu, Julie Marx, and Tarun Ramadorai. Reference dependence in the housing market. *Available at SSRN 3396506*, 2021.
- [4] Andrews, Isaiah, Matthew Gentzkow, and Jesse M Shapiro. Measuring the sensitivity of parameter estimates to estimation moments. *The Quarterly Journal of Economics*, 132(4):1553–1592, 2017.
- [5] Apicella, Coren L, Eduardo M Azevedo, Nicholas A Christakis, and James H Fowler. Evolutionary origins of the endowment effect: Evidence from hunter-gatherers. *American Economic Review*, 104(6):1793–1805, 2014.
- [6] Banerjee, Abhijit, Dean Karlan, and Jonathan Zinman. Six randomized evaluations of microcredit: Introduction and further steps. *American Economic Journal: Applied Economics*, 7(1):1–21, 2015.
- [7] Banerjee, Abhijit V and Esther Duflo. The economic lives of the poor. *Journal of economic perspectives*, 21(1):141–168, 2007.
- [8] Becker, Gordon M, Morris H DeGroot, and Jacob Marschak. Measuring utility by a single-response sequential method. *Behavioral science*, 9(3):226–232, 1964.
- [9] Beggan, James K. On the social nature of nonsocial perception: The mere ownership effect. *Journal of personality and social psychology*, 62(2):229, 1992.
- [10] Benmelech, Efraim and Nittai K Bergman. Liquidation values and the credibility of financial contract renegotiation: Evidence from us airlines. *The Quarterly Journal of Economics*, 123(4):1635–1677, 2008.
- [11] Benmelech, Efraim, Mark J Garmaise, and Tobias J Moskowitz. Do liquidation values affect financial contracts? evidence from commercial loan contracts and zoning regulation. *The Quarterly Journal of Economics*, 120(3):1121–1154, 2005.
- [12] Bester, Helmut. Screening vs. rationing in credit markets with imperfect information. *The American economic review*, 75(4):850–855, 1985.
- [13] Booij, Adam S, Bernard Van Praag, and Gijs Van De Kuilen. A parametric analysis of prospect theory’s functionals for the general population. *Theory and Decision*, 68(1):115–148, 2010.
- [14] Bordalo, Pedro, Nicola Gennaioli, and Andrei Shleifer. Salience in experimental tests of the endowment effect. *American Economic Review*, 102(3):47–52, 2012.
- [15] Carmon, Ziv and Dan Ariely. Focusing on the forgone: How value can appear so different to buyers and sellers. *Journal of consumer research*, 27(3):360–370, 2000.
- [16] Carmon, Ziv, Klaus Wertebroch, and Marcel Zeelenberg. Option attachment: When deliberating makes choosing feel like losing. *Journal of Consumer research*, 30(1):15–29, 2003.
- [17] Chan, Yuk-Shee and Anjan V Thakor. Collateral and competitive equilibria with moral hazard and private information. *The Journal of finance*, 42(2):345–363, 1987.

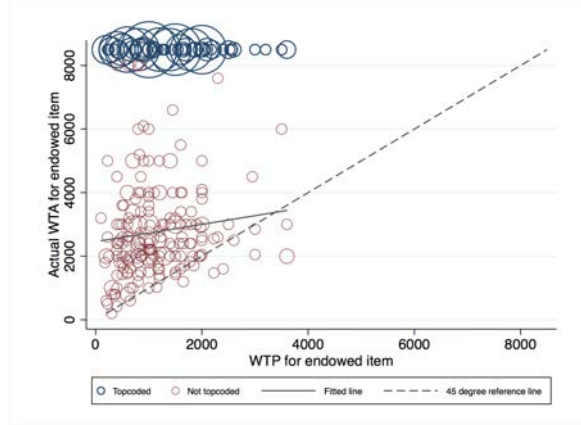
- [18] Coursey, Don L, John L Hovis, and William D Schulze. The disparity between willingness to accept and willingness to pay measures of value. *Quarterly Journal of Economics*, 102(3):679–690, 1987.
- [19] Crawford, Vincent P and Juanjuan Meng. New york city cab drivers’ labor supply revisited: Reference-dependent preferences with rational-expectations targets for hours and income. *American Economic Review*, 101(5):1912–32, 2011.
- [20] Davidoff, Thomas. Can “high costs” justify weak demand for the home equity conversion mortgage? *The Review of Financial Studies*, 28(8):2364–2398, 2015.
- [21] DellaVigna, Stefano, Jörg Heining, Johannes F Schmieder, and Simon Trenkle. Evidence on job search models from a survey of unemployed workers in germany. *NBER Working Paper*, (w27037), 2020.
- [22] DellaVigna, Stefano, Attila Lindner, Balázs Reizer, and Johannes F Schmieder. Reference-dependent job search: Evidence from hungary. *The Quarterly Journal of Economics*, 132(4):1969–2018, 2017.
- [23] Duflo, Esther and Abhijit Banerjee. *Poor economics*, volume 619. PublicAffairs, 2011.
- [24] Engström, Per, Katarina Nordblom, Henry Ohlsson, and Annika Persson. Tax compliance and loss aversion. *American Economic Journal: Economic Policy*, 7(4):132–64, 2015.
- [25] Fehr, Dietmar, Günther Fink, and Kelsey Jack. Poverty, scarcity, and exchange asymmetries. Technical report, National Bureau of Economic Research, 2019.
- [26] Gächter, Simon, Eric J Johnson, and Andreas Herrmann. Individual-level loss aversion in riskless and risky choices. *Theory and Decision*, pages 1–26, 2021.
- [27] Ganong, Peter and Pascal J Noel. Why do borrowers default on mortgages? a new method for causal attribution. Technical report, National Bureau of Economic Research, 2020.
- [28] Goette, Lorenz, Thomas Graeber, Alexandre Kellogg, and Charles Sprenger. Heterogeneity of gain-loss attitudes and expectations-based reference points. *Available at SSRN 3589906*, 2019.
- [29] Hart, Oliver and John Moore. A theory of debt based on the inalienability of human capital. *The Quarterly Journal of Economics*, 109(4):841–879, 1994.
- [30] Hartzmark, Samuel M, Samuel D Hirshman, and Alex Imas. Ownership, learning, and beliefs. *The Quarterly Journal of Economics*, 136(3):1665–1717, 2021.
- [31] Jack, William, Michael Kremer, Joost De Laat, and Tavneet Suri. Borrowing requirements, credit access, and adverse selection: Evidence from kenya. *Review of Economic Studies*.
- [32] Kahneman, Daniel, Jack L Knetsch, and Richard H Thaler. Experimental tests of the endowment effect and the coase theorem. *Journal of political Economy*, 98(6):1325–1348, 1990.
- [33] Kahneman, Daniel and Amos Tversky. Prospect theory: An analysis of decision under risk. *Econometrica*, 47(2):263–292, 1979.
- [34] Knetsch, Jack L. The endowment effect and evidence of nonreversible indifference curves. *The American Economic Review*, 79(5):1277–1284, 1989.
- [35] Knetsch, Jack L and J A Sinden. Willingness to pay and compensation demanded: Experimental evidence of an unexpected disparity in measures of value. *Quarterly Journal of Economics*, 99(3):507–521, 1984.

- [36] Kőszegi, Botond and Matthew Rabin. A model of reference-dependent preferences. *The Quarterly Journal of Economics*, 121(4):1133–1165, 2006.
- [37] Kremer, Michael, Gautam Rao, and Frank Schilbach. Behavioral development economics. In *Handbook of Behavioral Economics: Applications and Foundations 1*, volume 2, pages 345–458. Elsevier, 2019.
- [38] List, John A. Does market experience eliminate market anomalies? *The Quarterly Journal of Economics*, 118(1):41–71, 2003.
- [39] List, John A. Neoclassical theory versus prospect theory: Evidence from the marketplace. *Econometrica*, 72(2):615–625, 2004.
- [40] List, John A. Does market experience eliminate market anomalies? the case of exogenous market experience. *American Economic Review*, 101(3):313–17, 2011.
- [41] Loewenstein, George and Daniel Adler. A bias in the prediction of tastes. *The Economic Journal*, pages 929–937, 1995.
- [42] Loewenstein, George, Ted O’Donoghue, and Matthew Rabin. Projection bias in predicting future utility. *The Quarterly Journal of Economics*, 118(4):1209–1248, 2003.
- [43] Marzilli Ericson, Keith M and Andreas Fuster. The endowment effect. *Annu. Rev. Econ.*, 6(1):555–579, 2014.
- [44] Pennings, Joost ME and Ale Smidts. The shape of utility functions and organizational behavior. *Management Science*, 49(9):1251–1263, 2003.
- [45] Rampini, Adriano A and S Viswanathan. Collateral and capital structure. *Journal of Financial Economics*, 109(2):466–492, 2013.
- [46] Reb, Jochen and Terry Connolly. Possession, feelings of ownership, and the endowment effect. *Judgment and Decision making*, 2(2):107, 2007.
- [47] Sprenger, Charles. An endowment effect for risk: Experimental tests of stochastic reference points. *Journal of Political Economy*, 123(6):1456–1499, 2015.
- [48] Thakral, Neil and Linh T Tô. Daily labor supply and adaptive reference points. *American Economic Review*, 111(8):2417–43, 2021.
- [49] Tversky, Amos and Daniel Kahneman. Advances in prospect theory: Cumulative representation of uncertainty. *Journal of Risk and uncertainty*, 5(4):297–323, 1992.
- [50] Van Boven, Leaf, George Loewenstein, and David Dunning. Mispredicting the endowment effect:: Underestimation of owners’ selling prices by buyer’s agents. *Journal of Economic Behavior & Organization*, 51(3):351–365, 2003.
- [51] Voordeckers, Wim and Tensie Steijvers. Business collateral and personal commitments in sme lending. *Journal of Banking & Finance*, 30(11):3067–3086, 2006.
- [52] Williamson, Oliver E. Corporate finance and corporate governance. *The journal of finance*, 43(3):567–591, 1988.

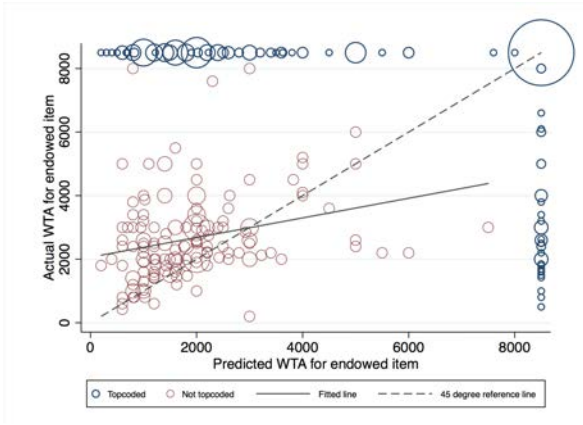
# A Appendix: Supplementary Figures and Tables

Figure A.1: Baseline WTP, WTA and Predictions: Heterogeneity

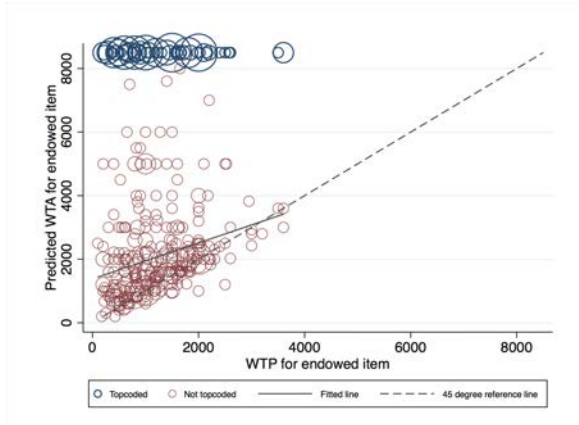
(a) WTA and Baseline WTP



(b) WTA and WTA Predictions

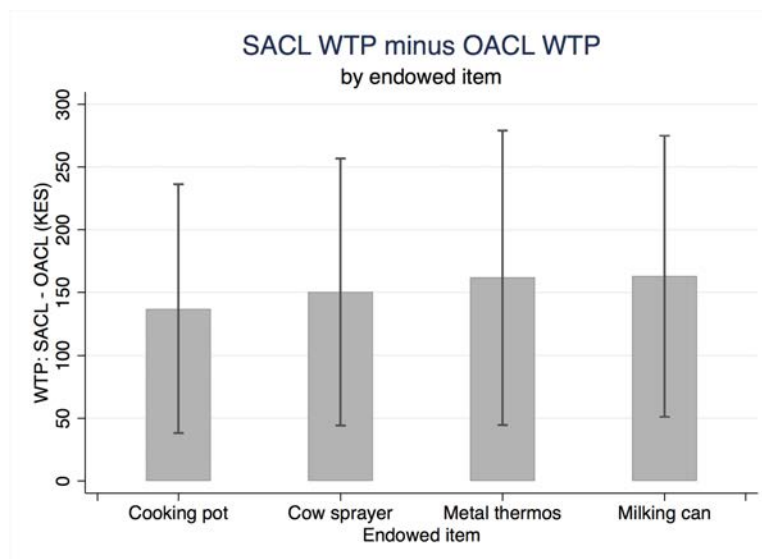


(c) WTA Predictions and Baseline WTP



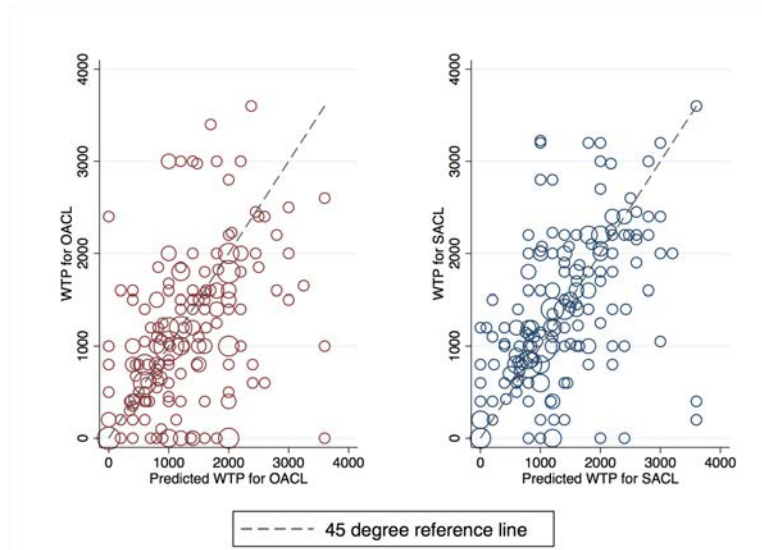
Notes: Figure A.1 displays scatter plots for subjects whose price list in the BDM procedure ranges from 0 to 8000 Kenya Shillings. The size of each circle is proportional to the number of participants who have the value indicated by the center of the circle. Darker blue circles represent individuals whose WTA or predicted WTA is top coded, while lighter red circles represent individuals whose valuations are not top coded. The fitted line is derived from a linear regression of the y-axis variable on the x-axis variable for the non-top coded subsample.

Figure A.2: Demand for SACL vs. OACL by Endowed Item



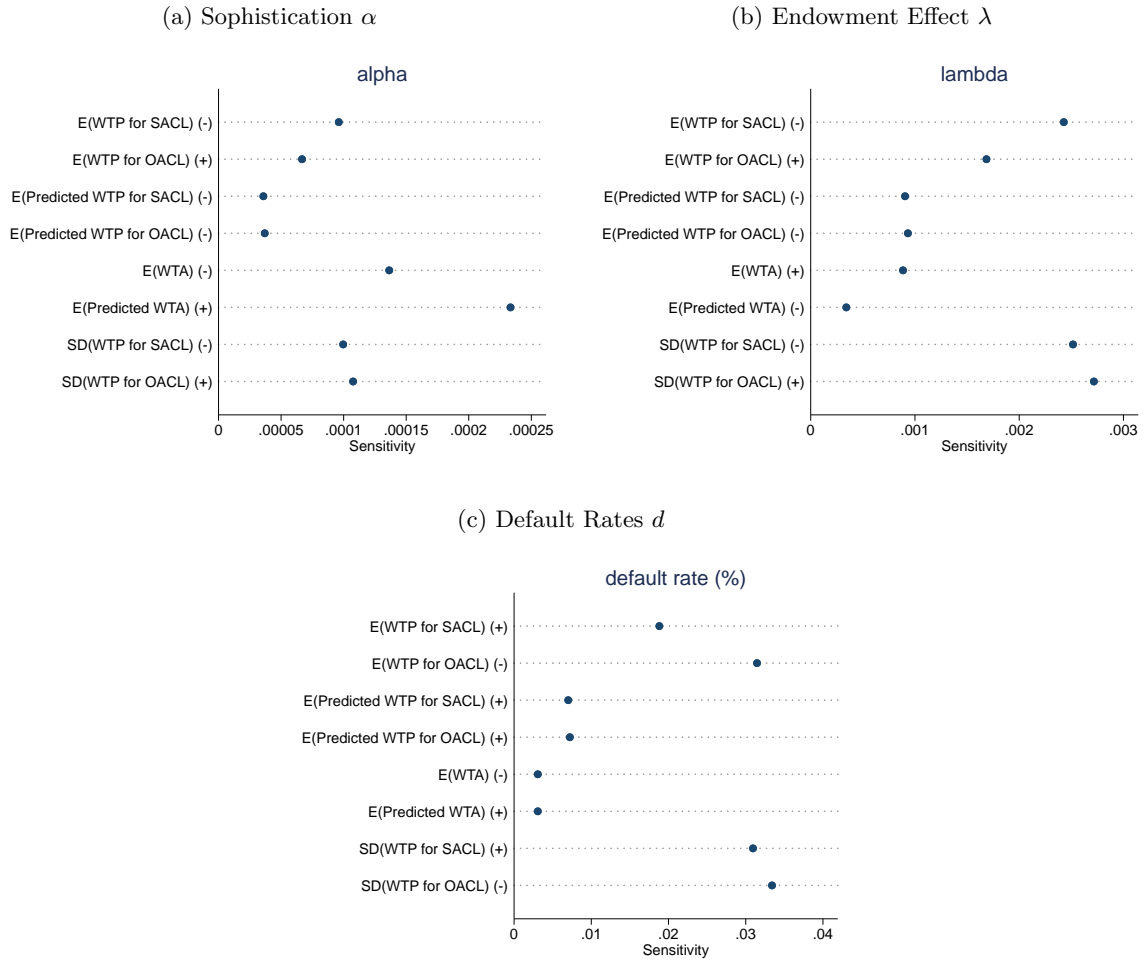
Notes: Figure A.2 presents the means (bars) and 95% confidence intervals (capped lines) of the gaps between willingness to pay for new items financed by SACLs and those by OACLs, by endowed item. The mean difference in valuation is approximately constant across all four items.

Figure A.3: Loan Take-up Prediction Heterogeneity



Notes: Figure A.3 shows the heterogeneity in the willingness to pay predictions for two types of loans. The size of each circle is proportional to the number of participants who have the value indicated by the center of the circle. The left panel presents results for OACLs, and the right panel presents results for SACLs. Circles to the left of the 45 degree line represent people who under predicted their WTP for the loan; circles to the right represent people who over predicted their WTP.

Figure A.4: Sensitivity of Structural Parameter Estimates to Empirical Moments



Notes: The plots show the absolute value of the sensitivity of different parameters with respect to the vector of estimation moments in the benchmark case, with the signs of the sensitivities in parentheses. The magnitude of the plotted values can be interpreted as the sensitivity of the estimated parameters to beliefs about the amount of misspecification of each moment (Andrews et al. 2017).

Table A.1: Predictions

<i>Panel A: Prediction incentives</i>	No incentive	Incentive (KES 50)	t-test p-values
Predicted WTA for endowed item	3829 (153.0)	3821 (160.9)	0.97
N	353	348	
Predicted SACL WTP	1271 (75.5)	1424 (70.4)	0.14
Predicted OACL WTP	1336 (75.8)	1260 (68.1)	0.46
N	117	105	
<i>Panel B: Prediction anchoring</i>	No loan predictions	Loan predictions	t-test p-values
SACL WTP	1356 (39.7)	1329 (52.1)	0.69
OACL WTP	1231 (38.2)	1116 (52.5)	0.09*
N	479	222	

Notes: Panel A of table A.1 compares predictions of WTA and loan take-up when incentives for prediction accuracy are offered versus when they are not offered. T-tests show that there are no significant differences between incentivized and non-incentivized predictions. Panel B compares loan willingness to pay when subjects made predictions versus when they did not, to show whether anchoring to predicted valuations impacted subjects' decision making. T-tests show no significant difference for the SACL, and a small and marginally significant difference for the OACL. Standard errors of the means are shown in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Table A.2: Baseline Valuations

	Number of Obs.	Mean	Standard Deviation	Min	Max
WTP: Milk Can	523	1177.9	642.8	200	3600
WTP: Cow Sprayer	701	1439.4	625.8	0	3600
WTP: Cooking Pot	606	1358.6	784.1	200	3600
WTP: Thermos	701	798.8	534.0	0	3600

Notes: Table A.2 shows summary statistics about the baseline valuations from the initial BDM exercise for each of the four items used in the experiment. Due to delays in procurement from the supplier, some subjects completed the experiment without either the milk can or the cooking pot. Therefore the number of milk cans and cooking pots used in the experiment is less than the total sample size. For all items, mean valuations were below the market price, which was approximately 2,500 Kenya Shillings for each of the items.

Table A.3: Balance Check

Variable	Means (standard errors)			t-test p-values		
	Endowed item (1)	SACL (2)	OACL (3)	1=2 (4)	1=3 (5)	2=3 (6)
Baseline WTP (KES)	1204.815 (25.123)	1207.454 (26.713)	1213.302 (24.725)	0.943	0.810	0.872
Share cow sprayer	0.304	0.268	0.295	0.140	0.727	0.260
Share milk can	0.223	0.225	0.213	0.898	0.651	0.561
Share cooking pot	0.243	0.243	0.284	1.000	0.079*	0.079*
Share thermos	0.231	0.264	0.208	0.155	0.302	0.014**
N	701	701	701			

Notes: Columns 1-3 of table A.3 show the mean baseline valuations of the randomly assigned endowed item, SACL new item, and OACL new item, as well as shares of the different goods that serve as each. Standard errors are shown in parentheses for the mean baseline valuation and are omitted for the shares, which are binary variables. Columns 4-6 show p-values from pairwise t-tests for the items. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Table A.4: Structural Estimation Results: Log Normal + Identity Weight Matrix

	(1)	(2)	(3)	(4)	(5)	(6)
	Benchmark	Include Baseline WTP	Not using loan prediction	Subsample Not topcoded	Fixed $d = 10\%$ no WTA	Fixed $d = 10\%$ no $\widehat{WTA}$
<b><i>Main Parameters</i></b>						
Loss aversion ( $\lambda$ )	2.720 (0.187)	2.634 (0.201)	2.691 (0.193)	0.812 (0.124)	2.068 (0.175)	2.353 (0.067)
Projection bias ( $\alpha$ )	0.582 (0.030)	0.579 (0.031)	0.581 (0.031)	0.448 (0.076)	0.691 (0.066)	0.740 (0.077)
Default rates ( $d\%$ )	6.227 (1.833)	7.434 (2.175)	6.479 (1.878)	10.612 (7.925)	10 NA	10 NA
<b><i>Auxiliary Parameters</i></b>						
Mean of the associated normal distribution ( $\mu$ )	7.124 (0.045)	7.233 (0.057)	7.133 (0.048)	7.108 (0.060)	7.186 (0.021)	7.228 (0.021)
Std. Dev. of the associated normal distribution ( $\sigma$ )	0.593 (0.012)	0.426 (0.020)	0.592 (0.013)	0.556 (0.021)	0.593 (0.012)	0.593 (0.012)
Liquidity cost ( $c$ )	NA NA	307.25 (75.36)	NA NA	NA NA	NA NA	NA NA
<b><i>Implied Standard Parameters</i></b>						
Loss aversion ( $\lambda^S$ )	4.505 (0.310)	4.397 (0.323)	4.469 (0.315)	2.086 (0.202)	3.269 (0.415)	3.463 (0.318)
Projection bias ( $\alpha^S$ )	0.520 (0.029)	0.515 (0.029)	0.518 (0.029)	0.297 (0.059)	0.608 (0.061)	0.669 (0.081)
Mean item valuation	1480.53 (64.126)	1515.78 (73.907)	1492.25 (68.104)	1425.96 (80.039)	1574.86 (25.425)	1642.55 (26.789)
Std. Dev. of item valuation	961.74 (44.201)	675.69 (12.316)	966.64 (44.663)	858.67 (52.983)	1023.02 (23.250)	1066.99 (24.438)
<b><i>Model Fit</i></b>						
Number of moments used	8	12	6	8	7	7
Number of estimated parameters	5	6	5	5	4	4
Goodness of Fit	3219.11	2996.44	2213.96	7868.04	3219.11	3219.11

Notes: As a robustness check, table A.4 re-estimates table 5 using the identity matrix as the weighting matrix (instead of the inverse of the diagonal of the variance-covariance matrix of the moments).

## B Appendix: Derivation of the Main Theoretical Results

This appendix presents a detailed derivation of the main theoretical results in Section 4.

**WTP for four items.** When participants' state their baseline willingness to pay for the items in period 0, their reference points do not yet include those items. If they choose to purchase the item, their utility is  $U(1|0) + w - (x + c)$ , where  $x$  is the price of the item and  $c$  is the potential liquidity cost incurred to purchase the item. If they choose not to purchase the item, their utility is  $U(0|0) + w$ . Equating the two expressions gives us participants' willingness to pay for the item.  $U(1|0) + w - (x + c) = U(0|0) + w \Rightarrow WTP_i^{item} = V_i - c$ .

**Actual and predicted WTA for the endowed item.** Participants state their actual willingness to accept in period 1, after the endowed item has fully entered their reference point. If they choose to sell the item, their utility is  $U(0|1) + w + x$ . If they choose to keep the item, their utility is  $U(1|1) + w$ . Equating the two expressions gives the lowest price at which they are willing to sell the item: their willingness to accept.  $U(0|1) + w + x = U(1|1) + w \Rightarrow WTA = (1 + \lambda)V_E$ .

We also elicit participants' predicted *WTA* at period 0, before they are endowed with the item. This predicted *WTA* depends on the participant's perceived reference point, which under projection bias is  $r_0^1 = (1 - \alpha) \cdot 0 + \alpha \cdot 1 = \alpha$ . If they believe that their future self will sell the item, their perceived utility is  $U(0|\alpha) + w + x$ . If they believe their future self will keep the item, their perceived utility is  $U(1|\alpha) + w$ . Equating the two expressions gives us the lowest price at which they predict that their future self would be willing to sell the item.  $U(0|\alpha) + w + x = U(1|\alpha) + w \Rightarrow \widehat{WTA} = (1 + \alpha\lambda)V_E$ . Here, we assume the predicted utility is equal to the decision utility that the agent maximizes if they are asked to commit to their predictions. We also assume that the agent is naive about their projection bias.

**Demand for SACL and OACL.** When a borrower considers taking up a loan, their perceived equivalent reference point is  $r_1^2 = (1 - \alpha)(1, 0) + \alpha(1, 1) = (1, \alpha)$ . A borrower's expected utility from taking up a SACL is then  $(1 - \widehat{d})\left(U(1, 1|1, \alpha) - x\right) + \widehat{d}U(1, 0|1, \alpha) + w$ . Similarly, the borrower's expected utility from taking up an OACL is  $(1 - \widehat{d})\left(U(1, 1|1, \alpha) - x\right) + \widehat{d}U(0, 1|1, \alpha) + w$ . If the agent does not take up a loan, they still keep the endowed item but does not receive a new item, and their utility is simply  $U(1, 0|1, 0) + w$ . As the loan price increases, taking up loans becomes less attractive. When the price reaches the borrower's willingness to pay, their utility from loan take-up is equal to their reservation utility, and they are indifferent between taking the loan or not:

$$(1 - \widehat{d})\left(U(1, 1|1, \alpha) - WTP_S\right) + \widehat{d}U(1, 0|1, \alpha) + w = U(1, 0|1, 0) + w$$

$$(1 - \widehat{d})\left(U(1, 1|1, \alpha) - WTP_O\right) + \widehat{d}U(0, 1|1, \alpha) + w = U(1, 0|1, 0) + w$$

Solving these equations yields expressions for  $WTP_S$  and  $WTP_O$ .

$$WTP_S = -\frac{\widehat{d}}{1 - \widehat{d}}(1 + \alpha\lambda)V_S + \frac{1}{1 - \widehat{d}}V_S \quad WTP_O = -\frac{\widehat{d}}{1 - \widehat{d}}(1 + \lambda)V_E + \frac{1}{1 - \widehat{d}}V_O$$

**(Mis)prediction of Future Demand for SACL and OACL.** We elicit participants' predictions of their future willingness to take up loans at period 0, before they are given the endowed item to take home with them. As before, we assume that the predicted utility is equal to the decision utility and that the agent is naive about their projection bias. From the standpoint of period 0, the agent's perceived equivalent reference point is  $r_0^2 = (1 - \alpha)(0, 0) + \alpha(1, 1) = (\alpha, \alpha)$  if they take up either of the loans, and  $r_0^2 = (1 - \alpha)(0, 0) + \alpha(1, 0) = (\alpha, 0)$  if not. Then, the agent's predicted expected utility from taking up a SACL is  $(1 - \widehat{d})\left(U(1, 1|\alpha, \alpha) - x\right) + \widehat{d}U(1, 0|\alpha, \alpha)$ . Similarly, the period-0 agent predicts that the

expected utility from taking-up an OACL will be  $(1 - \widehat{d})(U(1, 1|\alpha, \alpha) - x) + \widehat{d}U(0, 1|\alpha, \alpha)$ . If they do not take up a loan, they predict that their utility will be  $U(1, 0|\alpha, 0)$ . As before, we can solve for the predicted SACL and OACL WTP by setting the expected utility from the loans equal to the agent's reservation utility and solving for the price, which gives:

$$\widehat{WTP}_S = -\frac{\widehat{d}}{1 - \widehat{d}}(1 + \alpha\lambda)V_S + \frac{1}{1 - \widehat{d}}V_S \quad \widehat{WTP}_O = -\frac{\widehat{d}}{1 - \widehat{d}}(1 + \alpha\lambda)V_E + \frac{1}{1 - \widehat{d}}V_O$$

## B.1 A Mapping of Parameters

It is clear that all of our predictions are driven by the sense of loss. Assuming no sense of gain does not change our predictions and substantially simplifies the model. This section explains how to build a mapping between parameters in our model to those in the standard Kőszegi and Rabin (2006) model that allows for sense of gain.

If the endowed item, the new item offered using a SACL, and the new item offered using an OACL are valued equally, then the standard Kőszegi and Rabin (2006) model would have the following predictions:<sup>40</sup>

- Baseline willingness to pay for items:  $WTP = (1 + \eta^s(1 - \alpha^s))V^s$ <sup>41</sup>
- Willingness to accept:  $WTA = (1 + \eta^s\lambda^s)V^s$
- Predicted willingness to accept:  $\widehat{WTA} = (1 + \eta^s(\alpha^s\lambda^s + 1 - \alpha^s))V^s$
- Demand for SACL and OACL:

$$\begin{aligned} WTP_S &= \underbrace{-\frac{\widehat{d}^s}{1 - \widehat{d}^s}(1 + \eta^s(\alpha^s\lambda^s + 1 - \alpha^s))V^s}_{\text{Utility penalty from losing collateral}} + \underbrace{\frac{1}{1 - \widehat{d}^s}(1 + \eta^s(1 - \alpha^s))V^s}_{\text{Utility gain from getting new item}} \\ WTP_O &= \underbrace{-\frac{\widehat{d}^s}{1 - \widehat{d}^s}(1 + \eta^s\lambda^s)V^s}_{\text{Utility penalty from losing collateral}} + \underbrace{\frac{1}{1 - \widehat{d}^s}(1 + \eta^s(1 - \alpha^s))V^s}_{\text{Utility gain from getting new item}} \end{aligned}$$

Then we can compare the standard Kőszegi and Rabin (2006) model with our model that suppresses the sense of gain:

Kőszegi and Rabin (2006), with sense of gain		Our model, without sense of gain
$WTP = (1 + \eta^s(1 - \alpha^s))V^s$	$\iff$	$WTP = V$
$WTA = (1 + \eta^s\lambda^s)V^s$	$\iff$	$WTA = (1 + \lambda)V$
$\widehat{WTA} = (1 + \eta^s(\alpha^s\lambda^s + 1 - \alpha^s))V^s$	$\iff$	$\widehat{WTA} = (1 + \alpha\lambda)V$
$WTP_S = -\frac{\widehat{d}^s}{1 - \widehat{d}^s}(1 + \eta^s(\alpha^s\lambda^s + 1 - \alpha^s))V^s + \frac{1}{1 - \widehat{d}^s}(1 + \eta^s(1 - \alpha^s))V^s$	$\iff$	$WTP_S = -\frac{\widehat{d}}{1 - \widehat{d}}(1 + \alpha\lambda)V + \frac{1}{1 - \widehat{d}}V$
$WTP_O = -\frac{\widehat{d}^s}{1 - \widehat{d}^s}(1 + \eta^s\lambda^s)V^s + \frac{1}{1 - \widehat{d}^s}(1 + \eta^s(1 - \alpha^s))V^s$	$\iff$	$WTP_O = -\frac{\widehat{d}}{1 - \widehat{d}}(1 + \lambda)V + \frac{1}{1 - \widehat{d}}V$

Note that in our model, willingness to pay for SACL and OACL can be re-written as the linear combinations of baseline WTP and WTA or predicted WTA:

<sup>40</sup> Without loss of generality, we ignore the liquidity cost in the baseline WTPs in the following proofs.

<sup>41</sup> To distinguish parameters in two models, we add the superscript  $s$  to parameters in the standard model. The new parameter  $\eta^s$  is the weight of the gain-loss utility compared to the consumption utility.

- $WTP_S = -\frac{\widehat{d}}{1-\widehat{d}}\widehat{WTA} + \frac{1}{1-\widehat{d}}WTP$
- $WTP_O = -\frac{\widehat{d}}{1-\widehat{d}}WTA + \frac{1}{1-\widehat{d}}WTP$ .

Similarly, in the standard model,  $WTP_S$  and  $WTP_O$  can also be re-written in this way:

- $WTP_S = -\frac{\widehat{d}^s}{1-\widehat{d}^s}\widehat{WTA} + \frac{1}{1-\widehat{d}^s}WTP$
- $WTP_O = -\frac{\widehat{d}^s}{1-\widehat{d}^s}WTA + \frac{1}{1-\widehat{d}^s}WTP$

Thus, we only need to match  $WTP$ ,  $WTA$ , and  $\widehat{WTA}$ , setting  $\widehat{d} = \widehat{d}^s$ . The mapping between these two sets of parameters is as follows:

- $V = (1 + \eta^s(1 - \alpha^s))V^s$
- $\alpha = \frac{\alpha^s \lambda^s}{\lambda^s - (1 - \alpha^s)}$
- $\lambda = \frac{\eta^s \lambda^s - \eta^s (1 - \alpha^s)}{1 + \eta^s (1 - \alpha^s)} \stackrel{\eta^s = 1}{=} \frac{\lambda^s - (1 - \alpha^s)}{1 + (1 - \alpha^s)}$
- $\widehat{d} = \widehat{d}^s$

## C Appendix: Sensitivity Analysis

To explicitly identify which features of the data drive each parameter estimate, we use the method proposed by Andrews, Gentzkow, and Shapiro (2017) to test the sensitivity of the parameters and show how alternative empirical moments would change the parameter estimates. Moreover, this method allows us to evaluate whether we are over or underestimating the parameters by treating the censored values as if they were truly equal to 3600 or 8000 Ksh.

Suppose  $\hat{\theta}$  is the minimum distance estimator and  $\theta_0$  is the true value. Define  $\hat{g}(\theta) = \hat{m} - m(\theta)$ . Given an alternative  $a$ , Andrews, Gentzkow, and Shapiro (2017) assume that  $\sqrt{n}\hat{g}(\theta_0)$  converges in distribution to a random variable  $\tilde{g}(a)$ . They show that  $\sqrt{n}(\hat{\theta} - \theta_0)$  then converges in distribution to a random variable  $\tilde{\theta}(a)$  and  $\hat{\theta}$  has first-order asymptotic bias:  $E(\tilde{\theta}(a)) = \Lambda E(\tilde{g}(a))$ . The matrix  $\Lambda = (M'WM)^{-1}M'W$  is a sensitivity matrix, where  $M$  is the matrix of partial derivatives of  $m(\theta)$  evaluated at  $\theta_0$ .

Following Andrews, Gentzkow, and Shapiro (2017), we consider a perturbed model under which  $\hat{m} = \tilde{m} + \mu\eta$  where  $\eta$  is a vector of constants,  $\mu \in [0, 1]$  is a local perturbation such that  $\mu = 0$  indicates the original assumption and  $\mu = 1$  indicates an alternative assumption, and the distribution of  $\tilde{m}$  does not depend on  $\mu$ . Under certain local perturbations  $\mu$ , the first-order asymptotic bias is then  $E(\tilde{\theta}) = \Lambda\eta$ .

We estimate  $\Lambda$  using estimates of  $M$  and  $W$ . Figure A.4a plots the column of the estimated  $\Lambda$  corresponding to projection bias  $\alpha$ . This shows several intuitive relationships: a higher willingness to pay for a SACL or higher loan predictions would lead to estimates of more projection bias (i.e., a lower  $\alpha$ ). Similarly, as the predicted  $WTA$  gets closer to the actual  $WTA$ , the estimated  $\alpha$  becomes larger (i.e., less projection bias). If the censored values of  $WTA$  and  $\widehat{WTA}$  are in fact much higher, it is unclear whether we are over or underestimating  $\alpha$ , because a higher  $WTA$  lowers the estimated  $\alpha$  while a higher  $\widehat{WTA}$  drives up the estimated  $\alpha$ .

Figure A.4b plots the column of the estimated  $\Lambda$  corresponding to loss aversion  $\lambda$ . Higher willingness to pay for the OACL would lead to estimates of more loss aversion (i.e., larger  $\lambda$ ), while higher willingness to pay for the SACL or higher loan predictions would lower the estimated  $\lambda$ . As the  $WTA$  gets higher, the estimated  $\lambda$  becomes larger. The sensitivity analysis shows that it is unclear whether we are over or underestimating  $\lambda$  by treating the top-coded  $WTA$  and  $\widehat{WTA}$  as if they were truly equal to 3600 or 8000 Ksh, because a higher  $WTA$  drives up the estimated  $\lambda$  while a higher  $\widehat{WTA}$  lowers the estimated  $\lambda$ . Figure A.4c plots the column of the estimated  $\Lambda$  corresponding to the perceived default rate  $\hat{d}$ .

## D Appendix: Extended Model with Welfare Analysis

This section provides a generalization and extension of the baseline model in Section 4. We derive a lifecycle consumption model with income risk where a borrower has access to SACs and OACs. We model both the loan take-up decision and the subsequent decisions to repay or default on the loan. We use this model to guide the discussion of welfare consequences and policy implications described in Section 6.

*Setup.* Individuals live for an infinite number of periods. Their income  $\tilde{Y}_t$  in each period is stochastic with c.d.f.  $F(y)$ . The utility in period  $t$  is given by  $m(c_t) + u(l_t|r_t)$ , where  $c_t$  is the consumption of all goods other than the loan item,  $l_t$  is the consumption of the loan item, and  $r_t$  is the reference point (either perceived or actual). The utility function of all other consumption,  $m(\cdot)$ , is not reference dependent and satisfies  $m' > 0$ ,  $m'' < 0$ . The utility function of the loan item is reference dependent, as in the simple model in Section 4. Loss aversion is parameterized by  $\lambda$ , which represents the additional weight placed on losses relative to gains. Projection bias about the reference point is parameterized by  $\alpha$  which, represents the degree to which agents anticipate changes in their reference point. Further, we introduce a parameter  $\gamma$ , which describes the ‘persistence’ of agents’ sense of loss, as described in Section 6.

*Value functions.* First, we consider individuals’ optimal consumption decision when no loans are available, as characterized by the following Bellman equation

$$\begin{aligned} \mathcal{V}(A_t) &= \max_{c_t} m(c_t) + \delta \mathbb{E} \mathcal{V}(A_{t+1}) \\ A_{t+1} &= R(A_t - c_t) + \tilde{Y}_{t+1} \end{aligned}$$

where  $A_t$  is the asset level in period  $t$ ,  $\delta$  is the discount factor, and  $R$  is the rate of return on savings. Borrowers’ initial wealth,  $A_1$ , is determined exogenously.

### D.1 Loan Take-up Stage $t=1$

When loan contracts are available, borrowers decide whether they want to take up the loan in period 1 and whether they will repay the loan (or default) in period 2. Borrowers use backward induction: when they decide whether to take up a loan, they predict their repayment behavior in period 2 and make period 1 take-up decisions based on their prediction. Therefore, the expected decision utility from taking up a loan can be written as

$$\begin{aligned} \mathcal{V}_{1T}(A_1) &= \max_{c_1} m(c_1) + \delta \mathbb{E}[\max\{\hat{\mathcal{V}}_{2R}(A_2), \hat{\mathcal{V}}_{2D}(A_2)\}] \\ A_2 &= R(A_1 - c_1) + \tilde{Y}_2 \end{aligned}$$

where  $\hat{\mathcal{V}}_{2R}(A_2)$  is the *perceived* expected utility if they repay in period 2, which can be written as<sup>42</sup>

$$\hat{\mathcal{V}}_{2R}(A_2) = \mathcal{V}(A_2 - x) + V$$

---

<sup>42</sup> The reason  $\hat{\mathcal{V}}_{2R}(A_2)$  can be written this way is that the utility from the loan item enters linearly and does not change borrowers’ policy function.

with  $x$  representing the level of repayment and  $V$  representing the present value of the utility stream derived from the the loan item.<sup>43</sup> If borrowers default in period 2, the  $x$  they have paid toward the loan is returned to them, but they lose their collateral. Their *perceived* expected utility  $\hat{\mathcal{V}}_{2D}(A_2)$  is given by:

$$\hat{\mathcal{V}}_{2D}(A_2) = \begin{cases} \mathcal{V}(A_2) - \alpha\lambda V, & \text{if SACL} \\ \mathcal{V}(A_2) - \lambda V, & \text{if OACL} \end{cases}$$

If borrowers default, they will experience a sense of loss. The magnitude of the utility loss depends on how loss averse the borrower is ( $\lambda$ ) and the loan type. In the case of SACLs, borrowers do not own the collateral (which is the item being purchased) at the time of the take-up decision, and they believe that it will only partially enter their reference point, so they predict a lower level of utility loss if they default. In the case of OACLs, the collateral is the existing asset, which is already fully in the reference point.<sup>44</sup> We assume that the borrowers value the existing asset and the loan item equally.<sup>45</sup>

Having established this framework, we can show that the perceived utility from taking up a SACL is higher than that of an OACL, such that borrowers will always prefer SACL to OACL.

**Proposition 1.** (*Preference for SACL over OACL*)

*Suppose SACLs and OACLs have the same price. In this case, a borrower will have a higher decision utility from taking up a SACL than an OACL.*

*Proof.*  $\hat{\mathcal{V}}_{2D}(A_2)$  of a SACL is higher than that of an OACL for any given values of  $A_2$  and  $V$ . By the property of the maximum operator,  $\mathcal{V}_{1T}$  of SACL will also be higher.  $\square$

## D.2 Loan Repayment Stage $t=2$

Having described borrowers' loan take-up decisions, we now turn our attention to borrowers' repayment decisions in period 2. To understand the welfare consequences of the loans, we need to characterize these repayment decisions and derive borrowers' predicted and actual default probability. Proposition 2 states that borrowers overestimate their propensity to repay a SACL, but accurately estimate their propensity to repay an OACL.

**Proposition 2.** (*Repayment Decisions*)

(i) *In the loan take-up period (period 1), borrowers believe that they would repay a SACL if the income realized in the loan-repayment period  $Y_2$  is greater than some threshold  $\hat{y}_s$  and that they would repay an OACL if  $Y_2$  is greater than some lesser threshold  $\hat{y}_o$ .*

(ii) *In the loan repayment period, a borrower actually repays a SACL if  $Y_2$  is greater than  $y_s$  and repays an OACL if  $Y_2$  is greater than  $y_o$ .*

*And we have  $y_o = \hat{y}_o < y_s < \hat{y}_s$ .*

*Proof.* Borrowers, when they take up OACLs, act as if their  $\alpha = 1$  in the loan take-up period. So in the proofs below, we can compare SACLs and OACLs by computing comparative statics with respect to  $\alpha$  and treating OACLs like a special case where  $\alpha = 1$  in the loan take-up period.

<sup>43</sup>  $V = \sum_{j=0}^{\infty} \delta^j u(v|\alpha v) = \sum_{j=0}^{\infty} \delta^j v$ .

<sup>44</sup> The utility loss in the case of SACLs is derived in the following way:  $-\alpha\lambda V = \sum_{j=0}^{\infty} \delta^j u(0|\alpha v) = -\sum_{j=0}^{\infty} \delta^j \alpha\lambda v$ . And the utility loss in the case of OACL is derived in the following way:  $-\lambda V = \sum_{j=0}^{\infty} \delta^j u(0|v) = -\sum_{j=0}^{\infty} \delta^j \lambda v$ .

<sup>45</sup>By randomization, this is true in expectation in our experiment.

In the loan take-up period, borrowers think they would repay if  $\hat{\mathcal{V}}_{2R}(A_2) > \hat{\mathcal{V}}_{2D}(A_2)$  or  $\mathcal{V}(A_2) - \mathcal{V}(A_2 - x) < (1 + \alpha\lambda)V$ . Define  $\mathcal{V}(A_2) - \mathcal{V}(A_2 - x) = H(A_2(c_1, Y_2))$ . We have  $\partial H / \partial Y_2 = \mathcal{V}'(A_2) - \mathcal{V}'(A_2 - x) < 0$ . Therefore, there exists some  $y(c_1, \alpha)$  such that when  $Y_2 > y(c_1, \alpha)$ ,  $\mathcal{V}(A_2) - \mathcal{V}(A_2 - x) < (1 + \alpha\lambda)V$  holds and individuals repay; and  $y$  satisfies  $H(A_2(c_1, y)) = (1 + \alpha\lambda)V$ . Also because  $\partial H / \partial c_1 > 0$ , we have  $\partial y / \partial c_1 = R > 0$ . And it is obvious that  $\partial y / \partial \alpha < 0$ . In addition, the optimal consumption  $c_1^*$  will depend on  $\alpha$ , so to figure out the total effect of  $\alpha$  on  $y$ , we need to know the indirect effect of  $\alpha$  on  $y$  through optimal consumption choice  $c_1^*$ . Define  $G(c_1, \alpha) = m(c_1) + \delta \mathbb{E}[\max\{\hat{\mathcal{V}}_{2R}(A_2), \hat{\mathcal{V}}_{2D}(A_2)\}]$ , so that  $c_1^* = \operatorname{argmax} G(c_1, \alpha)$ .  $G(c_1, \alpha)$  can be re-written as  $G(c_1, \alpha) = m(c_1) + \delta \int_0^{y(c_1, \alpha)} \hat{\mathcal{V}}_{2D}(A_2) f(z) dz + \delta \int_{y(c_1, \alpha)}^{\bar{Y}} \hat{\mathcal{V}}_{2R}(A_2) f(z) dz$ . It can be shown that  $\frac{\partial G_1}{\partial \alpha} = -\delta \lambda V F(y(c_1, \alpha))$ . Therefore,  $\frac{\partial c_1^*}{\partial \alpha} \propto \frac{\partial^2 G}{\partial c_1 \partial \alpha} \propto -F' \frac{\partial y}{\partial c_1} < 0$ . Therefore  $dy/d\alpha < 0$ .

As discussed above, because borrowers act as if their  $\alpha = 1$  when they take up OACLs, we have  $\hat{y}_s = y(c_1^*(\alpha), \alpha)$  and  $\hat{y}_o = y(c_1^*(1), 1)$ . And because  $dy/d\alpha < 0$ , we have  $\hat{y}_s > \hat{y}_o$ .

In the loan repayment period, a borrower would repay if  $\mathcal{V}_{2R}(A_2) > \mathcal{V}_{2D}(A_2)$ , or  $\mathcal{V}(A_2) - \mathcal{V}(A_2 - x) < (1 + \lambda)V$ . Similar to the derivation above, we have  $y_s = y(c_1^*(\alpha), 1)$  and  $y_o = y(c_1^*(1), 1)$ . When borrowers are in the repayment period, the asset level  $A_2$  is treated as given and is determined by their consumption choice in the take-up period, but the sense of loss (governed by  $\alpha$ ) from defaulting may or may not be the same as the prediction in the past. We have shown that  $\partial y / \partial \alpha < 0$ , so  $y_s < \hat{y}_s$ . And  $y_o$  is obviously equal to  $\hat{y}_o$ . In addition,  $y_s > y_o$  because  $\partial y / \partial c_1 > 0$  while  $\partial c_1^* / \partial \alpha < 0$ . □

### D.3 Welfare

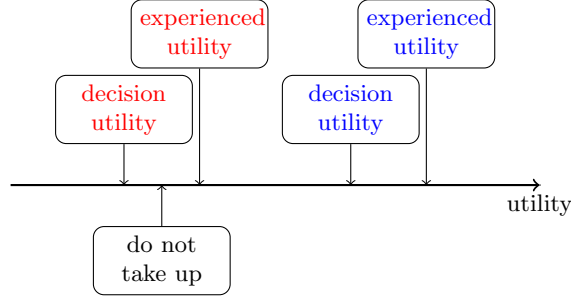
We now compare borrowers' anticipated repayment decision at the time of their period 1 take-up decisions to their actual repayment decisions in period 2. A SACL borrower's repayment decision is time inconsistent in that the actual default rate is lower than the perceived default rate. A borrower is more likely to repay if she takes up an OACL than if she takes up a SACL.

For a SACL borrower, time inconsistency in repayment decisions (induced by projection bias) generates a wedge between the borrower's decision utility and the experienced utility. Another important psychological force that could generate such a wedge for both SACL and OACL borrowers is the discrepancy between predicted and experienced *duration* of loss utility. We allow the experienced loss utility to be scaled down by a parameter  $\gamma \in [0, 1]$ , which represents how slowly borrowers' reference points adjust after a loss. The experienced utility if borrowers default in period 2 then becomes

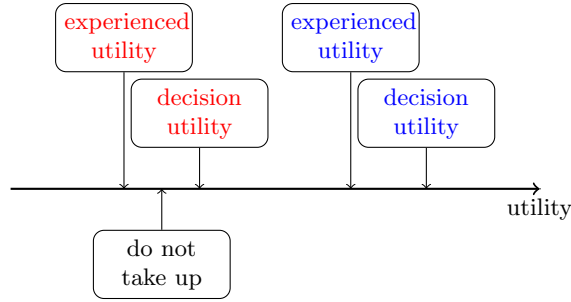
$$\mathcal{V}_{2D}(A_2) = \mathcal{V}(A_2) - \gamma \lambda V$$

Importantly, decision utility determines whether a borrower takes up a loan, while experienced utility determines whether she ultimately benefits from the loan (assuming that it is the experienced utility that matters for the welfare). For OACLs, decision utility and experienced utility are the same, because the collateral item is already in the borrower's reference point in period 1. But for SACLs, there may be a discrepancy between decision utility and experienced utility. This discrepancy means that borrowers who take up a loan are not necessarily those who would benefit from it, and vice versa. Some borrowers may take up loans that are ultimately bad for their welfare, while others may forego loans that would ultimately be good for their welfare.

When borrowers' decision utility is below their experienced utility, loan take-up is sub-optimally low. Borrowers (shown in blue in the figure below) who take up the loan will on average be positively surprised in the repayment period. For these borrowers, default, and loss of the asset, is less painful than anticipated. And some borrowers (shown in red below) who do not take up the loan miss a good opportunity because they are too pessimistic about the pain of losing the item in the case of default.



Conversely, when the decision utility is above experienced utility, the loan take-up is sub-optimally high. Borrowers who take up the loan will on average be negatively surprised, having not anticipated that the new item they purchased would enter their reference point, making default more painful than expected. These borrowers (shown in red in the figure below) would have been better off had they not taken up the loan.



In the propositions below, we discuss the relationship between decision utility and experienced utility in detail.

**Proposition 3.** (*Experienced Utility vs Decision Utility: SACLs*)

For a SACL borrower,

- (1) If the income shock is good ( $\tilde{Y}_2 > \hat{y}_s$ ), she follows her original plan of repaying and her experienced utility is the same as her decision utility.
- (2) If the income shock is moderate ( $y_s < \tilde{Y}_2 < \hat{y}_s$ ), she repays, though her original plan at the take-up stage was to default in this case. Her experienced utility is lower than her decision utility.
- (3) If the income shock is bad ( $\tilde{Y}_2 < y_s$ ), she follows her original plan of defaulting and her experienced utility is lower than her decision utility if  $\alpha < \gamma$  and is higher if  $\alpha > \gamma$ .

In sum, the expected experienced utility tends to be lower than the expected decision utility, such that loan take-up can be interpreted as bad for welfare, when the income shocks are more likely to be moderate or when the  $\gamma$  is relatively large relative to  $\alpha$ .

*Proof.* The expected welfare or experienced utility upon taking up a SACL is

$$\begin{aligned}\mathcal{W}_S &= m(c_1^*(\alpha)) \\ &+ \delta \int_0^{y_s} (\mathcal{V}(A_2) - \gamma\lambda V)f(z)dz \\ &+ \delta \int_{y_s}^{\tilde{Y}} (\mathcal{V}(A_2 - x) + V)f(z)dz \\ A_2 &= R(A_1 - c_1^*(\alpha)) + \tilde{Y}_2\end{aligned}$$

And the decision utility upon taking up a SACL is

$$\begin{aligned}\mathcal{V}_{1T} &= m(c_1^*(\alpha)) \\ &+ \delta \int_0^{\hat{y}_s} (\mathcal{V}(A_2) - \alpha\lambda V)f(z)dz \\ &+ \delta \int_{\hat{y}_s}^{\tilde{Y}} (\mathcal{V}(A_2 - x) + V)f(z)dz \\ A_2 &= R(A_1 - c_1^*(\alpha)) + \tilde{Y}_2\end{aligned}$$

Therefore, the difference between the two can be written as

$$\begin{aligned}\mathcal{W}_S - \mathcal{V}_{1T} &= \delta \int_0^{y_s} (\alpha - \gamma)\lambda V f(z)dz \\ &+ \delta \int_{y_s}^{\hat{y}_s} (\mathcal{V}(A_2 - x) + V - \mathcal{V}(A_2) + \alpha\lambda V)f(z)dz \\ A_2 &= R(A_1 - c_1^*(\alpha)) + \tilde{Y}_2\end{aligned}$$

It is obvious that (1) holds. For (2), notice that, by definition,  $\hat{y}_s$  satisfies  $\mathcal{V}(A_2 - x) + V = \mathcal{V}(A_2) - \alpha\lambda V$ , and when  $\tilde{Y}_2 < \hat{y}_s$ ,  $\mathcal{V}(A_2 - x) + V < \mathcal{V}(A_2) - \alpha\lambda V$ . Therefore the second term is always negative due to projection bias. For (3), note that the first term is positive when  $\alpha > \gamma$  and negative otherwise.  $\square$

**Proposition 4.** (*Experienced Utility vs Decision Utility: OACLs*)

For an OACL borrower,

- (1) If the income shock is good ( $\tilde{Y}_2 > y_o$ ), she would follow her original plan of repaying and her experienced utility is the same as her decision utility.
- (2) If the income shock is bad ( $\tilde{Y}_2 < y_o$ ), she would follow her original plan of defaulting and her experienced utility is higher than her decision utility.

In sum, the expected experienced utility is always above the expected decision utility.

*Proof.* Similar to the proof for SACLs, the difference between the experienced utility and decision utility of OACLs can be written as

$$\begin{aligned} \mathcal{W}_O - \mathcal{V}_{1T} &= \delta \int_0^{y_o} (1 - \gamma)\lambda V f(z) dz \\ A_2 &= R(A_1 - c_1^*(1)) + \tilde{Y}_2 \end{aligned}$$

It is obvious that (1) and (2) hold and  $\mathcal{W}_O - \mathcal{V}_{1T} > 0$  □

Based on proposition 4, the expected experienced utility from an OACL is always going to be above the expected decision utility. Therefore, in an environment where the only type of loan available is OACLs, borrowers who take up an OACL will always benefit from doing so. However, some people who do not take up OACLs could benefit from doing so: borrowers with decision utility below their outside option but experienced utility above it would be better off taking up an OACL, but they choose not to do so.

Because of people's preferences for SACLs over OACLs (as shown in proposition 1), introducing SACLs to an environment where only OACLs are available has two effects. First, borrowers who would have taken up an OACL now switch to a SACL. Second, there is a group of new borrowers who would not have taken up an OACL but are willing to take up a SACL.

For these new borrowers, although their decision utility is certainly above their outside option, if their experienced utility is below their decision utility,<sup>46</sup> introducing SACLs makes them worse off — especially if they are close to being indifferent between a SACL and their outside option. For the existing borrowers who switch from an OACL to a SACL, their welfare change is characterized in the following proposition.

**Proposition 5.** *For a given borrower who is willing to take up both loans, her welfare upon taking up a SACL may be higher or lower than the welfare upon taking up an OACL, depending on  $\gamma$  and the distribution of income shocks.*

1. *If  $\gamma$  is relatively small, then the borrower tends to be overly willing to repay if she takes up an OACL, so a SACL improves her welfare by lowering the repayment probability.*
2. *If the income shocks are likely to be moderate, then the borrower is worse off if she takes up a SACL than if she takes up an OACL, because she would repay the SACL even though her original plan was to default in the case of a moderate income shock.*

*Proof.* To compare the welfare of these two loans, note that, again, OACLs can be treated as a special case where  $\alpha = 1$ . So we can compare the welfare by looking at the sign of the derivative of  $\mathcal{W}_S$  w.r.t  $\alpha$ .

---

<sup>46</sup>Conditions under which this holds are spelled out in proposition 3.

Taking a derivative of  $\mathcal{W}_S$  w.r.t  $\alpha$  gives

$$d\mathcal{W}_S/d\alpha = m' \cdot c_1^*{}' \tag{1}$$

$$- \delta \mathcal{V}(A_2(y_s) - x) f(y_s) \frac{dy_s}{d\alpha} \tag{2}$$

$$+ \delta \int_{y_s}^{\bar{Y}} \mathcal{V}'(A_2 - x) (-R) c_1^*{}' f(z) dz \tag{3}$$

$$+ \delta \mathcal{V}(A_2(y_s)) f(y_s) \frac{dy_s}{d\alpha} \tag{4}$$

$$+ \delta \int_0^{y_s} \mathcal{V}'(A_2) (-R) c_1^*{}' f(z) dz \tag{5}$$

$$- \delta (1 + \gamma \lambda) V f(y_s) \frac{dy_s}{d\alpha} \tag{6}$$

$$= \underbrace{\delta f(y_s) \frac{dy_s}{d\alpha} (1 - \gamma) \lambda V}_{<0} + \underbrace{\delta R c_1^*{}' \int_{y_s}^{\hat{y}_s} [\mathcal{V}'(A_2) - \mathcal{V}'(A_2 - x)] f(z) dz}_{>0} \tag{7}$$

The first term in line (7) is the sum of lines (2), (4), (6) and uses the fact that  $y_s$  satisfies  $\mathcal{V}(R(A_1 - c_1^*(\alpha)) + y_s) - \mathcal{V}(R(A_1 - c_1^*(\alpha)) + y_s - x) = (1 + \lambda)V$ . The second term in line (7) is the sum of lines (1), (3), (5) and uses two facts: (i)  $c_1^*$  satisfies the FOC of the maximization of  $\mathcal{V}_{1T}$ ; and (ii)  $\hat{y}_s$  satisfies  $\mathcal{V}(R(A_1 - c_1^*(\alpha)) + \hat{y}_s) - \mathcal{V}(R(A_1 - c_1^*(\alpha)) + \hat{y}_s - x) = (1 + \alpha \lambda)V$ .

The first term in line (7) shows that SACLs can be welfare-improving by lowering the higher-than-optimal repayment probability. The second term in line (7) captures the negative effect of SACLs on welfare: naivete about the future endowment effect leads to time inconsistency in terms of repayment choice, which reduces welfare.  $\square$

*Discussion of Special Cases* The model also nests several interesting special cases. Below we discuss welfare implications of introducing SACLs into an environment that only has OACLs in these special cases.

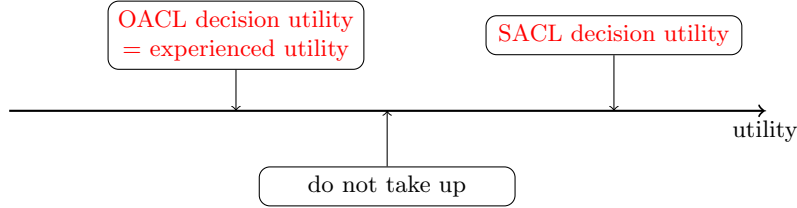
**Case 1** ( $\gamma = 1$  and exogenous default rates) The model with exogenous default rates can be reinterpreted as one that allowed only two extreme values for the borrower's income realization:  $\underline{Y}$  and  $\bar{Y}$ , with  $\underline{Y} \ll y_o$  and  $\bar{Y} \gg \hat{y}_s$ . Regardless of the loan type, borrowers default if their income shocks are bad and repay otherwise. The default probability is  $d \equiv Pr(\tilde{Y} = \underline{Y})$ . The expected decision utility from taking up a SACL can be written as

$$\begin{aligned} \mathcal{V}_{1T}(A_1) &= \max_{c_1} m(c_1) + \delta(1 - d) \left( \mathcal{V}(A_2 - x) + V \right) + \delta d \left( \mathcal{V}(A_2) - \alpha \lambda V \right) \\ A_2 &= R(A_1 - c_1) + \tilde{Y}_2 \end{aligned}$$

A similar expression holds for OACL with  $\alpha = 1$ .

Because utility from the loan item enters linearly, the optimal consumption will not depend on  $\alpha$ . Therefore, using a similar proof as in proposition 5, we can show that the experienced utility from a SACL is equal to that from an OACL when  $\gamma = 1$ . Also, according to proposition 4, the

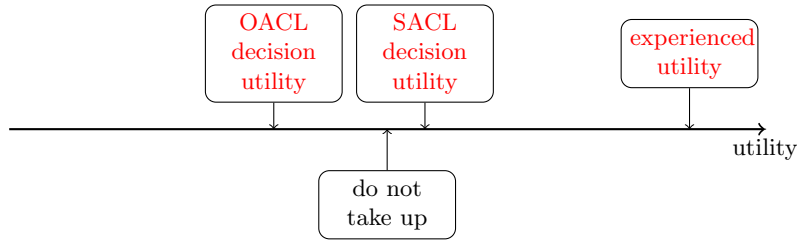
decision utility from taking up an OACL is equal to the experienced utility. Taken together, the welfare of existing borrowers will not change after they switch from an OACL to a SACL, but new borrowers are worse off because their experienced utility, which is equal to their decision utility from taking up an OACL, is worse than their outside option, as illustrated in the figure below.



Case 1: new borrowers

**Case 2** ( $\gamma < 1$  and exogenous default rates) As in Case 1, the experienced utility of SACLs is the same as that of OACLs, so the welfare of existing borrowers will remain the same. But when  $\gamma < 1$ , the experienced utility of OACLs will be higher than the OACL decision utility, leaving room for potential welfare gains for new borrowers.

Specifically, if  $\gamma < \alpha$ , the experienced utility will be higher than the decision utility of SACLs, according to proposition 3. New borrowers are better off, as illustrated in the figure below.

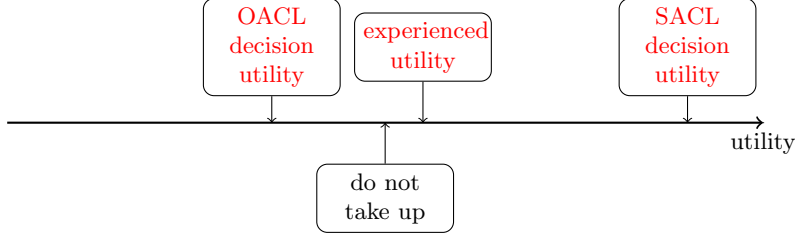


Case 2: new borrowers  $\gamma < \alpha$

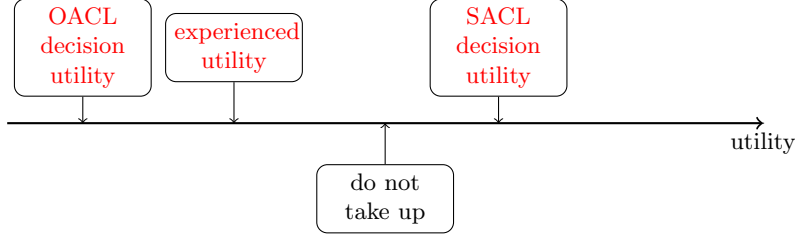
If  $\gamma > \alpha$ , the experienced utility will be lower than the decision utility of SACLs. New borrowers can be better or worse off depending on whether the experienced utility is above or below their outside option, as illustrated in the figure below.

**Case 3** ( $\gamma < 1$  and endogenous default rates) This case is the general model discussed above. We summarize the conclusions here.

If  $\gamma$  is relatively small or income shocks are extreme, SACLs tend to be welfare improving. Existing borrowers gain from switching to SACLs because the benefit of switching (lowering sub-optimally high repayment rate) outweighs the cost (time inconsistency in repayment). New borrowers are also likely to benefit from SACLs because their experienced utility tends to be higher than their decision utility. The opposite holds if  $\gamma$  is relatively large or income shocks are moderate.



(a) new borrowers are better off



(b) new borrowers are worse off

Case 2: new borrowers  $\gamma > \alpha$

#### D.4 $\gamma$ (Stickiness of Reference Points) and the Multi-Consumption-Period Model

In this section, we show that  $\gamma$  can be mapped to parameters in a multi-consumption-period model that captures how quickly actual reference points update. In the main model, we assume there is only one consumption period in which all consumption of durable assets occurs. This consumption period begins immediately after the repayment period ends.<sup>47</sup>

In the multi-consumption-period model, we allow consumption of durable assets to take multiple periods, and model a flow of per-period consumption  $v$  rather than the present-discounted value  $V$  used in the main model. The first consumption period also starts immediately after the end of the repayment period. The parameter  $\delta$  discounts the utility gained from consumption in future periods.

We assume that if an agent loses an item (either because she defaults or she sells the item), the item remains in her reference points for  $T$  periods during which she feels a sense of loss, but the agent (mis)believes that she would feel a sense of loss for  $\hat{T}$  periods. One extreme case is that the agent thinks she will feel a sense of loss for the rest of her life ( $\hat{T} = \infty$ ), which is what the main model implicitly assumes.

In the multiple-consumption-period model, it can be shown that:

- Baseline willingness to pay for items is  $WTP = \frac{1}{1-\delta}v$
- Willingness to accept is  $WTA = \frac{1}{1-\delta}v + \frac{1-\delta^{\hat{T}}}{1-\delta}\lambda^m v$ <sup>48</sup>

<sup>47</sup> For simplicity, we assume that consumption in the repayment period can be neglected.

<sup>48</sup> We add the superscript  $m$  to parameters in the multi-consumption-period model whenever needed to distinguish the parameters in the two models.

- Predicted willingness to accept is  $\widehat{WTA} = \frac{1}{1-\delta}v + \frac{1-\delta^{\widehat{T}}}{1-\delta}\lambda^m\alpha^mv$
- Demand for SACL / OACL is  $WTP_S = -\frac{\widehat{d}^m}{1-\widehat{d}^m}\left(\frac{1}{1-\delta} + \frac{1-\delta^{\widehat{T}}}{1-\delta}\lambda^m\alpha^m\right)v + \frac{1}{1-\widehat{d}^m}\frac{1}{1-\delta}v$ ,  $WTP_O = -\frac{\widehat{d}^m}{1-\widehat{d}^m}\left(\frac{1}{1-\delta} + \frac{1-\delta^{\widehat{T}}}{1-\delta}\lambda^m\alpha^m\right)v + \frac{1}{1-\widehat{d}^m}\frac{1}{1-\delta}v$
- For a borrower with a per-period valuation of  $v$  for all items, the welfare upon taking up a loan is  $W = (1-d)\left(\frac{v}{1-\delta} - x\right) + d\left(-\frac{1-\delta^T}{1-\delta}\lambda^m\alpha^m\right)v$ .

We can then establish a mapping between parameters in the two models based on the implicit assumption made in the main model that  $\widehat{T} = \infty$ . It can be shown that  $\gamma = 1 - \delta^T$ .<sup>49</sup> That is,  $\gamma$  in the main model captures how quickly the actual reference points update in a full model where consumption of durable goods spans multiple periods.

---

<sup>49</sup> The mapping of other parameters:  $\lambda = (1 - \delta^{\widehat{T}})\lambda^m = \lambda^m$ ;  $V = \frac{v}{1-\delta}$ ;  $\alpha = \alpha^m$ ,  $\widehat{d} = \widehat{d}^m$ .