

Household Borrowing High and Lending Low Under No-Arbitrage

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ABSTRACT

U.S. households often borrow high on credit cards while lending low in bank accounts. This behavior does not violate no-arbitrage, or require psychological explanations, because credit cards and demand deposits are different assets. The latter are significantly more liquid and hence have implicit value. In principle then BHLL is not a puzzle *per se* for neoclassical models. In practice BHLL might still cast some doubt on the descriptive power of traditional rationality. But simple calculations show that costly BHLL is not prevalent, particularly after one accounts for the implicit value of liquid assets. The few households who do incur substantial BHLL costs have relatively high income and education levels.

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I. Introduction

The average U.S. household with a credit card pays roughly \$100 per year in finance charges to hold bank account balances instead of using them to pay down credit card debt. Several recent papers have argued that this simultaneous borrowing high and lending low (BHLL) is a puzzle for neoclassical models of consumer choice (Bertaut and Haliassos 2002; Gross and Souleles 2002; Bogan and Hammami 2004; Haliassos and Reiter 2005).¹ The crux of these arguments is that BHLL violates no-arbitrage, a fundamental principle of traditional economic rationality: man leaves money on the table, ergo he is not *homo economicus*.

The notion that BHLL represents a foregone arbitrage opportunity is flawed because demand deposits and credit cards are different assets.² Cash is still king as a medium of exchange, while credit cards still can not be used to directly settle most household expenditures (e.g., mortgage and car loan payments; utility bills; home repairs). Credit card lines of credit can be converted to cash for settlement, but “cash advances” are too costly for routine transactions, and too rationed to rely on for contingencies. Consequently just as in corporate finance, households needing to manage their liquidity may find it too risky to rely on liability management. In contrast demand deposits can be converted to cash relatively cheaply and certainly. Decades of work on money demand has shown that this convertibility has implicit value and helps explain why households (and firms) hold liquid assets that are “rate of return dominated”.³

¹ E.g., Gross and Souleles (2002, p. 180): “Such behavior is puzzling, inconsistent with no-arbitrage, and thus inconsistent with any conventional model. Perhaps behavioral models of self-control or mental accounts might help explain it.” Laibson, Repetto, and Tobacman (2003) studies the simultaneous holding of credit card debt and *illiquid* assets. Illiquid assets may provide a binding commitment device that helps sophisticated agents with self-control problems avoid over-consumption (and over-borrowing). Liquid assets do not provide any real commitment—hence the focus on mental accounting as a behavioral explanation for BHLL with respect to liquid assets (Bertaut and Haliassos 2002; Bogan and Hammami 2004; Haliassos and Reiter 2005).

² Arbitrage, as commonly defined and applied, refers to *riskless* profit opportunities from the simultaneous purchase and selling of an *identical* asset.

³ Until recently the money demand literature focused on relatively high-yielding assets as the relevant opportunity cost margin. An exception is Tobin (1957), which studies BHLL with respect to installment

Thus BHLL is not a puzzle *per se* when viewed through the lenses of related literatures in money demand and finance.⁴ These literatures presume that agents are rational, and study which features of markets and contracts produce a unique role for liquid assets in payments. The apparent wedge between demand deposit yields and credit card borrowing costs need not be a real wedge if the relative liquidity provided by the assets is sufficiently valuable.

So if we accept that BHLL is not an foregone arbitrage opportunity, is there anything about the behavior that is worth studying? Yes, since high BHLL costs may still indicate that households value liquidity more, or perceive credit card borrowing to be cheaper, than neoclassical models would suggest. Existing evidence suggests that a substantial number of households do make portfolio mistakes that may be related to BHLL: they choose sub-optimal asset portfolios (see Campbell 2006 for a review), and underestimate credit card borrowing costs (Ausubel 1991).⁵

I explore the distribution and implications of BHLL costs using three types of simple calculations from the Survey of Consumer Finances (SCF).⁶ The first calculates an upper bound on the BHLL cost by assuming that liquid assets have no implicit value; even under this assumption, only 23-30% of U.S. households with credit cards lose more than \$10 per month by not using demand deposits to pay down credit card debt. The unadjusted BHLL costs incurred by credit card borrowers are very similar to the unadjusted opportunity costs incurred by households

debt. Telyukova and Wright (2006) provides a theoretical framework for rationalizing rate of return dominance in a world with debt.

⁴ An analogy from consumer goods make the same point. Economists rarely furrow their brows when consumers purchase milk at a convenience store rather than going down the street to obtain a lower price at the supermarket. This is because the convenience store milk clearly offers implicit value in the form of time cost savings, etc.

⁵ Some less directly related work, on installment borrowing, suggests that consumer choice deviates from neoclassical predictions (Bertrand, Karlan, Mullainathan, Shafir and Zinman 2005; Stango and Zinman 2006). Such borrowing decisions are made relatively infrequently; in contrast BHLL is a high-frequency decision that provides more opportunities for learning about and correcting costly mistakes (Lucas 1986; Agarwal, Chomsisengphet, Liu and Souleles 2005).

⁶ Other papers on BHLL have focused on the size of the *stock* of liquid assets that could be used to pay down credit card debt, rather than on the *costs* households incur by BHLL. The size of the stock is immaterial if the (real) wedge between borrowing and lending costs is small. Please see Section II-A for details.

without credit card debt who hold demand deposits instead of higher-yielding assets. The second type of calculation estimates how much a household could economize on the BHLL cost by managing its liquidity more aggressively. These results suggest that fewer than 10% of credit card holders could save more \$10 per month. A third set of calculations attempts to account more directly for the unique liquidity services provided by demand deposits. As noted above, theory suggests that households face very general motives for holding liquid assets to settle both routine and emergency transactions. Related empirical work points to other features of retail financial contracts that create incentives for BHLL-- minimum balance checking accounts (Stavins 1999), strategic default (Lehnert and Maki 2005), downpayment requirements (Faig and Shum 2002), nonlinear balance transfer pricing, and overdraft risk (Fusaro 2005; Tufano, Schneider and Beverly 2005). I adjust for such motives and incentives very roughly by constructing household-specific transaction demands and contracting incentives, and then using them to estimate real BHLL costs that take into account the implicit value of liquid assets. The results suggest that perhaps 7% to 10% of households pay more than \$10 per month by BHLL.

A remaining concern is that while few households incur substantial BHLL costs, those who do are those who can least afford it. Probit models estimating conditional correlations between BHLL costs and demographics suggest that this is not the case.⁷ There is no evidence that low-income or low-wealth households are more likely to incur substantial BHLL costs, and if anything costs are higher among *higher* income and education groups.

In all my arguments and results suggest that the implicit value of liquidity rationalizes nearly all BHLL. In this sense my paper is an informal complement to Telyukova (2006), which calibrates a stochastic partial equilibrium model with neoclassical agents and a precautionary motive for BHLL, and reaches similar conclusions. Hence both papers conclude that BHLL is

⁷ Gross and Souleles (2002) and Telyukova (2006) reach a similar conclusion based on unconditional correlations.

consistent with traditional rationality. Whether a neoclassical model or behavioral alternative does a *better* job at explaining BHLL is a question for future research.

II. BHLL Is Not Foregone Arbitrage

BHLL is not foregone arbitrage because demand deposits and credit cards are two (very) different assets. I start by defining BHLL precisely, and then present some descriptive evidence on payment acceptance and credit card pricing. The evidence suggests that credit cards are a relatively illiquid, costly, and risky payment device.

A. Basic BHLL Definitions

The basic notion behind the BHLL puzzle is that households should use relatively low-yielding liquid assets to pay down relatively expensive credit card debt. This implies a BHLL “wedge” that is defined by taking a snapshot of a household balance sheet and measuring something like:

$$[1] \text{ Unadjusted Wedge} = \min[\text{Credit Card Debt}, \text{Demand Deposit Balances}]^8$$

Where I label the wedge in [1] as “Unadjusted” to highlight the fact that it does not account for implicit returns to holding assets (see Section III-C). Then the unadjusted cost of BHLL can be calculated with reference to the unadjusted wedge between asset returns and borrowing costs:

$$[2] \text{ Unadjusted Cost}_i = \max[0, \text{Unadjusted Wedge} * (r_i^c - r_i^a)]$$

Here r_i^c is the nominal interest rate paid on household i 's primary credit card.⁹ I calculate [1] and [2] in the Survey of Consumer Finances (SCF) because it is the only dataset that has information on both liquid asset holdings and household-specific credit card interest rates. The SCF lacks data on household-specific asset yields, so I use national averages to calculate the post-tax return

⁸ I include checking and savings deposits in *demand deposits*: this is “money” in Mulligan and Sala-i-Martin (2000). Adding money market and call accounts does not have a material impact on the results. The SCF does not measure currency holdings, which are a very small and declining fraction of aggregate household consumption expenditure. See, e.g., Figure 7 in Alvarez, Atkeson, and Edmond (2003).

⁹ Tax deductions for credit card interest were eliminated with the Tax Reform Act of 1986. And most credit card rates were adjustable in my sample period, so I assume that any inflation does not change the wedge between borrowing costs and asset yields. Strategic default and nonlinear pricing can impact real credit card rates with respect to BHLL (please see Section III-D for related discussion).

r_t^a .¹⁰ This was essentially zero in 2004. Recent SCFs do not have a panel component, so we observe a single snapshot of each surveyed household's balance sheet.

Defining BHLL costs this way makes sense for four related reasons. First, explicit returns to holding demand deposits can be calculated relatively precisely using the available, aggregate, data. These returns have been quite homogeneous in recent years. In contrast, returns across and within other classes of financial assets may be more heterogeneous. Second, financial assets other than demand deposits are less liquid, and hence estimating [2] on a broader set of assets would require *ad-hoc* adjustments for transaction costs and timing considerations.¹¹ Third, credit card debt is the most expensive among the prevalent sources of consumer credit; e.g., a median interest rate of 11.5% and \$768 billion in outstanding revolving balances in 2004.¹² Fourth, credit cards are the marginal source of credit for most U.S. households; e.g., 71% of households owned a general purpose credit card in 2004, while only 12% had a home equity line of credit.

Whether the SCF adequately captures *Credit Card Debt* is uncertain. On the one hand, aggregating up SCF balances produces only 1/3 of the credit card debt reported by lenders. On the other hand, lender data includes float (Johnson 2006), other revolving debt (Furletti and Ody 2006), and debt held by small businesses, making direct comparisons to the SCF difficult

¹⁰ The SCF reports the total amount held by the household in different classes of assets (e.g., certificates of deposit, stocks, bonds, whole life, etc.) I take the nominal yield from the July M2 own rate series at <http://research.stlouisfed.org/fred2/series/M2OWN/downloaddata>, and adjust for the state+federal average marginal tax rates on interest income from the National Bureau of Economic Research's TAXSIM at <http://www.nber.org/~taxsim/marginal-tax-rates/plusstate.html>.

¹¹ Home equity is another potential source of liquidity for paying down credit card debt that I do not count in (1). It is true that interest rates on loans secured by a second mortgage are typically lower than those on credit card. For example, the median difference is 400 basis points among the 163 households in the 2004 SCF with a credit card balance and a home equity line balance (the SCF captures home equity line interest rates only for those who are currently borrowing). However this nominal cost advantage overstates the opportunity for real savings due to: 1) a larger option value of default in the case of credit card debt, which is typically unsecured; 2) larger upfront costs of borrowing against home equity, both in pecuniary and non-pecuniary terms (Hurst and Stafford 2004).

¹² Interest rate is the weighted median reported by credit card holders in the 2004 SCF. Aggregate outstandings is from the July 2004 Federal Reserve Board of Governors Statistical Release G19 at http://www.federalreserve.gov/releases/g19/hist/cc_hist_r.txt.

(Antoniewicz 2000). Consequently I calculate measures of the wedge both with and without corrections for underreporting.¹³

The BHLL literature thus far has focused largely on some variant of [1], the unadjusted wedge.¹⁴ But the economic object of interest is more closely related to [2], the cost. The size of the BHLL wedge is immaterial if the (real) wedge between borrowing and lending costs is small. Consequently I focus on BHLL *costs* in presenting and interpreting the results below.

B. Analysis Sample

I limit the sample to those possessing a general purpose credit card. This eliminates 29% of 2004 households in weighted terms. Including these households would reduce BHLL prevalence mechanically, but not necessarily reflect portfolio choices accurately, since balance sheet items that are not measured by the SCF may be relatively important for these households.¹⁵

C. Demand Deposits and Credit Cards Are Different Assets

A household with $Unadjusted\ Cost_i > 0$ is *not* forgoing arbitrage because credit cards are a very imperfect substitute for demand deposits as a payment device.

Only 24% of consumer expenditure was paid for by credit card in the early 2000s.¹⁶ This proportion is rising slowly, in large part because credit cards still can not be used for most major, recurring expenditures; e.g., housing, utilities, car loans.¹⁷ This friction implies that demand deposits have implicit value that are not reflected in their pecuniary yield r_t^a , and that virtually all

¹³ I ignore store cards, which have steadily diminished in importance in recent years, and count only revolving debt on general purpose (bank-type) cards. Also the interest rate and credit limit in the SCF typically apply to general purpose rather than store cards.

¹⁴ See, e.g., the key results in Gross and Souleles (Table VI), Bertaut and Haliassos (Table 4), and Lehnert and Maki (Table 5).

¹⁵ E.g., on the asset side: cash; on the liabilities side: payday, pawnshop, and auto title loans. Counting assets that are measured in the SCF suggests that while the median household without a general purpose card holds few liquid assets, there is a sizeable right tail with assets sufficient to produce a large BHLL *Unadjusted Wedge*.

¹⁶ The *Statistical Abstract of the United States 2004-05*, at <http://www.census.gov/prod/2004pubs/04statab/banking.pdf>, Table No. 1182.

¹⁷ See the ABA/Dove Consulting 2003/04 *Study of Consumer Payment Preferences*.

households need to hold some demand deposits for *routine* transaction purposes at any point in time.

Card holders can draw directly on their credit limit with “cash advances”, but these are typically too expensive for routine transactions and too restricted for emergency transactions. Circa 2001, for example, all of the top credit card issuers¹⁸ charged minimum fees ranging from 2.5%-4% of the advance amount. Only 3 of these issuers had maximum transaction fees, and these were large (\$30, \$35, and \$50).¹⁹ Cash advance interest rates (not including fees) also were substantially higher than those for purchases, ranging as high as 26.49%.²⁰ Moreover advances may be limited to a fixed amount or a fraction of available credit.²¹ Consequently just as in corporate finance, households needing to manage their liquidity may find it too risky to rely on borrowing for contingencies.²² Thus the limited acceptance of credit cards and the limited convertibility of credit limits to cash for settlement may produce precautionary motives for BHLL (see also Telyukova 2006).

III. Calculating Distributions of BHLL Costs

Section II-C highlights that demand deposits are a substantially more liquid than credit cards: thus by definition BHLL does not represent foregone arbitrage. In principle then BHLL is not a puzzle *per se* for neoclassical models. In practice BHLL might still cast some doubt on the descriptive power of traditional rationality. As noted above, substantial and prevalent BHLL costs would be symptomatic of systematic mistakes (Ausubel 1991; Agarwal, Chomsisengphet,

¹⁸ I include the 13 top issuers wedged on the *Nilson Report* Issue 756 (January 2002) in order to obtain a perfect union of size classification based on both accounts and volume.

¹⁹ Cash advance fees data are from the 2000-01 and 2001-02 Consumer @ction Credit Card Surveys at http://www.consumer-action.org:16080/English/library/credit_cards/index.php

²⁰ See the 2000-01 Consumer @ction survey linked above, and the Board of Governors of the Federal Reserve System website on “Choosing a Credit Card” at <http://www.federalreserve.gov/pubs/shop/default.htm>

²¹ The Board of Governors site referenced in footnote 20 states: “Some credit cards limit cash advances to a dollar amount (for example, \$200 per cash advance or \$500 per week) or a portion of your credit limit (for example, 75% of your available credit limit).”

²² Sullivan (2004) finds that the unemployed replace 10% of earnings using unsecured debt during a temporary shock.

Liu and Souleles 2005; Campbell 2006), or more sophisticated behavioral deviations (e.g., mental accounting).

I explore the distribution of BHLL costs, and related implications, using three types of simple, descriptive calculations. The first gives an upper bound by calculating the BHLL cost without adjusting for any implicit value of liquidity. The second estimates how much a household could save by managing its unadjusted wedge more aggressively. The third recalculates BHLL costs after adjusting roughly for household-specific transaction demands (routine and precautionary) for liquid assets. I conclude by discussing some additional, specific features of retail financial contracts that provide incentives for BHLL.

A. An Upper Bound on BHLL Costs

The unadjusted cost in equation [2] does not account for the implicit value of demand deposit liquidity, and hence places an upper bound on any real BHLL cost. This is useful analytically: if sizeable unadjusted BHLL costs are rare, then real costs must be rare as well. Table 1 reports distributions of monthly unadjusted costs among 2004 SCF credit card holders.²³ Column 1 reports results that are not inflated for any presumed underreporting of credit card debt. The mean cost is only \$9.46, and the median is \$0. But the 90th percentile is quite substantial at \$26.92, and 23% of households pay more than \$10 per month in unadjusted BHLL costs. Column 2 reports the cost distribution obtained when the wedge is calculated after multiplying credit card debt by three to correct for presumed underreporting. Costs increase, but less than proportionately.

For comparison, Columns 3 and 4 split credit card holders into borrowers and non-borrowers and present estimates of the unadjusted opportunity cost of holding liquid assets. For those with credit card debt (Column 3) this is the BHLL cost. For those without credit card debt

²³ Monthly unadjusted BHLL costs are stable across the 1995, 1998, 2001, and 2004 SCFs; e.g., the median ranges from zero to 71 cents, and the 90th percentile ranges from \$24.68 to \$28.27.

the opportunity cost is determined by *assets* with higher pecuniary yields (as discussed above, this is the standard formulation in the money demand literature). The cost distributions are remarkably similar.²⁴

In sum, Table 1's estimates of the upper bound do not rule out the possibility that many households incur economically significant costs by not using demand deposits to pay down credit card debt. But it is worth noting that these costs are very similar to those incurred by a behavior that economists have been less inclined to deem a puzzle for neoclassical models of consumer choice: the holding of demand deposits rather than higher-yielding assets.

B. Why Not "Pay Down and Charge Up"?

One indirect way to explore the real cost of BHLL is to examine that savings produced by a strategy that manages liquidity more aggressively and thereby reduces the unadjusted wedge. One such approach is a "pay down and charge up strategy" that makes higher-frequency credit card payments than the one required monthly payment. Given the credit card's imperfect acceptance as a payment device and some desire to smooth consumption by borrowing, minimizing liquid asset holdings and credit card debt (or, equivalently, maximizing yields) would require relatively high-frequency movements of funds from deposit accounts to the credit card issuer. Such transactions are not costless-- if nothing else they take time.²⁵ This type of tradeoff between maximizing portfolio yields and minimizing transaction costs has long been recognized in the "inventory management" or "transactions" strand of the money demand literature pioneered by Baumol (1952) and Tobin (1956).²⁶

²⁴ I calculate a risk-free yield of 2% using the 2004 nominal return on fixed 3-year Treasury securities from the Federal Reserve's H15, and adjusting for taxes as described in footnote 10. Then the opportunity cost = $Money * ((.02 - .005)) / 12$, where .005 was the average post-tax pecuniary yield on demand deposit accounts in 2004.

²⁵ Setting up automatic debits could reduce the marginal time cost, but involves an initial setup cost and increases risk by committing liquidity that might be valuable in bad states.

²⁶ Several empirical studies have found support for Baumol-Tobin type models; see, e.g., Daniels and Murphy (1994), Mulligan and Sala-i-Martin (2000), and Attanasio, Guiso, and Jappelli (2002).

Simple calculations suggest that higher-frequency credit card payments may not be optimal even for those with nontrivial unadjusted BHLL. Under reasonable assumptions paying twice a month instead of the required once will eliminate only a fraction of the unadjusted BHLL cost (Table 2). This is because the savings on interest expense from paying down the credit card bill midway through the cycle, and then charging expenditure back to the card over the remainder of the month, is limited by: a) the small fraction of expenditure that can actually be charged to the card; b) the interest expense incurred on charges during any cycle in which the initial balance is greater than zero. Thus the savings from making an additional credit card payment are small throughout most its distribution; e.g., the 75th percentile is only around \$5.00 per month, and fewer than 10% of the sample would save more than \$10 per month. Of course the real savings is actually smaller, since this calculation does not account for the other (e.g., precautionary) motives or contract incentives for BHLL that are detailed below. Most households have little ability to reduce their BHLL costs substantially through more frequent credit card payments.

C. Adjustments for Routine and Precautionary Demands for Liquidity

i. Routine Transaction Demand

As discussed above, the imperfect acceptance of credit cards as a payment device requires most households to hold demand deposits for routine transactions. I create direct, household-specific adjustments for this demand using two alternative proxies. The first subtracts one month's income from the unadjusted wedge, following Gross and Souleles (2002). The second subtracts recurring expenditures that are observable in the SCF (primarily rent, mortgage, and other loan payments) from the unadjusted wedge.²⁷ After calculating an adjusted wedge I then recalculate the BHLL cost.

²⁷ I actually subtract only $\frac{1}{2}$ of recurring expenses, given the snapshot nature of the SCF. For this and all other adjustments I set lower bounds on both the adjustment and the wedge at zero.

Table 3 shows that either of these adjustments substantially reduces the estimated monthly BHLL cost from its unadjusted upper bound in Table 1. Columns 1 and 2 of Table 3 report the distribution of cost estimates when the wedge is not inflated for any presumed underreporting of credit card debt. The mean cost is only \$3.75 after the income adjustment, and \$8.21 after the recurring expense adjustment. The 75th percentiles are \$0 and \$6.25. 8% and 19% of households pay more than \$10 in adjusted BHLL costs. Columns 5 and 6 report the results obtained when the wedge is inflated to correct for presumed underreporting. As in the unadjusted case (Table 1), the cost estimates increase, but much less than proportionately.

ii. Precautionary Transaction Demand

I adjust directly for household-specific precautionary demands using responses to the SCF question: “About how much do you think you (and your family) need to have in savings for emergencies and other unexpected things that may come up?” (Kennickell and Lusardi 2004).²⁸ I presume that the household gives the optimal precautionary amount given its preferences, constraints, and existing portfolio position. This implies, for example, that the household takes into account any available credit that could be used to smooth consumption. I then subtract the precautionary amount from the BHLL unadjusted wedge and recalculate the BHLL cost.²⁹

The precautionary adjustment alone reduces estimated BHLL costs substantially (Table 3, Columns 3 and 6). Making the adjustment to the uninflated (inflated) wedge leaves a mean cost

²⁸ The money demand literature derives precautionary money holdings from *high* frequency uncertainty regarding the timing and amount of receipts and expenditures. Households face *lower* frequency uncertainty on these margins as well; e.g., in the form of shocks to wage or asset income, health, and fixed assets (such as home and vehicle repairs). As has been widely studied, uncertainty combined with credit and/or insurance constraints can produce precautionary saving. An optimizing household that is borrowing to smooth life-cycle consumption may hold precautionary assets, if the expected cost of borrowing in a bad state is prohibitively expensive (see Section II, and Telyukova 2006).

²⁹ Since the BHLL wedge excludes financial assets other than demand deposits, my adjustment implicitly excludes these as sources of precautionary liquidity. This will not affect estimates of precautionary-adjusted BHLL provided that there is a pecking order of precautionary assets, where agents tap more liquid assets first.

of only \$3.37 (\$6.19) per month. Under these definitions 9% (12%) of households pay more than \$10 per month by BHLL.

iii. Cumulative Adjustments

Combining routine and precautionary adjustments reduces BHLL costs a bit further. Columns 4 and 8 show that if one adjusts the wedge for both recurring expenses and the precautionary amount, the mean cost is only \$2.96 (\$5.59 if corrected for presumed underreporting). The 90th percentile is \$6.04 (\$10.25), and only 7% (10%) of households pay more than \$10 per month in adjusted BHLL costs.

D. Other Incentives for BHLL Stemming From Financial Contracts

Several features of common contracts offered by financial institutions provide additional, specific incentives for BHLL by increasing the implicit value of demand deposits or decreasing the real cost of credit card borrowing. Data limitations make it difficult to make related adjustments for most of these features to my estimates of BHLL costs. So below I focus on highlighting the features while noting that, taken together, they imply that the adjusted BHLL costs in Table 3 may be too high.

Checking account overdraft penalties may provide an incentive for holding a buffer stock of demand deposits (Bar-Ilan 1990). Penalties tend to be substantial: a single overdraft fee averages about \$21 (Fusaro 2005), and overdrafts also may entail long-run costs by impinging on the household's ability to maintain or obtain a checking account (Tufano, Schneider and Beverly 2005).

Minimum balance checking accounts also raise the implicit value of demand deposits, by discounting the marginal cost of transactions. Stavins (1999) estimates that the average benefit to holding a minimum balance account is \$13.53 (in 2001 dollars) per month, and that the average minimum balance required to obtain this benefit is \$976. At these levels an optimizing revolver

with \$976 at her disposal should keep a minimum balance, rather than pay down credit card debt, if the card's interest rate is less than 16.6%. 36% of households with nonzero BHLL costs in my main sample met these criteria in 2001. If we assume that these households do in fact hold minimum balance accounts, then adjusting BHLL for just the average minimum balance of \$976 eliminates a nontrivial chunk of the unadjusted cost by itself, even without allowing for the other motives detailed above (results not reported). For example, the mean BHLL cost falls about 10% from the unadjusted measure.

Introductory pricing on credit card balance transfers, wherein transaction fees are waived on initial transfers only, may also provide incentives for BHLL. These fees can be substantial (akin to those on cash advances), and introductory interest rates can be quite low. Consequently it may be optimal for a borrower to accumulate balances, rather than pay them down with available liquid assets, in expectation of a deeply discounted balance transfer. Approximately 20% of cardholders transferred a balance in 2001 (Durkin 2002).

Downpayment constraints may also motivate BHLL. To take the most important example, financial institutions typically require a downpayment for obtaining a home purchase mortgage, and reward borrowers with lower financing costs for putting 20% down.³⁰ 10% of households in the 2004 SCF report saving for a home purchase at the time of the survey.

Strategic default also makes BHLL attractive, as explored by Lehnert and Maki (2005). Credit card borrowers who are not currently paying interest on their cards (i.e., who are delinquent) and are planning to default will be BHLL rationally, since their effective marginal credit card interest rate is zero.³¹ I adjust roughly for this motive by setting the interest rate wedge ($r_i^c - r_i^a$) in [2] to zero for the 3.8% of credit card borrowers in my main sample who report being behind schedule paying back any loan. The SCF does not specifically ask about late credit card payments, however, implying that there are both Type I and Type II errors in this

³⁰ Housing downpayments are one of the “personal illiquid projects” considered by Faig and Shum (2002).

³¹ Many delinquent borrowers do end up defaulting: the average credit risk on a credit card balance is 400 basis points (Davis, Kubler and Willen 2005; Kahn and Roberds 2005).

adjustment. Nevertheless the mean delinquency rate in the 2001 SCF is very close to credit card-specific rates calculated from roughly contemporaneous credit bureau files (Durkin 2000; Avery, Bostic, Calem and Canner 2003), so my estimate gives some sense of strategic default's impact on BHLL. The effect is almost certainly small; e.g., adjusting the upper bound cost in Table 1, Column 1 for strategic default reduces the mean by 3%, and the 90th percentile by 4%.

IV. Who Borrows High and Lends Low?

A remaining concern is that while few households incur substantial BHLL costs, those who do are those who can least afford it. Probit results presented in Table 4 suggest that this is not the case. Each model estimates multivariate correlations between a measure of whether the household incurs a substantial BHLL cost, and several demographic variables. The model in the first column defines substantial BHLL cost as greater than \$10 per month, unadjusted. The model in the second column defines substantial BHLL cost as greater than \$10 per month, after applying the underreporting correction and the cumulative adjustments.

Neither specification suggests that vulnerable households are most likely to incur substantial BHLL costs. To the contrary there is some evidence that, conditional on other demographics, costly BHLL is highest among higher education groups (Column 1) and higher income groups (Columns 1 and 2). Nor is costly BHLL most prevalent among the lowest wealth quintile.

V. Concluding Remarks

Borrowing high and lending low (BHLL) is an important economic phenomenon among U.S. households. Credit card holders pay upwards of \$100 per year on average, and about \$1 billion in aggregate, to hold low-yielding liquid assets rather than using them to pay down relatively expensive credit card debt. But BHLL is not foregone arbitrage and therefore not a puzzle *per se* for neoclassical models of consumer choice. The rationale for BHLL is easy to see when viewed

through the lenses of rich literatures on money demand and finance: liquid assets have implicit value. Thus the apparent wedge between borrowing costs and lending yields need not be a real wedge. The implicit value of liquid assets stems from frictions in payment and credit markets: the highly imperfect acceptance of credit cards as a payment device, the costly and risky convertability of available credit to cash, and several specific features of retail financial contracts.

Several calculations suggest that the implicit value of liquidity can rationalize nearly all of the BHLL on household balance sheets. Upper bounds on BHLL costs suggest that at most 23-30% of U.S. households with credit cards lose more than \$10 per month by not using demand deposits to pay down credit card debt. These costs are quite similar to those paid by households who are not borrowing on credit cards but hold demand deposits instead of higher-yielding liquid assets. Related calculations show that fewer than 10% of credit card holders could save as much as \$10 per month by managing their liquidity more aggressively. Another set of calculations adjusts directly for rough estimates of household-specific transaction demands (routine and precautionary) that could produce BHLL. These results suggest that perhaps 7% to 10% of households pay more than \$10 per month by BHLL. Data limitations preclude additional adjustments for many prevalent contracts that provide specific incentives for BHLL and presumably imply even lower real costs. There is no evidence that the few households who do incur substantial BHLL costs are especially vulnerable; if anything, costly BHLL is more prevalent among *higher* education and *higher* income households.

The approach and results in this paper suggest three important directions for further research on BHLL. First is the study of other potential BHLL combinations on household balance sheets. I have defined BHLL narrowly, based on credit card debt and demand deposits, for reasons related to economics and to measurement. Broader definitions could turn up more substantial and disconcerting costs. It is important to keep in mind, however, that the amount of liquid assets may bound the degree to which households could economize on other types of debt.

The ability to liquidate other assets (e.g., CDs, stocks, bonds, home equity) in order to reduce borrowing costs may be constrained by illiquidity and transaction costs.

A second and related direction for future research is the study of BHLL among those without credit cards. The balance sheets of these households may be relatively incomplete in existing data sources, due to the relative importance of cash and of expensive sources of credit that are not queried specifically in the SCF. New data may be needed to determine whether these relatively poor and credit constrained households engage in costly BHLL and/or related worrisome financial behaviors.

A third direction for future research is to test competing neoclassical and behavioral models of BHLL. This paper and Telyukova (2006) use very different methods to show that nearly all BHLL is *consistent* with traditional rationality. The next step is to develop convincing tests of whether a neoclassical model or behavioral alternative does a *better* job of explaining BHLL.

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Table 1. Upper Bound (Unadjusted) Monthly Costs of Borrowing High and Lending Low

<i>Unadjusted Wedge</i> =	$\min[\text{money, credit card debt}]$	$\min[\text{money, credit card debt} \times 3]$	$\min[\text{money, credit card debt} \times 3]$	money
Sample	Credit card holders	Credit card holders	Credit card borrowers	Non-borrowers
Number of households	3,476	3,476	1,461	2,015
	(1)	(2)	(3)	(4)
Mean	9.46	15.38	27.38	30.87
Median	0	0	11.14	9.00
75 th percentile	8.61	13.97	30.42	26.38
90 th percentile	26.92	40.50	68.15	68.75
Proportion cost > \$0	0.49	0.49	0.86	0.95
Proportion cost > \$10	0.23	0.30	0.53	0.48
Proport. cost/inc > .01	0.06	0.10	0.17	0.12
Median <i>Wedge</i> if <i>Wedge</i> > 0	1,100	1,800	1,800	15,600
<i>Wedge</i> = assets	0.52	0.64	0.64	1.00
<i>Wedge</i> = card debt(*3)	0.49	0.37	0.37	0.00

All results are weighted to reflect the U.S. population. “Money” in the *Unadjusted Wedge* refers to demand deposits (i.e., checking and savings account balances). Columns (1)-(3) present the distribution of the monthly BHLL *Unadjusted Cost* (equation [2]), in 2004 dollars, incurred by not using money to pay down credit card debt. Columns (2) and (3) calculate the *Wedge* after inflating credit card debt by 3 to correct for presumed underreporting. Column (4) shows the cost incurred by those credit card holders who do not have credit card debt and hold money instead of higher-yielding, safe assets (see footnote 24 for details on the calculation). The last two rows show the relative importance of liquid assets and credit card debt in determining the two different measures of the *Wedge*. In Columns 1-3 these proportions are calculated on the sub-sample of households with BHLL *Unadjusted Cost* > \$10 per month. For example, in Column (1), 0.52 = the proportion of these households for which (money < credit card debt). Hence money determines the *Wedge* for these households. Summing down the proportions in the last two rows slightly exceeds one when there are households where (money = credit card debt.)

Table 2. Estimated Cost Savings From An Extra Credit Card Payment Per Month

<i>Unadjusted Wedge</i> =	$\min[\text{money, credit card debt}]$	$\min[\text{money, credit card debt} \times 3]$
	(1)	(2)
Mean	3.28	3.52
Median	2.34	2.56
75 th percentile	4.68	4.97
90 th percentile	7.39	7.82

Each column describes an estimated distribution of monthly interest savings from making one extra credit card payment per month, in 2004 dollars, for the 1,461 households with credit card debt. The savings is estimated by:

$\min(BHLL \text{ Unadjusted Cost}_i, S_i)$, where:

$$S_i = Y_i * E * (r_i^c / 4),$$

Y is monthly income, E is the proportion of expenditure on credit cards, and r_i^c is the monthly credit card interest rate.

E is assumed to be 0.33, adjusting the national average (0.24) for the fact that only 73% of the population (and everyone in my sample) has a credit card. S will accurately depict the savings if the household has reached its steady-state borrowing level on credit cards, sets expenditure equal to income, gets paid once or twice a month, and therefore minimizes credit card finance charges (subject to the constraint of making only one additional payment a month) by paying card down card balances to the maximum extent possible ($Y * E$) at the middle of the credit card billing month, and then charging that amount back to the credit card over the course of the rest of the month. r_i^c is deflated by a factor of 4 because credit card “revolvers” must “borrow-to-charge”; see Zinman (2006) for more details. Hence the extra payment saves only *one* week’s worth of interest (rather than two weeks’), assuming that additional charges are spread evenly over the two weeks.

Table 3. Estimated Monthly BHLL Costs, Adjusted for Implicit Value of Liquid Assets

<i>Unadjusted Wedge=</i>	<i>min[money, credit card debt]</i>				<i>min[money, credit card debt*3]</i>			
Adjustment(s):	Income	Recurring Expenses	Precautionary	Cumulative	Income	Recurring Expenses	Precautionary	Cumulative
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mean	3.75	8.21	3.37	2.96	6.70	13.62	6.19	5.59
Median	0	0	0	0	0	0	0	0
75 th	0	6.25	0	0	0	10.20	0	0
90 th	7.29	23.13	7.91	6.04	28.83	36.13	13.90	10.25
Cost > \$0	0.18	0.41	0.19	0.17	0.18	0.41	0.19	0.17
Cost > \$10	0.08	0.19	0.09	0.07	0.11	0.25	0.12	0.10
Cost/income > .01	0.02	0.05	0.02	0.02	0.04	0.09	0.03	0.03

All results are weighted and for the 2004 sample of SCF 3,476 households with a credit card. Each column presents the distribution of the estimated monthly BHLL costs, in 2004 dollars, after adjusting for routine and/or precautionary demands for liquidity. The income adjustment (columns 1 and 5) subtracts one month's income from the unadjusted wedge and recalculates the BHLL cost (bounded below at zero). The recurring expenses adjustment subtracts one-half of the monthly expenses observable in the SCF from the unadjusted wedge. The precautionary adjustment subtracts the household's target amount of savings for unexpected events from the unadjusted wedge. The cumulative columns (4 and 8) adjust for both routine demand (using the recurring expenses measure) and precautionary demand.

Table 4. Who Borrows High and Lends Low?

<i>Dependent variable:</i>	<i>Unadjusted</i> <i>> \$10</i>	<i>Cumulative</i> <i>> \$10</i>
	(1)	(2)
high school	0.101 (0.069)	0.056 (0.054)
some college	0.122* (0.073)	0.090 (0.063)
college+	0.100* (0.061)	0.035 (0.042)
age	0.016*** (0.004)	-0.002 (0.002)
age^2	-0.000*** (0.000)	0.000 (0.000)
male head	-0.051* (0.030)	-0.032 (0.022)
white	-0.008 (0.023)	0.014 (0.014)
married	0.005 (0.027)	0.005 (0.018)
# hh members	0.094*** (0.031)	0.045** (0.020)
hh members^2	-0.013*** (0.005)	-0.007** (0.003)
owns home	-0.033 (0.026)	-0.031* (0.019)
net worth quintile 2	0.009 (0.031)	0.049* (0.026)
net worth quintile 3	-0.015 (0.035)	0.079*** (0.030)
net worth quintile 4	-0.124*** (0.033)	0.026 (0.030)
net worth quintile 5	-0.177*** (0.024)	-0.055*** (0.019)
income quintile 2	0.104*** (0.037)	0.012 (0.024)
income quintile 3	0.180*** (0.040)	0.103*** (0.030)
income quintile 4	0.199*** (0.047)	0.140*** (0.038)
income quintile 5	0.184** (0.087)	0.070 (0.059)
mean LHS	0.23	0.10
pseudo R-squared	0.06	0.07
N	3476	3476

* p<0.10, ** p<0.05, *** p<0.01.

Each column presents marginal effects from a single weighted probit of the dependent variable listed in the column heading on the right-hand-side variables listed in the row headings. Each dependent variable = 1 if the household exceeds the stated threshold for incurring substantial BHLL costs. Sample contains the 3,476 households with a credit card in the 2004 SCF.