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Housing Collateral and Household Indebtedness: Is there a Household Financial Accelerator?

by

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Abstract

We examine the 'financial accelerator' model of household behaviour, whereby shocks to household balance sheets increase the amplitude of fluctuations in consumer spending by tightening or unbinding collateral constraints. We construct an alternative model where households have access to both secured and unsecured debt, and examine the consequences of shocks to household balance sheets (primarily, the value of housing wealth) in this augmented setting. We demonstrate that our alternative model considerably reduces the amplitude of fluctuations in debt-financed consumer spending arising from fluctuations in household asset values. The paper tests the applicability of the two models using household panel data for the United Kingdom.

Key words: Financial accelerator; unsecured debt; consumer spending

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1. Introduction

This paper appraises the 'financial accelerator' model of household behaviour, whereby shocks to household balance sheets increase the amplitude of fluctuations in consumer spending by tightening or unbinding collateral constraints on debt-financed spending. It constructs an alternative model in which households have access to both secured and unsecured debt finance, and examines the consequences of shocks to household balance sheets (primarily, to the value of net housing wealth) in this augmented setting. It shows that the alternative model considerably reduces the potential amplitude of fluctuations in debt-financed consumer spending arising from fluctuations in household asset values. The paper tests the applicability of the two models using household panel data for the United Kingdom.

The outline of the paper is as follows. Section 2 describes the literature that relates the financial accelerator model to household behaviour, examines the role of unsecured debt and outlines the paper's broad hypotheses. Section 3 constructs a simple model of household behaviour that incorporates unsecured debt into the standard financial accelerator model. It illustrates diagrammatically the consequences of shocks to household balance sheets in the financial accelerator model and in the model augmented by unsecured debt. Section 4 briefly describes the United Kingdom household panel data set used in our empirical estimation. Section 5 tests several hypotheses implied by the two models using the data set. Section 6 provides a brief conclusion.

2. The financial accelerator hypothesis; role of secured and unsecured debt

In its most general formulation, the financial accelerator model, as developed by Bernanke *et al* (1999), focuses on how imperfect information in credit markets affects the quantity and cost of external finance to economic agents (primarily firms but potentially households). Lamont & Stein (1999), for example, describe the accelerator as the 'amplifying' effect whereby changes in asset prices caused by changes in fundamentals increase the volatility of prices via their impact on asset values. In their model, the ability to borrow to finance asset purchases is linked to asset values ('net worth', or collateral). Shocks to asset values thereby allow agents to relax their borrowing constraints. This link between access to finance and collateral in turn shifts asset demand ratios.

2.1. *The household financial accelerator: description and measurement*

In the context of consumer spending, the financial accelerator model argues that shocks to the value of household collateral (generally, for households, measured by the value of housing equity, or the household-specific value-to-loan ratio) feed into debt-financed consumption. It suggests that housing wealth affects consumption not through household wealth effects as such (which may cancel out in the aggregate – see Case, 2000; Carroll, 2004) but because credit-constrained households use collateral to relax borrowing constraints. The basic version of the model as it applies to households is clearly spelt out by Aoki *et al* (2004):

> "Houses represent collateral for homeowners, and borrowing on a secured basis against ample housing collateral is generally cheaper than borrowing against little collateral or an unsecured basis (via a personal loan or credit card). So an increase in house prices makes more collateral available to homeowners, which may in turn encourage them to borrow more, in the form of mortgage equity withdrawal, to finance desired levels of consumption and housing investment. The increase in house prices may be caused by a variety of shocks, including an unanticipated reduction in real interest rates, which will lower the rate at which future housing services are discounted." (p.415)

Iacoviello (2005) emphasises the importance to this mechanism of the fact that household debt (outstanding mortgage balances) is held in nominal terms. Inflation is an important stimulus to consumption, since it reduces the real value of nominal debt obligations so long as the marginal propensity to consume of borrowers exceeds that of lenders (as is likely to be the case in this example of housing wealth). As he points out, in a general equilibrium setting, there may be both 'accelerator' and 'decelerator' effects depending on whether these price effects arises from demand or supply shocks and depending on the redistributive effects of these wealth revaluations.

Existing empirical studies of the household 'financial accelerator' mostly utilise relatively aggregated time series data and/or simulation methods (Iacoviello, 2005; Aoki, Proudman and Vlieghe, 2004), cross-region (Lamont and Stein, 1999) or cross-country methods (Alemeida, Campello and Liu, 2005) to examine the validity of the household financial accelerator hypothesis. There are a number of problems including appropriate aggregation (over constrained and unconstrained households), valid instruments (since observed loan-to-value ratios are endogenous to changes in asset demands), and the covariance of demand shocks and asset price changes. These studies nevertheless suggest strong co-movements in asset values and measures of net debt acquisition and consumption spending.

One problem arising in the interpretation and use of macroeconomic data on changes in collateral-based consumer spending is noted by Davey (2001). The change in collateral financed-spending by households is generally proxied by a measure of net withdrawal of housing equity (HEW). However, if gross saving rates are less volatile than consumer borrowing, given the way that investment in housing is defined in the national accounts, there will be a strong link between changes in real consumption, real income and net HEW simply from the underlying accounting relationship. In effect, there must be a positive correlation between the various aggregate series, even if the degree of co-movement varies over time. Moreover there will also be a strong link with house-moving rates, which also tend to be pro-cyclical and which are strongly related with HEW episodes, noting also that moving costs are a component of measured investment in housing.

It is slightly surprising that existing studies have not attempted to measure time variation in the proportion of collateral-constrained households directly (akin to the literature on the role of liquidity constraints) to test the financial accelerator hypothesis, thereby combining aggregate and household data. Since the aggregate accounting relationship will almost certainly generate a measured positive relationship between consumption and collateralised lending, this points towards an alternative strategy for testing the financial accelerator model: of examining collateralised debt acquisition by exploiting the variation in collateral constraints across *households*.

2.2. The role of unsecured debt

The existing literature on the financial accelerator as applied to households also makes no more than a passing reference to unsecured debt – that is use of credit cards, loans from finance companies, purchases on store cards, mail order catalogues and so on. Yet much public concern on debt 'overhang' has tended to focus on these credit instruments rather than debt that is secured on household assets. Two rationales are generally given in the financial accelerator literature for emphasising secured rather than unsecured debt in the household's balance sheet: first, that the value of secured debt far outweighs the value of unsecured debt, and second, that interest rates on unsecured debt are typically higher than on secured debt.

It is surely correct that secured debt predominates in the household's overall debt portfolio, insofar as the largest debt-financed purchase that a household will make is likely to be its purchase of a house. However households will inevitably use unsecured

borrowing far more frequently in their lifetime than secured borrowing to finance lumpy purchases. It is sometimes also argued that even these purchases are collateralised, if not by housing wealth then by the good purchased on the loan such as an automobile, white goods, etc. Typically, for example, the US literature treats automobile loans as 'collateralised' by the value of the automobile purchased. Iacoviello (2004) states:

> "Consumers are actually inundated by offers of car loans, credit cards, home equity loans, and so on…Most of these loans require the borrower to post some collateral." (*ibid,* p.305)

Home ownership is indeed often a key variable used in credit scoring of households that are trying to obtain access to unsecured debt. Home ownership is associated with lower residential mobility than tenancy (a key attribute in obtaining a credit 'score') and may indicate other household characteristics such as potential stability of the household structure, prospective job tenure etc. Moreover, a mortgaged property signals that the household has previously been successful in obtaining credit. However, it is overstretching the argument, certainly in the UK context, to conclude that the value of housing wealth is thereby acting as 'collateral' for unsecured loans, even though there may be a positive relationship between home ownership *status* and access to unsecured debt, for the signalling/screening reasons described here and at greater length in Bridges, Disney and Henley (2006).

An essential difference between collateral based on homeownership and other forms of collateral is that the former tends to appreciate in real terms (relative to nominal debt) whereas other assets tend to depreciate, so that, over the term of the loan, the value of the collateral may fall, faster even than the outstanding balance.[1] Finally, whilst having collateral (usually in the form of home ownership) does widen the household's access to other credit instruments, it remains to be proven that the *value* of unsecured debt depends on the *value* of collateral. We test this proposition shortly.

The argument that interest rates are higher on unsecured debt, while also correct (if we abstract from 'rotating' credit on store and credit cards) must also be treated with some caution. There is plenty of evidence that this does not deter households from borrowing on unsecured terms even when unsecured credit is available (Bertaut and Haliassos, 2006). This may be because changing the value of secured debt is costly and households generally find it easier to vary their financial position on the unsecured rather than the secured margin.

Taking these points together, therefore, suggests that we should consider the role of unsecured debt more carefully in the financial accelerator model. For example, we might wish to model access to unsecured debt as a *substitute* for secured debt amongst households facing a collateral constraint. Whilst the higher average interest rate may dampen the demand for debt, such behaviour allows the household to offset any collateral constraint that it may face. The next section develops a model along these lines.

2.3. Outline of the paper

This paper provides a simple model in which the household has access to both secured and unsecured debt. Whilst having collateral may be a prerequisite for access to unsecured credit instruments, there is no positive covariance in the values of secured and unsecured debt across households in our model. Households subject to a collateral constraint substitute unsecured for desired secured debt, albeit at a higher rate of interest. Total household indebtedness is not therefore constrained by the value of collateral, as implied by the financial accelerator model as it is applied to households.

Increases in the value of housing collateral, brought about by exogenous changes in the price level, allow households to substitute secured for unsecured debt. Increases in asset values do not therefore induce the large co-movements in debt-financed consumption spending and the value of collateral that are implied by the financial accelerator model. At most, there is a relative price effect insofar as households are able to use the increased value of collateral to reduce the average rate of interest on their debt (weighted by the proportions of secured and unsecured debt in the household portfolio). In fact, since changing the value of secured debt is costly, we would only expect these adjustments to debt proportions to take place where households have large overhangs of unsecured debt.

Taking these points together, our model implies that the application of the financial accelerator model to households overstates the responsiveness of household debt-financed consumption to changes in house prices. This does not rule out a weaker relationship between house prices and consumption (nor does it rule out a direct wealth effect) but certainly rules out a mechanism that 'amplifies' or 'accelerates' the effect of

fluctuations in asset values. We now sketch out the standard financial accelerator model as applied to households, and our own augmented model with unsecured debt.

3. A model of household secured and unsecured debt

3.1. A model of secured debt

Our model of the role of collateral constraints in household decision–making follows closely that used by Iacoviello (2004, 2005) in the household sector component of his model. We assume that households maximise lifetime utility over consumption and over a flow of services derived from owning a house, subject to a lifetime wealth constraint and a per period collateral constraint. Hence the household's maximisation problem can be written as:

$$\max_{c_t,h_t;t=1..T} E_t\left[\sum_{t=1}^{T}\left(\frac{1}{1+\rho}\right)^t\left(u\left(c_t,h_t\right)\right)\right] \tag{1}$$

where u is some general utility function, ρ is the subjective discount factor, c_t is consumption, and h_t is units of housing. The household chooses a trajectory of consumption and increments (decrements) of units of housing that maximises its lifetime felicity function. The household is subject to two constraints: a lifetime budget constraint (2) and a collateral constraint on borrowing in any period depending on the lender's expectation of the price of the housing asset in the next period (3).[2]

$$\sum_{t=1}^{T} c_t + \sum_{t=1}^{T}(\Delta h_t.v_t) \le \sum_{t=1}^{T} y_t = \bar{Y} \tag{2}$$

$$b_t^s \le \frac{E_t(v_{t+1})h_t}{(1+r_t^s)} \tag{3}$$

where y_t is income, $\bar{Y}$ is *lifetime* income (wealth), v_t is the price per unit of housing, r_t^s is the interest rate on secured debt and b_t^s is the value of outstanding secured debt.

Households solve the Lagrangean:

$$L_t = E_t\sum_{t=1}^{T}\left(\frac{1}{1+p}\right)^t\left(u\left(c_t,h_t\right)\right) - \lambda_1\left[\left(\frac{1}{1+r_t^s}\right)\sum_{t=1}^{T}c_t + \left(\frac{1}{1+r_t^s}\right)\sum_{t=1}^{t}(\Delta h_t.q_t) - \left(\frac{1}{1+r_t^s}\right)\sum_{t=1}^{T}y_t\right]$$
$$-\lambda_2\left[(1+r_t^s)c_t - (1+r_t^s)y_t - E_t(v_{t+1})h_t\right] \tag{4}$$

where λ_1 is the shadow value of the lifetime borrowing constraint and λ_2 is the shadow value of the per period collateral constraint on consumption. Note that the constraints are 'discounted' at the rate of interest on secured debt, r_t^s.

A household with a value of ρ sufficiently low that desired borrowing does not exceed the borrowing constraint can be described as an endogenously *unconstrained household* given the rate at which it discounts future consumption. Hence the Euler equation for consumption for such households can be derived in the standard manner:

$$\frac{\partial L}{\partial c_t} : u'(c_t) - \lambda_1 = 0 \qquad \text{and} \qquad \frac{\partial L}{\partial c_{t+1}} : \frac{1}{1+\rho} u'(c_{t+1}) - \frac{\lambda_1}{1+r_t^s} = 0$$

Hence: $$u'(c_t) = \frac{1+r_t^s}{1+\rho} u'(c_{t+1}) \tag{5}$$

The first order condition for the demand for units of housing is:

$$\frac{\partial L}{\partial h_t} = u'(h_t) - \lambda_1 q_t + \frac{\lambda_1}{1+r_t^s} v_{t+1}$$

Hence, from the derivation of (5):

$$u'(c_t)v_t = u'(h_t) + \left(\frac{1}{1+\rho}\right) u'(c_{t+1})v_{t+1} \tag{6}$$

Alternatively, households with a value of ρ such that the borrowing constraint binds can be termed *constrained households*. Solving the problem for constrained households when the collateral constraint, λ_2 binds gives:

$$\frac{\partial L}{\partial c_t} : u'(c_t) - \lambda_1 \frac{1}{1+r_t^s} - \lambda_2(1+r_t^s) = 0 \qquad \text{and} \qquad \frac{\partial L}{\partial c_{t+1}} : \frac{1}{1+\rho} u'(c_{t+1}) - \lambda_1 = 0 \tag{7}$$

In the extreme case of $\rho = \infty$ the Euler equation is:

$$u'(c_t) = \lambda_2(1+r_t^s)$$

The first order condition for housing demand is:

$$\frac{\partial L}{\partial h_t} : u'(h_t) - \lambda_1 v_t + \lambda_2 E_t(v_{t+1}) \tag{8}$$

As $\lambda_1 = u'(c_t)$, housing demand is given by:

$$u'(c_t)v_t = u'(h_t) + \lambda_2 E_t(v_{t+1}) \tag{9}$$

and housing demand of the constrained household is higher than that of the unconstrained household as the shadow price of lifting the collateral constraint exceeds the marginal utility of consumption in (6).

It is therefore straightforward to consider the implications of a positive shock to the expected value of housing wealth for the collateral-constrained household. A possible consequence of a shock is depicted in Figure 1. Any alleviation of the borrowing constraint, such as arises from an increase in the expected value of housing wealth, induces the household to increase current consumption. The relationship may be termed a financial 'accelerator' insofar as increase in all values, including income, may lead to an increase in current consumption greater than the increase in income because the secured debt is fixed in nominal terms, so that borrowing capacity rises faster than nominal income growth.

3.2. Unsecured debt

The introduction of unsecured debt, b_t^u, to the model provides the household with an additional borrowing instrument. Unsecured debt is strictly more expensive than secured debt, $r_t^u > r_t^s$ as it is not secured against the homeowners' holding of housing equity. So, faced with a choice between secured and unsecured debt, we assume for the moment that the unconstrained household will always choose secured debt.[3] The household's maximisation problem remains as before in equations (1) to (3) although we now add a terminal condition (since we are working with an intertemporal budget constraint rather than the flow of funds approach of Iacoviello, 2004):

$$b_T^s + b_T^u < v_T h_T \tag{10}$$

This states that outstanding debt at the time horizon cannot exceed the value of housing wealth.

Households now face a non-linear budget constraint of the type depicted in the bold line in Figure 2, whereby households can borrow up to the collateral limit at rate r_t^s and thereafter at the interest rate on unsecured debt $r_t^u > r_t^s$. We can therefore distinguish three kinds of households which differ only in their value of ρ. One type,

with $\rho \leq \underline{\rho}$, are either lenders, or borrow less than the collateral constraint. They face an exogenous interest rate r_t^s. A second type, with $\underline{\rho} < \rho \leq \bar{\rho}$, are at the kink point on the budget constraint, borrowing up to the extent of their collateral. An increment of borrowing at the kink point will incur the interest rate r_t^u. A final type of household, with $\rho > \bar{\rho}$, has exhausted its collateral constraint and has unsecured borrowing. The average rate of interest on borrowing for this group, $\bar{r}$, is monotonically positively related to their level of borrowing given their collateral constraint, and monotonically negatively related to their level of collateral given their level of borrowing. For given borrowing, for this group we alter the effective interest rate facing the household in the constraints in (4) from r_t^s to $\bar{r}$ where:

$$\bar{r} = \frac{1}{1 + \left(\frac{r_t^s(\max b_t^s) + r_t^u(\bar{Y} - \max b_t^s)}{\bar{Y}} \right)} \tag{11a}$$

That is, the average interest rate on debt is determined by the weighted proportions of the interest rate on secured debt up to the borrowing constraint and the interest rate on unsecured debt up to the value of lifetime wealth. In turn, we can substitute for $(\max b_t^s)$ the collateral constraint defined in (2) so that:

$$\bar{r} = \frac{1}{1 + \left(\frac{r_t^s(\frac{E_t(v_{t+1})h_t}{(1+r_t^s)}) + r_t^u(\bar{Y} - \frac{E_t(v_{t+1})h_t}{(1+r_t^s)})}{\bar{Y}} \right)} \tag{11b}$$

This average interest rate is of course endogenous as it depends on the household's holding of housing h_t, which in turns limits secured borrowing, b_t^s. We can think of the household with a potential collateral constraint solving a stylised two stage problem in which it first solves for the optimal housing quantity, and thereby determines the average interest rate at which it can borrow. It then solves for the optimal allocation of consumption over time in the standard Euler equation framework but with a higher average interest rate than in the unconstrained case, since part of this borrowing is undertaken at the higher, unsecured, rate of interest. Such a model however cannot be solved analytically.

Figure 2 illustrates an example of how a relaxation of the collateral constraint affects a household in this position. Initially, the household has exhausted its collateral constraint and is also utilising unsecured debt. The relaxation of the collateral constraint allows the household to *substitute* secured for unsecured debt. This induces a positive wealth effect arising from the reduced average cost of borrowing which induces the household to increase its current consumption. Note however that the increase in current consumption is much lower than the change in the value of collateral (compare the change in consumption in Figure 2 to that in Figure 1). There is indeed an additional impact on consumer spending from the existence of collateralised debt in a period of rising prices and incomes, but this arises from a *relative price effect* rather than a quantity adjustment arising from the relaxation of a binding constraint. The extent to which households substitute secured for unsecured debt when a collateral constraint is relaxed is of course something that can be investigated empirically.

3.3. Impact of costly remortgaging

In equilibrium, we have assumed a 'hierarchy' of borrowing arrangements whereby the household initially borrows at the cheapest rate, given by collateralised borrowing, and then utilises unsecured borrowing at a high rate. Out of equilibrium, there may be adjustment costs to varying the amount of secured borrowing. Since this primarily takes the form of remortgaging of owned property, such remortgaging typically incurs transaction costs such as an arrangement fee and time spent negotiating the remortgaging. Although time costs are probably related to level of income, arrangement fees are typically lump sum and exogenous to the level of transaction. It is therefore apparent that a household will only remortgage if the change in the average interest rate on its debt multiplied by the level of desired debt is greater than the cost of remortgaging. For relatively small amounts of unsecured debt, therefore, it is probably rational for the household to avoid remortgaging. Such a household will be observed to hold unsecured debt even when it has not exhausted its collateral constraint. Thus the probability of remortgaging will be positively related to relaxations of the collateral constraint *only* if the value of outstanding unsecured debt exceeds a certain amount. This hypothesis, which is testable, further dampens the 'financial accelerator effect' of changes in collateral constraints as demonstrated in Figures 3 and 4.

In Figure 3, the lump sum cost of remortgaging is treated as a discontinuity in the budget constraint at the kink point equal to the initial value of the collateral. After an

increase in the value of collateral, the new budget constraint intersects the 'old' budget constraint (that is, if the household chooses not to remortgage). In Figure 3, the household does not remortgage because the arrangement fee for remortgaging exceeds the reduction in the average interest rate that would arise were the household to exploit the relaxation of its collateral constraint. In contrast, in Figure 4, the reduction in the average interest rate does outweigh the fee and the household both remortgages and increases its total borrowing.

4. Data

To investigate these hypotheses empirically, we utilise the British Household Panel Survey (BHPS), which is an annual panel survey of approximately 10,000 adults in around 5,000 households that has been running annually since 1991. Throughout the paper, we work at a household level in which we aggregate housing, debt and asset values of the respondent and his or her partner.

Apart from standard questions concerning household demographics, health and economic status, the BHPS asks about wealth and indebtedness in two of the twelve waves available at the time of writing: 1995 and 2000. Respondents in those waves are asked to list the sources of household debt, access to unsecured debt instruments and the total value of unsecured debt. This data on the amount of unsecured financial debt is collected in two stages. In the first stage, individuals are asked to give a precise value for the total amount they owe. Individuals who say that they do not know how much that they owe are then asked to give a banded answer. In this analysis we impute a continuous value for those households who report banded information.[4]

The BHPS in every wave collects information on secured debt, on housing status and self-assessed house value. The questions obtain detailed information on mortgaging and remortgaging, as well as year-on-year self-reported house values. The mortgage data contains data on type of mortgage, original mortgage value, the regular value of mortgage payments, and the current estimated value of the mortgage. A key variable in our analysis is the *loan-to-value ratio (LTV)* since this is our indicator of whether the household is facing a collateral constraint. In the cross-section analyses, we use the self-reported LTV ratio: that is the self-reported current value of the mortgage divided by the self-reported value of the house. Figure 5 illustrates the distribution of values of these household LTV ratios for 1995 and 2000 by decile of the LTV ratio. The lowest band includes those who own outright (i.e. LTV=0) but, other than this band, there is a

relatively uniform distribution across the deciles in 1995. However, due to the sharp rise in house prices between these dates, especially from 1997 onwards, average LTV ratios tended to fall between 1995 and 2000. In 1995 roughly 15% of the sample reported housing details which gave a measured LTV ratio greater than 0.8. By 2000, this proportion had approximately halved to 7%.

There are intrinsic difficulties for respondents in constructing current mortgage values – whilst annual mortgage statements typically report this statistic, those without the information available may attempt to estimate a value from an imperfect understanding of how mortgages work. More fundamentally, we need to incorporate explicitly, given the arguments of the previous section, that households may use rising house prices to remortgage – in other words the measured change in the LTV ratio from 1995-2000 is not an exogenous variable. To deal with this when examining changes from 1995 to 2000, we also utilise additional data constructed by Andrew Henley at the University of Swansea, which predicts current values of mortgages of BHPS respondents derived from the reported value of the original mortgage and from details on the terms of the mortgage (duration and type of mortgage). This proxy variable takes out any change arising from remortgaging and nets out some of the measurement error. This predicted LTV is used in the analysis where relevant.

The Appendix describes some of these questions in the BHPS on greater detail.

5. Empirical results

5.1. Access to unsecured debt and value of unsecured debt

As suggested in Section 2, the financial accelerator model implies that having collateral permits the household to access unsecured debt and, implicitly, that we might observe a positive correlation between a household's collateral and its unsecured debt, although we must obviously control first for life cycle factors and for heterogeneous preferences. In contrast, we have argued that access to unsecured debt is unlikely to be affected by the *value* of housing collateral, although credit bureaux may well take home ownership as one of a number of household attributes that are associated with lower default risk. Indeed, a cursory inspection of the budget constraint in Figure 2 might suggest that, *ceteris paribus,* households with greater potential collateral have *less* need for unsecured debt.

We test these alternative hypotheses in this sub-section using the BHPS. We take various measures of access to unsecured debt, and use of unsecured debt instruments, and examine their relationship to whether the household is a homeowner, to the value of their housing equity (self-reported house value net current reported mortgage value), and to controls for demographics, the life cycle and preferences. The data are pooled from the 1995 and 2000 waves and estimated in random effects specifications to control for uncorrelated individual heterogeneity.[5] We wish to test how access to these various unsecured debt instruments is affected by whether the household is a homeowner and the effect, if any, of the household's value of collateral on this access, measured by the net value of housing equity. The results are illustrated in Table 1.

Columns (1) to (4) use indicator variables of access to typical types of unsecured debt and are estimated as random effects probits. Column (1) examines whether the household has access to credit or store cards, whereas column (2) examines the probability that households use them for non-rotating credit. There is robust evidence of a positive association between homeownership and access to, and use of, credit and store cards. We have argued that, in common with other covariates such as employment status and level of household income, this finding reflects credit bureaux scoring procedures rather than the use of housing equity as collateral. This is confirmed by interacting homeownership with the net value of housing equity (HE), where we observe a positive (but insignificant) effect of housing equity on access to credit and store cards and a negative (but also insignificant) impact of housing equity on their use as debt instruments. Other characteristics have plausible signs – households that save regularly, have financial wealth and higher incomes (although these last two effects tail off at higher values), are more likely to have credit cards but less likely to use them for borrowing. Being a smoker (which may be proxying for being in a lower socio-economic group and/or having a higher rate of time preference) reduces the probability of having a credit card.

Column (3), which examines the probability of taking out a personal loan from a bank or a finance company, actually has a significant negative sign on the value of the housing equity interaction, suggesting that greater potential collateral, in the form of higher housing equity, actually lowers the need to obtain unsecured borrowing.

Column (4) examines credit obtained by purchases through mail order or catalogues. Since access to such purchases is not commonly credit scored, it is

particularly pervasive among low income groups and those without their own home (see Bridges and Disney, 2004). It is therefore not surprising to find a negative association with home ownership (and therefore an insignificant impact of housing equity on borrowing).

Finally, column (5) looks at the total value of financial debt (see the Appendix for a description of what is included in this value). Here, homeownership is positively associated with the value of unsecured debt but the value of net housing equity is again negatively and significantly associated with housing equity value. We reiterate our view that this last result does not arise from life cycle effects (for which we control with measures of financial assets, current income, age and demographics), nor from preferences (proxied by propensity to save, being a smoker, and with unobserved heterogeneity captured through the random effects specification). Nor does it directly suggest that homeowners have directly substituted secured for unsecured debt (since the housing equity measure nets out secured debt) although it does imply that greater *potential* collateral reduces the household's reliance on unsecured debt.

Overall, these results offer no suggestion that higher values of net housing equity are associated with greater incidence of purchases financed by unsecured debt. The model implies, but does not test explicitly, that secured and unsecured debt are substitutes rather than complements. We return to this issue shortly. Home ownership is (mostly) associated with unsecured debt availability, but we suggest that this arises from credit scoring techniques rather than from any positive association between the values of secured and unsecured debt. We can now test more explicitly whether households seek to unbind collateral constraints by using unsecured debt.

5.2. Loan-to-value ratio and unsecured debt

Our next regressions test explicitly the model depicted in Figure 2. We test whether households that are collateral constrained, as measured by a high loan-to-value ratio (LTV ratio), have a greater value of unsecured debt, controlling for other relevant factors. A positive association between the LTV ratio and unsecured debt, allowing for life cycle effects and preferences, would suggest that households are utilising unsecured debt to unbind their ceiling on secured debt, thereby dampening any potential household 'financial accelerator' effect arising from collateral constraints. Again we exploit the variation in LTV ratios across households to examine this hypothesis, using self-reported values of housing wealth and of outstanding mortgage to construct the ratio. The results

are illustrated in Table 2 for 1995 and 2000 separately, and for a random effects specification utilising both years.

All the regressions in Table 2 tell a common story, consistent with our theoretical model. A higher loan-to-value ratio, which we interpret as an indicator of a more tightly binding collateral constraint, is associated with a higher value of unsecured debt.[6] Households are using the unsecured debt market to unbind their collateral constraint. The coefficients on the controls also seem plausible: a non-linear relationship of the unsecured value to income and assets, a positive sign on dummies for whether the head of household is married (in a couple) and employed. As proxies for preferences, whether the household is a regular saver has a negative sign as does being a smoker (but neither significant); heterogeneity is also captured in column (3) by the random effects specification designed to rule out the hypothesis that what we are observing is simply a common preference for debt, whether secured or unsecured.

If these controls are not capturing heterogeneity of preferences or life cycle factors adequately, however, it is of course possible that we are simply observing a correlation in the demand for unsecured and secured debt arising from tastes or from life cycle factors, rather than the impact of the non-linear budget constraint described in Section 3. Much the same criticism would then apply also to the financial accelerator model, since the demand for debt is then being driven primarily by preferences rather than by the constraint which restricts access to debt. However the raw correlations between secured and unsecured debt values across households, though positive, are relatively low. In 1995, the correlation between the LTV ratio and amount of unsecured debt across households is 0.17; the correlation between the value of secured debt (current value of the mortgage) and the value of secured debt is 0.27. Since there is measurement error in both, this may understate the 'true' correlation but this result, combined with the regression results and the next section, suggests that we are observing behaviour compatible with our theoretical model.

The LTV ratio is used in Table 2 to proxy the collateral constraint, but it can be plausibly argued that the relationship between the LTV ratio and the value of unsecured debt is non-linear – raising the LTV ratio from 0.1 to 0.3 has a very different impact on the household's borrowing constraint than raising the LTV ratio from 0.8 to 1.0. However, given measurement error in the calculation of the LTV ratio on self-reported data, and the fact that collateral constraints may not literally bind at 1.0 for all

households, we expected some tightening in the constraint to occur as the LTV is higher at all ratios. Nevertheless we test the non-linearity explicitly by replacing the continuous LTV ratio in the specifications in Table 2 by a set of dummies for the quintiles of the LTV ratio (relative to a LTV ratio of 0). Rather than provide the full estimates (coefficients on controls are of course very similar to those in Table 2), we graph the results on quintiles of the LTV ratio in Figure 6 for the three specifications: 1995, 2000 and the random effects model.

It can be seen from Figure 6 that, as we might expect, the relationship of unsecured debt to LTV ratio is indeed non-linear across the quintiles, with a much reduced effect if the LTV ratio is less than 0.4. Use of unsecured debt rises sharply (and significantly) when the LTV ratio is greater than 0.4. It is perhaps surprising that this jump in unsecured debt does not occur closer to a LTV ratio of 1.0, but there are a number of plausible reasons for this (risk aversion of lender or borrower, costs of access to unsecured debt – see the next sub-section – and measurement error which leads us systematically to understate LTV ratios are all possible factors).

5.3. Unbinding the collateral constraint: changes in house prices and debt

As we have suggested sometimes, it is always possible to argue that results derived from cross-sections of households arise from unspecified differences in tastes (heterogeneity) rather than differences in behaviour driven by household-specific budget constraints. In this sub-section, therefore, we take the test of the model further by analysing what happens to household behaviour as rising house prices relax the collateral constraint. As discussed in Section 4, data on indebtedness are only available for 1995 and 2000 so we can only use a 'long difference' estimate of the impact of house price changes on secured and unsecured borrowing. However the period 1995-2000 saw a significant increase in house prices which, as described in Section 4, halved the number of households with LTV ratios of at least 0.8. Moreover, this average house price rise (of around 30% over the period at a time when underlying inflation was close to 2.5% per annum) concealed an uneven pattern of house price changes across the UK so that there was exogenous variation in the degree to which collateral constraints was relaxed.[7]

The financial accelerator model suggests that rising house prices directly unbind collateral constraints (as measured by high LTV ratios) and so allow households to increase their (secured) borrowing. Our model with unsecured debt suggests that such households will, on the margin, substitute secured for unsecured debt, so long as the gain

in reduced interest charges exceeds the cost of increasing secured debt (administrative fees). This increase in secured debt, which is central to both these hypotheses, can be measured by the probability that the household remortgages over the period. Thus we provide two tests of the core issue of the substitutability of secured for unsecured debt. First, we investigate whether the probability of a household remortgaging between 1995 and 2000 is related to a change in the LTV ratio arising from rising house prices over that period, and by the level of unsecured debt in 1995. Over 400 households in the sample remortgaged between 1995 and 2000. Second, we test whether the *change* in total debt over the period 1995 to 2000 is related to the change in house prices (which unbind the collateral constraint). We examine this relationship for collateral 'constrained' and 'unconstrained' households. This is closely related to a 'treatment' approach, in so far as we are testing whether households with a collateral constraint that became less binding over the period behaved differently in relation to acquisition of unsecured debt, relative to other households.

As mentioned in Section 4, the change in the LTV ratio constructed from self-reported current values of the house and the mortgage is not a good indicator of the underlying change in the value of collateral, since the measure incorporates any behavioural change, such as increasing secured debt, that takes place as a result of changing house prices. So we work with the changes in the predicted values of secured debt derived from modelling the value of mortgage over time defined by the original mortgage contract of each household as the numerator of our changes in household-specific LTV ratios, using the changes in self-reported housed value as the denominator of the ratios.[8] The distribution of changes by decile is illustrated in Figure 7 and the distribution of values of unsecured debt in 1995 in Figure 8.

In general terms, both models predict a *negative* association between the change in the underlying predicted LTV ratio and the probability of remortgaging, and the model proposed in this paper also predicts a *positive* association between the original value of unsecured debt and the change in the LTV ratio. The former association arises simply because a falling LTV ratio arising from rising values of the collateral allows the household to unbind its collateral constraint and to increase secured borrowing; the latter because the falling LTV ratio allows the household to substitute cheaper secured for unsecured debt.

Table 3 estimates a model of the remortgage rate and shows that these predictions are indeed confirmed by the data. Other important variables in explaining the remortgage rate include the level of household income and assets, the age of the household and employment status. This is not a fully specified model of why households remortgage although control variables include changes in financial and demographic circumstances that may explain why households move house (a common reason for remortgaging, although some households remortgage without moving house). In particular, we do not use data on self-reported motives for remortgaging in the BHPS (which unfortunately do not include explicit motives that could be used to characterise the theoretical models described here). More details on these issues around the remortgage data are provided in Bridges, Disney and Henley (2006). Nevertheless, the results here are sufficient to provide an empirical vindication of the theoretical models described in the present paper.

Column (2) of Table 3 provides a more precise test of the financial accelerator model, since it interacts the change in the predicted LTV ratio with the value of the LTV ratio in 1995, as well as the level of unsecured debt. The interaction is designed to capture the feature that the collateral constraint is only binding for households that have high LTV ratios in the first place. Thus the probability of remortgaging between 1995 and 2000 as LTV ratios fall should be strongest amongst households that had high LTV ratios in 1995. As can be seen, the sign on this interaction is correct but the variable is only weakly significant (at 9%). The coefficient on household unsecured debt remains significant with the correct sign.

Column (3) and (4) of Table 3 provide more precise tests of the unsecured debt model developed in Section 3. In Column (3), we again interact the predicted change in the LTV ratio – this time with the level of unsecured debt in 1995. Again, the argument is that it is only worth remortgaging to reduce unsecured debt as the collateral constraint is relaxed if the original level of unsecured debt is higher. In Column (4) the same point is made by using a cut-off that unsecured debt is higher than £500 – this being a typical fee for remortgaging. These specifications do not include the additional term in the absolute value of unsecured debt. In both cases, the interactions are significant, supporting the suggestion that remortgaging is a response to high levels of unsecured debt, as depicted in Figure 2. Moreover, the fact that, on grounds of values of the Log Likelihood, the cut-off model in Column (4) is marginally the preferred specification provides empirical support for the theoretical position advanced in the discussion of

Figures 3 and 4: that individuals will only substitute secured for unsecured debt where the secured debt is sufficiently large to exceed the administrative costs of doing so.

We have undertaken some sensitivity analyses. We experimented with raising the cut-off point on unsecured debt – it remains significant as the value of unsecured debt reaches £1000 and £1500 but loses significance thereafter. Of course, fewer households have many thousands of £ of unsecured debt. We experimented also with a specification which includes both the financial accelerator-type interaction in Column (2) and the unsecured debt interaction in Column (3). By construction, of course, these variables are potentially collinear but in fact the correlation coefficient is only 0.24. When we run this specification, the term $\Delta LTV * LTV_{1995}$ remains insignificant (indeed it is now only significant at a 23% confidence level) whereas the term $\Delta LTV *$ Unsecured debt$_{1995}$ is strongly significant (at a 0.1% confidence level). We believe that this result alone strongly suggests that it is the substitution of secured for unsecured debt, as in Figure 2, rather than the 'pure' financial accelerator model, as depicted in Figure 1, that is driving consumer behaviour.[9]

Table 4 provides a direct test of the proposition that unbinding the collateral constraint only has a significant impact on indebtedness of constrained households, in particular constrained households with unsecured debts. The theoretical model predicts that house price rises should only affect optimal indebtedness for households with binding constraints. Moreover, Figure 3 suggests that this relationship is only strong for households with higher unsecured debts relative to the cost of remortgaging.

In order to make this distinction between collateral 'constrained' and 'unconstrained' households we chose a threshold level of the household self-reported LTV exceeding 0.8 as an indicator of being collateral constrained. Though this choice of threshold is arbitrary, results indicate that the strongest behavioural response to house price rises among a constrained group occurs when this cut-off is chosen. This is a crude approximation to a 'treatment' model insofar as we are testing whether the 'treated group' (that is, those with an exogenous collateral constraint – a LTV ratio greater than 0.8 in 1995) behave differently from a 'control' group – that is individuals who may or may not have a falling LTV ratio but who are not constrained in this manner. We examine homeowners only, and in one case only households that did not move, since moving is often associated with changing both secured and unsecured debt levels.

Table 5 reports estimates of the effect of house price change on total debt (actual, not predicted, secured debt plus unsecured debt) over the two waves of data from 1995 to 2000. We first consider estimates for non-moving households to isolate the changes in total indebtedness due to behaviour other than moving activity. Column 1, our baseline regression, suggests no relationship between house price and total debt for the sample of non-moving households. Moreover, Column 2 suggests this is also the case when an interaction term of the household being constrained is included. The second regressor in Column 2 interacts the self-reported change in the household's house price with a dummy variable for the household being in the constrained group in 1995 (approximately 370 households). Incorporating a second dummy variable into this interaction term for the household having unsecured debts greater than £500 in 1995 generates the third regressor, included in Column 3 (approximately 300 households are in this 'constrained and indebted' group). A significant and positive coefficient on this interaction term suggests that a positive relationship between house prices movements and total indebtedness does exist for this subsample of households. We interpret the coefficient of 0.13, significant at the 1% level, as indicating that a £1000 increase in house prices increases total debt by £130 more for this subset of households compared to households in the rest of the sample.

Of course, these results could be due the choice of threshold for the household being in the constrained group of a LTV higher than 0.8. However, we have undertaken some sensitivity analysis here. Lowering the threshold to 0.7 or 0.6 reduces the coefficient on the interaction term from 0.13 to 0.09 and 0.04 respectively, with smaller t-values of 2.26 and 1.51 (compared to 2.79 with the 0.8 threshold). This suggests that lowering the threshold introduces households into the constrained group for whom the relationship between house prices and total debt is weaker, suggesting they were less likely constrained in 1995. Raising the threshold to 0.9 does increase the coefficient to 0.25 with a t-value of 3.56 suggesting these households faced a more binding constraint, but the number of households here falls to just over 150. Hence we favour our initial estimates using a threshold of the LTV exceeding 0.8 as defining the constrained group.

Including mover households in the sample raises the missing data problem of unobserved changes in total indebtedness had these households not moved over the period. Moving activity is highly likely correlated with changes in secured debt as households upsize and downsize. Moreover the fixed costs associated with remortgaging imply that households are more likely to refinance their debt portfolios when moving

home. We attempt to overcome this problem by estimating a first-stage selection equation for he household being a non-mover between 1995 and 2000, including variables correlated with moving activity but uncorrelated with changes in total indebtedness. The exclusion restrictions in the selection equation, including whether a household preferred to move house in 1995, whether the household likes its neighbourhood and whether the head of households' work prevents moving are jointly significant at the 5% level. Using this approach increases the sample size to slightly over two thousand households, slightly weakening the significance and magnitude of the interaction term to 0.09, significant at the 5% level.

Overall, these results strongly suggest that the relationship between changes in collateral values and total debt is much better captured by a model including unsecured debt than the pure financial accelerator model. Our assertion is that the data illustrates, predominantly, house price rises give rise to households with unsecured debts refinancing their debt with a small wealth effect due to the spread on interest rates between secured and unsecured debt. As homeowning households have the option of borrowing unsecured, they do not have to wait for increases in collateral values in order to borrow. Hence when increases in collateral values do occur, households' response is to re-finance existing debt, increases in overall indebtedness arising from the small wealth effect of substituting cheaper secured debt for more expensive unsecured debt.

The size of the impact of house prices on total indebtedness in our estimates is of the order of a £1000 increase in house prices increasing total indebtedness by £130 among the subsample of constrained and indebted households. These households represent approximately 14% of the entire sample, suggesting an average impact of in the region of £10 - £20, or 0.01 to 0.02 over the period in our estimates.

6. Conclusion

This paper has explored the 'financial accelerator' model as applied to household behaviour. It has become more fashionable to argue that changes in house prices affect household consumption (and, in particular, debt-financed consumption) not through traditional LCH wealth effects, but because consumers face collateral constraints arising from imperfect information, so that rising house prices relax constraints and allow households to increase their secured borrowing. Such changes 'amplify' or 'accelerate' the effect of changes in asset values on debt-financed consumption, particularly in

relation to the rather small effects on house prices on consumption generally found through the estimation of traditional 'wealth effects'.

We argue here that the model should be adjusted to take account of unsecured debt. On the margin, it is easier for households to adjust unsecured debt rather than secured debt, and to unbind collateral constraints by use of unsecured debt. Consequently, changes in collateral constraints arising from asset revaluations will only have an impact on debt-financed consumer spending insofar as households substitute cheaper secured debt for unsecured debt. This 'relative price effect' arising from changes in asset values will indeed increase debt-financed consumption, but the magnitude of the effect is likely to be much smaller than the 'amplification' of shocks implied by the financial accelerator model. Indeed, if changing the level of secured debt is costly, due to administrative fees, the net effect of asset value changes may be very small indeed. In this revised model, the link between house price changes and debt-financed consumption is therefore much weakened, relative to the financial accelerator model.

To our knowledge, the financial accelerator model has only been tested on aggregate data, or by simulations, and the issue concerning unsecured debt has been largely ignored. This is slightly surprising, insofar as the rather similar issue of 'liquidity constraints' soon led researchers to investigate household data sets in order to calculate indicators of the extent to which 'liquidity constraints' were binding on households. We follow the same strategy here, using household panel data, although we then utilise our empirical findings to examine the plausibility of the models rather than to attempt to calculate an indicator variable (e.g. 'proportion of households that are collateral constrained') that can be 'fed back' into the macroeconomic model.

Our results can be summarised as follows. First, whilst having some collateral is associated with access to unsecured debt instruments, which we interpret as a credit scoring phenomenon, we find no evidence that the *value* of collateral affects either the use of unsecured debt instruments or the value of outstanding self-reported unsecured debt. Second, we find that households with more binding collateral constraints (that is, higher self-reported loan-to-value ratios) do indeed have higher unsecured debt once we control for life cycle characteristics and for individual heterogeneity. We interpret this result as simply saying that households do unbind collateral constraints by using unsecured debt.

Finally, we use changes in loan-to-value ratios over time arising from rising house prices (that is, controlling for any change in loan values arising from household behaviour) to examine the competing hypotheses: that rising collateral values induce households with collateral constraints to increase secured debt (the 'pure' financial accelerator hypothesis), or that rising collateral values allow households with high values of unsecured debt to substitute secured for unsecured debt (the dampened 'relative price effect'). By using a series of non-nested specifications and a crude nesting test, we suggest that there is some support for both hypotheses, but that the second 'story' is much the more plausible and statistically significant explanation of how households respond to rising asset values. Households undoubtedly exploit rising asset values to increase their debt-financed consumption on the margin, but to suggest that mechanisms exist which 'accelerate' or 'amplify' asset price shocks, with all that such terminology implies, should be treated with caution. We confirm this result by a more direct test of the impact of unbinding collateral constraints on the value of total debt – we show that households with a 'high' loan-to-value ratio at the start of the period increase their total debt by a significantly greater value for a given rise in their house price than households who are not so constrained.

Summary Variables (Means, Financial Variables in £'000s)

		Constrained	Unconstrained
N		372	2,252
Age	age1a	33	51
Degree	deg1a	0.22	0.13
No. benefits	tnbenefits1	0.73	1.3
Retired	ret1a	0	0.25
Financial Variables			
Employed			
1995	emp1a	0.96	0.73
2000	emp6a	0.96	0.65
	emp_c	0	-0.1
Unsecured Debt			
1995	tdebt1	1.92	0.93
2000	tdebt6	3.83	1.32
	tdebt_c	1.91	0.39
Self-Rep Total Debt			
1995	totaldebt1	47.2	18.5
2000	totaldebt6	55.1	19.0
	totaldebt_c	*7.94*	*0.53*
Mortgage Debt			
1995	predicted mort_1	48.6	17.6
1995	self-rep mort1	45.3	17.5
2000	predicted mort_6	52.8	16.6
2000	self-rep mort6	*51.3*	*17.7*
House Value			
1995	rhsval1	52.1	74.0
2000	rhsval6	91.9	109.8
	rhsval_c	*39.8*	*35.8*
Financial Assets			
1995	asset1	3.23	16.3
2000	asset6	2.73	13.4
	asset_c	*-0.5*	*-2.9*
Income			
1995	tincome1	24.3	19.6
2000	tincome6	30.8	22.6
	tincome_c	*6.57*	*2.97*
Pred. LTV			
1995	ltv1	0.94	0.25
2000	ltv6	0.67	0.19
	ltv_c	*-0.3*	*-0.1*

Table 1: Access to Unsecured Debt and Home Ownership

Specification: Random Effects Probit 1995/2000 data	(1) Prob = 1 Household has credit or store card		(2) Prob = 1 Household owes money on credit or store card		(3) Prob = 1 Household owes money on personal loan		(4) Prob = 1 Household owes money on mail order catalogue		(5) Total unsecured debt of household (RE Tobit)	
Variable	*df/dx*	*Std Err*	*df/dx*	*Std Err*	*df/dx*	*Std Err*	*df/dx*	*Std Err*	*df/dx*	*Std Err*
Homeowner=1	0.86**	0.07	0.47**	0.07	0.13*	0.06	–0.16*	0.07	503.8**	192.2
Owner=1*HE (£)	0.0004	0.00	–0.0001	0.00	–0.002**	0.00	0.0005	0.00	–6.66**	2.18
H income (£)	0.06**	0.00	0.02**	0.00	0.02**	0.00	0.02*	0.01	125.8**	8.94
H income^2 (£)	–0.00016**	0.00	–0.0001**	0.00	–0.00003**	0.00	–0.00003**	0.00	–0.51**	0.07
N of benefits (N)	–0.06*	0.02	0.02	0.03	0.03	0.02	0.18**	0.02	253.5**	68.8
Age	0.05**	0.01	0.04**	0.00	–0.01	0.01	0.02	0.01	10.1	37.3
Age^2	–0.0006**	0.00	–0.0007**	0.00	–0.0002	0.00	–0.0003**	0.00	–1.31**	0.42
N of children (N)	–0.10**	0.04	–0.03	0.03	–0.03	0.03	0.07*	0.03	–66.8	84.3
Female HofH=1	–0.05	0.06	–0.09	0.06	0.08	0.05	–0.23**	0.06	–1.11	159.8
Married=1	0.23**	0.07	0.21**	0.07	0.20**	0.06	0.65**	0.08	1067.2**	191.4
Employed=1	0.30**	0.09	0.41**	0.09	0.35**	0.08	0.02	0.09	904.7**	248.6
Retired=1	0.30**	0.11	0.20	0.12	–0.28*	0.13	–0.35**	0.13	–544.1	337.0
Fin. Assets (£)	0.01**	0.00	–0.007**	0.00	–0.01**	0.00	–0.02**	0.00	–29.8**	4.45
Fin. Assets^2 (£)	–0.0002**	0.00	9.29e^{-06}**	0.00	0.00002**	0.00	0.00002	0.00	0.03**	0.01
Saver=1	0.33**	0.06	–0.06	0.05	–0.08	0.05	–0.07	0.06	–531.2**	156.2
Smoker=1	–0.46**	0.06	0.01	0.06	0.10*	0.05	0.18**	0.06	140.6	156.9
σ^e	1.24**	0.06	1.08**	0.06	0.75**	0.05	1.01**	0.06	4985.4**	68.4
Log L	–3333.7		–3426.8		–3245.4		–2758.3		–37019.5	
Wald χ^2 (20)	856.3		438.6		1175.5		443.8		1548.9	
Prob>χ^2	0.0000		0.0000		0.0000		0.0000		0.0000	

Notes: Specification also includes constant term and dummies for highest educational qualifications. H=household; HE=housing equity (£) = value of house *minus* current value of mortgage. N of obs=7654; N of groups=3827 (n=7614 in column (5)) **=1% level of significance; *=5% level of significance.

Table 2: Loan-to-Value Ratio and Value of Unsecured Debt

Unsecured Debt Limited to £30,000

Specification: Tobit *LHS Variable:* Value of unsecured debt (£)	(1) 1995	(2) 2000	(3) Random effects
Loan-to-value ratio	2.50** (0.42)	5.76** (0.63)	3.42** (0.4)
H income (£)	0.05** (0.1)	0.06** (0.01)	0.06** (0.01)
H income^2 (£)	-0.0002** (0.00006)	0.00006 (0.00005)	0.00006 (0.00004)
N of benefits (N)	0.23* (0.1)	0.13 (0.16)	0.16 (0.09)
Age	0.13* (0.06)	0.067 (0.08)	0.14* (0.52)
Age^2	-0.002* (0.0006)	-0.001 (0.0008)	-0.002** (0.0006)
N of children (N)	-0.19 (0.11)	0.053 (0.17)	-0.03 (0.1)
Female HofH=1	-0.18 (0.20)	0.48 (0.31)	0.1 (0.2)
Married=1	0.57 (0.26)	0.52 (0.39)	0.54 (0.25)
Employed=1	1.06** (0.38)	1.27* (0.58)	1.01** (0.36)
Retired=1	-0.067 (0.043)	-0.55 0.65	-0.85 (0.4)
Fin. Assets (£)	-0.008 (0.006)	-0.01 (0.008)	-0.01 (0.003)
Fin. Assets^2 (£)	-0.00001 (0.00003)	5.73e-06 (0.00001)	6.23e-06 (9.66e-06)
Saver=1	-0.21 (0.20)	-0.049 (0.3)	-0.24 (0.2)
Smoker=1	-0.029 (-0.20)	-0.03 (0.3)	-0.1 (0.2)
N of obs *Log L* *Wald/LR* χ^2 (19) Prob>χ^2	2369 -3689.52 467.29 0.0000	2569 -4284.48 721.23 0.0000	4937 -8042.22 840.86 0.0000

Notes: Specifications also include constant term and dummies for highest educational qualifications. Coefficient (standard errors in parentheses) are quoted, not conditional marginal effects. To maximise N, random effects specification is an unbalanced panel; authors can provide (very similar) balanced panel estimates on request. **1% level of significance, *=5% level of significance.

Table 3: Unbinding Collateral Constraints : Remortgaging, Changes in Loan-to-Value Ratio and Value of Unsecured Debt 1995-2000

Specification: Probit *LHS Variable:* Prob. of remortgaging 1995-2000	(1) ΔLTV ratio + unsecured debt	(2) ΔLTV ratio*LTV ratio in 95	(3) ΔLTV ratio *unsecured debt in 95	(4) ΔLTV ratio *unsecured debt >£500 in 95
ΔLTV ratio$_{1995\text{-}2000}$	-0.07** (0.02)	-	-	-
Unsecured debt$_{1995}$ in £	0.01** (0.002)	0.01** (0.003)	-	-
ΔLTV ratio$_{1995\text{-}2000}$ *LTVratio$_{1995}$	-	-0.006 (0.004)	-	-
ΔLTV ratio$_{1995\text{-}2000}$ *unsecured debt$_{1995}$	-	-	-0.03** (0.01)	-
ΔLTV ratio$_{1995\text{-}2000}$ *unsecured debt>0.5$_{1995}$	-	-	-	-0.2** (0.05)
H income$_{1995}$ (£)	0.004* (0.002)	0.004* (0.002)	0.004* (0.002)	0.004* (0.002)
H income$^2_{1995}$ (£)	-0.00005* (0.00003)	-0.00005* (0.00003)	-0.00006* (0.00003)	-0.00005 (0.00003)
N of benefits$_{1995}$ (N)	0.02* (0.008)	0.02* (0.008)	0.02* (0.008)	0.02* (0.008)
Age$_{1995}$	0.03** (0.007)	0.03** (0.007)	0.03** (0.007)	0.03** (0.007)
Age$^2_{1995}$	-0.0004** (0.00009)	-0.0004** (0.00009)	-0.0004** (0.00009)	-0.0004** (0.00009)
Employed=1	0.08** (0.03)	0.09** (0.03)	0.09** (0.03)	0.09** (0.03)
Change employed status$_{1995\text{-}2000}$	0.04 (0.03)	0.04 (0.03)	0.05 (0.03)	0.05 (0.03)
Fin. Assets$_{1995}$ (£)	-0.002* (0.0007)	-0.002* (0.0007)	-0.002* (0.0007)	-0.002* (0.0007)
Fin. Assets$^2_{1995}$ (£)	3.31e-06 (2.30e-06)	3.25e-06 (2.03e-06)	3.17e-06 (1.93e-06)	2.90e-06 (1.58e-06)
Change in financial assets$_{1995\text{-}2000}$ (£)	0.0006 (0.002)	0.0008 (0.002)	0.0008 (0.002)	0.0008 (0.002)
Saver=1$_{1995}$	-0.007 (0.02)	-0.009 (0.02)	-0.005 (0.02)	0.00009 (0.02)
Smoker=1$_{1995}$	-0.01 (0.02)	-0.01 (0.02)	-0.02 (0.02)	-0.02 (0.02)
Log L *LR* χ^2 (22 or 23) Prob>χ^2	-665.06 331.06 0.0000	-670.58 320.01 0.0000	-668.52 324.13 0.0000	-662.66 335.87 0.0000

Notes: Coefficient (standard errors in parentheses) are *dF/dX*. N=2006 confirmed. **=1% level of significance; *=5% level of significance.
Specifications also include constant term and dummies for highest educational qualifications, marital status in 1995 and change in marital status 1995-2000, number of children in 1995, whether retired in 1995, and whether female head of household in 1995.
ΔLTV ratio is the predicted change in the LTV ratio given the original mortgage value, and excludes consequences of remortgaging.

Table 4: House Prices and Total Debt: Changes in Total Debt and House Prices

	Non- Movers			Heckman
OLS Estimates Δtotal debt 1995-2000	(1)	(2)	(3)	(4)
Δself-reported house value$_{1995\text{-}2000}$	-0.01 (0.008)	-0.01 (0.008)	-0.01 (0.008)	-0.01 (0.008)
Δself-reported house value$_{1995\text{-}2000}$ *constrained$_{1995}$	-	0.02 (0.03)	-0.05 (0.04)	0.003 (0.03)
Δself-reported house value$_{1995\text{-}2000}$ *constrained$_{1995}$ *unsecured debt 1995>£500	-	-	0.13** (0.05)	0.09* (0.04)
H income$_{1995}$ (£)	0.06 (0.07)	-0.06 (0.07)	-0.07 (0.07)	-0.09 (0.07)
H income$^2_{1995}$ (£)	0.001 (0.0009)	0.001 (0.0009)	0.001 (0.0009)	0.001 (0.0009)
N of benefits$_{1995}$ (N)	0.48 (0.36)	0.49 (0.36)	0.49 (0.36)	0.49 (0.36)
Age$_{1995}$	-0.54** (0.21)	-0.5** (0.21)	-0.48** (0.21)	-0.52** (0.21)
Age$^2_{1995}$	0.005** (0.002)	0.005** (0.002)	0.005** (0.002)	0.005** (0.002)
Employed=1	1.81 (1.51)	1.86 (1.51)	1.83 (1.51)	1.48 (1.52)
Change employed status$_{1995\text{-}2000}$	1.62 (1.2)	1.66 (1.21)	1.68 (1.2)	1.97 (1.2)
Fin. Assets$_{1995}$ (£)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.01 (0.02)
Fin. Assets$^2_{1995}$ (£)	-0.000029 (0.00004)	0.0000006 (0.00004)	-0.000006 (0.00004)	-0.000006 (0.00004)
Change in financial assets$_{1995\text{-}2000}$ (£)	0.01 (0.04)	0.01 (0.04)	0.01 (0.04)	0.01 (0.04)
Saver=1$_{1995}$	-1.06 (0.73)	-1.01 (0.73)	-0.89 (0.73)	-0.58 (0.74)
Smoker=1$_{1995}$	-0.47 (0.74)	-0.49 (0.74)	-0.54 (0.74)	-0.12 (0.74)
R^2 N $F()$	0.04 1564 2.68	0.04 1564 2.62	0.04 1564 2.84	- 2029 -

Notes: Coefficient (standard errors in parentheses). **=1% level of significance; *=5% level of significance. Specifications also include constant term and dummies for highest educational qualifications, marital status in 1995 and change in marital status 1995-2000, number of children in 1995, whether retired in 1995, and whether female head of household in 1995. Note on Heckman: 2566 observations (861 censored, 1705 uncensored). Regressors as table 4.

Figure 1
The financial accelerator

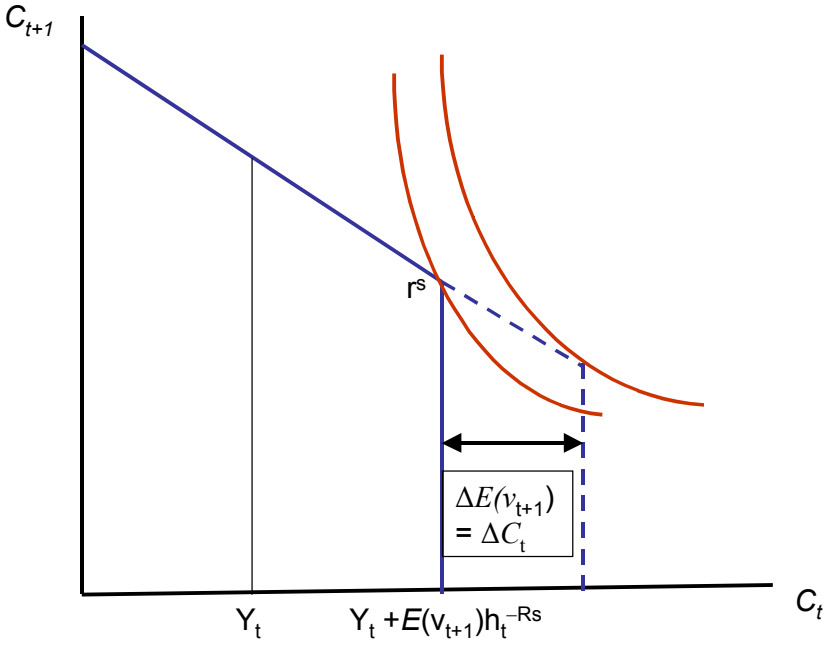


Figure 2
Relaxing the collateral constraint with unsecured debt

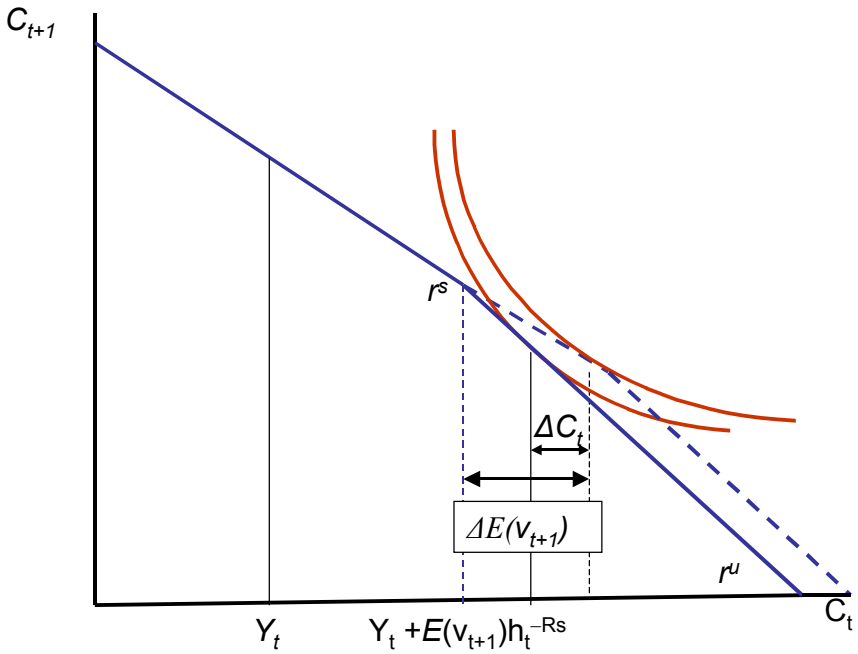


Figure 3
Relaxing the collateral constraint with costs of remortgaging:
Case 1 – no change in debt

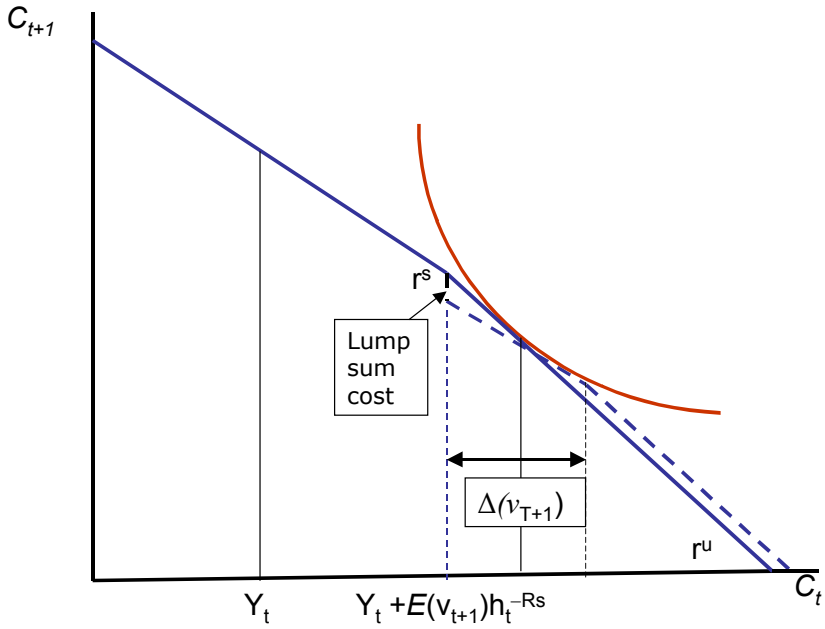


Figure 4
Relaxing the collateral constraint with costs of remortgaging:
Case 2 – refinancing raises debt

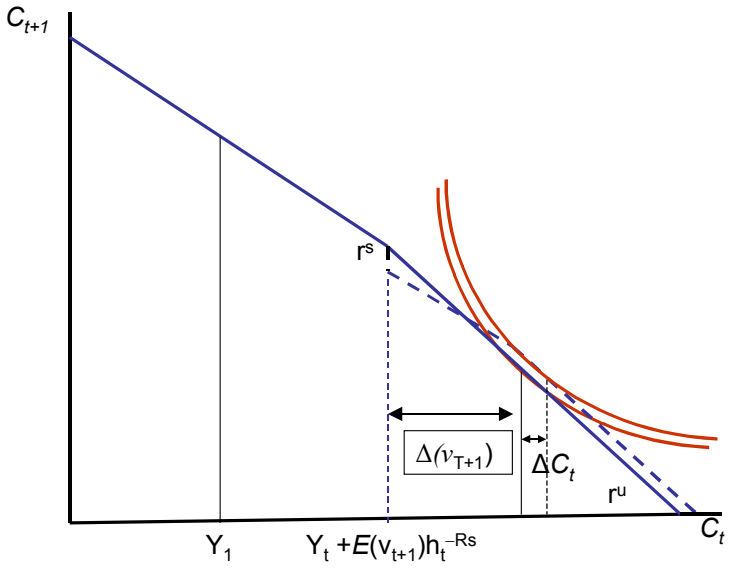
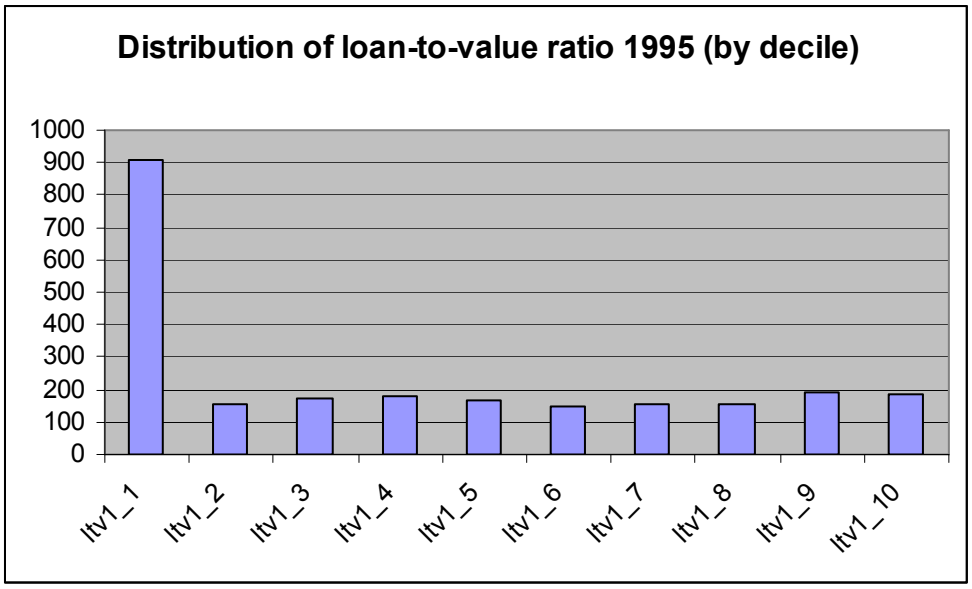


Figure 5

Distributions of loan to value ratios by decile



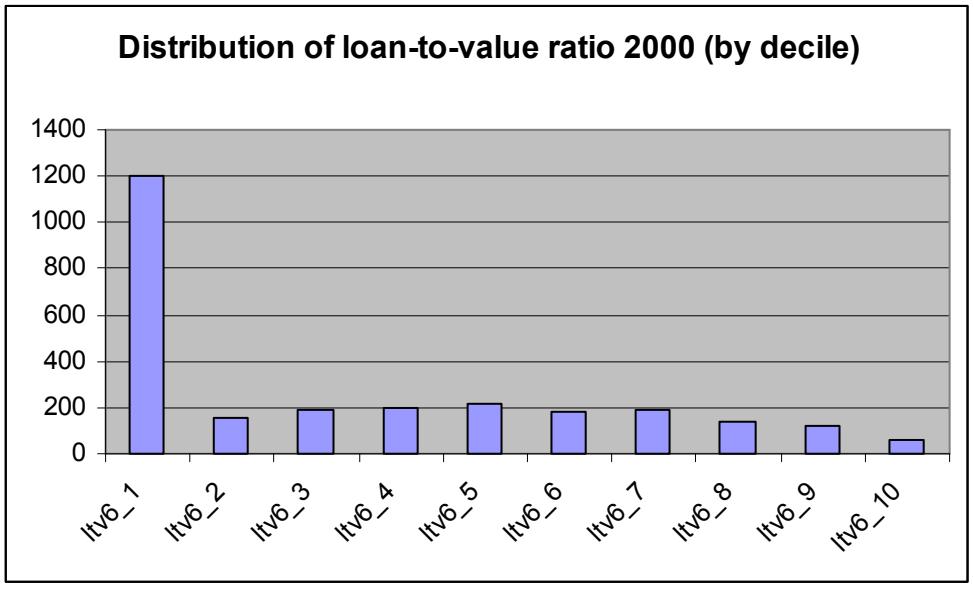


Figure 6

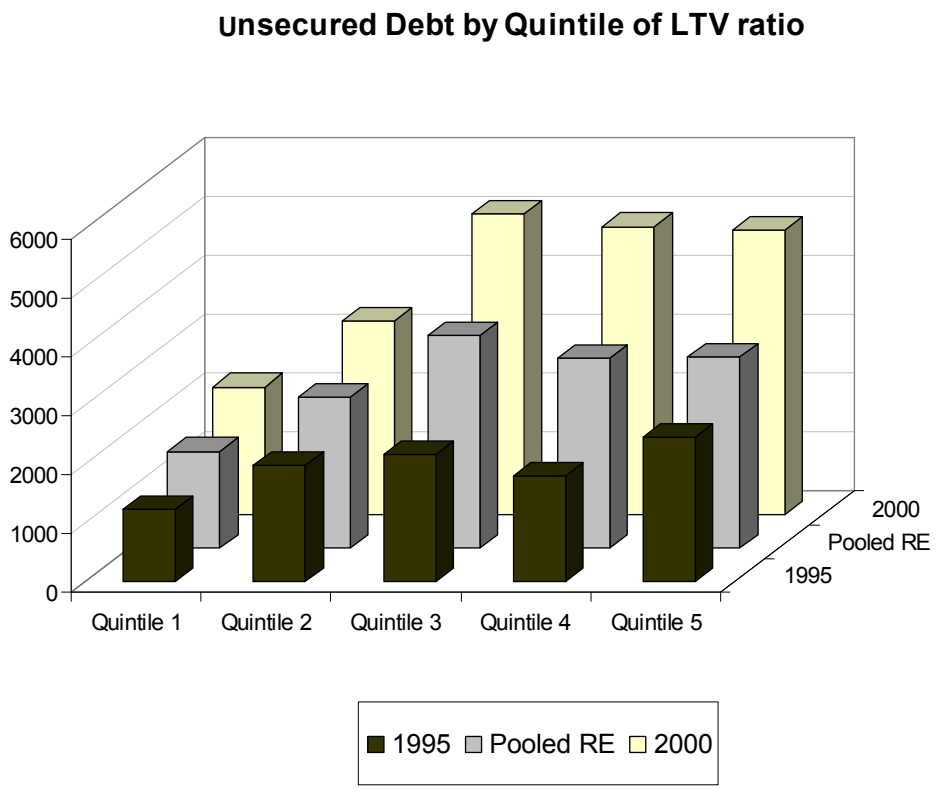

Unsecured Debt by Quintile of LTV ratio
6000
5000
4000
3000
2000
1000
0
Quintile 1
Quintile 2
Quintile 3
Quintile 4
Quintile 5
2000
Pooled RE
1995
1995
Pooled RE
2000

Figure 7

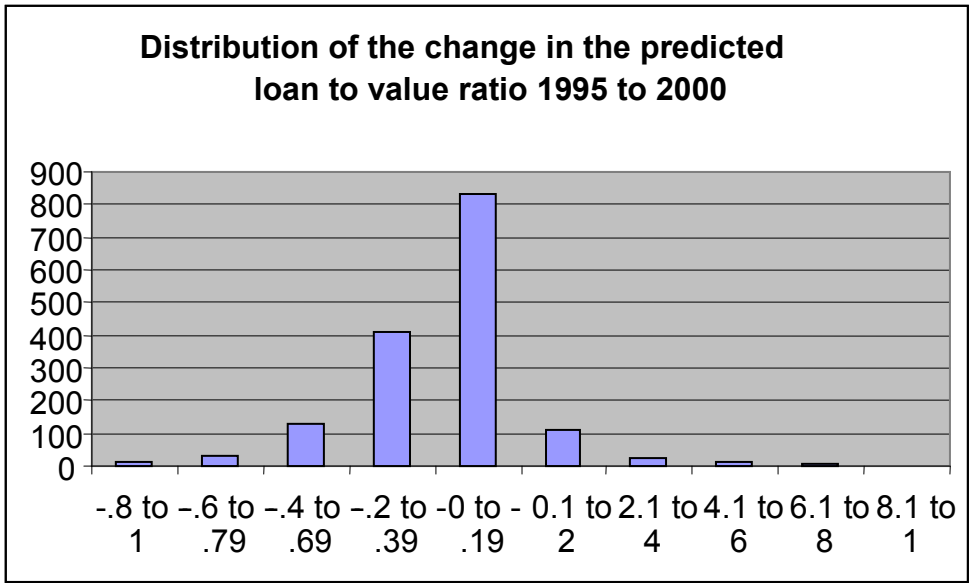
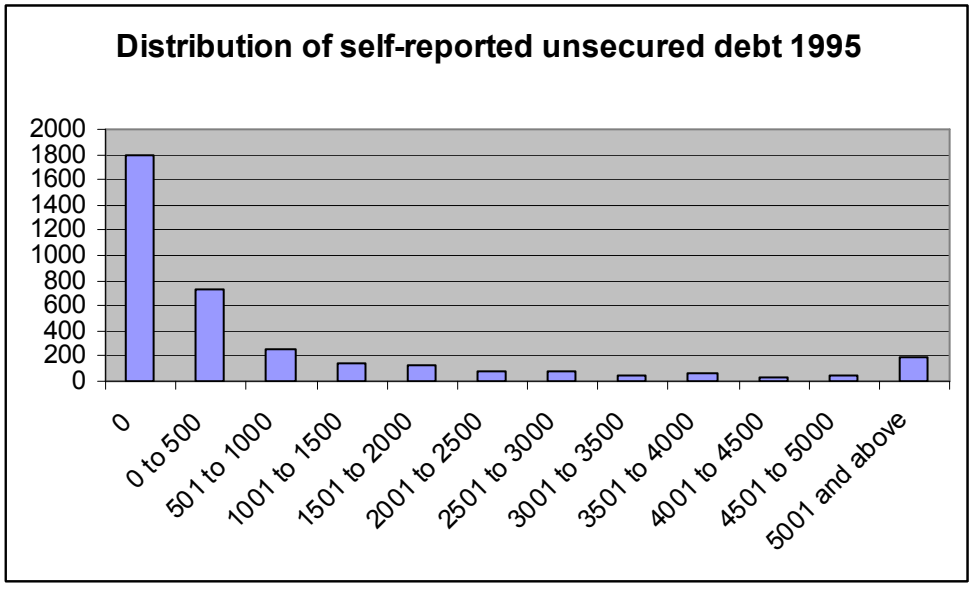


Figure 8



References

Almeida, H., Campello, M. and Liu, C.H. (2005) 'The financial accelerator: evidence from international housing markets', Available at SSRN: http://ssrn.com/abstract=348740

Aoki, K., Proudman, J. and Vlieghe, G. (2004) 'House prices, consumption, and monetary policy: a financial accelerator approach', *Journal of Financial Intermediation*, 13, 414-435.

Bernanke, B., Gertler, M., and Gilchrist, S. (1999) 'The financial accelerator in a quantitative business cycle framework', 1341-1393 in Taylor, J.B. and Woodford, M. (eds) *Handbook of Macroeconomics*, Vol 1C, Amsterdam, Nld: Elsevier Science, North Holland.

Bertaut, C. and Haliassos, M. (2006) 'Credit cards: facts and theories', 181-238 in Bertola, G., Disney, R. and Grant, C. (eds) *The Economics of Consumer Credit*, Cambridge, Mass: MIT Press.

Bridges, S. and Disney, R. (2004) 'Use of credit and arrears on debt among low-income families in the United Kingdom', *Fiscal Studies*, 25, 1-25.

Bridges, S., Disney, R. and Henley, A. (2006) 'Housing wealth and the accumulation of financial debt: evidence from UK households', 135-180 in Bertola, G., Disney, R. and Grant, C. (eds) *The Economics of Consumer Credit*, Cambridge, Mass: MIT Press.

Case, K. (2000) 'Real estate and the macroeconomy', *Brookings Papers on Economic Activity*, 2, 119-162.

Carroll, C. (2004) 'Housing wealth and consumption expenditure', mimeo, Department of Economics, John Hopkins University, Baltimore, Md.

Davey, M. (2001) 'Mortgage equity withdrawal and consumption', *Bank of England Quarterly Bulletin*, 41, 100-103.

Disney, R., Henley, A. and Jevons, D. (2003) 'House price shocks, negative equity and household consumption in the UK', *mimeo*, University of Nottingham, as: http://www.nottingham.ac.uk/economics/staff/details/richard_disney.html.

Iacoviello, M. (2004) 'Consumption, house prices, and collateral constraints: a structural econometric analysis', *Journal of Housing Economics*, 13, 304-320.

Iacoviello, M. (2005) 'House prices, borrowing constraints, and monetary policy in the business cycle', *American Economic Review*, 95, 739-764.

Lamont, O., and Stein, J. (1999) 'Leverage and house price dynamics in US cities', *Rand Journal of Economics*, 30, 498-514.

Appendix: Questions in the British Household Panel Survey 2000 concerning debt and related issues

Unsecured debt instruments:

Debt instruments: respondents are asked whether they have store cards, credit cards, personal loans etc.

Indebtedness:

Respondents are asked 'about any other financial commitments you may have apart from mortgages and housing related loans. Do you currently owe any money on the things listed on this card? Please do not include credit cards or other bills being fully paid off in the current month.'

Hire purchase
Personal loan (from bank, building society, or other financial institution)
Credit card(s) (including store card)
Catalogue or mail order purchase
DSS Social Fund loan
Loans from individual
Overdraft
Student loan
Anything else?

In 1995, 'student loans' are not separately identified

If owes money
Asked how much in total is owed? In nearest pounds, or:

If don't know, the following series of questions is asked to determine a band for debt

Would it amount too?

a) 500 or more? (if yes, ask (b), if no, ask (d)
b) 1500 or more? (if yes ask (c))
c) 5000 or more?
d) 100 or more?

Saving

Other financial investments: Respondents are asked how much they hold in: premium bonds; unit trusts / investment trusts; Personal Equity Plans; shares (UK or foreign); National Savings Bonds (capital, income or deposit); other investments, government or company securities.

Respondents are also asked: 'Do you save any amount of your income, for example by putting something away now and then in a bank, building society or post office account other than to meet regular bills? Please include share purchase schemes and Personal Equity Plan schemes.' If respondents do save some money each month they are asked how much.

Secured debt

Respondents are asked to state the total amount of outstanding loans on all property they or a member of their household own. Respondents who have a mortgage are asked to state the size of their last total monthly instalment on the mortgage.

Remortgaging: they are asked whether they have taken out any additional mortgage or loan on their house/flat since the last survey and if so, the amount of the additional mortgage.

Housing wealth

Households who own their home or who are buying it with a mortgage are asked to provide an estimate of the current value of their house.

Selected descriptive statistics (pooled 1995/2000 BHPS)

Variable	*Mean*	*Std. Dev*
Age (years)	48.9	15.4
Household income (£000)	19.8	17.2
Total N of social security benefits received	1.38	1.34
Prob. of being homeowner	0.73	
Financial assets (saving accounts + investments) (£000)	10.2	32.7
Value of property (£000)	95.0	75.8
Total mortgage (£000)	20.5	37.3
LTV ratio	0.39	0.49
Net housing equity (£000)	15.1	43.3
Does respondent or partner save from current income (SAVER)	0.50	
Value of self-reported unsecured debt (£000)	1.8	5.0
Prob. have credit or store card	0.63	
Prob. owes money – not rotating – on card	0.22	
Prob. owes money on catalogue or mail order	0.16	
Prob. owes money on personal loan	0.20	
Prob. Of being a smoker	0.33	

Footnotes

[1] The use of 'voluntary termination' is well known in automobile finance in the UK, especially among sub-prime lenders. Under consumer credit legislation, borrowers are allowed to return the debt-financed purchased good in order to terminate immediately the loan contract. This measure, brought in to protect borrowers (and lenders) where a household has engaged in excessive purchase on consumer durables and consequent problems of indebtedness, is often used in practice by consumers where their preferences, economic conditions or general consumer tastes have changed and the consumer no longer wants to pay off the loan.

[2] To simplify notation, we assume that the household can borrow exactly the amount of the expected value of its collateral, not a multiple or fraction of that value. The process of 'financial liberalisation', as occurred in the UK in the late 1970s and several European countries in the 1980s, can be regarded as a process by which this fraction, or multiple, is raised.

[3] Thus we leave aside for the present the issue of why households might choose to borrow unsecured when they have not yet exhausted their lines of secured credit (see Bertaut and Haliassos, 2006). We suggest later that this may be because changing the value of secured debt (as household circumstances change) may involve significant transactions costs (i.e. remortgaging). Households may only engage in changes in the value of secured debt in the event of major 'shocks' such as changes in family composition or changes in employment status (e.g. moving job, losing a job or retiring from the labour force) or, as the model suggests here, when the overhang of unsecured debt is substantial at a time when a collateral constraint is alleviated.

[4] Since 'households' may include several family members that do not share resources, we follow standard practice and take as the 'household' the 'benefit unit' – that is, the household as defined for receipt of welfare benefits (this would also be the 'tax unit' except that in the UK, income tax is now individually assessed, although tax credits are assessed at household level).

[5] Very similar results are obtained if we simply pool both years, or run regressions on the 1995 and 2000 waves separately. Results are available on request from the authors.

[6] We interpret the absolute value of the coefficient as the effect of moving from a LTV ratio of 0 to 1.

[7] For further evidence on the degree of variation, see Disney, Henley and Jevons (2003).

[8] We could also instrument the change in house values, rather than using self-reported changes. In Disney, Henley and Jevons (2003), county-level house price changes are used to instrument self-reported variations in house prices over time. This of course imposes restrictions on within-county and across household-type variation in prices.

[9] A telling statistic is that, although roughly half of the sample had no unsecured debt in 1995 (see Figure 8), all the households that remortgaged between 1995 and 2000 had positive unsecured debt in 1995.