CFCM

CENTRE FOR FINANCE AND CREDIT MARKETS

Working Paper 06/01

Housing Wealth and Household Indebtedness: Is There a Household Financial Accelerator?

Sarah Bridges, Richard Disney & John Gathergood

Produced By:

Centre for Finance and Credit Markets
School of Economics
Sir Clive Granger Building
University Park
Nottingham
NG7 2RD

Tel: +44(0) 115 951 5619
Fax: +44(0) 115 951 4159
enquiries@cfcm.org.uk

CFCM

12 December 2006

Housing Wealth and Household Indebtedness: Is there a Household 'Financial Accelerator'?

by

Richard Disney†, Sarah Bridges* and John Gathergood*

Abstract

The 'financial accelerator' model when applied to households states that shocks to household balance sheets (primarily changes in house prices) amplify fluctuations in consumer spending by tightening or relaxing collateral constraints on borrowing. We construct an alternative model where households also have access to unsecured debt, and examine the effect of shocks to house prices on debt-financed consumption in this augmented setting. Our alternative model 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 panel data for the United Kingdom that allow us to measure collateral constraints, changes in asset values and financial indebtedness at the household level.

Key words: Housing wealth; collateral; unsecured debt; consumer spending

JEL classification: D12 D14 R21

---

* Centre for Finance and Credit Markets, School of Economics, University of Nottingham
† Centre for Finance and Credit Markets, School of Economics, University of Nottingham and Institute for Fiscal Studies, London.
Corresponding author: Disney, School of Economics, Sir Clive Granger Building, University of Nottingham, Nottingham, NG7 2RD Tel: (44) 1159 515619 Fax: (44) 1159 514159 email: richard.disney@nottingham.ac.uk

We should like to thank Experian-Scorex for part-funding of this research, Andrew Henley of the University of Swansea for the constructed mortgage data described in the paper, and the ESRC Data Archive for providing the BHPS data. Comments on successive drafts have been gratefully welcomed from participants at a Finance and Consumption workshop on credit markets at EUI Florence, at the 2nd CSEF-IGIER symposium C6 in Capri, at a workshop on household debt at the University of Reading, and the MMGD conference at the University of the Algarve, and at seminars at the Bank of England, the Czech National Bank, and the universities of Loughborough, Nottingham and St Andrews.

Housing Wealth and Household Indebtedness: Is there a Household 'Financial Accelerator'?

1. Introduction

This paper uses household panel data to explore the relationship between changes in house prices and household indebtedness (both secured on housing assets and unsecured) in the United Kingdom (UK). The UK is a particularly good test-bed for examining this issue because, as in the United States (US), housing wealth is the dominant asset in many household portfolios. In fact, Banks, Blundell and Smith (2003), using comparable UK and US data sets, suggest that the value of home equity accounts for 60% of household financial wealth in the UK, almost twice the fraction for the US. Moreover, following the deregulation of the United Kingdom's mortgage lending market in the period 1980 to 1986 (on which, see Muellbauer and Murphy, 1990; Attanasio and Weber, 1994; and Aoki et al, 2004), UK lending to households secured on housing wealth has grown rapidly.

Rising house prices have been associated with growing equity withdrawal from housing in the UK. Chart 1 confirms that, since the 'boom-bust' in house prices from the mid-1980s to the early 1990s, UK house prices have grown strongly. It also shows that net aggregate 'housing equity withdrawal' (HEW) as a proportion of household disposable income – calculated by the Bank of England as the difference between borrowing secured on housing and investment in housing, tends to follow house price changes, albeit with a lag of 2 to 3 years.[1] House price 'shocks', with the value of nominal secured debt held constant, may thereby amplify the response of household consumption spending to changes in nominal incomes – a variant of the 'financial accelerator' model developed by Bernanke et al (1999) (see Aoki et al, 2004). The implications of this relationship between house price volatility and household indebtedness has been of concern to central bankers, not least the Bank of England.

The upward trend over the period from 1993 onwards in household debt secured on housing – primarily mortgages – relative to household disposable income

[1] HEW, or 'mortgage equity withdrawal' in Bank of England parlance, is defined as the difference between net borrowing secured on property (largely mortgages) plus grants, minus purchases of houses, home improvement, moving costs and transfers such as land purchases for housing development. See Davey (2001).

is illustrated in Chart 2, with growth accelerating in the late 1990s as house price growth also accelerated. It is also noticeable from the chart that *unsecured* consumer debt has risen as a share of disposable income in the same period, albeit at a somewhat faster rate in the first part of the period than the second.[2] Unsecured debt includes outstanding balances on credit and store cards, unsecured loans from finance companies and banks, hire purchase agreements, purchases from mail order catalogues and so on. Financial liberalisation and increased competition in the credit supply market have also been important influences underpinning the growth of unsecured debt, but it is apparent that the trends in secured and unsecured debt are somewhat different over the period.

Households that are collateral constrained – that is, limited in their secured borrowing by low or zero housing equity – are particularly likely to respond to rising house prices by increasing their indebtedness in order to finance consumption. Recently Campbell and Cocco (2006), using a 'quasi-panel' of UK households, have argued that there is a very strong relationship between changes in house prices and household consumption in the UK, with implicit elasticities of 1.3 to 1.9 of consumption changes to house price changes, which, for average values of housing wealth and consumption, translate into a marginal propensity to consume out of housing wealth of between 0.8 and 1.2 (*ibid*, p.11). This range of parameter estimates is very much in line with estimates derived from more structural models in which household consumption growth is directly linked to the ability of households to increase their debt by securing it on the value of their house – for example it happens to be exactly the range of parameter values derived from aggregate Euler equations of the impact on consumption of housing prices using US data by Iacoviello (2004).

The starting point of the present study therefore is to examine the extent to which the observed co-movement in house prices and debt-financed consumer spending might be attributed to the collateral role of housing. This study then makes two new contributions. First, it augments the collateral constraint model of debt-financed consumption by explicitly modelling the role of unsecured debt as an alternative to secured debt. If households are able to borrow on an unsecured basis, then unsecured debt is a potential substitute for secured debt. It is then straightforward

[2] Unfortunately, a major change in definitions of secured and unsecured debt in the Bank of England data in 1993 preclude an examination of trends over a longer period.

to demonstrate that the collateral role for housing is weakened and house price shocks will have a smaller effect upon consumption. The relationship between changing household wealth and the growth of total debt-financed consumption of households is then less clear-cut than is suggested by the basic 'financial accelerator' model. This phenomenon of debt substitutability is not captured by structural models of the household financial accelerator nor estimated in existing empirical studies using aggregate series or household data.

Second, whereas previous studies have instrumented the collateral constraint using either an excess-sensitivity test (as in Campbell and Cocco, 2006) or an indicator of aggregate credit market conditions (as in Aron and Muellbauer, 2006), we directly measure the evolution over time of household-specific loan-to-value ratios using self-reported responses about house value and calculated outstanding mortgage debt. Moreover, in contrast to previous studies on the relationship between housing and consumption in the UK, we estimate the impact of house prices directly on changes in *total* household indebtedness (including unsecured debt) rather than consumption.

The panel dimension of our data is crucial for our empirical work. Using a panel of UK households, the British Household Panel Survey, which collects annual data on housing wealth and secured debt, and detailed information on financial assets and unsecured debt in two waves – 1995 and 2000, we can observe heterogeneity in responses to household-specific collateral constraints relaxing over time. In contrast to the existing literature, we can precisely identify those households which exhibit the strongest responses to rising house prices.

Our approach and main results are as follows. Section 2 briefly summarises the literature underlying the relationship between housing wealth, consumption and indebtedness. We differentiate models that rely on a pure wealth effect of house price 'shocks' from those where the 'route' is through house price changes relaxing or tightening collateral constraints. There are in contrast a few papers that consider only unsecured debt, in which alternative mechanisms to a collateral constraint are required to limit household borrowing. Most of the literature considers either secured or only unsecured debt, or assumes that secured and unsecured debt are implicit complements. In contrast, we outline heuristically a model where secured and unsecured debt are substitutes, not complements, allowing households at the limit of

their secured debt capacity to unbind a potential collateral constraint. This model serves to weaken the 'financial accelerator' effect of changes in collateral values.

In Section 3, we examine the evidence from our data on the fraction of households that are collateral constrained. We show, using measures of loan-to-value ratio and net household wealth, that only a relatively small proportion of households fall into this category. We contrast this finding with assumptions made in other studies and address why we obtain it. We also show in this section that use of unsecured debt is a pervasive phenomenon among UK households, that access to unsecured debt is not dependent on the *value* of collateral; and that controlling for life cycle effects, demographics and proxies for preferences, collateral-constrained households use unsecured debt more than unconstrained households.

In Section 4 we consider the impact of house price shocks. We show that households re-mortgage (increase their secured debt) in response to the relaxing of collateral constraints by house price increases if they previously had high holdings of unsecured debt – this suggests that households primarily use changes in wealth values to rebalance their debt portfolio towards lower-priced secured debt. We also calculate the aggregate *net* effect on total debt from house price changes. Not surprisingly, given the relatively low fraction of collateral-constrained households and the way in which households on their constrained margin substitute unsecured for secured debt, we find that the *macroeconomic* consequences of house price changes on debt-financed consumption are considerably smaller than those obtained by studies using time series and cross-section methods based on widespread collateral constraints. We estimate an average aggregate marginal propensity to increase household net borrowing in response to an increase in house prices of around 0.03 – varying from almost 0.4 for highly levered households to zero for households with very low loan-to-value ratios. We consider how this conclusion 'fits' with other studies that find much stronger relationships between changes in housing wealth and consumption and consider alternative explanations in our concluding section.

2. Previous literature, and secured and unsecured debt

2.1. Existing theory and evidence

The existing literature draws two links between changes in house prices and household consumption. The first is that 'surprises' to the value of housing wealth (or indeed to other financial assets) shift the intertemporal budget constraint and induce households to change their consumption, in line with the standard LCH/PIH model of consumption (for representative studies on housing wealth for the US using household data, see Bhatia, 1987; Case, 2000; Carroll, 2004; Engelhardt, 1996; Skinner, 1989; recent studies for the UK include Attanasio *et al*, 2005, Campbell and Cocco, 2006; Disney, Henley and Jevons, 2003).

Measured housing wealth-induced effects on household consumption through this 'route' may be rather small in practice for two reasons: first, because of measurement errors in modelling 'shocks' to housing wealth as residuals from some autoregressive process, and secondly because of redistributive effects insofar as the wealth gains to potential home 'downsizers' (primarily households later in the life cycle) will be offset by the adverse impact on potential 'upsizers' (such as young renters and first-time homeowners). For the UK, Campbell and Cocco (2006) estimate that the elasticity of consumption to 'surprises' to housing wealth is 0.5 – far lower than their elasticity of changes in consumption to average changes in house prices described in the earlier section and implying a much lower marginal propensity to consumer out of housing wealth of around 0.03. The other cited UK studies find similar, or even lower (and less precise) estimates. Moreover, Campbell and Cocco's prediction that older homeowners should have higher consumption responses to house prices shocks is contradicted in the study by Attanasio *et al* (2005).

The second 'story', which is our main focus here, arises because households (potential borrowers) and lenders have asymmetric information on default risk that induces lenders to require the posting of collateral as a pre-requisite to lending money to homeowners (as in Bernanke *et al*, 1999). Since housing wealth is the dominant source of collateral available to households, changes in housing wealth affect the borrowing capacity of impatient consumers (that is, households which have borrowed up to their 'collateral constraint'). In this setting, there may be excess sensitivity of debt-financed consumption to changes in house prices among such consumers

because the changes in nominal values of income and wealth contrast with a fixed nominal value of mortgage debt. The process by which changes in housing wealth have a disproportionately large impact on consumption through tightening or relaxing collateral constraints is sometimes termed the 'financial accelerator' (as in Aoki *et al*, 2004) although in GE-models with firms and households there may be both financial accelerators and 'decelerators' at work (Iacoviello, 2005).

There is now a rapidly expanding number of studies on household consumption and housing wealth which utilise collateral constraint models to rationalise the observed relationships (see *inter alia:* Alemeida *et al*, 2005, Aoki *et al*, 2004, Calza *et al*, 2006; Iacoviello, 2004, 2005; Lamont & Stein, 1999; Ortalo-Magné and Rady, 2006). To our knowledge, almost all these studies use calibration methods, aggregate data or cross-region or cross-country panels in order to investigate the implications of collateral constraints. Perhaps surprisingly, few if any of these studies have made serious efforts either to measure either the pervasiveness of collateral constraints using data drawn from household surveys, or the association of (changes in) collateral constraints with (changes in) secured household debt rather than total consumption, although the link between household-specific collateral and indebtedness is central to the 'financial accelerator' hypothesis.[3]

There is a further, theoretical, issue. In the imperfect capital market literature, potential borrowers generally face a spectrum of contracts with different interest rates, depending on how much collateral they can offer (as in, for example, Bester, 1985; and Milde and Riley, 1988). Thus there is not a single 'collateral constraint' but rather a non-linear budget constraint over which agents face different marginal interest rates according to their desired borrowing (determined by preferences given characteristics) and their asset structure. Specifically, households can borrow both secured against their property and unsecured. Much of the existing literature using the household 'financial accelerator' either assumes that unsecured borrowing is prohibitively expensive, or contingent on secured borrowing. If neither of these

[3] There is some analogy with the evolution of the investigation of liquidity constraints. It initially used aggregate data and/or simulation methods – whereas later investigations by Jappelli and Pagano (1989) utilised cross-country household data to investigate the pervasiveness of such constraints. However there are intrinsic difficulties in measuring the extent of liquidity constraints across households – see Duygan and Grant (2006) for some cross-country evidence – whereas collateral constraints are in principle much easier to measure.

statements is true (as we show to be the case in the UK), then the impact of house price changes on debt-financed consumption is not the same as in the simple secured debt-only case.

There is an alternative, and smaller, literature that focuses on *unsecured* debt and household consumption, as in Chatterjee *et al* (2005). Here, the constraints on household borrowing stem from the supply side – that is, the threat of default risk limits the supply of credit to any household (see also Gross and Souleles, 2002). The unsecured debt literature models the sources of default risk and the optimal strategy of credit providers. It has been argued that a model in which there is simply a ceiling on the *supply* of credit to any household, rather than one specific to its structure of asset holding, provides more straightforward modelling and testable predictions (Kehoe and Levine, 2001) – in contrast, the introduction of default risk into the standard collateral constraint model of debt-financed consumption complicates the predictions of a financial accelerator (Elul, 2006). In general, a model in which access to unsecured debt is dependent on having some form of collateral but is not (positively) related to the *value* of that collateral seems to accord more closely with the facts of household indebtedness – see below for further discussion.

2.2. **Secured and unsecured debt**

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 first and perhaps subsequent house purchases. However households 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. Unlike other assets, houses generally appreciate in value.[4] Home ownership is associated with lower residential mobility than tenancy (a key attribute in obtaining a good credit 'score') and indicates other household characteristics such as potential stability of the household structure, prospective job tenure etc. In addition, a mortgaged property signals that the household has previously been successful in obtaining credit. In the UK context, the positive relationship between home ownership *status* and access to unsecured debt stems from credit scoring methods rather than indirect collateralisation of unsecured debt (Bridges, Disney and Henley, 2006). We show in the next section that access to unsecured debt typically depends on the household having some collateral but not on the *value* of that collateral.

As to interest rate differentials, Chart 3 demonstrates that, in general, the average differential between interest rates on unsecured and secured loans has significantly diminished in the UK in the past 15 years. Interest rates on secured mortgages have fallen slightly but have remained broadly stable given general price stability over much of the period. UK mortgages are predominantly variable rate and track nominal interest rates, although term-fixed and discounted rates are also common on new loans. Refinancing or changing mortgage conditions often incurs a flat rate fee.

As the chart also shows, interest rates on unsecured loans from banks and from finance companies have diminished over the period, reflecting increased competition and greater sophistication in credit scoring. However, unsecured loan interest rates are typically much more heterogeneous across customers and, with the growth of the sub-prime loan market, the market has widened to incorporate higher risk borrowers, so that this composition effect of greater risk diversity has partially offset the downward trend in average rates. Finally, although credit card interest rates still

[4] Loan terminations that involve return of other assets, such as cars, white goods and household effects are generally not welcomed by loan companies in the UK – the trade resale values of such assets are generally low and they are not effectively treated as 'collateral'.

remain significantly higher than rates of secured debt (despite the significant fall in the early 2000s illustrated in Chart 3), increased competition has tended to eliminate charges for card ownership and other transactions costs. Moreover, much of this credit is revolving credit.[5] The pervasive use of unsecured credit and the reduced differential between interest rates on secured and unsecured debt over time suggest that the demand for unsecured debt should be incorporated explicitly into the model and not treated as an adjunct to secured debt.

The standard collateral constraint model is formalised in Appendix 1 to this paper. The implications of the model – in particular the implied 'financial accelerator – can be illustrated graphically. In Figure 1, denote consumption by c, income by y, net financial assets (cash-in-hand) by a, units of housing held by h and price per unit of household v, and periods are denoted by $t, t+1$. The household can borrow secured against its housing wealth at interest rate r^s, with γ measuring the fraction of the house value against which the household can borrow $0<\gamma<1$.[6] The budget constraint has a cliff non-convexity where the collateral constraint 'bites': that is, the maximum that the impatient household can consume in period t is its current income and cash-in-hand, plus the expected value (to the lender) of the value of its house, discounted at the rate of interest on a loan secured on the collateral. A rise in the house price, as illustrated by Δv, allows the household to increase its consumption up to (or within) the budget constraint augmented by the higher value of the collateral. If the value of the collateral is higher than per period consumption spending, this gives rise to a 'financial accelerator' stemming from changes in the collateral constraint.[7]

Figure 2 illustrates an augmented model, which underlies the empirical analysis in the next section, in which the household on the collateral constraint kink point has the opportunity to obtain unsecured debt at rate $r^u > r^s$. The consumer now faces a non-linear budget constraint but can reach an equilibrium solution as illustrated here where the marginal utility of consumption is equated to the rate of

[5] According to Bertaut and Haliassos (2006), a significant proportion of US consumers do not pay off credit card balances even when cheaper finance is available to the household. The UK evidence suggests that this practice is common, but not as pervasive, and that many people are primarily credit revolvers (Tudela and Young, 2003).

[6] In the Appendix, we assume without loss of generality that $\gamma=1$.

[7] A general rise in prices reduces the real value of mortgage debt and increases housing equity. However, with variable interest rates, consumer spending on housing will also rise. This serves to dampen any wealth effects but still unbinds the constraint in the manner indicated in Figure 1.

interest on *unsecured* debt.[8] The unbinding of the collateral constraint, as in the previous case, allows the household to change its level of consumption spending. In the example of behaviour illustrated here, the household chooses to refinance its debt, substituting some debt secured on the higher value of its collateral for unsecured debt. The wealth effect arising from the reduction in the average interest rate on its borrowing allows it to increase its consumption spending so that the new equilibrium can involve no use of unsecured debt (as here), or a higher proportion of secured debt in its portfolio, or an equilibrium on the new kink point. Whatever the outcome, the net effect on household spending, whilst positive, is dampened relative to the simple 'financial accelerator' model depicted in Figure 1. Indeed where, as in practice, there are transactions costs involved in refinancing secured debt, there will be a discontinuity at the original kink point in the budget constraint and the household may not change its debt structure or debt level at all should the costs of refinancing outweigh the gains to be had in reducing the average interest rate of its debt portfolio.

3. Collateral constraints and household debt: Empirical evidence

3.1. **Data**

To investigate these hypotheses, 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.

Aside 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

[8] As indicated in the discussion in the Appendix, a formal solution of this problem would have the household endogenising the kink point in the budget constraint. There will be several outcomes, depending on whether we obtain interior solutions on the segments of the non-linear budget constraint or remain at a kink point. This is not easily tractable analytically for reasonable specifications of preferences. Rather than solve the problem numerically, we use this illustration to motivate the empirical analysis of the next section.

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 assign the median for those households who report banded information.

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 household's *loan-to-value ratio (LTV)* since this is a direct indicator of whether the household is facing a collateral constraint.

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, 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.

Appendix 2 describes some of these questions in the BHPS on greater detail and provides descriptive statistics of the data set for 1995 and 2000.

3.2. **Which are the collateral constrained households?**

At the heart of the collateral constraint model is the presumption that, for a significant fraction of households, the collateral constraint is binding. For example, Aoki *et al* (2004) assume that the proportion of collateral constrained households in the UK is 50%. In Iacoviello (2004, 2005), the proportions are 25% and 36% respectively. Earlier work by Campbell and Mankiw (1989) differentiating 'life

cycle' from 'rule of thumb' consumers (arguably the latter can be regarded as credit constrained) takes 40% as the proportion of the latter in the population. Many of these studies implicitly rely on external evidence of credit constraints from studies in the United States such as that of Jappelli (1990) rather than from self-constructed estimates. It should therefore be noted that estimates from US household studies generally put the proportion of credit-constrained households at no more than a quarter of the population, rely on measures of self-reported credit refusals, and that estimates for the United States of credit constraints based on self-reported refusals are much higher than for other countries.[9]

Table 1 describes the sample fractions with different loan-to-value (LTV) ratios across households in our data for 1995. Collateral constraints typically bind below LTV ratios of 1 and remortgaging is costly. To benchmark an estimate of the appropriate LTV that defines the collateral constraint, according to the Halifax Bank (the largest UK mortgage lender), in 1995 its mortgage lending limit to households was 90% or 3.5 times household gross income (whichever value was lower). From 1999 the income multiples limit was abolished in favour of an affordability criterion. The Halifax reported an actual average LTV of first-time buyers in 1995 was 0.81.[10] Among our sample, as Table 1 shows, we calculate that 13% of homeowning households had LTVs greater than 0.9 in 1995, and nearly one quarter exhibited LTVs over 0.8. At a LTV ratio of 0.65, we still observe less than 40% of households in this category. Rising house prices between 1995 and 2000 reduced the proportion of households in each of these categories still further.

All this suggests that the typical proportions of collateral constrained households assumed in some of the models based on calibration and/or macroeconomic data may be too high to fit recent UK experience. In fact we show later that our estimates of the macroeconomic effects of house price changes on indebtedness are not too sensitive to the exact cut-off at which we define the collateral constraint so long as the constraint is defined as a LTV ratio of at least 0.65.

---

[9] See Duygan and Grant (2006). Lower self-reported credit constraints for other OECD countries may of course simply reflect a greater incidence of discouraged borrowers who do not expect to be offered credit, but this finding nevertheless suggests that caution should be exercised in using the self-reported incidence of credit constraints.

[10] This information was obtained from correspondence with the Halifax Bank.

As an alternative measure of credit constraints, Chart 4 illustrates the distribution of household net worth among homeowners in our sample for 1995, 2000 and averaged over the two years. We calculate net worth as the nominal value of housing plus financial assets (cash in hand) plus monthly income minus the value of mortgage debt and minus the value of unsecured debt. Only 3-4% of homeowning households have negative or zero net worth overall (again, slightly larger in 1995 than 2000) and 18% of the sample had less than £20000 net worth on average over the period. Again, these are relatively small proportions of the sample of homeowners.[11]

3.3 **Collateral constraints and unsecured debt: UK cross-section evidence**

We now consider the evidence from our data set on whether UK households are able to use unsecured debt to unbind collateral constraints. As a preliminary step, we examine whether access to, and use of, unsecured debt is related to the value of collateral held by households.

We pool the data from the two waves of the household panel survey which contain information on financial debt in order to examine access to various forms of unsecured debt among all households. We use random effects estimators and a standard set of controls, including demographics, employment status, qualifications, access to social security benefits and proxies for preferences. The most interesting coefficients for our hypothesis are described in Table 2.

The table shows that owning a home, whether mortgaged or unmortgaged, is positively associated with use of unsecured debt instruments in the form of access to credit, debit and store cards, borrowing on credit, debit and store cards, owing money on unsecured personal loans, and the total value of unsecured debt. We interpret these results as primarily a credit-scoring effect, with debt providers using home ownership as a proxy for various dimensions of household stability. The exception is the coefficient for debts on catalogue or mail order purchases, where the coefficient on home ownership is negative and insignificant. Such a means of purchase is very much an inferior good, used pervasively by poorer families and those without assets (Bridges and Disney, 2004). Typically, purchases from mail order catalogues do not involve any credit screening prior to purchase.

[11] Not surprisingly, non-homeowners have much lower levels of net worth: for evidence see Bridges and Disney (2004).

In contrast, the coefficients on the *value* of home equity and use of unsecured debt are largely negative – higher values of home equity are associated with lower values of outstanding debt and use of various unsecured debt instruments. Only the positive coefficient on access to credit, debit and store cards suggests that higher collateral values allow access to more debt. Of course, these are reduced form regressions that do not separately permit us to identify supply and demand factors and we are likely observing that households with higher asset values demand less unsecured debt. But a plausible reading of the difference in coefficients between ownership and the value of collateral is that it is home ownership *per se* that is associated with access to many unsecured debt instruments rather than differences in the value of the home.

The estimates in Table 3 provide an examination of the hypothesis that impatient households use unsecured debt to unbind constraints on collateral-based lending, as illustrated in Figure 2. Here, we examine the relationship between the underlying loan-to-value (LTV) ratio (that is, with mortgage debt predicted from the characteristics and initial value of the mortgage rather than self-reported current value) and the value of unsecured debt for both years and pooled across the years.[12] The Table shows a strong and significant positive relationship between the LTV ratio and the size of unsecured debt, exactly as our theory would predict – an interpretation of the magnitude of the coefficient is discussed shortly. The quadratics in income and age are also significant and the level term in the value of financial assets is also significant in the random effects specification. Households where the head of household is employed are more likely to have more unsecured debt; other variables are largely insignificant including the proxies for preferences ('regular saver' and smoking).

Table 3 imposes a linear relationship between LTV ratio and the value of unsecured debt. This is consistent with our 'story', insofar as when the LTV ratio rises, the household can anticipate a greater probability that the collateral constraint will bind and it will be forced to access unsecured debt instruments to carry out desired borrowing. However, it seems likely that the probability of the constraint binding is low at low levels of the LTV ratio, even when the LTV ratio is increasing,

[12] We exclude households reporting more than £30,000 of unsecured debt, which is 1% of the sample, and households reporting LTV ratios greater than 1, which comprises 3% of the sample.

and that for many households the collateral constraint 'bites' well before the LTV ratio reaches 1. Therefore we also estimate the model with dummies for decile-banded LTV ratios, to seek any non-linearity in the relationship with unsecured debt at higher LTV ratios. The result is plotted in Chart 5, where marginal effects at deciles of the LTV ratio from the pooled 1995 and 2000 random effects tobit are illustrated. Below a LTV ratio of around 0.3, the relationship is flat; it is evident from this illustration that the collateral constraint begins to bite at LTV ratios of around 0.5 and that at LTV ratios over 0.7, there is no apparent increase in unsecured debt.

Are there other interpretations of the regression relationships depicted here? As the descriptive statistics in Appendix 2 make clear, households with high LTV ratios are typically younger, with higher values of debt, both secured and unsecured, smaller financial assets and faster growing incomes. The raw differences in LTV ratios and debt therefore partly reflect life-cycle factors – however the specifications utilised a standard set of control variables such as age, income, assets and family composition to control for these factors. A second possibility is that we are simply observing heterogeneity of tastes for indebtedness and therefore a high correlation between individual households' values of secured and unsecured debt. We argue that we control for unobserved preferences in several ways: first by proxies for taste shifters (smoker, saving intentions) and second by the fact that the coefficients remain robust in the specification in column (3) that allows for random heterogeneity in household responses. In addition the relationship is not linear and in particular is broadly flat above a LTV ratio of 0.7

3.4. Cross-section results: summary

To summarise this section, we have show three features of the data: Firstly, at most around 25% of households were most likely collateral constrained in 1995, given the distribution of LTV ratios and lending limits imposed by lenders at that time. The proportion had fallen by 2000 due to general house price increases over the period. Secondly, access to unsecured debt is contingent upon being a homeowner, but is available as a substitute rather than a complement to secured debt. Thirdly, we show that impatient households unbind their collateral constraint by making use of unsecured debt – the constraint appearing to bite sharply at LTV ratios of around 0.7.

4. Relaxing collateral constraints: the effect on household indebtedness

We now examine how households responded in their remortgaging behaviour and total indebtedness to changing collateral constraints between 1995 and 2000. As mentioned in the previous section, results derived from cross-sections of households may be attributed to unspecified differences in tastes (heterogeneity) or other covariates, rather than to differences in behaviour driven by household-specific budget constraints. In this sub-section, therefore, we further test the models by analysing household behaviour as rising house prices over the period relax the collateral constraint. As discussed in section 3.1, data on indebtedness are only available for 1995 and 2000, so we exploit cross-section variation in long-differences to estimate the of the impact of house price changes on remortgaging activity and changes in household indebtedness. The period 1995 to 2000 saw a significant average increase in house prices (Chart 1) and halved the number of households with LTV ratios of at least 0.8 in our panel but 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 from UK, hence our data exhibits exogenous variation in the degree to which collateral constraints were relaxed.[13]

The financial accelerator model suggests that house prices directly relax collateral constraints 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 hypotheses, can be measured by the probability that the household remortgages over the period. Thus we provide two tests of the core issues 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 house price changes over that period, and by the level of unsecured debt in 1995. Over 400 households in the sample remortgage 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 relax the

[13] For further evidence on the degree of variation in house price changes, see Disney, Henley & Jevons (2003).

collateral constraint) and to outstanding unsecured debt, focussing in particular on collateral constrained households.

4.1 Relaxing collateral constraints and remortgaging behaviour.

As mentioned in section 3.1, the change in the LTV ratio constructed from self-reported current values of the house and mortgage is not a good indicator of the underlying change in the value of collateral, since the measure incorporates behavioural change such as any increase in secured debt that takes place as a result of changing house prices. Consequently we work with changes in the predicted values of secured debt derived from modelling the value of the 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 house value as the denominator of the ratios. The distribution of these changes by decile is reported in Chart 6.

In general terms, both models described in section 2 predict a *negative* association between the change in the household's underlying predicted LTV ratio and its probability of remortgaging, most particularly for households with high initial LTV ratios: as house prices rise, the LTV ratio falls and households can unbind any collateral constraint. In addition, the model incorporating unsecured debt predicts a *positive* association between the original value of unsecured debt and the probability of remortgaging given the change in the predicted LTV ratio. This arises simply because the falling LTV ratio allows the household to substitute cheaper secured debt for its outstanding unsecured debt. However, having demonstrated in section 3 that households unbind collateral constraints using unsecured debt, we expect that the household most likely to remortgage will be those with unsecured debt which they seek to refinance rather than those with high LTV ratios but no unsecured debt – our assertion being that the latter group are less likely to react to a relaxing constraint by increasing borrowing given that they did not use the opportunity of unsecured debt to unbind their constraint in the earlier period.

Table 4 provides various regressions that explore these possibilities for homeowners. All specifications are probit models of the remortgage rate where the dependent variable is a dummy variable for whether the household remortgaged at least once between 1995 and 2000. The change in the predicted LTV ratio is

interacted with dummy variables for values of the LTV ratio and values of unsecured debt in order to captured the impact of relaxing collateral constraints on different groups – those with high LTV ratios and those with unsecured debt. The covariates include demographic and economic characteristics in 1995 and terms for change in income, assets, employment and number of children between 1995 and 2000. This is not a fully specified model of why households remortgage (which includes, of course, demographic as well and financial changes) – in particular, we do not use the 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 responses to the actual questions asked can be found in Bridges, Disney and Henley, 2006). Nevertheless, the results here are, in our view, sufficient to provide an empirical vindication of the models described in the present paper.

Column 1 of Table 4 is our baseline regression. It indicates, as expected, an increased probability of remortgaging when the underlying loan-to-value ratio falls. Columns 2 and 3 provide a more precise test of the financial accelerator model, since the specifications interact the change in the predicted LTV ratio with whether the household had a LTV ratio in 1995 indicating that they were collateral constrained (taking respectively LTV>0.9 and >0.8 as indicators). The inference is that the probability of remortgaging between 1995 and 2000 as LTV ratios on average fell should be strongest amongst households that had high loan-to-value ratios in 1995.[14] The coefficients on these variables are insignificant and indeed switch sign between columns 2 and 3. Experimentation with alternative cut-off values is unable to verify that there is any pure collateral constraint effect on remortgaging arising from the level of the LTV ratio at the start of the period.

Our augmented model suggests that we should include unsecured debt in the equation: households may utilise unsecured debt to unbind a collateral constraint and therefore use rising home equity to substitute secured for unsecured debt. When we consider households with positive values of unsecured debt (Column 4), captured by the interaction between the dummy variable for unsecured debt and change in the LTV ratio, the coefficient is significant and negative: households with unsecured debt

[14] Note that we do not simply include a term in the size of the LTV ratio in 1995, since it is the *combination* of a falling LTV ratio and a high LTV ratio in 1995 that is the source of the 'financial accelerator' effect.

were 3 percentage points more likely to remortgage for a given change in their LTV ratio compared to households without unsecured debt. That the marginal effect on this coefficient is small is not too surprising – it may *not* be optimal for households with low levels of unsecured debts to remortgage as the remortgaging cost will exceed the benefit in terms of the spread on interest payments from substituting secured for unsecured debt.

This suggests using threshold values of unsecured debt in 1995 > 0 to look for a larger impact of unsecured debt on remortgaging. Columns 5 and 6 therefore include interactions for higher threshold values of unsecured debt, at £500 and £750 respectively. The marginal effect on these indicators increases substantially, to 0.21 and 0.23 respectively. Hence households with a considerable value of unsecured debt were much more likely to remortgage over the period – the effect on the probability of remortgaging when the LTV relaxes being three times stronger for these households compared to the baseline regression. Finally, since these are non-nested specifications, Columns 7 and 8 include both the interaction terms for the level of the LTV ratio (at 0.8 and 0.9) and the value of unsecured debt (at £500).[15] In both cases, the relative size and magnitude of the coefficients are as before, suggesting that it is a combination of falling LTV ratio and 'high' unsecured debt that increases the probability of remortgaging – being collateral constrained *per se* does not induce remortgaging since such households can exploit unsecured debt to alleviate the constraint, as described in Section 3. Taken together, these results lend support for the refinancing model, strongly suggesting 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[16].

4.2 Relaxing collateral constraints and total debt

We now consider the impact of relaxing LTV ratios on the level of household debt by estimating the impact of changes in housing wealth (which relax the constraint) on changes in the level of household debt. This provides a direct test of the proposition that the relaxing of collateral constraints only has a significant impact

[15] The correlations between the two interaction terms in columns 7 and 8 are 0.23 and 0.27 respectively.

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

on the indebtedness of constrained households – in particular of constrained households with unsecured debts – and allows us to quantify that response. Given the remortgaging results in the previous section, we would expect to find the strongest relationship between house price changes and total debt to be among constrained households with high levels of unsecured debt. We again proceed in making the distinction between constrained and unconstrained households by choosing threshold levels of the household-specific LTV ratio and values of unsecured debt. We consider non-moving homeowners only, since there is a strong likelihood that moving is associated with changes in net financial assets associated with home improvement, moving costs and so on.[17] [18] In some of our specifications, therefore, we correct for the non-random nature of non-movers utilising the standard Heckman procedure.

Table 5 reports estimates of the effect of house price changes on total debt (actual, not predicted, secured plus unsecured debt) over the two waves of data. Column 1 is our baseline regression. In this specification there is no significant relationship between changes in house prices and changes in household indebtedness. This in itself is a striking result: despite the correlation between house price and equity withdrawal in aggregate series, our results suggest that this correlation is not observed across households when we control for household characteristics. Column 2 follows the approach of the previous section by interacting the change in the household's house price with a dummy variable for the level of the LTV ratio, here using a threshold of 0.8. The results suggest that even for households very likely to be constrained there is no significant relationship between the change in the house price and the change in indebtedness. As in the previous section, we conclude that household's initially exhibiting high LTV ratios do not respond to rising house prices in a significantly different manner to households with lower LTV ratios – a 'pure' financial accelerator effect does not show up in these estimates.

[17] According to the Survey of English Housing, administered by the UK government's Department of Communities and Local Government for 2005-06, 56% of households reporting housing equity withdrawal reported that they used it to fund home improvements, 29% reported that they used it to reduce debt, and 15% reported that they used it directly to finance household purchases (Source: BBC website, November 23rd, 2006).

[18] We exclude households with changes in unsecured debt over +/-£60,000 (which excludes 2.4% of the sample) and households with changes in the house price over +/-£275,000 (which excludes 1.37% of the sample). Such households will, most likely, have experienced changes in debt and housing values of these magnitudes over the five-year period due to downsizing or receiving inheritances or unexpected windfalls.

Columns 3-4 test our alternative model with unsecured debt. Here we interact the change in the house price with two dummy variables – whether the household has a LTV ratio greater than a certain threshold, and whether the household has unsecured debts greater than £500. As shown Section 4.1, unsecured debts of £500 or greater induce a higher probability of remortgaging among households and we use various levels of the LTV ratio to test whether the relationship is stronger for households more likely to be constrained given that they have unsecured debts. As we move from column 3 to 4 we notice that the coefficient on this interaction term weakens – the coefficient in column 3 implying that a household with unsecured debt over £500 and LTV ratio over 0.9, which experienced an increase in its house price of £1000 is lead to increase total indebtedness by £250 more than a household not in this subset. This is a very large response but of course the number of households in this category is rather small (Table 1). As the threshold is lowered to 0.8 in column 4 the number of households captured by the interaction term increases and the coefficient on that variable falls. Hence we are introducing households for which the relationship between changes in the house price and changes in total debt is weaker.

Chart 7 illustrates a broader set of OLS estimates of the coefficient on this triple interaction term from a sequence of regressions where we set the LTV ratio threshold at values between 0.65 and 0.95 in 0.05 point intervals. We plot the value of the coefficient in each case, which falls as the LTV ratio threshold falls. Of course, as the proportion of households in the dummy variable group rises as the LTV ratio falls. A benchmark for the macroeconomic effect of this relationship is to multiply the coefficient (we also provide $\pm$ one standard error in the Chart) by the proportion of the sample measured as constrained. For example, at a LTV ratio>0.9, 0.13 of households are treated as constrained and the estimated coefficient is 0.25, so the average effect is $0.13 \times 0.25 = 0.033$. This average effect is 0.03 (± 0.003) in all cases until LTV>0.6, where the coefficient is no longer significant. This average can be considered the macroeconomic effect of house price gains on debt-financed consumption in our sample.

Columns 5-6 use a selectivity correction for the household being a non-mover between 1995 and 2000. The BHPS questions respondents on whether they prefer to move work, like their current neighbourhood and whether work commitments prevent the household from moving. We use these responses (using a lag of the preference for

moving response) as exclusion restrictions in the first-stage regression for whether the household is a non-mover over the period. The coefficients on the exclusion restrictions are jointly significant at the 5% level. Marginal effects are reported conditional upon the household being a non-mover. We see that under this specification the strength of the coefficient on the unsecured debt interaction weakens by approximately one half and falls with lower thresholds for the LTV ratio, consistent with our results in the OLS specification.

The positive relationship between changes in house prices and indebtedness for the groups of households captured by the interaction terms implies that households in these subsets *do* increase their indebtedness in response to house price rises. Crucially though, these households had existing unsecured debts in 1995. Hence we interpret this increased indebtedness (and consumption) as the wealth effect of substituting secured debt for unsecured debt. This is a financial accelerator effect, but it occurs via refinancing unsecured debt and is hence weaker than the pure financial accelerator effect.

5. Conclusion

This paper has explored the mechanisms by which house price changes affect household indebtedness through tightening or relaxing collateral constraints – most familiarly characterised as the 'financial accelerator' model. Changes in asset values 'amplify' or 'accelerate' the effect of changes in nominal income on debt-financed consumption, in contrast to the rather small effects of house prices on consumption generally found through the estimation of traditional 'wealth effects' from the perspective of the life cycle model. Empirical support for the financial accelerator model come from a variety of sources, including calibrated macroeconomic models which assume that there is a large fraction of collateral constrained households, and from the excess sensitivity tests of Campbell and Cocco (2006) on UK data, which also suggest large responses of consumption to (predictable) changes in house prices.

We argued that the financial accelerator 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 the use of unsecured debt. Consequently, the primary means by which changes in collateral constraints arising from asset revaluations impact on debt-financed consumer spending is that

households substitute cheaper secured debt for unsecured debt, if the gain from lower interest payments outweighs the transactions costs of so doing. This relative price effect arising from changing 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.

We utilise household panel data to examine the financial accelerator model and our modification, and also contrast our empirical findings with those of Campbell and Cocco, and others. We find that these studies tend to overstate the fraction of collateral-constrained households in the UK, by whatever exact criterion is used to define 'collateral constraint'. Secondly, households with more binding collateral constraints (that is, higher self-reported LTV ratios of around 0.7 or greater) do indeed have higher unsecured debt once we control for life cycle characteristics and for individual heterogeneity. We interpret this result as confirming that households can in practice unbind collateral constraints by using unsecured debt.

We use the panel aspect of the data to show that households exploit relaxing collateral constraints to refinance their debt portfolios, substituting secured for unsecured debt, and thereby test between the pure financial accelerator model and the model with unsecured debt. We show that remortgaging is not associated with high LTV ratios *per se*, but is associated with high levels of unsecured debt, as our augmented model suggests. We confirm this by a direct test of the impact of relaxing collateral constraints (due to rising house prices in our period) on the value of total debt among non-moving households (to abstract from the effect of moving itself on holding of financial assets and on consumption). Our results strongly suggest that a relationship between changes in house prices and total indebtedness is only found among collateral constrained households who initially exhibit high levels of unsecured debt.

When we consider the macroeconomic effect across the whole sample, our results imply an average marginal propensity to increase indebtedness (and thereby consumption) of 0.03 – even lower if we believe the selectivity-corrected estimates. This is between a third and a quarter of the magnitude of that found by Campbell and Cocco, and by calibrated studies using the financial accelerator model. We show that our result is robust to alternative definitions of the collateral constraint. Hence, averaged across all households, an increase in the value of housing of £1000 would

lead the average household to increase debt-financed consumption by approximately £30. This result is not out of line with estimates derived from a traditional life cycle model of the impact of unpredictable changes in housing wealth on consumption. However we argue that a 'collateral effect' does exist, and is strong for a subset of households, but this subset of households is relatively small, implying that the macroeconomic effect is actually quite small.

How do we square this with other evidence? As indicated in footnote 17, the Survey of English Housing suggests that, after housing improvements, households report 'paying off debt' as the second most important rationale for utilising housing equity gains. This fits with our argument that exogenous housing wealth gains allow constrained households to substitute secured for unsecured debt. It is a greater puzzle to reconcile our results with the large effects of UK house prices on consumption found by Campbell and Cocco (2006). One possible counter-argument to our results is that we have not fully tested the excess sensitivity model, stemming from Flavin (1981) and the subsequent literature. For example, an observed response of consumption to predictable changes in wealth may indicate not just borrowing constraints (as described here) but also the existence of buffer stock saving. So one alternative mechanism underpinning their results is that persistently growing housing wealth over time allows households to decumulate previously built-up financial assets so inducing the consumption response described in their paper.

A simple test of this hypothesis is to use the panel component of our data to test what happens to the financial assets of households as house prices increase. If rising housing wealth allows financial asset decumulation, we might expect a *negative* correlation between household-specific changes in housing wealth and changes in financial assets controlling for age (lifecycle effects) and preferences (proxied by lagged value of financial assets). In fact we find no such effect: household financial asset levels in 2000 are strongly positively correlated with financial assets in 1995, significantly related to a quadratic in age and *positively* (but insignificantly) associated with changes in house values between 1995 and 2000. Thus the 'story' where rising asset values relax collateral-constraints seems to be the 'right' one but, given the small fraction of collateral-constrained households and the mechanism by which such households can and do substitute secured for unsecured debt, does not

explain why some studies obtain such large consumption responses to housing wealth.[19]

[19] For another response to Campbell and Cocco (2006), see Attanasio *et al* (2005).

Table 1

Proportion of sample with Loan-to-Value ratio>0.X in 1995

LTV>0.X	0.95	0.90	0.85	0.80	0.75	0.70	0.65
% of sample	0.08	0.13	0.19	0.24	0.28	0.33	0.37
Total number	127	198	292	372	438	509	578

Table 2

Unsecured debt and housing equity

(Method: Random effects probit/tobit, pooled over 1995 & 2000 waves)

Variable	Prob. owning a credit or store card	Prob. owing money on credit or store card	Prob. owing money on mail order purchase	Prob. owing money on a personal loan	Value of unsecured debt (tobit)
Homeowner=1	0.82** (0.08) 0.15	0.54** (0.08) 0.09	–0.08 (0.08) –0.01	0.16* (0.06) 0.03	0.63** (0.18) (0.18)
Value of housing equity	0.002** (0.0004) 0.0003	–0.002** (0.001) –0.0002	–0.002** (0.001) –0.0003	–0.002** (0.001) –0.0003	–0.01** (0.001) (0.002)
N (obs) N (groups) LogL	7418 3709 –3196.0	7418 3709 –3318.0	7418 3709 –2677.3	7418 3709 –3087.9	N=0=4057 N>0=3341 –11902.5

Notes: Value of housing equity = self-reported value of home *minus* predicted value of current mortgage. Each cell contains, respectively, coefficient, standard error, marginal effect. **=1% significance, *=5% significance. Controls include: quadratic in household income, in value of financial assets, and in age of head of household, gender of head of household, number of children, employment and retirement status, total number of social security benefits received, educational qualifications and whether head of household saves regularly and is/is not a smoker.

Table 3

Loan-to-Value Ratio and Value of Unsecured Debt

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, for whether smoker, saver, gender of HofH, other labour market status. Coefficient (standard errors in parentheses) are quoted, not conditional marginal effects. **=1% level of significance; *=5% level of significance.

Table 4

Remortgaging, Changes in Loan-to-Value Ratio and Value of Unsecured Debt 1995-2000. (Probits; marginal effects.)

Specification: **Probit** *LHS Variable:* **Prob. of remortgaging 1995-2000**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
ΔLTV ratio$_{1995\text{-}2000}$	-0.07* (0.02)	-0.07* (0.02)	-0.07* (0.02)	-0.05* (0.02)	-0.04* (0.02)	-0.04* (0.02)	-0.04* (0.02)	-0.04* (0.02)
ΔLTV ratio$_{1995\text{-}2000}$* LTV>0.9$_{1995}$	-	0.001 (0.05)	-	-	-	-	0.06 (0.05)	-
ΔLTV ratio$_{1995\text{-}2000}$* LTV>0.8$_{1995}$	-	-	-0.001 (0.04)	-	-	-	-	0.06 (0.05)
ΔLTV ratio$_{1995\text{-}2000}$* Unsecured debt > £0$_{1995}$	-	-	-	-0.03** (0.01)	-	-	-	-
ΔLTV ratio$_{1995\text{-}2000}$* Unsecured debt >£500$_{1995}$	-	-	-	-	-0.21** (0.04)	-	-0.24** (0.05)	-0.23** (0.05)
ΔLTV ratio$_{1995\text{-}2000}$* Unsecured debt >£750$_{1995}$	-	-	-	-	-	-0.23** (0.05)	-	-

Notes: Coefficient (standard errors in parentheses) are *dF/dX*. N=2006. **=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, number of benefits, household income & financial assets squared, whether smoker, saver, gender of HofH, other labour market statuses. ΔLTV ratio is the predicted change in the LTV ratio given the original mortgage value, and excludes consequences of remortgaging.

Table 5

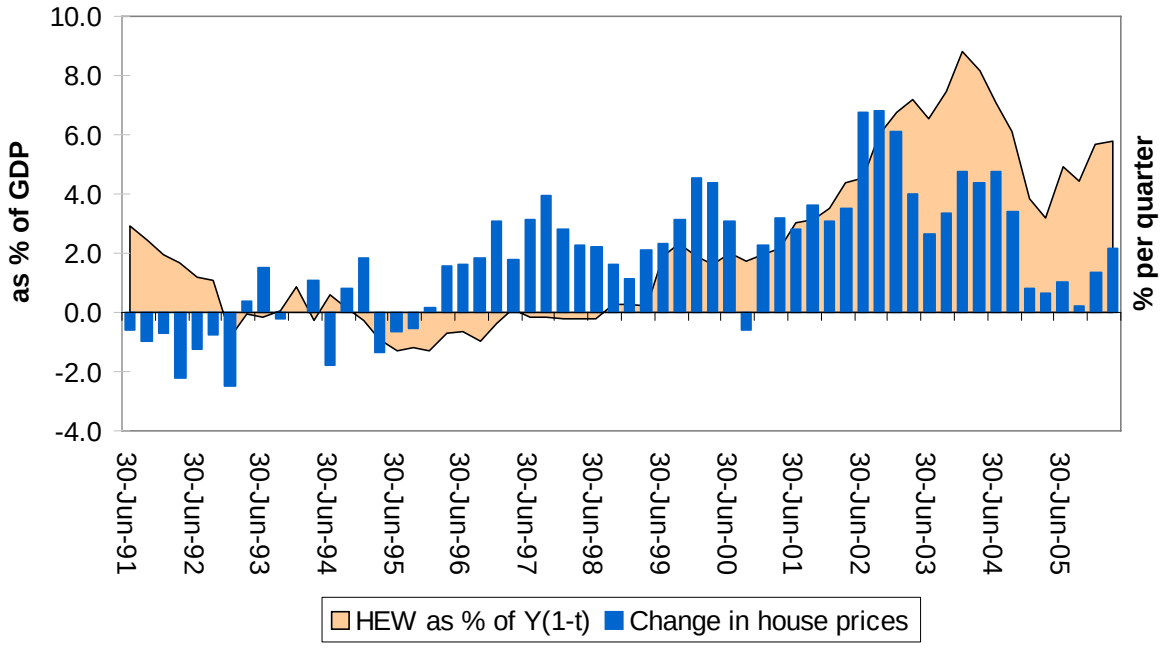
Changes in Housing Wealth and Household Debt

	OLS Estimates				**Heckman Estimates**	
Δtotal debt 1995-2000: non-movers only	*(1)*	*(2) LTV>0.8*	*(3) LTV>0.9*	*(4) LTV>0.8*	*(5) LTV>0.9*	*(6) LTV>0.8*
Δself-reported house value$_{1995\text{-}2000}$	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.004 (0.008)	-0.008 (0.008)
Δself-reported house value$_{1995\text{-}2000}$ *constrained$_{1995}$	-	0.02 (0.02)	-0.02 (0.05)	-0.04 (0.04)	-0.08 (0.05)	0.003 (0.03)
Δself-reported house value$_{1995\text{-}2000}$ *constrained$_{1995}$ *unsecured debt 1995>£500	-	-	0.25** (0.07)	0.13** (0.05)	0.12* (0.05)	0.09* (0.04)
Age	-0.54** (0.21)	-0.54** (0.21)	-0.52** (0.21)	-0.48** (0.21)	-0.58** (0.22)	-0.52** (0.21)
Age^2	0.005* (0.02)	0.05* (0.02)	0.01** (0.002)	0.01** (0.002)	0.01** (0.002)	0.01** (0.002)
Income$_{1995}$	0.01 (0.0009)	0.01 (0.008)	-0.05 (0.07)	-0.07 (0.06)	-0.07 (0.07)	-0.09 (0.07)
ΔIncome$_{1995\text{-}2000}$	0.08** (0.03)	0.08** (0.03)	0.08** (0.03)	0.08** (0.03)	0.1** (0.03)	0.1** (0.03)
Assets$_{1995}$	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.01 (0.02)
ΔAssets$_{1995\text{-}2000}$	0.01 (0.04)	0.01 (0.04)	0.01 (0.04)	0.01 (0.04)	0.02 (0.04)	0.02 (0.04)
R^2 N F( )	0.04 1564 2.68	0.04 1564 2.69	0.05 1564 3.08	0.04 1564 2.84	 2029	 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.

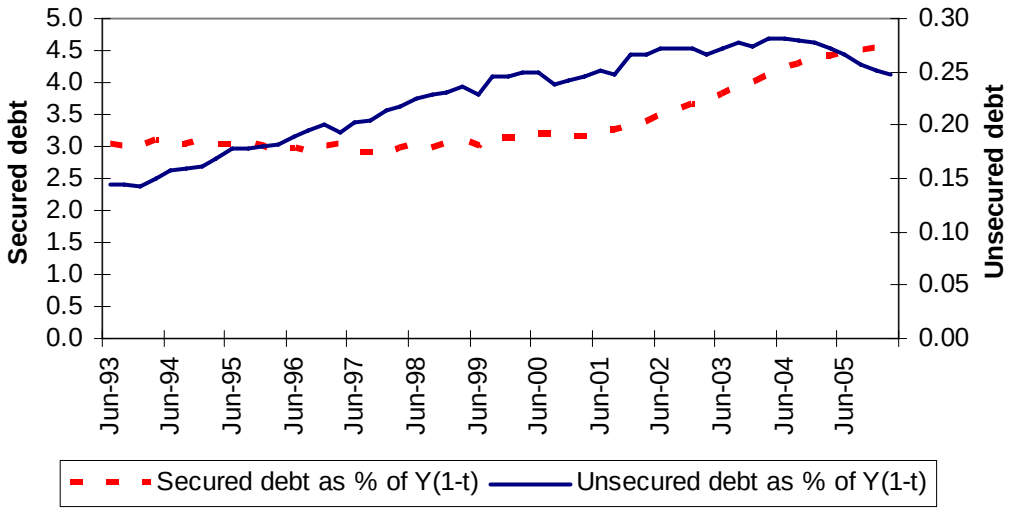
Note on Heckman specifications: There are 2029 total observations including movers. We report results for non-movers using BHPS questions on whether respondents intend to move (lagged), like their current neighbourhood and whether work commitments prevent the household from moving as instruments.

Chart 1
Housing equity withdrawal and house price changes
Quarterly changes 1991-2006



Notes: HEW as % of Y(1-t). Housing equity withdrawal, as defined in footnote 1, as % of household disposable income. Quarterly changes in house prices are derived from the Nationwide Building Society house price index, also used in Campbell and Cocco (2006).

Chart 2
Total Debt as % of Household Disposable Income



Debt defined as of % household disposable income. Source: Bank of England online statistics.

Chart 3

Average Interest Rates: Secured and Unsecured Debt
1995-2006 (*Source: Bank of England*)

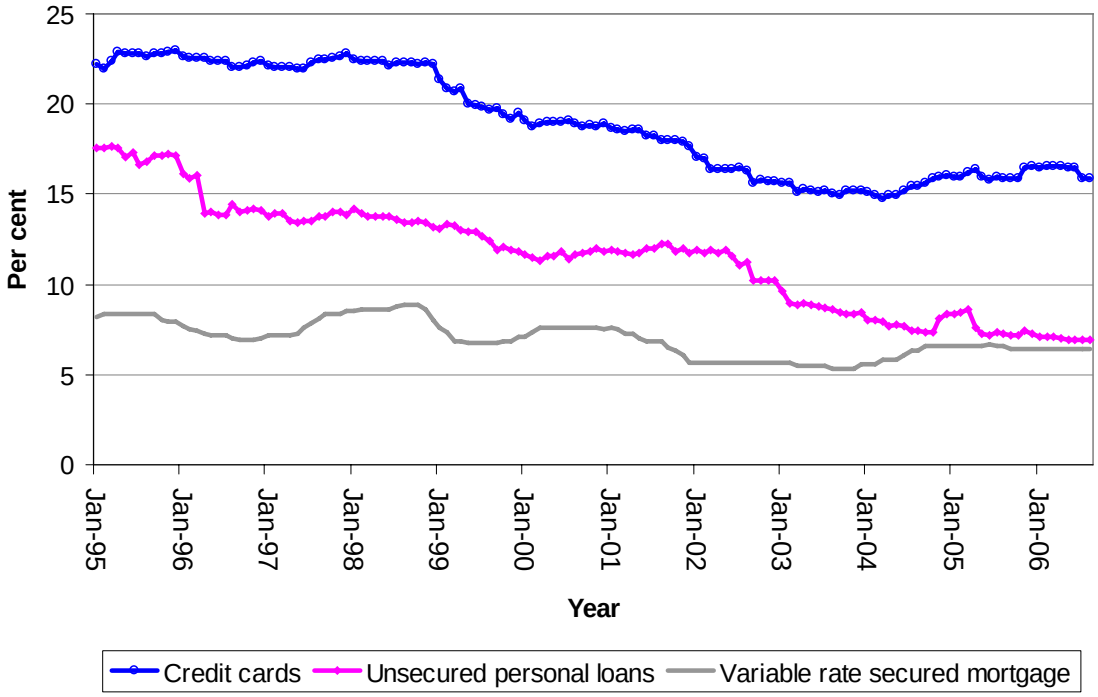


Chart 4
Distribution of Net Worth 1995, 2000 and Pooled
1-100th Percentile

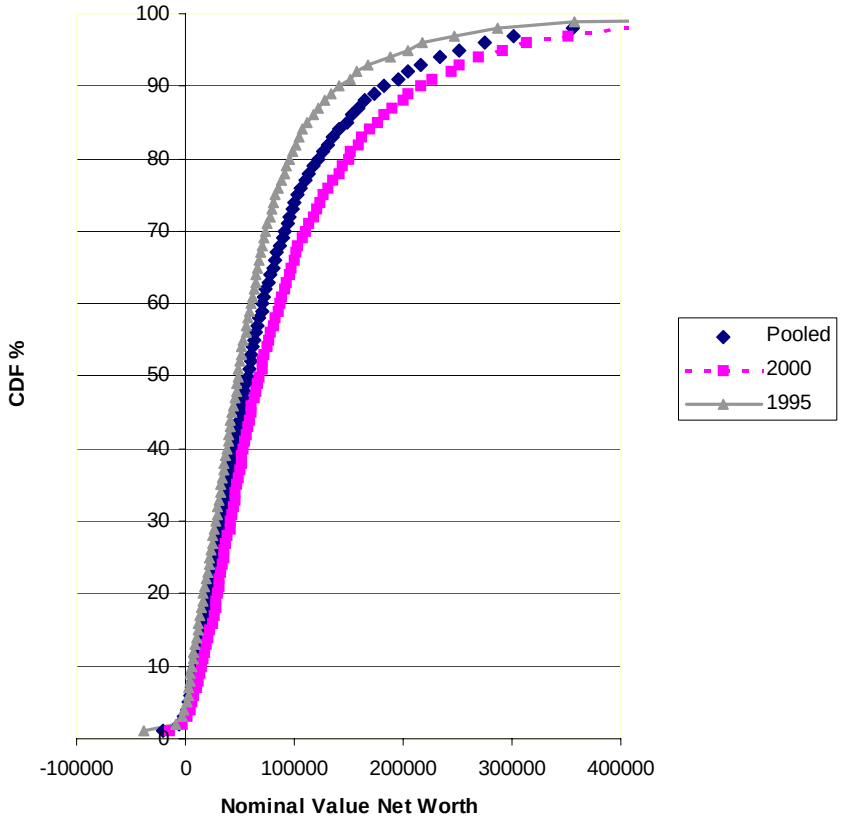
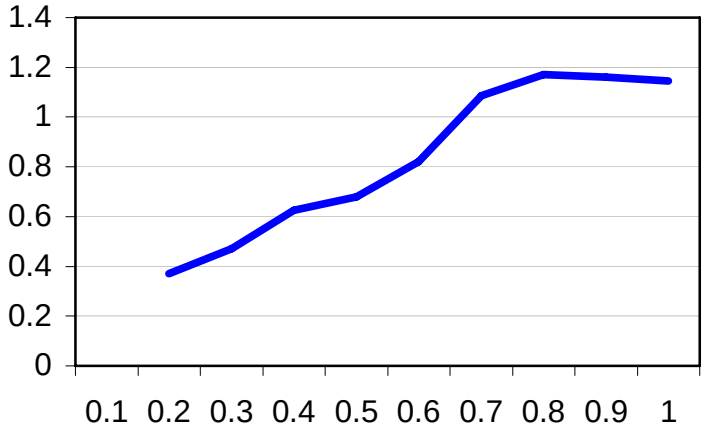


Chart 5
Value of Unsecured Debt (£000) by LTV Ratio



Note: Moving 2-band average; pooled data from 1995 and 2000 BHPS waves.

Chart 6
Distribution of the change in the predicted loan to value ratio 1995 to 2000

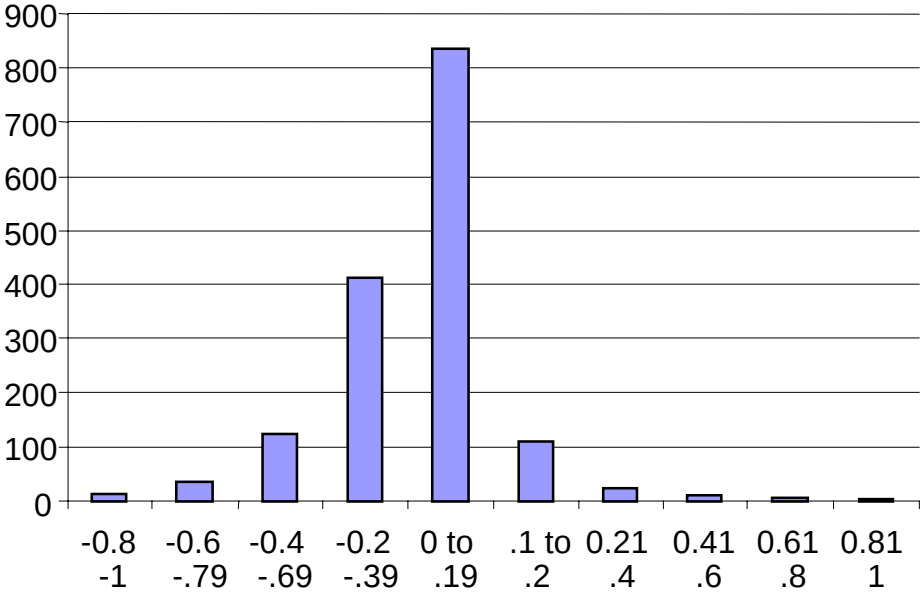


Chart 7

Impact of change in LTV on total debt by LTV (where unsecured debt >£500)

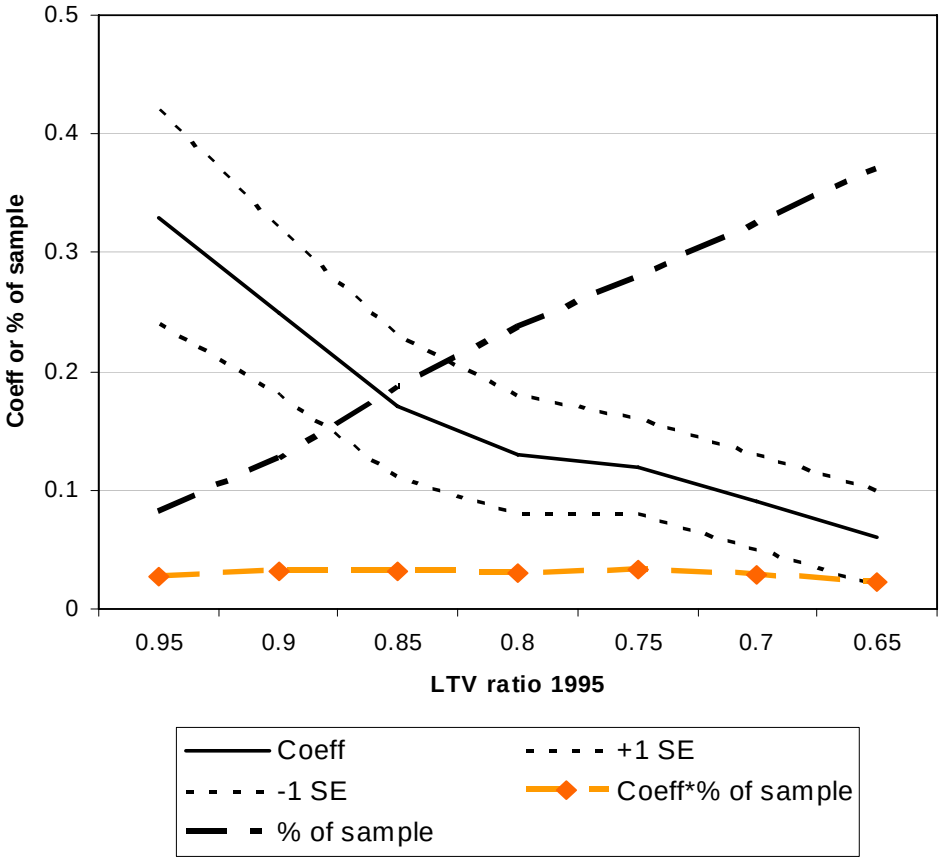


Figure 1
The financial accelerator

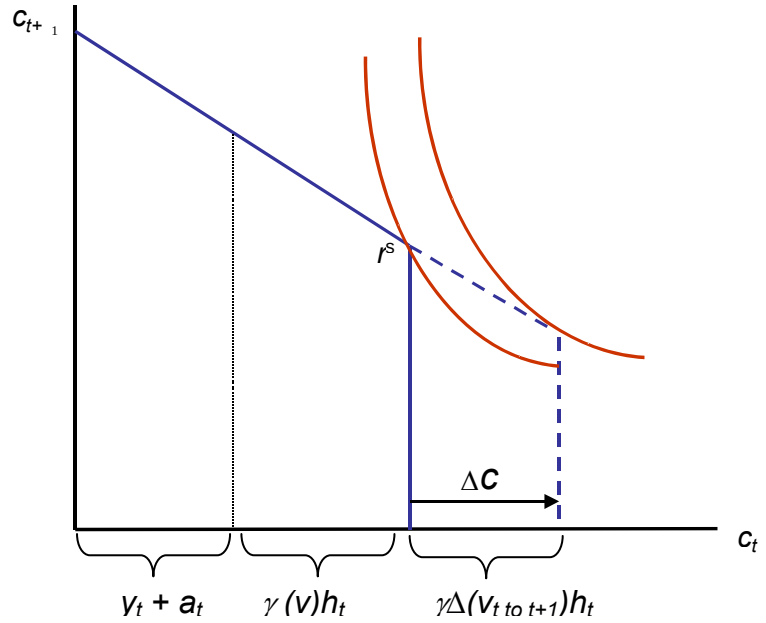
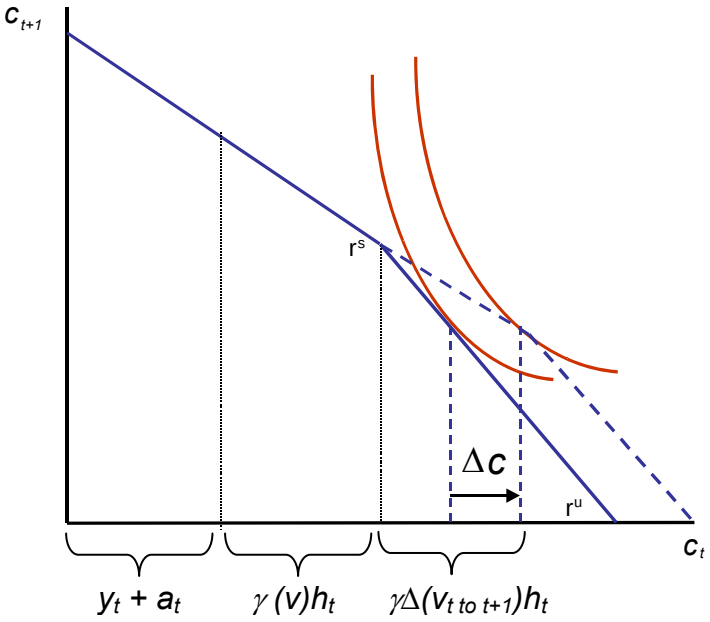


Figure 2
Unsecured debt and effect of house price increase



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.

Aron, J., & Muellbauer, J. (2006) 'Housing wealth, credit conditions and consumption', *Centre for the Study of African Economics* Working Paper 2006: No.8.

Attanasio, O. and Weber, G. (1994), "The UK consumption boom of the late 1980s: aggregate implications of microeconomic evidence", *Economic Journal*, 104: 1269-1302.

Attanasio, O., Blow, L., Hamilton, R. and Leicester, A. (2005) 'Consumption, house prices and expectations', *Bank of England* Working Paper No. 271.

Banks, J., Blundell, R. and Smith, J.P. (2003) 'Understanding differences in household financial wealth between the United States and Great Britain', *Journal of Human Resources*, 38, 2, 241-279.

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.

Bester, H. (1985) 'Screening vs. rationing in credit markets with imperfect information', *American Economic Review*, 75, September, pp.850-855.

Bhatia, K. B. (1987), "Real estate assets and consumer behaviour", *Quarterly Journal of Economics*, 102: 437-443.

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

Calza, A., Monacelli, T. and Stracca, L. (2006) 'Mortgage markets, collateral constraints and monetary policy: Do institutional factors matter?', presented at Finance and Consumption workshop, EUI, March 2006.

Campbell, J. Y. and Cocco, J. F. (2006) 'How do house prices affect consumption? Evidence from micro data', *Journal of Monetary Economic, in press*.

Campbell, J.Y. and Mankiw, N.G. (1987) 'Are output fluctuations transitory?' *Quarterly Journal of Economics*, 102, 4, 857-880.

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, Deprtment of Economics, John Hopkins University, Baltimore, Md.

Chatterjee, S., Corbae, D., Nakajima, M. and Rios-Rull, J-V. (2005) 'A quantitative theory of unsecured consumer credit with risk of default', *mimeo*, University of Pennsylvania.

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', *under revision*, School of Economics, University of Nottingham.

Duygan, B. and Grant, C. (2006) 'Household debt and arrears: what role do institutions play?', presented at Finance and Consumption workshop, EUI, May 2006.

Elul, R. (2006) 'Collateral, credit history and the financial decelerator', *mimeo*, Federal Reserve Bank of Philadelphia.

Engelhardt, G.V. (1996) 'House prices and home owner saving behaviour', *Regional Science and Urban Economics*, 26: 313-336.

Flavin, M. (1981) 'The adjustment of consumption to changing expectations about future income', *Journal of Political Economy*, 89, 974-991.

Gross, D. and Souleles, N. (2002) 'Do liquidity constraints and interesrt rates matter for consumer behavior? Evidence from credit card data', *Quarterly Journal of Economics*, 117, 2, 149-185.

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.

Jappelli, T. (1990) 'Who is credit constrained in the US economy?', *Quarterly Journal of Economics*, 105, 1, 219-234.

Jappelli, T. and Pagano, M. (1989) 'Consumption and capital market imperfections: An international comparison', *American Economic Review*, 79, 5, 1088-1105.

Kehoe, T. and Levine, D. (2001) 'Liquidity constrained markets versus debt constrained markets', *Econometrica*, 69, 3, 575-598.

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

Milde, H. and Riley, J.G. (1988) 'Signalling in credit markets', *Quarterly Journal of Economics*. 103, February, 101-129.

Muellbauer, J. and Murphy, A. (1990), 'Is the UK balance of payments sustainable?', *Economic Policy*, 347-382.

Ortalo-Magné, F. and Rady, O. (2006) 'Housing market dynamics: On the contribution of income shocks and credit constraints'. *Review of Economic Studies* **73**:2, 459-485.

Silos, P. (2006) 'Housing, portfolio choice and the macroeconomy', presented at Finance and Consumption workshop, EUI, March 2006.

Skinner, J. (1989) 'Housing wealth and aggregate saving' *Regional Science and Urban Economics*, 19, 305-324.

Tudela, M. and Young, G. (2003) 'The distribution of unsecured debt in the United Kingdom: survey evidence', *Bank of England Quarterly Bulletin*, Winter, 417-427.

Appendix 1: The collateral constraint and unsecured debt

As in Iacoviello (2004) and other related models, 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).[20]

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

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

where y_t is income, $\overline{Y}$ 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:

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

[20] 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.

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:

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

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. 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.

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 that the unconstrained household will always choose secured debt.[21] 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.

[21] 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 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.

Households now face a non-linear budget constraint. 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. 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 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. In this modified version of the standard problem of the liquidity or collateral-constrained consumer with a non-linear endogenous budget constraint, it is not feasible to obtain analytical solutions to the problem for plausible specifications of preferences, as is well known in the more standard models. In the text, therefore, we examine whether the empirical predictions of the model (in particular as to the substitutability of unsecured for secured debt) are verified.

Appendix 2: Questions in the British Household Panel Survey concerning debt and related issues (2000 wave unless otherwise stated)

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, the initial value, the type of mortgage and its starting date.
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 for all heads of households, financial variables in £000s

Variable	Name	Obs	Mean	Std. Dev.	Min	Max
Unsecured debt 1995	tdebt1	2623	1.23234	3.8907	0	99.999
Unsecured debt 2000	tdebt6	2623	1.868872	4.8836	0	100
Change 1995-2000	tdebt_c	2623	.6365322	5.331944	-74.999	100
Self-rep Total debt 1995	totaldebt1	2623	25.61265	38.28306	-.009	1003
Self-rep Total debt 2000	totaldebt6	2623	26.71186	43.84358	-.008	800
Change 1995-2000	totaldebt_c	2623	1.099208	44.49499	-1003.003	713
Predicted mortgage 1995	mort_1	2448	24.37439	26.02393	0	249.6005
Predicted mortgage 2000	mort-6	2458	25.13351	33.74402	-39.96	615.2924
Self-Rep mortgage 1995	mort1	2623	24.38031	37.38744	-.009	1000
Self-Rep mortgage 2000	mort6	2623	24.84299	42.41827	-.008	800
All owned houses value 1995	tvalue1	2621	79.89314	58.72092	2	685
All owned houses value 2000	tvalue6	2481	126.4273	112.9648	3	1076
Change 1995-2000	tvalue_c	2480	46.07671	82.61727	-546	918
Self-reported house value 1995	rhsval1	2621	74.31626	50.68138	2	685
Self-reported house value 2000	rhsval6	2481	115.9023	89.47925	3	999
Change 1995-2000	rhsval_c	2480	41.22604	62.49619	-546	775
Financial Assets 1995	asset1	2623	14.61443	38.73717	0	830
Financial Assets 2000	asset6	2623	12.13411	36.69199	0	830
Change 1995-2000	asset_c	2623	-2.480324	8.345206	-129.3	0
Household Income 1995	tincome1	2623	20.97394	15.87328	0	297.602
Household Income 2000	tincome6	2623	24.33514	19.81642	0	397.3198
Change 1995-2000	tincome_c	2623	3.361197	16.41628	-261.3746	242.7034
Employed=1 1995	emp1a	2623	.7662981	.4232654	0	1
Employed=1 2000	emp6a	2623	.704918	.4561666	0	1
Change 1995-2000	emp_c	2623	-.0613801	.3488664	-1	11
HofH Gender (male=1)	sex1a	2623	.6584064	.4743345	0	1
HofH had Degree 1995 = 1	tdeg1	2623	.1578345	.3646553	0	1
HofH no. of social security benefits 1995		2623	1.210827	1.172793	0	8
HoH retired status 1995 = 1	ret1a	2623	.2051087	.403858	0	1
Predicted LTV 1995	ltv1	2446	.3710544	.4281343	0	7.636364
Predicted LTV 2000	ltv6	2361	.247305	.3347003	-.7984	8.88
Change *predicted* 1995-2000	ltv_c2	2302	-.1176397	.3762394	-7.207678	8.325833
Constrained Group 1995 (i.e. has LTV>0.8)	con1	2623	.1414411	.3485424	0	1
con1 ltv_c1 interaction	con1ltv_c1	2302	-.0463848	.1519545	-1.908995	.1885867
remortgage event 1995-2000	remort_t1	2623	.144491	.351654	0	1
con1 rhsval interaction	con1rhsval_c	2480	6.792339	27.73307	-27	478
con1 rhsval tdebt1>£500	con_rhs_~500	2480	3.832381	21.07583	-12.5	360

Selected descriptive statistics: Unconstrained v. constrained households (latter defined as predicted LTV>0.8)

Unconstrained households

Variable	Obs	Mean	Std. Dev.	Min	Max
age1	2252	50.37034	13.58258	20	89
tdebt1	2252	1.097174	3.899427	0	99.999
tdebt6	2252	1.471378	3.907612	0	75
tdebt_c	2252	.3742038	4.743774	-74.999	75
totaldebt1	2252	21.81798	38.07192	-.009	1003
totaldebt6	2252	21.84362	42.47747	-.008	800
totaldebt_c	2252	.0256416	44.53901	-1003.003	713
mort_1	2077	19.81372	24.2018	0	249.6005
mort_6	2089	19.71098	31.46576	-39.96	615.2924
mort1	2252	20.72081	37.21212	-.009	1000
mort6	2252	20.37224	41.42193	-.008	800
tvalue1	2250	84.24643	61.67272	2	685
tvalue6	2495	126537.6	115256.3	3000	1076000
tvalue_c	2138	44.69345	82.88359	-546	891
rhsval1	2250	77.77021	53.18907	2	685
rhsval6	2139	118.022	92.15809	3	999
rhsval_c	2138	44.69345	82.88359	-546	891
asset1	2252	16.41632	41.17992	0	830
asset6	2252	13.61061	39.05893	0	830
asset_c	2252	-2.805707	8.910056	-129.3	0
tincome1	2252	20.4044	16.06274	0	297.602
tincome6	2252	23.05434	18.17924	0	209
tincome_c	2252	2.649937	15.6631	-261.3746	179.6394
emp1a	2252	.7349023	.4414832	0	1
emp6a	2252	.6642984	.47234	0	1
emp_c	2252	-.0706039	.3624868	-1	1
sex1a	2252	.651865	.4764849	0	1
tdeg1	2252	.14254	.3496807	0	1
tnbenefits1	2252	1.289964	1.169669	0	8
ret1a	2252	.2384547	.4262332	0	1
ltv1	2075	.2691589	.3796879	0	7.636364
ltv2	2021	.1838166	.307319	-.7984	8.88
ltv_c2	1962	-.0836028	.3817493	-7.207678	8.325833
con1	2252	0	0	0	0
con1ltv_c1	1884	0	0	0	0
remort_t1	2252	.1314387	.3379546	0	1
con1rhsval_c	2173	0	0	0	0
con_rhs_~500	2173	0	0	0	0

Constrained households

Variable	Obs	Mean	Std. Dev.	Min	Max
age	371	33.0027	7.360045	19	61
tdebt1	371	2.052809	3.738809	0	45
tdebt6	371	4.281695	8.32553	0	100
tdebt_c	371	2.228887	7.848509	-17.5	100
totaldebt1	371	48.64662	30.78949	-.002	440.6
totaldebt6	371	56.26246	40.31174	-.008	278
totaldebt_c	371	7.615841	43.72314	-396.55	277.001
mort_1	371	49.90675	20.5461	12.997	140
mort_6	369	55.83174	29.54385	-19.96	236.048
mort1	371	46.59381	30.08128	-.009	440
mort6	371	51.98077	38.10864	-.008	270
tvalue1	371	53.49177	21.98145	15	160
tvalue6	342	108.2474	88.34094	22	965
tvalue_c	382	53737.3	81155.84	-152000	918000
rhsval1	371	53.36912	21.90354	15	160
rhsval6	342	102.6446	69.09994	22	500
rhsval_c	342	49.25439	59.1083	-27	478
asset1	371	3.676814	13.31349	0	220
asset6	371	3.17159	12.85772	0	220
asset_c	371	-.5052237	2.445049	-35	0
tincome1	371	24.43109	14.20824	1.340331	154.6163
tincome6	371	32.10969	26.48785	0	397.3198
tincome_c	371	7.678598	19.88584	-74.34824	242.7034
emp1a	371	.9568733	.2034166	0	1
emp6a	371	.9514825	.2151472	0	1
emp_c	371	-.0053908	.2437833	-1	1
sex1a	371	.6981132	.4596964	0	1
tdeg1	371	.2506739	.4339863	0	1
tnbenefits1	371	.7304582	1.074327	0	8
ret1a	371	.0026954	.0519174	0	1
ltv1	371	.9409552	.1388386	.8	1.909091
ltv2	340	.6246878	.2241349	-.1174118	1.294522
ltv_c2	340	-.3140523	.269105	-1.908995	.1885867
con1	371	1	0	1	1
con1ltv_c1	340	-.3140523	.269105	-1.908995	.1885867
remort_t1	371	.2237197	.4172991	0	1
con1rhsval_c	342	49.25439	59.1083	-27	478
con_rhs_~500	342	27.79037	50.61049	-12.5	360

Working Paper List 2005

Number	Author	Title
05/02	Simona Mateut and Alessandra Guariglia	Credit channel, trade credit channel, and inventory investment: evidence from a panel of UK firms
05/01	Simona Mateut, Spiros Bougheas and Paul Mizen	Trade Credit, Bank Lending and Monetary Policy Transmission