Credit conditions and the real economy: the elephant in the room

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1. Introduction

We explore crucial but unobserved influences on the real economy due to structural shifts in non-price credit supply conditions. The global financial crisis (GFC) of 2007–09 demonstrated that shifts in credit conditions are the "elephant in the room" for economies with liberalised financial markets: large, and ignored at one's peril. We chose Australia as an interesting case study because over the three decades to 2008 it experienced one of the most rapid increases in household balance sheets and house prices in the world.

The literatures on consumption, house prices and credit suggest that credit conditions may operate on the real economy through several channels. First, financial liberalisation and innovation (FLIB) enhances the ability of all households to smooth housing and non-housing consumption across periods. Second, FLIB relaxes the mortgage down payment constraint on young, first-time home-buying households. Third, FLIB introduces a collateral channel from housing capital gains to real activity. Households with existing housing wealth can extract capital gains for other purposes through mortgage refinancing or home equity withdrawal products. However, rising house prices not only boost collateral for existing homeowners but also raise the mortgage deposit requirement. The balance of these two effects on the economy depends on the state of credit conditions and, to a lesser extent, the age distribution of the population. When credit conditions are easy, the positive collateral benefit of higher house prices to existing homeowners outweighs the negative effect on non-home-owning households who must now save for a larger deposit. Under these conditions, rising house prices raise consumption, mortgage debt and housing equity withdrawal (HEW).

We have chosen the acronym "latent interactive variable equation system" (LIVES) to describe our method. A common unobserved factor – a credit conditions index – determines intercept and parameter shifts in equations for consumption, house price, mortgage credit and HEW. This methodology provides a powerful technique for handling evolving and far-reaching structural change in an economy – a serious problem for econometric modellers. Our system extends the single equation house price and consumption modelling for Australia in Williams (2009, 2010), consumption equations for the United Kingdom, the United States and Japan in Aron et al (2011), and multi-equation work using UK credit data in Fernandez-Corugedo and Muellbauer (2006). Strong priors about the institutional environment and rich controls for other economic and demographic variables allow interpretation of the latent variable as credit conditions shifts due to FLIB. We represent this as a spline function consisting of smoothed step dummies. Credit conditions enter each equation as a common intercept term and through their interaction with interest rates, income growth expectations, housing collateral and so on.

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This paper summarises the results for the consumption equation only. See the full version of the paper, Muellbauer and Williams (2011), for discussion of the equations for house prices, mortgage stock and HEW.

2. Methodology

Shifts in the credit supply schedule are not directly observable. Indirect measures such as debt to income suffer from obvious endogeneity with other economic and demographic variables. An alternative strategy is a common factor or latent variable approach. Stock and Watson (1988) suggest that some time series may be cointegrated by possessing the same stochastic trend. Hendry (1997) discusses co-breaking where a common unobserved regime change affects the mean of several economic variables. Maravall (1995) reviews the unobserved components literature, including economic applications such as the business cycle, natural unemployment rate, credibility of the monetary authority and so on.

Our LIVES method is more general. A single latent variable, the CCI, captures an evolutionary structural shift that affects not only the intercept of each equation, but also interacts with some of the other variables. We do not rely on "black box"-type statistical methods because economic theory provides exploitable prior information for a more disciplined approach. This includes information about the direction of the change in the latent credit conditions index and its impact.

We represent the CCI as a linear combination of smoothed step dummies, the SDMMAs, that form a smooth non-linear curve. An important set of priors are those for the slope coefficients in the spline function since, in principle, this function could be very general. These priors rely on knowledge of the institutional environment described in the full version of the paper. They suggest: non-negative coefficients on the SDMMA terms from 1982 to 1990; non-positive for around 1992 to 1994; non-negative until 2006; and non-positive from 2007 due to the GFC. The method also uses priors about the sign and magnitude of other economic and demographic influences in the specification and their interaction with the latent variable. Eleven parameters are needed to fit CCI subject to these priors.

The system consists of equilibrium correction models for house prices, consumption, mortgage credit and HEW:

$$\Delta y^*_{it} = \varphi_i (\alpha_{i0} + \zeta_i CCI_t + \alpha_{i1} Z_t - y^*_{i,t-1}) + \beta_i \Delta X_t + \varepsilon_{it}, \text{ for } i \in [1,4] \quad (1)$$

$$CCI_t = \sum_{s=1} a_s SDMMA_{st} \quad (2)$$

y^*_i is the dependent variable when correctly measured[3], φ_i is the equilibrium adjustment speed for equation i, ζ_i is the intercept effect of credit conditions (CCI_t) in equation i, Z_t is a vector of long-run variables (including interaction effects with CCI), and ΔX_t is a vector of I(0) short-run dynamic terms. Several key explanatory variables such as interest rates and income growth expectations in each equation are interacted with the credit conditions in the form $CCI_t(x_{j,t-1} - (\text{mean})x_j)$, where x_j is the explanatory variable and (mean)x is the post-1979 arithmetic mean. The speeds of adjustment (φ_i), the long-run coefficients (α_i) and the short-run coefficients (β_i) are uniquely identified in Equation 1. Identification of the coefficients requires that one of the ζ_i is normalised to one. This is done for the house price equation.

3 We allow for some measurement bias in pre-1986 house price data and pre-1988 mortgage debt data.

3. Consumption and the credit channel

The consumption to income ratio in Australia rose substantially from the late 1970s to 2008. Standard life cycle models of the Ando and Modigliani (1963) kind suggest that part of the explanation lies in wealth effects. The log linearisation of the simple life cycle model with habits suggest the following model, where A is net worth; see Aron et al (2011):

$$\Delta \log c_t = \varphi(\alpha_0 + \gamma A_{t-1}/y_t + \psi \log(y^p/y)_t + \log y_t - \log c_{t-1}) + \varepsilon_t \quad (3)$$

The model implies partial adjustment of log real per capita consumption to a long-run target defined by the first four terms in the parentheses. y^p is permanent real per capita non-property income and the log ratio to current income (y) is:

$$\log(y^p/y)_t = E_t \sum_{s=1}^{k} (1-\eta)^{s-1} \log y^{t+s}) / \sum_{s=1}^{k} (1-\eta)^{s-1} - \log y_t \quad (4)$$

Thus, $\log y^p$ is the annualised discounted future value of log income. We assume that households discount future income at roughly 20 per cent per annum ($\eta = 0.05$), with a ten-year horizon ($k = 40$). While not exactly the same as the log of the discounted future value of the level of income, it is a very good approximation. The strict version of the hypothesis implies that the weight on $\log(y^p/y)_t$ should be equal to one minus the risk-adjusted real interest rate ($\psi = 1 - \eta$), implying an upper bound of 0.95 for ψ when $\eta = 0.05$. One must then impute some information set to households in forming expectations about $\log(y^p/y)_t$. Williams (2010) canvassed several alternatives and we rely on the "sophisticated" household information set from that paper to generate households' expected future income growth.

The concept of net worth used in the Ando-Modigliani model aggregates all assets minus debt into a single figure. Net worth includes housing wealth, so this imputes the same wealth effect to liquid assets and to housing as to all other types of wealth. However, the wealth effect from housing implied by the life-cycle theory is suspect and hence so must be the theory's net worth concept. If there is a credit channel, systematic rises in consumption can result from increases in the collateral values of houses. The presence of mortgage down payment constraints faced by first-time buyers introduces another link between house prices and consumption. Shifts in credit accessibility will affect the size of these linkages and the balance of house price effects on consumption. When access to credit is restricted, a rise in house prices, given the down payment constraint, can actually result in a fall in aggregate consumption, particularly if home equity loans are hard to access.

There is also a liquidity argument for not aggregating liquid with illiquid financial assets since the buffer stock role of liquid assets gives them a higher marginal propensity to consume (MPC) than for illiquid assets. Similarly, but contingent on the availability of home equity loans and cheap refinancing, housing equity can play a buffer stock role against unanticipated income fluctuations (Miles (1992), Parkinson et al (2009)). Thus, the combination of the collateral and liquidity arguments suggests a three-fold disaggregation of wealth into liquid assets minus debt, illiquid financial assets, and housing wealth interacted with an index of credit liberality.

The original Ando-Modigliani model took no explicit account of income uncertainty, the precautionary motive for saving, or of time-varying interest rates. A more comprehensive model could include a simple proxy for income uncertainty such as the change in the unemployment rate, with this role possibly diminishing as credit conditions ease. Also, real interest rates affect consumers because they influence intertemporal substitution choices and the user cost effects for goods with some durability. Further, since three quarters of Australian mortgage debt is at floating rates, changes in nominal interest rates could affect household cash flows, again dependent on credit conditions. Finally, as credit access improves, so the role of income growth expectations should increase because households can then borrow to consume ahead of the expected income rise.

The above considerations and the three potential credit interaction effects have been combined in an empirical model for the United Kingdom, the United States and Japan in Aron et al (2011):

$$\Delta \log c_t = \varphi(\alpha_{0t} + \alpha_{1t} r_{t-1} + \alpha_{2t}\theta_t + \gamma_{1t} HA_{t-1}/4y_t + \gamma_2 IFA_{t-1}/4y_t + \gamma_3 NLA_{t-1}/4y_t + \psi_t \log(y^p/y)_t$$

$$+ \log y_t - \log c_{t-1}) + \beta_{1t}\Delta \log y_t + \beta_{2t}\Delta_4 i_{t-1} \times (CR_{t-1}/4y_t) + \varepsilon_t \qquad (5)$$

The speed of adjustment is φ; r is the real interest rate; θ is uncertainty; $HA_{t-1}/4y_t$ is the ratio of housing wealth to annualised non-property income; $IFA_{t-1}/4y_t$ is the ratio of illiquid financial assets to income; $NLA_{t-1}/4y_t$ is the ratio of liquid assets minus debt to income; $\Delta_4 i_{t-1} \times (CR_{t-1}/4y_t)$ measures the cash flow impact on borrowers of changes in nominal mortgage rates (i) scaled by the household debt to income ratio. The parameters γ_i measure the MPCs for each of the three asset types. The log income growth term can be rationalised by aggregating over credit-constrained and unconstrained households. Equation 5 reduces to the "classical" consumption equation (Equation 3 earlier) with the following testable restrictions:

$$\alpha_{1t} = \alpha_{2t} = 0 \;;\; \gamma_{1t} = \gamma_2 = \gamma_3 \;;\; \beta_{1t} = \beta_{2t} = 0 \;;\; \psi_t = \psi \qquad (6)$$

There is time variation in some of the parameters of Equation 5 induced by shifts in credit availability. The credit channel enters the consumption function through the different MPCs for net liquid assets and for housing, through the cash flow effect for borrowers, and by allowing for possible parameter shifts. As noted above, credit market liberalisation should raise the intercept α_0, implying a higher level of log(c/y); shift the real interest rate coefficient α_1 in a negative direction; raise α_3 by increasing the impact of expected income growth; and increase the MPC for housing collateral, γ_1. It could also lower the current income growth effect, β_1, and the cash flow impact of the change in the nominal rate, β_2.

4. Some consumption equation results

The consumption to non-property income ratio for Australia rose by 14.4 percentage points across 1978–2008. Estimated jointly with the house price, mortgage stock and HEW equations within our LIVE system, we find that the long-run consumption to income ratio is determined by credit conditions shifts, household income growth expectations, a three-fold disaggregation of household net worth, variable real interest rates, and the change in the proportion of the population of working age (15–64 years) and of first-home-buying age (22–34 years). The demographic variables have negative coefficients since the working age population save for retirement and the young save to invest in housing. The long-run coefficients on housing collateral, income growth expectations and real interest rates are all time-varying depending on the degree of credit liberality. In the short run, our parsimonious consumption model includes the change in the log unemployment rate, the lagged four-quarter log change in consumption, risk aversion to negative housing returns and some outlier dummies.

Figures 1 and 2 plot the partial equilibrium long-run influences on the log consumption to non-property income ratio. During the 1980s, the major positive influences on consumption are easing of credit conditions, initially low house prices relative to income, rising illiquid financial wealth and age-demographic effects. The latter broadly reflect the ageing of the post-WWII "baby-boomer" generation. The easing of the down payment constraint through CCI contributes about 0.10 to the log consumption to income ratio across 1978–1992, subtracts about 0.02 during the early 1990s, and contributes another 0.06 from 1998 until the GFC in 2007.

The relaxation of the housing collateral constraint, effected through the interaction between housing wealth (to annualised income) and CCI, contributes a further 0.09 to the log consumption to income ratio between 1998–2007. The estimated long-run wealth MPCs are 0.049 for housing assets (at the peak of credit liberality in 2007), 0.022 for illiquid financial assets and 0.159 for net liquid assets. Rising optimism about future income begins to play a positive role from the early 1990s, offset by higher real interest rates and rising household indebtedness (negative net liquid assets to annualised income). The exception is during the period 2000–2004, when low real interest rates contributed positively to consumption. This was perhaps an unnecessary policy setting, given the easy state of credit conditions.

The full version of the paper discusses the house price, mortgage stock and HEW equations in the system. It also discusses our robustness checks. First, we estimated the CCI, excluding the consumption equation from the system. Second, we estimated the income forecasting equation from Williams (2010) as a fifth equation in the system. Third, we estimated the system over two shorter samples to check parameter stability. Fourth, we included a measure of household property income instead of relying on non-property income alone. Fifth, we constructed a generalised cointegration test on the consumption equation. Our estimates and conclusions are robust to these variations.

Figure 1

Contributions to long-run log consumption to income (I)

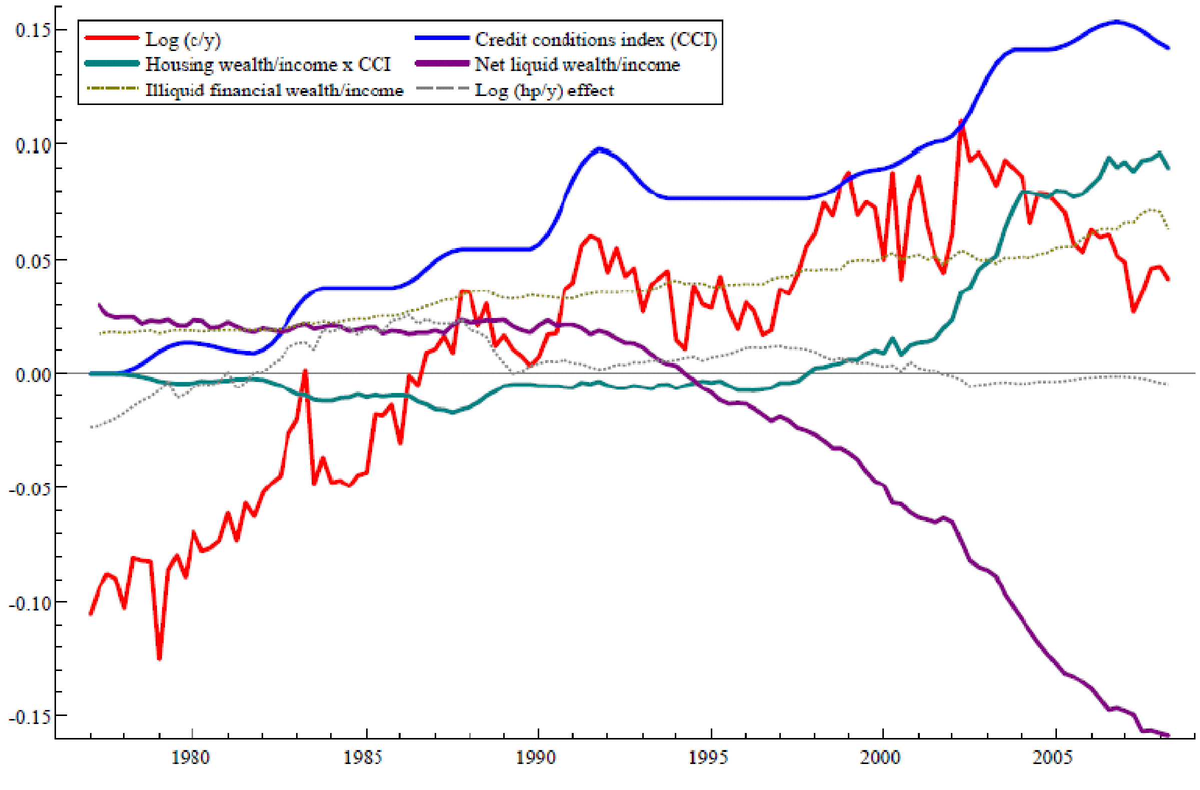
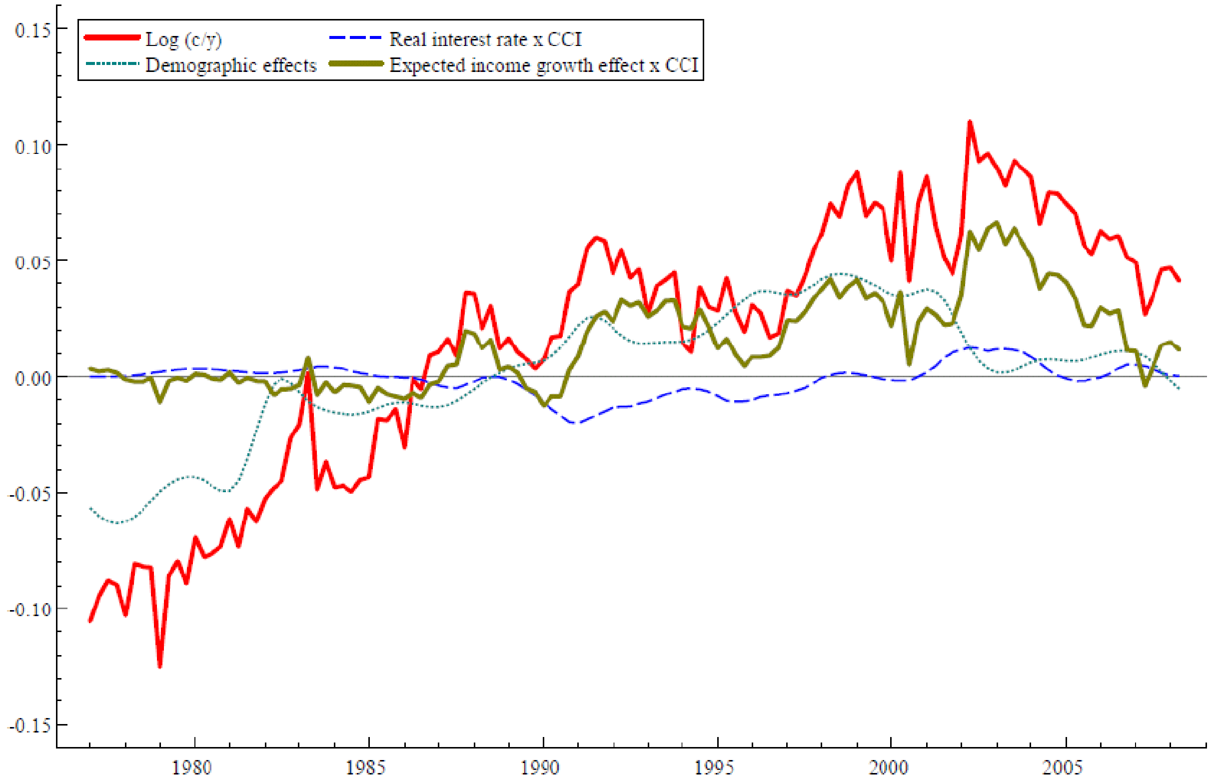


Figure 2

Contributions to long-run log consumption to income (II)



Notes: Figures 1 and 2 show the de-meaned contributions from the interaction terms (and net of their intercept effect, if any). Interaction effects are constructed as $\alpha_{ij}CCI_t(x_{jt-1} - (\text{mean})x_j)$, where α_{ij} is the long-run coefficient on explanatory variable x_j.

5. Conclusion

Unobserved shifts in credit conditions help explain many of the stylised facts about the Australian economy over the last three decades. These include sustained increases in consumption and house prices relative to income, an unprecedented expansion in household balance sheets, increased mortgage refinancing activity, and an increase in the level and volatility of housing equity withdrawal (HEW). Australia was high on the OECD's list of countries with greatly overvalued house prices in the mid-2000s, but there are few signs of the kinds of distress suffered by the United States after 2007. Among the reasons are better financial regulation and hence the absence of poor quality sub-prime lending, better monetary policy which in part headed off excessive house price euphoria, the absence of a speculative house building boom, and Australia's good economic fortune in riding the commodities boom fuelled by China and other emerging markets.

We show that credit conditions operate on the real economy through several channels. First, the relaxation by lenders of the mortgage down payment requirement facing young, first-time homebuyers raises long-run mortgage demand, house prices and consumption. Second, debt product innovation introduces a collateral channel from house prices to real activity. Older households with existing wealth benefit from cheap mortgage refinancing and home equity loans (popular since about the mid-1990s). Through HEW, housing capital gains can be accessed and redirected towards immediate consumption, asset portfolio rebalancing or debt consolidation. However, for young households without collateral, higher house prices require saving for a larger deposit. The balance of house price effects on consumption and mortgage demand thus hinges on the state of credit conditions. Third, easing of credit conditions makes intertemporal consumption smoothing possible. This raises the importance of real interest rates and income growth expectations in household decisions, and diminishes the importance of economic uncertainty. With liberal credit conditions, mortgage credit and housing equity are increasingly used to smooth fluctuations in economic conditions.

Our latent interactive variable equation system (LIVES) presents a solution to the difficult macroeconometric challenge of handling large, unobserved structural changes. The method relies on institutional knowledge, economic theory, and consistency in logic and empirical findings across the equations (with common roles played by the latent credit conditions index (CCI), income growth expectations and other variables). Our system throws a good deal of light on the underlying shocks driving the economy and on the workings of the monetary policy transmission mechanism. Evidence of non-linearities and shifts in marginal responses with the CCI imply that the underlying impulse response functions are far from constant. These findings have obvious application for policymakers, since existing models without credit conditions effects are misspecified and are likely to lead to policy errors.

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