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Monetary Policy Transmission and Household Indebtedness in Australia

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Abstract

We highlight the importance of high and low states of household debt for the transmission of monetary policy in Australia during the period from 1994Q1 to 2019Q3. Using a state-dependent local projection model, we demonstrate that the impact of a monetary policy shock varies depending on the level of household debt. In particular, in low household debt conditions, output, investment, house prices, household debt-to-GDP, and debt-to-asset increase significantly to an expansionary monetary shock, while the responses of these variables are largely muted when the households are in a high-debt state. We infer from our results that the "home equity loan channel" may be active when household indebtedness is moderate, but inactive when it is high. We conjuncture that this channel likely played a crucial role in the transmission of monetary policy in Australia, and potentially accounted for the diminished effects of monetary policy under high household debt conditions.

Keywords

JEL Classification

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Monetary policy transmission and household indebtedness in Australia[*]

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February 16, 2025

Abstract

We highlight the importance of *high* and *low* states of household debt for the transmission of monetary policy in Australia during the period from 1994Q1 to 2019Q3. Using a state-dependent local projection model, we demonstrate that the impact of a monetary policy shock varies depending on the level of household debt. In particular, in low household debt conditions, output, investment, house prices, household debt-to-GDP, and debt-to-asset increase significantly to an expansionary monetary shock, while the responses of these variables are largely muted when the households are in a high-debt state. We infer from our results that the "home equity loan channel" may be active when household indebtedness is moderate, but inactive when it is high. We conjuncture that this channel likely played a crucial role in the transmission of monetary policy in Australia, and potentially accounted for the diminished effects of monetary policy under high household debt conditions.

Keywords: household debt, monetary policy, home equity loans.

JEL codes: E21, E32, E52

1 Introduction

The 2008 Global Financial Crisis (GFC) has highlighted the risk that household indebtedness poses to a country's financial stability and its overall economy.[1] In Australia, household indebtedness has continued to rise after the GFC and has been a lingering concern to policymakers for the last two decades (Debelle, 2004; Kearns et al., 2021; Dumitrescu et al., 2022). This trend contrasts with many other developed economies where household indebtedness has generally stabilized or decreased after the GFC, making Australia an interesting case to study. Recent studies investigate the influence of household indebtedness on the transmission of monetary policy in the US or other OECD countries (Alpanda and Zubairy, 2019; Alpanda et al., 2021; Flodén et al., 2021; Cumming and Hubert, 2023). However, this particular question remains largely unexplored in the Australian context. Our aim is to fill this gap by examining how high and low states of household debt affect monetary policy transmission in Australia.

Our research is motivated by Australia's housing market, which differs from the global trends for two reasons. First, since the GFC, household debt and house prices have increased significantly in Australia, whereas globally, these have generally decreased or stabilized (Figures 1 and 2). Second, variable-rate mortgages (VRMs) traditionally make up the majority of home loans in Australia (Debelle, 2004). Figure 3 shows a close correlation between the mortgage rate and the cash rate, suggesting that changes in monetary policy may have a more immediate impact on household finances in Australia.

We adopt the empirical strategy of Alpanda and Zubairy (2019) to investigate the household debt related state dependencies of an expansionary monetary policy shock for Australia. To this end, we first construct a binary state variable measuring the degree (high or low) of households' indebtedness by extracting a low frequency trend from the household debt-to-GDP ratio. We then use quarterly data and the monetary policy shocks

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[1]Schularick and Taylor (2012) and Jordà et al. (2013) find that an increase in household debt helps predict the occurrence of financial crises.
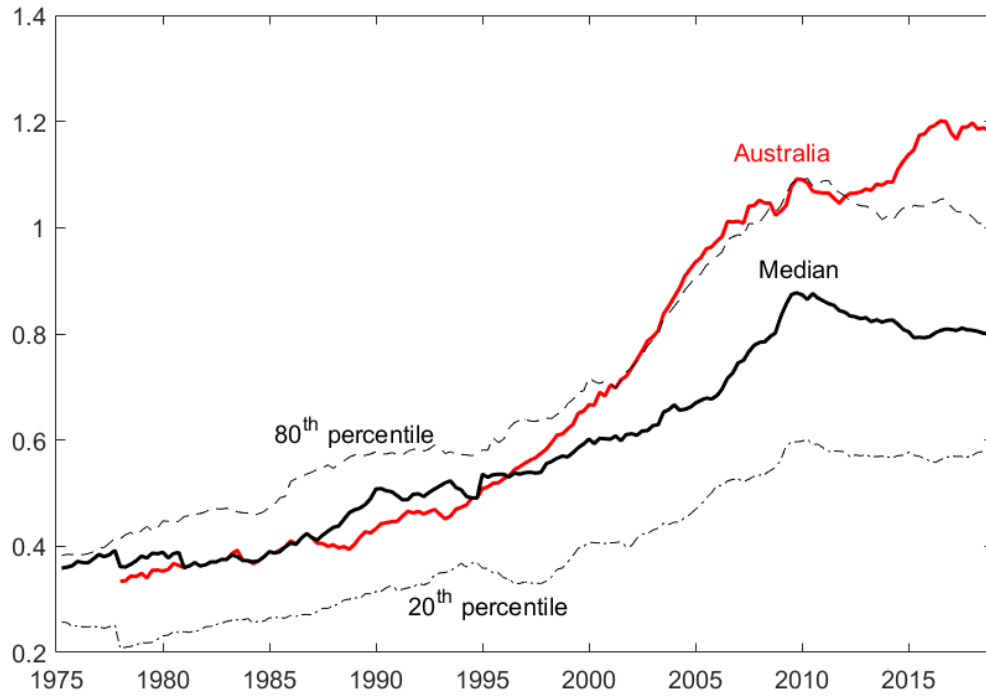
Figure 1: Household debt-to-GDP ratios in advanced economies. Sample: 1975Q1–2018Q4. Source: Alpanda et al. (2021) and authors' calculations.
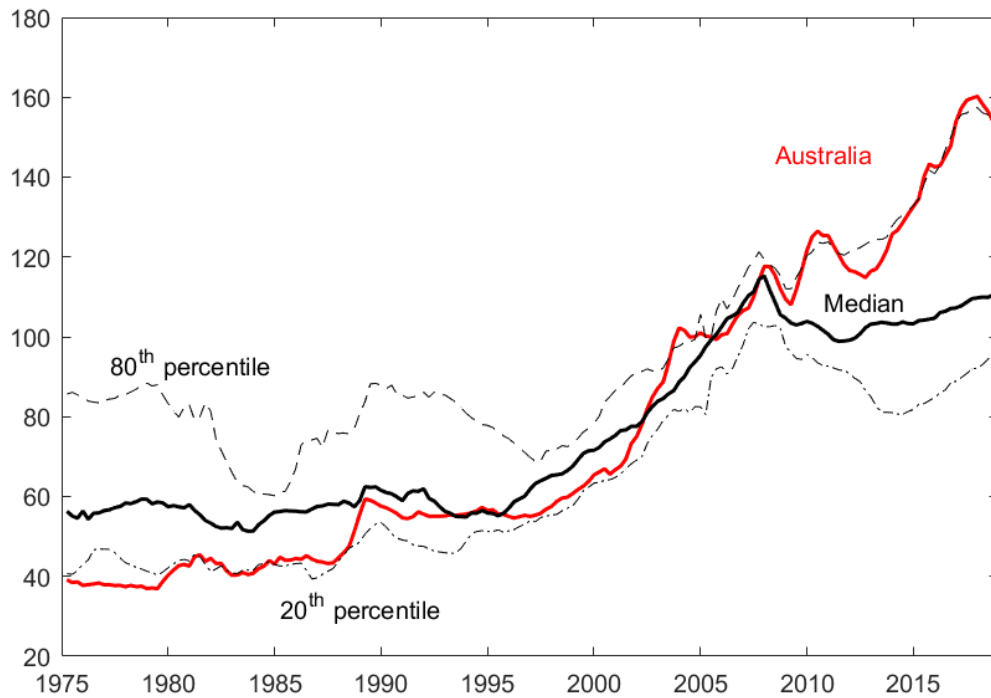
Figure 2: House price indices in advanced economies. Sample: 1975Q1–2018Q4. Source: Alpanda et al. (2021) and authors' calculations.

Figure 3: Cash rate and mortgage loan rate for Australia. Sample: 1990M9–2021M8.

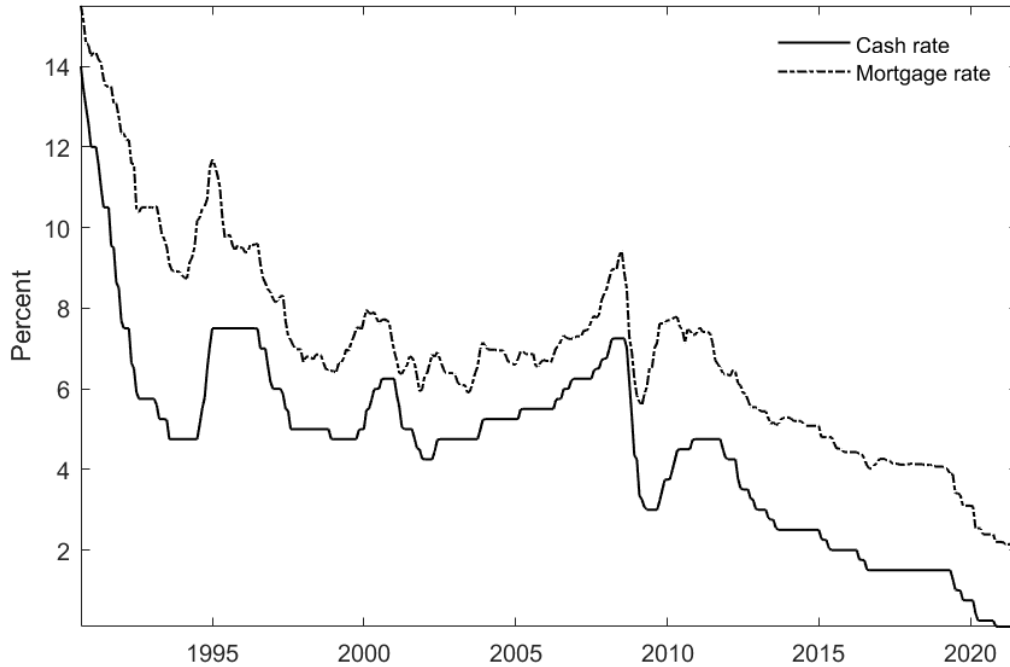of Beckers (2020) over the period 1994Q1-2019Q3 to estimate a state-dependent local projection model.[2] This model enables us to compare the responses of key macroeconomic variables to a surprise cut in the cash rate, when the initial state of household indebtedness is either high or low.

We find that monetary policy in Australia is less effective when household debt is high, which is in line with the empirical findings of Alpanda and Zubairy (2019) for the US. In particular, to an expansionary monetary shock, the responses of output, consumption, investment, house prices, household debt-to-GDP, and debt-to-asset ratios are largely muted in the high-debt state. In contrast, these variables increase significantly when households are in low-debt conditions. In addition, our consumption and investment subcomponents analysis shows a significant increase in durable goods consumption and residential and nonresidential investments when households are in a low-debt state.

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[2]Beckers (2020)'s monetary shocks are based on the Romer and Romer (2004) strategy. See also Bishop and Tulip (2017).

Our results are also closely related to the two main channels through which household indebtedness may affect the propagation of monetary shocks (Calza et al., 2013; Bhutta and Keys, 2016; Hofmann and Peersman, 2017; Alpanda and Zubairy, 2019; Kim and Lim, 2020; Flodén et al., 2021): (i) the debt service channel, i.e. how a change in the policy rate affects the burden of interest payments borne by households, and (ii) the home equity loan channel, which refers to the ability for home owners to withdraw home equity when house prices increase. The literature suggests that the debt service channel (or cash flow channel) becomes stronger in context where adjustable-rate mortgages (ARMs) are predominant and where households' indebtedness is high. On the other hand, the efficacy of the equity channel hinges primarily on the extensiveness of mortgage equity release (i.e., home equity withdrawal). We discuss these two channels of monetary transmission further in the following.

The debt service channel makes monetary policy more effective under ARMs when household debt is high. The reason is that a policy rate cut immediately reduces mortgage rates, and both households with high and low debt can switch to mortgage loans with cheaper rates. The effects of a cut in the policy rate on households with high and low debt are then proportional. In other words, the more indebted a household is, the more it benefits from the interest rate cut through reduced interest payments.

The home equity loan channel, instead, dampens the efficacy of monetary policy as household indebtedness rises. The reason is: despite the fact that a policy rate cut lowers mortgage rates and increases house prices, highly indebted households are unable to access home equity loans due to their existing high debt. Put differently, the home equity channel amplifies the stimulative effects of a policy rate cut only for households with low levels of debt. Thus, this channel weakens at higher aggregate levels of household indebtedness. Moreover, the strength of this channel does not depend so much on whether mortgage rates are fixed or adjustable. Rather, it depends positively on the widespread availability of home equity withdrawal facilities and on the sensitivity of house prices to monetary

policy.

Whether household indebtedness amplifies or dampens the effectiveness of monetary policy would therefore depend on which of these two channels dominates. If the debt service channel prevails, monetary policy would become more effective as household debt increases. If, instead, the home equity channel predominates, monetary policy would be more powerful when household debt is low.

Our findings are consistent with a home equity transmission channel of monetary policy. We observe that for households in a low-debt state, a policy rate cut results in a significant increase in house prices and in the debt-to-GDP and debt-to-asset ratios. These findings reflect the ability of moderately indebted home owners to increase their borrowing through home equity withdrawals after a policy rate cut. Our empirical results suggest that such a home equity loan channel may have been at work in Australia during the period 1994-2019.[3],[4]

The rest of the paper is structured as follows. The next section highlights our contribution to the literature. Section 3 describes our econometric strategy. Section 4 presents our main results. Section 5 provides four key robustness checks, while Section 6 concludes.

2   Related literature

Our paper is related to three strands of literature. The first strand, to which our paper is closely related, focuses on empirical studies on the role of households' indebtedness in the transmission of monetary policy (Alpanda and Zubairy, 2019; Kim and Lim,

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[3]Bhutta and Keys (2016) note that equity extraction is an understudied topic despite its potential importance to the macroeconomy. They argue that a home represents the largest asset in most households and their primary source of collateral for borrowing.

[4]La Cava et al. (2016) find evidence of 'borrower' cash flow channel for Australian households with variable-rate mortgage debt compared to those with fixed-rate mortgages (FRMs). Also see Price et al. (2019), La Cava and He (2021) and La Cava and Wang (2021).

2020; Alpanda et al., 2021; Cumming and Hubert, 2023).[5] Our work closely follows the empirical methodology of Alpanda and Zubairy (2019). They investigate whether the transmission of monetary policy shocks in the US changes according to the level of household indebtedness. They identify high and low states of indebtedness using the cyclical component of the household debt-to-GDP ratio. They estimate a state-dependent local projection model in which monetary policy shocks are identified through a standard recursive (Cholesky) identification scheme.[6] They find that US monetary policy is less powerful when household debt is high.

Beyond our specific focus on Australia, our empirical approach differs from Alpanda and Zubairy (2019) in two ways. First, our identification of monetary disturbances is different: we borrow the series of Australian monetary policy shocks constructed by Beckers (2020) who augments Romer and Romer (2004)'s methodology by taking into account the financial market conditions of Australia.[7] Second, in the robustness section, we adapt the empirical model to take into account small-open-economy dimensions, which are crucial in the Australian context, by controlling for two key global variables: the World Industrial Production index constructed by Baumeister and Hamilton (2019) and the Global Financial Cycle estimated by Miranda-Agrippino and Rey (2020).

Alpanda and Zubairy (2019) also calibrate a partial equilibrium model for the US economy, where long-maturity fixed-rate mortgages are prevalent and equity withdrawal facilities are widely diffused. Their model simulations show that a policy rate cut has a greater stimulative effect on low-debt households compared to high-debt households. In other words, their calibrated model predicts that the home equity channel is stronger than

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[5]Another branch of the literature investigates the opposite causal link, i.e. how monetary policy affects household-debt dynamics. See Duygan-Bump et al. (2015), Fagereng et al. (2021) and Canakci (2021) among others.

[6]Alpanda and Zubairy (2019) construct monetary shocks using residuals from a three-variable Cholesky-identified SVAR model where the federal funds rate is ordered last after GDP and inflation. The shocks, thus obtained, are then used in their state-dependent local projection model to identify monetary disturbances.

[7]Alpanda and Zubairy (2019) also consider Romer and Romer shocks in their robustness analysis.

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the debt service channel in the US. As a result, monetary policy is more effective when household debt is low. This theoretical prediction is consistent with their empirical findings.[8] We obtain the same result for Australia, even though there are notable institutional disparities across the US and Australian mortgage markets. Generally, most home loans in Australia are VRMs, whereas long-maturity fixed-rate mortgages are predominant in the US. Our results are also in line with the empirical findings of Calza et al. (2013). They find that the effects of monetary policy shocks on residential investment and house prices are markedly stronger in countries with more developed and flexible mortgage markets, such as Australia. Moreover, they also document that the impact on consumption is stronger only in those countries where (i) mortgage equity release is common and (ii) mortgage contracts are predominantly of the variable rate type. These two characteristics are also common in the Australian mortgage market.[9]

Alpanda et al. (2021) investigate whether the effectiveness of monetary policy may jointly depend on the business cycle, the state of household debt, and the average level of interest rates. They use panel data from 18 OECD countries to estimate a panel state-dependent local projection model. They find that monetary policy is least effective during recessions that coincide with moderate levels of household debt and high interest rates. Focusing on the state-dependence of monetary policy with respect to household debt, the findings of Alpanda et al. (2021) seem to contradict the ones of Alpanda and Zubairy (2019) for the US and ours for Australia.[10] This divergence may be explained in two ways: First, Alpanda et al. (2021) consider a panel of 18 countries. Hence, their average findings do not necessarily reflect the Australian mortgage market. Indeed, we have seen

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[8]Alpanda et al. (2021) consider a simpler version of the partial equilibrium model which only features the debt service channel. They use data from 18 OECD countries to calibrate their model. They find that monetary policy is more effective when household debt is high.

[9]For further insights into the relationship between monetary policy and household indebtedness, see Iacoviello (2005), Calza et al. (2013), Sufi (2015), De Luigi and Huber (2018) and Beraja et al. (2019).

[10]Using different methodologies and datasets, Hofmann and Peersman (2017), Gelos et al. (2019), Kim and Lim (2020) and Flodén et al. (2021) also find evidence suggesting that the effects of monetary policy tend to be stronger when households' indebtedness is high.

that, in terms of the dynamics of household debt, Australia is an outlier among OECD countries (Figure 1). Second, Alpanda et al. (2021) and Alpanda and Zubairy (2019) identify their monetary shocks using different identification schemes, sign restrictions on impulse responses, and a Cholesky-identified SVAR, respectively.[11]

Our conjecture that the home equity loan channel is active when households are in a low-debt state is consistent with the findings in the US literature. Bhutta and Keys (2016) find that lower interest rates stimulate greater equity extraction during the housing boom due to the increase in home equity levels, whereas households with low home equity levels find it more difficult to use their home as collateral. Beraja et al. (2019) and Chen et al. (2020) present evidence that households with low levels of home equity have difficulty refinancing at a lower mortgage rate.[12] Similar evidence is documented for Australia by Schwartz et al. (2010), who find that households with high debt, measured by the loan-to-value ratio (LVR), face constraints against further borrowing or home equity withdrawals.

Our results contrast with those of Kim and Lim (2020). They find evidence of a cash flow channel for a panel of 23 economies, including Australia. They also find asymmetric effects of monetary policy such that the contractionary impact of monetary policy is more pronounced than the expansionary one. Their findings document that monetary policy is more powerful for countries in high-debt state with a higher share of ARMs, under a contractionary policy stance.[13,14] In response to monetary tightening, they find a significantly negative response of economic activity, consumption, investment, the price level

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[11]Using UK loan-level microdata, Cumming and Hubert (2023) show that the response of aggregate consumption to a monetary shock depends on the distribution of household debt relative to income. They find that consumption responds more to monetary policy when the share of highly indebted households is large.

[12]Johnson and Li (2010) use US household survey data and find that a household with a debt service ratio (DSR) in the top two quintiles of the distribution is significantly more likely to be turned down for credit.

[13]Rubio (2011) and Garriga et al. (2017) employ New Keynesian dynamic stochastic general equilibrium and general equilibrium models, respectively, and conclude that monetary policy shocks have a stronger effect under ARMs.

[14]Under cash-flow channel, monetary policy can have a direct impact on aggregate household spending via the transfer of income between household borrowers and lenders (Kim and Lim, 2020).

and house prices. Similar findings are documented in Hofmann and Peersman (2017), who find evidence of a debt service channel of monetary transmission in 18 high-debt economies, including Australia. They attribute the dominance of the debt service channel to the responses of the debt service ratio (DSR).[15] A monetary tightening triggers an increase in DSR that leads to an income transfer from debtors to creditors. As a consequence, aggregate output declines because the reduced spending by the debtor is only partially compensated for by an increased spending of the creditors.

The second strand of literature examines the implications of household debt for business cycles and macroeconomic stability. Mian et al. (2013), Jordà et al. (2016) and Mian and Sufi (2018) find that episodes of buoyant household debt dynamics foreshadow severe recessions and financial crises. Dumitrescu et al. (2022) stress that, in periods of economic slack, lending institutions are less likely to extend new loans to highly indebted households, thus impeding them from smoothing consumption and, thereby, further exacerbating the slump.[16]

The third strand focuses on a growing literature that finds evidence of non-linearity based on business cycle, uncertainty, and sentiments in the transmission of monetary policy.[17] Several papers explore the extent to which the effectiveness of monetary policy depends on the state of the business cycle and compare the transmission of expansionary versus contractionary monetary shocks (Cover, 1992; Thoma, 1994; Weise, 1999; Angrist et al., 2018). From a methodological point of view, the closest paper to ours, in this branch of literature, is Tenreyro and Thwaites (2016). They estimate a smooth-transition local projection model on US data and find that the efficacy of monetary policy is subdued in

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[15]DSR is the ratio of total debt payments (principal and interest) to the income of the private non-financial sector.

[16]See Benito et al. (2009) and Hunt et al. (2015) for further discussions of the macroeconomic implications of elevated household debt. For related discussions centered on the Australian context, see Wilkins and Wooden (2009), Loukoianova et al. (2019), Kolios (2020) and Kearns et al. (2021).

[17]For Australia, this literature is scant. The only papers studying the non-linear effects of monetary policy in Australia that we are aware of are Bodman (2006) and Leu and Sheen (2006). Both papers investigate the asymmetry of positive versus negative monetary shocks.

recessions. Besides the state of the business cycle, some papers investigate other sources of non-linearity in the transmission of monetary policy. Employing interacted VAR models, Aastveit et al. (2017) and Pellegrino (2021) find that monetary policy is less effective when uncertainty is high. Kurov (2010), Lien et al. (2021), and Dahmene et al. (2021) examine the influence of investor sentiment on the propagation of monetary disturbances. They find that monetary shocks have a greater impact on stock returns when investor sentiment is high. Debes et al. (2014) and Guo et al. (2016) consider the role of consumer sentiment and obtain similar results.

Our contribution lies in evaluating the non-linearity in the transmission of Australian monetary policy based on the low and high states of household debt. Using the state-dependent local projection approach of Alpanda and Zubairy (2019), we find that households with low debt respond strongly to an expansionary monetary shock compared to those with high debt. Our results showing an increase in house prices, debt-to-GDP and debt-to-asset ratios for the households in low-debt state reflect an active home equity loan channel. We discuss this further in the results section.

3   Econometric strategy

3.1   Data

We use quarterly data from 1994Q1–2019Q3.[18] The start date corresponds to the adoption of Inflation Targeting (IT) by Australia and the availability of monetary shock series by Beckers (2020).[19] We avoid the early period of Australia's IT regime, which the Reserve Bank of Australia (RBA) adopted in 1993. The end date marks the onset of the COVID-19 pandemic. The choice of our variables largely follows from Alpanda

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[18]The data sources and descriptions are provided in Appendix A1.

[19]Beckers (2020) constructs augmented monetary shock series for Australia. He extended the approach of Romer and Romer (2004) by including credit spreads in the systematic component of monetary policy.

and Zubairy (2019). The variables of interest include: the cash rate (r), real GDP (gdp), real consumption (con), real investment (inv), real house price index (hp), household debt-to-GDP ratio ($debt/gdp$), household debt-to-asset ratio ($debt/asset$), household interest payments-to-income ratio (ip/inc), durable consumption ($dcon$), non-durable consumption ($ndcon$), service consumption ($scon$), residential investment ($rinv$), and non-residential investment ($nrinv$).[20] We control for core CPI inflation (π) and the trade weighted real exchange rate (rer). All variables are expressed in logs, except for the cash rate, inflation rate, household debt-to-GDP, debt-to-asset, and interest payments-to-income ratios.

3.2 Model

We apply the local projection techniques of Jordà (2005) to estimate a state-dependent local projection model following Alpanda and Zubairy (2019):

The linear local projection model takes the form:

$$y_{t+h} = \alpha_h + \theta_h(L)x_t + \beta_h\varepsilon_t + u_{t+h}, \quad \text{for } h = 1, 2, ..., \text{H}_\text{z} \tag{1}$$

where $y = [r, gdp, con, inv, dcon, ndcon, scon, rinv, nrinv, hp, debt/gdp, debt/asset, ip/inc]'$ contains the variables of interest. $x = [r, gdp, \pi, rer, hp, z]'$ is a set of control variables. $z = [inv, con, dcon, ndcon, scon, rinv, nrinv, debt/gdp, debt/asset, ip/inc]'$. $\text{H}_\text{z} = 16$ is the number of horizons. We include one variable at a time from the vector z to our set of controls, x. $\theta_h(L)$ is a polynomial in the lag operator. We include three lags of r, gdp, π, rer, hp, and z along with the current values of gdp, π, rer, and hp to the set of control variables.[21] α_h is a constant, and ε is the identified monetary shock series. The coefficient

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[20]We use the real residential property prices index to measure real house prices. We use dwelling and non-dwelling private capital formation to measure residential and non-residential investment, respectively.

[21]In our setting, it implies that gdp, π, rer and hp respond to the cash rate with a lag but the cash rate responds to changes in these variables contemporaneously.

β_h measures the responses of y at time $t+h$ to the shock ε at time t. The impulse response functions (IRFs) are a sequence of all $H_z \times 1$ vectors of estimated $\beta_h s$ for each variable of interest in y.

We extend the linear model of equation (1) to a state-dependent model by including an indicator variable I_{t-1}:

$$y_{t+h} = (I_{t-1})\left[\alpha_h^H + \theta_h^H(L)x_t + \beta_h^H \varepsilon_t\right] + \left(1 - I_{t-1}\right)\left[\alpha_h^L + \theta_h^L(L)x_t + \beta_h^L \varepsilon_t\right] + u_{t+h}, \quad (2)$$

where $I_{t-1} \in \{0,1\}$ is a dummy variable in time $t-1$ that takes 1 if the household is in high-debt state (H) and 0 if the household is in low-debt state (L).

A state-dependent local projection approach has two key advantages: (i) they offer a convenient approach to compute IRFs that allow for transitions between states, and (ii) the coefficients β_h^H and β_h^L in equation (2) capture the average impact of the shock of interest conditional on the initial state and, hence, account for changes in the state variable over the projection horizon h.[22]

3.3   The state variable

Following Alpanda and Zubairy (2019) and Alpanda et al. (2021), we use the household debt-to-GDP ratio as a state variable. This ratio is a common measure of household indebtedness in a country. We first derive a household debt gap measure which is used to classify high- and low-debt states. To do so, we apply the Hodrick-Prescott (HP) filter with a large smoothing parameter $\lambda = 10^4$ to the household debt-to-GDP ratio and extract the trend component. This approach yields our household debt gap measure, which is expressed as the percentage deviation from the trend. Positive gaps correspond

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[22]Literature that employs state-dependent local projection models includes: Auerbach and Gorod-nichenko (2013), Tenreyro and Thwaites (2016), Alpanda and Zubairy (2019), Auer et al. (2021), Alpanda et al. (2021), among others.

to states of high debt, while negative gaps refer to states of low debt.[23] The large value for λ captures the long duration and large amplitude of the debt cycle. The value we use for λ is in line with Bauer and Granziera (2016), Aikman et al. (2017), and Alpanda and Zubairy (2019).[24]

Figure 4 plots the household debt-to-GDP ratio (solid line) with its HP trend (dashed line). The two vertical lines indicate the subsample that we use in our model estimation. The household debt-to-GDP ratio generally has an upward trend throughout the sample except for a drop following the GFC. Since the middle of the 1990s, the trend has increased over time in a context marked by rising household income, falling mortgage rates, easy access to credit (Claus and Nguyen, 2020; Kearns et al., 2021), and robust optimism among households about the overall economy (Claus and Nguyen, 2020; Drachal, 2020; Lim and Bone, 2022).

Figure 5 shows the debt gap constructed from the household debt-to-GDP ratio. The household debt gap provides additional insights into the evolution of household indebtedness in Australia. The rapid accumulation of household debt in Australia may to a large extent have been driven by easy access to credit resulting from financial deregulation in the 1990s and low interest rates post-GFC (Loukoianova et al., 2019). The Australian mining boom that lasted between 2000 and 2015 may also have contributed to this fast accumulation. The mining boom drove up both residential investment and household income. These factors led to the accumulation of high household debt. In Figure 5, the positive debt gap reached its highest level and lasted for the longest period between 2002Q2 and 2010Q4 (excluding a short dip during the GFC), which coincided with the boom period of the mining sector and the housing market.

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[23]To compute the debt trend, we HP-filter the household debt-to-GDP series for the period 1977Q1–2020Q4. To estimate our model in equation (2), we discard the debt gap data before 1994Q1 and after 2019Q3 to address the end-point problem associated with the HP-filter (Kim and Lim, 2020).

[24]Bernardini and Peersman (2018) employ the same methodology to construct the state variable using the domestic non-financial private debt-to-GDP ratio.
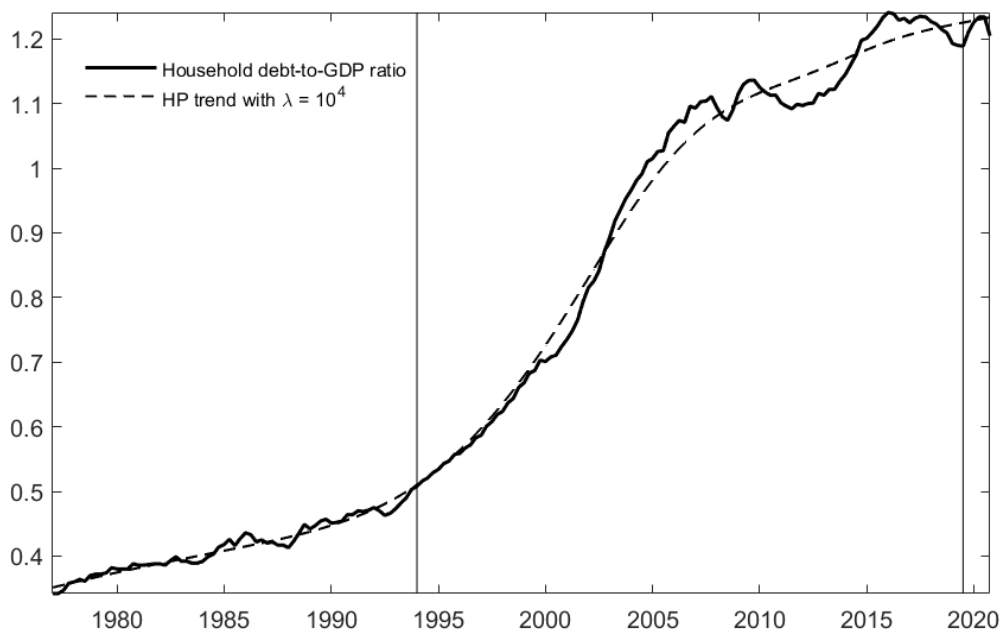
Figure 4: The household debt-to-GDP ratio. Sample: 1977Q1–2020Q4. Solid line: the household debt-to-GDP ratio. Dashed line: a HP trend with $\lambda = 10^4$. Two vertical lines: subsample for the model estimation, 1994Q1–2019Q3.

3.4   Romer and Romer monetary shocks for Australia

We use the Augmented Romer and Romer monetary shocks for Australia, constructed by Beckers (2020), in our state-dependent local projection model. Beckers (2020)'s methodology for identifying monetary policy shocks for Australia builds on Romer and Romer (2004) and Bishop and Tulip (2017). Beckers specifies a forward-looking Taylor-type rule, which he estimates using the RBA's forecasts of output, unemployment, and inflation. Motivated by Caldara and Herbst (2019), Beckers also includes different measures of credit spreads for Australia as additional explanatory variables in his regression. This accounts for the systematic response of the cash rate to changes in credit market conditions.[25] The residuals from this regression are dubbed 'Augmented Romer and Romer monetary shocks'. These residuals capture the non-systematic changes in the cash rate, conditional on the RBA's information set, including credit spreads, at the time of

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[25]Caldara and Herbst (2019) show that including credit spread is essential to correctly characterize the systematic component of US monetary policy.
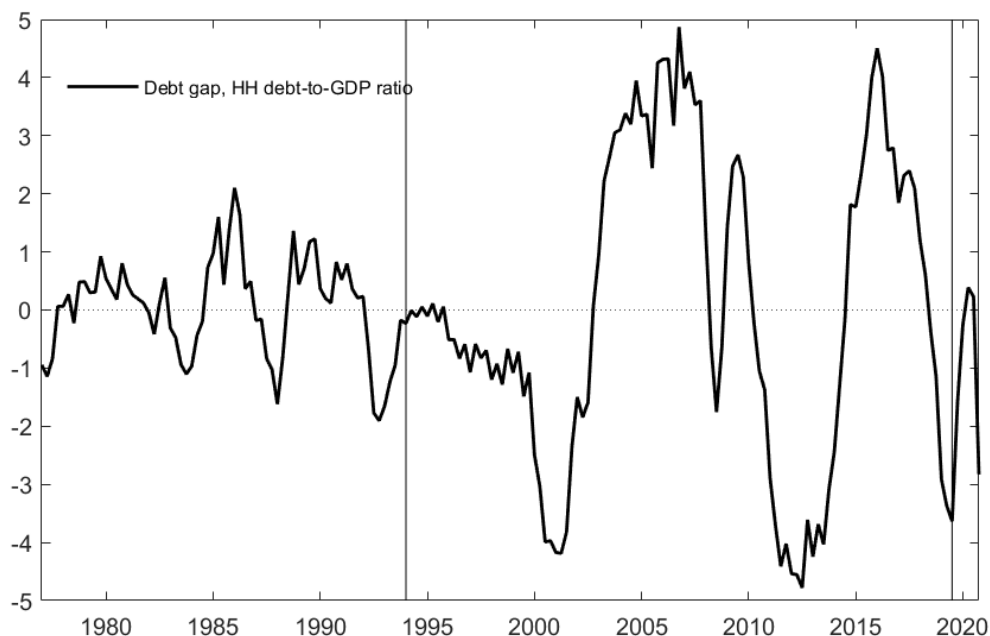
Figure 5: Household debt gap. Percentage deviation from HP trend with $\lambda = 10^4$. Sample: 1977Q1–2020Q4. Two vertical lines: subsample for the model estimation, 1994Q1–2019Q3.

each monetary policy decision.[26] Appendix A2 presents further details on the Augmented Romer and Romer monetary shocks for Australia.

4   Results

Figure 6 reports the smoothed impulse responses of the key macroeconomic and household finance variables to a 1 percentage point expansionary monetary shock.[27] The horizon h is on the x-axis showing the number of quarters, and the coefficients β_h^H and β_h^L are on the y-axis. The blue and red lines represent the impulse responses in high- and low-debt states, respectively. Figure 6(a) shows a significant expansion in real GDP and an increase in real consumption, and real investment to an expansionary monetary shock that hits the Australian economy when households are in low-debt state. For GDP and

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[26]Beckers (2020) shows that adding the credit spread to the RBA's interest rate rule helps to remove the price puzzle

[27]"Smoothed" here means three-period centered moving averages of the IRFs and the confidence intervals (Tenreyro and Thwaites, 2016).
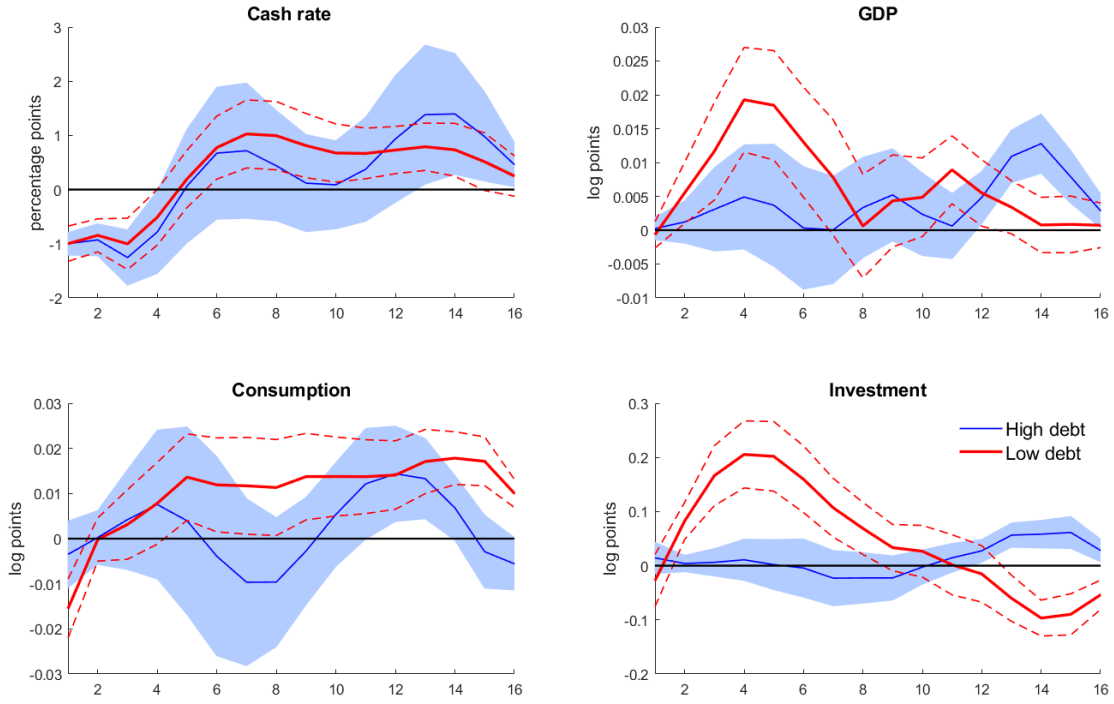
(a) Key macroeconomic variables
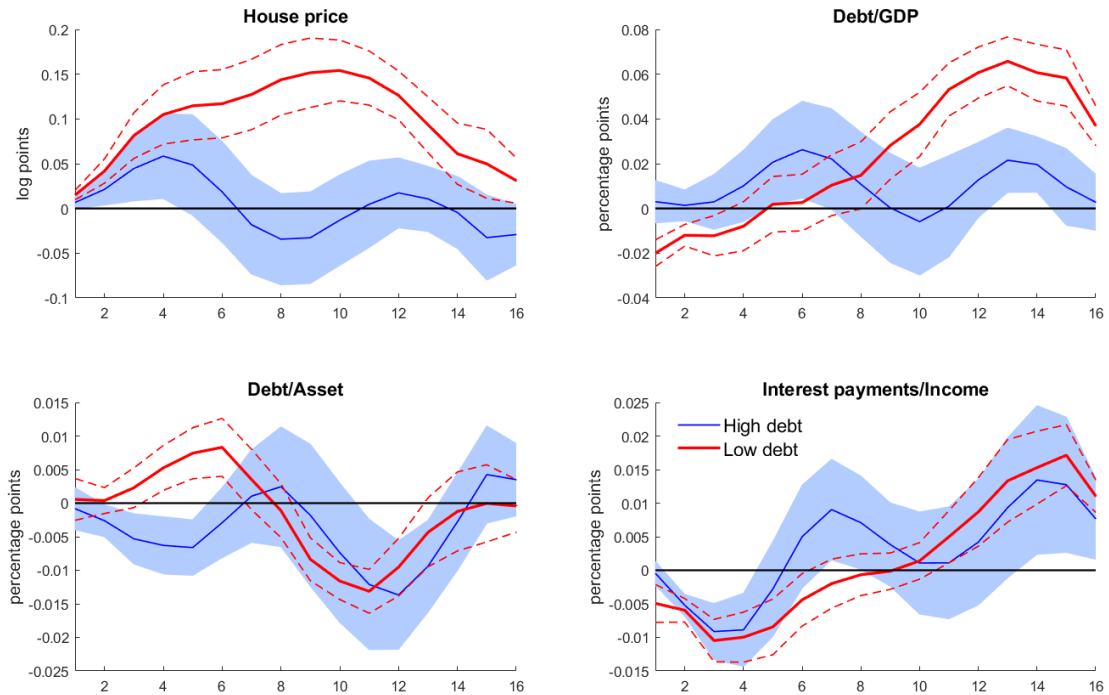
(b) Key household finance indicators

Figure 6: IRFs to a monetary shock that reduces the cash rate by 1 percentage point. Blue (red) lines show responses to a shock that hits the economy in the high-(low-) debt state. Dashed lines (shaded regions) represent 95% confidence bands.

investment, peak responses occur in the fourth quarter after the shock hits. For consumption, the response is insignificant in the first four quarters, but becomes significantly persistent throughout the rest of the horizon. In contrast, in the high-debt state, the responses of these three variables are muted to an expansionary monetary disturbance. The differences that we observe in the responses of real GDP across the two debt states appear to be driven by the state-dependent reactions of real investment and real consumption. Specifically, as we discuss below, real durable goods consumption and real residential investment seem to be the key drivers of the different responses of real GDP in the two states.

Figure 6(b) shows the impulse responses of key household finance variables. In the low-debt state, a combination of significantly positive responses of house prices and debt-to-asset ratio shows that households with low debt are more likely to use their home equity as collateral.[28,29] The response of the debt-to-GDP ratio, on the other hand, is negative in the first four quarters, reflecting the cut in the policy rate. However, the debt-to-GDP ratio starts to increase gradually from the fifth quarter, which corresponds to the rising interest payments-to-income ratio reflecting the increase in the debt stock of households under low debt. The response of the interest payments-to-income ratio qualitatively tracks the response of the cash rate, with a lag of about five quarters. Quantitatively, the pass-through of the policy rate shock to the interest payments-to-income ratio is incomplete. Precisely, the initial decrease in the interest payments-to-income is only a fraction of the cut in the cash rate. The responses of house prices, debt-to-GDP and debt-to-asset ratios show the gradual accumulation of debt stock of households under low-debt state, potentially through the home equity loan channel. Low-debt households appear to utilize

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[28]Di Maggio et al. (2017) use the US individual loan level information to compute zip-code level mortgage characteristics that feature households with large and small shares of adjustable rate mortgages (ARMs). They find a significant increase in house price growth in zip codes with a larger share of ARMs during the period of interest rate decline (2007:III through 2012:IV).

[29]Aladangady (2014) also find evidence of an increase in home values in the US in response to monetary easing. He further documents that collateral effects through increased home values play a dominant role in amplifying consumption responses for households with high debt service ratios (DSRs).
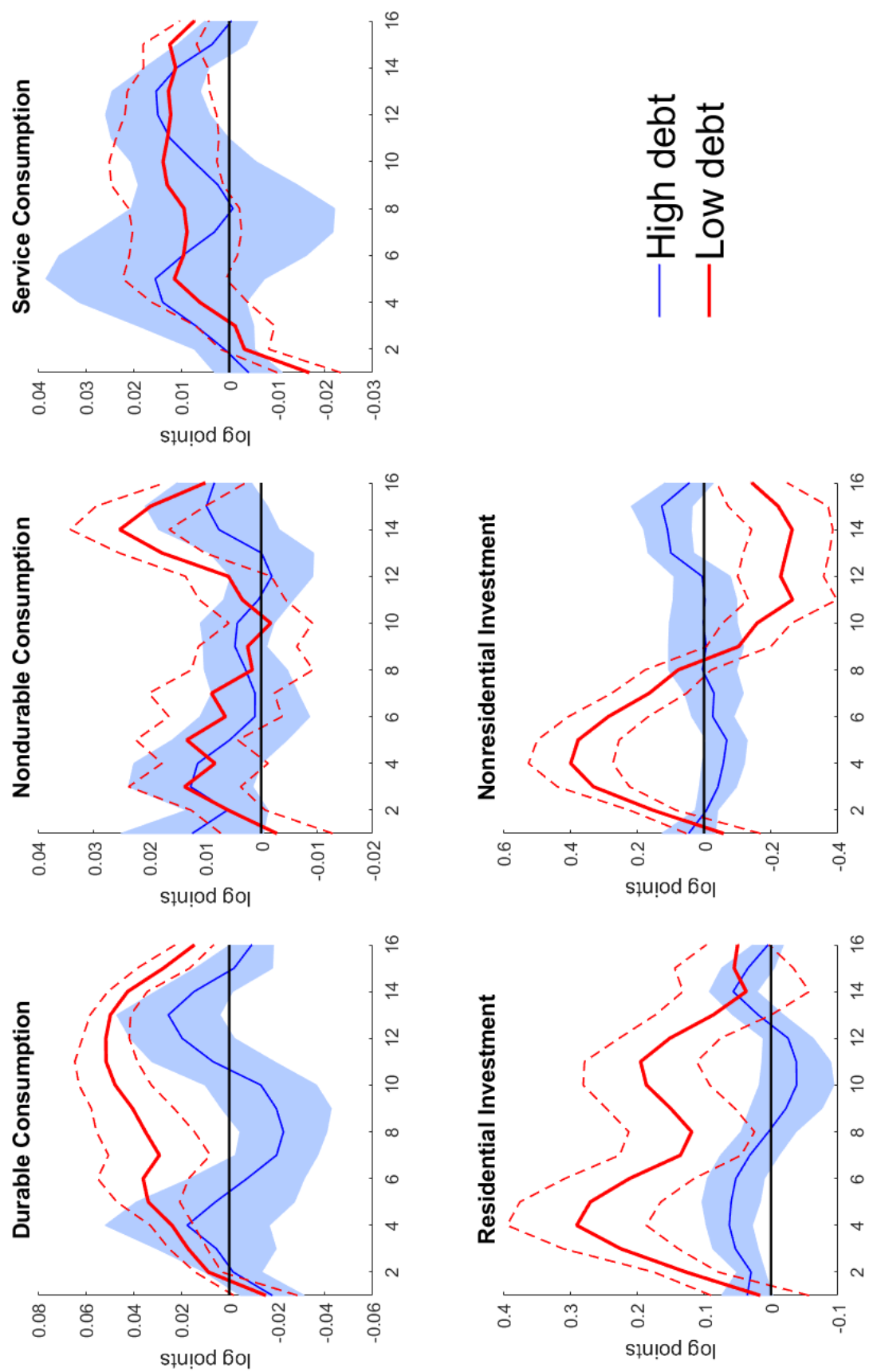
Figure 7: IRFs to a monetary shock that reduces the cash rate by 1 percentage point. The blue (red) lines show responses to a shock that hits the economy in the high-(low-) debt state. Dashed lines (shaded regions) represent 95% confidence bands.

18

the equity withdrawal facilities against the increase in their house prices, resulting in an increase in the household debt-to-asset and debt-to-GDP ratios in the medium and long term, respectively. In the high-debt state, again we observe that the responses of these variables are mostly insignificant.

In Figure 7, we consider the IRFs of the subcomponents of real aggregate consumption and investment. We report significantly positive and hump-shaped responses of durable consumption, residential investment, and nonresidential investment in the low-debt state.[30] On the other hand, when the shock hits in the high-debt state, responses of the subcomponents of consumption and investment are subdued and largely insignificant.

Overall, our results indicate that a policy rate cut activates the home equity loan channel for low-debt households, while it is turned off for high-debt households. This finding is consistent with that of Alpanda and Zubairy (2019), who find that the effectiveness of US monetary policy diminishes when households are relatively highly indebted. They attribute this decline in monetary policy effectiveness in the high-debt state to the weakening of the home equity loan channel. We conjecture that highly indebted Australian households may encounter greater difficulties in accessing home equity loans or cheaper funding sources following a mortgage rate decline, compared to households with low levels of debt.

5   Robustness checks

This section examines the robustness of our findings with respect to (i) an alternative measure of household indebtedness, (ii) controlling for open-economy variables, (iii) controlling for the lags of debt-to-GDP ratio, and (iv) controlling for the lags of debt-to-asset and interest payments-to-income ratios. Overall, our baseline results are robust to these

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[30]La Cava et al. (2016) also find an increase in durable goods spending of Australian households with variable rate mortgage debts, when the cash rate declines.

checks. We report the robustness results at the end of this section.

(i) *Alternative measure of household indebtedness.* In our baseline case, we use the household debt-to-GDP ratio to measure household indebtedness. Here, we want to assess whether our results are robust to using an alternative measure of household indebtedness, the debt-to-income ratio.[31,32] We repeat the same econometric procedure as in the baseline: we apply the HP filter (with $\lambda = 10^4$) to the debt-to-income ratio in order to construct the debt-gap measure and its associated binary state variable. We then re-estimate equation (2), using our baseline variable specification. Figure 8 shows the debt-to-income ratio along with its trend. Figure 9 displays the corresponding debt gap. Figures 10 and 11 report the responses of the key macroeconomic and household finance variables. Overall, we see that our results are robust and consistent with our baseline findings. These results re-emphasize that home equity loan channel dominates over the debt service channel in determining the transmission of monetary shocks in Australia.

(ii) *Controlling for open-economy variables.* Next, we examine the robustness of our baseline findings by including additional controls that account for open-economy aspects which are crucial to the Australian context (Brischetto and Voss, 1999; Dungey and Pagan, 2000). As extra controls, we consider the World Industrial Production index constructed by Baumeister and Hamilton (2019) to proxy for global economic activity, and the Global Financial Cycle estimated by Miranda-Agrippino and Rey (2020) to capture the influence of US monetary policy on global funding costs.[33] We replace house prices with the World Industrial Production index (wip) and the Global Financial Cycle (gfc) in equation (2), such that $x = [r, gdp, \pi, rer, wip, gfc, z]'$, while we move house prices to vector z. In Figure

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[31]Price et al. (2019) use owner-occupier household debt as a measure of debt while controlling for income and housing wealth, in the Australian context. They find evidence of reduced household spending for high levels of owner-occupier mortgage debt.

[32]Kearns et al. (2021) assess the riskiness of household indebtedness in Australia by using the household debt-to-income ratio. For household indebtedness ratios, the higher the ratio, the higher the risk of default.

[33]Miranda-Agrippino and Rey (2020) exploit a worldwide cross section of risky asset prices to estimate a global common factor dubbed the Global Financial Cycle. They show that US monetary policy is the main determinant of the Global Financial Cycle.

12, we again see that the responses of key macroeconomic variables are robust. Notably, the increase in GDP, consumption, and the debt-to-GDP ratio is more pronounced relative to the baseline results. Figure 13 shows that the responses of the subcomponents of the variables are more pronounced in the low-debt state relative to that in the high-debt state. Overall, Figures 12 and 13 show that the differences in the magnitudes of the IRFs across the two states widen when we take into account global factors.

(iii) Controlling for the lags of debt-to-GDP ratio. As another robustness check, we consider controlling for the lags of the debt-to-GDP ratio. In the baseline case, equation (2) had six controls, $x = [r, gdp, \pi, rer, hp, z]'$. In this exercise, we add three lags of the debt-to-GDP ratio to equation (2) as an additional control. Thus, equation (2) has seven controls in total, $x = [r, gdp, \pi, rer, hp, debt/gdp, z]'$. Figure 14 shows the responses of key macroeconomic and household finance variables to a monetary shock that reduces the cash rate by one percentage point. Overall, the results are robust with the baseline findings and consistent with our inference that home equity loan channel dominates over the debt service channel.

(iv) Controlling for lags of the debt-to-assets and interest payments-to-income ratios. Finally, we check the robustness of our baseline results with two household indebtedness measures, the debt-to-asset and interest payments-to-income ratios, as additional controls. We replace house prices with debt-to-asset and interest payments-to-income ratios, such that $x = [r, gdp, \pi, rer, debt/asset, ip/inc, z]'$. Figure 16, top and bottom panels, shows the responses when we include the two indebtedness ratios as control variables. We again find that the results are robust to those of our baseline. The responses of most variables are more pronounced to an expansionary monetary shock in the low-debt state compared to that of the high-debt state, especially for investment, house prices, and the debt-to-GDP ratio. Figure 17 reports that the responses of the subcomponents are also robust to our baseline results.
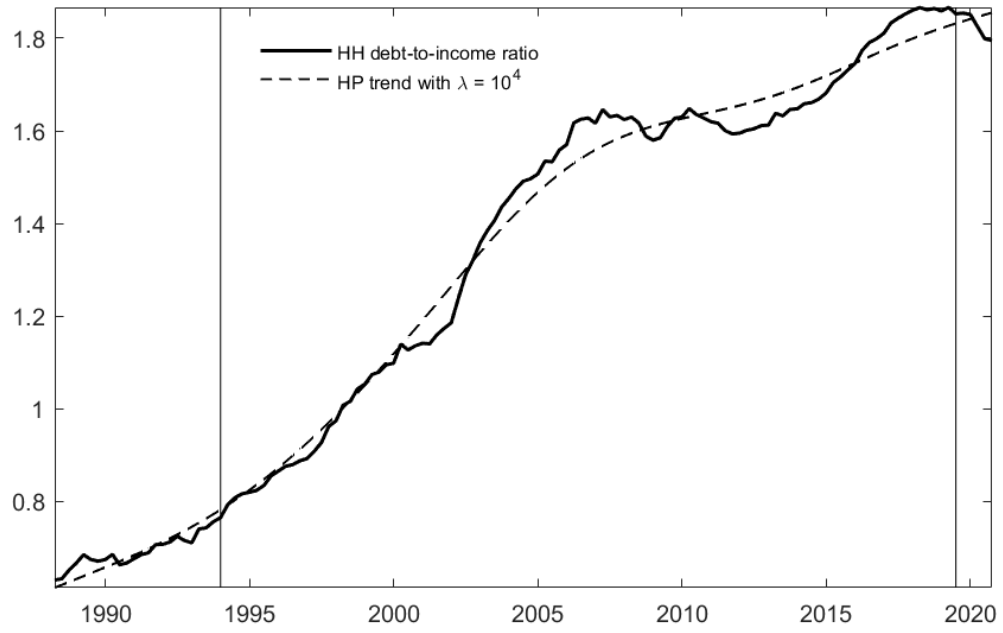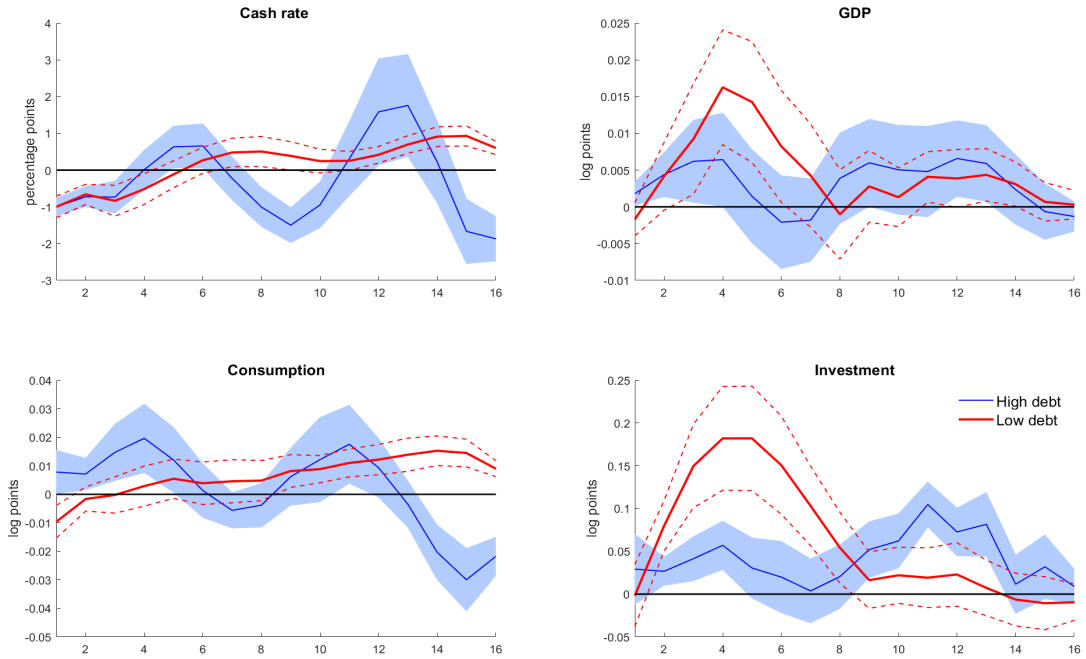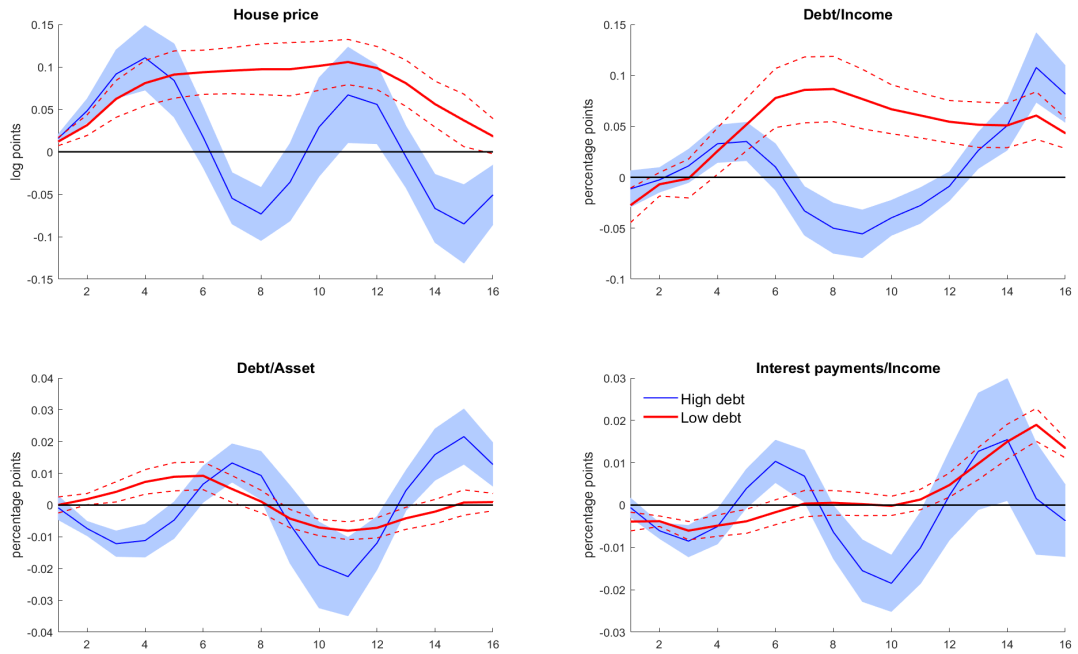
Figure 8: Debt-to-income ratio
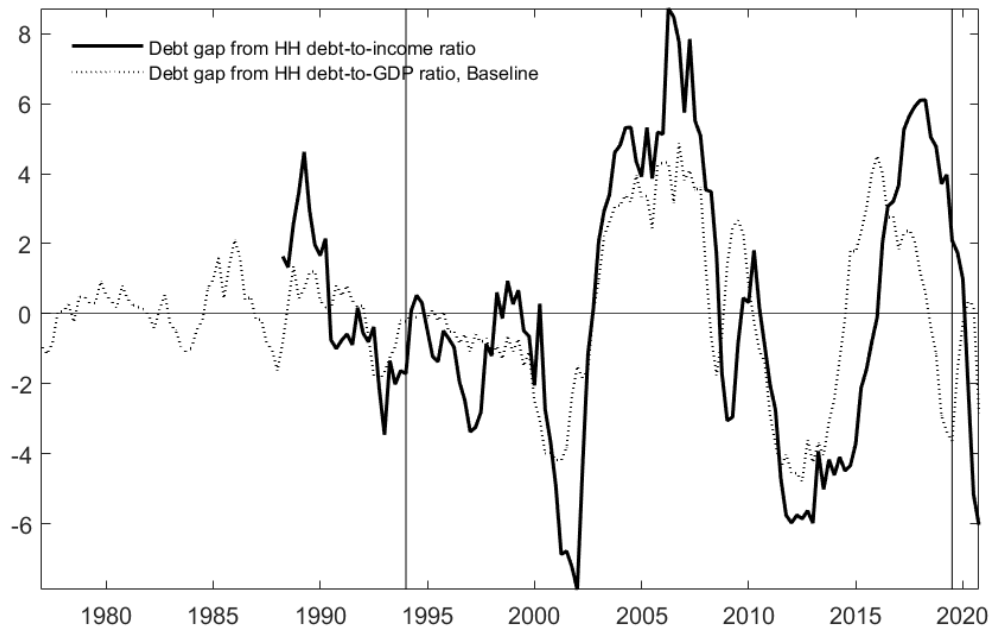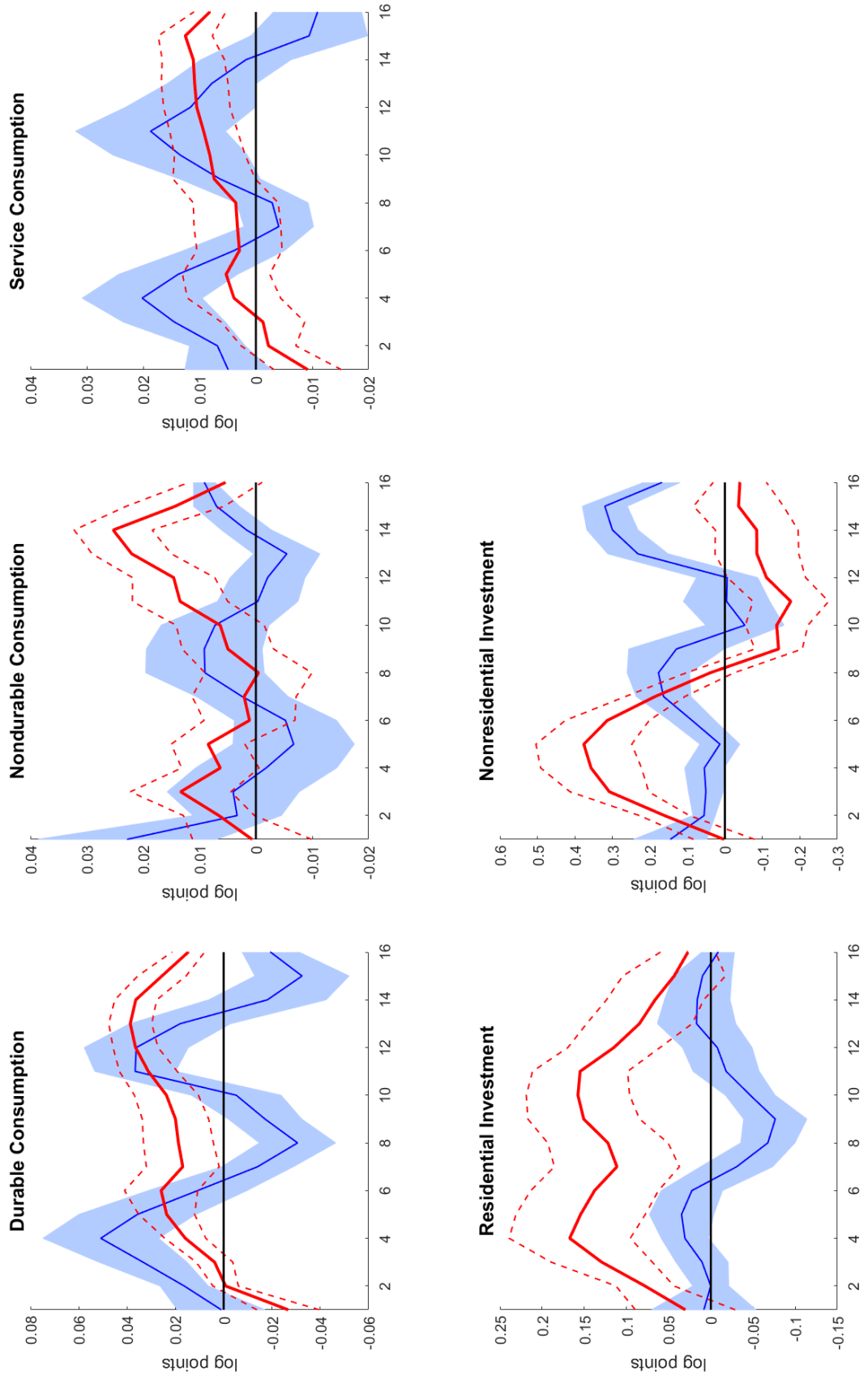

Figure 9: Debt-to-GDP and debt-to-income gaps
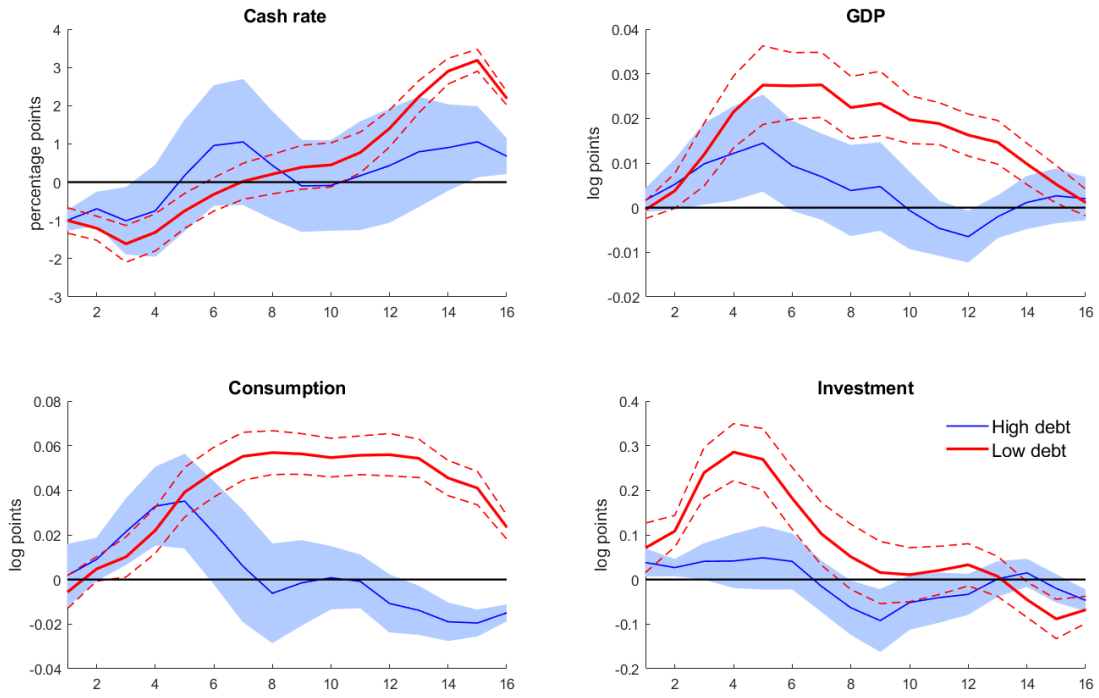
(a) Key macroeconomic variables

(b) Key household finance indicators

Figure 10: Robustness check 1: IRFs to a monetary policy shock that reduces the cash rate by 1 percentage point, with the debt-to-income ratio as the state variable. Blue (red) lines show responses to a shock that hits the economy in the high-(low-) debt state. Dashed lines (shaded regions) represent 95% confidence bands.

Figure 11: Robustness check 1: IRFs to a monetary policy shock that reduces the cash rate by 1 percentage point, with the debt-to-income ratio as the state variable. Blue (red) lines show responses to a shock that hits the economy in the high-(low-) debt state. Dashed lines (shaded regions) represent 95% confidence bands.
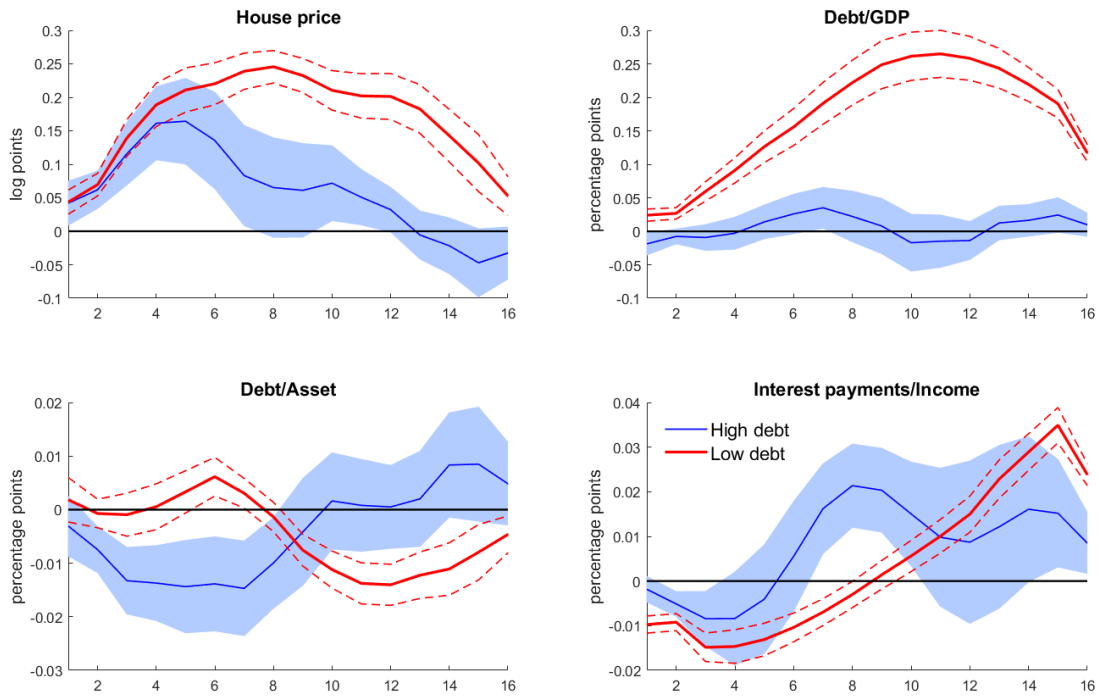
(a) Key macroeconomic variables

(b) Key household finance indicators

Figure 12: Robustness check 2: IRFs to a 1 ppts expansionary monetary shock using the model with two global variables as additional controls: World Industrial Production index and Global Financial Cycle index. Blue (red) lines show responses to a shock that hits the economy in the high-(low-) debt state. Dashed lines (shaded regions) represent 95% confidence bands.
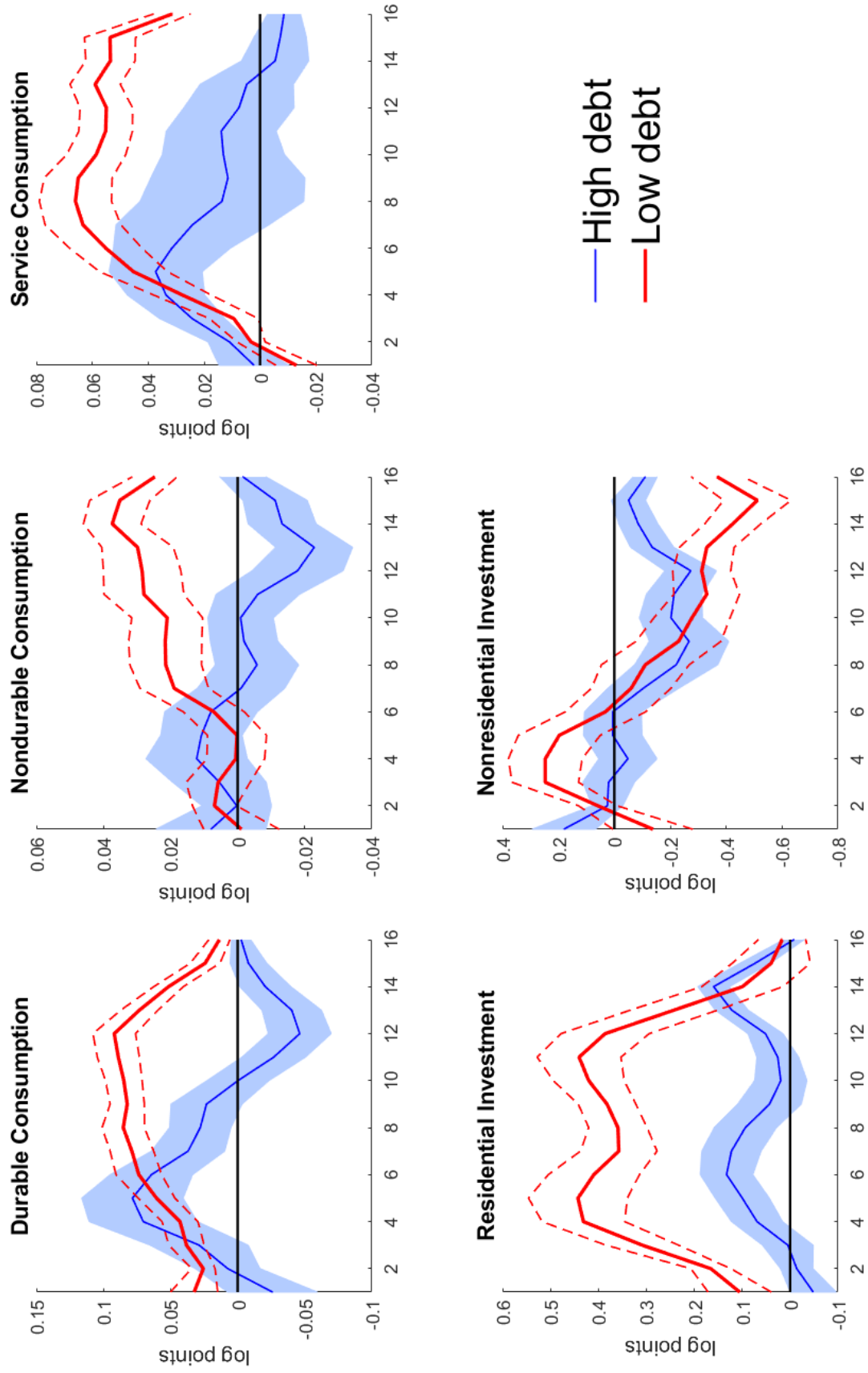
Figure 13: Robustness check 2: IRFs to a 1 ppts expansionary monetary shock using the model with two global variables as additional controls: World Industrial Production index and Global Financial Cycle index. Blue (red) lines show responses to a shock that hits the economy in the high-(low-) state. Dashed lines (shaded regions) represent 95% confidence bands.

Subcomponents of aggregate consumption and investment
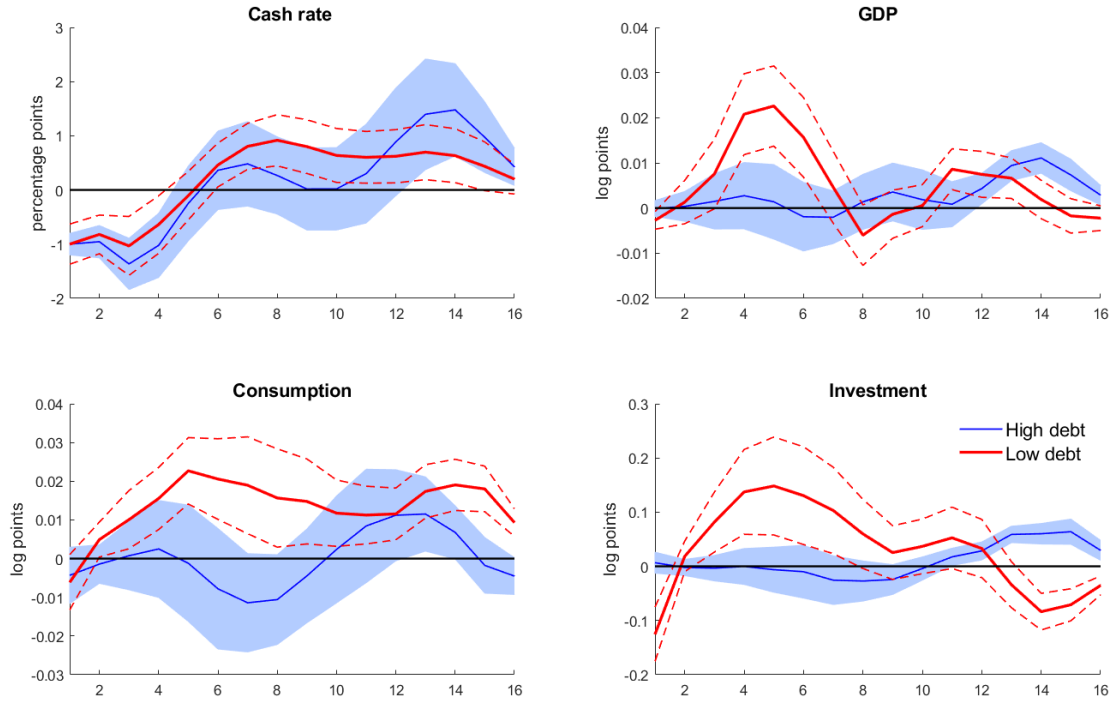
(a) Key macroeconomic variables

(b) Key household finance indicators

Figure 14: Robustness check 3: IRFs to a 1 ppts expansionary monetary shock using the model with three lags of debt-to-GDP as additional controls. Blue (red) lines show responses to a shock that hits the economy in the high-(low-) debt state. Dashed lines (shaded regions) represent 95% confidence bands.
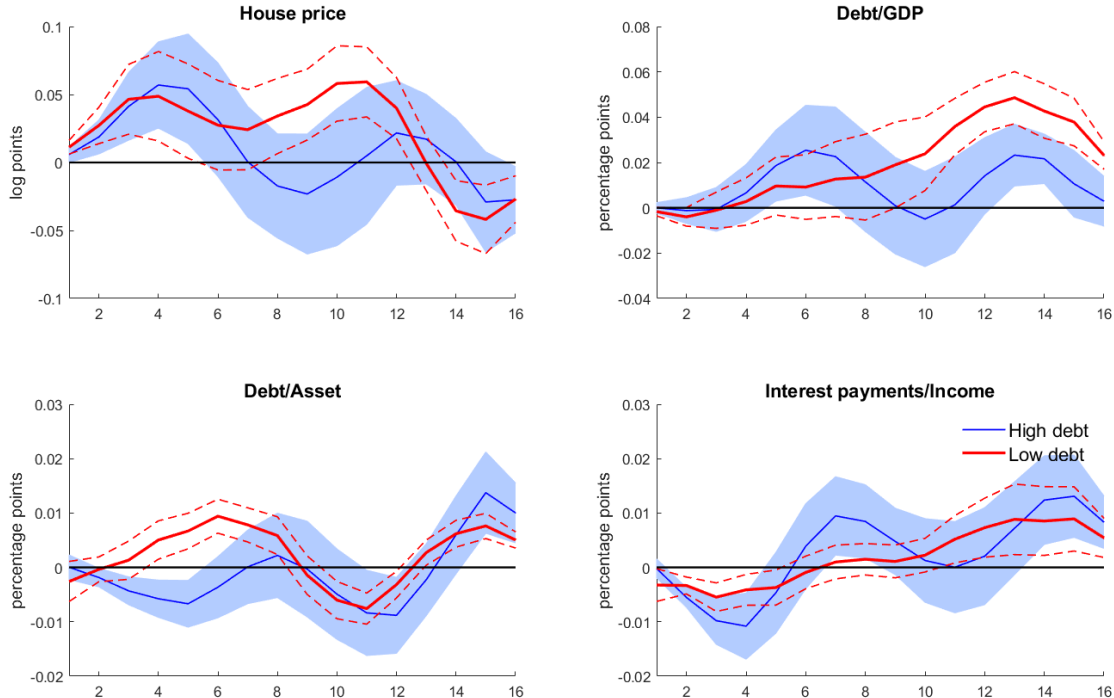
Figure 15: Robustness check 3: IRFs to a 1 ppts expansionary monetary shock using the model with three lags of debt-to-GDP as additional controls. Blue (red) lines show responses to a shock that hits the economy in the high–(low–) debt state. Dashed lines (shaded regions) represent 95% confidence bands.
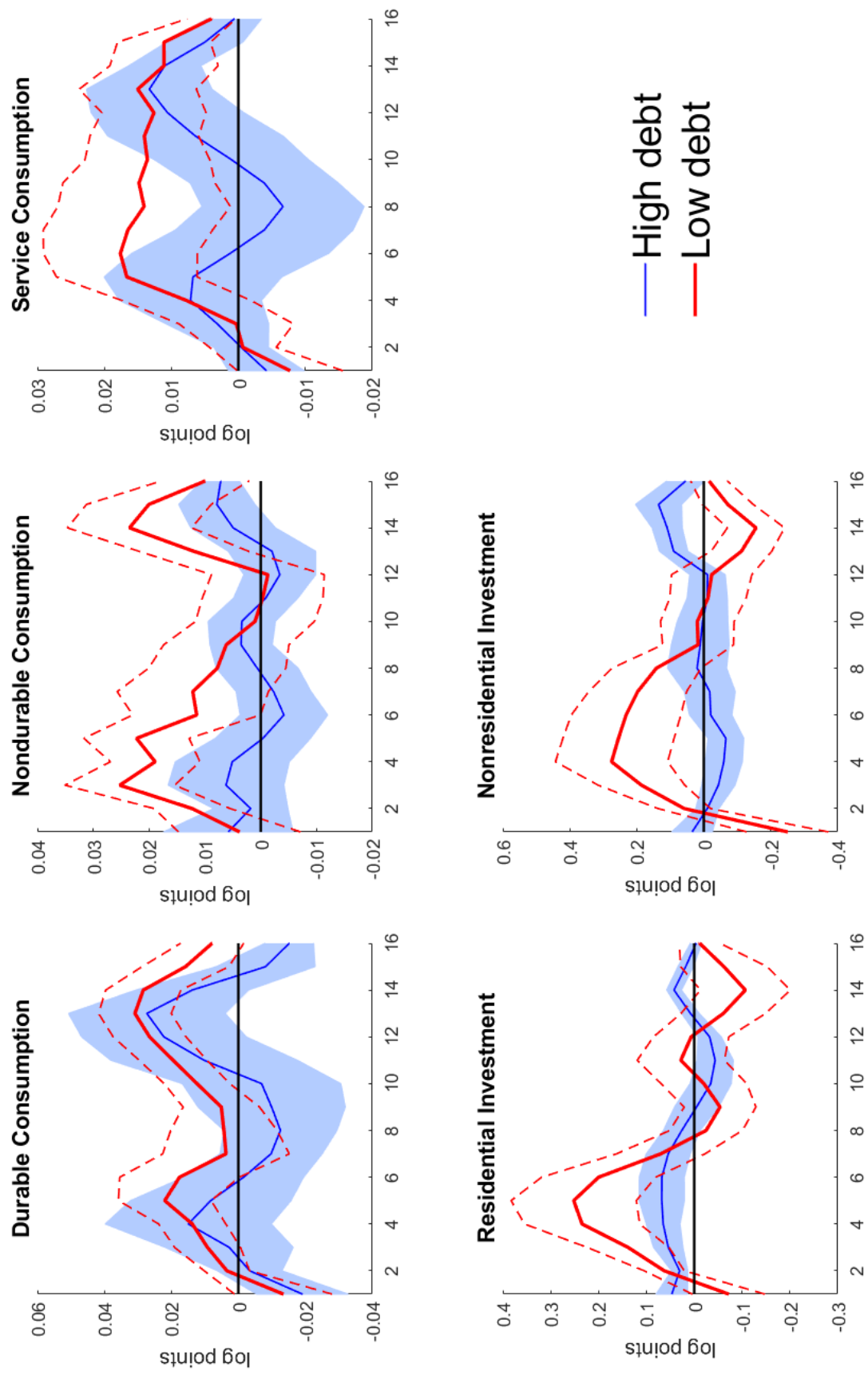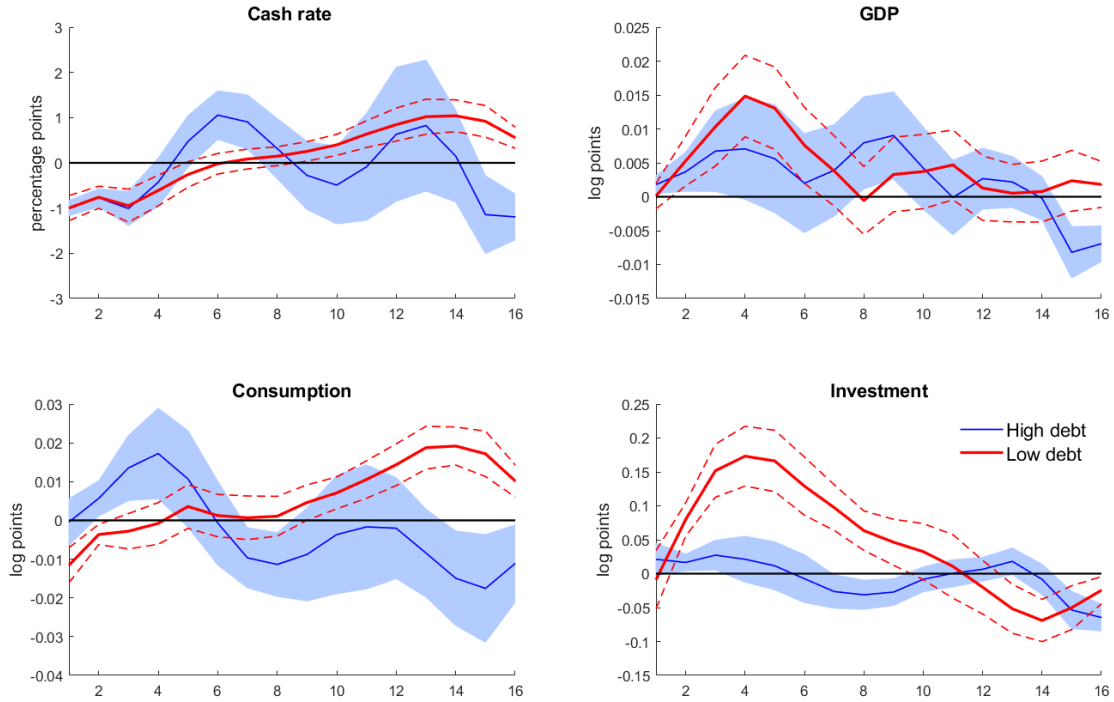
(a) Key macroeconomic variables
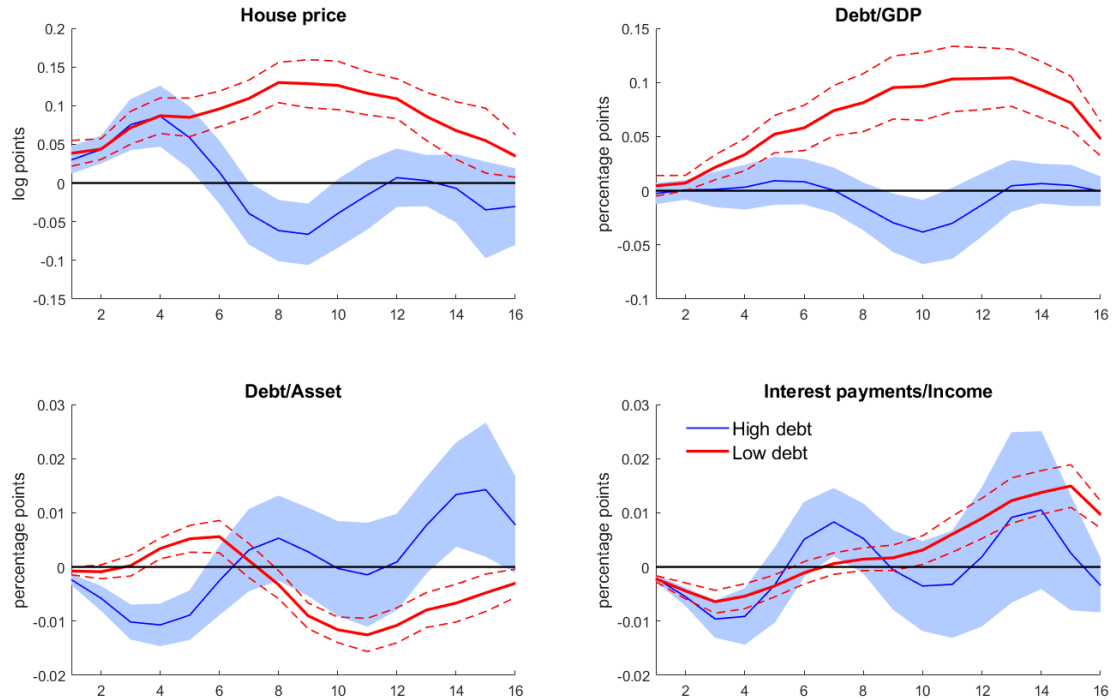
(b) Key household finance indicators

Figure 16: Robustness check 4: IRFs to a 1 ppts expansionary monetary shock using the model with three lags of debt-to-assets and interests-to-income as additional controls. Blue (red) lines show responses to a shock that hits the economy in the high-(low-) debt state. Dashed lines (shaded regions) represent 95% confidence bands.

Figure 17: Robustness check 4: IRFs to a 1 ppts expansionary monetary shock using the model with three lags of debt-to-assets and interests-to-income as additional controls. Blue (red) lines show responses to a shock that hits the economy in the high-(low-) debt state. Dashed lines (shaded regions) represent 95% confidence bands.
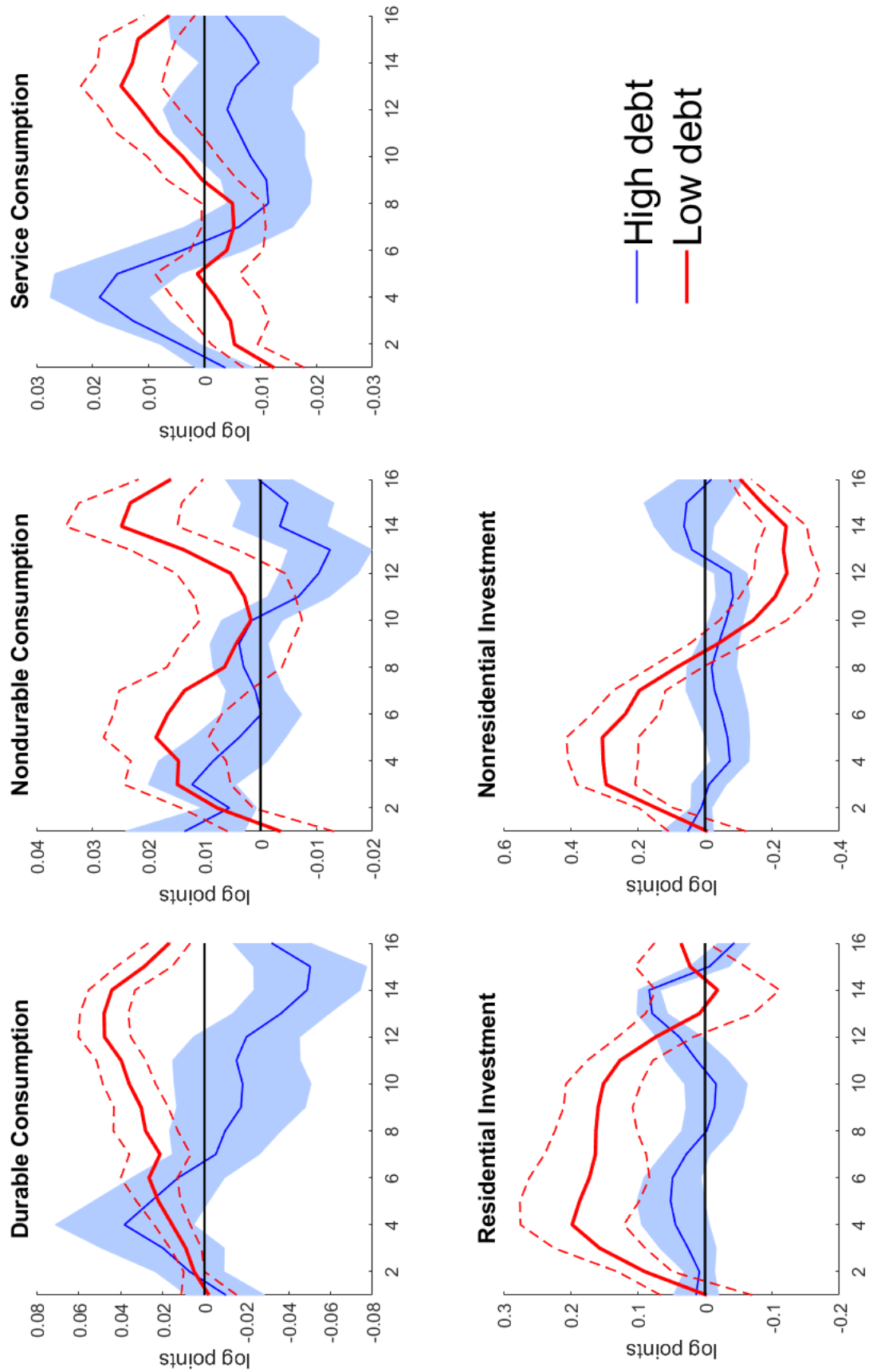
30

6 Conclusion

Our paper provides new empirical evidence that shows how the high versus low state of household indebtedness in Australia is instrumental in gauging the efficacy of monetary policy. We use a state-dependent local projection model to demonstrate that the effectiveness of monetary policy amplifies when households are in a low-debt state, while it largely diminishes in high-debt conditions. In particular, to an expansionary monetary shock, we observe a significant increase in output, investment, house prices, debt-to-GDP and debt-to-asset during periods of low household debt. Our results are robust to using debt-to-income as an alternative measure of household indebtedness and controlling for two open-economy variables: World Industrial Production index and Global Financial Cycle.

In addition, our findings point to a likely dominant home equity loan channel for the households with low debt. The significant increase in house prices to an expansionary monetary shock makes it more likely for low-debt households to have easy access to collateral through increased home values and reduced interest burden. Thus, we conjecture that a combination of an increase in house prices along with a rise in debt-to-GDP and debt-to-asset reflects an underlying home equity loan channel at work.

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Appendix

A1   Data sources

Variable	Source and code
Augmented Romer and Romer shock	Beckers (2020), Nguyen and La Cava (2020)
Cash rate	RBA
Consumption	ABS, A2304081W
Durable consumption	ABS, authors' calculation
Non-durable consumption	ABS, authors' calculation
Service consumption	ABS, authors' calculation
GDP	ABS, A2304402X
GDP price deflator (2015=100)	FRED
Global financial cycle	Miranda-Agrippino and Rey (2020)
Household debt-to-gdp ratio	Trading economics
Household debt-to-income ratio	RBA, BHFDDIT
Household debt-to-asset ratio	RBA, BHFDA
House prices (Real residential prop. price index for AU)	FRED
Inflation (CPI inflation, q-to-q, exl. volatile items)	ABS, A2330845W
Investment (Private, fixed capital formation)	ABS, A2304100T
Residential investment	ABS, authors' calculation
Non-residential investment	ABS, authors' calculation
Oil price (WTI spot price)	FRED
Trade-weighted index (in real terms)	RBA, FRERTWI
Unemployment rate (Aged 15-64)	FRED
World industrial production index	Baumeister and Hamilton (2019)

Table A1: Data sources

A2   Romer and Romer regression for Australia

The Taylor-type regression is directly from Beckers (2020). The regression follows the methodology used by Romer and Romer (2004) and estimates the Australian version of Romer and Romer monetary policy shocks.

$$\Delta cr_t = \alpha + \rho_1 cr_{t-1} + \mathbf{Y}^{fc}_{t+h|t}\boldsymbol{\beta} + \mathbf{CS}_t\boldsymbol{\gamma} + m_t \tag{3}$$

where Δcr is the change in the cash rate at the RBA Board meeting in month t, cr_{t-1} is the cash rate prior to the meeting, $\mathbf{Y}^{fc}_{t+h|t}$ is a vector of variables that contains the RBA's h-quarters ahead macroeconomic forecast, and $\mathbf{CS}_t$ is credit market spread (the spread between large business lending rate and 3-month BAB rate) at the time of the meeting. The residual, $\hat{m}_t$, from equation (3) is the augmented RR shock. The residual, $\hat{m}_t$, is a monthly series. Following Coibion et al. (2017) and Romer and Romer (2004), we sum the estimated residual, $\hat{m}_t$, within each quarter to convert it to a quarterly series.

Figure A1 plots the Augmented RR shocks. The figure shows two episodes marked by highly volatile monetary policy shocks, one at the very beginning of the sample period, the other around 2008. The first episode corresponds to the adoption of Inflation Targeting by the RBA. The second episode relates to the bankrupty of Lehman in September 2008.
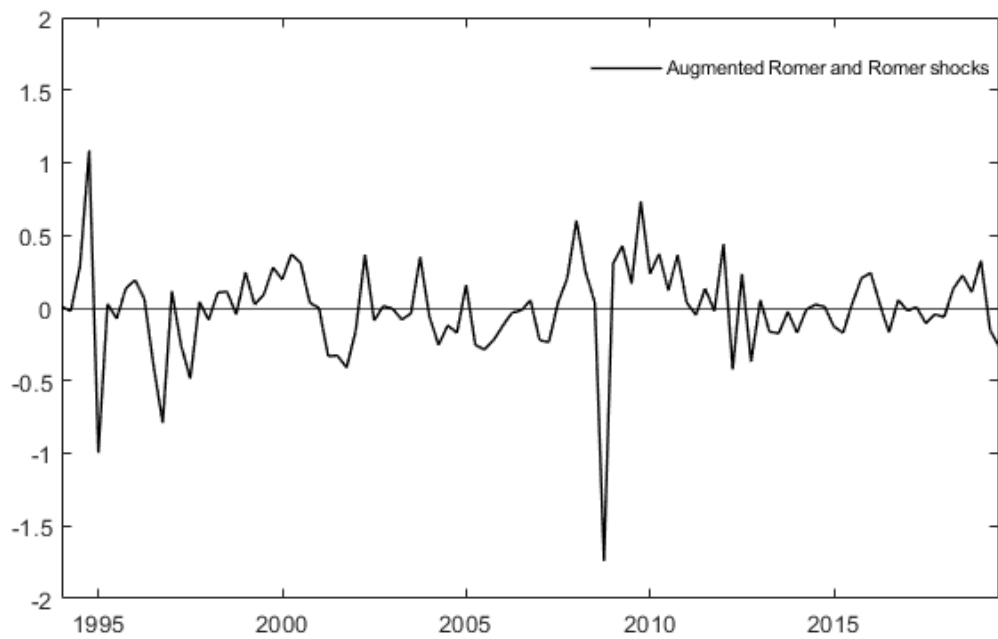
Figure A1: The Augmented Romer and Romer monetary shocks. Sample: 1994Q1–2019Q3. Sources: Beckers (2020) and Nguyen and La Cava (2020) who extended the shock series from 2018Q4 until 2019Q3.