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Household Debt, Consumption, and Monetary Policy in Australia

by Elena Loukoianova, Yu Ching Wong, and Ioana Hussiada

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Abstract

This paper discusses the evolution of the household debt in Australia and finds that while higher-income and higher-wealth households tend to have higher debt, lower-income households may become more vulnerable to rising debt service over time. Then, the paper analyzes the impact of a monetary policy shock on households' current consumption and durable expenditures depending on the level of household debt. The results corroborate other work that households' response to monetary policy shocks depends on their debt and income levels. In particular, households with higher debt tend to reduce their current consumption and durable expenditures more than other households in response to a contractionary monetary policy shocks. However, households with low debt may not respond to monetary policy shocks, as they hold more interest-earning assets.

JEL Classification Numbers: D12, E21, E52

Keywords: household debt; consumption; household survey data; monetary policy; household; consumer debt

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I. INTRODUCTION

Household debt in Australia has increased to comparatively high levels over the last three decades, a period during which housing prices also have risen rapidly. By end-September 2018, the ratio of household debt to household gross disposable income reached 189 percent, among the highest in advanced economies. High levels of household debt are widely considered to be risky, as they can amplify the impact of external and domestic shocks and, thereby, increase a country's economic and financial vulnerabilities and pose risks to financial stability. In addition to amplifying financial and economic vulnerabilities, high household debt can also intensify the ongoing corrections in the housing market in Australia.

The macroeconomic impact of and the risks from household debt depend not only on the average debt level but also its distribution across households. Higher-income households might be at lower risk of debt default than lower-income households, for example. The latter might also be more likely to be finance-constrained in times of debt distress. From a monetary policy perspective, a key consideration is the extent to which household debt levels and distribution affect monetary policy transmission.

This paper contributes to the growing literature on the importance of household debt. It examines how the household debt distribution affects monetary policy transmission in Australia, focusing on the interaction between the consumption behavior of households with different debt levels and a broad range of shocks affecting financial conditions. Specifically, the paper focuses on monetary policy shocks, examining household reactions to such shocks, depending on their debt exposure during 2001-16.

The paper is organized as follows. Section II provides a brief review of literature. Section III examines the evolution and characteristics of household debt dynamics in Australia. Section IV provides an overview of the data used in the empirical analysis. The empirical analysis in Section V investigates the role of household debt exposure in households' consumption responses to unexpected monetary policy shocks. Section VI focuses on the impact of the monetary policy shocks on aggregate consumption and how it has become more important over time in the RBA's communication through textual analysis. Finally, Section VII discusses the policy implications and concludes.

II. A PRIMER ON HOUSEHOLD DEBT AND VULNERABILITIES

Many studies have focused on the implications of household debt, including on the central question of when and why high household debt matters. It is not the household debt per se, but various debt metrics—such as rising leverage, excessive credit, or debt distribution—that matter for the analysis. There is an extensive body of literature that examines the relationship between household balance sheets, consumption, and the macroeconomy (Debelle, 2004; Krueger and Perri, 2006; and Mian, Rao, and Sufi, 2013, among others). Many of these

recent studies are motivated by the experience of the Global Financial Crisis (GFC) in 2008 or previous banking and financial crises. The analysis by Mian, Roa and Sufi (2013), for example, provides evidence on how high leverage in combination with asset price shocks can lead to demand driven recessions. They found that the marginal effect of a decline in home value on tighter credit constraints is significantly larger for postal codes that have a high housing leverage ratio.

Several studies have examined the impact of high household debt in Australia. Some of these studies have used household-level microdata to examine the impact of high household indebtedness on consumer spending. Atalay, Whelan, and Yates (2017) found a positive relationship between changes in housing wealth and consumption expenditure, based mainly on *Household Expenditure Survey* (HES) data. The wealth effect was the strongest for middle-aged home owners. Their analysis also suggests that the wealth effect has become smaller post-GFC, as households with higher loan-to-value ratios appeared to have become more conservative in their response to a change in house prices. Bilston, Johnson, and Read (2015) conducted a stress testing analysis using *the Household, Income, and Labor Dynamics in Australia* (HILDA) data in the 2000s and concluded that, despite rising aggregate indebtedness, households were resilient to shocks, as the distribution of household debt remained concentrated among households that were well placed to service it. Price, Beckers, and La Cava (2018) explored the relationship between owner-occupied mortgage debt and spending using panel data. They found that households typically cut back on their spending when they have higher levels of outstanding mortgage debt (debt overhang effect).

Some other studies looked at the impact from household debt distribution. The composition of the household balance sheet should be an important factor in explaining why some households respond more to a monetary policy shock or interest rate changes than others. Using HILDA data for 2002-14, La Cava, Hughson, and Kaplan (2016) found evidence for a "borrower" cash flow channel. The effect of interest-sensitive cash flows on spending is particularly strong for liquidity-constrained households. Their central estimates indicate that a 100 basis points cut in interest rates resulted in a 0.1 to 0.2 percent increase in household spending in aggregate.

La Cava and Price (2017), based also on HILDA data, covering 2001-15, concluded that high levels of debt relative to income and assets, and low debt-servicing capacity can reduce household spending growth relative to their income. As expected, they confirmed that households with high levels of debt are more sensitive to income and housing equity shocks than households with lower levels of debt. In addition, they found that effect of high debt levels in reducing household consumption spending is stronger during times of adverse shocks (e.g., financial crisis) when households are more likely to face binding borrowing constraints or higher uncertainty compared with positive shocks (the latter may be due to rainy-day-savings behavior of households). They also found that changes in the level of

household debt can have implications for aggregate consumption growth, although this aggregate effect can vary over time depending on multiple factors, including the distribution of changes in debt and the effect of debt on consumption growth across households depending on their household characteristics (e.g., those with lower income and wealth, younger households, and households experiencing financial stress).

The composition of the household balance sheet is an important factor in explaining why some households respond more to interest rate changes than others. As pointed out by Cloyne, Ferreira, and Surico (2018), grouping households by their level of debt can be motivated by various theoretical models, including Iacoviello (2005), Eggertsson and Krugman (2012), and Kaplan and others (2015), which imply that expenditure responses to a monetary policy shock differ, depending on initial debt levels.

This paper follows the empirical methodology of Cloyne, Ferreira, and Surico (2018) to analyze the impact of the monetary policy on the consumption behavior of households with different debt levels relative to income and wealth in Australia. They used micro data from the U.K. *Living Costs and Food Survey* and the U.S. *Consumer Expenditure Survey*. Unlike Cloney et al., this paper uses longitudinal data, from the HILDA survey. The advantage of this data source is that we can use wealth data directly, rather than using housing tenure—renters, mortgagors, and outright owners—as a proxy for household's indebtedness and asset positions.

Using the HILDA dataset also sets our paper apart from the aforementioned paper by La Cava, Hughson, and Kaplan (2016) who consider households by their net borrower or net lender status (and by the type of mortgage used), variables that do not capture the level of household indebtedness directly. Also, they investigated the direct cash flow channel using household cash flows (that is, income less taxes and required mortgage repayments), not the impact of monetary policy shocks, the subject of this paper. We group households by the level of indebtedness, which provides for a more direct and precise measure of their balance sheet positions compared with previous research.

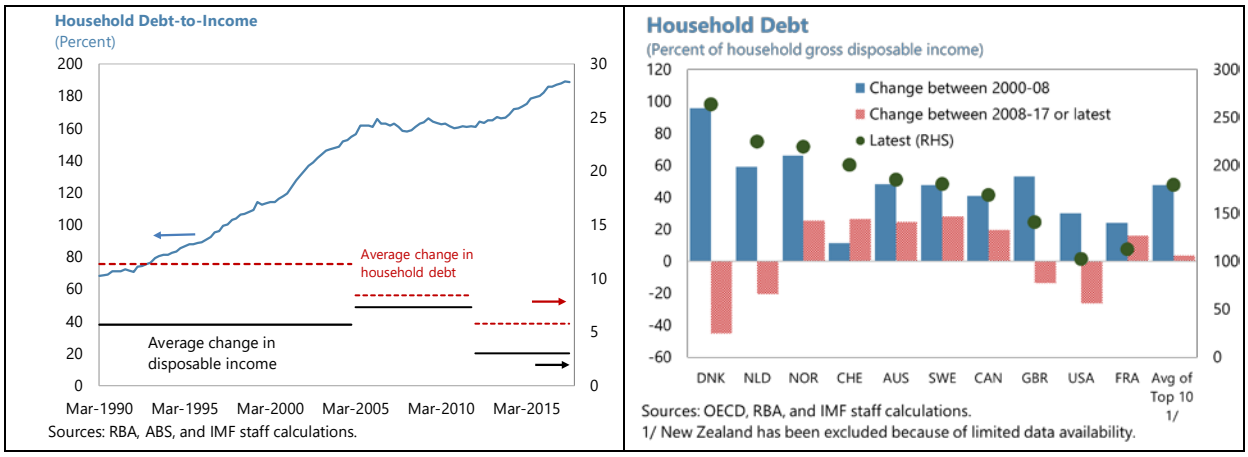
III. Evolution and Characteristics of Household Debt

This section examines how the level and distribution of household debt in Australia have evolved over the past three decades, where the debt is now, and draws some conclusions on the implications to macroeconomic and financial stability.

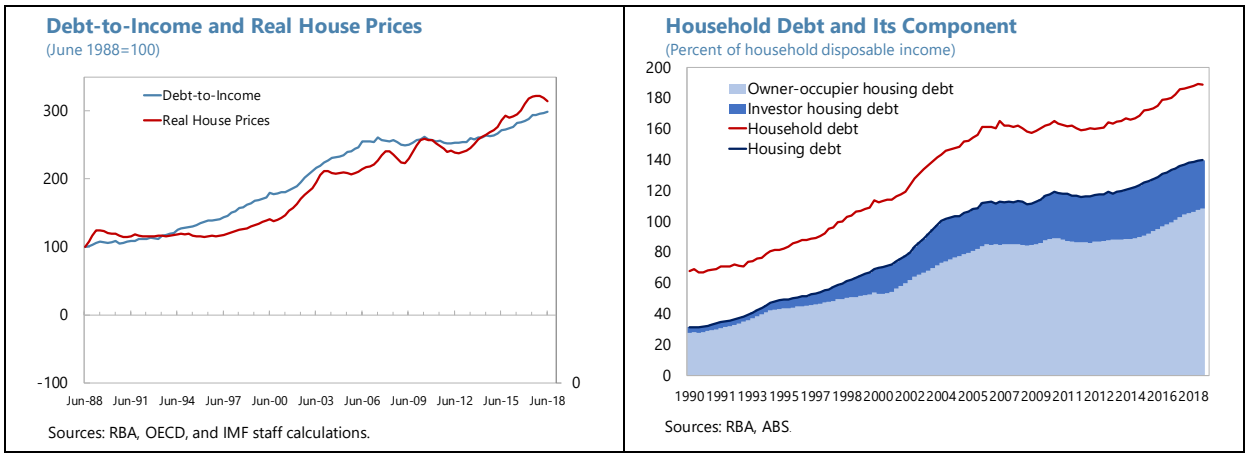
Evolution of Household Debt

Household debt in Australia has been rising faster than household disposable income for the past three decades. As a result, the household debt ratio has risen to one of the highest levels among advanced economies. Similar to other advanced economies, the accumulation of

household debt has been influenced by the ease of access to credit resulting from financial deregulation in the 1990s and historically low interest rates post-GFC that largely helped to offset debt service costs against larger loans outstanding (Debelle, 2004).

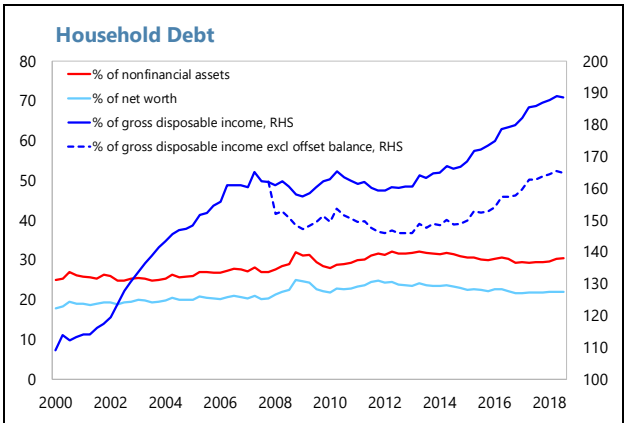


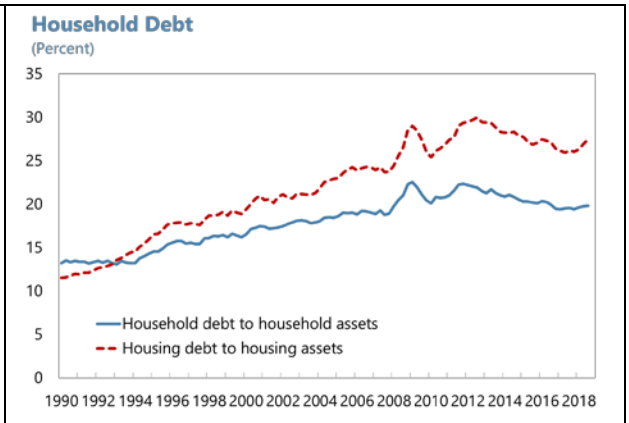
The housing boom has also played a significant role in the rapid accumulation of household debt. High housing demand due to income and population growth in conjunction with relatively inelastic supply have pushed up house prices, and expectations of future capital gains has encouraged investment demand for housing.[2] The interaction between the long-term upswing in housing prices and relatively easy mortgage financing has therefore led to the buildup of a high level of residential mortgage debt. Meng, Hoang, and Siriwardana (2013) studied the determinants of household debt in Australia and found evidence that housing prices, GDP, and population have a positive effect on household borrowing while interest rates, unemployment rates, the number of new dwellings, and inflation have a negative effect on household debt.



[2] See more discussions in Mohommad, Nyberg, and Pitt (2015).

High household debt also reflects the preference for home ownership and housing investment in Australia. Housing debt at 140 percent of household disposable income accounted for about three-quarters of household debt outstanding as of September 2018, with owner-occupied housing debt accounting for a relatively stable share of about one half. The rise in the share of investor housing debt since 2000 has also contributed to the fast increase in household debt, while other personal debt has remained broadly stable (one quarter of household debt outstanding) at about 46 percent of household disposable income since 2000.





Debt measurement issues

For the analysis of household debt, it is most common to scale the amount of household debt outstanding by annualized gross household disposable income, which provides a measure of total debt level relative to repayment capacity. A debt-to-income (DTI) ratio also has the merit of enabling comparison across time and across countries. A more granular measure is the debt-service-to-income (DSTI) which focuses on the size of debt service payments—as influence by interest rates and terms of loans—to household income. Critics may argue that the proportionality of the DTI—a simple metric like debt being three or more times income—and similarly DSTI do not take into account that higher-income household have a higher capacity for debt accumulation, because their living expenses do not increase one-for-one with disposable income.[3]

Other measures to scale household debt include assets (liquid, financial, and non-financial), and net worth. For instance, while household debt has risen steadily to almost 190 percent of gross disposable income by September 2018, housing debt has remained below 20 percent of the total housing assets since 2010, helped by a 42 percent rise in housing prices. Similarly, household leverage, measured by the liabilities-to-net-worth ratio, has been trending down to close to 22 percent in 2017. However, the leverage ratio could increase rapidly, if there were to be a large downward correction of house prices.

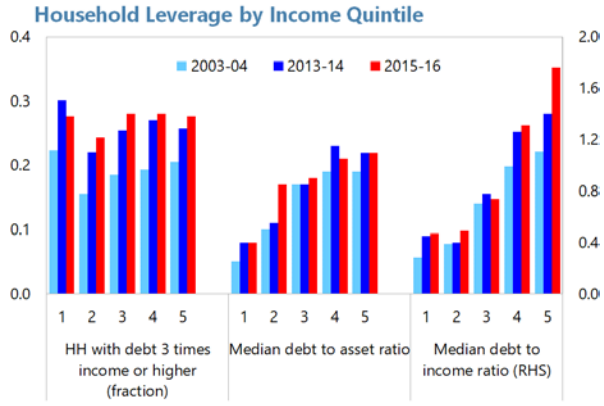
[3] See Box B and Box C, RBA, 2018 Financial Stability Review, October 2018.

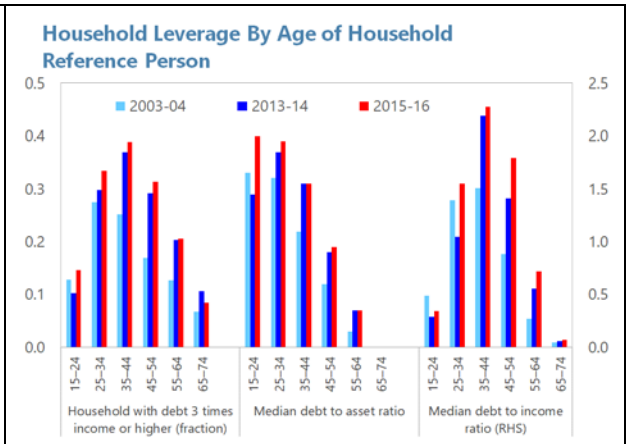
Distribution of debt

For financial stability, as well as monetary and macroprudential policies, it is not only the level of household debt that matters but also the speed of debt accumulation or leverage increases, the extent of leverage, and, more importantly, the distribution of debt. In this paper, we concentrate on the latter.

There is considerable heterogeneity across households in terms of debt distribution in Australia. While the empirical analysis in this paper utilizes the HILDA longitudinal data for the panel regression analysis, which will be discussed below, the recent *Survey of Income and Housing* (SIH) 2015-16 conducted by the Australian Bureau of Statistics (ABS) provides timely, complementary information on the cross-sectional distribution of household debt.

The SIH indicated that three quarters of households held debt and that the share of households with a debt-to-income ratio of three and above has risen across income quintiles. The rise in median debt-to-income ratio was most pronounced in the top 40 percent of the higher-income households.[4] The debt-to-income ratio also rose across all age groups, as higher house prices required larger mortgages, suggesting that older households obtained more mortgages or have been left with higher mortgage balances after retirement, including their investment property mortgages. Households with a reference person 35-44-years old had the highest median debt-to-income ratio of 2.3 in 2015-16.





Source: ABS.

The HILDA longitudinal survey provides useful information on the structure and distribution of household debt by income, age groups, and tenure types (mortgagors, renters, outright owners, and investors), by following individuals and households over time. A few salient features on household debt distribution informed the empirical study of this paper. For example, somewhat unexpectedly, notwithstanding higher DTI in 2014 than 2002, the

[4] The SIH 2015-16 collected information from a sample of 17,768 households over the period July 2015 to June 2016. The SIH has been conducted every two years (since 2003-04) and the SIH 2015-16 was integrated with the HES.

distribution of debt ratios across households are broadly similar in 2002 and 2014, as shown by the histograms of the ratios of household debt to disposable income and net worth (Figure 1). In 2014, about 30 percent of respondent households in the HILDA survey indicated that they had no debt, about one-third of the households had a DTI ratio of less than or equal to one, while only close to 20 percent of households had DTIs above 3. Likewise, about 27 percent of total households had a debt-to-net worth ratio of less than zero (i.e., a net liability position). For the other 73 percent of total households with positive net worth (a net asset position), about three quarters of these households have debt-to-net worth ratio of between zero and one inclusive, and another close to 15 percent of them have debt-to-net worth ratio of between one and two inclusive.

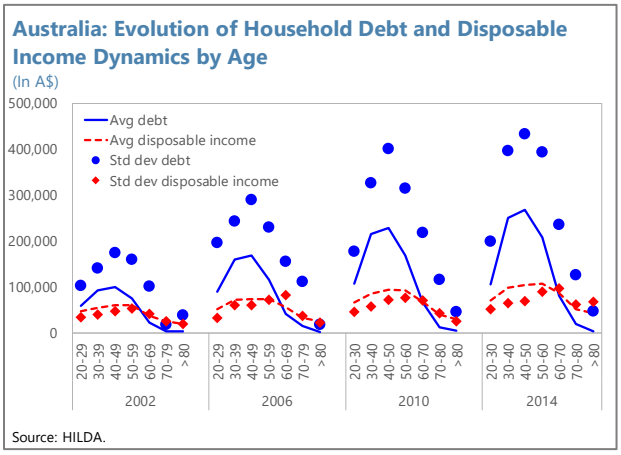
As for the share of total household debt held by different household type, the top two disposable income quintiles increased their total household debt from 70 percent in 2010 to 78 percent in 2014. Similar to the findings of the SIH, household debt held by head of household 45 years or older rose from 38 to 47 percent during 2002-14. By housing tenure, mortgagors held 77 percent of total household debt, followed by outright owners (13 percent), and renters (10 percent) in 2016, broadly unchanged from previous years.

Distribution of Household Debt
(In percent; share of total household debt by household type)

	2002	2006	2010	2014
Housing tenure				
Mortgagor	73	74	77	76
Outright owner	17	15	13	12
Renter	10	11	10	12
Disposable income quintiles				
1st	15	9	4	4
2nd	25	16	11	6
3rd	28	24	15	12
4th	18	27	28	25
5th	14	24	42	53
Head of household age				
15-34	26	26	25	24
35-44	37	32	30	29
45-54	26	28	31	29
>55	12	14	15	18

Sources: HILDA and IMF staff calculations.

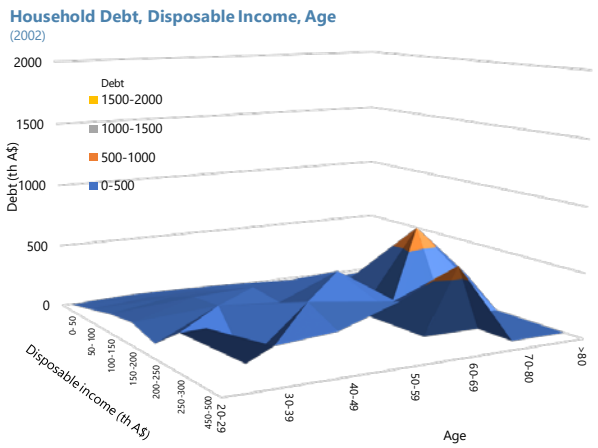
Further, within quartiles of the household debt distribution in percent of household net worth, the average debt level of the high (A$460 thousand) and medium-high (A$274 thousand) debt groups has risen rapidly during 2002-14, being multiple times higher compared with medium-low (A$58 thousand) and low debt (A$36 thousand) households (Figure 2). Household net worth is the largest for the medium-low debt group, while net worth is the smallest for households in the high debt category (Figure 2).

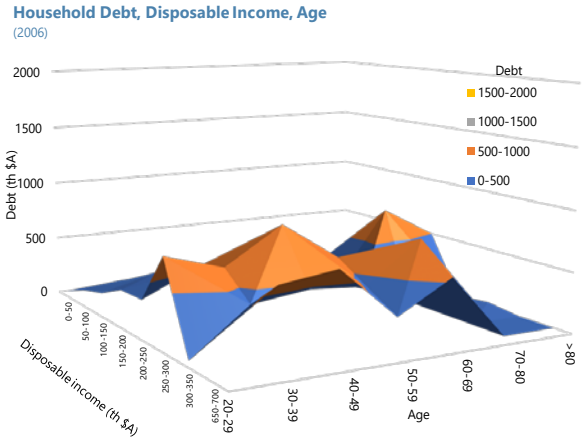


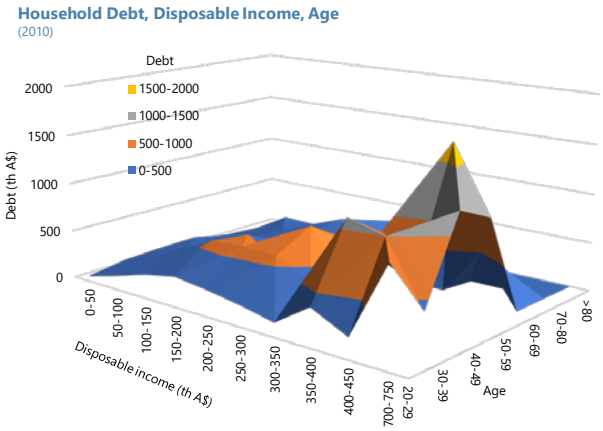
Finally, DTI ratios over 2002-14 have risen across households defined by the age of the household head, with the DTI ratios of the 30-40 and 40-50 age groups rising to 2.6 since 2010. The three-dimension presentation helps to highlight that household debt has evolved over the years not only by income, but also by age distribution. In 2002, the peak of the household debt was skewed toward higher age groups and higher income. By 2006, younger borrowers at age 30-39 with medium income had higher household debt level largely because of the need to borrow more to afford higher house prices. By 2014, the 40-49 age high-income households had the highest debt level.

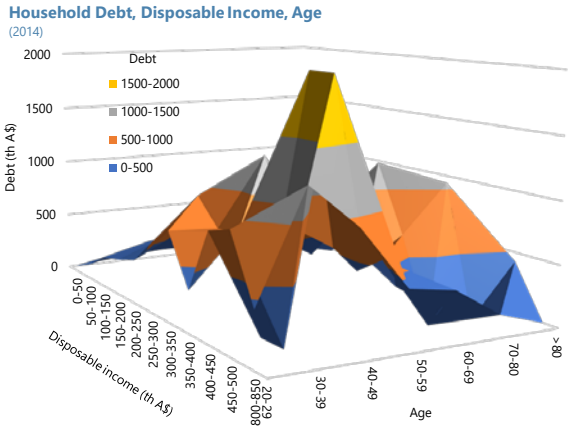
The discussions above highlighted that, with the rise in overall household indebtedness, household debt ratios have increased across all income quintiles and debt also appeared to be more concentrated in higher-income households. The response of these highly indebted households to negative shocks would likely have important implications on financial stability and responsiveness of the economy to policy changes, a point that warrants closely examination in the empirical analysis that follows.

Distribution of Household Debt by Disposable Income and Age (Average by Age Groups)





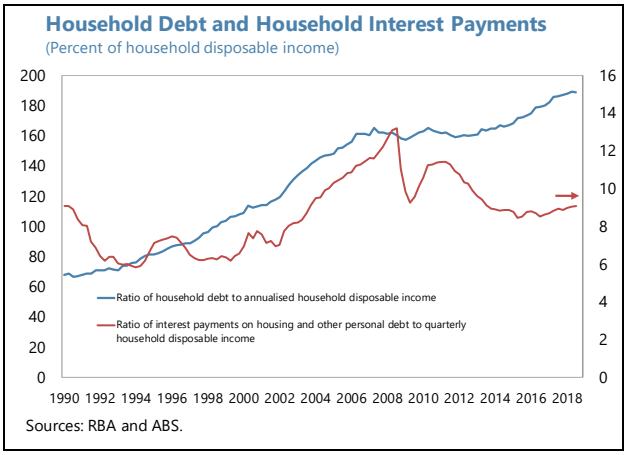


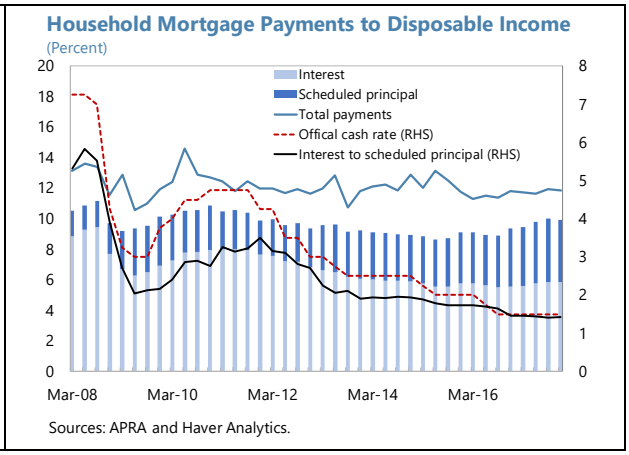


Sources: Hilda and IMF staff calculations.

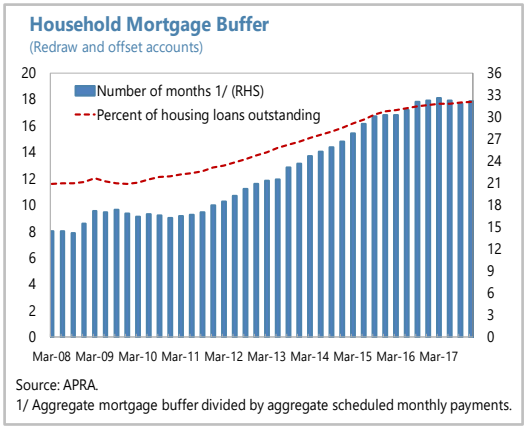
Financial Stress of High Household Debt

As discussed earlier, while the average household DTI ratio has been rising over the years, households have been able to service higher levels of debt with historically low interest rates. The decline in interest rates has resulted in the debt-servicing ratio—the ratio of scheduled principal and interest mortgage repayments to household disposable income—remaining broadly unchanged at 9 to 11 percent in the post-GFC period despite the rise in household debt levels. In fact, the mortgage interest to scheduled principal repayment ratio declined from 5.8 in 2008 to 1.4 in 2017 against the backdrop of historically low interest rates. This has in part facilitated households to make higher-than-scheduled total payments by about 2 percent of household disposable income in 2017.





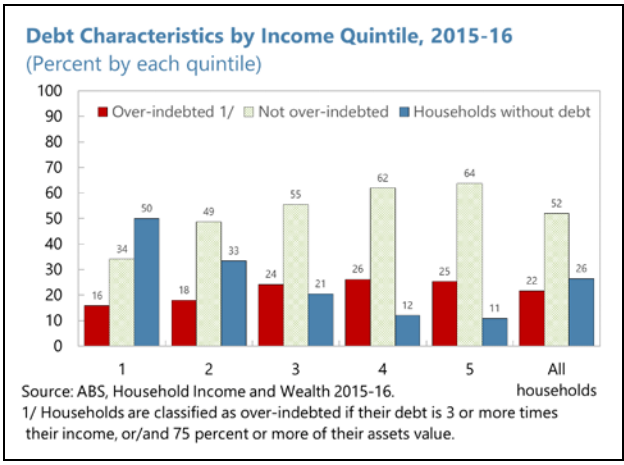
Meanwhile, the Australian Prudential Regulation Authority (APRA) has tightened the serviceability assessments for mortgage borrowers in order to ensure adequate debt repayment capacity. Since end-2014, prudent serviceability assessments for new mortgage lending are required to include an interest rate buffer of at least 2 percentage points above the effective variable rate applied for the term of the loan, and a minimum floor assessment interest rate of at least 7 percent to allow borrowers to accommodate future increases in interest rates. While this prudential measure has helped to strengthen substantially borrowers' ability to weather higher interest rates, repayment capacity risk could still heighten if interest rates were to rise much higher than expected.

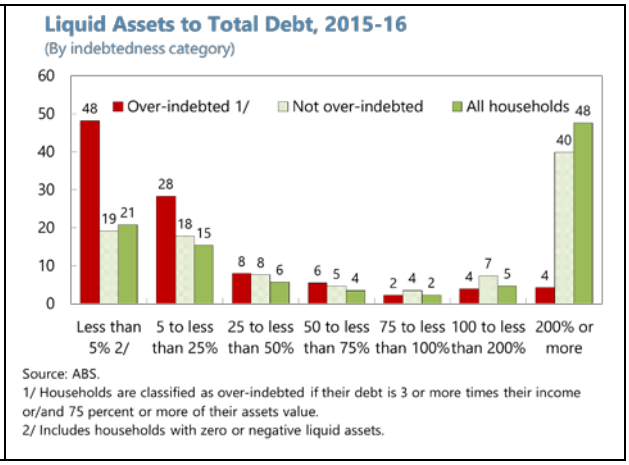


Moreover, mortgage repayment buffers have further helped to increase household resilience to shocks. Mortgage buffers—including balances in offset accounts and redraw facilities, which are held for tax and precautionary reasons—have been rising over the past few years, as households have taken advantage of

falling interest rates to pay down debt faster than required.[5] Total household mortgage buffers were 18 percent of outstanding loan balances or around 2½ years of scheduled repayments at current interest rates in 2017. However, the distribution of these buffers is not even as "while one-third of the outstanding owner-occupier mortgages had at least two years equivalent of buffer, about one-quarter had a mortgage buffer of less than one month" (RBA, 2018).[6]

On the other hand, the SIH results point to the vulnerability of over-indebted households. Households are classified as over-indebted, if their debt is three or more times their income or/and 75 percent or more of the value of their assets. Under this definition, 29 percent of households are over-indebted based on the ratio of debt to either disposable income or assets. High income households were more likely to be over-indebted, with one quarter of the households in each of the top three income quintiles being over-indebted compared to about one-sixth in the lowest and second income quintiles. These over-indebted households are exposed to changes in income or interest rates that will have a substantial impact on their debt service capacity. Results of the SIH indicated that about three quarters of over-indebted households did not have sufficient liquid assets to cover a quarter of their debt values. Staff's estimates based on the data for 2015-16 suggest that a one percentage point increase in interest rates would increase the debt service repayment (principal and interest) of over-indebted households in the highest (lowest) income quintile by 22 percent (18 percent). These data on the increases in debt service repayment provide some background on the impact of interest rate changes on disposable income and spending.





[5] An offset account acts like an at-call deposit account, which funds in the account are netted against the borrower's outstanding mortgage balance for the purposes of calculating interest on the mortgage loan. A redraw facility allows a borrower to reduce the mortgage balance and interest payments by making higher-than-scheduled repayments. A drawdown of funds accumulated in the redraw facility would be recorded as new loan flow.

[6] In addition, "data from HILDA Survey suggest that households with large mortgage buffers tend to be older and have higher incomes, which is consistent with these households having had more time and/or income to accumulate such buffers. Borrowers that have small or no buffers tend to be younger or have more recently taken out their loan" (Box B in RBA, 2012).

Takeaways on the stylized facts

The discussions in this session highlighted the rise in household debt relative to disposable income to historically high levels, in close synchronization with upward trend in house prices and historical low interest rates. Micro-survey data indicated that while high debt is more prevalent among higher-income households, they also tend to be more exposed to risks from being over-indebted. At the same time, the debt exposure of lower-income and more vulnerable households (including higher age and retired households) has also increased over time. This evidence suggests that a sizeable share of households is vulnerable to interest rate changes and other shocks, thereby impacting debt-servicing repayment and consumption.

IV. HOUSEHOLD SURVEY DATA AND HOUSEHOLD GROUPS

In this paper, the micro-level detailed household data are obtained from the HILDA survey, which has been running with annual frequency from 2001 to 2016 by the time the empirical analysis was conducted.[7] The bulk of the macroeconomic variables for Australia and other advanced countries is taken from the IMF's International Financial Statistics (IFS) and the World Economic Outlook (WEO) databases.

The HILDA survey contains micro data on household income, wealth, expenditure, housing tenure status, age, gender, and other household characteristics. The survey contains detailed information on weekly and annual expenditures on non-durable goods and services, durable goods, housing and rental costs, mortgage payments, as well as household gross and disposable income, household total debt, household total net worth, total household financial and non-financial assets, total property-apportioned debt and equity, and house-apportioned debt and equity.[8]

There is no unique way to look at the distribution of the household debt in the empirical analysis, and the debt distribution can be split in many possible ways to get a better understanding of the impact on dependent variable. This paper uses the information on household debt to look at household groups with various level of indebtedness. For this purpose, the series of the total debt, total property-apportioned debt, and home-apportioned debt are used to construct household debt quartiles to examine the impact of the monetary policy shocks on household with different level of debt.[9] The paper constructs ratios of debt indicators to wealth variables, such as household total net worth and household non-financial assets. Subsequently, we use these quartiles to construct three groups of households with

[7] The 2017 HILDA survey results are available now, but they were released after the paper was written, and thus they are not included in the empirical analysis.

[8] Appendix I provides a detailed description of the variable definitions and the sample restrictions.

[9] Appendix I provides definition of various household debt.

different debt ratios: [10] high debt—the highest quartile; medium debt—the two middle quartiles; and low debt—the lowest quartile. Such a split provides a more accurate picture on the reaction of households with different debt ratios to various shocks, compared with the previous studies that classified households into three groups: renters, mortgagors, and outright owners of their residences. The latter classification provides only approximate information on the debt level of the households. For example, an outright owner can have a loan on its second property and high debt to net worth/non-financial assets, thereby grouped under the high debt group.

The study aggregates detailed information on household consumption and expenditures into current consumption and durable expenditure panel series on annual basis. Then, both aggregated variables are divided by total disposable income to normalize and detrend these series.[11]

Before conducting empirical analysis, several outliers have been removed from the dataset. For the debt ratios, all outliers were removed, and all negative reported debt indicators were taken out of the final sample. For the household consumption ratios, (i) all observations for the current consumption that are negative were removed; (ii) the 99th percentile for the ratio of the current consumption to the total disposable income were dropped; and (iii) the first and the 99th percentiles for the ratio of durable expenditures to the total disposable income were dropped (with the first percentile including zero and negative durable expenditures).

The empirical analysis is based on an unbalanced panel, with households (using household identification numbers) as units and years for the time dimension. The full sample is split by household groups by debt ratio quartiles as identified above. Such grouping addresses concerns that a household can transit from one group to another, as this is captured by the debt ratios. As the wealth survey under HILDA is conducted every fourth year (starting from 2002), the study assumes that the household balance sheet position stays the same for the four years prior to the next wealth questionnaire. This is the best available proxy for the balance sheet position of households for the full length of the survey, which allows us to utilize the full sample.

As Australia's domestic economy was not severely affected by the GFC, the paper uses the full sample of the HILDA survey for 2001-16 for about 16,000 participating households.

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[10] An alternative could be to estimate regressions with a debt variable, so that the expected impact would depend on the product of coefficient and debt ratio. However, it is impossible to do it using the HILDA dataset, as the debt indicators are available only for each fourth year.

[11] Cloyne, Ferreira, and Surico (2018) converted the survey data for the United Kingdom and the United States into quarterly time series using the date of interview, and then deflated the resulting series by the retail/consumer price index to convert the data into real series.

This study captures the newest 2016 wave, whereas La Cava, Hughson, and Kaplan (2016), only used the HILDA survey up to the 2014 wave.

V. Empirical Analysis

Consistent with the literature, the expectation for the empirical analysis is that consumption behavior will differ by household type. Households with high debt exposure will, in principle, react more to changes in financial conditions in general and monetary policy in particular compared to households with medium debt or, even more so, to households with low debt. This section focuses on the empirical analysis of the impact of a monetary policy shock on current consumption and durable spending of households. To do this, the paper sets up an empirical framework, following some recent empirical studies, as well as defining a monetary policy shock. The empirical results shed light on how households would react on an unexpected monetary policy shock, depending on the level of their household debt.

A. Monetary Policy Shock Identification

The paper aims to examine the effect of monetary policy on the spending and income of households grouped by different level of accumulated debt (by quartiles described above). As Cloyne, Ferreira, and Surico (2018) noted, there is the usual macroeconomic reverse causation problem, that the economy reacts to monetary policy, but that monetary policy also responds to macroeconomic developments. Therefore, following their framework, this paper uses a *monetary policy shock series* to identify unanticipated changes in the cash rate.

This paper uses the widely-used Romer and Romer (2004) narrative approach that identified monetary policy shocks in the United States.[12] Specifically, it uses the estimates for Australia of Bishop and Tulip (2017), which were constructed using this approach.[13] One of the largest policy shocks occurred in 2008-09, when the RBA cut the cash rate by more than suggested by historical relationships. Contractionary shocks in 1994 were also unusually large.

By construction, the monetary policy shock variable is almost perfectly correlated with the RBA's cash rate.[14] Therefore, the cash rate is not included in the regression analysis, as this variable would be collinear to the monetary policy shock variable.

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[12] This method first constructs a target policy rate measure and then regresses the change in the target rate on the forecasts for output growth and inflation.

[13] Bishop and Tulip (2017) regressed the change in the target cash rate announced at an RBA Board meeting on the two-quarter-ahead forecasts of year-ended underlying inflation, real GDP growth, the revisions to the forecasts since the previous forecast round three month ago (for inflation and GDP growth), a nowcast of the unemployment rate for the current quarter (which incorporates some real-time data), and the cash rate announced at the previous month's RBA's Board meeting. They also used 12 alternative specifications to estimate monetary policy shocks, and the results were similar to the baseline specification.

[14] The correlation coefficient is 0.9987.

B. Empirical Framework

The empirical specification in this paper follows that of Cloyne, Ferreira, and Surico (2018). Accordingly, a measure of current consumption or durable expenditures is regressed on a lag of the monetary policy shocks, controlling for the lagged endogenous variable as is common for relatively short samples. Specifically, the following equation is estimated:

$$X_{i.t} = \alpha_0^i + \beta^i(L)X_{i,t-1} + \sum_{j=t-1}^{t} \gamma_j^i(L)S_{i,j} + \sum_{j=t-1}^{t} \delta_j^i(L)Z_{i,j} + u_{i,t}$$

where X is a ratio of a household's current consumption to its total disposable income, or a ratio of a household's expenditures on durables to its total disposable income in year *t*. *S* is a vector of monetary policy shocks (which includes implicitly the RBA's cash rate, as described above) at times *t* and *(t-1),* and *Z* is a vector of other control variables. For the current consumption ratio, this vector consists of household's total disposable income, average annual inflation, average mortgage rate, and world GDP growth. To capture global financial conditions, the paper considered to include the 3-month U.S. T-bill rate. However, it is highly correlated with the RBA's cash rate and thereby with the monetary policy shock variable, and it was, therefore, not included in the regression analysis. For the expenditures on durables, the control variables include year-dummies.[15] The term α represents intercepts. Finally, the group index *i* refers to high-debt households, medium-debt households, and low-debt households, as described above.

We use Arrelano-Bond dynamic panel regressions for the unbalanced panel dataset for up to 26,400 households over 16 years, with robust standard errors based on robust two-step estimators of the variance-covariance matrix using one lag for the dependent variables.

C. Results

Our hypothesis is that a positive monetary policy shock—implying tighter financial conditions— has a negative impact on current consumption and durable expenditure for the full sample of households and, at least, for households with high debt ratios. Several regressions are run in this paper using various debt ratios to split the full sample.

The results of the empirical analysis show that there are differences across households in the response of current consumption and durable expenditures to a monetary policy shock, depending on debt quartiles. In addition to monetary policy shocks and household debt,

[15] Several regression specifications have been tried for durable expenditures. However, because of the average length of the time series per household being only two years, control variables used for the current consumption appear to be collinear, and thus those specifications were not used in the final analysis. Similarly, the current and one-lag monetary policy shocks use together appear collinear, therefore, only lagged monetary policy shock is used in the final specification.

consumption behavior also depends on household income and age, though these two variables are insignificant. Therefore, these household characteristics were not included in the final regressions that we report here.

For the ratio of current consumption to total disposable income, households react negatively and significantly to monetary policy shocks (and thus to the policy rate) in the previous year for most of the debt-ratio groupings. However, households react positively (although with a smaller coefficient) to the current monetary policy shocks. Current consumption also significantly depends on households' consumption decisions in the previous period (Table 1). Interestingly, the reaction of the household changes depends on the types of debt ratio. For example, for the total debt ratios, the strongest combined reaction is for high- and medium-debt households, while the low-debt households react positively to the monetary policy shock, consistent with our priors.

Specifically, for the household groups split by the ratio of total debt to total non-financial assets, a monetary policy shock of one basis point would cause the total decrease in the current consumption ratio to total disposable income by 0.28 percentage points for the high-debt households, while decreasing the same ratio by 0.13 percentage points for medium-debt households, but would cause an overall increase by 0.19 percent for the low-debt households. These results are intuitive, as most mortgages in Australia have variable rates, meaning that there is rapid pass-through of policy rates to household decisions. Nevertheless, an increase in the policy rate would have a larger impact on households with higher debt, and thus they would more likely need to adjust their current consumption.

These results are robust to alternative specifications, in which other macro variables are included as controls, or regressions that were run with annual time fixed effects in lieu of control variables. For example, including the ratio of general government balance over GDP, as a proxy for the fiscal policy, does not affect the overall results. However, the inclusion of year dummies, reverses the sign of the coefficients of the monetary policy shock variable, which may be caused by collinearity of some dummies and short time series for each ID (six years on average). Alternatively, year dummies might also take out some of the reaction to the monetary policy shocks, as monetary policy shocks vary within the financial cycle. For example, monetary policy shocks were larger in 2008 and 2009, and the corresponding year dummy coefficients for 2008 are larger and more significant in absolute terms (the year dummy for 2009 is dropped due to collinearity). As a robustness check, we run regressions excluding years 2008 and 2009, and the previous results continue to hold.

Clear evidence of differences in reactions across the household groups can also be seen in the response of the ratio of the durable expenditures to total disposable income (Table 2). As in the case of the current consumption, all the coefficients of the lagged monetary policy shocks are negative and significant for high- and medium-debt households. The results show that for

most specifications, the response of the high-debt households tends to be larger than that of the medium-debt households. Specifically, when grouping of households by the ratio of total debt to total net worth, the high-debt households would reduce their durable expenditures by 0.3 percentage points, while medium-debt households would react by only 0.2 percentage points. Low-debt households do not respond significantly to monetary policy shocks for their durable expenditures. This suggests that the income channel of the monetary policy transmission mechanism may dominate the intertemporal substitution channel for the low-debt households. Being savers, they likely hold a higher quantity of interest-earning assets than other households, which gives them capacity to smooth their consumption decisions.

Overall, the results of this analysis suggest that the behavior of high- and medium-debt households drives the durable expenditure results for the full sample. At the same time, for the current consumption the behavior of all household quartiles drives the results for the full sample. In addition, the data show that younger households have higher debt, including property related debt, and these households tend to have higher consumption and durable expenditures. Therefore, these households would react faster to the changes in the policy rates. Similar to the regressions for current consumption, the robustness checks include introducing a variable on fiscal policy and excluding years 2008 and 2009. In both cases, the results hold.

For another robustness check, the analysis was conducted for the three household groups—mortgagors, renters, and outright owners—as in Cloyne, Ferreira, and Surico (2018), using the same independent variables as above. The results, outlined in Tables 3 and 4, are similar to those in their paper. For current consumption, the reaction to a monetary policy shock is the most negative and statistically significant for the mortgagors, followed by renters and outright owners. For durable expenditures, mortgagors' reaction to monetary shocks is the most negative and statistically significant, followed by renters. However, the reaction of the outright owners is positive but insignificant, indicating that the income channel for this group dominates the intertemporal substitution channel for durable expenditures, such that they have enough interest earning assets to avoid adjusting their durable expenditures.

The overall results of the empirical analysis for Australia are also consistent with the results of the previous study for the United States and the United Kingdom by Cloyne, Ferreira, and Surico (2018). Similarly, the results of this analysis are in line with the results by La Cava, Hughson, and Kaplan (2016) for Australia, which found that the cash flow channel of monetary policy transmission is significant if net borrowers are considered as a proxy for high-debt households. At the aggregate level, the cash flow channel is reasonably strong, as household spending increases with a reduction in interest rates. This is similar to this study's negatively-signed coefficients for monetary policy shocks.

VI. Impact on Household Consumption and RBA's Communication on Household Debt

The empirical results in the previous section demonstrate that the impact of monetary policy shocks on household's current consumption and durable expenditures differs, depending on the household debt ratios. In particular households with higher debt-to-net worth ratio seem to be more sensitive to monetary policy shocks.

From a macroeconomic perspective, it is not the impact on individual households that matters, but the aggregate impact of unexpected changes in financial conditions. With the recent increase in debt-to-income or debt-to-wealth ratios and a larger share of households with higher debt ratios, the sensitivity of household spending in the aggregate should, in principle, also have increased. This information may influence RBA's policy rate decisions, as well as its communication about monetary policy decisions.

To assess the impact of monetary policy shocks on aggregate consumption, we will utilize the results from the previous section. First, we assess a one-period impact of an increase in the policy interest rate on the ratio of current consumption and durable expenditures to total household disposable income for the full samples and household groups with different level of debt-to-wealth ratios. Then, we assess a long-term impact for the full sample and all subsamples. Following that, the section provides a textual quantitative analysis of RBA's communication in several of its monetary policy communication instruments, published in the RBA website, to further improve households' and financial market participants' awareness of high household debt.

The Aggregate Consumption Impact of Monetary Policy Shocks and RBA Communications

To determine the one-period impact of the monetary policy shock on the consumption ratios, we use the regression coefficients and calculate sensitivity of the ratios of the current consumption and durable expenditures for the full sample and all subsamples with regards to a contractionary monetary policy shock. Assuming everything else being equal, the only change is a monetary policy shock of 25 basis points in period (t-1), the impact on the aggregate ratios of the aggregate household current consumption and durable expenditures to the aggregate household total disposable income would be negative for the full samples and all subsamples except for the durable expenditures of the households with low debt-to-wealth ratio.

The current consumption depends significantly on the contemporary and past monetary policy shocks, while durable expenditures depend only on a monetary policy shock with a one-period lag. The sign of the contemporaneous monetary policy shock in the regression for the current consumption is positive for the full sample and all subsamples, but the sign of the

monetary policy shock coefficient in the previous period is negative, and its absolute value of that shock is higher than contemporaneous shock. Thus, the cumulative effect of a monetary policy shock on current consumption is negative for the full sample and households with high and medium debt, while it is positive for households with low debt. This could allude that the aggregate current consumption would react slightly less to a monetary policy shock compared with durable expenditures for the full sample, which would in turn affect aggregate domestic demand.

The impact on the ratio of current consumption is lower than on that of the durable expenditures for the full sample and the households with high debt, suggesting that those households would adjust their durable expenditures immediately, but would need to maintain certain categories of their current consumption following a contractual monetary policy shock as a share of their disposable income.[16] The effect is almost identical for households with medium debt. At least a part of households would increase their current consumption and durable expenditures after a contractual monetary policy shock, that is households with low debt. Moreover, households with low debt would increase their current consumption more than their durable expenditures.

To determine the long-run impact, we take a partial derivative of the consumption ratio over the cumulative monetary policy shock:

$$\frac{\partial(X_t)}{\partial(S_{t-1})} = \frac{(\gamma_{t-1} + \gamma_t)}{1-\beta_{t-1}},$$

where $X = \frac{C}{Y}$, the ratio of consumption (current or durable) to the disposable income.

The long-term impact of the one-period monetary policy shock on the consumption ratios is higher compared with the one-period impact for both ratios of the current consumption and durable expenditures, suggesting the effect of this shock will accumulate over time. The long-run effect is positive for households with low debt, and remain negative for the full sample and households with high and medium debt.

[19] In this example, we took the latest available observations for the ratios of the aggregate current consumption (2016) and aggregate durable expenditures (2010) to the household's total disposable income and applied a positive monetary policy shock of 25bps with corresponding regression coefficients, assuming other things being equal.

Impact of a Contractual Short-term 25bps Monetary Policy Shock on Consumption-to-disposable Income Ratio and a Long-term Impact

(In percent)

	Current Consumption to Disposable Income	
	Short-Term Impact=(γ(t-1)+γ(t))*0.25	Long-Term Impact=((γ(t-1)+γ(t))/(1-β(t-1))
Full Sample	-0.0002	-0.0009
High Debt	-0.0004	-0.0020
Medium Debt	-0.0006	-0.0026
Low Debt	0.0005	0.0022
	Durable Expenditures to Disposable Income	
	Short-Term Impact=γ(t-1)*0.25	Long-Term Impact=γ(t-1)/(1-β(t-1))
Full Sample	-0.0004	-0.0018
High Debt	-0.0008	-0.0032
Medium Debt	-0.0005	-0.0024
Low Debt	0.0001	0.0004

Sources: HILDA and IMF staff estimates.

The above example of the impact of a contractionary monetary policy shock, together with the overall results of the empirical analysis conducted in this paper, would suggest that over the recent years, the RBA should have been paying more attention to household debt and consumption in its monetary policy decisions and in its related communication.

We now examine this conjecture using textual analysis of RBA communication, as available on its public website.

Textual Analysis

The textual analysis helps us to examine the frequency of using key words in the RBA communication published on its website. As a first step, we selected a list of keywords consisting of the exact text and its variations covering household debt, housing prices, housing market, credit to housing sector, and mortgage rate. Then, the textual analysis examined the word count for a narrowly defined *household debt* and a broader defined *generalized household debt* comprising word phases *household debt*, *housing debt*, *household leverage*, and *household debt-to-income*. The paper uses the Python programming language for text mining, which counts these selected word phases in the RBA's Interest Rate Decisions (11 releases per year), RBA Board Minutes (11 per year), Statement on Monetary Policy (four times per year in February, May, August, and November), and speeches by the RBA Governor and senior management for the period from 2008 to the cut-off data as of December 12, 2018.

The results of the textual analysis suggest that the RBA has increased the focus on the household debt issues in its communications as reflected in the increase in word counts for

the *household debt* word phases in 2015-17, while decreasing somewhat in 2018 (Figures 3 and 4).

Similarly, the word count for word phases on *housing prices* and *housing market* have picked up earlier since around 2012 which broadly coincided with the start of the housing boom. Likewise, the number of word count on *credit to housing sector* has increased sharply since 2015. On the other hand, the word count for *mortgage rate* also increased since 2005 but only moderately, likely reflecting a lower concern as mortgage rates have remained low so far.

VII. CONCLUSIONS AND POLICY IMPLICATIONS

This paper discusses the evolution of the household debt in Australia and focuses on the empirical analysis of the impact of a monetary policy shock on households' current consumption and durable expenditures depending on their level of debt. The discussion about the level and distribution of household debt concentrates on the concern whether household consumption could respond differently to monetary policy changes, given that current levels of the household debt are much higher compared with previous episodes of policy rate increases.

The paper finds that high debt exposure is more prevalent among higher-income and higher-wealth households. Nevertheless, the debt exposure of lower-income and more vulnerable households has also increased over time, and thereby more exposed to risks from rising debt service. The presence of over-indebted households at both low- and higher-income quintiles suggests that macro-financial risks have increased, suggesting a need for close monitoring.

Despite the high debt level, households' debt service burden has remained manageable due to historical low mortgage interest rates and given that financial institutions assess mortgage serviceability for new mortgage lending with interest rate buffers above the effective variable rate applied for the term of the loans. However, downside risks on debt service capacity and consumption remain with regards to a sharp tightening of global financial conditions which could spill over to higher domestic interest rates.

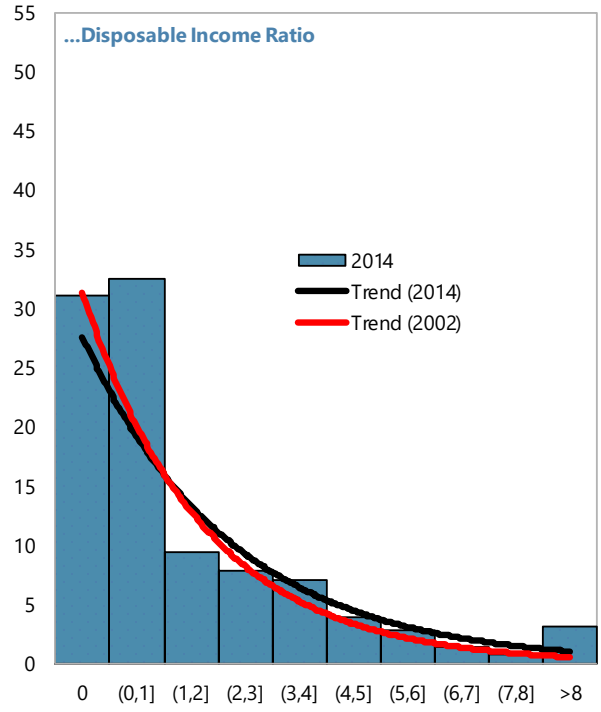
The empirical analysis investigates the transmission of monetary policy shocks to the current consumption and durable expenditures of households with different debt-to-wealth ratios. With reasonable assumptions and using the large sample of households available in the HILDA survey for 2001-16, the results corroborate that households' response to monetary policy shocks will vary, depending on both their debt and income levels. In particular, the results suggest that households with high debt tend to reduce their current consumption and durable expenditures relatively more than other households in response to a contractionary monetary policy shocks. At the same time, households with low debt may not respond to monetary policy shocks, as they hold more interest-earning assets and thereby can smooth

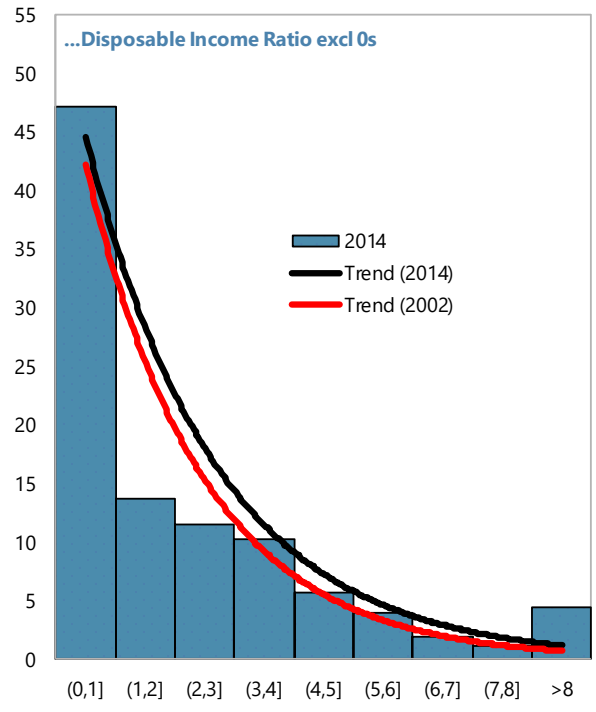
their consumption using the higher interest income, suggesting that for these households, the income effect dominates the intertemporal substitution effect.

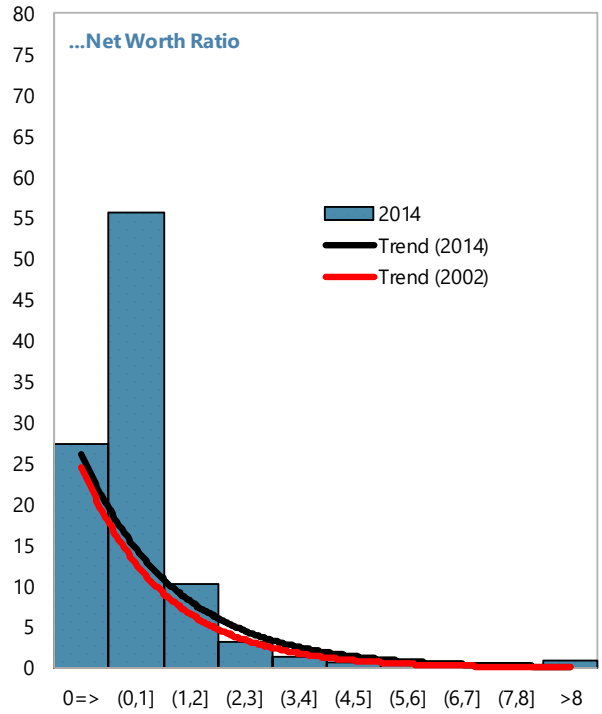
The results of the analysis suggest that, with a larger share of high-debt households and given their high responsiveness to a monetary policy shock, it may take a smaller increase in the cash rate for the RBA to achieve its policy objectives, compared to past episodes of policy rate adjustments. It corroborates recent RBA research, which suggests that the level and the distribution of the household debt will likely alter monetary policy transmission, in other words, more bang for the buck. By responding gradually, the RBA can still meet its mandates.

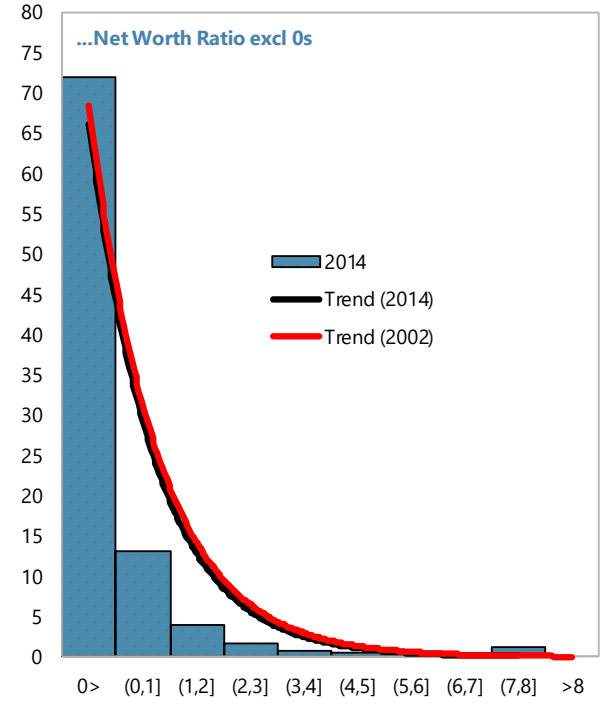
The implications of higher household debt for monetary policy have also required that the RBA addresses this challenges in its communication. The results of the textual analysis show that the RBA's communication has increasingly focused on the impact of household debt on monetary conditions and financial stability over the past decade, consistent with the rise in debt-to-income ratios. Markets have also started to take into account household debt in their assessment of monetary policy and market expectation analysis. Therefore, continuing with a transparent and strengthened communication strategy on issues related to the household debt and household consumption will further improve predictability and efficiency of monetary policy in Australia.

Figure 1. Australia: Household Debt to Disposable Income and Net Worth Ratios
(Percent of Households)



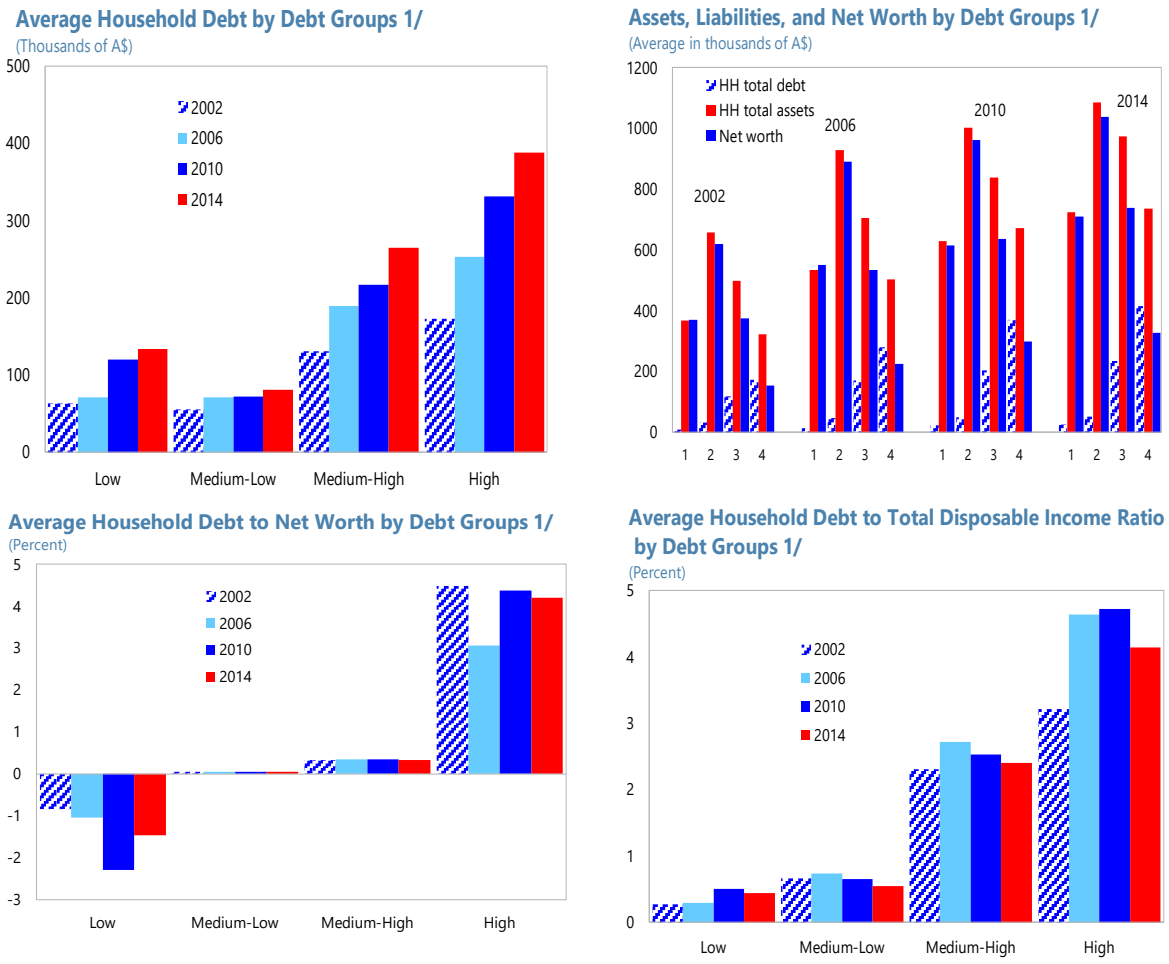






Sources: HILDA and IMF staff calculations.

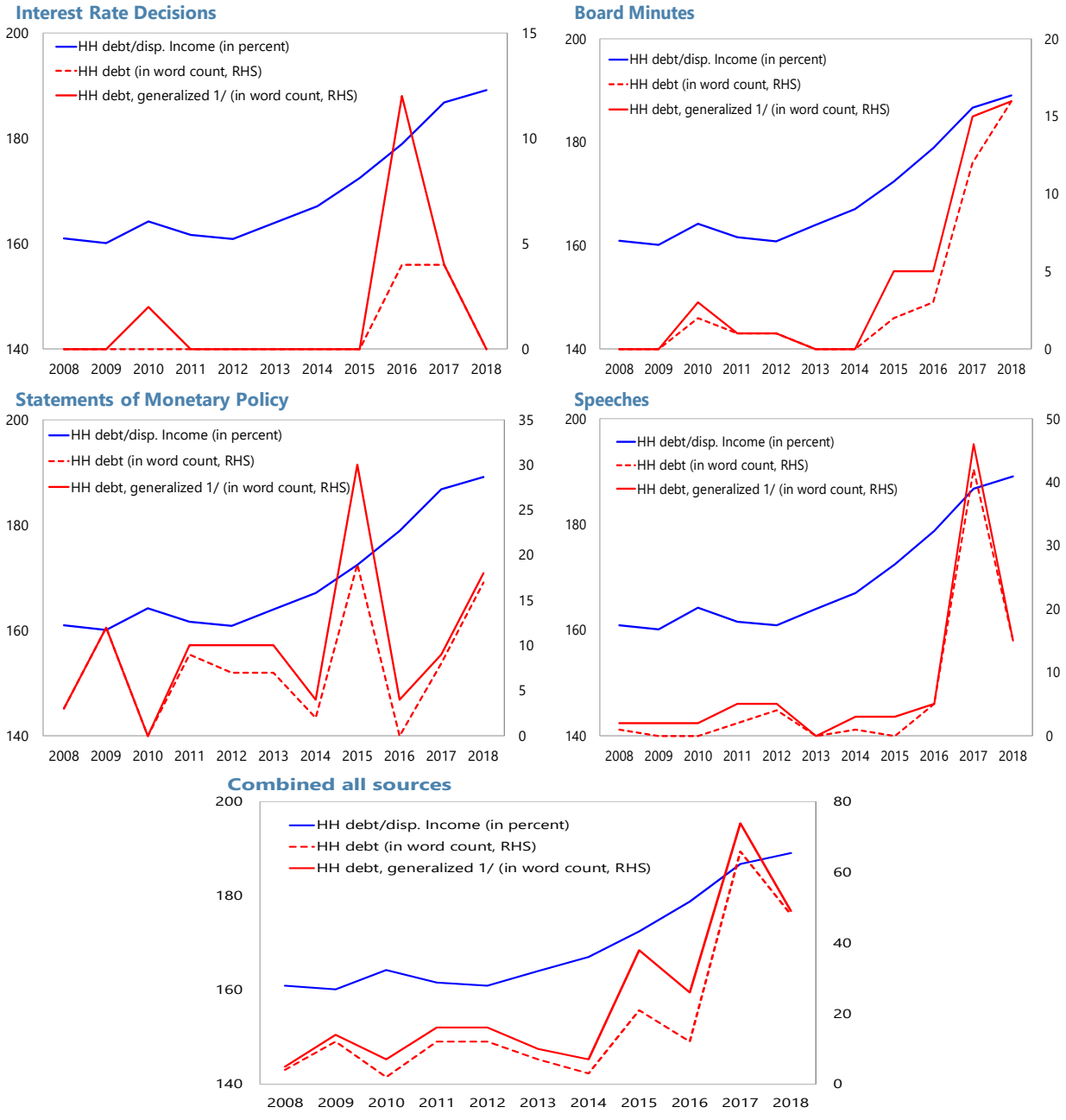
Figure 2. Australia: Household Debt Distribution



Sources: HILDA and IMF staff calculations.

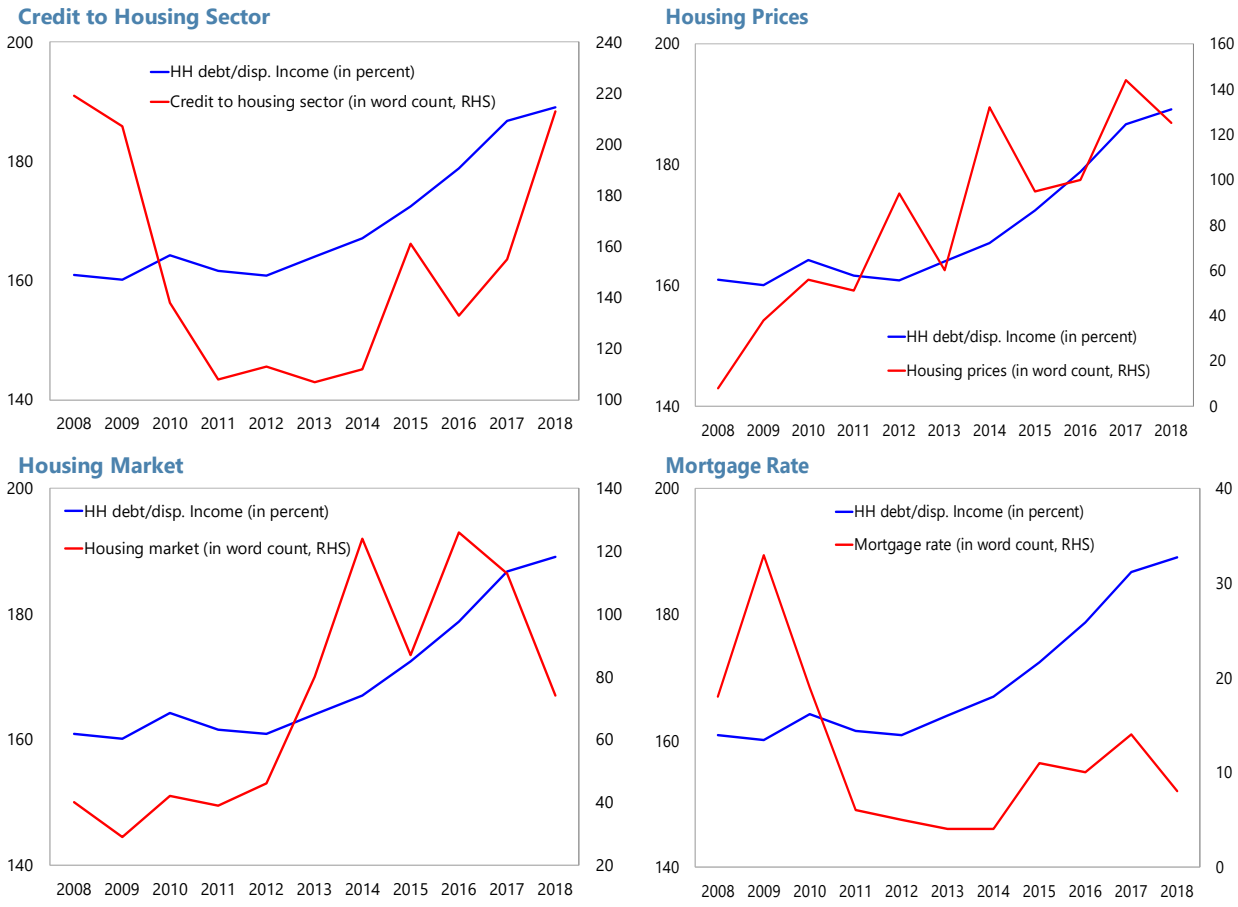
1/ Based on quartile of total debt in percent of household net worth.

Figure 3. RBA Communication on Household Debt



Sources: RBA and IMF staff calculations.
1/ Defined as the number of references to phrases: HH debt, housing debt, HH leverage, and HH debt-to-income.

Figure 4. RBA Communication on Housing Sector[1]



Sources: RBA and IMF staff calculations.

[1] All charts are based on the phrase counts from the RBA's communications in Interest Rate Decisions, Board minutes, Monetary Policy Statements, and Speeches combined.

Table 1. Current Consumption and Monetary Policy Shocks

	(1)	(2)	(3)	(4)
VARIABLES	Full Sample	High Debt	Medium Debt	Low Debt
Total Debt to Total Net Worth				
L.ConsTDI	0.130***	0.133***	0.131***	0.118***
	(0.00645)	(0.0144)	(0.00939)	(0.0116)
MPShock	0.0153***	0.0134***	0.0130***	0.0196***
	(0.00124)	(0.00217)	(0.00170)	(0.00294)
L.MPShock	-0.0161***	-0.0151***	-0.0153***	-0.0177***
	(0.00106)	(0.00183)	(0.00141)	(0.00263)
Observations	168,028	42,556	81,025	44,447
Number of xwaveid	26,431	10,380	17,156	10,270
Total Debt to Non-Financial Assets				
L.ConsTDI	0.130***	0.128***	0.118***	0.126***
	(0.00645)	(0.0132)	(0.00906)	(0.0126)
MPShock	0.0153***	0.0117***	0.0153***	0.0199***
	(0.00124)	(0.00230)	(0.00164)	(0.00304)
L.MPShock	-0.0161***	-0.0145***	-0.0166***	-0.0176***
	(0.00106)	(0.00199)	(0.00139)	(0.00270)
Observations	168,028	44,414	83,750	39,864
Number of xwaveid	26,431	10,715	16,862	8,721
Total Property Apportioned Debt to Total New Worth				
L.ConsTDI	0.130***	0.124***	0.108***	0.132***
	(0.00645)	(0.0140)	(0.0137)	(0.00848)
MPShock	0.0153***	0.0147***	0.0171***	0.0145***
	(0.00124)	(0.00194)	(0.00232)	(0.00200)
L.MPShock	-0.0161***	-0.0147***	-0.0152***	-0.0170***
	(0.00106)	(0.00158)	(0.00182)	(0.00177)
Observations	168,028	45,331	38,225	84,472
Number of xwaveid	26,431	10,056	8,609	17,152
Total Property Apportioned Debt to Non-Financial Assets				
L.ConsTDI	0.130***	0.101***	0.115***	0.139***
	(0.00645)	(0.0148)	(0.0130)	(0.00860)
MPShock	0.0153***	0.0165***	0.0153***	0.0142***
	(0.00124)	(0.00197)	(0.00231)	(0.00202)
L.MPShock	-0.0161***	-0.0140***	-0.0155***	-0.0173***
	(0.00106)	(0.00159)	(0.00190)	(0.00179)
Observations	168,028	44,797	41,592	81,639
Number of xwaveid	26,431	10,062	9,122	16,504
House Apportioned Debt to Total New Worth				
L.ConsTDI	0.130***	0.108***	0.106***	0.133***
	(0.00645)	(0.0140)	(0.0149)	(0.00808)
MPShock	0.0153***	0.0170***	0.0153***	0.0147***
	(0.00124)	(0.00196)	(0.00248)	(0.00186)
L.MPShock	-0.0161***	-0.0137***	-0.0174***	-0.0167***
	(0.00106)	(0.00159)	(0.00207)	(0.00164)
Observations	168,028	45,217	28,305	94,506
Number of xwaveid	26,431	9,921	6,780	18,712

House Apportioned Debt to Non-Financial Assets				
L.ConsTDI	0.130***	0.101***	0.105***	0.138***
	(0.00645)	(0.0147)	(0.0148)	(0.00815)
MPShock	0.0153***	0.0169***	0.0148***	0.0146***
	(0.00124)	(0.00197)	(0.00255)	(0.00187)
L.MPShock	-0.0161***	-0.0144***	-0.0162***	-0.0171***
	(0.00106)	(0.00160)	(0.00216)	(0.00165)
Observations	168,028	44,614	31,309	92,105
Number of xwaveid	26,431	9,906	7,275	18,197

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table 2. Durable Expenditures and Monetary Policy Shocks				
	(1)	(2)	(3)	(4)
VARIABLES	Full Sample	High Debt	Medium Debt	Low Debt
Total Debt to Total Net Worth				
Durable Exp (t-1)	0.0948***	0.0491***	0.0943***	0.135***
	(0.00915)	(0.0176)	(0.0128)	(0.0183)
MP Shock (t-1)	-0.00166***	-0.00306***	-0.00217***	0.000372
	(0.000491)	(0.00095)	(0.000708)	(0.000958)
Observations	43,874	10,102	21,982	11,790
Number of xwaveid	16,327	5,489	10,383	5,815
Total Debt to Non-Financial Assets				
Durable Exp (t-1)	0.0993***	0.0679***	0.0921***	0.128***
	(0.00853)	(0.0215)	(0.0119	(0.0190)
MP Shock (t-1)	-0.00164***	-0.00218***	-0.00269***	0.000591
	(0.000488)	(0.000779)	(0.000717)	(0.00108)
Observations	43,874	10,063	23,103	10,708
Number of xwaveid	16,327	5,287	10,484	5,101
Total Property Apportioned Debt to Total New Worth				
Durable Exp (t-1)	0.0948***	0.0854***	0.102***	0.104***
	(0.00915)	(0.0174)	(0.0173)	(0.0141)
MP Shock (t-1)	-0.00166***	-0.00511***	-0.00337***	0.000710
	(0.000491)	(0.00100)	(0.00105)	(0.000658)
Observations	43,874	10,997	10,724	22,153
Number of xwaveid	16,327	5,564	5,416	9,803
Total Property Apportioned Debt to Non-Financial Assets				
Durable Exp (t-1)	0.0993***	0.0755***	0.0970***	0.106***
	(0.00853)	(0.0179)	(0.0168)	(0.0145)
MP Shock (t-1)	-0.00164***	-0.00532***	-0.00286**	0.000631
	(0.000488)	(0.00100)	(0.000991)	(0.000677)
Observations	43,874	10,489	11,961	21,424
Number of xwaveid	16,327	5,408	5,940	9,495
House Apportioned Debt to Total New Worth				
Durable Exp (t-1)	0.0948***	0.0825***	0.0752***	0.112***
	(0.00915)	(0.0180)	(0.0183)	(0.0127)
MP Shock (t-1)	-0.00166***	-0.00390***	-0.00436***	-0.000106
	(0.000491)	(0.00102)	(0.00118)	(0.000626)
Observations	43,874	11,161	7,951	24,762
Number of xwaveid	16,327	5,603	4,168	10,849
House Apportioned Debt to Non-Financial Assets				
Durable Exp (t-1)	0.0993***	0.0756***	0.0835***	0.114***
	(0.00853)	(0.0173)	(0.0180)	(0.0129)
MP Shock (t-1)	-0.00164***	-0.00435***	-0.00323***	-0.000023
	(0.000488)	(0.000987)	(0.00116)	(0.000640)
Observations	43,874	10,821	8,917	24,136
Number of xwaveid	16,327	5,450	4,592	10,596

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table 3. Current Consumption and Monetary Policy Shocks by Ownership Groups				
	(1)	(2)	(3)	(4)
VARIABLES	Full Sample	Outright Owner	Mortgagor	Renter
Curr Cons (t-1)	0.130***	0.117***	0.161***	0.104***
	(0.00645)	(0.0124)	(0.0110)	(0.0108)
MP Shock	0.0153***	0.0178***	0.0158***	0.0131***
	(0.00124)	(0.00276)	(0.00166)	(0.00267)
MPShock (t-1)	-0.0161***	-0.0193***	-0.0132***	-0.0174***
	(0.00106)	(0.00242)	(0.00136)	(0.00230)
Total Household Disposable Income	-1.40e-06***	-1.17e-06***	-1.30e-06***	-2.27e-06***
	(2.64e-08)	(3.15e-08)	(3.64e-08)	(8.96e-08)
Inflation	-0.00206*	-0.00535**	-0.00632***	0.00659***
	(0.00121)	(0.00262)	(0.00149)	(0.00255)
Mortgage Rate	-5.59e-05	-0.00402	-0.00460***	0.00870***
	(0.00123)	(0.00271)	(0.00143)	(0.00255)
World Growth rate	-0.00804***	-0.0104***	-0.00524***	-0.0102***
	(0.000765)	(0.00171)	(0.000977)	(0.00167)
Constant	0.501***	0.545***	0.465***	0.540***
	(0.00547)	(0.0115)	(0.00824)	(0.0123)
Observations	168,028	46,448	70,796	50,794
Number of xwaveid	26,431	10,926	14,627	12,120

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 4. Durable Expenditures and Monetary Policy Shocks by Ownership Groups				
	(1)	(2)	(3)	(4)
VARIABLES	Full Sample	Outright Owner	Mortgagor	Renter
Durable Exp (t-1)	0.0948***	0.0988***	0.0962***	0.0835***
	(0.00915)	(0.0153)	(0.0127)	(0.0192)
MP Shock (t-1)	-0.00166***	0.000949	-0.00406***	-0.00123*
	(0.000491)	(0.00107)	(0.000795)	(0.000657)
y7	0.0106***	0.00575	0.0133***	0.00968***
	(0.00181)	(0.00395)	(0.00323)	(0.00283)
y8	-0.000299	-0.00853**	0.00163	0.00408*
	(0.00173)	(0.00360)	(0.00285)	(0.00240)
Constant	0.121***	0.114***	0.154***	0.0825***
	(0.00311)	(0.00670)	(0.00525)	(0.00441)
Observations	43,874	12,626	18,563	12,687
Number of xwaveid	16,327	5,755	8,076	5,674

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Appendix I. Data Description

The empirical analysis of the paper is based on data drawn from the *Household, Income and Labour Dynamics in Australia* (HILDA), a longitudinal survey that contains information about the economic and personal life of over 18,000 persons who have participated in the survey.[1] The HILDA survey is sponsored by the Australian Department of Social Studies, and designed and managed by the Melbourne Institute. The panel data cover the period from 2001 to 2016 on an annual basis, which is also referenced as "waves" 1-16.

The manipulation of the data occurred in several steps:

First, the 16 HILDA "Combined"[2] Stata databases were downloaded—one dataset per "wave"—and were appended to generate one Stata data file that contained 2,441 variables with 317,738 observations. Then a subset was generated using variables in categories pertaining to household consumption, income, financial and non-financial assets, expenditure, debt, mortgage and other loan payments, and an unbalanced panel was built based on the identifiers "xwaveid"[3] and "wave." This trimmed version of the dataset contained 293 variables and 317,738 observations.

Next, the dataset was further simplified by deriving the variables listed in Table 1, notably the seven household indebtedness ratios.[4] After excluding the outliers by dropping the first and 99th percentiles and negative values, the distribution of those ratios was calculated by splitting them into quartiles, and dummy variables were assigned to capture the risk of indebtedness.[5] Additional dummy variables were generated by assigning 1 to those respondents whose indebtedness jumped from the 1st to the 4th quartile during any period within the 16 "waves." The wealth and debt variables are collected every four years (starting from 2002 and ending in 2014), and we have assumed that the debt ratios remain unchanged until the next wealth survey.

The age of the head of household was compiled based on the disposable income of the enumerated persons by creating a panel data file from the 16 "Eperson" Stata databases. This

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[1] https://melbourneinstitute.unimelb.edu.au/hilda, Table 2.2.

[2] The "Combined" datasets contain data from Household Files, Enumerated Person Files, and Responding Person File which are based on various questionnaires per wave.

[3] "xwaveid" is the unique identifier for an individual across waves.

[4] Referring to the three household debt permutations, i.e. total debt, property-apportioned debt, and home-apportioned debt, as a ratio to household net worth and as a ratio to household non-financial assets, respectively. Additionally, a ratio of household total debt to household total assets was calculated.

[5] 1=Low-risk (1st quartile), 2=Medium-low risk (2nd quartile), 3=Medium-high risk (3rd quartile), and 4=High risk (4th quartile).

paper defined the head of the household as the individual of that household with the highest disposable income.

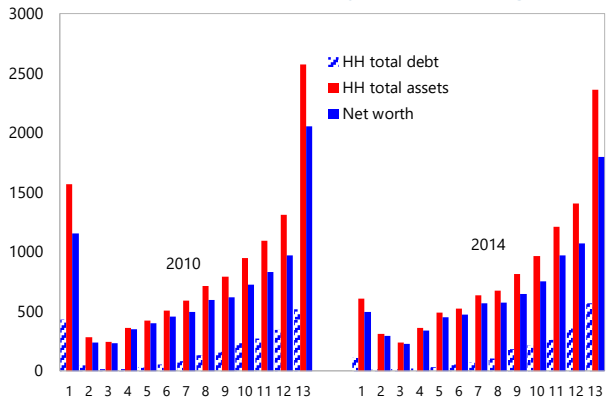
Finally, several macroeconomic indicators for Australia, such as nominal and real GDP, interest rates (mortgage, overnight indexed swaps, bank bills), inflation, and house price index were downloaded from Haver Analytics. The variable on world growth was taken from the IMF, World Economic Outlook database. For monetary policy shock, the findings by James Bishop and Peter Tulip, "Anticipatory Monetary Policy and the Price Puzzle", RDP-2017-02 were used. The variables above were compiled in an unbalanced panel structure by repeating the observation arranged by "xwaveid" and "wave" and were appended to the existing Stata dataset. Fifteen dummy variables (Y1, Y2,…,Y15) were created so as to capture the effects from the sixteen "waves".

In Appendix Figure 1, the top two panels show the characteristics of households in terms of the average value of household debt, total assets, net worth, financial assets, and non-financial assets by the 13 gross income bands of households as defined by HILDA for years 2010 and 2014. The two middle panels plot the same variables by household income quintiles (five equal groups) for years 2002, 2006, 2010, and 2014. Similarly, the last two panels show the variables above by household debt quartiles (four equal groups) for years 2002, 2006, 2010, and 2014.

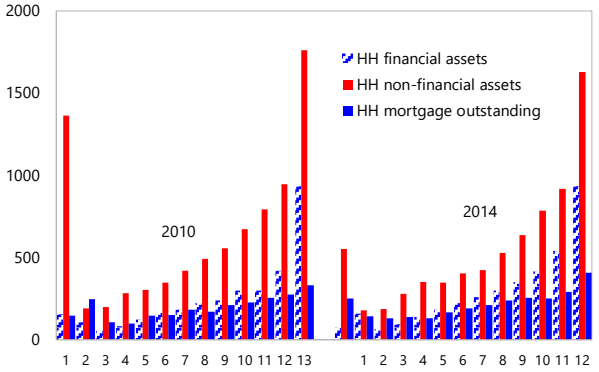
Appendix Figure 1. Australia: Household Balance Sheet

(Average in thousands of A$)

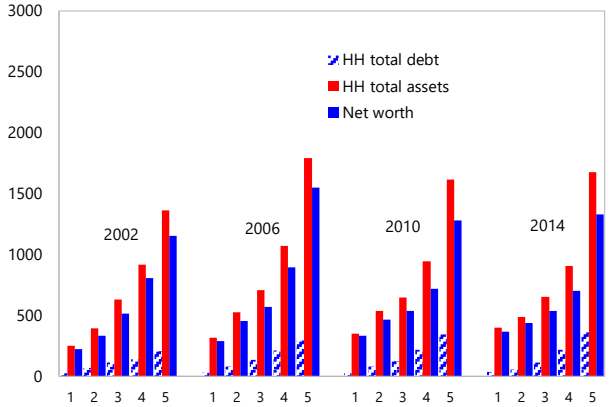
Assets, Liabilities, and Net Worth by 13 Income Categories 1/



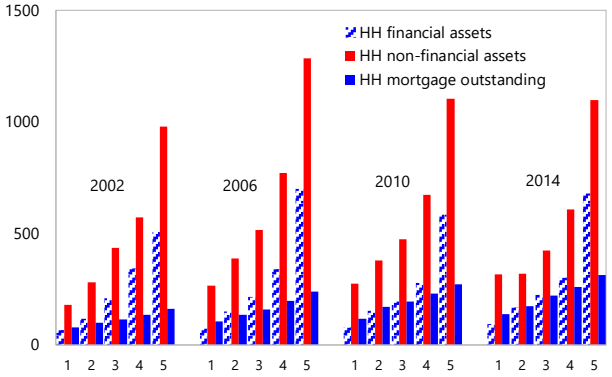
Financial Assets, Non-Financial Assets, Mortgage by 13 Income Categories 1/



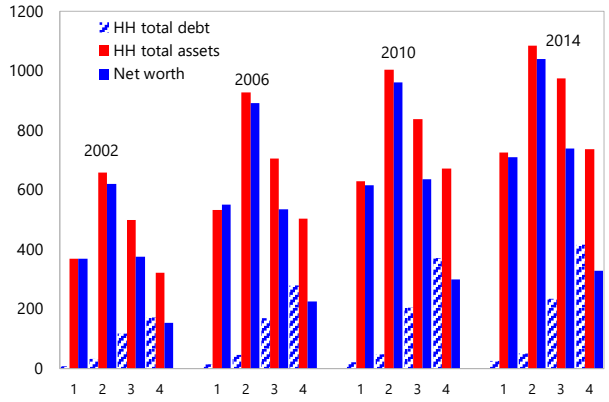
Assets, Liabilities, and Net Worth by Income Quintiles 2/



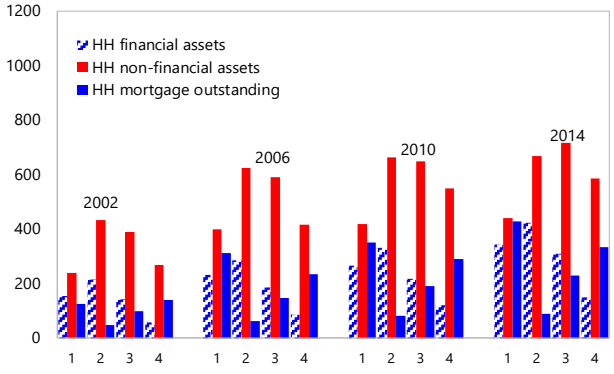
Financial Assets, Non-Financial Assets, Mortgage by Income Quintiles 2/



Assets, Liabilities, and Net Worth by Debt Groups 3/



Financial Assets, Non-Financial Assets, Mortgage by Debt Groups 3/



Sources: HILDA and IMF staff calculations.

1/ Gross income band taking the values 1-9 for income increments of A$10,000 and 10-13 for income increments of A$25,000, e.g. 1 is defined for income up to A$9,999; 2 for income between A$10,000-19,999; 10 for income between A$100,000-124,999; 12 for income between A$150,000-199,999; and 13 for income above A$200,000.

2/ Income divided in 5 quantiles, e.g. 1st and 5th quintile correspond to the 20 percent lowest and 20 percent highest income, respectively.

3/ Based on quartiles of total debt in percent of household net worth.

Appendix Table 1. Data and Descriptive Statistics

Table 1: Variables used for our Analysis

Variable	Label	Obs	Mean	Std. Dev.	Min	Max
xwaveid	Row id for the panel data	317738	333203	396504	100001	1601187
Year	Year	317738	2009	5	2001	2016
hhrhid	Household id	0				
MortTaken	Mortgage taken (1=took out institutional loan, 2 no institutional loan)	216258	1	0	1	2
PaidOff	Loan paid off (1=yes, 2=no)	171699	2	0	1	2
PaySchedule	Payment schedule of mortgage (1=ahead of time, 2=on time, 3=behind schedule)	117939	2	1	1	3
OtherLoan	Other loan (1=yes, 2=no)	316608	1	1	0	2
SecondMortEq	Second mortgage against equity (1=yes, 2=no)	316632	1	1	0	2
SecondMortRep	Amount paid for second mortgage (0=no second mortgage)	196820	0	0	0	0
HouseProvision	House provision (1=yes, e.g. house part of job compensation etc)	317738	0	0	0	1
RentW	Weekly rent received if rented	7214	290	224	0	3500
ExpGroceryW	Weekly expences, groceries	212079	197	104	0	1250
ExpFoodW	Weekly expences, food	212079	154	88	0	1000
MortOutst	Oustanding mortgage	117154	205966	172342	0	1854628
Age	Age of persons in household	317738	36	23	0	101
Gender	Gender of persons in household	317738	2	0	1	2
HDebtTotal	Total household debt	76713	156965	309403	0	2888969
HDebtOther	Other household debt	76713	6397	37133	0	869776
HNetWorth	Household net worth	76713	643046	1050509	-4855980	8481406
HNFinAssets	Household non-financial assets	76713	554967	888434	0	10800000
HFinAssets	Household financial assets	76713	245475	515639	0	4948122
HTotAssets	Household total assets	76713	801087	1204960	0	10600000
HTPropAppDebt	Household wealth, total property, apportioned debt	76713	124455	249672	0	2620156
HTPropAppEq	Household wealth, total property, apportioned equity	76713	344004	613223	-5999272	10500000
HTPropAppDebt	Household wealth, total property, apportioned debt	76713	89856	165160	0	1341911
HHomePropApp	Household wealth, home, apportioned equity	76713	253207	371850	-3775000	4122694
HIndNFinA	Household indebtedness, HH total debt over HH non-financial assets	317738	1	60	0	8278
HIndTA	Household indebtedness, HH total debt over HH tota assets	317738	2	109	0	12500
HIndProp1	Household indebtedness, HH total property apportioned debt as share of HH net worth	317738	0	-9	601	919
HIndProp2	Household indebtedness, HH total property apportioned debt as share of HH non-financial assets	317738	1	59	0	8278
HIndHome1	Household Indebtedness, HH home apportioned debt as share of HH net worth	317738	0	-6	601	469
HIndHome2	Household indebtedness, HH home apportioned debt as share of HH non-financial assets	317738	1	59	0	8278
HGrTotIncome	Household gross total income	317738	102438	98763	-2010000	1452536
HDispTIncome	Household disposable total income	317738	83834	71523	-2010000	937853
ConsCurrA	Current consumption expenditure including alcohol	244586	29266	15533	72	436828
ConsCurrNA	Current consumption expenditure excluding alcohol	244586	27779	14849	72	436828
ExpDur	Household expenditure on durable goods	87364	11267	23564	0	1523100
GrIncBand	Gross income band (takes value 1-9 for each income increment of A$10,000 between 0 and A$99,999; 10-11 for income increment of A$25,000 from A$100,000-A$149,999; 12 for income between A$150,000 and A$199,999; and 13 for income above A$200,000)	169874	8	3	1	13

Appendix Table 1. Data and Descriptive Statistics (Continued)

Table 1: Variables used for our Analysis

Variable	Label	Obs	Mean	Std. Dev.	Min	Max
TDNW	Household total debt over household net worth, quartiles	317738	2	1	1	4
TDNW_DL	of which: dummy for 1st quartile (low risk)	317738	0	0	0	1
TDNW_DML	of which: dummy for 2nd quartile (medium-low risk)	317738	0	0	0	1
TDNW_DMH	of which: dummy for 3rd quartile (medium-high risk)	317738	0	0	0	1
TDNW_DH	of which: dummy for 4th quartile (high risk)	317738	0	0	0	1
TDTA	Household total debt as share of household total assets, quartiles	317738	2	1	1	4
TDTA_DL	of which: dummy for 1st quartile (low risk)	317738	0	0	0	1
TDTA_DML	of which: dummy for 2nd quartile (medium-low risk)	317738	0	0	0	1
TDTA_DMH	of which: dummy for 3rd quartile (medium-high risk)	317738	0	0	0	1
TDTA_DH	of which: dummy for 4th quartile (high risk)	317738	0	0	0	1
TDNFA	Household total debt as share of household non-financial assets, quartiles	317738	2	1	1	4
TDNFA_DL	of which: dummy for 1st quartile (low risk)	317738	0	0	0	1
TDNFA_DML	of which: dummy for 2nd quartile (medium-low risk)	317738	0	0	0	1
TDNFA_DMH	of which: dummy for 3rd quartile (medium-high risk)	317738	0	0	0	1
TDNFA_DH	of which: dummy for 4th quartile (high risk)	317738	0	0	0	1
TPNW	Household total property-apportioned Debt as share of household net worth, quartiles	317738	2	1	1	4
TPNW_DL	of which: dummy for 1st quartile (low risk)	317738	1	0	0	1
TPNW_DML	of which: dummy for 2nd quartile (medium-low risk)	317738	0	0	0	0
TPNW_DMH	of which: dummy for 3rd quartile (medium-high risk)	317738	0	0	0	1
TPNW_DH	of which: dummy for 4th quartile (high risk)	317738	0	0	0	1
TPNFA	Household total property-apportioned debt as share of household non-financial assets, quartiles	317738	2	1	1	4
TPNFA_DL	of which: dummy for 1st quartile (low risk)	317738	1	0	0	1
TPNFA_DML	of which: dummy for 2nd quartile (medium-low risk)	317738	0	0	0	0
TPNFA_DMH	of which: dummy for 3rd quartile (medium-high risk)	317738	0	0	0	1
TPNFA_DH	of which: dummy for 4th quartile (high risk)	317738	0	0	0	1
HNW	Household home-apportioned debt as share of household net worth, quartiles	317738	2	1	1	4
HNW_DL	of which: dummy for 1st quartile (low risk)	317738	1	0	0	1
HNW_DML	of which: dummy for 2nd quartile (medium-low risk)	317738	0	0	0	0
HNW_DMH	of which: dummy for 3rd quartile (medium-high risk)	317738	0	0	0	1
HNW_DH	of which: dummy for 4th quartile (high risk)	317738	0	0	0	1
HNFA	Household home-apportioned debt as share of household non-financial assets, quartiles	317738	2	1	1	4
HNFA_DL	of which: dummy for 1st quartile (low risk)	317738	1	0	0	1
HNFA_DML	of which: dummy for 2nd quartile (medium-low risk)	317738	0	0	0	0
HNFA_DMH	of which: dummy for 3rd quartile (medium-high risk)	317738	0	0	0	1
HNFA_DH	of which: dummy for 4th quartile (high risk)	317738	0	0	0	1

Appendix Table 1. Data and Descriptive Statistics (Concluded)

Table 1: Variables used for our Analysis

Variable	Label	Obs	Mean	Std. Dev.	Min	Max
trend	Defined as Year minus 2000	317738	8	5	0	15
ptrend	Polynomial trend	317738	1114	1164	0	3615
CPI	Consumer price index (2011Q3-2012Q2=100, Haver)	317738	93	11	75	109
InflEOP	Inflation, end-of-period	317738	3	1	1	4
InflPA	Inflation, period average	317738	3	1	1	4
HPI	House price index, existing homes (2011Q3-2012Q2=100, Haver)	317738	93	25	47	137
GDP	Nominal GDP (Haver)	317738	1264780	326229	727494	1700118
GDPRGDPcap	Real GDP per capita (Haver)	317738	1397723	184839	1082574	1678018
GDPGrw	Real GDP growth (Haver)	317738	57043	10972	37526	69726
MortR	Standard variable mortgage rate, owner-occupier (end of period, %, Haver)	317738	3	1	2	4
GGBalGDP	General government fiscal balance (%GDP, The Treasury)	317738	-2	2	-5	2
OISEOP	Overnight indexed swap rates, 3-months, end of period (Haver)	317738	7	1	5	9
OISPA	Overnight indexed swap rates, 3-months, period average (Haver)	317738	4	2	2	7
BBREOP	Bank accepted bill rates, 3-month (end of period, %, Haver)	317738	4	1	2	7
BBRPA	Bank accepted bill rates, 3-month (period average, %, Haver)	317738	4	1	2	7
MPShock	Monetary policy shocks 1/	317738	4	1	2	7
ConsTDIa	Consumption expenditure as share of total disposable income (including alcohol)	244272	1	-5	250	924
ConsTDI	Consumption expenditure as share of total disposable income (excluding alcohol)	244272	0	-4	235	873
ExpDurTDI	Household expenditure on durable goods as share of total disposable income	87243	0	2	-20	457
OurightOwner	Outright owner (1=outright owner, 0=otherwise)	317738	0	0	0	1
Mortgagor	Mortgagor (1=has mortgage, 0=otherwise)	317738	0	0	0	1
Renter	Renter (1=has rent, 0=otherwise)	317738	0	0	0	1
US3mTB	US 3-month T-bill rate	317738	1	2	0	5
US1yTB	US 1-year T-bill rate	317738	1	2	0	5
WorldGr	World growth (World Economic Outlook database)	317738	3	-1	2	4
LowIndebt1-6	Low indebtedness (1 if TDNW (TDTA, TDNFA, TPNW, TPNFA, HNW, HNFA)=1, 0 otherwise)	317738	0	0	0	1
Change1-6	HH moving from low to high indebtedness (1 if TDNW (TDTA, TDNFA, TPNW, TPNFA, HNW, HNFA) becomes 4 from 1 within waves)	317738	0	0	0	1
HIndNWorth	Household indebtedness (HH total debt over HH net worth)	317738	1	-28	633	7200
IncQuintile	HH Gross total income, quintiles	317738	3	1	1	5
AssQuintile	HH Gross total assets, quintiles	76713	3	1	1	5
IncQuart	HH Disposable Income, quintiles	317738	3	1	1	5
EDispTIncome	Enumarated person total disposable income	317738	28912	41458	-2010000	886310
HeadHH	Age of head of household	317738	45	15	3	101

Source: HILDA unless otherwise noted.
1/ “Anticipatory Monetary Policy and the Price Puzzle”, James Bishop and Peter Tulip (2017).

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