

Rich debt, poor debt: assessing household indebtedness and debt repayment capacity¹

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Abstract

In this study, we explore the relationship between the debt service ratio (DSR) and individual borrowers' ability to withstand shocks in Malaysia. Using a micro-level dataset that matches borrowers' debt and income, we quantify the financial resilience of individual borrowers and subsequently simulate a model of loan default and credit losses in response to generated financial and economic shocks on debt repayment, cost of living and variable income. The simulation allows us to differentiate the sensitivity of borrowers in different income segments to each shock and estimate the banking system's exposures to borrowers who are more likely to default. The observations and findings could contribute towards the formulation of more targeted policies to manage household indebtedness in Malaysia. The results show that, in the pre-shock scenario, borrowers across all income groups are more likely to have a negative financial margin if their DSR is above 60%. However, for borrowers in the bottom 40th percentile income group, some borrowers with a DSR of less than 60% also recorded a negative financial margin. In the post-shock scenario, borrowers across all income groups are more likely to have a negative financial margin if their DSR is above 40%. On aggregate, borrowers are most sensitive to an income shock, particularly those in the middle income group.

Keywords: household debt, household balance sheet, stress test, debt service ratio

JEL classification: E20, E21, E58, G28

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1. Introduction

In the aftermath of the global financial crisis, the high level of household debt in several advanced economies has been blamed for the slow economic recovery. Countries with the fastest increase in household debt prior to the crisis experienced the sharpest drop in real private consumption during the recent crisis (Glick and Lansing (2010)). Mian and Sufi (2010) found that US counties with the largest increase in the debt-to-income ratio in 2002–06 displayed the largest decline in private consumption following the crisis. One potential explanation is that highly leveraged households prior to the crisis were compelled to reduce their spending due to tighter borrowing conditions. Another possible reason is that some households cut their expenditures as a precaution in anticipation of weaker income and employment outlook.

Household debt in Malaysia has expanded annually by 10.7% since 2009 to account for 88.7% of GDP as of 2016Q3. Several structural and demographic factors have contributed to the increase in household debt. First, the working age population of Malaysia (ie those aged between 15 and 64 years old) increased from 67.7% in 2009 to 69.1% in 2014. Second, the median household income grew annually by 11.7% between 2009 and 2014. Third, there was greater access to financing schemes and favourable lending conditions (low interest rates and longer loan tenures). The share of households with at least one loan facility has increased to 65% in 2014 from 55% in 2009.

The household debt-to-GDP ratio has been commonly used to measure the level of household indebtedness. However, a high household debt-to-GDP ratio may not necessarily imply that households are over-indebted or in financial distress (Bilston et al (2015)). The composition of household debt is an important consideration as some debt is taken on for the purpose of accumulating wealth, which, over time, can add to the financial buffer which can be tapped when required (Bank Negara Malaysia (2015c)). While the number of delinquent and impaired loans in Malaysia has remained low relative to total credit extended to the household sector, the attendant credit risk and its implications for financial stability should not be underestimated. Taking this into account, this paper explores the nexus between debt servicing capacity across the income spectrum and how individual borrowers respond to potential economic and financial shocks. To this end, the paper uses borrowers' income and debt data obtained from a Bank Negara Malaysia internal database to calculate the borrowers' financial margin.

We then apply various simulated economic and financial shocks to the financial margin of these individuals to identify the potential deterioration in their debt repayment capacity. We apply the sensitivity analysis model adopted by Bilston et al (2015) and Albacete and Fessler (2010). The results show that, in the pre-shock scenario, borrowers across all income groups are more likely to have a negative financial margin if their debt service ratio (DSR) is above 60%.

This paper is organised as follows. Section 2 describes the distribution of household debt in Malaysia. Sections 3 and 4 introduce the model and results, respectively. Section 5 discusses the limitations of the model. The final section concludes the paper with a discussion on policy design implications.

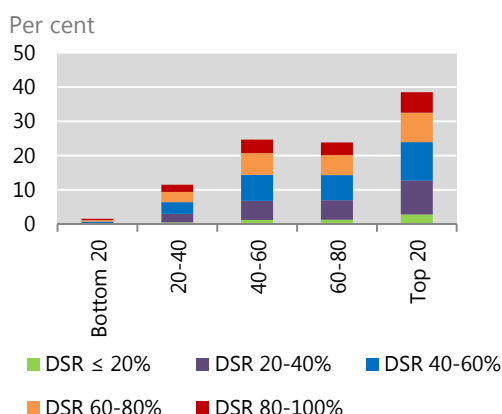
2. Stylised facts

In Malaysia, about 38% of household debt is owed by those in the top 20% of the income distribution (Graphs 1 and 2). The median DSR for this income segment is relatively low at 30% (Graph 3). The Appendix provides the formula for computing the DSR. While the debt held by borrowers in the bottom 20% and 20%~40% of the income distribution accounted for only 13.2% of total household debt, the median DSR for each income segment is higher at 37% and 34%, respectively. The average size of debt peaked at RM 283,000 for those in the top 20% of the distribution (Graph 4), largely supported by higher income and debt servicing capacity.

The higher income segment has a larger share of debt for wealth accumulation purposes such as the purchase of residential properties and securities (Graph 5). In contrast, lower income borrowers have most of their loans for consumption purposes (eg purchase of motor vehicles and personal use). About 52% of debt in value terms owed by those in the bottom 40% of the income distribution is based on a variable rate, compared with 72% of debt owed by those in the top 20% (Graph 6).

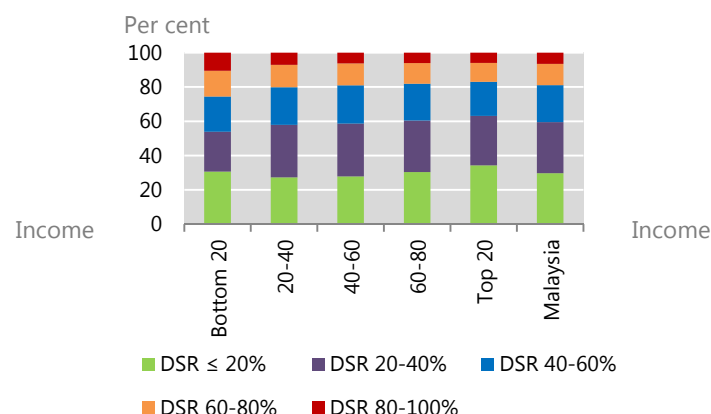
Distribution of debt, by income and DSR

Graph 1



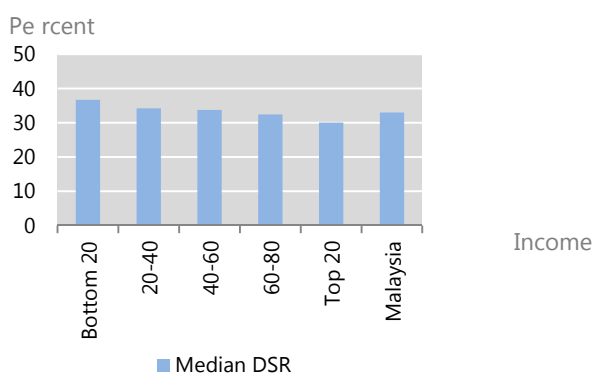
Proportion of DSR for borrowers within each income group

Graph 2



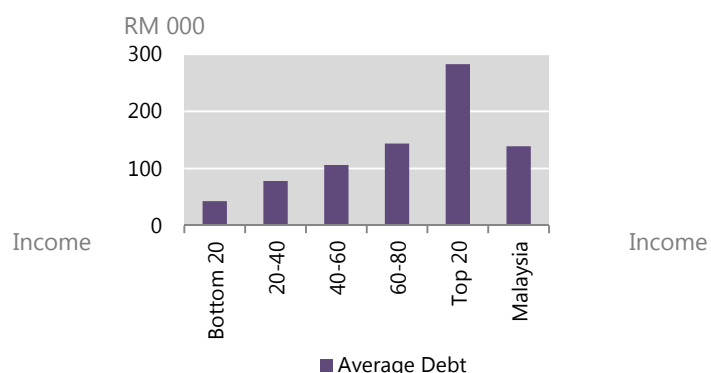
Median DSR

Graph 3

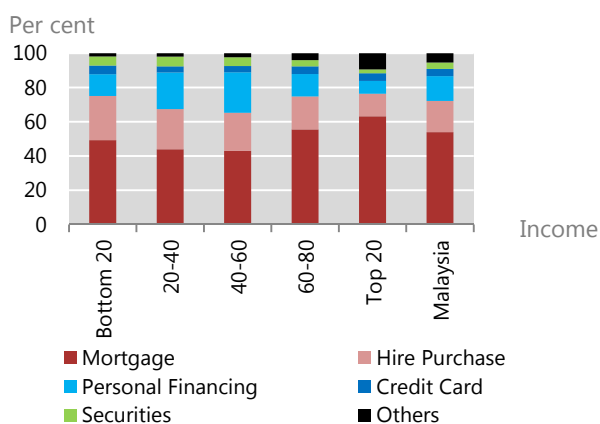


Average debt per borrower

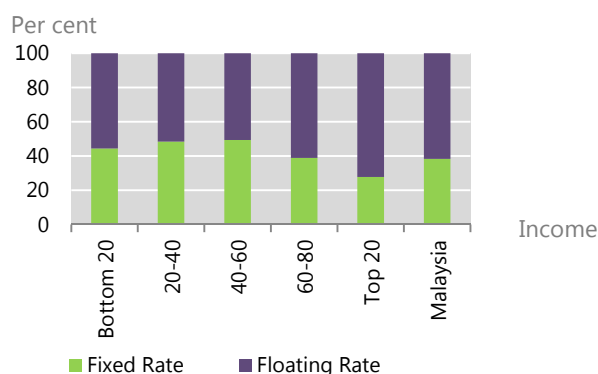
Graph 4



Proportion of loan facility for borrowers within each income group Graph 5



Proportion of pricing type for borrowers within each income group Graph 6



3. Methodology

3.1. Data

The main dataset employed in this paper is the Integrated Income Indebtedness Database (IIID) established by Bank Negara Malaysia using the latest available cross-sectional data on taxable income and credit in 2014. The sample used in this article has close to 2 million individual borrowers and captures approximately RM 200 billion or 20% of total household debt in Malaysia. This represents about 5% and 10% of Malaysian population and labour workforce, respectively. We also leveraged on the Household Expenditure Survey (HES) 2014 and Household Income and Basic Amenities Survey (HIBA) 2014 (Department of Statistics Malaysia, 2015a and 2015b) to estimate individuals' expenditure on basic necessities.³ To ensure consistency with other official publications, the clustering of income groups in this paper is based on the structure of HIBA 2014.

3.2. Model

This paper adopts the financial margin approach, similar to the methodology applied by Bilston et al (2015) and Albacete and Fessler (2010) to determine the level of financial distress among individuals. Table 1 depicts a schematic representation of the assessment framework.

³ Items in the basic necessities category include (i) food and non-alcoholic beverages; (ii) housing and water, electricity and gas and other fuels; (iii) transportation; (iv) education; and (v) healthcare (Bank Negara Malaysia (2015b)).

Model assessment framework

Table 1

Step	Parameters of interest	Interpretation			
1	Financial margin	Residual income, sufficient to make ends meet			
2	Probability of default	Default if financial margin falls below zero			
3	Debt-at-risk (DAR)	Share of net debt (those who defaulted) to total household debt that lenders cannot recover			
4	Scenarios	Compute steps 1–3 for each scenario <table border="1" style="margin-left: 20px;"> <tr> <td>Pre-shock</td> <td>Individual shocks</td> <td>Combined shocks</td> </tr> </table>	Pre-shock	Individual shocks	Combined shocks
Pre-shock	Individual shocks	Combined shocks			

Note: see the Appendix for detailed formulae.

The financial margin is the residual income (net of statutory obligations, debt repayment and expenditure on basic necessities) that is sufficient for an individual to make ends meet. An individual is assumed to be in default with certainty if the financial margin or residual income is less than zero. We assume that individuals do not use their assets, savings or any form of liquid assets to avoid default (Albacete and Fessler (2010)). Total income is derived from the IID. Each individual’s personal disposable income is computed by deducting the estimated income tax and mandatory contribution to the Employee Provident Fund (EPF). Using the granular credit information in the IID enables us to estimate the monthly debt obligation for every debt facility for each individual. Meanwhile, expenditure patterns for each income group were obtained from the HES 2014.

The debt-at-risk (DAR), which is essentially the expected loan losses to lenders, is the share of net debt from those who defaulted to total household debt. In our analysis, we assume that lenders are able to recoup only 50% of the collateral value for housing assets. Other loans are assumed to have a loss-given-default of 100%.

Individuals’ financial resilience is further assessed under different stress scenarios. This paper considers three different financial and macroeconomic shocks – higher cost of borrowing and cost of living,⁴ and lower income for borrowers. The impact on financial resilience is derived from the individual shocks as well as combined shocks (Table 2).

⁴ This paper assumes that the proportion of expenditure rises by an equal measure for all income levels and that substitution effects do not take place.

Selection of macroeconomic and financial shocks

Table 2

Shocks	Parameters	Magnitude	Rationale
Financial shock: borrowing cost	Higher credit/ funding costs, impact via monthly debt repayment	↑ 50bps	Based on increase in the average lending rate (ALR) following two consecutive increases in Overnight Policy Rate (OPR) in 2006 (funding cost)
		↑ 150bps	Based on the largest increase in ALR from 10.6% to 12.1% during the Asian Financial Crisis (credit cost)
Macroeconomic shock: cost of living	Increase in basic expenditures, impact via residual income	↑ 10%	Compounded annual growth rate (CAGR) for expenditures on basic necessities over 2009–14: 10.1% (Source: HIES 2014)
		↑ 20%	Doubling of the CAGR for expenditures on basic necessities
Macroeconomic shock: income	Decline in variable income, impact via total income	↓ 10%	On average over 2011–14, variable income accounted for 7% of total income – round up to 10% for simplicity (Source: Malaysian Employers Federation (MEF))
		↓ 20%	Based on the maximum level of variable income as a percentage of total income in 2014 (Source: MEF)

4. Results

4.1. Pre-shock scenario

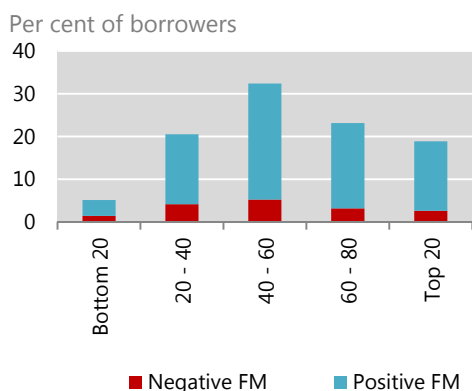
4.1.1. Pre-shock scenario: financial margin

In Malaysia, individuals with a negative financial margin are estimated at 16.6%⁵ of total borrowers in the dataset, comprising mainly those from below the 60th percentile income groups (Graph 7) or those with a high DSR of above 60% (Graph 8). The associated debt held by those with a negative financial margin accounted for 32.1% of total household debt, comprising mainly loans for the purchase of residential property. These were acquired mainly by the mid- to high-income earners (Graphs 9 and 10).

⁵ Similar to the findings of Albacete and Fessler (2010) that the percentage of households in financial distress in Austria is up to 15.6%.

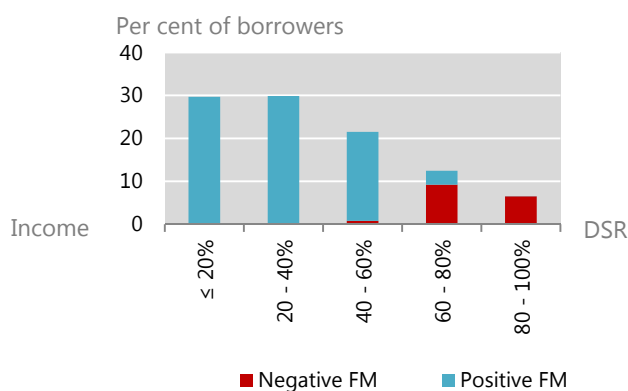
Distribution of financial margin by income

Graph 7



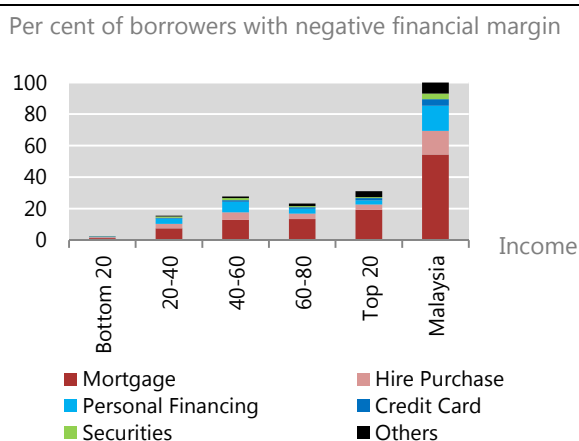
Distribution of financial margin by DSR

Graph 8



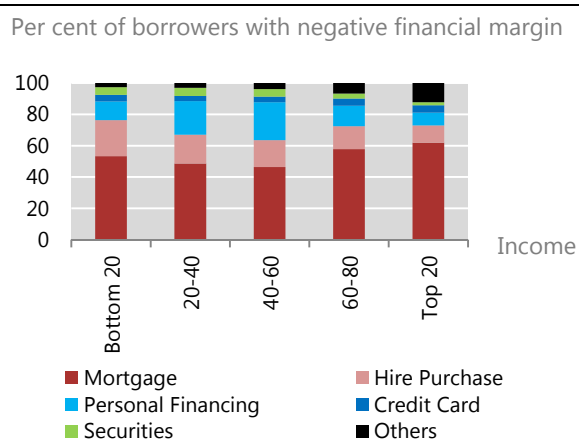
Distribution of loan facility for those with negative financial margin by income

Graph 9



Proportion of loan facility for borrowers with negative financial margin within each income group

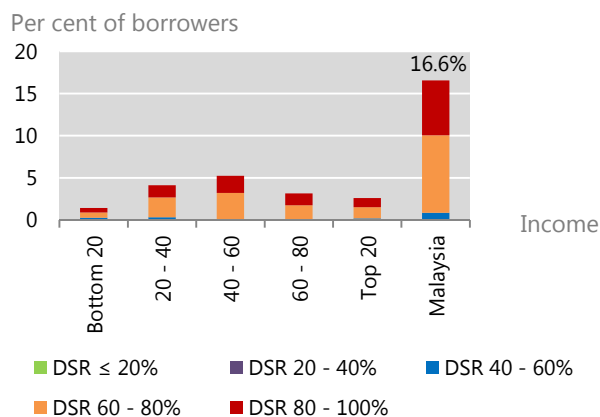
Graph 10



Generally, borrowers with a DSR of less than 60% do not exhibit a negative financial margin (Graph 11). However, for those in the bottom 40th percentile income group, some borrowers with a DSR of less than 60% also recorded a negative financial margin. These only accounted for 6.9% of the total number of individuals in the bottom 40th percentile income group (Graph 12).

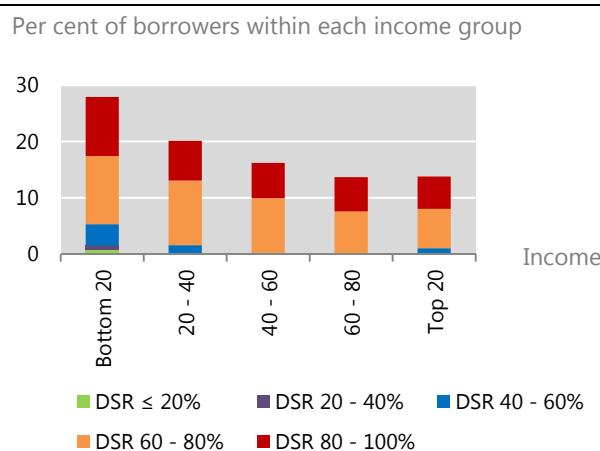
Distribution of DSR for borrowers with negative financial margin by income

Graph 11



Proportion of DSR for borrowers with negative financial margin within each income group

Graph 12

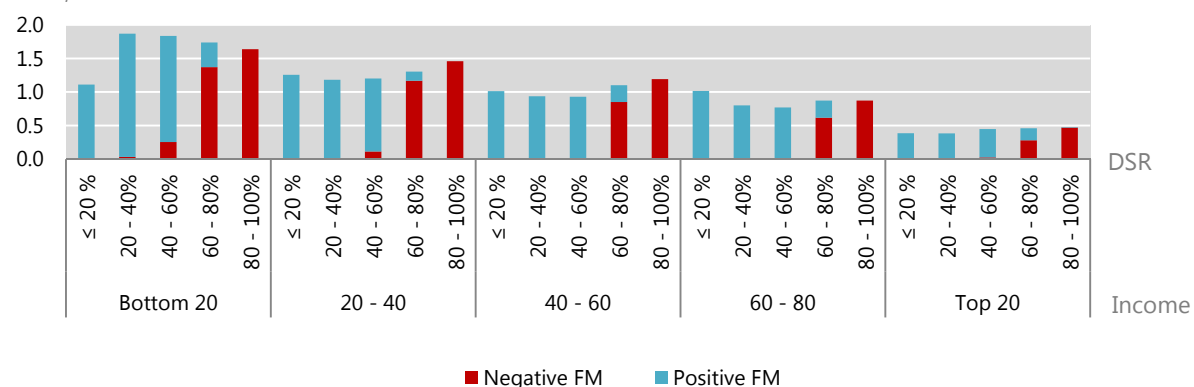


Delinquent⁶ and impaired loans⁷ in this sample accounted for 0.8% and 0.5% of outstanding loans, respectively. About 60% of the delinquent and impaired loans are contributed by those from the bottom 60th income percentile, half of which are from the bottom 40th income percentile. The higher impaired loan ratios for those with a DSR 40% and below across all income segments need to be interpreted with caution. One possible explanation is that borrowers whose loans have been restructured or rescheduled are classified as “impaired” in this dataset – their DSR typically declines to lower levels following the lower new obligated monthly repayments. Across all income groups, for individual borrowers with a negative financial margin, delinquent and impaired loan ratios are higher for those with a DSR of 60% and above (Graphs 13 and 14).

Delinquency ratio

Graph 13

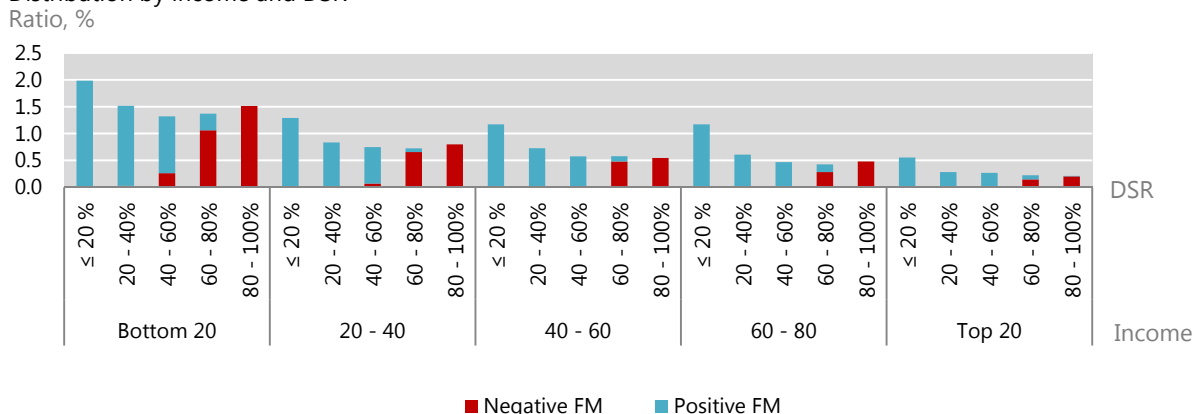
Distribution by income and DSR



⁶ Loans-in-arrears of between one and three months.

⁷ Loans-in-arrears of three months or more.

Distribution by income and DSR

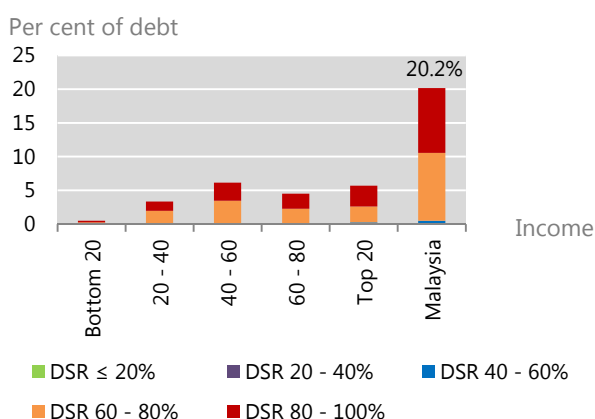


4.1.2. Pre-shock scenario: debt-at-risk (DAR)

The overall DAR of individuals with a negative financial margin in the pre-shock scenario is estimated at 20.2% of the total debt in the dataset, with a risky net debt of RM 43.2 billion. Individuals with a DSR of higher than 60% are the main contributors to this (Graph 15). When we break down by income percentile, the DAR is highest for the 40th~60th percentile income category, contributing about 30% to the overall DAR. This is attributed mainly to the higher proportion of non-collateralised debt, which is mainly loans for personal use and car purchase (Graph 10).

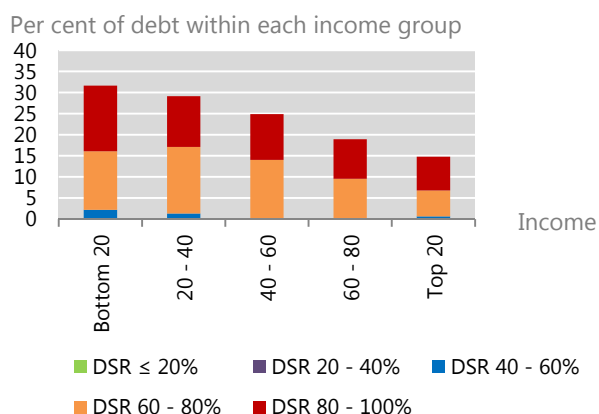
Distribution of debt-at-risk for borrowers with negative financial margin by income

Graph 15



Proportion of debt-at-risk for borrowers with negative financial margin within each income group

Graph 16



About half of the DAR is from the 60th income percentile and above. This simply reflects the higher size of debt owed by this group (Graph 1) and does not imply that the credit risk exposures to this group are riskier. Further analysis within each income group shows that borrowers will likely have a lower DAR as earnings increase (Graph 16). The DAR accounts for 18.9% and 14.8% of the DAR in the 60th~80th and

top 20th income percentiles, respectively, within the same income categories. In contrast, this is higher at 31.6% for borrowers in the lowest income percentile. All DARs are computed without taking into account other financial assets or savings that can be drawn upon, which could potentially result in a lower DAR.

4.2. Post-shock scenario

This subsection discusses the impact of simulated stress scenarios based on both financial and macroeconomic shocks as highlighted in the previous section. Our analysis suggests that, even after combining all shocks based on the worst-case scenarios, the banking system in Malaysia is able to withstand the associated potential losses. This is reflected in the stress test results as summarised in Table 3. The amount of risky net debt to the banks, after taking into account the collateral value for housing loans, is estimated at RM 77.5 billion, well within the total capital of the banking system in 2014.

Scenario simulation				Table 3		
Scenario	Financially distressed borrowers (PD=1; FM<0)					
	% of total number of borrowers	% of amount of debt	Debt-at-risk (%)	Risky net debt (RM billion)		
				Banking system	Non-banks	Total
Pre-shock	16.6	32.1	20.2	35.2	8.0	43.2
Post-shock: single						
Cost of borrowing shock (150 bps)	19.1	38.1	23.2	41.3	8.6	49.9
Cost of living shock (20%)	22.7	41.2	25.9	45.1	10.5	55.6
Income shock (20%)	34.7	57.7	36.4	63.2	14.8	78
Post-shock: combined (all of the above)	48.1	74.2	44.3	77.5	17.5	95.0

Source: Bank Negara Malaysia.

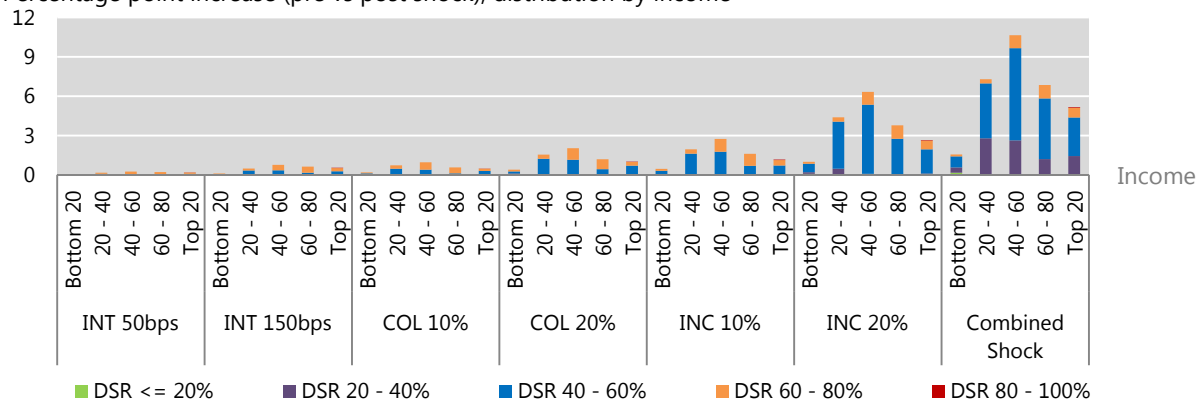
4.2.1. Post-shock scenario: cost-of-borrowing shock

The debt repayment capacity of borrowers is largely unaffected by the simulated 50 basis point hike in the lending rate (Graphs 17 and 18). Some signs of distress, however, are observed when the lending rate increases by 150 basis points. The impact is more evident amongst the mid- to high-income individuals. This is due mainly to the higher proportion of loans for the purchase of residential property based on variable interest rates acquired by these individuals (Graph 9), compared with the lower income group, where the loans are mainly based on fixed interest rates. Of significance, a 150 basis point hike in the lending rate raises the proportion of borrowers with DSR levels of 40%~60% and a DSR above 60% by 1.1 percentage points and 1.4 percentage points, respectively. On the other hand, DAR increases marginally by 1 percentage point (+RM1.2 billion) and 2.1 percentage points (+RM3.3 billion), respectively, as exposures are mainly for the purchase of properties.

Negative financial margin – individual and combined shocks

Graph 17

Percentage point increase (pre vs post shock), distribution by income

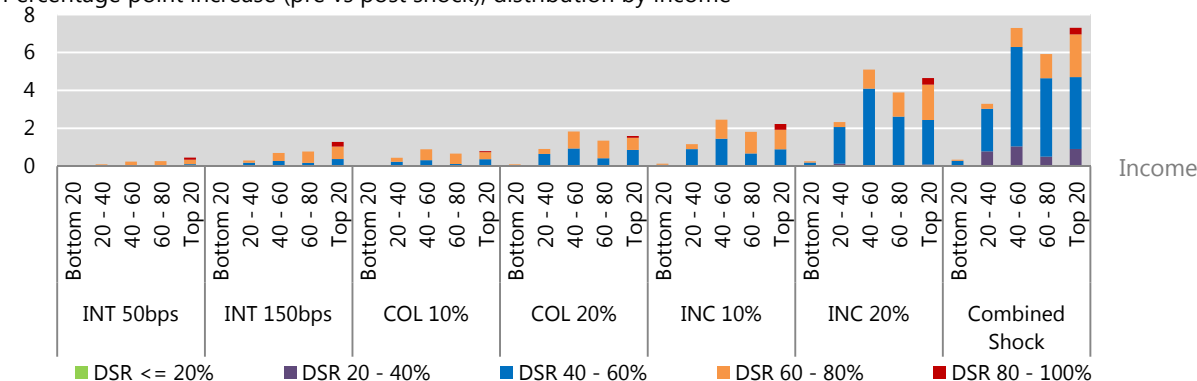


INT50bps, INT150bps: increase in interest rates by 50 bps and 150 bps respectively; COL10%, COL20%: increase in cost of living by 10% and 20% respectively; and INC10%, INC20%: decline in income by 10% and 20% respectively.

Debt-at-risk – individual and combined shocks

Graph 18

Percentage point increase (pre vs post shock), distribution by income



INT50bps, INT150bps: increase in interest rates by 50 bps and 150 bps respectively; COL10%, COL20%: increase in cost of living by 10% and 20% respectively; and INC10%, INC20%: decline in income by 10% and 20% respectively.

4.2.2. Post-shock scenario: cost-of-living shock

The impact of a higher cost of living on individual borrowers is slightly higher than the cost-of-borrowing shock. The overall share of borrowers with a negative financial margin and the DAR increases by 2.9 percentage points and 2.8 percentage points, respectively, when the cost of living goes up by 10% (Graphs 17 and 18). About two thirds of the increase in the number borrowers with a negative financial margin is mainly from those below the 60th income group percentile. The higher income earners only become more financially stretched when the cost of living increases by 20%. The increase in the number of individuals who now exhibit a negative financial margin is larger amongst those with DSR levels of 40%~80%, but the corresponding DAR is limited, even at the higher cost of living of 20%. Borrowers aged between 30 and 40 years old living in the city are found to be the most affected by the higher cost-of-living shocks.

4.2.3. Post-shock scenario: income shock

The impact from a decline in income is the most significant compared to other simulated shocks, particularly for those in the middle income group (Graph 17 and 18). On aggregate, a decline in income by 10% will increase the share of borrowers with a negative financial margin by 7.9 percentage points, while DAR rises by 7.8 percentage points to 28%. Even borrowers in the 20%~40% DSR bucket begin to exhibit a negative financial margin under the simulated shock, particularly for those in the bottom 40th income percentile category. Of significance, every borrower who has a DSR greater than 60% also exhibits a negative financial margin.

4.2.4. Post-shock scenario: combined shock

The combination of all three simulated shocks is obtained by taking the extreme magnitude of each shock. The share of borrowers with a negative financial margin increases by 31.5 percentage points across all income groups under the combined shock scenario (Graphs 17 and 18).

To recap, under the pre-shock scenario, we have established that individuals with a DSR of more than 60% are more susceptible to default. This is extended to those with a DSR of 40%~60% under the individual macroeconomic and financial shocks. Under the combined shock scenario, individuals who exhibit a negative financial margin extend to those with a lower DSR of 20%~40%.

5. Model limitations and future work

We acknowledge that the methodology applied in this paper has some limitations that require further calibration in order to support policy analysis and formulation. We intentionally used a relatively simple model and assumptions, given that this is the first attempt to use the IID. As data quality and mining methods improve in the future, we will be able to explore more sophisticated models with less broad-based assumptions.

The probability of default computed in this model is likely to be overestimated as savings and/or liquid financial assets are not recognised as buffers against shocks. DAR could also be overestimated, given the high haircut of 50% for residential properties in this model. Also, the model does not take into account any effects of possible policy intervention by the Government and Bank Negara Malaysia to manage the potential impact on the economy and financial system. The predictive ability to capture household financial stress using micro-level datasets is also relatively untested. Nevertheless, the model does provide a useful starting point for developing a holistic stress-testing framework to assess financial system exposures to individuals in distress.

The data used in this paper are a cross-section of taxpayers' income and credit in 2014. The model assumes that individuals 'jump to default' in a single period. Including multiple periods and other dynamics could potentially affect the overall results. Basing macroprudential analysis and decision on the data could be a challenge given the time lag. On one hand, while the structure and composition of debt and income is stable over the past years (BNM, 2015a; and BNM, 2015c), the significant change in the cost of living (BNM, 2015a) might have altered the overall

results. On the other hand, the higher house prices from 2014 to 2016 may reflect higher wealth that acts as buffers against potential shocks.

For future work, we plan to explore panel data regression to uncover a deeper understanding of the causal relationship between the DSR and delinquent/impaired loans over time. Alternatively, we can also explore other more refined methods to calculate financial margin, eg defining financially stressed individuals as those with excess expenditure over income of 20% and the DSR above 50% and 75% (Fuenzalida and Ruiz-Tagle (2009)).

6. Policy implication

The area of study covered in this paper could provide support for policy design and implementation to manage and mitigate risks arising from financial institutions' exposures to the household sector. For example, the relationship between the DSR and impaired household loans may provide guidance to both banks and regulators on indicative levels of the prudent threshold of the DSR for different income groups. This could contribute towards banks' credit underwriting, risk management and loan loss provisioning practices. It could also contribute towards a more granular application of such a technique to different borrowers with different DSRs across different age groups, geographical location and type of financing facility.

For regulators, the area of study can better support the design and implementation of targeted macroprudential and microprudential policies to address specific sources of vulnerabilities. Through the application of proportionality of regulations, this can reduce potential unintended consequences of broad policies, such as reduced access to financing by eligible borrowers. In addition, the area of study could better inform the design and calibration of stress test scenarios and parameters in assessing the shock absorption capacity of households, banks and the financial system.

7. Conclusion

In this paper, we used a new granular income and debt dataset (IIID) to study individual borrowers' debt repayment capacity. To do so, we calculated the financial margin of these borrowers and subjected them to various macroeconomic and financial shocks, including a higher cost of borrowing, an increase in the cost of living and a decline in income. We also estimated financial institutions' exposure to individuals who are more likely to be financially distressed and have a higher chance of default. The results from our empirical analysis suggest the following:

- Financial margins and the DSR are indicators that can provide greater insight into the assessment of financial distress and debt repayment capacity of households across different income groups.
- The results show that, in the pre-shock scenario, borrowers across all income groups are more likely to have a negative financial margin – and, hence, have a greater likelihood of default – if their DSR is above 60%.

- For borrowers in the bottom 40th percentile income group, a similar trend is observed if their DSR is above 40%.
- In the post-shock scenario, borrowers across all income groups are more likely to have a negative financial margin if their DSR is above 40%.
- On aggregate, borrowers are most sensitive to an income shock, particularly those in the middle income group.
- Our analysis suggests that, even after combining all shocks based on the worst-case scenarios, the banking system in Malaysia is able to withstand the associated potential losses.

Appendix

Formula

Debt service ratio (DSR)

$$DSR = \frac{\text{Monthly loan obligations}}{\text{Personal Disposable Income}}$$

where
 Personal Disposable Income =
 Gross monthly income net of
 statutory deductions (such as the
 contribution to the Employee
 Provident Funds and income tax)

Financial margins and probability of default

$$FM_i = Y_i - DO_i - E_i$$

Where
 FM = financial margins
 Y = personal disposable income
 DO = monthly debt obligation
 E = expenditure on basic
 necessities
 PD = probability of default
 i = subscript for individuals

$PD_i = 0$ if $FM_i \geq 0$;
 $PD_i = 1$ if $FM_i < 0$

Loss-given-default and debt-at-risk

$$LGD = \frac{\sum_i^N PD_i M_i}{\sum_i^N PD_i D_i} \times 100$$

$$DAR = \frac{\sum_i^N PD_i M_i}{\sum_i^N D_i} \times 100$$

where
 LGD = loss-given-default
 PD = probability of default
 A = RM value of individual's
 eligible collateral
 M = max ($D_i - A_i$, 0): net loss in
 RM value as a result of an
 individual defaulting upon
 recovering the collateral
 D = total debt for each individual
 DAR = Debt-at-Risk
 N = total number of individuals
 i = subscript for individuals

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