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The Relationship Between Household Credit and Banking Stability in Malaysia: Panel Evidence

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Abstract: This study investigates the relationship between household credit and banking stability in Malaysia using a sample of 37 commercial banks spanning the period from 2008 to 2015. In analyzing household credit's influence on the Malaysian banking sector's stability, household credit was categorized into two components, namely mortgage and consumer credit. The Banking Stability Index (BSI) for each bank is constructed using 15 bank-specific variables and some macro-economic variables. The determinants of the BSI are estimated using a static panel data technique. The fixed-effects regression results showed a statistically significant negative relationship between both forms of household credit (mortgage credit and consumer credit) upon the banking sector's stability. The finding signals that understanding the link between household credit and the Bank Stability Index is crucial to the policymakers and the banks' management in closely monitoring household credit, particularly mortgage and consumer credit.

Keywords: household credit; household debt to GDP; mortgage credit; consumer credit; banking stability; index.

JEL Classification: G2, G5

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Introduction

Household credit has gained increasing importance in both developed and developing countries. In 2007, more than 40% of total bank lending in many countries went to household credit (Beck, Büyükkarabacak & Valey 2012). This is particularly true for Malaysia, where household credit comprised 55% of total bank lending in 2015 (BNM 2015). Household credit has attracted many countries' attention and has emerged as an essential research topic (Rinaldi & Sanchis-Arellano 2006; Abid & Zouari-ghorbel 2012; Debelle 2004; Charpe & Flaschel 2013). Increased household lending has helped improve the housing market (Debelle 2004) and stimulated consumption (Kim et al., 2014). In these respects, it has contributed to enhancing the macro-economic situation regarding business activity and employment trends. However, a certain level of household credit may start to affect the overall macro-economic outcomes. This was confirmed by Sassi and Gasmi (2014), who empirically assessed the effects of business credit and household credit on economic growth, finding that business credit boosts economic growth while household credit dampens economic growth. In a similar study, Beck et al., (2012) found that business lending enhances economic growth and reduces income inequality, while household lending has no statistically significant economic growth effect.

Rapid growth in household credit affects not only economic growth but also banking stability. This is illustrated by the fact that the substantial increase in household credit, such as the Korean credit card crisis of 2003 (Kang & Ma 2009), the US subprime mortgage crisis of 2007 to 2009 (Sengupta 2014), and the European sovereign debt crisis in 2010 have significantly had a bigger impact on the banking industry, which led to spillover effects on the entire economy and the financial intermediaries (Angelopoulou, Balfoussia & Gibson 2014; Agnello & Sousa 2012). Household credit represents a large proportion of a bank's balance sheet, and any changes will increase the risks to a bank's assets. A study by Foos et al., (2010) found that credit expansion reduced banks' capital and profitability. Additionally, when borrowers default on repayments, the bank must make unexpected payments, affecting bank liquidity (Charpe & Flaschel 2013). Another concern is the exposure of banking institutions to the household sector during times of financial stress. The household sector is susceptible to inflation, unemployment, and changes in income and interest rates (Nakornthab 2010), leading to increases in the fragility of the banking sector (Charpe & Flaschel 2013).

Empirical findings by Cecchetti, Mohanty, and Zampolli (2011) suggest that the threshold for household debt to GDP should be no more than 85%. However, at 88.4%, Malaysia has surpassed this recommended threshold, potentially leading to damaging effects (Cecchetti et al., 2011). This raises concerns about the potential implications for increased household credit on the stability of the banking sector. Further, in comparison with other countries such as Indonesia (16.8%), the Philippines (35%), China (39.5%), Hong Kong (67.1%), Singapore (72%), Taiwan (83%), Thailand (84%) and South Korea (88.4%), household debt to GDP in Malaysia is among the highest in Asia (World Bank 2015). Moreover, research concerning household credit and banking stability is still limited (Freitakas & Mendelsonas 2015), particularly for developing countries such as Malaysia (Mokhtar & Ismail 2013).

The current study focuses on banking stability for two reasons. First, the banking sector represents the largest financial system component, accounting for approximately 67% of its total assets (BNM 2016). Therefore, any risks incurred in the banking sector will affect the entire financial system (Crockett et al., 1996; Cevik, Dibooglu & Kenc 2016). Moreover, it is the only finance source in developing countries (Nisar et al., 2015).

Second, this study was motivated by earlier studies focusing on total credit growth, including credit in the household and business sectors (Amador et al., 2013; Foos et al., 2010; Igan & Pinheiro 2011; Baradwaj et al., 2015; Kashif, Iftikhar & Iftikhar 2016; Koong et al., 2017). However, this study focused solely on the ratio of household credit to total loans because, Büyükkarabacak, Neven T. Valev (2010) and Demirgüc-Kunt and Detragiache (1998) put forward an argument that a high level of household credit has been an essential predictor of banking instability. Meanwhile, Kaminsky and Reinhart (1999), have shown that rapid credit growth is the leading indicator of banking instability in a 12-month horizon. Indeed, a report from the International Monetary Fund (IMF) (2004) indicated that about 75% of credit growth in emerging markets end in banking fragility. Furthermore, in contrast with other Southeast Asian Central Bank member countries, Malaysia exceeded the 50% household credit threshold (Nakornthab 2010). Business loans were excluded in this study to provide in-depth analysis since the composition of banks' portfolios has changed substantially over time, with household credit currently exceeding the business credit volume (BNM 2016). Moreover, household credit is increasing faster than GDP growth (e.g., nominal GDP at 7.5%, household credit at 11% (BNM 2015), and household loans represent the largest portion of banking institutions debt, rather than business loans.

This study's main objective was to provide empirical evidence of household credit's influence on banking stability. In achieving this objective, this study proposed an indexing system to measure banking stability to explain the relationship between household credit and the Malaysian banking sector.

Previous studies have applied many different approaches to gauge the level of stability in banking sectors. Among them are stress testing (Borio, Drehmann & Tsatsaronis 2014; Jakubík & Heřmánek 2008), z-score (Cihák & Hesse 2007, 2010; Uhde & Heimeshoff 2009), and Capital adequancy, Assets, Management capability, Earnings and Liquidity or CAMEL (Baral 2005; Kumar, Harsha, Anand & Dhruva 2012; Roman & Şargu 2013). Each of these approaches has its advantages and disadvantages in providing accurate information regarding banking stability. Albulescu (2010) and Jakubík (2013) argue that the current measurements are not able to predict the possibility of banking instability in the future because they only use internal factors (the financial ratio), which is not enough to predict future banking instabilities.

Borio, Drehmann, and Tsatsaronis (2014) mentioned that, given the current technology and the rapid changes in innovation and financial deregulation, stress tests are not reliable as an early warning signal. In other words, the stress test approach is insufficient, as a supervisory tool, for identifying vulnerabilities during tranquil periods. Further, the limitations of the stress test approach include (i) it does not permit comparisons of the level of stability during different periods and (ii) it is harder to make comparisons amongst individual banking institutions (Albulescu

2010). An alternative, the z-score, also has several drawbacks. For instance, it may provide a positive assessment of the banking institutions' stability due to the manipulation of the reported data by the management (Cihák 2007). Kabir, Worthington, and Gupta (2015) highlighted the limitations of using accounting information alone as it might not be informative for assessing banking systems as the management can manipulate it to increase the value of their bank's assets. The z-score applied to an individual banking institution does not consider the correlation of institutions in the system, potentially overlooking the risk that a default in one banking institution may cause losses to other banking institutions in the system (Cihák & Schaeck 2010). Dang's (2011) study mentioned the drawbacks of adopting the CAMELS rating, such as the role of allowances and provision for the loan-loss ratio had been overlooked. Provision for loan losses and allowances are essential to mitigate banks against potential risks (Elnahass et al., 2014) therefore, these factors need to be considered when evaluating banking performance. Besides, it is an internal instrument for analyzing the bank's overall condition based on financial, operational, and managerial characteristics (Sarker 2005). Different types of banks may have a distinct focus on the ratios, depending on the portfolio characteristics of the individual banks (Cihák & Schaeck 2010).

Based on these arguments, this study proposed the construction of a Banking Stability Index (BSI) as an alternative approach to banking stability and to improve the existing model, but not as a replacement for the existing approaches, which will provide officials with a better measurement to see into the future and predicate future vulnerabilities in banking systems. This will allow them to devise a solution for an upcoming crisis, allowing them to have a better and more stable banking system. BSI is needed for several purposes. For instance, BSI is a summary of many financial variables (Koop & Korobilis 2014). BSI offers to make comparisons between different periods, with different categories of banking systems (Albulescu 2010). Besides, BSI can capture the level of stability in the banking system (Morris 2011). The index approach was based on recommendations from the literature (IMF 2006; Chaibi & Ftiti 2015; Castro 2013; Nkusu 2011; Ali & Daly 2010) that have explored indicators from the financial and economic perspectives.

While previous studies (Kashif et al., 2016; Baradwaj et al., 2015; Foos et al., 2010; Amador et al., 2013) have focused on the effect of total credit growth (including both business and household loans), this study contributes to the existing finance literature by providing evidence about the effects of household credit only, rather than considering business credit as well, on banking stability in developing countries such as Malaysia. Given that it is the largest credit source for the household sector, the banking sector must continually monitor the potential risk (Endut & Hua 2009; Abdul Ghani 2010).

This study's further contribution is the empirical examination of household credit's effect on banking stability using a total household credit to total loan indicator. The influence of household credit on banking stability using a Banking Stability Index (BSI) has not been previously explored in the literature. Previous studies have examined other variables—for example, Nakornthab (2010) investigated problem loans by calculating nonperforming loans (NPLs) and loan losses to total loans, while others have used household debt to GDP as a proxy of

household credit (Sassi & Gasmi 2014; Berisha & Meszaros 2017; Büyükkarabacak & Valev 2010). The present study also offers a deeper understanding of the relationship between two different credit categories—mortgage and consumer credit—rather than focusing on overall household credit. In particular, differences in the credit categories' sensitivities may affect each type of credit differently. According to Morgan and Zhang (2017), mortgage credit has a lower risk than consumer credit. The property acts as collateral to secure the loan, indicating the banks have a lower cost in terms of capital. Besides, different estimations allow the identification of which household credit components, either mortgage credit or consumer credit, are driving the negative relationship between credit and banking stability. Therefore, this study distinguished between household credit, mortgage credit, and consumer credit and examined each of these variables separately.

Literature Review

Several studies have shown that indebtedness is a leading indicator for possible increases in the banking system's instability (Kaminsky & Reinhart 1999; Kraft & Jankov 2005; Hume & Sentence 2009; Büyükkarabacak & Valev 2010). Freitakas and Mendelsonas (2015) found that excessive credit growth weakens the balance sheet and increases the financial system's susceptibility to economic fluctuations. This can disrupt the financial intermediation role of financial institutions, increasing the financial system's risk and eventually causing a financial crisis.

Early empirical studies have shown that increased lending activity is accompanied by an increase in NPLs and loan losses and a reduction in bank profitability and capitalization, ultimately affecting banking stability (Sinkey & Greenawalt 1991; Clair 1992; Demirguc-Kunt & Detragiache 1998; Kaminsky & Reinhart 1999; Salas & Saurina 2002; Nkusu 2011; Louzis et al., 2012). Such problems have been seen in some credit card markets' boom bust cycles, the rapid house price increases in several economies, and the ongoing global financial turmoil. The International Monetary Fund (2011) has also highlighted that in countries with high household credit, housing busts and subsequent recessions have resulted in severe and protracted contractions in consumption and general economic activities, compared to countries with low household credit.

Sinkey and Greenawalt (1991) found a positive relationship between past credit growth and loan loss rates in US banks from 1984 to 1987. Similarly, using data on individual banks in Texas from 1976 to 1990, Clair (1992) examined the effect of credit growth on NPLs and loan charge-off rates in the first year after a bank's credit expansion, finding a somewhat positive relationship in subsequent years. Salas and Saurina (2002) explored the determinants of NPLs in Spanish commercial and savings banks from 1985 to 1997, confirming that credit growth in Spanish savings banks was significantly associated with loan losses 3 to 4 years later. Leaven and Majnoni (2003) reported similar results using Bankscope data for 45 countries, finding a negative and significant contemporaneous relation between credit growth and loan losses. Other studies (Keeton 1999; Caprio & Klingebiel 2003; Cottarelli et al., 2005; Kraft & Jankov 2005) have reported that continuous credit growth is one of the main factors associated with problem loans, which may lead to future NPLs.

Kashif et al., (2016) analyzed panel data from 324 banks in Pakistan for the period

from 2006 to 2014. The findings support those of previous empirical studies, suggesting that abnormal credit growth during lending booms increases the ratio of NPLs to gross advances, and that rapid growth in bad loans diminishes the capital ratio, indicating a decrease in bank solvency. In a similar study, Baradwaj et al., (2015) examined the effect of a growth in lending on Chinese banks' risk from 1992 to 2007. They found that promoting credit growth significantly impacted banking stability, returns, and capital adequacy. Growth in lending leads to increases in loan loss provisions, interest income, and lower capital ratios. Amador et al., (2013) revealed that abnormal credit growth for a prolonged period increased the risk to banks, accompanied by a reduction in their solvency and an increase in the ratio of NPLs to total loans. Foos et al., (2010) presented similar findings from a sample of 16 developed countries from 1997 to 2007, showing that credit growth was negatively associated with bank solvency because banks may not increase their capital proportionally. The difference between the studies by Foos et al., (2010) and Amador et al., (2013) is that the former used time-series data, while the latter used panel data. Besides, Amador analyzed the effects of abnormal loan growth on financial performance during times of financial distress. Igan and Pinheiro (2011) used a bank-level dataset from banks in 90 countries from 1995 to 2005. They found a negative relationship between credit and bank soundness during the boom period. Contradicting the above studies, Fenech, Yap, and Shafik (2014) argued that the association between credit growth and the banking system was positive and found no evidence to suggest that credit weakens the banking system's soundness.

To increase their lending volume, individual banks may relax their credit standards for lower-income borrowers (Kraft & Jankov 2005). Büyükkarabacak and Valev (2010) argued that rapid credit growth increases credit quality's deterioration probability, making it risky for banks when borrowers have difficulties repaying their debts.

Such a reduction in credit standards increases the chance of loan defaults and causes a credit bubble. When a bank's lending rises over a long period, a proportion of new loans are extended to borrowers without credit histories or who would have been rejected under normal circumstances. This may be attributable to inadequate screening to verify the ability of the borrowers to make repayments. Eventually, banks experience a deterioration of their loan portfolios, which may lead to a banking crisis or collapse.

The association between credit and banking stability is unclear, especially when it involves the household sector. When analyzing the relationship between credit and banking stability, previous studies (Kashif et al., 2016; Amador 2013; Foos et al., 2010) have measured indebtedness by including lending to households and businesses. To date, empirical investigations regarding household credit are limited, perhaps because of insufficient available data (Endut & Hua 2009; Hull 2003). Freitakas and Mendelsonas (2015) reviewed the relationship between household credit and financial institutions, concluding that a relationship between household credit and financial stability clearly exists but it has not been sufficiently researched. Abdul Ghani (2010) and Endut and Hua (2009) have explained the influence of household credit on banking stability through comparative illustrations and trends; however, their findings were not rooted in an empirical analysis.

Given that the volume of credit has shifted from businesses to households, leading to a rapid increase in the household debt ratio to GDP, it is essential to focus on household credit rather than including business credit.

Based on the argument above, this study investigated the effects of household credit on banking stability. Following Büyükkarabacak and Valev (2010), the hypothesis for this study was that household credit has a significant negative impact on banking stability. Büyükkarabacak and Valey (2010) used household credit to GDP as a proxy for household credit, while the present study used household credit to total gross loans at the institutional banking level.

Methods

Data on 37 Malaysian banks were collected from the Bankscope and IMF databases. The sample period was limited to eight years (2008 to 2015) because of the limitation that not all banks, particularly foreign banks, provide all credit facilities (e.g., credit cards, personal loans, or hire purchase) to households.

Construction of the banking stability index

The construction of a BSI involved two main processes—selecting the variables followed by their transformation using empirical normalization—before the variance-equal weight method could be applied (Morales & Estrada 2010; Illing & Liu 2006).

The selection of variables was crucial because they represent conditions that may underpin the threats to banking stability (Hakkio & Keeton 2009). Hence, the variables used should cover all the banking system's determinants (Baselga-Pascual et al., 2015). In general, banking stability depends on both internal and external factors (Creel et al., 2014; Baselga-Pascual et al., 2015). Internal factors refer to bank-specific variables (Salas & Saurina 2002; Louzis et al., 2012) as the potential determinants of banking stability, while external factors refer to macro-economic variables (Zouari-ghorbel et al., 2014; Castro 2013) which highlight changes to the economic conditions that affect banking stability. There is an argument about the banking systems' fragility, which is not from the banks themselves, but depends on the external factors, i.e., the macro-economic performance. For instance, in the case of the subprime mortgage crisis of 2008, this affected the entire banking system through the macro-economic factors (De Jonghe 2010). In addition, the IMF and World Bank suggest that the measurement should shift from a micro-prudential (bank-specific factors) to a macro-prudential (macroeconomic factors) framework. All the variables were grouped into two sub-indexes, namely the Banking Index (BI) for bank-specific variables and the Banking Vulnerability Index (BVI) for macro-economic variables. Appendix A presents the summary of the selection of variables to construct the BSI.

The current study used the IMF's Financial Soundness Indicators framework, as recommended by the IMF's Financial Soundness Indicators: Compilation Guide (2006) and previous literature (Chaibi & Ftiti 2015; Castro 2013; Nkusu 2011; Ali & Daly 2010). The selection of variables followed the IMF's Financial Soundness Indicators (FSI) (IMF 2006) framework because they have the following criteria. Firstly, the IMF indicators were designed for international comparisons across countries so that other countries can use the same methodology (IMF 2006). Sec-

ondly, the indicators have been used by the IMF member countries, including Malaysia. Hence they were believed to provide an insight into banking's health and soundness (Cihák & Schaeck 2010). However, the selection of variables was adapted to Malaysia's local economic conditions, to include the entire banking system's determinants.

Next, in constructing the indices, the aggregation method (or weighting) is essential because of the resulting index's ability to reflect banking stability. In previous studies, various aggregation methods have been applied, including the variance-equal weights method, in which all the variables are given the same weight (Balakrishnan et al., 2011; Cardarelli et al., 2011; Hanschel & Monnin 2005; Illing & Liu 2006; Puddu 2013), aggregation schemes based on expert judgment and experience (Gersl & Hermanek 2010), principal components analysis (Cevik et al., 2013; Hakkio & Keeton 2009; Illing & Liu 2006) and the logit model (Grimaldi 2010; Nelson & Perli 2007). This study employed the variance-equal weights method because it provides better goodness of fit for complex methodologies and allows for a cross-country comparison (Morales & Estrada 2010). Further, this method has been suggested for studies with highly correlated variables (Popovska 2014). In this context, each variable was given the same weight of 0.5. The following equations were used:

$$BSI_t = w_1 * x_1 + w_2 * x_2 + \cdots + w_n * x_n \quad (1)$$

To calculate the indices, all the indicators were assigned the same weight.

$$BSI_t = w_1 * BI_t + w_2 * BVI_t \quad (2)$$

$$BSI = 0.5 \left(\frac{\sum_{i=1}^{10} BI_t}{10}\right) + 0.5 \left(\frac{\sum_{i=1}^{5} BVI_t}{5}\right) \quad (3)$$

where $w_1+w_2=1$..

Following the index's construction, the next step was to conduct an empirical estimation of the relationship between the different types of credit and banking stability in each banking category. The baseline model was as follows:

$$BSI_{it} = \beta_0 + \beta_1 hc_{it} + \beta_2 dsize_{it} + \beta_3 lev_{it} + \beta_4 mgmt_{it} + \varepsilon_{it} \quad (4)$$

where *i* represents banks, *t* denotes the period from 2008 to 2015 ($t = 8$), $\beta 0$ is the constant of the model, $\varepsilon(i,t)$ is the error term, *c* denotes all three types of credit, *hc* denotes household credit, *mc* is mortgage credit, and *cc* is consumer credit. This study proposes three control variables, namely bank assets (dsize), bank leverage (lev), and management efficiency (mgmt) (refer to appendix B). Bank assets are defined as the log of the total assets of the banks (Sufian 2009). Bank assets can be used as a measure of banking stability because this variable reflects the financial strength of a bank (Morgan & Zhang 2017). The leverage ratio is calculated by the proportion of total liabilities divided by total assets. Higher leverage ratios also mean that banks have enough funds to make future investments and gain more profits. Management efficiency is measured using the cost to-income ratio (De Jonghe 2010; Kabir et al., 2015; Muhmad & Hashim 2015). In the present study, the cost-to-income ratio reflects management efficiency by measuring the cost of running the bank, such as salaries as a percentage of generated income. The growth and success of banking institutions depend on efficient management practices to detect, monitor, and control risk exposures, ensuring the safety and efficiency of the banks' activities (De Jonghe 2010).

Panel data estimation

This study did not use the GMM model because the GMM approach would shorten

the sample size by at least two waves. Due to the short series and relatively few banks in the panel, the GMM approach would mean a severe reduction in the sample size. Moreover, this study used indices systems such as the dependent variables (the value of the indices is between zero and one), which cause the results to be less significant. Thus, this study used the static linear panel data model.

First, this study used the Breusch-Pagan Lagrange multiplier test to distinguish between the pooled and random-effects models. The null hypothesis for the Breusch–Pagan Lagrange multiplier test was pooled ordinary least squares regression, while the alternate hypothesis was the random-effects model. The p-value for the Breusch–Pagan Lagrange multiplier test was 0.001. Hence, the random-effects model was more appropriate than the pooled model.

Second, this study used the Hausman specification test to assess whether the fixed effects or the random-effects model was more suitable. The null hypothesis (H0) for the Hausman specification test was the random-effects model, while the alternate hypothesis was the fixed effect model. The p-value for the Hausman specification test was 0.001. Because the p-value was less than 0.05, the null hypothesis (H0) was rejected. This result indicates that the random-effects model was not appropriate and, therefore, the fixed-effects model specification was preferable.

Next, to verify the reliability of the regression model, diagnostic tests for multicollinearity, heteroscedasticity, and autocorrelation were performed. Multicollinearity was assessed using Pearson's correlation coefficient, with the variance inflation factor confirming that there were no multicollinearity issues in this model. White's method was used to determine the existence of heteroscedasticity, with results indicating that the model had a heteroscedasticity problem. Thus, to attain optimal results, this study applied robust regression techniques to control for heteroscedasticity and serial correlation in the dataset.

Results

The relationship between household credit and banking stability

After eliminating the outliers, the total number of observations (as identified by Cook's distance) was 293. As shown in Table 1, household credit's coefficient was significantly negative at the 1% level for individual bank-level variables. The negative relationship between household credit and banking stability is consistent with the proposition that credit growth leads to an overall decline in bank health. The coefficient of household credit was in the hypothesized direction and in accordance with Hyman Minsky's theory (1992) on the importance of the margin of safety, because banks with sustained periods of credit growth frequently take higher risks and eventually experience loan portfolio deterioration. Similarly, Kashif et al., (2016), Amador et al., (2013), and Foos et al., (2010) found a negative relationship between credit growth and banking stability. During periods of credit expansion, banks are more likely to expand their total credit volume to relatively low-quality borrowers (Kraft & Jankov 2005). Thus, risky loans are being approved, leading to an increasing number of potential defaults. Decisions to expand or reduce lending activities may compromise the soundness of the banking system.

Extensive lending activities ultimately lead to the possibility of default payments and

thus higher loan losses in the future (Sinkey & Greenawalt 1991; Clair 1992; Cottarelli et al., 2005; Kraft & Jankov 2005). Default payments do not begin immediately after new loans are granted. Salas and Saurina (2002) found that credit growth is significantly and positively associated with loan losses 3 to 4 years ahead, while Foos et al., (2010) found that credit growth influences subsequent loan losses with a lag of 2 to 4 years. However, these studies used total credit (household and business) in their analysis and did not focus on household credit alone.

The relationship between mortgage credit and banking stability

As shown in Table 1, the coefficient of mortgage credit was negatively related to banking stability at a significance level of 1%. The coefficient of mortgage credit supported this study's hypothesis, which was based on the argument that mortgage credit involves a longer period and is highly sensitive to house price fluctuations, in line with the study by Morgan and Zhang (2017). According to Minsky's financial instability hypothesis, higher credit may pose a higher financial risk during economic booms when banks overextend their balance sheets by offering higher lending to households and lowering their credit standards, which destabilizing the financial system.

The findings are also validated by Tajik et al., (2015), who found that the risks to which banks are exposed are susceptible to house price fluctuations. Nakornthab (2010) and Tajik et al., (2015) posit that house price movement is one factor forcing households into debt because changes in house prices have direct effects on household wealth. However, a sharp fall in property prices can lead to banking instability and weaken the economy as housing construction slows, triggering financial strain and default payments. Further, increased unemployment rates result in NPLs and default payments among households, leading to a rapid worsening of banks' balance sheets. Periods of mortgage credit are often linked with economic factors such as GDP, interest rates, and inflation (Debelle 2004; Meng et al., 2013; Dinh, Mullineux & Muriu 2012; Howard, Lewis-Bynoe & Moore 2011).

Table 1: The Effects of Household Credit (HC), Mortgage Credit (MC) and Consumer Credit (CC) on Banking Stability

Regressor	**Coefficients**		
	Model A: HC	**Model B: MC**	**Model C: CC**
Household credit	−0.0076 (−4.52 ***)		
Mortgage credit		−0.0121 (−4.42***)	
Consumer credit			−0.0172 (−3.89***)
Leverage	0.0464 (1.54)	0.0434 (1.46)	0.0501 (1.61)
Bank asset	−0.0721 (−10.91***)	−0.0713 (−11.00***)	−0.0732 (−10.74***)
Management efficiency	−0.0312 (−0.95)	−0.0302 (−0.91)	−0.0329 (−1.01)
Constant	0.9933 (13.14***)	0.9872 (13.35***)	1.0027 (12.89***)
R-squared	0.4273	0.4269	0.4276
F-statistic	46.77***	56.13***	43.57***
Observations	293	293	293

Notes: *Indicates significance at the 10% level; **Indicates significance at the 5% level; ***Indicates significance at the 1% level. The baseline model in Equation (4) is estimated using fixed-effects with robust standard error.

The impact of mortgage credit on banking health depends on the quality of the loan portfolios (Salas & Saurina 2002), with risky borrowers causing banks to suffer from high loan losses during periods of economic shock. Aligned with International Monetary Fund (2011) findings, mortgage credit has a negative relationship with banking stability. The explanatory power of the results on mortgage credit was approximately 42.7%, with two variables having significant effects on banking stability at a significance level of 1%.

The relationship between consumer credit and banking stability

The results presented in Table 1 show that the estimated coefficient of consumer credit with banking stability was negative and statistically significant at the 1% level, indicating that an increase in consumer credit will reduce banks' stability. This result is similar to that found in the first two models.

Consumer credit is often associated with consumption and maintaining one's lifestyle. During boom periods, competition among bankers to offer instant cash, balance transfers, cashback, and discounts (Baradwaj et al., 2015) is high. During economic crises, falls in income and asset prices lead to the inability to repay debt, particularly when interest rates are higher.

Discussion on the regression results of control variables

Three control variables were used in this study: bank assets, bank leverage, and management efficiency. Regarding the control variables, this study found no difference between a mortgage and consumer credit; therefore, combining these variables is suggested. Bank assets were negatively associated with banking stability for all the models (household, mortgage, and consumer credit). The coefficients were high in the estimation, indicating that bank assets were significant at the 1% level for all models. The results suggest that the larger the bank, the greater its access is to capital markets and the higher the risk (Kashif et al., 2016).

The positive relationship between bank leverage and banking stability appeared for all models and was consistent with previous studies' findings (Amador et al., 2013; Louzis et al., 2012). High leverage may lead to higher banking stability because of funds to increase banks' returns and liquidity. Louzis et al., (2012) claimed that this effect occurs only up to a certain size threshold, above which leverage has no statistically significant effect on banking stability. However, leverage is not a significant factor for household, mortgage, and consumer credit (Ahmad & Arif 2007). Management efficiency was negative and insignificant in determining banking stability for all types of credit. The present study's findings suggest that management efficiency plays no significant role in banking stability.

Summary and Conclusions

This study provides new empirical evidence on the relationship between household credit and the Banking Stability Index (BSI) in Malaysia using bank-level data. In examining the role of both consumer and mortgage credit on bank stability using static panel estimation, the main findings show that household credit had a significant negative effect on banking stability. The results were similar for the sub-component of household credit, namely mortgage and consumer credit. According to Meng (2014), each type of credit

has a different collateral and tenure period and carries different risks to banking health, influencing banking stability in the future.

This study's results can be used as an early warning signal for the policymakers to formulate strategies and policies for promoting an effective and sound banking system and prevent it from going into financially distressed situations due to excessive debt. This study's findings also give an overview of other countries plagued with escalating household debts to GDP. Some of the suggestions to improve the policy imperatives for banks include building an individual credit system through creating credit records for customers, by combining all the potential borrower's debts either from banks or non-bank lenders (Court Mammort, cooperative loans, AEON Credit Services and Singer Sdn. Bhd., which also provide financing options for in-store items). From this, the management team would assess an individual's financial condition by tracking his/her historical borrowing records. This effort is to gauge borrowers' credit worthiness and minimize the default payment risk to the banking sector. Currently, the Malaysia Central Credit Reference Information System (CCRIS) does not include the nonbank lenders.

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APPENDIX A: VARIABLES IN BSI

Variables	**Definition**	**Acronym**	**Previous Literature**
Banking Index (BI)			
Capital adequacy ratio	Regulatory capital to risk-weighted assets	RCRW	Popovska (2014)
	Regulatory tier I capital to risk-weighted assets	RTRW	Cardarelli et.al (2011)
	Nonperforming loans net of provisions to capital	NPLC	
Asset quality ratio	Nonperforming loans to total gross loans	NPL	Cheang & Choy (2010)
Liquidity ratio	Liquid assets to total assets	LATA	Morris (2010) Gersl & Hermanek (2010)
	Liquid assets to short term liabilities	LAST	
Profitability ratio	Return on assets	ROA	
	Return on equity	ROE	Yaaba (2014)
	Interest margin-to-gross income ratio	IM	Morales & Estrada (2010)
	Noninterest to gross income	NIM	
Banking Vulnerability Index (BVI)			
External factor	Current account balance to GDP ratio	CA	Albulescu (2010)
	Money supply to foreign reserves	M2	
Real sector	Inflation rate	INF	Uhde & Heimeshoff (2009)
	GDP growth rate	GDP	
	Interest rate	INT	

(Source: IMF 2006: Compilation Guide and previous literature)

APPENDIX B: SUMMARY OF VARIABLES

Notation	**Definition**	**Sources**	**Expected sign**
BSI	Indices consist of capital, assets, profitability, liquidity, GDP, inflation, and interest rate	Bankscope, World Bank	
Household credit	Household loan/ total gross loan.	Bankscope Annual report	-
Mortgage credit	Mortgage loan divided by the total gross loan offer for each individual bank.	Bankscope Annual report	-
Consumer credit	A consumer loan is divided by the total gross loan offered for each individual bank.	Bankscope Annual report	-
Bank asset	The logarithm of total assets of the banks	Bankscope	-
Leverage	Total liabilities/total assets	Bankscope	+
Management efficiency	Total operating cost/total operating income	Bankscope	-