Chapter 4

STRESS TESTING HOUSEHOLD DEBT IN MONGOLIA

By

Byambatsogt Tserendejid and Ganchimeg Ganpurev

1. Introduction

Household debt in Mongolia has been increasing sharply, doubling in the last 5 years. The Government of Mongolia and the Bank of Mongolia (BOM) have been implementing the subsidized “mortgage program” that substantially contributed to this rise in household debt.

Based on other countries’ experiences, it is observed that the negative consequences of any macroeconomic shock on household’s ability to repay worsen as household debt increases. Moreover, there are cases where household loans affect financial stability and macroeconomic developments unfavorably as household loans rise. Therefore, this research paper studies the impacts of fiscal (wage, social welfare benefit) and monetary policy (policy rate), real sector (real estate price), and external sector (foreign exchange rate) aggregates on household financial position and household credit quality.

In this paper, we used the annual “Household Socio-Economic survey” (HSES) conducted by the National Statistical Office of Mongolia (NSO) for 2013-2016 (12-16 thousand households included for each year) to: (i) estimate the credit risk for each household and assess the share of outstanding risky loans in total outstanding loans; (ii) study and assess how policies and economic shocks affect the household financial and credit risks; and, (iii) assess how these measures have changed in the recent years.

This research paper has the following two main features: (i) the paper employed the micro-stress testing methodology used widely in other central banks to assess macroeconomic shocks and (ii) the paper modified the macroeconomic shocks to fit the shocks for the Mongolian economy specifically.

For our country, Ariun-Erdene and Gan-Ochir (2016) conducted the research for the first time utilizing the same method based on the same data for 2014. However, the Bank of Mongolia has yet to complete a similar type of research.

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1. The views expressed in this paper are those of the authors and do not represent those of the Bank of Mongolia or the SEACEN Centre. All errors or the omissions are the responsibility of the authors.

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The authors are grateful to the Bank of Mongolia and the SEACEN Centre for providing us an opportunity to work on this collaborative research project, “Household Debt in SEACEN Economies,” organized by The SEACEN Centre. We would like to thank Gan-Ochir Doojav (PhD), Tsevelmaa Khyargas (PhD), the project leader, Maria Tereza Punzi (PhD), and participating researchers of this project for their fruitful comments and discussions on early versions of this paper.
In the next section of the paper, we introduce the household debt dynamics in Mongolia and the factors that have impacts on them, while we present the common approaches used to assess household credit risk and their applications in Section 3. Data and debt at risk are discussed in Section 4, while Section 5 discusses the stress-test results. In the final section, we discuss conclusion, limitations, and recommend possible policy options.

2. Household Loan and its Dynamics

2.1 Household Loan Level

Not only has household debt of Mongolia increased, but also both household loan composition and terms have changed in recent years. Mortgage loan contributed substantially to credit growth during 2013-2016, while wage and pension loan rose sharply since 2016. The average maturity is 10 times longer and the weighted average interest rate is twice higher for wage and pension loans compared to those for the mortgage loans. Therefore, wage and pension loans carry a higher risk of putting more pressure on household loans.

Moreover, as of October 2017, the number of citizens with double counting who have outstanding debt at banks and other financial institutions is more than 1.0 million which exceeds the number of households (approximately 870 thousand households as of 2016). In other words, it shows that there is at least one person in each household who has outstanding debt at financial institutions.

Figure 1: Individuals’ Loan /Including Mortgage Loan Portfolio Transferred to MIK*/

Figure 2: Individuals’ Overdue and Non-performing Loans

Sources: BOM and NSO
Although the share of individuals’ overdue and non-performing loans to total loans is relatively lower than that of other sectors, it has been increasing since 2015. There are several factors for this increase, including collateral price valuation and economic stance. Besides these two factors, one more possible factor would be the impact of unexpected negative shock for household income on the household’s loan repayment ability caused by the increased loan amount issued to households. For example, in 2015 and 2016, decreased household income caused the overdue and non-performing household loans outstanding to increase, although total household loan outstanding increased. Meanwhile, it is shown that the share of overdue and non-performing household loans outstanding to total household loans outstanding has been relatively stable as a result of increased household average income in 2017 (Figure 1 and 2).

2.2 Factors Affecting the Household Loans

There exist many factors that affect the household loan level to rise except economic circumstances, government support, policies, and changes in loan criteria at the banks. In this section, in order to define the macroeconomic shocks used in the stress testing, we introduce factors that affect the household loan growth based on economic models and international practice.

*The life-cycle model of consumption* links aggregate demand for borrowing in an open small economy to consumption, the expected income path and real interest rate. A younger demographic profile would suggest a higher aggregate debt level, as people in their youth tend to finance current consumption with borrowing against expected future income. As incomes grow in later years, households accumulate assets and reduce debt. Once they retire, they begin dissaving, drawing down assets accumulated during their working lives (Karasulu 2008).

Based on this model, it is concluded that the relatively young demographics of Mongolia can be considered as one of the factors inducing high aggregate demand for the loans.

**Figure 3:** Individuals with Mortgage Loans by Age Category (by the Number of Individuals) – as of October 2017

**Figure 4:** Individuals with Mortgage Loans by Average Contract Terms – as of October 2017

Source: Monthly Mortgage Loan Report for October 2017, BOM.
Also, the effect of real interest rate changes on aggregate net household debt is ambiguous. According to the life-cycle hypothesis, a decline in real interest rates would have opposing effects on different age cohorts (Muellbauer 1994). For young cohorts, a decline in interest rates would reduce debt servicing costs while increasing present value of future income, providing incentives for higher debt levels. However, for older cohorts this would mean lower returns on accumulated assets and hence a desire to dissave less, leading to lower net aggregate debt levels (Karasulu 2008).

**Housing needs and housing price:** One of the main factors that cause the household debt to rise is a consumer’s decision to buy any type of housing. If the consumers choose to purchase housing through loans instead of renting, they have to cut the expense for other consumptions in short-run when the housing price is not expected to rise in near future. Furthermore, the cost incurred to buy housing for the household is highly correlated with the level of the household’s debt. In other words, whenever the housing price exceeds the household income, it triggers the household debt level to rise.

For our country, the subsidized “mortgage program” was implemented without taking into consideration the aggregate housing supply. As a result, a housing bubble occurred in the market which can be considered as one of the possible stimulants for the jump in household debt.

**Financial regulations and requirements:** Supply-side factors including banks’ requirements adhered to by the borrowers, market competition, and financial sector development have impacts on the household debt level.

Habibullah, Smith, and Azman-Saini (2006) studied 10 Asian developing economies and concluded that financial liberalization resulted in the reduction of liquidity-constraints, eventually causing the household debt to increase in Korea, Sri Lanka and Chinese Taipei. For instance, Korea’s household debt was 38% of GDP in 1997 and reached 66% of GDP in 2007 after credit card service became widespread in the 2000s, causing the ratio to increase to 66%.

In our country, even though the consumers’ housing needs and associated loan demand have been high due to the relatively young demographics, consumers’ opportunity to take out loans has been limited due to the household income level, loan terms and conditions and collateral requirements. However, the interest rate declined and the term length of loans was extended under the subsidized “mortgage program” implemented in the last several years. Such a decline in the interest rate and extension in loan length served to bring about favorable conditions for household debts to increase.

3. **Methodologies to Assess the Household Loan Risks**

When the household debt is at a high level, the sensitivity of household balance sheets and the risk of becoming unable to service their loans increase. Furthermore, as illustrated by the credit card crisis in 2003–04, a subsequent retrenchment of credit from the household sector could further depress consumption and economic growth (Meral 2008).

Stress testing is used by private financial institutions to manage their internal risks and by policymakers to determine potential vulnerabilities that might occur in the financial sector, to assess the financial system as a whole, to safeguard financial stability as well as to estimate the effects of macro economic shocks, and such.
The prominence of system-wide stress testing has been increasing since the global financial crisis and it is being used widely to assess credit risk – the risk that borrowers will not repay their debts (Bilston, Johnson and Read, 2015).

Due to limited data availability some countries use macroeconomic indicators such as the debt-to-income (DTI) ratio to assess the risk. This approach has several shortcomings, such as failing to estimate the impacts of macroeconomic shocks precisely. Furthermore, for the indebted households with substantial amount of savings and assets, the impact of adverse macroeconomic shocks on credit risk is low even when the DTI increases (Djoudad, 2012).

Therefore, many central banks around the world started developing micro stress testing that uses detailed household-level data to assess credit risk. In general, these methodologies are divided into 3 main categories depending on the approach used, to assess credit risk and data used in the assessment.

3.1 “Threshold” Approach

The threshold approach is based on the simple assumption that each household will default or face difficulty in repaying their loans when the loan repayment amount exceeds a certain share of household income. The main advantage of this approach is that it is simple to estimate requiring fewer assumptions (it does not require detailed data).

The increase in the debt-service ratio (DSR) yields negative consequences on both the real economy and financial system and cuts household consumption, eventually leading to a decline in economic growth. In other words, in the case of a high DSR, the pressure caused by unforeseen negative changes of household income and loan repayment on household finance is substantial. This has adverse impact on lending institutions as well. For wage and pension loans, which account for a substantial share of individuals’ loans in Mongolia, the DSR is high and this can be one of the possible factors that result a high debt level.

\[
DSR_i = \frac{P_t + ri}{Y_t}, \quad ri = rm_i + r_o_i + r_n_i
\]

where \(DSR_i\) – Debt service to income ratio for household \(i\), \(P_t\) - principal repayments for household \(i\), \(ri\) – interest repayments for household \(i\), \(rm_i\) - interest repayments for mortgage loan for household \(i\), \(r_o_i\) - interest repayment for non-mortgage loans taken prior to the last 12 months for household \(i\), \(r_n_i\) - interest repayment for non-mortgage loans taken in the last 12 months for household \(i\), \(Y_t\) - total disposable income for household \(i\).

In other research papers, the researchers utilize two common methodologies to estimate the threshold for the risky level of DSR which are: (i) two standard deviation higher than the mean; and, (ii) more than 40% in other research papers. Furthermore, DTI limits can be used as macroprudential policy instrument and are often used in mortgage loans. In Mongolia, the banks commonly require the DTI limit on mortgage loan to be less than 45% for pre-tax income. In this paper, we conduct the estimation for DTI for two thresholds of 40% and 45%, respectively.

2. DSR is 50%-80% for wage loan and 100% for pension loan for banks.
When the threshold is taken at 40%, the portion of risky loans in total loans outstanding is 50% on average and the portion elevated sharply in 2006 because of the decline in household income and increased wage and pension loans. Furthermore, when the threshold is taken at 45%, which is reflected on the “Regulation on Mortgage Lending Process”, proportion of vulnerable households which face difficulties in repaying their loans is reduced by 7 unit percent. Even though the proportion of the risky loans outstanding in total loan outstanding decreased by 7% for threshold of 45%, it is still higher than the average of other countries (Figure 6).

**Figure 5:**
Debt Service to Income Ratio

![Debt Service to Income Ratio](chart)

Sources: BOM, NSO, and authors’ calculations.

However two of the shortcomings of this approach are: (i) it does not take account of household expenditure and consumption level when estimating household’s loan repayment ability; and, (ii) universal threshold is applied to all households regardless of their income levels. For example, for high-income households, the risk of not completing their debt service on time might be lower despite their high DTI.

### 3.2 “Financial Margin” Approach

In this approach, each household is assigned with a financial margin, which is calculated as a difference between income and estimated household expense (summation of debt service and consumption). The approach assumes that consumption can be lowered to a minimum living expense. In other words, a household is considered to have credit risk if the residual of their income after paying their debt service can not meet the minimum living expense. The weight of loans outstanding for households with negative financial margins in total loans outstanding (WPD) is used to estimate the credit risk for households. High WPD implies a risk for the loan becoming overdue and non-performing.

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3. Financial margin-type approaches are also known as the household budget constraint method, financial surplus method or the residual income approach. For some examples of these approaches, see Johansson and Persson (2007) and Sveriges Riksbank (2009) for Sweden; Holló and Papp (2007) for Hungary; Herrala and Kauko (2007) for Austria; and, Sugawara and Zaluendo (2011) for Croatia.
\[ FM_i = Y_i - (P_i + r_i) - MC_i \]  

(2)

where, \( FM_i \) - financial margin (difference between income and expenditure) for household \( i \), \( MC_i \) - estimated minimum living expense for household \( i \).

\[ PD_i = \begin{cases} 1 & \text{if } FM_i < 0 \\ 0 & \text{if } FM_i \geq 0 \end{cases} \]  

(3)

where, \( PD_i \) is the probability of default for household \( i \) and it takes value of “0” if financial margin, \( FM_i \), is positive and “1” if financial margin, \( FM_i \), is negative.

\[ WPD = \frac{\sum_{i=1}^{N} PD_i (P_i + r_i)}{\sum_{i=1}^{N} (P_i + r_i)} \]  

(4)

\( WPD \) – is the weighed-average probability of default for \( N \) number of households, \( N \)- is the number of households that were included in the survey for a given year.

Based on the results estimated with the financial margin approach, the share of risky credit or WPD decreased in 2015 and has been increasing since 2016 (Figure 7). Furthermore, the share of risky credit is 5 unit percent lower than that estimated by using the previous or threshold approach and the trend for the share is different.

Figure 6:
Results for “Financial Margin” Approach:
Weighted Probability of Default (WPD) and Household Debt Outstanding/GDP

Several research studies have been completed using the financial margin approach. Johansson, and Persson (2007), Sveriges Riskbank (2009), Hollo and Papp (2007), Herrala and Kauko нар (2007) assessed the impact of unemployment and household income on risky credit level, while Andersen (2008), Albacete and Fessler (2010), Sugawara and Zaluendo (2011) introduced the additional macroeconomic shocks into the model and assessed the impact of those shocks.
Some studies categorize households based on their income level and investigate on which category the macroeconomic shocks are affecting the most adversely. For example, Johansson and Persson (2007) concluded that 20% of high income households account for the 57% of total household debt. Sveriges Riskbank (2009), Hollo and Papp (2007) showed that the most financially vulnerable households tend not to have debt in most cases.

Despite several advantages, this approach has a shortcoming which omits the fact that households have their assets they can draw on to repay their loans if they face a risk of defaulting (a negative financial margin).

3.3 “Extended” Approach

Herrala (2007) and Karasulu (2008) modified the model used in the previous approach by introducing households’ assets that can be sold. This modification enabled them to estimate credit risk accurately for households that have low income, but otherwise have substantial values of assets that can be sold. In this approach, the following assumptions are made: (i) households can sell their assets to repay their loans when they face financial adverse shocks such as decreased income; or, (ii) households can repay their loans outstanding with their collaterals. The share of loans outstanding that can not be repaid with collaterals in total loans outstanding is defined as debt at risk (DAR) and used to determine the credit risk level.

\[
DAR = \frac{\sum P_i D_i M_i}{\sum P_i D_i}; \quad M_i = \max(D_i - A_i, 0)
\]

where, \(M_i\) is the difference between loans outstanding and collaterals’ value for household \(i\), \(D_i\) is total loans outstanding or total debt for household \(i\), \(A_i\) value of total assets that can be used as collaterals for household \(i\), \(DAR\) - share of loans outstanding that cannot be repaid with collaterals in total loans outstanding for \(i\) households.

In this paper, collateral assets include real estate, land, livestock, savings, patents, and any type of ownership license.\(^4\)

\(^4\) We were able to estimate valuations for real estate, livestock and savings for each household based on extensively conducted HSES for 2014 and 2016, while we calculated valuations for livestock and savings based on HSES 2013 and 2015 which are conducted in brief modules. We used data from HSES 2014 and 2016 to estimate the valuations on real estate for 2013 and 2015 for which the years did not reflect the data on real estate on their briefly conducted HSES. Therefore, there may be limitations in comparing the tests results for 2014 and 2016 with those of 2013 and 2015.
Figure 7:
Result of “Extended” Approach (DAR) and Share of Overdue and Non-performing Loans in Total Loans for Individuals

![Graph showing the relationship between stress tests and loan performance](image)

Sources: BOM, NSO, and authors’ calculations.

According to the “Extended” approach, prior to applying shocks, the DAR was 3.0% in 2014 and 3.1% in 2016. These estimates compare reasonably with shares of non-performing loans in total loans for those years. On the contrary, the DAR was 6.2% in 2013 and 8.5% in 2015, which is approximately 6% higher than shares of non-performing loans in total loans for those years (Figure 8). These deviations illustrate that there exists potential error in evaluating the valuations for real estate properties for 2013 and 2015.

Furthermore, it should be emphasized that the results obtained in this model stand the closest to the level of non-performing loans compared with the results obtained in other models. This shows that household assets have increased more than the household loans, as there is a common tendency for households to draw on their assets including livestock to repay their loans when they become unable to meet their debt servicing obligations with their permanent income. Also, banks evaluate collaterals for lower than the market values, which can be the reason that households are still able to repay their loans even when the assets prices decline.

4. Data and Calibration

4.1 Data

In this paper, we used data from the “Household Socio Economic Survey” (HSES), which is a nationally representative household-based longitudinal study collected annually by the NSO. In estimating the necessary indicators and additional calculations, we referred to statistics and methodologies released by the BOM and NSO.
The HSES comprises the data from 11-16 thousand households that can well represent the nation. It is conducted in the detailed module for the even numbered years, while it is conducted in brief module for the odd numbered years. Also it should be noted that some questions were not covered in HSES for the years prior to 2013. Therefore, we completed the calculations based on data covering 2013-2016.5

**Limitations:** Since all the necessary information for the paper is not reflected in HSES and some information available through HSES can not be utilized directly, we faced several limitations in completing the stress testing for the paper. To overcome these limitations, we carried out additional calculations for odd numbered years as HSES in those years lack information on valuations for household debt, savings and assets. For example, we used the average price of livestock sold for the specific year to estimate the valuations for total livestock for households, while we divided the savings income by the average savings interest rate to derive the total savings outstanding for households.

HSES covers data on household loan outstanding only for the loans taken in the last 12 months and does not reflect any information regarding any other loan type in terms of loan length. Consequently, we calculated the outstanding amount for loans taken more than 12 months ago by referring to data on monthly debt service, loan average term, and interest for those loans.

Moreover, there arose other limitations - such as the data quality of HSES was not sufficient to calculate some indicators, survey results were not aligned with real observations in the economy and datasets were incorrect in some cases. These limitations illustrate that focus should be directed at the content and quality of the data in order to complete the study based on similar data source.

### 4.2 Macroeconomic Shocks Affecting the Household Loans

This paper aims to assess the effects of external and domestic macroeconomic shocks on household loans after estimating risky loans based on household-level data using 3 main approaches introduced in the previous section. In similar research studies completed in other countries, they mainly investigate the effects of unemployment rate, interest rate, prices of consumer goods and real estate prices.

Conversely for Mongolia, we chose the following policy decisions, external economic stance, domestic price change as shocks which have impacts on household income and collateral valuations:
- Effects of monetary policy (rise in policy rate),
- Changes in fiscal policy (rise in tax, cut on wage and pension),
- Effects of external sector (depreciation in exchange rate for national currency, tugrug, against USD),
- Effects of real estate market (fall in real estate prices).

The abovementioned macroeconomic shocks can affect household credit risk both directly and indirectly, passing through multiple channels. For instance, as illustrated in Picture 1, policy rate change affects the deposit rate, loan rate, asset prices, and exchange rate through the channel of

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5. The data and indicators used in this research paper are shown in the appendix.
interbank rate and market expectation. Eventually it affects the household credit risk through the following transmission channels:

- These changes have impacts on household consumption by changing the inflation,
- Loan rate affects debt service for the new loans or floating rate loans,
- Exchange rate affects the income and debt services measured in domestic currency for households who are earning or borrowing in foreign currency,
- Deposit rate increases interest income for the household…etc.

### Picture 1:
**Macroeconomic Aggregates’ Channels Affecting Credit risk**

It becomes challenging to assess the impacts of all channels in a similar manner mentioned above and the effects of some macroeconomic shocks are not unequivocal, eventually requiring the conduct of another research study. Therefore, we used the results obtained in the research papers by Doojav and Kalirajan (2016), Tserendejid and Byambasuren, Bayarsaikhan et al. (2015), and Bazarsad (2014). The next section explains the effect of each macroeconomic shock in detail.

We used the annual change or average of the first 12 periods for response impulses to the macroeconomic and policy shocks analyzed in those research papers.

### 5. Stress Testing Results

As it was impossible to conduct stress testing for each approach in studying effects of macroeconomic shocks on credit risk due to inadequate data quality and coverage, we employed the “Financial Margin” approach to study effects of monetary policy, fiscal policy, and exchange rate and “Extended” approach for effects of fall in asset prices.

#### 5.1 Effects of Monetary Policy

We assume that an increase in the policy rate has effects on: (i) decreasing DAR by increasing the deposit interest income; (ii) increasing DAR by increasing the interest repayments for new loans;
and, (iii) affecting household’s financial wellbeing positively by decreasing inflation, eventually leading to a decline in the minimum living cost.

**Figure 8:**
Effects of Change in Policy Rate (Financial Margin Approach)

![Graph showing the effects of policy rate changes on credit risk over time.](image)

Sources: Authors’ calculations.

Results show that the effects of the policy rate on credit risk has the tendency to deteriorate over time. For instance, when the policy rate was increased by 5 unit percent, the DAR calculated using the financial margin approach increased by 0.6% in 2013, while it increased by 0.3% in 2016, seeing a deceleration in the increase. This can be due to the decrease in new loans issued and inflation in recent years.

### 5.2 Effects of External Sector

The effects of the external sector is represented by the exchange rate of tugrug, MNT, against USD. Depreciation of MNT has effects on: (i) increasing debt service for individuals who have borrowings in foreign currency; (ii) affecting the household balance sheet negatively by raising imported goods prices eventually leading to a hike in household consumption expenditure; and, (iii) affecting the household balance sheet favorably by raising household income that have earnings in foreign currency.

**Figure 9:**
Effects of Exchange Rate Depreciation (Financial Margin Approach)

![Graph showing the effects of exchange rate depreciation on credit risk over time.](image)

Sources: Authors’ calculations.

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6. The share of outstanding loan in foreign currency in total loan is 4% as of 2017 December.
In this section, we consider the effects of exchange rate only on inflation as approximately 97% of individuals’ bank loans is in MNT and the number of individuals who have earnings in foreign currency is meager. The results suggest that the effects of the exchange rate weakened in 2015 but have strengthened since 2016.

This can be explained by the fact that the effects of the exchange rate on inflation decreased in 2015 due to the slowdown in the economy.

5.3 Effects of Fiscal Policy

**Effects of fiscal policy:** Decrease in wage and pension cost has effect on: (i) increasing DAR by decreasing household income; and, (ii) decreasing DAR by decreasing inflation. In this section, direct effects that decrease income are discussed while the inflation effect is not covered.

**Figure 10:**
Effects of Change in Household Income (Financial Margin Approach)

![Graph showing the effects of change in household income](image)

Sources: Authors’ calculations.

Results indicate that the effects of income decrease on DAR has been rising continuously since 2013. This shows that wage, pension and social welfare expenditure which are mainly dependent on fiscal policy have substantial effects on credit risk.

This also reflects the fact that in the last several years, social welfare expenditure has increased and it has become the main source of household income. Based on the abovementioned results, it is concluded that imposing a cut on social welfare expenditure or increase on tax is highly likely to entail non-performing loans to increase and to bring about vulnerabilities in the financial sector.

5.4 Effects of Housing Prices

**Effects of stock market:** In this section, we investigate the effects of real estate assets on DAR by employing the extended approach. We assume that a fall in asset prices increase DAR by reducing the valuations for collaterals.
Figure 11:
Effects of fall in assets prices (Financial Margin Approach)

![Figure 11: Effects of fall in assets prices (Financial Margin Approach)](image)

Sources: Authors’ calculations.

Results illustrate that although the effects of a fall in assets prices on DAR increased in 2015, it has decreased since 2016. This can be interrelated with the fact that real estate price have stabilized relatively since 2016, after observing an unceasing drop since the last half of 2014. On the contrary, it could also be due to incomplete data on real estate valuations for 2015.

6. Conclusion and Possible Policy Recommendations

In recent years, it is observed that the impact of macroeconomic changes on household credit risk is widening as household debt rises. Therefore, it becomes crucial and necessary to study the effects of macroeconomic variables on credit risk on a regular basis.

In this paper, we used data from HSES covering 54 thousand households for the last 4 years to assess risky loans or DAR using several different approaches. Moreover, we conducted micro stress testing to investigate the effects of policy decisions and macroeconomic shocks on credit quality and this can be considered as a novel aspect of this research paper.

In conclusion, our results suggest that: (i) the effects of policy rate change on credit quality have weakened in the last several years; (ii) the effects of wage, pension, and social welfare benefit on credit quality have strengthened continuously; and, (iii) the effect of the exchange rate decreased in 2015 while it increased in 2016.

Continuing this study with some further extensions should enable authorities, researchers and policy makers to utilize its results for policy decisions and estimating the stance for the economy.

But it should be noted that before conducting future similar research studies, several areas of work should be completed including: (i) re-estimating macroeconomic channels that affect household finance and enhancing the estimation methodologies; (ii) studying the sample errors in-depth and correcting the errors; and, (iii) introducing some new questions on the HSES to capture additional information necessary for future research studies.
References


### APPENDIX

#### Explanations for data used in the paper

<table>
<thead>
<tr>
<th>Variable (for household “i”)</th>
<th>Explanation (resource)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$p_i$ Loan principal repayment</td>
<td>It includes principal repayments of wage, pension, mortgage, consumption, herder, small and medium enterprise, leasing, and car loans for household members.</td>
</tr>
<tr>
<td>$rm_i$ Interest repayment for 5-8% mortgage loan</td>
<td>We assumed that it will remain constant as it is the interest rate for subsidized “mortgage program” by the Government of Mongolia.</td>
</tr>
<tr>
<td>$ro_i$ Interest repayment for non-mortgage loans taken prior to the last 12 months for household $i$</td>
<td>We assumed that no macroeconomic shock will affect interest repayment for this type of loan as the loan contract is signed before any shock occurs (prior to the last 12 months.)</td>
</tr>
<tr>
<td>$rn_i$ Interest repayment for non-mortgage loans taken in the last 12 months for household $i$.</td>
<td>It is the interest repayment for non-mortgage loans taken within a year and can fluctuate depending on effect of any shock occurring during the year.</td>
</tr>
<tr>
<td>$Y_i$ Total both monetary and non-monetary disposable income for household $i$</td>
<td>It is a difference between summation of wage, bonus, pension, social welfare benefits, interest income, household output, household service income, rent income, sales income, grants given by others, and food goods received from own enterprises and costs related to own enterprise and services. For Mongolia, considerable share of total population has private business in husbandry and agriculture. Moreover, many households receive food and other household goods from their relatives and friends. So we have made additional estimations by adding gifts and grants households received and raw materials and goods they consumed from their enterprises for households’ non-monetary income.</td>
</tr>
<tr>
<td>$MC_i$ Estimated minimum consumption for household $i$</td>
<td>We used the living minimum cost for an adult calculated for Ulaanbaatar city, and 5 regions of the country by NSO annually. While estimating the living minimum cost for household, we assigned weights of 1.0, 0.7, and 0.5 for the first adult member, the second adult member, and a child in the household, respectively.</td>
</tr>
<tr>
<td>$D_i$ Debt outstanding for household $i$</td>
<td>HSES contains information on loans outstanding only for the loans taken in the last 12 months and debt service for the loans taken prior to the last 12 months. So we used data for debt service, loan average term, and interest rate to calculate loan outstanding for the loans taken more than 1 year earlier.</td>
</tr>
<tr>
<td>$A_i$</td>
<td>Amount of assets that are considered as eligible collaterals household $i$</td>
</tr>
<tr>
<td>-------</td>
<td>---------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>We considered real estate properties, vehicles, livestock, and savings to be eligible collaterals for bank loans in Mongolia. We did not include land, stock, bonds, ownership license and patent for the eligible collaterals as there is no available information for them. Since there is no valuation information on household’s real estate prices for 2013 and 2015, we used information for prices of similar properties from 2014 and 2016. For valuation of household’s total livestock, we used average price for livestocks sold in that year, while for savings outstanding we divided saving interest income by average deposit rate.</td>
</tr>
</tbody>
</table>
