The Credit-Driven Business Cycles in South Korea: How Important is the Credit Supply Channel?

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Abstract

This study analyzes the dynamics between credit (household debt) and economic growth in South Korea from 2000 to 2020. We show that they empirically have an intertemporal trade-off relationship, as previous cross-country studies suggest. We employ the three-stage least squares method to demonstrate that the credit supply channel primarily mediates the relationship. Our findings indicate that in the loan market, where banks have the incentive to oversupply, changes in the lending attitude of banks due to macroprudential regulations imposed by policy authorities concerned with excessive credit movement explain a substantial portion of household debt fluctuations and the resulting economic activity. This channel – the so-called "credit supply channel" – accounts for 72% of the growth rate sensitivity over the next two years to the household debt ratio.

Key words: credit, household debt, macroprudential regulation, lending attitude

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1. Introduction

Before the global financial crisis, the consensus regarding the role of credit in explaining business cycles in macroeconomics was largely that credit was merely a veil for economic fluctuations (Woodford 2003; Kiyotaki 2011). However, since the crisis, the role and significance of credit being not trivial have been increasingly widely accepted. Some influential studies showed that the rapid increase in credit to private sectors heightens, with a time lag, the likelihood of an economic recession, sometimes accompanied by a financial crisis, thus threatening the real economy and financial stability (Schularick & Taylor 2012; Mian & Sufi 2014; Mian et al. 2017).

Since the early 2000s, the relationship between credit and economic growth in South Korea has also attracted the attention of the central bank and academics. This is because credit to the private sector, mainly household debt, has been increasing rapidly, fluctuating around the upward trend ever since. Corporate debt has also shown a sharp rise in recent years. The household debt to nominal gross domestic product (GDP) ratio increased by 49.1%p (51.9%→101.0%) over the past 21 years, and the corporate debt to nominal GDP ratio increased by 6.6%p in the fourth quarter of 2020 compared with the same period in 2019 (Figure 1).

[Figure 1]

This paper analyzes the empirical relationship between household debt and economic growth in South Korea from 2000 to 2020, and then, it attempts to determine the main channel to explain the results. Specifically, it tries to answer the following two questions:

- Is the surge in credit related to future growth slowdown? If so, how much?
- If the increase in credit is related to a future slowdown in economic growth, what is the main channel that can explain this?

Using South Korea's macrovariable data since 2000, this study confirms the robustness of the results of previous studies by providing empirical evidence that the rapid increase in household debt is related to the subsequent slowdown in economic growth. Notably, the sample period of the present study does not include the domestic banking crisis experienced by the majority of target countries in most previous studies. This is an important feature of this study. The causes of banking crises are diverse and may include factors besides credit surges (e.g., capital outflows) as is usually observed in reality. If so, the true degree of the trade-off between credit expansion and future growth might be less than that suggested by the previous studies.

Another feature of this paper is that credit cycles are analyzed by identifying the credit demand-led and supply-led phases (shifts of credit demand and supply curves). When determining the causes of credit fluctuations and measuring their effects on the quantity of credit, one must identify credit demand and credit supply. This is because the trend and cyclical change in credit is mainly due to the supply side rather than the demand side, according to previous studies on several countries. In particular, the credit cycle is divided into four phases and analyzed based on the direction of quantity (household debt to GDP ratio) and price (household loan interest rate).

Finally, this study explains the increase in household debt and the subsequent slowdown in growth as the result of the endogenous interactions between lenders (banks) and policy authorities with their own incentives. Such interactions affect economic growth via credit fluctuations and consumption-driven aggregate demand channels. Specifically, the macroprudential intervention of the policy authorities to achieve financial stability is suggested as the cause of the change from the optimistic lending attitude of the lenders to the pessimistic one. This can be seen as a new contribution in light of the fact that Mian et al. (2017) and others, who emphasized the adjustment of the behavioral bias of lenders as a cause generating credit and economic cycles, failed to provide a specific reason why such adjustment happens. Therefore, the explanation presented in this paper can be interpreted as combining financial friction theory and behavioral bias theory while complementing the latter's weaknesses. It is suggested that the endogenous interaction between banks and policy authorities acts as a shock of lending constraints, which slows credit growth with a time lag, resulting in aggregate demand and a subsequent slowing of growth.

The structure of this paper is as follows. Section 2 examines two theories that explain the relationship between credit and economic growth. Section 3, we empirically investigate how much an increase in credit contributes to predicting a future economic downturn to answer the first question.. Section 4 deals with the second question. We identify and assess the importance of the major channel through which the intertemporal trade-off between the credit and economic growth occurs.

2. Literature Review

2.1 What Causes Intertemporal Trade-off Relation Between Credit And Growth?

Several empirical studies have analyzed that the surge in private credit is closely related to the boom–bust of the real economy (Mian et al. 2017; IMF 2017; Greenwood et al. 2021; Bordalo et al. 2017; Greenwood et al. 2016; López-Salido et al. 2017). In many countries, a period of rapid credit expansion was accompanied by an economic boom, but it was followed by rapid economic

deterioration.[1] This paper refers to this as the intertemporal trade-off between credit and economic growth. In particular, the rapid increase in credit preceded the major banking crisis.[2]

Studies explaining the negative relationship between the credit and future growth are classified into theories based on financial friction and those based on behavioral finance literature.

2.1.1 Financial Friction-Based Theory

This type of study focuses on the effect of amplification and propagation of negative shocks due to imperfection in financial and real markets. Bernanke & Gertler (1989), Kiyotaki & Moore (1997), Eggertsson & Krugman (2012), among others, are notable studies using various types of financial friction, and Fisher's (1933) theory of debt deflation is also an early form of financial friction model. When an exogenous negative economic shock occurs, firms and households experience a decrease in the value of their net assets, which restricts borrowing. Credit contraction from this reduces investment and consumption, thereby amplifying the shock effect. This process is advantageous for explaining the process of the deterioration of the real economy, but it has the disadvantage of failing to identify the cause and frequency of exogenous shocks.

2.1.2 Behavioral Finance-Based Theory

This strand of theories focuses on shaping and reversing the beliefs or expectations of a borrower or lender (investor) to explain why expanding credit and economic activity turn into contraction at any given moment. Therefore, these theories are free from the exogeneity problem of the shock, which the financial friction-based theory suffers. See Minsky (1977) and Kindleberger (1978) for early research on this topic. They focused on i) why investors become overly optimistic, ii) what endogenously reverses this optimism and cripples credit markets, and iii) what the macroeconomic effects are.

For example, during periods of credit expansion, lenders tend to underestimate the risk of borrower default (Greenwood et al. 2016) and maintain an overly optimistic view of the future economy

[1] Mian et al. (2017) analyzed 30 countries from 1960 to 2012, whereas IMF (2017) expanded the target to 80 countries.

[2] The following are major banking crises by country preceded by a surge in private credit: US (1929–1933, 2008), UK (1991), Sweden (1991), Spain (1972), Japan (1992), South Korea (1998). Norway (1987). See Schularick & Taylor (2012) and Mian & Sufi (2014).

(Mian et al. 2017), but if on average the economy falls short of this, a reversal in sentiment occurs. This tendency is commonly referred to as behavioral bias in the behavioral finance literature. Bordalo et al. (2017) introduced the concept of diagnostic expectation formation to explain the tendency of investors' over-reliance on the current economic status news. In this type of study, the shock that results in reversal is endogenous, arising from the irrational expectations of economic agents.

Although logical differences exist between the two approaches to analyzing the relationship between credit and economic fluctuations, the mechanisms of the two theories can be viewed as complementary in practice. The theory based on financial friction is suitable to explain the process by which the entire economy becomes vulnerable and the process by which shocks spread when a shock occurs. Meanwhile, the behavioral finance approach is appropriate to explain the process by which the credit market's psychology is reversed and the shock itself occurs.

2.2 Credit Supply Channel Versus Credit Demand Channel: Which Is More Important In Explaining The Credit Or Business Cycles?

Because the behavioral finance-based theories consider the sentiment of banks or investors as the main cause of credit change, those views indicate that the credit supply channel is more important than the demand channel in explaining credit or business cycles. Regarding the question of which is the primary channel through which credit expands and contracts, the majority of academics favor the credit supply channel. They argued that the phenomenon in which the GDP growth rate declines immediately after credit surges is caused by credit supply shocks caused by changes in, for example, lending attitudes of borrowers as opposed to credit demand shocks caused by factors like permanent income growth and demographic changes.

Mian et al. (2017) noted that examining changes in quantity (loan volume) and price (interest rate) is a useful method for determining which shock, credit supply or demand, is more attributable to the change in household debt. When a positive supply shock (a shift to the right of the supply curve) occurs, the amount of loans increases and interest rates fall, whereas when a positive demand shock occurs, the amount of loans increases and interest rates rise. In a sample of 30 developed countries, a cross-country analysis reveals that the credit spread of household loans (mortgage loan interest rate minus government bond interest rate) narrowed significantly in the four years preceding the household debt explosion of the early 2000s. They argued that this supports that the surge was mainly due to supply shocks.

Some studies have shown the importance of expanding credit supply through episodic analysis (Mian et al. 2020; Favilukis et al. 2012). Through an analysis of the deregulation of U.S. banks in the 1980s, Mian et al. (2020) argued that the expansion of credit supply can stimulate the economy in the short term, but lead to a severe economic downturn in the medium term. They compared and analyzed

the effect of expanding credit supply due to deregulation in 1983 by dividing the states into those that initially eased the requirements for establishing bank branches and those that did not. They found that bank lending (credit supply) increased more between 1983 and 1989 in states that eased banking regulations first, housing prices soared with the economic boom, and the unemployment rate decreased substantially. The house prices rose even more and fell more sharply.

In the case of introducing the euro around 2000, Mian and Sufi (2018) also confirmed that the rapid increase in household debt due to the expansion of credit supply leads to a temporary economic boom and a midterm economic recession. They found that the introduction of the euro has alleviated currency risk, government bond spreads (local government bond yield minus U.S. government bond yield) have decreased significantly, and the credit supply has exploded, especially in Denmark, Finland, Ireland, and Greece, where currency risk was previously high. In addition, various pieces of evidence are being presented to prove a credit supply shock in terms of credit spreads, loan attitude surveys, and the development of new MBS (Mortgage Backed Securities) products before the U.S. subprime mortgage crisis.

3 Empirical Relationship Between Credit and Economic Growth in South Korea

This section empirically investigates how much a credit surge contributes to predicting a future economic downturn in South Korea.

3.1 Empirical Methodology

We analyze the relationship between the change in the private debt ratio and output growth through the following regression equation proposed in Mian et al. (2017). Let y_t be log per capita real gross domestic output (GDO),[3] and let Δ_8 be the average annual change over the previous two years (eight quarters). Moreover, let $d_{H,t}$ and $d_{F,t}$ be the household and firm debt to nominal GDP ratio, respectively. X_t and Y_{t-8} are a vector for control variables with economic significance and one for technical control variables, respectively.

$$\Delta_8 y_{t+h} = \alpha_h + \beta_{H,h}\Delta_8 d_{H,t} + \beta_{F,h}\Delta_8 d_{F,t} + X_t\Gamma_h + Y_{t-8}\Xi_h + e_{t+h}, h = \{0, 8\}$$

[3] For the benchmark estimation, we use per capita real GDO data rather than real GDP because it is believed to more accurately reflect income growth. Using real GDP as the growth variable yields almost identical results.

Therefore, when $h = 0$, the equation examines the contemporaneous relationship between the change in the private debt ratio and the rate of output expansion. When $h = 8$, it checks whether the change in the private debt ratio predicts the average annual growth rate for the next two years. As control variables with economic significance, changes in 10-year Treasury yields (average annual change over the previous two years) and changes in the spread between 10-year and 1-year U.S. Treasury yields (average annual change over the previous 2 years) are considered. From the standpoint of South Korea's economy, a small open economy, the yield on U.S. Treasury bonds and long-term spreads, which represent external financial conditions, are important exogenous variables.

The past level of the output (log GDO) is used as a technical control variable to solve the spurious regression problem. The explanatory variables that includes the change in the private debt ratio is stationary series (I(0)), whereas the two-year average growth rate, which is the dependent variable, includes a unit root. If a regression analysis consisting of a dependent variable with I(1) and an explanatory variable with I(0) is performed, spurious regression occurs because the unit root is included in the residual (Stewart 2006). Following the idea of Hamilton (2018), we address this issue by setting the historical level of the growth as a control variable.

Two regression equations for $h = 0$ and 8 are simultaneously estimated using the ordinary least squares method (OLS), and statistical inference is performed through the block bootstrap method taking into account the potential autocorrelation of the error terms and the correlation between the error terms. Both the dependent and explanatory variables have high persistence, so the error term likely has an autocorrelation. In addition, considering economic fluctuations, a correlation is highly likely to exist between the current and future growth rates that are not explained by the same explanatory variable. In the case of statistical inference through the bootstrap method, the block size was set to 8 and the bootstrap replication was performed 30,000 times.

3.2 Results

In our analysis of the South Korean economy since 2000, we show an intertemporal trade-off by estimating the household debt and economic growth. A 1%p (year-on-year, annual average) increase in the household debt ratio is associated with 0.3%p (annual average) growth during the same period, but a slowdown in growth of 0.3%p (annual average) is predicted for the next two years. Refer to columns (3) and (4) of Table 1.

[Table 1]

This means that growth accompanied by excessive household borrowing has to pay the future

growth slowdown as its cost. This also suggests that the permanent income hypothesis based on "rational expectations" cannot adequately explain the empirical relationship between household debt and economic growth. Under the permanent income hypothesis, an increase in debt should be associated with an increase in the future growth rate because households only increase their consumption through borrowing when their future income is expected to increase permanently. Even if the forecast horizon is extended to three years ($h = 12$), the intertemporal trade-off relationship between household debt and economic growth is still valid (see Figure 2).

However, the negative sensitivity of future growth over the past two years to the household debt ratio shows a gradual easing after peaking in two years ($h = 8$). The sensitivity of real GDP to household debt shows a pattern similar to that of real GDO (Figure 2).

[Figure 2]

Additionally, the relationship between corporate debt and growth is examined. In contrast to the case of household debt, however, they do not show an inter-period trade-off. See the second row in columns (3) and (4) in Table 1. Even if corporate bonds are included in corporate debt, the result is the same, although not reported here. This is presumably because the proportion of corporate bonds in corporate debt (around 20% on average for 2015–2020) is relatively low. The increase in the corporate debt ratio shows a negative correlation with economic growth during the same period. However, the relationship with the subsequent growth rate is not statistically significant (see Figure 3). Previous studies have empirically demonstrated the tendency for corporate debt to increase during recessions. The estimation result regarding corporate debt to nominal GDP ratio in this study seems to be consistent with those findings.

[Figure 3]

One thing to note is that after South Korea's currency crisis in 1997, financial institutions' loans have been concentrated on households rather than corporations. Given the foregoing points, this may be a reason why the growth rate in South Korea is empirically more related to household debt than to corporate debt.

The relationship between the household debt ratio and consumption growth is also examined, and the regression result is shown in Figure 4. Each consumption growth variable is used as a dependent variable in the previous regression's baseline specification. When the household debt ratio increases, consumption expenditure also increases but then slows down, as shown in the case of economic growth. An increase of 1%p (two-year average) in the household debt ratio is associated with private consumption growth of 0.6%p (annual average) concurrently. However, a decrease of 0.5%p (annual

average) in private consumption is predicted for the next two years. When examining consumption expenditures by type, consumption expenditures for durable goods, non-durable goods, and services all show a statistically significant intertemporal trade-off with household debt. The magnitude of the trade-off was most prominent in the consumption of durable goods. A 1%p increase in the household debt ratio is associated with a 1.2%p increase in durable goods consumption expenditure contemporaneously but a 1.7%p decrease intertemporally.

[Figure 4]

4 How Important is Credit Supply Channel?

This section identifies the primary channel through which the intertemporal trade-off between the credit surge and the economic downturn occurs. It also measures the channel's importance.

4.1 Some Empirical Facts About Cyclicality of Credit and Economic Activities

4.1.1 Identification of Credit (Loan) Supply/Demand-Led Phases

To understand the results of the previous section, that is, "the increase in the household debt ratio is related to the subsequent slowdown in growth," we must look at the causes of the increase in the household debt ratio in terms of not only loan interest rate but also the factors shifting credit (loan) demand and supply curves. If lenders' behavioral bias is a meaningful channel, an increase in the household debt ratio should show a significant correlation with, for example, bank's lending attitude. This is because behavioral bias shifts the loan supply curve by altering lending attitudes. Alternatively, if the financial friction theory is the dominant channel, whether the increase in the household debt ratio is due to a change in loan supply or demand is not quantitatively important. Considering this point, we identify and analyze credit fluctuations into the credit demand-led and supply-led phases (shift of loan demand and supply curves). This is in consideration of the fact that the trend and cyclical surge in credit in previous studies targeting a number of countries is mainly due to the factors related to the supply side rather than to the demand side. After identifying the peaks and troughs of quantity (household debt ratio) and price (household loan interest rate), we define expansion and contraction phases according to the peak/trough identification method described by Dupraz et al. (2021) and Mian et al. (2017). The household debt ratio can be divided into four cyclical phases (demand-led expansion, demand-led contraction, supply-led expansion, and supply-led contraction). The following phases are identified as

a result of applying this method.[4]

[Figure 5]

The stylized facts that are found are as follows:

1 A supply-led and demand-led expansion phases of the household debt ratio occur alternately.
2 Before the beginning of the 2010s, in case the household debt ratio decreases, it repeats the pattern of supply-led expansion → demand-led expansion → supply-led contraction → demand-led contraction phase.
3 However, from 2013, the supply-led and demand-led expansion phases took place alternately, and the household debt ratio continued to increase.

4.1.2 The Lending Attitude's Nature of Cyclical Fluctuations

The lending (to household) attitude index, a variable that represents changes in credit supply (supply curve shift), exhibits predictable (2–3 years cycle) fluctuations in South Korea (Figure 6). The results are comparable to those of Favilukis et al. (2013), who used credit standards as a proxy for loan supply to analyze changes in housing prices. This indicates that the attitude will become stricter after two to three years when the current lending attitude is accommodative.

[Figure 6]

We contend that the predictability of such lending attitudes results primarily from endogenous interactions between banks and macroprudential policy authorities. Due to the interaction between banks and policy authorities with their own incentives, the household loan attitude index appears to exhibit cyclical fluctuations (mean reversion). South Korean banks are incentivized to keep expanding supply mainly on mortgage loans due to i) profit maximization motive, ii) absence of internalization of externalities, and iii) behavioral bias. Since the LTV (Loan to Value) level in South Korea has been relatively low, interbank loan competition for top-line expansion has been consistent with banks' profit maximization objective, because mortgage loans have been a key financial product that can achieve lower risk and stable returns than other investment products. Another factor to consider when deciding about loan behavior is that banks are not incentivized to consider negative externalities caused by the

[4] Although not reported here, the cyclical fluctuations in the household debt ratio identified by this method are generally consistent with indicators such as the household debt ratio gap and household debt growth rate.

surge in household debt. This negative externality problem has existed not only in South Korea but also in other advanced economies; therefore, the problem is intrinsic. A typical example of a negative externality is a phenomenon in which the income of other households also decreases (aggregate demand externality) when borrowing households reduce their consumption expenditure during a credit contraction period, and a phenomenon in which the value of collateralized assets of neighboring households also decreases when collateralized assets are sold during times of financial distress (pecuniary externality). However, banks do not consider this when making a loan decision. Hence, business cycles are more amplified than in an economy where banks internalize this externality. The third factor that makes lending attitudes cyclically fluctuating is the banks' tendency to underestimate both the upside and downside risk (Greenwood et al. 2016). In the case of South Korea, banks tend to predict more conservative lending attitudes than actual lending attitudes concerning policy authority regulations. When the household debt ratio rises sharply, policymakers take action, causing banks to anticipate a more stringent household lending attitude. However, the realized loan attitude tends to be more restrictive than the bank's forecast, demonstrating a negative correlation between the two-year increase in the household debt ratio and the forecast error (Figure 7). Conversely, when the debt ratio falls sharply, banks anticipate an accommodative lending attitude. However, the realized ones turn out to be more accommodative.

[Figure 7]

Policy authorities in South Korea have been responding to the negative externalities of household loans through a series of macroprudential policies after learning about the negative externalities caused by excessive corporate debt through the currency crisis in 1997. Due to the crisis, it incurred the economic costs of financial instability. This is because the crisis caused by bank failures severely harmed the real economy by restricting credit access and causing additional corporate failures. The fact that the Bank of Korea's economic outlook appears to partially reflect potential risks to the real economy from household debt is evidence of learning. The Bank of Korea's real GDP forecast for $t+2$ years tends to decrease when the household debt ratio increases (See Figure 8). The fact that a positive relationship exists between the increase in the household debt ratio and the forecast error also supports this tendency, even though the statistical significance is low, and the sample size is not sufficiently large.

[Figure 8]

As the importance of macroprudential policies, centered on the BIS (Crockett 2000; Borio 2003), has been emphasized, South Korean policy authorities have been implementing measures to prevent

financial instability caused by the surge in household debt since 2002. Macroprudential regulations have been concentrated during the late supply-led and early demand-led expansion phases, when the household debt ratio is rapidly increasing (see Figure 9).

[Figure 9]

4.2 Identification of the Credit Supply Channel

This section evaluates the importance of the credit supply channel in South Korea based on the credit supply hypothesis and the consensus of prior research.

4.2.1 Conceptual Framework

Our identification strategy for the credit supply channel has the following conceptual framework (See Figure 10). During the early phase of a supply-led expansion, banks expand credit supply due to a profit maximization motive, the absence of internalization of externalities, and behavioral bias, and the household debt ratio consequently rises. A surge in the household debt ratio prompts policymakers to intervene to mitigate the risk of financial instability. Enforcement of regulations by policy authorities aggravates lending attitudes (supply curve shifts to the left), which leads to a slowdown in the household debt ratio and a slowdown in growth. Since the household debt ratio and growth show a positive (+) correlation in the same period, a cyclical change in the household debt ratio suggests a cyclical change in economic growth rate. Briefly, the tightened lending attitude brought about by the strengthening of regulations and the resulting decline in the household debt ratio result in a slowdown in growth and sluggish aggregate demand. We argue that the credit supply channel outlined above is an important mechanism for explaining the negative relationship between current household debt and future economic growth. In reality, credit demand-led phases could also exist between supply-led phases, although we do not focus on those in this paper. For example, in the credit demand-led expansion period, an increase in both asset price and household debt ratio tends to accelerate while stimulating each other. Previous studies have attributed the credit demand-led expansion to the self-enhancing property of housing prices.

[Figure 10]

4.2.2 First- and Second-Stage Regression: Changes in Lending Attitude Act as an Important Determinant of Cyclical Changes in the Household Debt Ratio.

In South Korea, if the household debt ratio rises sharply, it tends to decelerate and decrease over the subsequent two years. An estimated 1%p (annual average for 2 years) increase in the historical household debt ratio will contribute to a 0.44%p (annual average) decrease over the next two years. Here, 0.44%p is the regression coefficient of the two-year cycle change in the household debt ratio.

[Figure 11]

We estimate to what extent the credit supply channel contributes to this mean reversion tendency of the household debt ratio as follows. Specifically, the degree to which changes in lending attitude caused by endogenous interactions between banks and policy authorities contribute to cyclical changes in the household debt ratio is analyzed via a two-stage regression analysis employing the methodology of López-Salido et al. (2017).

In the first stage, we estimate the following equation based on the hypothesis that in the case of a sharp increase (decrease) in the household debt ratio, policy authorities will respond with contractionary (expansionary) macroprudential regulations with a time lag, and consequently, banks' lending attitudes will be tightened (eased), resulting in a decrease (an increase) in the index. $\Delta_8 a_{t+8}$ is the change in lending attitude index trend from t to $t+8$, and $\Delta_8 d_{H,t}$ is the average annual change in the household debt ratio from $t-8$ to t.

$$\Delta_8 a_{t+8} = \theta_0 + \theta_1 \Delta_8 d_{H,t} + u_{t+8}$$

The second-stage regression is conducted under the hypothesis that the tightening of lending attitudes (loan supply curve shift to the left) due to regulations will result in a slowdown or decrease in the household debt ratio. $\Delta_8 \widehat{\alpha_{t+8}}$ is the predicted value from the first-stage regression of the change in the lending attitude index trend from t to $t+8$.

$$\Delta_8 d_{H,t+8} = \kappa_0 + \kappa_1 \Delta_8 \widehat{\alpha_{t+8}} + v_{t+8}$$

The result of the analysis indicates that the cyclical change in the household debt ratio is substantially explained by the interaction between banks and policymakers and the variation in loan supply (Figure 12). A 1%p (annual average) increase in the household debt ratio over the past two years predicts a 0.44%p (annual average) slowdown in the household debt ratio over the next two years due

to a shift in the loan supply curve.

[Figure 12]

4.2.3 Third-Stage Regression: Credit Supply Channels Account for Much of the Trade-Off Between Household Debt and Future Economic Growth.

To estimate the degree of influence of the household debt ratio on future growth through the credit supply channel, the additional third regression equation is estimated. Previously, the change in the household debt ratio in period t was used as the explanatory variable. However, here, the change in the household debt ratio for the next two years, which the change in the household debt ratio in period t predicts through the credit supply channel, is used as the explanatory variable.

$$\Delta_8 y_{t+8} = \beta_0 + \beta_1 \Delta_8 \widehat{d_{H,t+8}} + Z_{t+8}\Gamma + e_{t+8}$$

In this specification, β_1 is an estimator of the sensitivity of growth for the next two years to the conditional forecast ($\Delta_8 \widehat{d_{H,t+8}}$) of the household debt ratio change for the next two years due to the interaction between banks and policy authorities. $\Delta_8 y_{t+8}$ is the average annual growth from t to $t+8$. $\Delta_8 \widehat{d_{H,t+8}}$ is the predicted value from the second-stage regression of the change in the household debt ratio from t to $t+8$, which is the value predicted through the credit supply channel by the average annual change in the household debt ratio from $t-8$ to t, $\Delta_8 d_{H,t}$. Z_{t+8} is a vector for control variables with economic significance. Then, the sensitivity of the growth rate for the next two years to the 1%p increase in the household debt ratio at t explained by the credit supply channel is measured by ($\widehat{\theta_1}$ x $\widehat{\kappa_1}$ x $\widehat{\beta_1}$)%p. Recall the following:

▪ **First-stage regression coefficient:** $\widehat{\theta_1}$ shows the sensitivity to the change in the lending attitude index trend from t to $t+8$ to the average annual change of 1%p in the household debt ratio from $t-8$ to t.

▪ **Second-stage regression coefficient:** $\widehat{\kappa_1}$ indicates the sensitivity in the change of the household debt ratio in the $t+8$ period to a 1 unit increase in the change of the conditional household lending attitude index trend in the $t+8$ period.

The importance of the credit supply channel is evaluated by comparing the sensitivity estimate

($\widehat{\theta_1}$ x $\widehat{\kappa_1}$ x $\widehat{\beta_1}$) and the sensitivity of future growth ($\widehat{\beta_{H,h}}$) to the household debt ratio estimated in the basic model of Section 3. The result shows that an increase in the household debt ratio can explain a substantial portion of the future slowdown in i) GDO, ii) consumer spending, and iii) facility investment via the credit supply channel. Refer to Table 2.

[Table 2]

Considering the specific values of the estimates, the increase in the household debt ratio of 1%p (annual average) over the past two years will result in the following change over the next two years (annual average) via the credit supply channel: i) 0.2%p growth slowdown, ii) 0.4%p consumption expenditure slowdown, and iii) 1.0%p slowdown in facility investment.

Notably, considering the share of facility investment in the service industry in South Korea (approximately 41% of total facility investment as of 2020) and the fact that the service industry is closely related with consumption expenditure, this result suggests that the credit supply channel causing the intertemporal trade-off between credit and growth works mainly through the consumption-oriented aggregate demand channel. The results show that the credit supply channel explains the 72% sensitivity of growth (measured by GDO) to the change in the household debt ratio over the next two years. Furthermore, the credit supply channel explains the sensitivity of consumer spending by 78%, which means that a growth slowdown is accompanied by a slowdown in aggregate demand mainly driven by the change in consumption expenditure.

5 Conclusion

Through an analysis of South Korea from 2000 to 2020, this study shows that credit (household debt) and economic growth have an intertemporal trade-off relationship. This suggests that the future growth slowdown must compensate for excessive credit and economic growth today. This also means that when policy authorities consider credit and macroprudential policies to stabilize economic growth and financial stability, they should consider the intertemporal effects on the growth of such policies.

Furthermore, based on previous studies identifying the supply side of credit as the main cause of the credit cycle, this study measures the importance of the credit supply channel in the cyclical fluctuations in South Korea's household debt ratio and growth. This study shows how the credit supply channel operates. In the loan market where there is an oversupply incentive for banks, the change in the lending attitude of banks because of macroprudential regulations by policy authorities concerned with excessive credit movement explains a substantial portion of household debt fluctuations and the

resulting economic activity. The credit supply channel explains the 72% growth sensitivity to the current change in the household debt ratio over the next two years. This channel's existence can be interpreted as evidence of the effectiveness of macroprudential policies.

However, it should be noted that implementing macroprudential policies may amplify economic fluctuations if the appropriateness of the regulatory strength and timeliness of the implementation are neglected. In addition, market participants must be encouraged to form rational expectations for credit and asset markets by enhancing predictability and consistency of macroprudential regulations.

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TABLE 1
CREDIT EXPANSION AND CONTEMPORANEOUS AND FUTURE TWO-YEAR REAL GROSS DOMESTIC OUTPUT (GDO) GROWTH

	Dependent Variable: $\Delta_8 y_{t+h}$					
	2002.1/4–2020.4/4				2012.1/4–2020.4/4	
	$h = 0$	$h = 8$	$h = 0$	$h = 8$	$h = 0$	$h = 8$
Explanatory variable:	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_8 d_{H,t}$	0.36* (0.19 0.52)	-0.29* (-0.49 - 0.10)	0.34* (0.24 0.45)	-0.31* (-0.48 - 0.14)	0.24* (0.01 0.48)	-0.35* (-0.54 - 0.11)
$\Delta_8 d_{F,t}$	-0.19* (-0.32 - 0.06)	-0.04 (-0.20 0.10)	-0.11* (-0.19 - 0.02)	-0.00 (-0.14 0.14)	0.46* (0.23 0.67)	0.04 (-0.24 0.26)
change in 10-year U.S. Treasury yields	0.59 (-0.08 1.27)	-1.43* (-2.21 - 0.63)	0.84* (0.33 1.34)	-1.12* (-1.83 - 0.38)	3.16 (-1.26 6.71)	-4.43* (-9.30 - 0.60)
changes in spread between 10-year and 1-year U.S. Treasury yields	0.16 (-0.27 0.61)	0.40 (-0.10 0.94)	-0.13 (-0.48 0.21)	0.25 (-0.25 0.74)	-2.53 (-6.01 1.66)	4.13* (0.42 8.93)
Technical control variable			✓	✓	✓	✓
adj. R^2	0.41	0.34	0.67	0.47	0.71	0.90

Notes. This table presents results from the estimation of the following specification $\Delta_8 y_{t+h} = \alpha_h + \beta_{H,h}\Delta_8 d_{H,t} + \beta_{F,h}\Delta_8 d_{F,t} + X_t\Gamma_h + Y_{t-8}\Delta_h + e_{t+h}$, for $h = \{0, 8\}$. The estimates for the constant and the technical control variable (Y_{t-8}) are omitted. * indicates the *p-value* < 0.1. The two values in parentheses are 90% confidence interval based on the block bootstrap standard error.

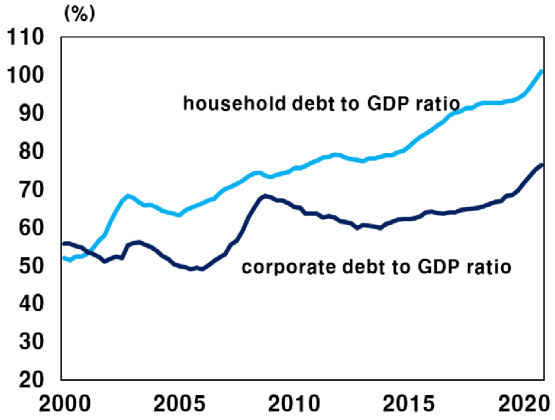
TABLE 2
CONTRIBUTION OF CREDIT SUPPLY CHANNEL TO GROWTH

	GDO	GDP	Consumption	Investment
Supply Channel Sensitivity ($\widehat{\theta_1}$ x $\widehat{\kappa_1}$ x $\widehat{\beta_1}$)	-0.22* (-0.52 -0.04)	-0.15* (-0.40 -0.01)	-0.37* (-0.81 -0.08)	-0.98* (-2.48 -0.06)
Third stage ($\widehat{\beta_1}$)	0.52* (0.19 0.83)	0.35* (0.06 0.62)	0.85* (0.46 1.24)	2.25* (0.27 4.14)
Total Sensitivity ($\beta_{H,h}$)	-0.31* (-0.48 -0.14)	-0.24* (-0.40 -0.07)	-0.47* (-0.70 -0.23)	-1.51* (-2.36 -0.66)
Contribution of Supply Channel (%)	72%	64%	78%	65%

Notes. This table presents the results three-stage OLS regression to measure the size of the contribution of the credit supply channel in South Korea. * indicates the *p-value* < 0.1. The two values in parentheses are 90% confidence interval based on the block bootstrap standard error. The contribution of the supply channel is calculated as Supply Channel Sensitivity/Total Sensitivity. GDO, gross domestic output; GDP, gross domestic product.

FIGURE 1. DEBT TO NOMINAL GROSS DOMESTIC PRODUCT (GDP) RATIO BY BORROWING SECTOR IN SOUTH KOREA

RATIO



CHANGE IN RATIO

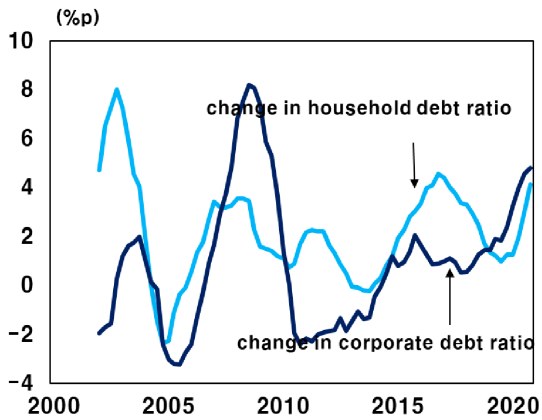
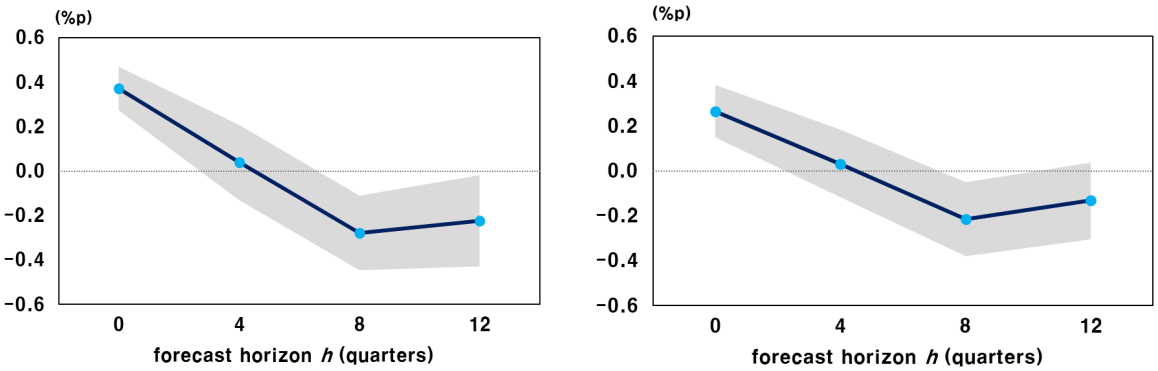


FIGURE 2. SENSITIVITY OF GDO AND GDP TO HOUSEHOLD DEBT

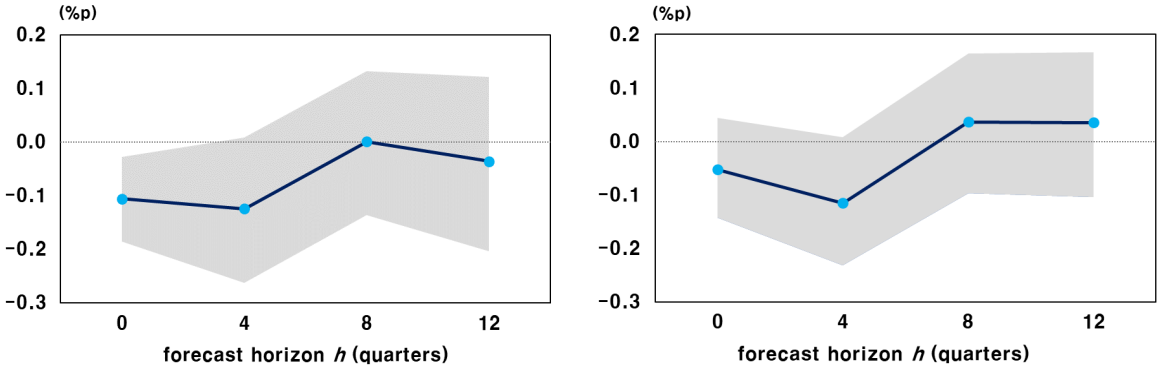
GDO GDP



Notes. This figure presents the estimates for $\beta_{H,h}$ by forecast horizon. Therefore, this can be interpreted as if household debt to the GDO (GDP) ratio increases by 1%p, the GDO (GDP) growth rate increase by $\beta_{H,h}$%p. The gray area represents the 90% confidence interval. GDO, gross domestic output; GDP, gross domestic product.

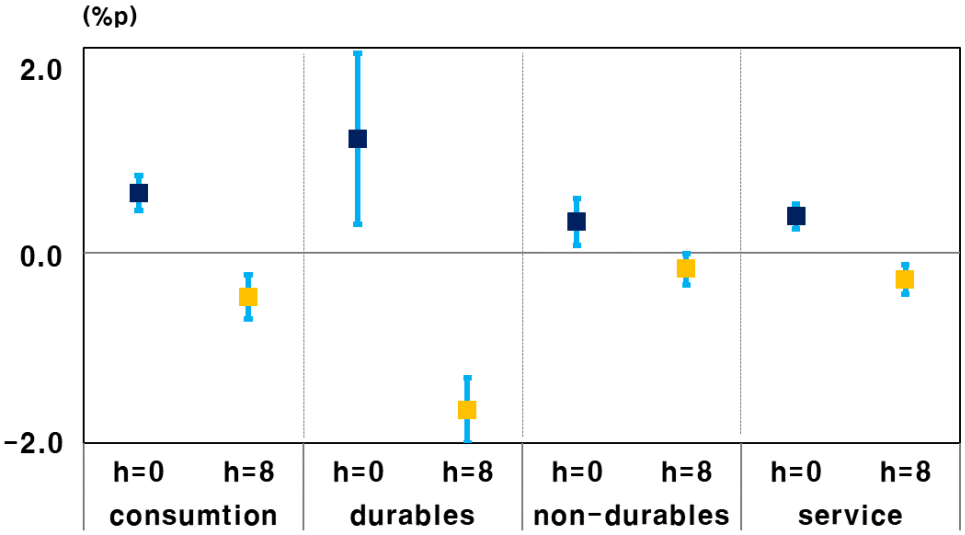
FIGURE 3. SENSITIVITY OF GDO AND GDP TO CORPORATE DEBT

GDO GDP



Notes. This figure presents the estimates for $\beta_{F,h}$ by forecast horizon. Therefore, this can be interpreted as if corporate debt to the GDO (GDP) ratio increases by 1%p, the GDO (GDP) growth rate increase by $\beta_{F,h}$%p. The gray area represents the 90% confidence interval. GDO, gross domestic output; GDP, gross domestic product.

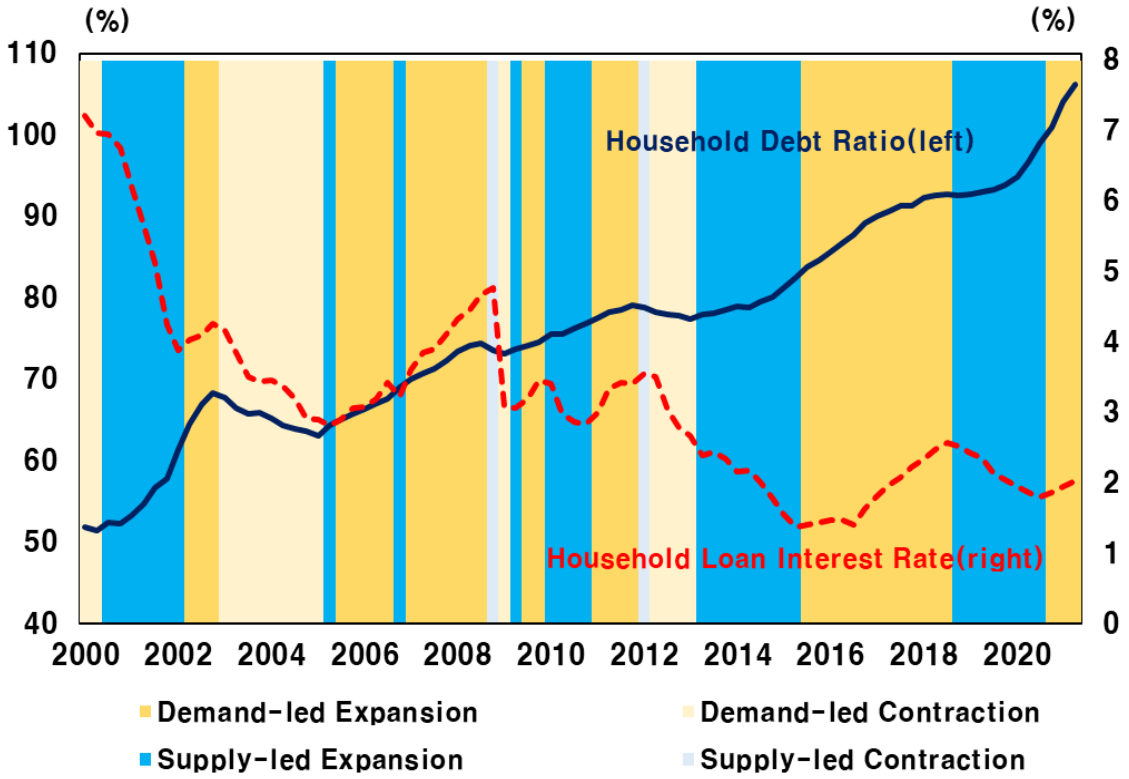
FIGURE 4
RELATIONSHIP BETWEEN HOUSEHOLD DEBT AND CONSUMPTION



Notes. The square dot is the estimate for $\beta_{H,h}$ when each consumption growth variable is used as a dependent variable in the regression baseline specification. The bar represents the 90% confidence interval.

FIGURE 5

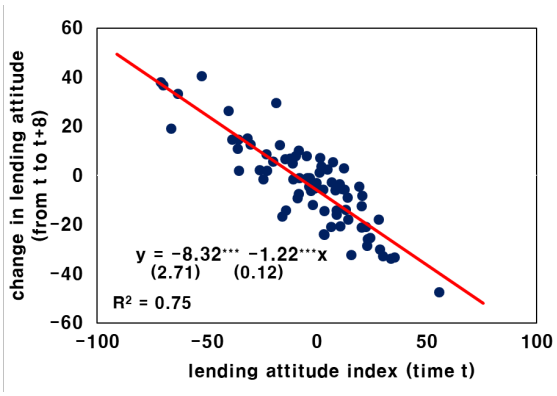
FOUR CYCLICAL PHASES OF HOUSEHOLD DEBT TO NOMINAL GDP RATIO



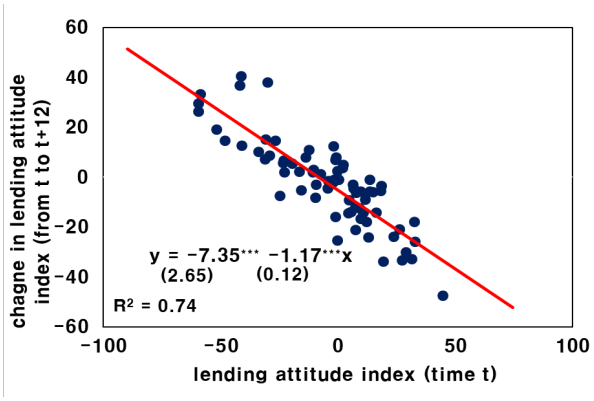
Notes. Household loan rate is deflated by CPI HP trend.

FIGURE 6. MEAN REVERSION OF LENDING ATTITUDE INDEX FOR 2-YEAR AND 3-YEAR HORIZONS

2-YEAR HORIZON



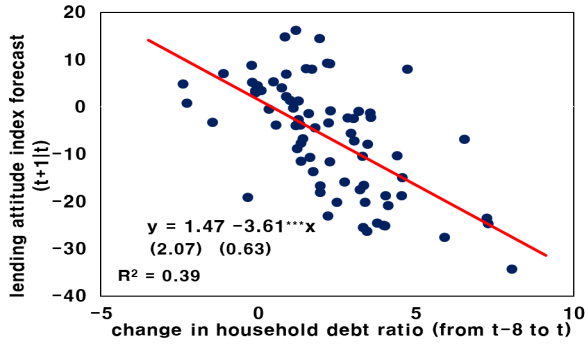
3-YEAR HORIZON



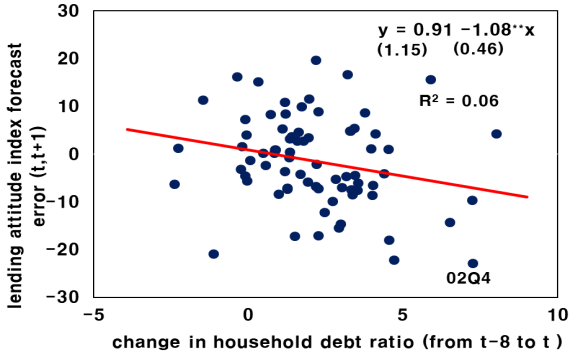
Notes. Values in parentheses are New-West standard errors of OLS estimates. *** indicates *p-value* < 0.01. The sample period is 2000.1/4 ~ 2020.4/4.

FIGURE 7. CHANGE IN HOUSEHOLD DEBT RATIO AND LENDING ATTITUDE INDEX FORECAST

LENDING ATTITUDE INDEX FORECAST OF BANKS CONDITIONAL ON CHANGE IN HOUSEHOLD DEBT RATIO



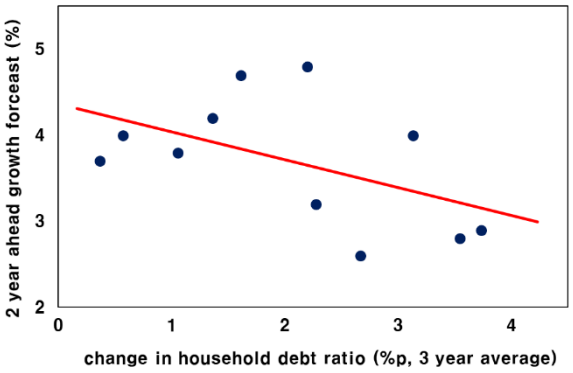
LENDING ATTITUDE INDEX FORECAST ERROR AND CHANGE IN HOUSEHOLD DEBT RATIO



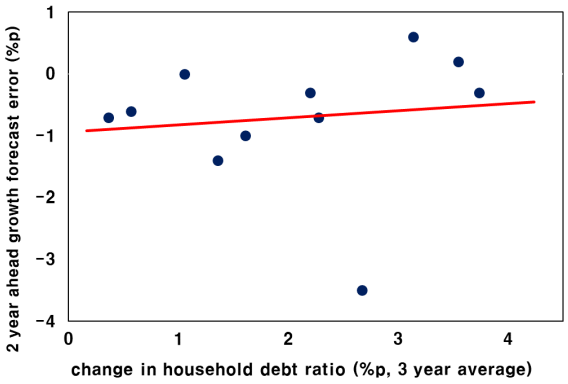
Notes. Values in parentheses are New-West standard errors of OLS estimates. *** and ** indicate *p-value* < 0.01, *p-value* < 0.05, respectively. The sample period is 2002.1/4 ~ 2020.4/4. The forecast error is the lending attitude index at t minus the predicted value at t-1 of the lending attitude index at t

FIGURE 8. CHANGE IN HOUSEHOLD DEBT RATIO AND BANK OF KOREA'S 2-YEAR AHEAD GROWTH FORECAST

2-YEAR AHEAD GROWTH FORECAST



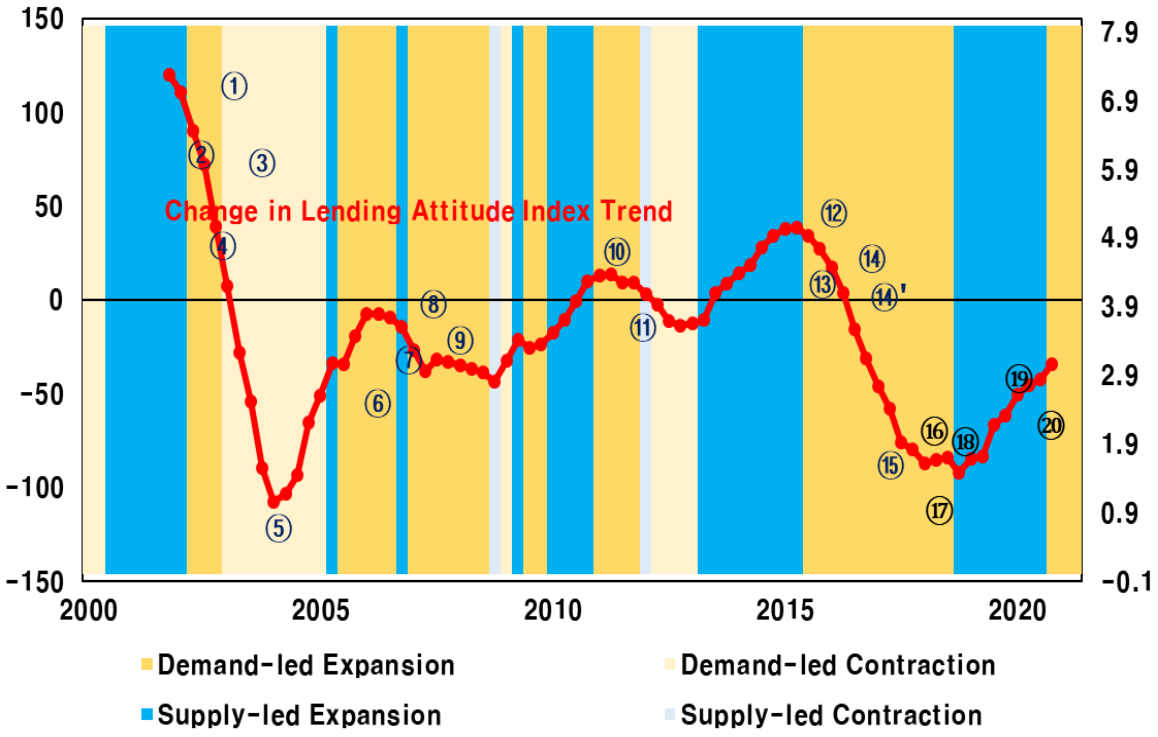
2-YEAR AHEAD GROWTH FORECAST ERROR



Notes. Sample period is 2008–2020.

FIGURE 9

CHANGE IN LENDING ATTITUDE INDEX TREND AND MACROPRUDENTIAL REGULATIONS



Notes. The change in the lending attitude index is defined as the change over 2 years of the cumulated lending attitude index. The sample period is 2000: I–2020: IV. The numbers indicate the date when major restrictive macroprudential regulation measures are pronounced by the financial regulation authorities.

FIGURE 10
CREDIT SUPPLY CHANNEL AND INTERTEMPORAL TRADE-OFF RELATIONSHIP BETWEEN CREDIT AND GROWTH

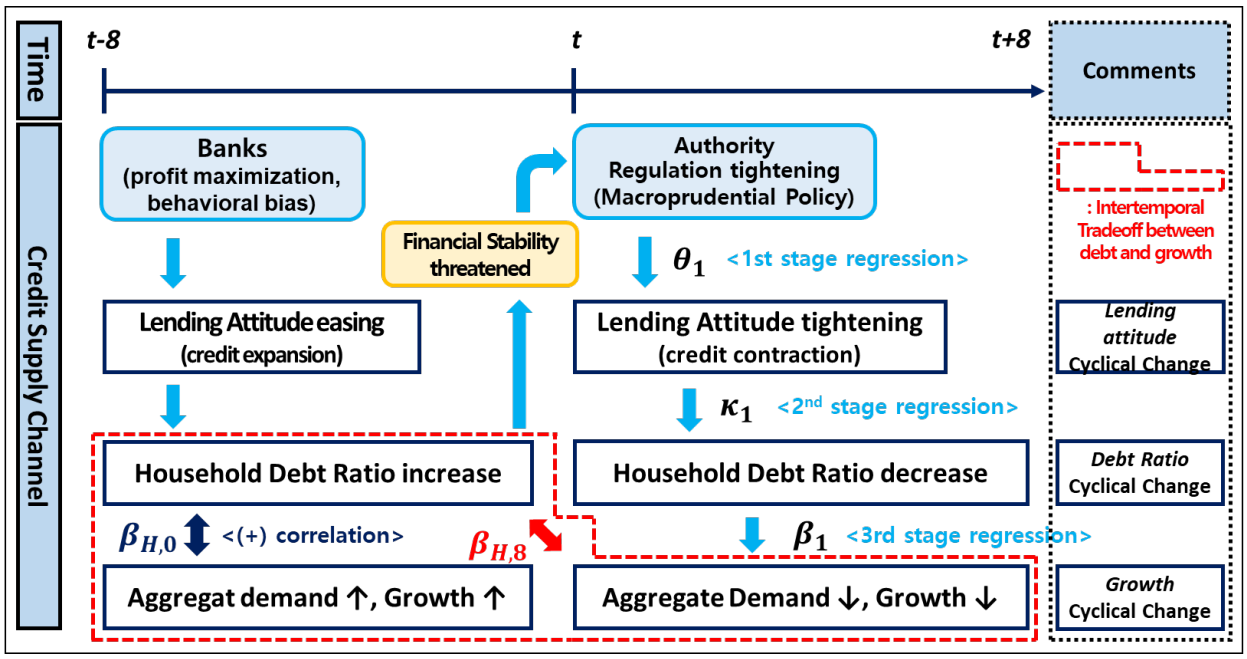
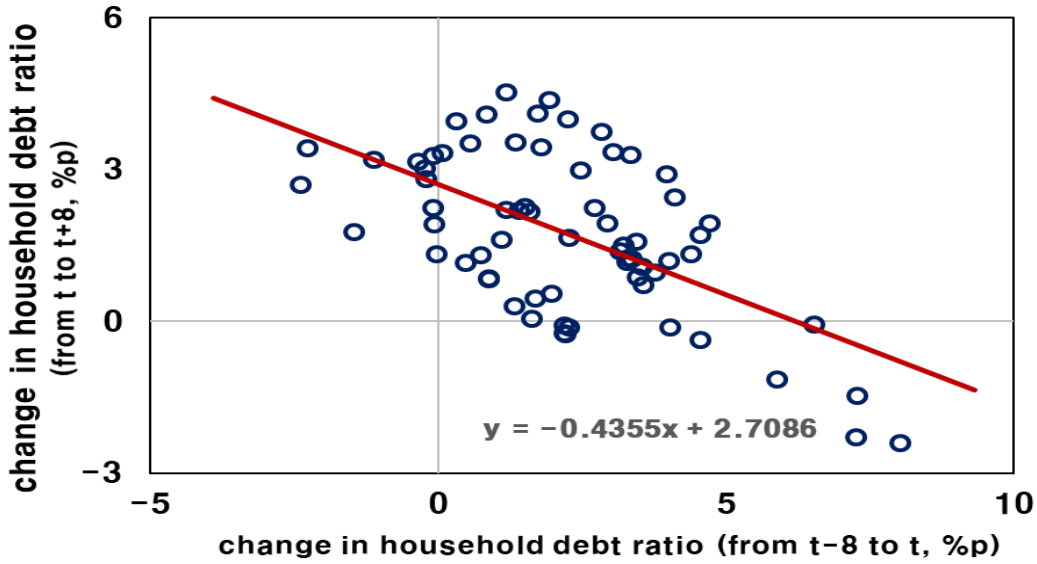


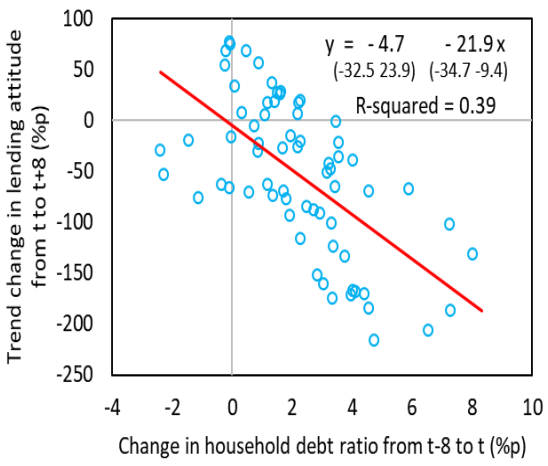
FIGURE 11
MEAN REVERSION OF HOUSEHOLD DEBT RATIO



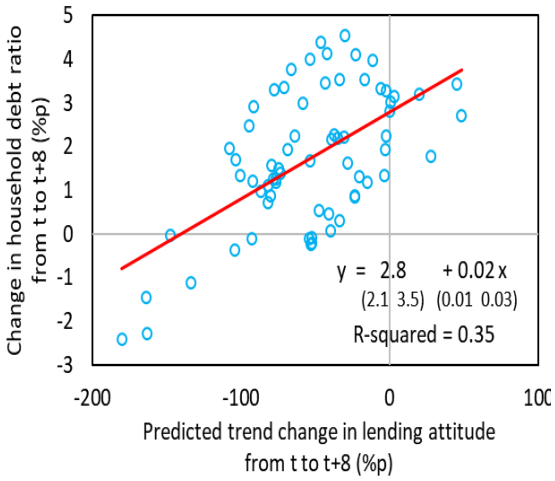
Notes. The sample period is 2000:I–2020:IV.

FIGURE 12. RESULTS OF THE FIRST- AND SECOND-STAGE REGRESSION

FIRST-STAGE REGRESSION



SECOND-STAGE REGRESSION



Notes. The values in parentheses are 90% confidence intervals based on block bootstrap standard errors. Results are based on block size 8 and 30,000 bootstrap replications. The sample period is 2000: I–2020: IV.