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

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Abstract

This paper analyzes the dynamics between credit (household debt) and economic growth in Korea from 2000 to 2020. We show that they have intertemporal trade-off relationship empirically as previous cross-country studies suggest. In order to show that the relationship works mainly through credit (loan) supply channel, we use 3-stage least squares method. The result shows that in the loan market where there is an oversupply incentive, the changes in the lending attitude of banks due to macroprudential regulations by the policy authorities, who are concerned with excessive movement of credit, explain a substantial part of household debt fluctuations and the resulting economic activity. The credit supply channel is shown to explain the 72% sensitivity of growth over the next two years to the household debt ratio.

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

JEL code: G32, G33, G34

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1. Introduction

Before the GFC, the consensus in macroeconomics was that credit was the veil of economic fluctuations (Woodford 2003; Kiyotaki 2011). However, after the crisis, it was widely accepted that the rapid increase in private credit increased the possibility of an economic recession, occasionally accompanied by a financial crisis, threatening the real economy and financial stability (Schularick·Taylor 2012; Mian·Sufi 2014; Mian et al. 2017).

In Korea, the relationship between private credit and economic growth has also continued to be of interest to the central bank and academia since the early 2000's. This is because, private credit, mainly household debt, has been increasing rapidly, fluctuating around the trend ever since. Corporate debt is also showing a sharp rise in recent years. The household debt to GDP ratio increased by 49.1%p (51.9%→101.0%) over the past 21 years, and the corporate debt to GDP ratio increased by 6.6%p in the fourth quarter of 2020 compared to the same period last year.

This paper empirically analyzes the dynamics between private credit and economic growth in Korea from 2000 to 2020, and then tries to find out the main channel to explain the results. Specifically, it tries to answer the following two questions:

1) How is the surge in private credit related to future growth slowdown?
2) If the surge in private credit is related to future growth slowdown, what is the main channel to explain this?

This paper confirms the robustness of the results of previous studies by presenting the empirical analysis that the rapid increase in household debt is related to the subsequent growth slowdown using Korea's macro-variable data since 2000. In particular, it is worth noting that in the most of the previous studies, the sample period of most of the target countries includes the banking crisis experiences, whereas that of this paper does not include ones. This is an important feature of this paper. The causes of banking crises are diverse and could be the factors other than credit surges (e.g. capital outflows) as is usually observed in reality. If so, the true degree of the trade-off between the period of credit expansion and growth could be less than the previous studies suggest.

Another characteristic of this paper is that credit cycles are analyzed by identifying the loan demand-led phase and supply-led phase (shifts of the loan demand and supply curves). It is important to identify credit demand and credit supply in finding the causes of credit fluctuations and measuring their effects on the quantity of credit. This is because the trend and cyclical change in credit is found out to be mainly due to the supply side rather than the demand side in the

previous studies on a number of countries. Specifically, the credit cycle is divided into four phases and analyzed according to the direction of quantity (household debt ratio) and price (household loan interest rate).

Finally, this paper 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 different incentives. Such interactions affect growth through credit fluctuations and consumption-oriented 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 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 put emphasis on the adjustment of the behavioral bias of lenders as a cause generating credit and economic cycles, failed to provide a specific reason why then such adjustment happens. Therefore, the explanation presented in this paper can be interpreted in the form of combining the financial friction theory while complementing the weaknesses of the behavioral bias theory. It is suggested that the endogenous interaction between banks and policy authorities acts as a shock of lending constraints, which slows aggregate demand and leads to a subsequent slowdown in growth.

2. Literature Review

A number of 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 increase in private credit was accompanied by an economic boom, but after that, rapid economic deterioration was observed.[1] This paper refers to this as the intertemporal tradeoff between credit and economic growth. In particular, the rapid increase in private credit preceded the major banking crisis.[2]

Studies explaining the negative relationship between the surge in private credit and future growth are classified into theories based on financial friction and those based on behavioral

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

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

finance.

2.1 Financial Friction-Based Theory

These type of studies 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), etc. are noteworthy studies using various type of financial friction, and Fisher (1933)'s theory of debt deflation is also an early form of the financial friction model. When a negative shock to the economy occurs exogenously, firms and households experience a decrease in their net assets, which limits borrowing, which reduces investment and consumption, thereby amplifying the effect of the shock. This view is advantageous in explaining the process of the deterioration of the real economy, but it has the disadvantage of not being able to identify the cause and frequency of exogenous shocks.

2.2 Behavioral Finance-Based Theory

This strand of theory focuses on the process of shaping and reversing the beliefs or expectations of a borrower or lender (investor) so as not to rely on exogenous assumptions of the shock. For early studies in this regard, see Minsky (1977) and Kindleberger (1978). They focus 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 credit extension periods, lenders tend to underestimate the risk of default on borrowers (Greenwood et al. 2016) and maintain an overly optimistic outlook on the future economic situation (Mian et al. 2017), but if on average, the economy falls short of this, a reversal in sentiment occurs. This tendency is usually referred to as behavioral bias in the behavioral finance literature. Bordalo et al. (2017) introduce the concept of a diagnostic expectation formation to explain the tendency of investors' over-reliance on the current economic status news. From this point of views above, the shock is endogenous due to the irrational expectations of economic agents.

Although there are logical differences between the two approaches to analyzing the relationship between credit and economic fluctuations, in reality, the mechanisms of the two theories can be viewed as complementary to each other. it can be seen that the theory based on financial friction is suitable to explain the process in which the entire economy becomes vulnerable and the process in which shocks spread when a shock occurs, and the behavioral finance approach is suitable to explain the process in which the credit market psychology is

reversed and the shock itself occurs.

3 Empirical Relationship Between Credit and Economic Growth in 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 which was proposed in Mian et al. (2017). Let y_t be log per capita real GDO (Gross Domestic Output)[3], Δ_8 refer to the average annual change over the previous two years (8 quarters) and $d_{H,t}$ and $d_{F,t}$ be household and firm debt to Nominal GDP ratio[4], respectively. X_t and Y_{t-8} are a vector for control variables with economic significance, one for technical control variables, respectively.

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

So, when $h = 0$, the equation tests the contemporaneous relationship between the change of the private debt ratio and the output growth rate. When $h = 8$, it checks whether the change in the private debt ratio is predictive for 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 2 years) and changes in spread between 10-year and 1-year U.S. Treasury yields) (average annual change over the previous 2 years) are considered. From the perspective of the Korean economy, which is 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 issue. The explanatory variable including change in the private debt ratio is a stationary series (I(0)), while 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, the spurious regression occurs because the unit root is included in the residual (Stewart 2006). Following the idea of Hamilton (2018), we address

[3] We use per capita real GDO data rather than real GDP in the estimation because it is thought to be reflect income growth better. For details, see <Appendix #>

[4] For, details, see <Appendix #>

pseudo-regression issue by setting the historical level of the growth as a control variable.

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

3.2 Results

In our analysis of the Korean economy since 2000, it is estimated that household debt and economic growth show an intertemporal tradeoff. A 1%p (year-on-year, annual average) increase in the household debt ratio is related to 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. See columns (3) and (4) in Table 1.

[Table 1]

This means that growth accompanied by excessive household borrowing has to pay future growth slowdown as its cost. This also suggests that "the rational expectations"-based permanent income hypothesis is insufficient to 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 future growth rate because households increase consumption through borrowing only when their future income is expected to increase permanently. Even if the forecast horizon is extended to 3 years ($h = 12$), the intertemporal tradeoff relationship between household debt and economic growth is found out to be still valid.

However, the negative sensitivity of the 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 1).

[Figure 1]

The relationship between corporate debt and growth is also examined. In contrast to the case of household debt, however, they do not show a trade-off between periods. See the second row in the columns (3) and (4) in the Table 1. Even if corporate bonds are included in corporate debt, the result is the same, though not reported here, which 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. The relationship with the subsequent growth rate, however, is not statistically significant (See also Figure 2). The tendency for corporate debt to increase during bad economic times has already been empirically demonstrated in many studies. The estimation result regarding corporate debt to Nominal GDP ratio in this study seems to be consistent with those ones.

[Figure 2]

One thing to note is that after the currency crisis of South Korea in 1997, financial institutions' loans has been concentrated on households rather than corporations. Considering these points, this may be one of the reasons why the growth rate in South Korea are empirically more related to household debt than to corporate debt.

The relationship between household debt ratio and consumption growth is also examined and the regression result is shown in Figure 3. Each consumption growth variables is used as a dependent variable in the baseline specification of the previous regression. When the household debt ratio increases, consumption expenditure also increases, but then slows down as shown in the case of growth. A 1%p (2-year average) increase in the household debt ratio is related to 0.6%p (annual average) private consumption growth contemporaneously, but a decrease of 0.5%p (annual average) private consumption is predicted for the next two years. When looking at consumption expenditures by type, consumption expenditures for durable goods, non-durable goods, and services all show a statistically significant trade-off with household debt intertemporally. The magnitude of the trade-off was most prominent in durable goods consumption. A 1%p increase in the household debt ratio is related to an increase in durable goods consumption expenditure of 1.2%p contemporaneously,, but a 1.7%p decrease in durable goods consumption intertemporally.

[Figure 3]

4 How Important is the Credit Supply Channel?

4.1 Identification of supply and demand-driven phases

In order 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," it is necessary to look at the causes of the increase in the household debt ratio in terms of loan demand and supply.

If lenders' behavioral bias is a meaningful channel, an increase in the household debt ratio should show a significant correlation with loan supply. This is because behavioral bias causes a shift in the loan supply curve by changing the loan supply attitude. On the other hand, if the financial friction theory is an important channel, it is not important whether the increase in the household debt ratio is due to supply or demand for loans. Considering this point, we identify and analyze credit fluctuations into loan demand-driven phase and supply-driven phase (movement 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 supply side rather than 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 periods respectively following the peak/trough identification method described in Dupraz et al. (2021). Conceptully….The household debt ratio can be divided into four cyclical periods (demand-driven expansion and contraction, supply-driven expansion and contraction, respectively). As a result of applying this method, the following phases are identified.[5]

[Figure 4]

The stylized facts that are found are as follows:

① A supply-driven expansion and a demand-driven expansion of the household debt ratio occur alternately.

② Until the early 2010s, there is a period in which the household debt ratio decreases, repeating the pattern of supply-led expansion → demand-led expansion → supply-led contraction → demand-led contraction.

③ However, from 2013, supply-led and demand-led expansion took place alternately, and the household debt ratio continued to increase.

[5] 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. See <Appendix 3>.

4.2 Characteristics of cyclic fluctuations

4.2.1 Loan attitude (supply) has the nature of cyclical fluctuations.

Household loan attitudes, which are proxy variables for loan supply, change with a time lag (2~3 years), and the predictability of such loan attitudes is judged to be the result of endogenous interactions between banks and policy authorities. The household loan attitude index, a variable that represents changes in loan supply (supply curve shift), exhibited predictable (2~3 year cycle) fluctuations.The results are similar to those of Favilukis et al. (2013) using credit standards as a proxy for loan supply to analyze changes in housing prices.

This indicates that when the current household loan attitude is accommodative, after 2-3 years, the household loan attitude will change to tighter.

[Figure 5]

Due to the interaction between banks and policy authorities with different incentives, the household loan attitude index appears to exhibit cyclical fluctuations (mean regression).

In the case of banks, they have an incentive to expand supply mainly on mortgage loans due to profit maximization, de-internalization of externalities, and behavioral convenience. Considering the historical LTV level, mortgage loans are a means of achieving low risk and stable returns, and interbank loan competition for top-line expansion is in line with banks' profit maximization.Another factor to consider when making decisions on loan behavior is that banks have no incentive to consider negative externalities caused by the surge in household debt.

A typical example of 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 (pecuniary externality) when collateralized assets are sold (pecuniary externality) However, the bank does not take this into consideration when making a loan decision. On the other hand, banks tend to underestimate the downside risk during household debt expansion (Greenwood et al. 2016).

In the case of Korea, it was found that banks tend to forecast more accommodative than actual lending attitudes (optimistic outlook bias) despite policy authorities' regulations. When the household debt ratio rises sharply, the policy authorities take a policy response, which causes banks to anticipate a tighter household loan attitude. However, the realized loan attitude is more austere than the bank's forecast, showing a negative correlation between the two-year increase in

the household debt ratio and the forecast error.

[Figure 6]

Policy authorities 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 foreign exchange crisis. It has experienced the economic cost of financial instability from the foreign exchange crisis. This is because the foreign exchange crisis (1998) accompanied by bank bankruptcies severely damaged the real economy by limiting credit access and causing additional corporate bankruptcies.

Evidence of learning evidence is that the Bank of Korea's economic outlook is analyzed to partially reflect potential risks to the real economy due to household debt. ▪ When the household debt ratio increases, the Bank of Korea's real GDP forecast for t+2 years tends to decrease. However, it seems that there is an insignificant positive relationship between the increase in the household debt ratio and the forecast error.

[Figure 7]

As the importance of macroprudential policies has been highlighted, centered on BIS (Crockett 2000; Borio 2003), Korean policy authorities have been implementing measures to prevent financial instability caused by the surge in household debt since 2002. In fact, macroprudential regulations have been concentrated in the late supply-led expansion period and early demand-led expansion period, when the household debt ratio is rapidly increasing.

[Figure 8]

4.2.2 Changes in loan attitude (supply) act as an important determinant of cyclical changes in the household debt ratio.

If the household debt ratio rises sharply (compared to the previous year), the household debt ratio tends to slow down and decrease (compared to the previous year) two years later. A 1%p (annual average) increase in the past household debt ratio is analyzed to contribute to a decrease of 0.44%p (annual average) for the next two years. Here, 0.44%p is the average regression coefficient of the change in the household debt ratio in a two-year cycle.

[Figure 9]

The degree to which changes in loan attitude (supply) caused by endogenous interactions between banks and policy authorities contribute to cyclical changes in household debt ratio (mean regression) was analyzed through two-stage regression analysis. The methodology of López-Salido et al. (2017) was used. In the case of a sharp increase in the household debt ratio, the first-stage regression analysis was estimated as follows under the hypothesis that the policy authorities will respond with macroprudential regulations with a time lag, and accordingly, banks' lending attitudes will be strengthened.

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

$\Delta_8 a_{t+8}$: t기에서 $t+8$기까지의 가계 대출태도지수 추세변화

$\Delta_8 d_{Ht}$: $t-8$기에서t기까지의 가계부채비율 증감(전전년동기대비, 연평균)

A two-step regression analysis was carried out as follows under the hypothesis that the strengthening of loan attitudes (reduction of loan supply) due to regulations would cause a slowdown or decrease in the household debt ratio.

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

$\Delta_8 \hat{a}_{t+8}$: t기에서 $t+8$기까지의 대출태도지수 추세변화 1단계 예측치

As a result of the analysis, it appears that the change in loan supply caused by the interaction between banks and policy authorities explains to a large extent the cyclical change in the household debt ratio (mean regression). A 1%p (annual average) increase in the household debt ratio over the past two years appears to predict a slowdown in the household debt ratio of 0.42%p (annual average) for the next two years through changes in loan supply.

[Figure 10]

4.2.3 Loan supply channels account for much of the trade-off between household debt and periods of growth.

The reduced loan attitude (supply) due to the strengthening of regulations by the policy authorities and the resulting slowdown in the household debt ratio lead to a slowdown in growth accompanied by sluggish aggregate demand. In other words, the loan supply path appears to be an important path to explain the negative relationship between household debt and future growth.

The path of loan supply (interaction between banks and policy authorities) where the household debt ratio affects future growth can be explained through the following conceptual diagram.

[Figure 11]

Banks expand loan supply (supply-led expansion period) for reasons such as profit maximization, de-internalization of externalities, and behavioral convenience, and accordingly, the household debt ratio increases. A surge in the household debt ratio triggers intervention by policymakers to lower the risk of financial instability. Reinforcement of regulations by policy authorities causes a decrease in lending attitudes (supply), 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 growth.

In order to estimate the degree of influence of the household debt ratio on future growth through this route, the previous 1st and 2nd regression equations and the additional (3rd) regression equations are estimated. Previously, (increase and decrease in the household debt ratio in period t) was used as the explanatory variable, but here, instead of the two-step regression equation (increase or decrease in household debt ratio in two years, in which the increase or decrease in household debt ratio in period t is predicted through the loan supply channel), is used as the explanatory variable.

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

$\Delta_8 y_{t+8}$: t기에서 $t+8$기까지의 연평균 성장률

$\Delta_8 \hat{d}_{H,t+8}$: 대출공급 경로를 통한 t기 가계부채비율 증감의 $t+8$기 조건부 가계부채비율 증감 예측치(2단계 회귀식 결과)

Z_{t+8} : $t+8$기의 통제변수

The sensitivity of growth after two years ( ) was estimated for the conditional forecast ( ) of the increase and decrease in the household debt ratio after 2 years due to the interaction between banks and policy authorities. The sensitivity of the growth rate after 2 years (t+8) to the 1%p increase in the household debt ratio (compared to the same period of the previous year) in the t period explained by the loan supply route is measured by ()%p.

▪ **Step 1 regression coefficient:** Shows the sensitivity to the trend change of the household loan attitude index in the t+8 period to the 1%p increase in the household debt ratio in the t period.

▪ **Step 2 regression coefficient:** Indicates the sensitivity of the increase or decrease of the household debt ratio in the t+8 period to a 1 unit increase in the trend change of the conditional household loan attitude index in the t+8 period.

The importance of the loan supply path is evaluated by comparing the sensitivity estimate ( ) above and the sensitivity of future growth ( ) to the household debt ratio estimated in the basic model (Section III). An increase in the household debt ratio causes a slowdown in future 1) GDO, 2) consumer spending, and 3) facility investment through loan supply channels. Looking at the specific figures, the increase in the household debt ratio of 1%p (annual average) over the past two years leads to the following results over the next two years (annual average) through this route.

① 0.2%p growth slowdown, ② 0.4%p consumption expenditure slowdown, ③ 1.0%p slowdown in facility investment.

Considering the share of facility investment in the service industry (approximately 41% of total facility investment, as of 2020), this path suggests that it is related to consumption-oriented aggregate demand. Next, the loan supply route appears to explain to a large extent the negative relationship between the household debt ratio and future real economic activity (the result of Section III). The loan supply route explains the 72% sensitivity of growth (based on GDO) over the next two years to the household debt ratio. In addition, the loan supply route explains the sensitivity of consumer spending by 78%, so growth slowdown is accompanied by a slowdown in aggregate demand.

[Table 2]

5 Conclusion

Through an analysis of Korea from 2000 to 2020, this paper shows that credit (household debt) and economic growth had an intertemporal trade-off between periods. This suggests that the subsequent slowdown in growth has to be paid for the excessive credit and economic growth today. This also means that when policy authorities consider credit and macroprudential policies for the purpose of the stabilization of economic growth and financial stability, they should consider the intertemporal effects on growth of such policies.

In addition, based on previous studies that identify 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 the household debt ratio in Korea.

This paper shows that the credit supply channel works as follows. In the loan market where there is an oversupply incentive of banks, the change in the lending attitude of banks due to macroprudential regulations by the policy authorities, who are concerned with excessive movement of credit, explain a substantial part of household debt fluctuations and the resulting economic activity. . The credit supply channel is shown to explain the 72% sensitivity of growth over the next two years to the household debt ratio. The existence of this channel is evidence of the effectiveness of macroprudential policies.

On the other hand, it should be noted that, if the appropriateness and timeliness of the regulatory strength is overlooked, the implementation of regulations may amplify economic fluctuations. At the same time, it is necessary to induce the market participants to form their expectations for credit and asset markets rationally by improving the predictability and consistency of prudential regulations.

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APPENDIX

A

TABLE 1
CREDIT EXPANSION AND CONTEMPORANEOUS AND FUTURE TWO-YEAR 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 estimating 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 constant and technical control variable (Y_{t-8}) are omitted. * indicates *p-value* < 0.1. Two values in parentheses are 90% confidence interval based on block bootstrap standard error.

TABLE 2

TABLE 2

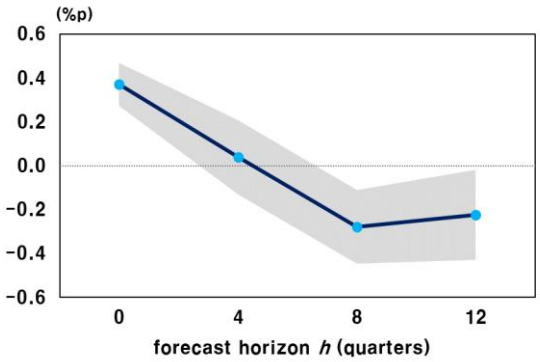
CONTRIBUTION OF CREDIT SUPPLY CHANNEL TO GROWTH

	GDO	GDP	Consumption	Investment
Supply Channel Sensitivity (θ_1 x κ_1 x β_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)
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%

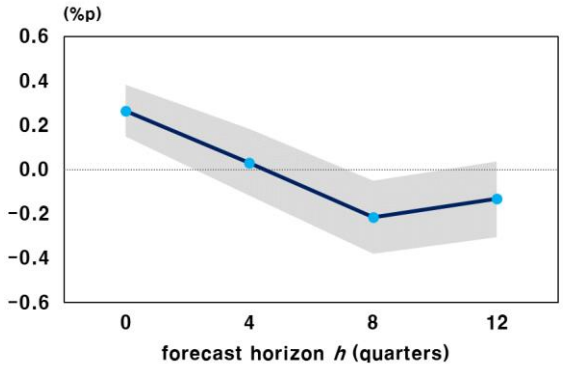
Notes. This table presents results…… * indicates *p-value* < 0.1. Two values in parentheses are 90% confidence interval based on block bootstrap standard error. Contribution of Supply Channel is calculated as Supply Channel Sensitivity/Total Sensitivity

FIGURE 1

SENSITIVITY OF GDO TO HOUSEHOLD DEBT



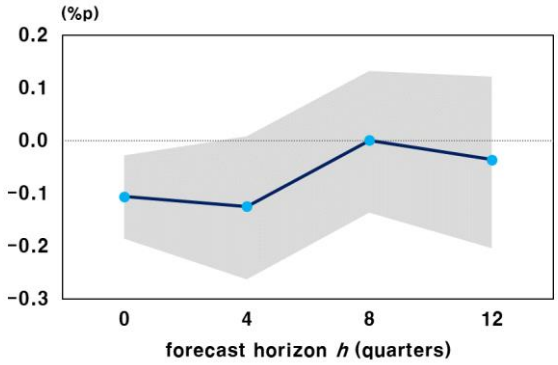
SENSITIVITY OF GDP TO HOUSEHOLD DEBT



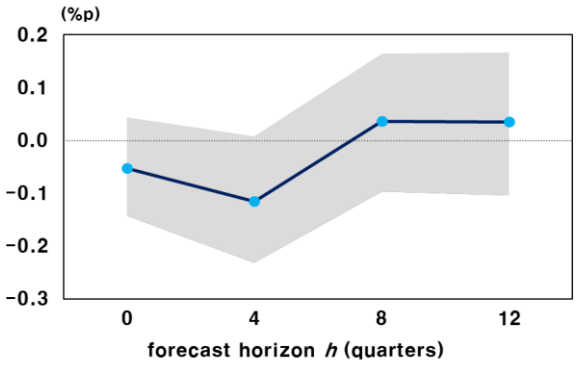
Notes. This figure presents the estimates for $\beta_{H,h}$ by forecast horizon. This, therefore, can be interpreted as if household debt to GDO (GDP) ratio increases by 1%p, GDO (GDP) growth rate increase by $\beta_{H,h}$%p. Grey area represents 90% confidence interval.

FIGURE 2

SENSITIVITY OF GDO TO CORPORATE DEBT

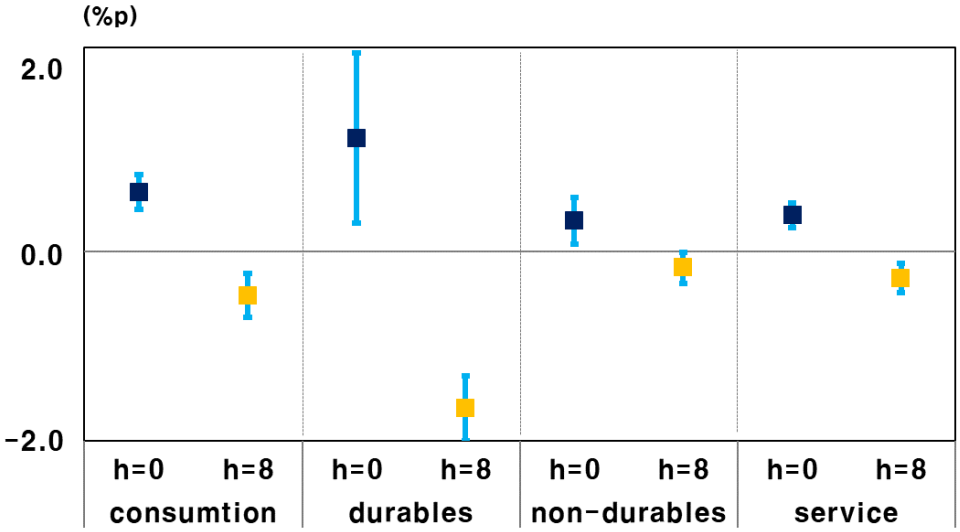


SENSITIVITY OF GDP TO COPORATE DEBT



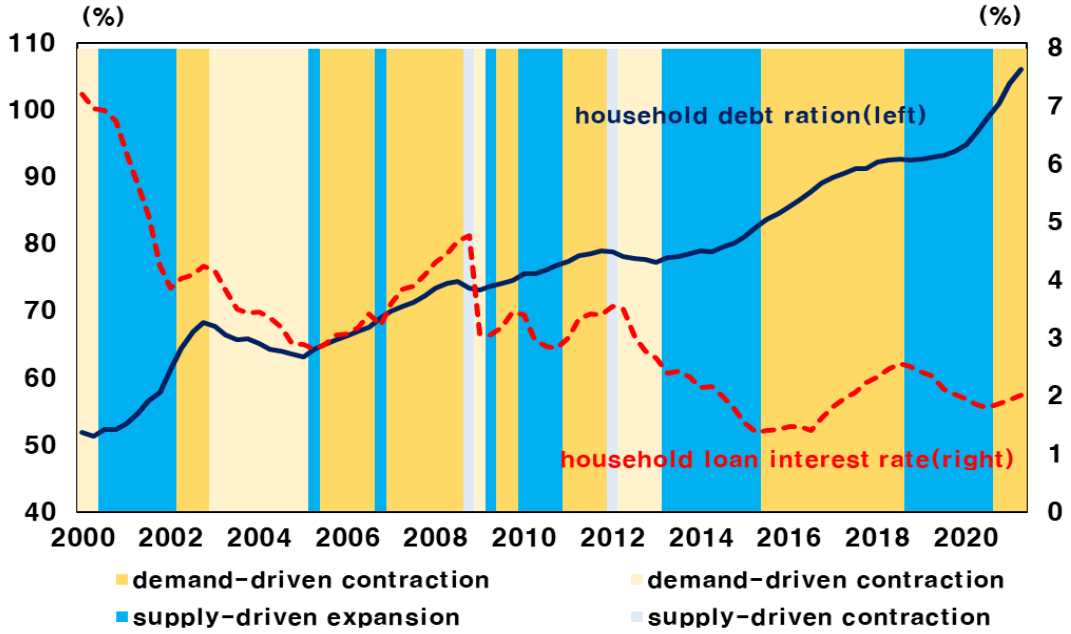
Notes. This figure presents the estimates for $\beta_{F,h}$ by forecast horizon. This, therefore, can be interpreted as if corporate debt to GDO (GDP) ratio increases by 1%p, GDO (GDP) growth rate increase by $\beta_{F,h}$%p. Grey area represents 90% confidence interval.

FIGURE 3
RELATIONSHIP BETWEEN HOUSEHOLD DEBT AND CONSUMPTION



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

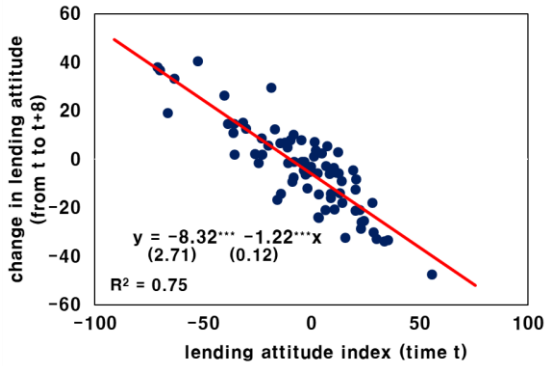
FIGURE 4
FOUR CYCLICAL PAHSES OF HOUSEHOLD DEBT RATIO TO NOMINAL GDP



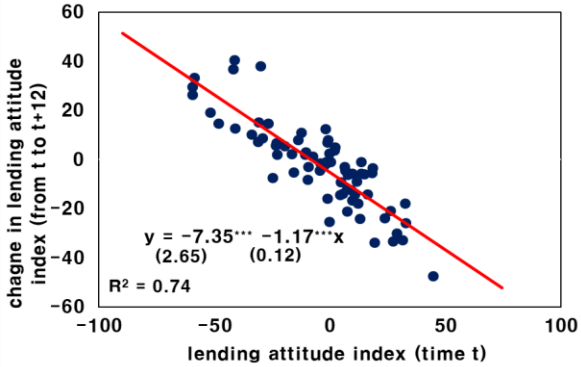
Notes. Household loan rate is deflated by CPI HP trend.

FIGURE 5

MEAN REVERSION OF LENDING ATTITUDE INDEX (2 YEAR HORIZON)



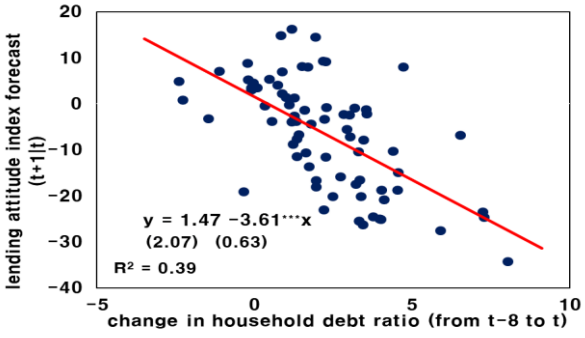
MEAN REVERSION OF LENDING ATTITUDE INDEX (3 YEAR HORIZON)



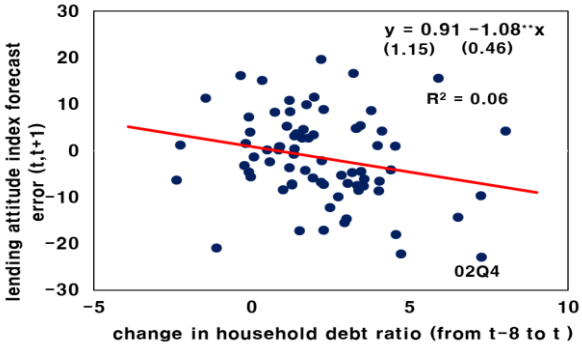
Notes. Values in parentheses are New-West standard errors of OLS estimates. *** indicates *p-value* < 0.01. Sample period is 2000.1/4～2020.4/4.

FIGURE 6

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



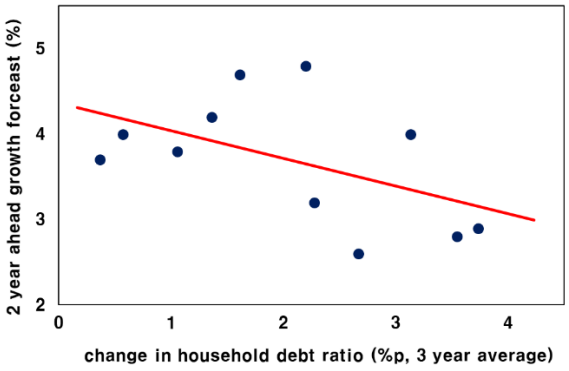
LENDING ATTITUDE INDEX FORCAST ERROR AND CHANGE IN HOUSEHOLD DEBT RATIO



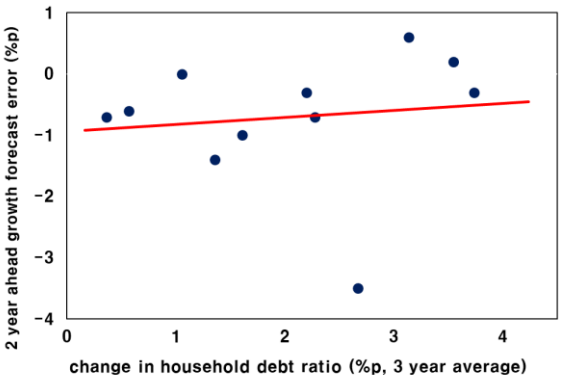
Notes. Values in parentheses are New-West standard errors of OLS estimates. *** and ** indicates *p-value* < 0.01, *p-value* < 0.0, respectively. Sample period is 2002.1/4～2020.4/4. Forecast error is lending attitude index at t minus predicted value at t-1 of lending attitude index at t

FIGURE 7

CHANGE IN HOUSEHOLD DEBT RATIO AND BOK'S 2 YEAR AHEAD GROWTH FORECAST



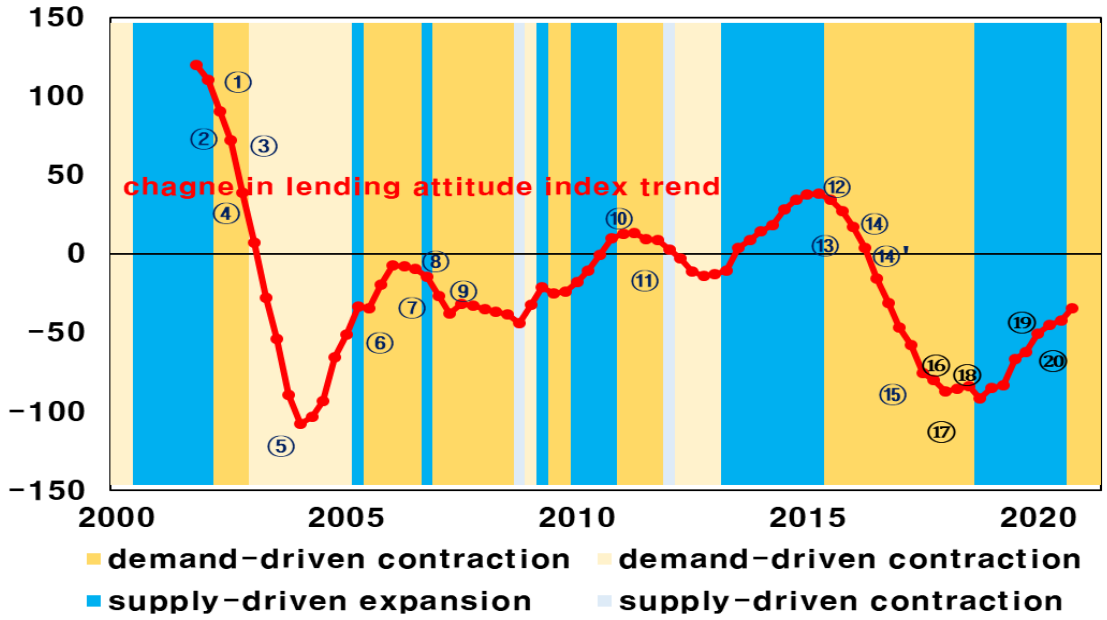
CHANGE IN HOUSEHOLD DEBT RATIO AND BOK'S 2 YEAR AHEAD GROWTH FORECAST ERROR



Notes. Sample period is 2008~2020.

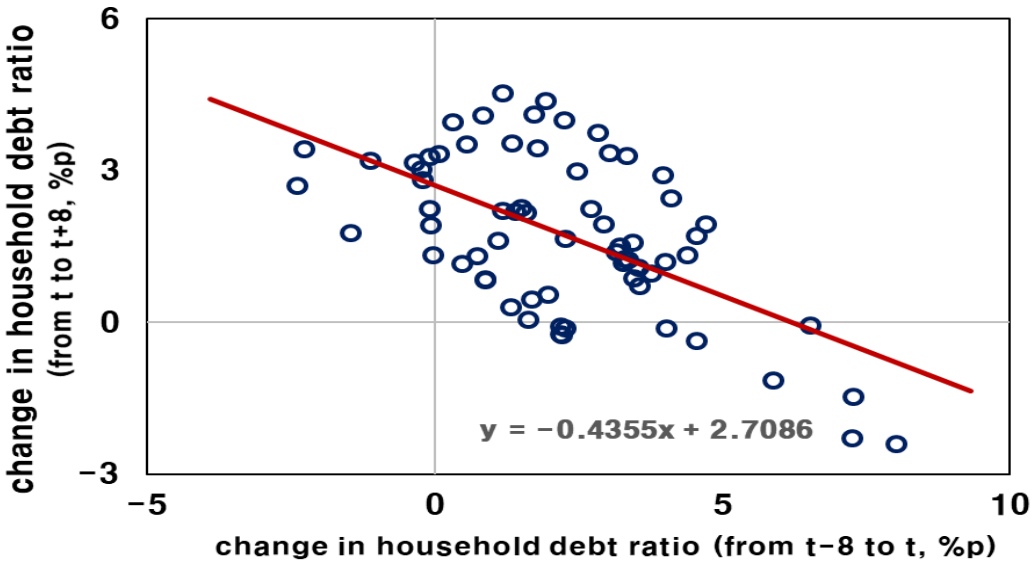
FIGURE 8

CHANGE IN LENDING ATTITUDE INDEX TREND AND MACORPRUDENTIAL REGULATIONS



Notes. Change in lending attitude index is defined as change over 2 years of cumulated lending attitude index. Sample period is 2001.1/4~2020.4/4. Numbered circles indicate the date when major macroprudential regulation measures are pronounced by financial regulation authorities.

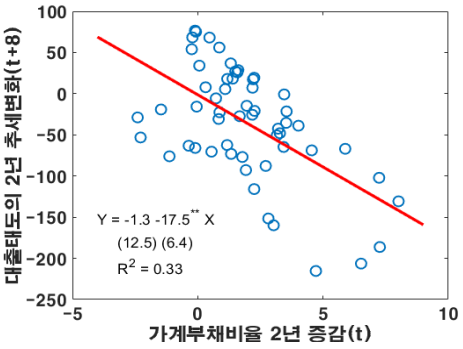
FIGURE 9
MEAN REVERSION OF HOUSEHOLD DEBT RATIO



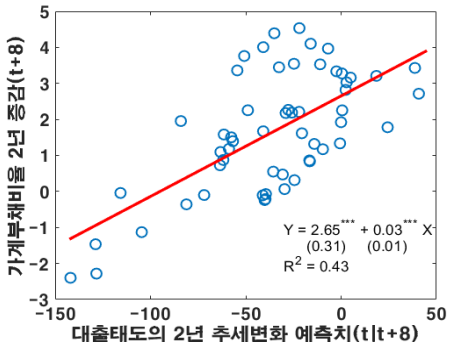
Notes. Sample period is 2000.1/4~2020.4/4

FIGURE 10

FIRST STAGE REGRESSION RESULT



FIRST STAGE REGRESSION RESULT



Notes. Values in parentheses are New-West standard errors of OLS estimates. *** and ** indicates *p-value* < 0.01, *p-value* < 0.0, respectively. Sample period is 2000.1/4～2020.4/4.

FIGURE 11
CREDIT SUPPLY CHANNEL AND INTERTEMPORAL TRADEOFF RELATIONSHIP BETWEEN DEBT AND GROWTH