The Effectiveness of Credit Policy: Evidence from the Republic of Korea

JIHO LEE*

In response to the global financial crisis and subsequent Great Recession, central banks embarked on a variety of unconventional measures. Among others, credit policy has been widely employed in many advanced economies. However, credit policy is far less understood than unconventional monetary policy by both policy makers and academic scholars. This paper sheds new light on what credit policy is, how it differs from other central bank policies, and what its risks and limitations might be. In particular, I examine whether credit policy has been effective in stimulating the real economy in the Republic of Korea.

Keywords: credit policy, fiscal aspects of central banking, quantitative easing and credit easing, unconventional monetary policy

JEL codes: E40, E50, E52, E58, E60

I. Introduction

Prior to the 2008–2009 global financial crisis, mainstream macroeconomists seemed to have reached an international consensus regarding the central bank’s mandates and monetary policy. The two main features of the consensus were the necessities of central bank independence and flexible inflation targeting. Under this paradigm, a central bank’s job description was straightforward: to minimize volatility in inflation and output. For example, according to the popular Taylor (1993) rule, a central bank should set short-term interest rates in response to the deviation of inflation from its desired or target level (inflation gap) and the deviation of output from its potential output level (output gap). Flexible inflation targeting, together with central bank independence, had appeared to achieve price stability and deliver macroeconomic stability in advanced economies and many emerging market economies, at least until the global financial crisis (Eichengreen et al. 2011). The so-called Great Moderation period was viewed as the heyday of central banks.

*Jiho Lee: Head of Industry and Labor Research Team, the Bank of Korea. E-mail: jiho_lee@bok.or.kr. The author is grateful to Byoung-Ki Kim, Jun-Han Kim, and Myung-Soo Lee for their valuable comments, and to Sun-Young Kim for excellent assistance. He would also like to thank the managing editor and two anonymous referees for helpful comments and suggestions. The views expressed herein are the author’s and not necessarily those of the Bank of Korea. The usual ADB disclaimer applies. ADB recognizes “Korea” as the Republic of Korea.

1See, for example, Goodfriend (2007), Mishkin (2007), and Woodford (2007).
The global financial crisis and subsequent Great Recession, however, brought unprecedented changes to the world’s central bank landscape. In response, many central banks lowered short-term interest rates to effectively zero and increased aggregate bank reserves enormously; the extraordinary times required extraordinary measures. The precrisis consensus view of central banks was also highly criticized as focusing too narrowly on inflation and output gaps. Today, the proper mandates and roles of central banks are thus more highly contentious topics than ever before among academics and policy makers around the world. Historically, it was not uncommon for crises to change the mandates and functions of central banks (Goodhart 2010, Reis 2013). After the experience of the so-called Great Inflation of the 1970s, which combined with poor real economic performance, many countries assigned a sole mandate of price stability to their independent central banks. At the current juncture, however, criticism of the previous consensus has broadly evolved into two strands. The first criticism is that central banks seemed to underestimate their ex ante role with respect to financial stability. Where low policy rates are consistent with low inflation, they may still contribute to excess credit growth and the build-up of asset bubbles, and thus sow the seeds of financial imbalance. Prior to the crisis, it was often argued that central banks should not target asset prices or try to prick a bubble. They were only to mop up the mess after a bubble had burst by injecting sufficient liquidity to avoid a financial and macroeconomic meltdown. But one key lesson from the recent crisis is that microprudential policy focusing solely on the health of individual financial institutions is not sufficient for systemwide financial stability. Further, central banks are often requested to adopt macroprudential policy, which addresses risks to the financial system as a whole in pursuit of financial stability (Yellen 2014).

Another important social demand is that central banks should play a more active role in facilitating the flow of credit when financial institutions reduce their lending for the sake of deleveraging following financial market turmoil. I believe that credit policy—by which a central bank directly or indirectly channels credit to private entities and lowers specific interest rates in order to restore the functioning of a particular market—has the potential to serve the aforementioned purpose. The problem is that since credit policy is not a standard policy of central banks it is not

2For postwar recessions in the United States (US), the deep contractions of 1973–1975 and 1980–1982 were each also called the Great Recession (Blinder 2013). This paper uses the term Great Recession to refer to the economic slump observed during the late 2000s.

3Larry Summers (2014) rebukes the precrisis consensus view as follows: “What has happened in the last few years suggests the second moment—the volatility of output around its normal level—is second-order relative to the first moment—the average level of output through time.”

4This is also true for the development of economics. Issing (2012) argues that the development of economics is not driven by either cycles or trends but by severe crises.

5As a result, many countries have established committees responsible for mitigating systemic risks such as the Financial Policy Committee in the United Kingdom (UK), the European Systemic Risk Board, and the Financial Stability Oversight Council in the US.
well established. Therefore, a key motivation of this paper is to develop a conceptual framework for credit policy and to shed light on what credit policy is and how it differs from a central bank’s other policies.

Then, more importantly, I attempt to investigate whether credit policy has been effective in stimulating the real economy. Unfortunately, there have been so few attempts to examine the effects of credit policy, partly because the available datasets are very limited (Churm et al. 2015). In stark contrast, there is a large amount of literature on the effects of unconventional monetary policy such as quantitative easing (QE). To fill this gap, I choose to use the Korean dataset for credit policy effectiveness because the Bank of Korea (BOK) has a long history of utilizing modern credit policy since March 1994.

Before proceeding further, it would be useful to review a brief history of credit policy in the Republic of Korea (The Bank of Korea 2012). In March 1994, the BOK replaced automatic rediscounts with Aggregate Credit Ceiling Loans as a modern credit policy tool. Under this scheme, the BOK has provided loans to banks at a slightly lower rate than its policy rate within a certain ceiling set by the BOK’s Monetary Policy Committee. Since then, the BOK has gradually retreated from credit policy to promote the market mechanism in financial resource allocation.

After the global financial crisis, the need for credit policy reemerged, but for different reasons. In response, the BOK lowered its policy rate steeply from 5.25% in October 2008 to 2% in February 2009, its lowest level since the policy rate target began to be announced in May 1999. Nevertheless, severe uncertainty in financial markets and risk aversion have broken the last segment in monetary policy transmission channels that linked financial conditions and the real economy. In particular, many small and medium-sized enterprises (SMEs), which heavily rely on banks for funding in bankcentric financial systems such as in the Republic of Korea, have been denied access to credit at affordable interest rates.

Another contributing factor to resurrect credit policy is that the effective lower bound for the policy rate could be higher in the Republic of Korea compared to major advanced economies, potentially due to the concerns about sudden capital outflows. Against these backdrops, the BOK has strengthened its credit policy through the Bank Intermediated Lending Support Facility, which replaced the

---

6 A recent study exploring the effectiveness of credit policy failed to find a statistically significant direct effect of the incentive mechanisms in the UK’s Funding for Lending Scheme (FLS) for banks to increase their lending to SMEs (Havrylychyk 2016). It pointed out limited data availability as a potential explanation for this failure.

7 A number of authors have already conducted substantial research on the effectiveness of QE programs. See, for example, Gagnon et al. (2011), Krishnamurthy and Vissing-Jorgensen (2012), and D’Amico and King (2013) for the US; and Joyce et al. (2011) and Joyce and Tong (2012) for the UK.

8 Indeed, the Bank of Korea Act makes this point clear under Article 1 as follows: “The purpose of this Act shall be to establish the Bank of Korea and to contribute to the sound development of the national economy by pursuing price stability through the formulation and implementation of efficient monetary and credit policies.”

9 When this lending scheme was adopted, the BOK seemed to regard it as a transitional stage in the evolution of the central bank’s lending facilities.
existing Aggregate Credit Ceiling Loans. With this new facility, the BOK raised the ceiling and broadened the scope of the previous lending facility.10

The rest of the paper is organized as follows. Section II briefly describes recently implemented unconventional monetary policy measures and presents a conceptual framework for credit policy. Section III examines whether credit policy has promoted real economic activity with Korean data. Section IV discusses potential risks for implementing credit policy tools and emphasizes that the bar for the use of credit policy should be higher than for conventional polices. Finally, section V concludes.

II. Conceptual Framework

A. Recently Implemented Unconventional Measures

In response to the 2008–2009 financial crisis and subsequent Great Recession, major central banks embarked upon the use of various unconventional policy tools once their policy rates had nearly reached the zero lower bound. Many of these programs initially attempted to alleviate financial market distress. Thereafter, the purpose of those programs was broadened to stimulate the anemic real economy (Fawley and Neely 2013).

One good example is the United States (US) Federal Reserve’s QE program, which involved central bank purchases of securities financed by the creation of bank reserves held at the central bank.11 The purchases included a substantial amount of long-term securities, such as US Treasury securities and mortgage-backed securities (MBS). Its main goal is to put downward pressure on long-term yields to support economic growth. QE is believed to work through two main channels: the portfolio balance channel and the signaling channel.12

Analogously, the Bank of England (BOE) undertook a series of asset purchases, mostly government debt, via an asset purchase facility beginning in

---

10The BOK seems mindful of striking a balance between improved credit flows and possible market distortion caused by credit policy. In 2013, the governor of the BOK stated: “Going forward, we plan to monitor and critically review the performance of the funding program and any associated side effects. Such efforts will guide us to a better design of credit policy that can strike the right balance between improved credit flows to where most needed and possible market inefficiencies that credit policy itself can create.” Nevertheless, central banks should do their best to avoid distorting or replacing the market mechanism through excess interventions.

11A similar idea was proposed by Milton Friedman (1969) and referred to as helicopter money, which is an expansionary fiscal policy—whether an increase in public spending or a tax cut—financed by a permanent increase in the money stock. Recently, the idea of helicopter money has received great attention, partly because monetary policy alone may be inadequate to spur economic recovery amid very low inflation (Buiter 2014, Gali 2014, Turner 2015, Bernanke 2016). But a key difference between QE and helicopter money is that the former involves a transitory increase of the money stock while the latter involves a permanent increase.

12The signaling channel involves asset purchases leading market participants to revise downward their expectations of future short-term interest rates. On the other hand, the portfolio balance channel, affecting term and risk premiums, involves the reinvestment of the proceeds from asset sales into substitutable assets, pushing up asset prices in general (Bean et al. 2015, Bernanke 2017).
March 2009 (Bank of England 2014). In July 2012, the BOE introduced the Funding for Lending Scheme (FLS) to lend long-term, low-interest funds to banks in an effort to boost SMEs. On the other hand, the European Central Bank (ECB) started by extending the range of collateral it accepts for monetary operations, and from 2015 bought €60 billion worth of bonds from banks each month.

In April 2013, the Bank of Japan announced a program of quantitative and qualitative easing that involved a doubling of the monetary base, a lengthening of the expected average maturity of Japanese government bond purchases, and an increase in central bank purchases of risky assets such as stocks. Also in Asia following the global financial crisis, the BOK strengthened its credit policy using the Bank Intermediated Lending Support Facility, which aims to encourage commercial banks to lend more to SMEs. Under this scheme, the BOK offered lower-interest loans to banks in order to compensate for the additional credit risk costs associated with bank loans to SMEs struggling to access credit, even amid ample aggregate liquidity, due to heightened uncertainty in financial markets and risk aversion.

It is clear from the above that even though major central banks have used QE programs, their focuses differ slightly. For instance, the ECB and the Bank of Japan have focused on direct lending to banks—reflecting the bankcentric structure of their financial systems—while the Federal Reserve and the BOE preferred to expand their respective monetary bases by purchasing bonds.

More recently, many central banks have embarked on forward guidance by which central banks signal their willingness to keep monetary policy ultraloose until their economies regain some strength. Both QE and forward guidance aim to directly affect the longer-end of the yield curve. A key difference between them is that QE directly changes long-term interest rates largely through term premia, while forward guidance changes long-term interest rates through future short-term interest rates. By launching forward guidance, central banks sought to counter the upward pressure on market expectations of future rates, enabling them to plan their spending and investment decisions with more confidence.

Given the complex and evolving nature of recent unconventional measures, they cannot be easily understood, at least in a systematic way, if they are simply classified as unconventional policies as a whole. Hence, it may be useful to review these unconventional policy tools to understand what they are and how they

---

13In April 2013, the BOE made changes to the duration, method, and eligibility criteria of the FLS to encourage banks to lend more to SMEs. In November 2015, the BOE announced a 2-year extension of the FLS.

14The ECB carried out two rounds of long-term refinancing operations for European banks in December 2011 and February 2012.

15Precisely for this purpose, in early 2013, the ECB and the BOE introduced forward guidance, expressing a commitment to maintain monetary easing, in response to rising concerns regarding the Federal Reserve’s QE tapering. However, a critical concern regarding forward guidance is that such guidance could raise uncertainty if the recovery is faster than anticipated.
differ from central banks’ conventional instruments (International Monetary Fund 2013).

B. Conceptual Framework for Credit Policy

Goodfriend (2011) has proposed a good starting point in conceptualizing credit policy. He divides central bank operations into monetary policy and credit policy. In his categorization, monetary policy refers to open market operations that expand or contract bank reserves and currency by buying or selling Treasury securities. On the other hand, credit policy shifts the composition of central bank assets, holding their total amount fixed. In other words, credit policy involves lending to particular borrowers or acquiring non-Treasury securities with the proceeds from the sale of Treasuries. Surely, in principle, any monetary policy is a credit policy as credit is the main transmission channel of monetary policy. But there is still a key distinction between the two policies. That is, monetary policy contributes to a broad easing in financial market conditions, but credit policy facilitates funding conditions of specific sectors that have difficulty in accessing credit. In this context, credit policy could be viewed as a debt-financed fiscal policy.

Armed with this overview, this paper proposes to categorize the current policies of central banks into monetary policy, credit policy, and macroprudential policy. In this classification, monetary policy can be further divided into conventional and unconventional monetary policies. While conventional monetary policy can be summarized as adjusting central banks’ policy rate at the very short end of the yield curve, unconventional monetary policy can take many different forms, such as large purchases of government bonds and forward guidance. On the other hand, credit policy intends to ease credit conditions in the economy and affect capital flows or credit allocation in the private sector by making

---

16 Goodfriend (2011) also discusses the interest-on-reserves policy adopted by the Federal Reserve in the midst of the global financial crisis, which pays and adjusts interest on bank reserve balances at the central bank. I do not discuss it here, however, partly because target reserves and required reserves were remunerated by central banks such as the BOE and the ECB even before the crisis. In those cases, that policy is a part of the corridor system within the monetary policy operating framework (Lee 2016).
17 The fiscal authorities then receive interest on the credit assets instead of interest on the Treasuries held by the central bank.
18 In practice, however, central banks can employ a mix of monetary and credit policies. Some of the unconventional monetary policy actions recently taken by major central banks had a direct or indirect impact on credit allocation as well as on liquidity volume. Moreover, credit policy can complement an accommodative monetary policy stance. As noted by Bernanke, Gertler, and Gilchrist (1998), a properly working credit market is a critical prerequisite for the transmission of monetary policy. As a consequence, credit policy could not only facilitate the flow of credit in the economy but also help restore the channels of monetary policy transmission.
19 There is a key distinction between credit policy and fiscal policy, especially in the Republic of Korea. The reason is that credit is allocated by commercial banks’ own decision via an incentivized scheme rather than by a government or central bank decision.
changes to the composition of a central bank’s assets. In this vein, Richmond Federal Reserve President Jeffrey Lacker also saw the MBS purchases under the third stage of QE, which was introduced in September 2012, as an example of central bank credit policy (Lacker 2012). Therefore, the following actions can be classified as credit policy as they were intended to encourage sector-specific credit allocation: (i) the Federal Reserve’s funding support for nonbank financial institutions (e.g., American International Group) and direct purchase of MBS; (ii) FLS and purchases of corporate bonds and commercial bills by the BOE; and (iii) funding support for stronger growth by the Bank of Japan. In the same vein, the Bank of Korea has recently revamped its Bank Intermediated Lending Support Facility in an effort to incentivize commercial banks to lend more funds to highly promising SMEs that have little collateral.

Finally, macroprudential policy aims to moderate the procyclicality of the financial system. Thus, credit policy and macroprudential policies could overlap because both policies often involve some form of credit control or credit allocation aimed at specific sectors (Shin 2015). In spite of these similarities, the two policies apparently differ in their priorities. Macroprudential policy mainly aims to restrict the growth of credit from the perspective of systemic risk management, whereas credit policy pays close attention to credit availability, in either the overall economy or particular sectors, and aims to rectify failures in financial intermediation.

III. Effectiveness of Credit Policy in the Republic of Korea

In this section, I evaluate whether credit policy has promoted real economic activity, tackling the question with Korean data. This choice is motivated by the fact that the BOK has a long history of utilizing modern credit policy. One reason for this long tradition is that the Republic of Korea’s financial system has maintained a bankcentric structure. Figure 1 shows changes in the amount of the BOK’s credit ceiling and its lending rate.

I examine the impact of credit policy on the real economy in two steps in reverse order. Unlike many studies on QE that analyzed its impact on interest rates, corporate bond yields, and exchange rates, I believe that a more important question is whether credit policy has indeed promoted real economic activity. Hence, I first examine which interest rates or spreads are relevant in stimulating the real economy. Then, I check which interest rates or spreads were affected by the BOK’s credit policy.

---

20 According to Her Majesty’s Treasury (2013), credit easing refers to measures aimed at easing credit conditions for businesses that do not have ready access to capital markets by giving them access to cheaper bank loans and nonbank sources of finance.

21 A few studies have looked at the macroeconomic effect of QE using a vector autoregressive approach (Baumeister and Benati 2012, Weale and Wieladek 2015).
The Effectiveness of Credit Policy: Evidence from the Republic of Korea

A. Which Interest Rate Spreads Are Relevant in Promoting the Real Economy?

The first question to address is which interest rate or interest rate spreads are more important in promoting economic activity. Specifically, are credit spreads more important than term spreads? To answer this question, I modify the existing methodology that uses the slope of the yield curve (term spreads) to predict future real economic activity (Hamilton and Kim 2002; Favero, Kaminska, and Soderstrom 2005; Wright 2006; Rudebusch, Sack, and Swanson 2007).

First, I use monthly data rather than quarterly data because some Korean financial market data are available only from the 2000s. Hence, the data I use span from January 2001 to July 2017. Also, I choose the annual growth of industrial production in the Republic of Korea as a dependent variable. To compute the growth rate, the log of monthly industrial production with no seasonal adjustments is used. Second, I include the real policy rate and two credit spreads as independent variables, as well as one term spread. For example, the real policy rate is defined

\[ Y_{t+4} - Y_t = \beta_0 + \beta_1 (Y_t - Y_{t-4}) + \beta_2 (i_t^{(n)} - i_t) + \epsilon_t \]

where \( Y_t \) is the log of real GDP at time \( t \) and \( i_t^{(n)} \) is the \( n \)-quarter interest rate.

---

Figure 1. Changes in the Bank of Korea’s Credit Ceiling and Lending Rate

lhs = left-hand side, rhs = right-hand side.
Source: The Bank of Korea.
as the BOK’s Base Rate minus the annual inflation rate. The first credit spread is the interest rate gap between high-quality (AA−) 3-year corporate bonds and 3-year Treasury bonds: that is, \( i_t^{AA−} - i_t^{3yr} \), where the latter is the risk-free government bond interest rate. The second one is the interest rate gap between low-quality (BBB−) 3-year corporate bonds and high-quality (AA−) 3-year corporate bonds: that is, \( i_t^{BBB−} - i_t^{AA−} \). Finally, the term spread is computed as the difference between the 3-year Treasury bond rate and the 91-day certificate of deposit rate.24

As a preliminary step, I verify the stationarity of the variables above using the Augmented Dickey–Fuller test. The test results, reported in Table A1 in the Appendix, show that most variables are stationary. The only exception is the credit spread between low-quality and high-quality 3-year corporate bonds, \( i_t^{BBB−} - i_t^{AA−} \), which is found to be \( I(0) \).25 But, conventional unit root tests are often biased to falsely find the existence of a unit root if the series are stationary with a structural break (Perron 1989, Hansen 2001). Therefore, I further implement unit root tests with a breakpoint for \( i_t^{BBB−} - i_t^{AA−} \). This is largely motivated by the fact that the sample period contains the 2008–2009 global financial crisis and that the crisis could sharply widen the credit premia. Indeed, Table A2 suggests that \( i_t^{BBB−} - i_t^{AA−} \) is stationary with a structural break in October 2008. Here the structural breakpoint is selected to minimize Dickey–Fuller \( t \)-statistics. Intuitively, this breakpoint seems consistent with the collapse of Lehman Brothers in September 2008. Having said that, I include a dummy variable in the equation for the period September 2008–June 2009 to address concerns about the potential structural break around the global financial crisis.

Now, I estimate a forecasting equation for real economic activity as follows:

\[
Y_{t+12} - Y_t = \alpha + \beta_1 RBR_t + \beta_2 (i_t^{3yr} - i_t^{91d}) + \beta_3 (i_t^{AA−} - i_t^{3yr}) + \beta_4 (i_t^{BBB−} - i_t^{AA−}) + Dum_{0809} + \varepsilon_t
\]  

(1)

where \( Y \) is the log of monthly industrial production; \( RBR \) is the real policy rate and is calculated as \( i_t^{BR} - 100(\log p_t - \log p_{t-12}) \), where \( p \) is the consumer price index and \( i_t^{BR} \) is the BOK’s Base Rate; \( i_t^{3yr} - i_t^{91d} \) is the term spread; and \( i_t^{AA−} - i_t^{3yr} \) and \( i_t^{BBB−} - i_t^{AA−} \) are credit spreads. Finally, \( Dum_{0809} \) is a dummy variable with a value of 1 for the period September 2008–June 2009.

23Corporate credit spreads are assumed to reflect compensation for expected default; compensation for the uncertainty about the probability of default; and differences between government and corporate bonds in terms of liquidity, regulation, and tax (Churm and Panigirtzoglou 2005).

24Since there is no short-term Treasury bill rate available in the Republic of Korea, in practice the 91-day certificate of deposit rate has been widely used as a proxy for it.

25In addition, Kwiatkowski–Phillips–Schmidt–Shin test results, which are not reported here, reinforced this finding (Kwiatkowski et al. 1992). It is well established in the literature that many interest rates are often found to be nonstationary (Campbell and Clarida 1987, Newbold et al. 2001), partly because those time series are not immune to structural breaks.
The Effectiveness of Credit Policy: Evidence from the Republic of Korea

Table 1. Forecasting Equations for Industrial Production Growth

| Dependent Variable: | $Y_{t+12} - Y_t$ | $RBR_t$ | $i_{t}^{3yr} - i_{t}^{91d}$ | $i_{t}^{BBB-} - i_{t}^{3yr}$ | $i_{t}^{AAA-} - i_{t}^{3yr}$ | $i_{t}^{BBB-} - i_{t}^{AAA-}$ | J-statistics |
|---------------------|------------------|---------|---------------------------|-----------------------------|---------------------------|-----------------------------|-------------|
| (1)                 |                  | −0.07   | 1.13**                    | −0.55**                     | −0.55**                   | 12.65                       |             |
|                     |                  | (0.35)  | (0.46)                    | (1.04)                      | (0.24)                    | [0.12]                      |             |
| (2)                 |                  | −0.07   | 1.30**                    | −0.58**                     |                          | 11.36                       |             |
|                     |                  | (0.31)  | (0.48)                    | (0.24)                      |                           | [0.13]                      |             |

$Y_t$ = monthly industrial production, $RBR_t =$ Bank of Korea’s real Base Rate, $i_{t}^{3yr} =$ 3-year Treasury bond rate, $i_{t}^{91d} =$ 91-day certificate of deposit rate, $i_{t}^{AAA-} =$ high-quality (AA−) 3-year corporate bond rate, $i_{t}^{BBB-} =$ low-quality (BBB−) 3-year corporate bond rate.

Note: Coefficient estimates are shown with their standard errors in parentheses. Significant coefficients at the 10%, 5%, and 1% levels are superscripted with *, **, and *** respectively. Each regression includes a constant and a dummy variable (2008:9 to 2009:6) that are not reported. P-values of J-statistics are reported in square brackets.

In the above equation, if industrial production growth is a determinant of any of the right-hand-side variables in the model, an ordinary least squares regression that does not take into account this endogeneity problem will yield biased and inconsistent parameter estimates. To address this concern, I estimate the above model using a single equation generalized method of moments estimator. In particular, I use the lagged values of regressors and a set of US financial variables as instruments. An important caveat here is that equation (1) is only a reduced-form relationship that has no economic structure. However, this is the common approach in the literature to investigate whether the term spreads and the credit spreads have significant predictive power for future real economic activity.

Table 1 presents the empirical results in two different specifications. The null hypothesis that all the instruments are exogenous cannot be rejected based on the J-test results for overidentifying restrictions in Table 1. Furthermore, Cragg–Donald F-statistics of 16.55 in the first-row setting and 46.72 in the second, which exceed the rule-of-thumb criterion 10, suggest that the instruments are relevant (Cragg and Donald 1993). Next, I focus on four $\beta$’s: (i) real policy rate, (ii) term spread, (iii) high-quality corporate spread, and (iv) low-quality corporate spread. In particular, the term spread captures the slope of the term structure, reflecting both expectations of the path of future short rates and the pure term premium, while the two credit spread terms in equation (1) capture risk factors.

Note first that all coefficients on the real Base Rate in rows 1 and 2 are of the expected negative sign but not statistically significant. Second, the coefficients on the term spread in both settings are positive and significantly different from zero. That is, an increase in the term spread forecasts higher future industrial production.

26I include three financial variables retrieved from the Federal Reserve Economic Data of the Federal Reserve Bank of St. Louis. The first variable is the US term spread, which is calculated as the spread between the 10-Year Treasury Constant Maturity and 3-Month Treasury Constant Maturity. The second is the US credit spread, computed as the spread between Moody’s Seasoned Baa Corporate Bond and the 10-Year Treasury Constant Maturity. The third is the US real federal funds rate.

Electronic copy available at: https://ssrn.com/abstract=3346736
Table 2. Vector Autoregressive Estimates, January 2001–July 2017

|          | ΔYt | RBRt | 3yr  | 3yr  | 3yr  |
|----------|-----|------|------|------|------|
| ΔYt−1    | 0.20*** | −0.01 | −0.001 | 0.01 |
|          | (0.07) | (0.01) | (0.01) | (0.01) |
| RBRt−1   | 0.01 | 0.90*** | 0.02 | −0.02 |
|          | (0.22) | (0.04) | (0.02) | (0.02) |
| 3yr−1 − 91d−1 | 2.53*** | 0.07 | 0.92*** | −0.14*** |
|          | (0.37) | (0.06) | (0.03) | (0.03) |
| 3yr−1 − 3yr−1 | −0.62*** | −0.05* | 0.03** | 0.98*** |
|          | (0.17) | (0.03) | (0.01) | (0.01) |
| R2       | 0.49 | 0.86 | 0.87 | 0.98 |

ΔYt = growth of monthly industrial production compared with the same month of previous year, RBRt = Bank of Korea’s real Base Rate, 3yr = 3-year Treasury bond rate, 91d = 91-day certificate of deposit rate, BBB− = low-quality (BBB−) 3-year corporate bond rate.

Notes: The values in parentheses denote standard errors. Significant coefficients at the 10%, 5%, and 1% levels are superscripted with *, **, and *** respectively. A constant and a dummy variable are included in the V AR estimation.

Source: Author’s calculations.

The finding that a rise in the long-term rate relative to the short-term rate predicts higher future real activity is consistent with the existing empirical evidence in Rudebusch, Sack, and Swanson (2007), and Walsh (2014). Most interestingly, in row 2, the coefficient on the credit spread (iBBB− − i3yr) is of the expected negative sign and statistically significant. In particular, as displayed in row 1, most of these effects appear to come from the credit spread between low-quality (BBB−) 3-year corporate bonds and high-quality (AA−) 3-year corporate bonds: (iBBB− − iAA−). On the other hand, the coefficient on the credit spread between high-quality 3-year corporate bonds and 3-year Treasury bonds (iAA− − i3yr) is negative but not statistically significant in row 1.

The results in Table 1 suggest that central bank policy makers should focus on reducing the credit spreads, particularly between high-grade corporate bonds and low-grade corporate bonds. The reason is that a rise in the term spread may just reflect the expectation of stronger economic growth in the future. Importantly, this finding implies that QE, mainly working through the term premium channel, might have little effect on the real economy.

To explore further the effects of interest rate spreads on real economic activity, I estimate a vector autoregressive (VAR) model with the growth of industrial production, the real Base Rate, and term and credit spreads. Table 2 reports the results of the VAR estimation.27

27Both a constant and a dummy variable are included in the VAR estimation. We also estimated a VAR model with two credit spreads separately iBBB− − i3yr and iBBB− − iAA−, rather than an aggregate credit spread (iBBB− − i3yr) with similar results.
The Effectiveness of Credit Policy: Evidence from the Republic of Korea

Table 3. F-Statistics of Granger Causality Tests, November 2000–July 2017

|                                      | Lag 1 | Lag 2 | Lag 3 | Lag 4 | Lag 5 | Lag 6 |
|--------------------------------------|-------|-------|-------|-------|-------|-------|
| Credit Ceiling ⇒ Real Base Rate       | 0.58  | 0.38  | 0.31  | 0.21  | 0.56  | 0.73  |
| Real Base Rate ⇒ Credit Ceiling       | 0.05  | 0.54  | 1.33  | 0.98  | 0.92  | 0.76  |
| Credit Ceiling ⇒ Term Spread          | 0.40  | 0.60  | 1.33  | 1.76  | 1.39  | 1.14  |
| Term Spread ⇒ Credit Ceiling          | 6.18**| 3.59**| 2.43* | 1.81  | 1.89  | 1.58  |
| Credit Ceiling ⇒ Credit Spread        | 2.02  | 1.68  | 1.75  | 0.95  | 0.76  | 0.62  |
| Credit Spread ⇒ Credit Ceilings       | 1.14  | 2.30  | 1.69  | 1.26  | 0.83  | 0.86  |
| Credit Ceiling ⇒ Credit Spread        | 0.01  | 3.32**| 2.19* | 1.68  | 0.58  | 0.64  |
| Credit Spread ⇒ Credit Ceiling        | 1.15  | 1.26  | 0.99  | 0.64  | 0.57  | 0.57  |

*aRBR = log(RBR) - 100(log_(p_t/log_(p_(t-12))) where p is the consumer price index
*b_i3yr_t - i_{91d_t}
c_{iAA_t - i_{BBB_t}}
d_i^{BBB} - i_{AA_t}
i_{BBB} = Bank of Korea’s Base Rate, i_{3yr_t} = 3-year Treasury bond rate, i_{91d_t} = 91-day certificate of deposit rate, i_{AA_t} = high-quality (AA-) 3-year corporate bond rate, i_{BBB_t} = low-quality (BBB-), 3-year corporate bond rate.

Note: The symbols *, **, *** in the superscript denote significance at the 10%, 5%, and 1% levels, respectively.
Source: Author’s calculations.

The risk-free term spread again has a positive sign and is statistically significant. Similar to the result in Table 1, the risk spread captured by the difference between the BBB–rate and the 3-year Treasury rate is of a negative sign and statistically significant. Therefore, this corroborates the previous finding that credit policy would be effective only if it is capable of lowering credit spreads.

B. Which Interest Rate Spreads Were Affected by the Bank of Korea’s Credit Policy?

The evidence in the previous section suggests that, to be effective, the BOK’s credit policy needs to tighten the credit spreads. Narrowing in the term spread seems to just reflect the rising expectation of future economic activity. This brings us back to the first question posed earlier: which interest rate spreads have been affected by the BOK’s credit policy?

To answer the question, I carry out Granger causality tests. Table 3 reports the F-statistics of the tests between the BOK’s credit ceiling—as a measure of credit policy—and the real Base Rate, term spreads, and credit spreads. In the table, I

---

28In the preliminary analysis, which is not reported here, I also examined whether credit policy could increase retail sales—proxy for household consumption. I found little evidence that retail sales are meaningfully affected either by credit spreads or credit policy. Potentially, this finding implies that credit policy is more effective in boosting business activities than household consumption, given that there is escalating global concern about subdued wage growth and worsening inequality recently.

29For X and Y, when Y can be better explained on the basis of past X’s and past Y’s than on the basis of past Y’s alone, a causal relationship exists from X to Y according to Granger (1969).
present test results with various lags because previous studies claimed that results of Granger tests can be sensitive to the lag length structure (Hamilton 1994). The sample period runs from November 2000 to July 2017 because of the credit spread of \( \Delta (i_{BBB} - i_{AA}) \), where \( i_{BBB} \) is available only from November 2000.

The Granger causality tests support the notion that a change in the BOK’s credit ceiling affects the credit spread of \( \Delta (i_{BBB} - i_{AA}) \). On the other hand, there is little evidence that the credit spread of \( \Delta (i_{BBB} - i_{AA}) \) affects the amount of the credit ceiling. Together with the previous finding that the credit spread rather than the term spread is important in stimulating real economic activity, the current finding is encouraging. These two findings jointly imply that the BOK’s credit policy has been effective in promoting the real economy.

More importantly, the BOK’s credit policy does not seem to affect or be affected by the real Base Rate. Moreover, there is little evidence that the BOK’s credit policy may affect the credit spread of \( \Delta (i_{AA} - i_{TB3}) \). These results are consistent with the objective of the BOK’s credit policy, which is in fact targeted at the improvement of funding conditions for SMEs with relatively lower credit ratings.

However, there are at least a few caveats to this approach. First, Granger causality is not necessarily true causality if two variables of interest are driven by a common third process. In this case, one might still fail to reject the alternative hypothesis of Granger causality. Second, this exercise cannot provide any estimate of the quantitative impacts scaled by the size of the credit policy. Instead, it simply assesses the statistical significance of the effects.

**IV. Potential Risks**

Unconventional monetary policy like QE is often claimed to pose critical risks to the economy, partly because it takes a central bank close to the political arena (Stein 2012). Similarly, several policy makers and economists have identified the potential risks for implementing credit policy tools.

The first and most severe concern is that credit policy invades the territory of the fiscal authorities and puts central bank independence in jeopardy, which could undermine the credibility and effectiveness of the central bank in its conventional role (Goodfriend 2011). For this reason, Rajan (2013, p. 10) warns that expansive credit policy, pursued in an attempt to revamp economic activity, can be “a step into the dark.” But perceptions of timidity and caution in central banking also have the potential to threaten the independence of central banks. Moreover, most central bank policies have fiscal aspects and implications, and it appears a reasonable idea for a central bank to implement credit policy in close cooperation with the Treasury and to strengthen its accountability to Congress or Parliament.30

---

30 The Federal Reserve and the US Department of the Treasury issued a statement in March 2009 on the delineation of responsibilities between the two institutions. While the statement indicated that “decisions to influence
Second, the central bank may face strong political pressure and criticism from the public. Central banks could be criticized for subsidizing bank lending, which is the inherent role of banks. Furthermore, credit policy could escalate financial stability concerns because it incentivizes risk-taking among banks and thus could weaken their asset qualities, even if this were exactly what the central bank aimed at achieving. An even bigger challenge is that an exit from credit policy could be more difficult than that from QE because it involves specific beneficiaries such as SMEs.

As a consequence, the bar for the use of nonconventional policies should be higher than for conventional policies. This is in part because the effects of those policies on economic activity and inflation are uncertain and their potential costs are well beyond those associated with standard policies (Bernanke 2012). Hence, the former president of the ECB, Jean-Claude Trichet, argues that four conditions should be met for implementing unconventional measures. They must first be independent from the standard measures; second, they must be targeted at helping restore a more normal functioning of monetary and financial markets with a limited amount of interventions; third, they must be transitory by nature; and fourth, they must not be intended to fine-tune the transmission mechanism of conventional monetary policy (Trichet 2013). Of course it is easy to state this as a principle but harder to know how to implement it in practice. Therefore, a careful cost–benefit analysis is really required to assess the net impact on social welfare.

V. Conclusion

After presenting a conceptual framework for credit policy along with other related policies, this paper highlighted that the Bank of Korea's credit policy indeed has been effective in stimulating real economic activity. I find evidence that the risk premium rather than the term premium is relevant to promoting the real economy, and that the implementation of the BOK's credit policy affects the risk premium. Therefore, credit policy can be more effective than QE, which mainly aims at reducing the term premium, particularly when the economy suffers from a rising credit risk premium due to a credit crunch.

Until the early 2000s, credit policy played a relatively minor role in advanced economies. Now, however, there is growing recognition that the conventional approach to central banking needs to be fundamentally rethought. Using interest

the allocation of credit are the province of the fiscal authorities,” and pledged the Treasury’s help in removing the Maiden Lane assets from the Federal Reserve’s balance sheet, it largely reaffirmed the Federal Reserve’s continued long-term use of its emergency lending powers. See, US Department of the Treasury and US Federal Reserve. 2009. “The Role of the Federal Reserve in Preserving Financial and Monetary Stability: Joint Statement by the Treasury and the Federal Reserve.” 23 March. http://federalreserve.gov/newsevents/press/monetary/20090323b.htm.

31 More often than not, the fiscal authorities favor expansive credit policy ex ante, but they preserve the option to criticize central bank actions ex post (Goodfriend 2012). In the same vein, central banks may often choose to lend rather than risk a potential panic by not lending, even though they lend at very low interest rates with poor collateral.

Electronic copy available at: https://ssrn.com/abstract=3346736
rates as the main monetary policy tool was initially considered a radical step for central banks to stabilize inflation and the macroeconomy. But, with the benefit of hindsight, it has proven to be effective.

In summary, credit policy represents a useful addition to central banks’ toolkit. After all, central banks cannot plead ignorance as justification for doing nothing. At the same time, since we do not yet have a full understanding of this mechanism, deeper research is needed to ascertain its longer-term benefits and unintended consequences.

References

Bank of England. 2014. *The Bank of England’s Sterling Monetary Framework*. London.
The Bank of Korea. 2012. *Monetary Policy in Korea*. Seoul.
Baumeister, Christiane, and Luca Benati. 2012. “Unconventional Monetary Policy and the Great Recession: Estimating the Macroeconomic Effects of a Spread Compression at the Zero Lower Bound.” Bank of Canada Working Paper No. 12–21.
Bean, Charles, Christian Broda, Takatoshi Ito, and Randall Kroszner. 2015. “Low for Long? Causes and Consequences of Persistently Low Interest Rates.” CEPR-ICMB Geneva Report on the World Economy 17. CEPR Press.
Bernanke, Ben. 2012. “Monetary Policy since the Onset of the Crisis.” Speech at the Federal Reserve Bank of Kansas City Economic Symposium in Jackson Hole, Wyoming. 30 August–1 September.
_____. 2016. “What Tools Does the Fed Have Left? Part 3: Helicopter Money.” 11 April. https://www.brookings.edu/blog/ben-bernanke/2016/04/11/what-tools-does-the-fed-have-left-part-3-helicopter-money/.
_____. 2017. “Monetary Policy in a New Era.” Prepared for Conference on Rethinking Macroeconomic Policy at the Peterson Institute. Washington, DC. 12–13 October.
Bernanke, Ben, Mark Gertler, and Simon Gilchrist. 1998. “The Financial Accelerator in a Quantitative Business Cycle Framework.” National Bureau of Economic Research Working Paper No. 6455.
Blinder, Alan S. 2013. *After the Music Stopped: The Financial Crisis, the Response, and the Work Ahead*. New York: Penguin Press.
Buiter, Willem H. 2014. “The Simple Analytics of Helicopter Money: Why It Works—Always.” *Economics–The Open-Access, Open-Assessment E-Journal* 8: 1–51.
Campbell, John Y., and Richard H. Clarida. 1987. “The Term Structure of Euromarket Interest Rates: An Empirical Investigation.” *Journal of Monetary Economics* 19 (1): 25–44.
Churm, Rohan, Michael Joyce, George Kapetanios, and Konstantinos Thoedoidis. 2015. “Unconventional Monetary Policies and the Macroeconomy: The Impact of the United Kingdom’s QE2 and Funding for Lending Scheme.” Bank of England Working Paper No. 542.
Churm, Rohan, and Nikolaos Panigirtzoglou. 2005. “Decomposing Credit Spreads.” Bank of England Working Paper No. 253.
Cragg, John G., and Stephen G. Donald. 1993. “Testing Identifiability and Specification in Instrumental Variable Models.” *Econometric Theory* 9 (2): 222–40.
D’Amico, Stefania, and Thomas B. King. 2013. “Flow and Stock Effects of Large-Scale Treasury Purchases: Evidence on the Importance of Local Supply.” *Journal of Financial Economics* 108 (2): 425–48.
Eichengreen, Barry, Mohamed El-Erian, Arminio Fraga, Takatoshi Ito, Jean Pisani-Ferry, Eswar Prasad, Raghuram Rajan, Maria Ramos, Carmen M. Reinhart, Helene Rey, Dani Rodrik, Kenneth Rogoff, Hyun Song Shin, Andres Velasco, Beatrice Weder di Mauro, and Yongding Yu. 2011. *Rethinking Central Banking*. Brookings Institution.

Favero, Carlo, Iryna Kaminska, and Ulf Soderstrom. 2005. “The Predictive Power of the Yield Spread: Further Evidence and a Structural Interpretation.” CEPR Discussion Paper No. 4910.

Fawley, Brett W., and Christopher J. Neely. 2013. “Four Stories of Quantitative Easing.” *Federal Reserve Bank of St. Louis Review* 95 (1): 51–88.

Friedman, Milton. 1969. *The Optimum Quantity of Money and Other Essays*. Chicago: Aldine Publishing Company.

Gagnon, Joseph, Matthew Raskin, Julie Remache, and Brian Sack. 2011. “The Financial Market Effects of the Federal Reserve’s Large-Scale Asset Purchases.” *International Journal of Central Banking* 7 (1): 3–43.

Gali, Jordi. 2014. “The Effects of a Money-Financed Fiscal Stimulus.” Universitat Pompeu Fabra Economics Working Paper No. 1441.

Goodfriend, Marvin. 2007. “How the World Achieved Consensus on Monetary Policy.” *Journal of Economic Perspectives* 21 (4): 47–68.

_____. 2011. “Central Banking in the Credit Turmoil: An Assessment of Federal Reserve Practice.” *Journal of Monetary Economics* 58 (1): 1–12.

_____. 2012. “The Elusive Promise of Independent Central Banking.” Institute for Monetary and Economic Studies Discussion Paper Series 12-E-09. Bank of Japan.

Goodhart, Charles. 2010. “The Changing Role of Central Banks.” Bank for International Settlements Working Paper No. 326.

Granger, Clive W. J. 1969. “Investigating Causal Relations by Econometric Models and Cross-Spectral Methods.” *Econometrica* 37 (3): 424–38.

Hamilton, James D. 1994. *Time Series Analysis*. Princeton University Press.

Hamilton, James D., and Dong Heon Kim. 2002. “A Reexamination of the Predictability of Economic Activity Using the Yield Spread.” *Journal of Money, Credit and Banking* 34 (2): 340–60.

Hansen, Bruce E. 2001. “The New Econometrics of Structural Change: Dating Breaks in US Labour Productivity.” *Journal of Economic Perspectives* 15 (4): 117–28.

Havrylychyk, Olena. 2016. “Incentivising Lending to SMEs with the Funding for Lending Scheme: Some Evidence from Bank-Level Data in the United Kingdom.” OECD Economics Department Working Paper No. 1365.

Her Majesty’s Treasury. 2013. “Review of the Monetary Policy Framework.” Presented to Parliament by the Chancellor of the Exchequer by Command of Her Majesty. London.

International Monetary Fund. 2013. *Unconventional Monetary Policies: Recent Experience and Prospects*. Washington, DC.

Issing, Otmar. 2012. “Central Banks–Paradise Lost.” Mayekawa Lecture at the Institute for Monetary and Economic Studies, Bank of Tokyo. 30 May.

Joyce, Michael A. S., Ana Lasaosa, Ibrahim Stevens, and Matthew Tong. 2011. “The Financial Market Impact of Quantitative Easing in the United Kingdom.” *International Journal of Central Banking* 7 (3): 113–61.

Joyce, Michael A. S., and Matthew Tong. 2012. “QE and the Gilt Market: A Disaggregated Analysis.” *Economic Journal* 122 (564): F348–84.

Krishnamurthy, Arvind, and Annette Vissing-Jorgensen. 2012. “Why an MBS Treasury Swap Is Better Policy than the Treasury Twist.” Kellogg School of Management Working Papers.
Kwiatkowski, Denis, Peter C. B. Phillips, Peter Schmidt, and Yongcheol Shin. 1992. “Testing the Null Hypothesis of Stationarity against the Alternative of a Unit Root.” *Journal of Econometrics* 54 (1–3): 159–78.

Lacker, Jeffrey M. 2012. “Perspectives on Monetary and Credit Policy.” Speech at the Shadow Open Market Committee Symposium in New York. 20 November.

Lee, Jiho. 2016. “Corridor System and Interest Rates: Volatility and Asymmetry.” *Journal of Money, Credit and Banking* 48 (8): 1815–38.

MacKinnon, James G. 1996. “Numerical Distribution Functions for Unit Root and Cointegration Tests.” *Journal of Applied Econometrics* 11 (6): 601–18.

Mishkin, Frederic S. 2007. “Will Monetary Policy Become More of a Science?” Board of Governors of the Federal Reserve System of the US Finance and Economics Discussion Series 2007-44.

Newbold, Paul, Stephen Leybourne, Robert Sollis, and Mark E. Wohar. 2001. “US and UK Interest Rates, 1890–1934: New Evidence on Structural Breaks.” *Journal of Money, Credit and Banking* 33 (2): 235–50.

Perron, Pierre. 1989. “The Great Crash, the Oil Price Shock, and the Unit Root Hypothesis.” *Econometrica* 57 (6): 1361–401.

Rajan, Raghuram. 2013. “A Step in the Dark: Unconventional Monetary Policy after the Crisis.” Andrew Crockett Memorial Lecture at the Bank for International Settlements. Geneva. 23 June.

Reis, Ricardo. 2013. “Central Bank Design.” *Journal of Economic Perspectives* 27 (4): 17–44.

Rudebusch, Glenn D., Brian P. Sack, and Eric T. Swanson. 2007. “Macroeconomic Implications of Changes in the Term Premium.” *Federal Reserve Bank of St. Louis’ Review* 89: 241–70.

Shin, Hyun Song. 2015. “Corridor System and Interest Rates: Volatility and Asymmetry.” *Journal of Money, Credit and Banking* 48 (8): 1815–38.

Taylor, John B. 1993. “Discretion versus Policy Rules in Practice.” *Carnegie-Rochester Conference Series on Public Policy* 39: 195–214.

Trichet, Jean-Claude. 2013. “Unconventional Monetary Policy Measures: Principles-Conditions-Raison d’etre.” *International Journal of Central Banking* 9 (1): 229–50.

US Department of the Treasury and US Federal Reserve. 2009. “The Role of the Federal Reserve in Preserving Financial and Monetary Stability: Joint Statement by the Treasury and the Federal Reserve.” 23 March. http://federalreserve.gov/newsevents/press/monetary/20090323b.htm.

Walsh, Carl E. 2014. “Monetary Policy Transmission Channels and Policy Instruments.” Prepared for Conference on Monetary Policy and the Public at the Federal Reserve Bank of Cleveland. 29–30 May.

Weale, Martin, and Tomasz Wieladek. 2015. “What Are the Macroeconomic Effects of Asset Purchases?” CEPR Discussion Paper No. 10495.
Wright, Jonathan H. 2006. “The Yield Curve and Predicting Recessions.” Board of Governors of the Federal Reserve System Finance and Economics Discussion Series 2006-07.

Yellen, Janet. 2014. “Monetary Policy and Financial Stability.” Speech at the Michel Camdessus Central Banking Lecture at the International Monetary Fund. Washington, DC. 2 July.

Appendix: Tests for Unit Root

Table A1 presents the Augmented Dickey–Fuller test results for the presence of a unit root in $\Delta Y_t$, $RBR_t$, $i_{t}^{3yr} - i_{t}^{91d}$, $i_{t}^{AA-} - i_{t}^{3yr}$, and $i_{t}^{BBB-} - i_{t}^{AA-}$. The results strongly support the assumption of the nonexistence of a unit root in $\Delta Y_t$, $RBR_t$, $i_{t}^{3yr} - i_{t}^{91d}$, and $i_{t}^{AA-} - i_{t}^{3yr}$. The only exception is $i_{t}^{BBB-} - i_{t}^{AA-}$, which is found to be $I(1)$ because its difference is stationary.

But, conventional unit root tests are often biased to falsely find the existence of a unit root if the series are stationary with a structural break (Perron 1989, Hansen 2001). Therefore, I further implement unit root tests with a breakpoint for $i_{t}^{BBB-} - i_{t}^{AA-}$. This is largely motivated by the fact that the sample period contains the 2008–2009 global financial crisis and that the crisis could sharply widen the credit premia. Table A2 presents the Augmented Dickey–Fuller test results for the presence of a unit root with a structural break in $i_{t}^{BBB-} - i_{t}^{AA-}$. It suggests that the credit premia are stationary with a structural break in October 2008. Here, the structural break point is selected to minimize Dickey–Fuller $t$-statistics. Intuitively, this break point seems consistent with the collapse of Lehman Brothers in September 2008.

### Table A1. Augmented Dickey–Fuller Tests for the Presence of a Unit Root

| Lag Length | 1 | 2 | 3 | 4 |
|------------|---|---|---|---|
| $\Delta Y_t$ | -4.24 | -3.17 | -3.38 | -3.45 |
| $RBR_t$ | -3.07 | -2.74 | -2.92 | -3.22 |
| $i_{t}^{3yr} - i_{t}^{91d}$ | -3.68 | -3.80 | -3.33 | -2.92 |
| $i_{t}^{AA-} - i_{t}^{3yr}$ | -4.32 | -4.39 | -2.96 | -2.97 |
| $i_{t}^{BBB-} - i_{t}^{AA-}$ | -1.31 | -1.48 | -1.52 | -1.25 |

<Critical Values>

| % | 1% | 5% | 10% |
|---|----|----|-----|
| 1% | -3.46 | -2.88 | -2.57 |

$\Delta Y_t$ = growth of monthly industrial production compared with the same month of previous year, $i_{t}^{3yr}$ = 3-year Treasury bond rate, $i_{t}^{91d}$ = 91-day certificate of deposit rate, $i_{t}^{AA-}$ = high-quality (AA–) 3-year corporate bond rate, $i_{t}^{BBB-}$ = low-quality (BBB–) 3-year corporate bond rate, $RBR_t$ = Bank of Korea’s real Base Rate.

Notes: Figures are $t$-statistics when the estimated model includes a constant. Critical values are from MacKinnon (1996).

Source: Author’s calculations.

Electronic copy available at: https://ssrn.com/abstract=3346736
Table A2. **Augmented Dickey–Fuller Tests for the Presence of a Unit Root with a Structural Break**

| Lag Length | 1     | 2     | 3     | 4     |
|------------|-------|-------|-------|-------|
| $i_t^{BBB}$ − $i_t^{AA}$ | −6.85 | −5.35 | −5.12 | −4.89 |

*Critical Values*

- 1%: −4.95
- 5%: −4.44
- 10%: −4.19

$i_t^{AA}$ = high-quality (AA−) 3-year corporate bond rate, $i_t^{BBB}$ = low-quality (BBB−) 3-year corporate bond rate.

Notes: Figures are $t$-statistics when the estimated model includes a constant and a structural break in October 2008. The break date is selected to minimize Dickey–Fuller $t$-statistics. Critical values are from Perron (1989).

Source: Author’s calculations.