Countercyclical capital buffer: building the resilience or taming the rapid financial cycle?

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Abstract

Countercyclical capital buffer came in 2009 after Basel Committee proposed it through Basel III regulation to build banking resilience and tame the systemic risk due to excessive growth in the credit cycle. Basel committee proposed the credit to GDP gap or credit gap as the indicator of when such buffer is activated. In 2014, the European Central Bank recommended that European Economies adopt the countercyclical capital buffer or CCB in their macroprudential policies. However, in the implementation, every financial authority in EU markets imposed the CCB differently. Some groups use CCB to build resilience as their primary objective. At the same time, the other group attempted not only resilience but also to control the excessive credit growth as their primary objective. The next challenge in implementing CCB is the negative feedback on the usage of the credit gap as the indicator and guidance on setting the CCB rate. The input lies in the Hodrick-Prescott or HP filter containing polynomial drift with a structural break, creating a spurious result. There are two novelties in this paper. First, the paper attempts to see whether the differences in such purposes will affect the country's resilience and ability to tame excessive credit growth. Second, the paper will employ the boosted Hodrick-Prescott filter or bHP from Phillips and Shi (2021) and compare it to the original Hodrick-Prescott filter. The empirical analysis uses data from Germany as the resilience focus market and France focusing on resilience and taming the rapid financial cycle. Using quarterly data from 1999 to 2021, we find that the boosted HP filter significantly improves the accuracy of the credit gap and output gap by removing the polynomial drift in the original HP filter. By analyzing the speed of economic recovery after financial shock, Germany, which focuses primarily on building economic resilience, recovers faster than France. Later, we find no significant difference between the two markets in their ability to tame the financial cycle by analyzing the credit gap cycle after the CCB implementation shock. And last, we find that after 2014, Germany has been able to moderate credit procyclicality, better than the period before.

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Keywords: boosted Hodrick-Prescott filter, Output gap, Credit to GDP gap, Countercyclical capital buffer

1. Introduction

The global financial crisis in 2008-2009 was one more episode of procyclical relation between excessive credit growth and a sound economy (Reinhart and Rogoff, 2010) that was not appropriately moderated and damaged the economy (Drehmann and Tsatsaronis, 2014). The growth of credit larger than GDP peaked in the financial cycle and preceded the financial crisis on their downturn. In 2009, the Basel Committee introduced a Basel III to capture the systemic vulnerability after credit procyclicality. Major financial regulators, such as the European Central Bank (ECB), introduced the countercyclical capital buffer (CCB) policy in 2014. The CCB has two primary purposes: to increase banks' resilience by adding more capital buffer during economic expansion and taming excessive credit that occurs in a short period. Financial authority in the market raises the CCB rate when the related risk indicator rises. The collected buffer is used when the economies face a downturn. The following CCB objective is to dampen the excessive credit that generates systemic risk during the economic upswing. In an actual implementation, a group of markets focuses primarily on building resilience, and another group focuses both on resilience and taming the financial cycle, see Babić et al. (2017). The impact of these objective differences on the effectiveness of CCB in weakening the link between the financial and business cycles is the primary interest of academics and economic policymakers. Moreover, the research that analyzes these differences in such topics is still scarce.

In the last decades, the research on the countercyclical capital buffer and its ability to improve economic resilience has increased, especially in European countries (Didier et al., 2012; Pfeifer and Hodula, 2021). There has been an exposure from the macroprudential supervisory board in each country to implement them since 2014. However, the problem in the implementation lies in the methodology to filter the data from its long-run trend. The most popular technique to filter them is the Hodrick-Prescott filter from Hodrick and Prescott (1997). However, many researchers suggest not using the HP filter since it contains a polynomial drift and creates a spurious result. Schüler (2020) found that the method of finding credit to the GDP gap by the Hodrick and Prescott filter gives a potential spurious relationship. Hamilton (2017) found that the HP filter created a spurious dynamic relationship with no base for underlaying data generation. He also found that the filtered values at the end of a sample differ from the value in the middle, indicating a spurious dynamic relation. However, Phillips and Shi (2021) suggested using the Hodrick-Prescott filter as long as it's boosted. They found that the boosted HP filter can overcome the polynomial drift with structural changes from the original HP filter.

This paper's contribution to the literature is implementing the boosted HP filter from Phillips and Shi (2021) in actual data and comparing them with the original Hodrick-Prescott filter. The following contribution to the literature is answering the question of whether the difference between two objectives impacts the actual practice of country resilience. We propose three hypotheses, starting from the hypothesis that the resilience focus market has a relatively faster recovery speed after a crisis. To prove this hypothesis, we analyze the difference in the recovery speed of the two markets after financial shocks using the output gap cycle. The second hypothesis is the taming credit procyclicality focus market performs better in moderating its credit cycle. We analyzed the credit gap cycle after the CCB implementation shock to prove the second hypothesis. The last hypothesis is the output gap has a positive relationship with the credit gap. The structure of the paper will start with the literature review, theoretical framework, methodology and data, result and discussion, and conclusion.

2. Literature review

The literature review in this paper consists of two main points. First is the literature review related to the research on the policy impact on building economic resilience and controlling the financial cycle. The second literature review is on the methodology for the development of the Hodrick-Prescott (1997) filter in setting the credit to GDP gap or credit gap as the indicator to design the countercyclical buffer rate.

The literature on procyclicality between financial and business cycles has been voluminous in the last decades (Benmelech and Dvir, 2013; Hodrick and Prescott, 1997; Reinhart and Rogoff, 2010). When the

business cycle increases, there is a procyclicality - the credit cycle also increases. The level becomes critical when this credit build-up is faster than its long-run trend. Voluminous research also has mentioned CCB as an effective tool in building bank resilience and mitigating vulnerability risk (Jiménez et al., 2012; Jokivuolle et al., 2015). Kelly (2013) analyzed the credit to GDP steady-state in Ireland and found a rapid growth of loans before the financial crisis occurred. Joukiville (2015) found that the debt losses increased during the recession if the country had excessive debt. Drehmann and Tsatsaronis (2014) found that CCB works in curbing systemic risk. Jokivuolle et al. (2015) found the drop in output will increase the number of loan losses if the private sector is highly indebted. Accordingly, calibrating the CCB based on credit to GDP gap or credit gap helps the bank prevent excessive loans. Grosse and Schumann (2014) found the German bank's procyclicality in giving loans with the sound economy chapter, shown by GDP growth. Pfeifer and Hodula (2021) suggested using the profit-to-provisioning approach as the base in setup CCB. They use banking prudence indicators to accommodate the profit and loan loss provision under the financial report standard. Claessens et al. (2012) found that CCB is not a good tool in preventing banks from banking crisis due to its ability to detect the financial cycle. The financial cycle has a bigger amplitude and duration than the business cycle. Therefore according to Claessens et al. (2012), the increase in credit does not indicate that the crisis will occur anytime soon.

After the global financial crisis of 2008-2009, major economies started to recognize the importance of macroprudential policies, especially countercyclical capital buffer (later called CCB), as a tool that supports the economic resilience goal(Araujo et al., 2020; Borio, 2010; Claessens et al., 2013). However, the research regarding the different aspects of these two objectives is still rare, see Babić et al., (2017). The research related to the differences between the policy that focuses on building resilience or taming the rapid credit cycle has more exposure recently while implementing a countercyclical capital buffer across the European market in 2014. Babić et al. (2017) state that some markets focus solely on building resilience, including Germany, Norway, and Sweden. Meanwhile, the other market group, such as France, Spain, and Italy, focuses on resilience and taming the financial cycle. The guidelines and parameters for setting up the CCB rate from these two objectives are different. However, both objectives have the same end goal, which is to prevent the occurrence of the financial crisis

In the last decade, most European economies have been excellent examples of excessive credit growth. Based on Kelly (2013), in Ireland, the increase in the private sector goes hand in hand with the house price and activities in such industry. The amount of mortgage in last decade is going two-fold, for example, 50000 mortgages in Ireland in 1995 increase to 125000 in 2005, including the average from 56000 Euro to 231 000 Euro. Most of these are the late manifestation of financial regulation changes, such as deregulation and liberalization. Traditionally credit source is a total domestic deposit. However, it changed in the last decades into cross-border funding in interbank borrowing and debt issuance. The practice that is entirely neglected before 1990. McQuinn and O'Reilly (2006) found a relationship between house and asset price and mortgage credit.

The article on economic resilience started when Keynes (1935) wrote his response to Schumpeter's economic disruption theory. Keynes introduced the soft landing theory to answer Schumpeter's theory of economic destruction (Minsky, 1975). According to Keynes, regarding economic resilience, the monetary and fiscal policy can help the authorities stabilize the economic indicator, such as inflation, especially after the Great Depression in the late 1920s. Research-related economic resilience policies have relied on two main aspects in the last decades. The first is related to the speed of economic recovery from the crisis, and the second is associated with the policy's effectiveness in dampening the shock. Blanchard and Summers (1986) found that structural policies such as employment protection have supported the country's resilience in front of the crisis. The policy supporting employment and private consumption has helped a country's resilience, dampened the negative shock, and prevented a company from laying off workers in the short run. However, the side effect is it slows down the wage adjustment process.

The spirit of global economic integration has highly influenced economic resilience research. Krugman (1993) mentioned since most European markets have the same monetary policy and currency, it gives more role

to the idiosyncratic shock toward the output gap. Frankel and Rose (1998) found that the similarity in currency, especially in Europe, leads to greater integration, faster transmission, and better alignment in the cycle. Catte et al. (2004) found that the degree of mortgage "completeness", such as the large variety and mortgage product choice to borrowers, has amplified the transmission from housing wealth to consumption. Cotis and Coppel (2005) researched cross-country business cycle patterns and found that the financial market flexibility has been key to the strong resilience of certain OECD countries. Deroose (2006) found that the transmission from housing to consumption in a more liberalized market is frequent. According to Duval and Vogel (2008), the shock factor influences the business cycle. Duval and Vogel (2008) hypothesize that there will be a more synchronized output gap among markets due to the less divergence policy, especially in OECD countries. They found that strong policies such as employment labour protection and product market ambiguously increase economic resilience. However, the flexible monetary transmission policy unambiguously dampens the shock. Duval and Vogel (2008) used the output gap to analyze the shock's economic recovery speed. Based on the research from Christensen and Meh (2011), Drehmann and Tsatsaronis (2014), and Grosse and Schumann (2014), the latest implementation of countercyclical capital balance has improved the economic resilience by helping the bank in collecting a buffer and running their intermediary functions during the occurrence of shock.

Meanwhile, the research regarding excessive credit risk started with the debt-deflation theory (Fisher, 1933). According to Fisher (1933), the economy experiences a downturn when the actual value of debt increases due to economic inflation. The situation worsens when the debt has origin from abroad and the currency crisis occurs in the home country. According to Reinhart and Rogoff (2009), the financial crisis during the two previous centuries is rooted in the issue of debt, especially debt deflation. The actual value of debt increases, and the ability to pay the debt is lower. According to Bordo et al. (2001), the financial crisis is described as a bank run, started by the rapid growth of bank loans five years preceding the crisis, increasing the probability of a crisis significantly. According to Stein (2021), an econometrician looking at the rapid growth of banking credit might conclude that the economy is in a vulnerable state. However, the rapid increase in debt does not always indicate that the crisis will occur and depends on whether the market is emerging.

Research from Mian et al. (2017) shows that the increase in household debt harms GDP. They used data from the 30 most advanced economies from 1962 to 2012 and found the 6.2% increase in debt during the credit boom within three years impacted to 2.1% decline in GDP for the following three years. The research from Jordà et al. (2013) and Schularick and Taylor (2012) found similar results where the credit boom harms output. A study by Greenwood and Hanson (2013) found when there is excessive credit in a relatively short period, above-average high yield shares indicate the elevated credit-market sentiment. Research from López-Salido et al. (2017) found that too much excitement in credit market sentiment in years t-2 is associated with the decline in output in years t and t+1. Excessive credit growth in a narrow range has a higher risk of default. The research from Kirti (2018) found that a 30% increase in credit to GDP ratio over five years impacts the 1.10% slower growth over the following three years period.

The research from Krishnamurthy and Muir (2017), using the data from the last 150 years, has found that price and quantity behaviour suggests that credit supply expansions are a precursor to the crisis. According to Stein (2021), looking at the impact of the credit boom on output, the government should implement a regulation that can follow the movement of credit, especially when the credit spreads are narrow, and there is a lot of low-quality debt issuance. Stein (2021) suggests the policy that can tame the credit are dynamic recapitalization, regulatory arbitrage, and lack of time-varying macroprudential tools, such as countercyclical capital buffer. According to Drehmann and Tsatsaronis (2014), the countercyclical capital buffer is already part of monetary policies and a companion since 1980. The tool has helped the financial authority control excessive credit growth during this period.

The literature on the credit gap has also been developed in the last decade. As an indicator of excessive credit growth, the credit gap has been used in numerous countries as guidance in setting the countercyclical capital balance. Research from Jokivuolle et al. (2015) found that the credit gap has effectively guided the market in setting up its countercyclical capital buffer. According to (Babić et al., 2017), all economies in the

European Union use the credit gap to assist them in implementing a Countercyclical capital buffer and calculating its rate. It becomes essential for some markets that do not have a capital market index. According to Hamilton (2017) and Phillips and Shi (2021), the issue in the credit gap relies on the methodology where the Hodrick-Prescott (1997) filter is implemented. The HP filter issue is that the method relies heavily on the setting of the smoothing parameter and how long the duration of the data. Hamilton (2017) found that the cycle from the HP filter is contaminated with the stochastic trend, especially when the data has a structural break. It creates a spurious result. There are a couple of other solutions, such as the Hamilton filter (2017) or the Baxter King filter. However, HP is still dominantly used. Phillips and Shi (2021) suggest that the HP filter can be used as long as the boost is implemented. The boosted HP shows that it can eliminate the polynomial drift in the previous HP filter.

3. Theoretical framework

3.1. Procyclicality of credit and business cycle

Credit plays a significant role in the development of the economy (Akram, 2014; Jokivuolle et al., 2015; Kelly et al., 2013; Schüler, 2020). Thanks to credit, small-medium enterprises, large corporations, and government can run their economic activities. Banks successfully run their intermediation function by lending money to the most productive sector. Moreover, the current economic system encourages the practice of spending on consumer goods by using loans and mortgages (Minsky, 1978). Therefore, there is always massive credit growth when the economy is growing. However, too fast development of credit can create a risk, majorly a systemic risk. It is evident from the role of credit in financial crises. Financial crises are a repeated phenomenon with a destructive effect on the economy (Reinhart and Rogoff, 2010) that arise after a long chapter of strong credit growth (Kindleberger, 1978). This credit growth comes with the economic output, making a procyclicality relation. In the last decades, credit growth has no longer impacted deposit growth due to financial innovation. The strong credit growth is the nature of systemic risk from economic activities that made the crisis an inevitable situation (Roubini and Mihm, 2010). The securitization practice made banks increase their loan without increasing their real asset. The massive build-up of credit has triggered several financial crises, such as the Asian and Latin American crises in 1990 (Kaminsky and Reinhart, 2000). A decade after the Asian crisis, another financial crisis occurred in 2008 due to excessive credit. These excessive credit build-ups result in the credit boom and default (Dell'Ariccia and Marquez, 2006). Meanwhile, The other impact of massive credit growth is the loan losses (Clair, 1992).

Generally, during the upswing, credit tends to increase. These practices become common because economic agents tend to underestimate the risk in lending (Kelly et al., 2013). Meanwhile, in the bank balance sheet, the growth of asset price gives the potential opportunity for a bank to increase its loan. As the price of stock increases, if we follow the accounting rule where total assets should be equal to total liabilities, it creates a gap in the loan amount. Therefore bank can increase their loan or credit during the good economic condition. Besides the property and housing prices, the volume of credit is an essential indicator of the financial cycle. The financial cycle has a larger amplitude and longer duration than the business cycle (Claessens et al., 2012). The financial cycle has a longer duration because it takes time for a credit to be distributed and taken. However, the financial and business cycle path is almost similar, with growth, a boom, a decline, and the through. Therefore, even though it is a co-movement in the financial and business cycle, the impact of credit supply toward GDP as a proxy of the business cycle is not always direct or related.

According to Bordo et al. (2001) and Greenwood et al. (2010), the theory of the excessive growth in the credit cycle roots in two questions. First, investors come overoptimistically and drive the spreads to an unacceptable level. The second question is why the cycle occurred endogenously. Minsky (1986) and Kindleberger (1978) brought the idea of unavoidable financial risk with their work in behavioural finance,

which focuses on investors with imperfectly-rational beliefs. Greenwood et al. (2020) found that time-varying credit-market sentiment arises from the extrapolative views of investors. For example, the agency problem between intermediaries and their shareholders is intensified in periods of low-interest rates. During the credit expansion, bank stakeholders get pressure not to lose the market share. Therefore, herd mentality plays a significant role. Managers create a credit mistake due to shareholder pressure if they continually lose the market share (Rajan, 1994). It aligns with Keynes's beauty contest, where every investor decision follows what most investors did and thought (Keynes, 1935). Managers also tend to underestimate the risk from previous crises, known as Institutional memory loss (Berger and Udell, 2004).

Before ECB introduced CCB in 2014, both countries experienced a pro-cyclical bank (Grosse and Schumann, 2014). It means that during the economic downturn, the bank collects more capital. The bank does not want to fall short during the downturn. This 'detrimental' behaviour focuses on the Basel committee and supervisor board. The Basel committee focuses on the pro-cyclical impact by observing uncommon changes in balance sheet leverage, insufficient liquidity buffers, and the capital base quality. As Grosse and Schumann (2014) found in their aggregated data, they documented a German banking procyclical behavior where banks increased their capital base during the downturn. Similar research was found by Jokipii and Milne (2011), which observed a slow adjustment process of this procyclicality. According to Grosse and Schuman (2014), in Germany, the countercyclical capital buffer attempts to fix a paradox where a minimum capital requirement is not functioning in mitigating the risks. Strict minimum capital requirements can further hurt the economy (through lower bank lending), which could cause more problems for the banks, a vicious circle with a destabilization of the banking system. D'Avack and Levasseur (2007) find evidence that banks in Central and Eastern European Countries (CEECS) behaved pro-cyclical between 1997 and 2005, meaning that they decreased their capital buffers to take advantage of business opportunities.

2.2. Countercyclical Capital Buffer and credit gap

After the global financial crisis, the Basel committee emphasizes that many economies re-invent their financial policy that cut the systemic risk after the procyclical relation between credit and economic output. All these policies are accommodated in Basel III regulation and implemented in every market through a Macroprudential approach. One of the tools expected to cut this procyclicality is the countercyclical capital buffer. A countercyclical capital buffer (CCB) is an instrument of the macroprudential policy that aims to prevent the bank from taking excessive risk. The risk is giving the excessive loan amount in the expansion period (economic boom) that impacts the build-up of systemic risk. The purpose of CCB is to help frame the decision on when to activate the buffer and the communication of related findings (Drehmann and Tsatsaronis, 2014). This buffer is extra money for the economy that experiences a contraction moment. Therefore, the buffer can keep the bank running its intermediation function. The amount of CCB is relatively dynamic and depends on the economic situation.

In Basel III, the Bank of International Settlement uses the credit gap to help the authorities implement CCB. The data from the credit gap helps the authority find the current situation compared with the credit trend. The credit gap is the difference between the credit to GDP ratio and its long-term trend (Drehmann and Tsatsaronis, 2014). The credit gap has been helpful as the guidance of policymakers in detecting the potential of financial crisis occurrence (Borio and Lowe, 2002). The credit gap can reflect the impact of credit on the business cycle and, at the same time, can show whether there is a rapid credit build upon some period. Therefore credit gap can be used as an indicator of future default (Basurto et al., 2006). The idea to bring credit gap comes after excessive credit growth. The abnormal movement of credit is one of the components of a crisis indicator.

The Basel Committee also proposes to wire this approach into the regulatory system using the credit gap to calibrate the countercyclical capital buffer. Most financial authorities get the value of the credit gap by filtering the long-run trend using a Hodrick-Prescott (HP) filter. However, there are critiques why the credit gap is not suitable for the guidance of policymakers in setting up the capital buffer. A credit gap is not the best

indicator of a banking crisis, especially for Emerging market economies (Jokivuolle et al., 2015). Another research mention that the credit gap is not a suitable anchor for the buffer because it moves countercyclically with the GDP growth. Their argument is based on the business cycle stage that CCB driven by the credit gap will worsen the GDP fluctuations (Repullo and Saurina, 2011). Rajan and Zingales (2001) mentioned that the HP filter would fit all trends; it will not be detected if there is a structural break. In the long run, the structural break is straightforward to occur. For example, credit growth beyond the GDP commonly occurs in developed economies.

2.3. Resilience vs Taming the credit cycle policies

In economic literature, there were several definitions of financial crisis resilience. Foster (2006) defined financial crisis resilience as the ability to anticipate, prepare for, respond to, and recover from a disturbance. Based on Simmie and Martin (2010), financial crisis resilience is a system's ability to either regain a situation to a previous equilibrium state or move quickly to a new one. Based on Hill et al. (2008), financial crisis resilience is an adaption ability toward changes and shocks in the market. This change involves technology, policies, and any condition that brings the economy's dynamicity and trajectories. There were many interruptions and disruptions within the economic process, such as periodic economic recession, the unpredictable rise of significant competitors, unexpected plant closures, and the challenges arising from technological change. Didier et al. (2012) found that the emerging economies were more resilient during the global financial crisis than developed economies. However, the number only shows during a financial crisis because before the problem and after the disaster, the emerging economies also had severe economic growth and recession. Fleming (2016) defined the financial crisis resilience as the capacity of a system to regenerate itself after a particular shock.

In the countercyclical capital buffer role research, financial resilience is the bank's ability to run its task as an intermediary agent when the economy contracts (Babić et al., 2017; Grosse and Schumann, 2014; Repullo and Saurina, 2011). The first step in the calibration CCB is to assess the current and possible forecast for the next stage of the financial cycle. However, the challenge is setting a clear nominal threshold that would signal that a particular variable trend is unsustainable or moving away from equilibrium (Rychtárik, 2009). The additional money in the economy and credit expansion becomes a buffer during the economic downturn. Besides, the CCB is a benign cost that will not harm the economy. A countercyclical capital buffer's objective is to mitigate the systemic risk/vulnerability resulting from the massive credit growth. Geršl and Jašová's (2014) research showed that measures such as asset classification and provisioning rules, and loan eligibility criteria effectively tame bank credit growth in Central and Eastern European countries during 2003 – 2007. However, they mentioned that this policy loses its effectiveness by the international bank's role in delivering direct credit to their sub-branch. Another research about taming the financial cycle comes from Popoyan et al. (2017), which develops an agent-based model that focuses on the output gap, inflation, and credit growth. They found those minimum capital requirements and countercyclical capital buffer effectively smooth the output fluctuation. The following research is from Scheubel et al. (2019), who analyzed the impact of the global financial cycle on emerging market economies can be tamed or not. They found that access to IMF reserves and Global Financial Safety net usage can help them reduce the shock to output fluctuation.

2.5. Countercyclical Buffer implementation in European countries

In theory, the increased bank credit should match the bank capital (Jokivuolle et al., 2015). Therefore, Basel III introduced the countercyclical capital buffer as an indebted country relative to its trend. The following research question is whether the CCB can improve the economic model of credit volume toward GDP volume. The countercyclical capital buffer implementation started in 2014, based on the European Systemic Risk Board (ESRB) recommendation 2014/1. It was followed by recommendation 2015/1 on recognizing and setting CCB

rates for exposure to the third countries. The ESRB issued the commentary on the indicators about when to activate CCB. ESRB gave the periodically report about such detail quarterly. In practice, the European central bank can apply a higher requirement for capital buffer than those used by authorised member states that joined the Single supervisory mechanism (SSM). ECB has considered the member state's specific economic and financial situation. The CCB has two objectives in European economies; such first is to focus on improving policy in building resilience against future financial crises. Primarily there was information that several European countries' economic cycles are worsening (Babić et al., 2017). The CCB also potentially impacts credit provisioning during the downturn and relatively benign costs during the upswing phase.

Based on European Central Bank, Among 27 members of European Union countries, only 14 economies have set up a countercyclical capital buffer. Even though Basel Committee and ESRB guide the CCyB implementation, in fact, every country runs CCyB in a different way. Countries set their CCB at a different level implied by the Basel buffer guidance suggested by ESRB/2014/1. It is understandable as the CCB regime in the EU follows the principle of 'guided discretion, for example, a rule-based approach combined with control on the part of the policymaker. Implementing the Countercyclical capital buffer has been 164 times occurring in all markets with different periods. Some markets revise their CCB every quarter. The implementation occurs in 14 countries. However, due to the limitation of data, we exclude Bulgaria, Lithuania, Iceland, Slovakia, and Romania in this paper.

The next following section is the discussion regarding the background of our market sample, Germany and France. We discuss the economic situation in both countries before implementing CCB. The section also discusses both countries' differences in running the countercyclical capital buffer policy. Germany is the largest market in the European Union, its share in the European economy is 28% among all member states. The largest employment in Germany is in the industry sector, with 78% of the GDP share. In 2016, Germany had the world's largest trading surplus, worth 310 billion USD (IMF, 2021). It helps to construct their GDP, wherein 2022 has 4,55 trillion USD.

Meanwhile, France is also part of the largest economy in the European Union, recorded a GDP of 2.72 trillion USD in 2022. France is recorded as the largest recipient of Foreign direct investment in the EU in 2020 (OECD, 2021). The GDP in France is mainly constructed by the service sector, which constructs 78% of GDP. However, France experienced stagnant growth between 2012 and 2014, by below 1% when it comes to economic growth. This was followed by an increase beyond 1.1% in the following years (OECD, 2021).

Regarding the date of both market's CCB implementation, the French market, through the country council for financial stability (HCSF), decided to raise their CCB rate from 0% to 0,25% on 29 June 2018, and the announcement date is the first of July 2018. The reason behind this rise is that non-financial private-sector indebtedness reached 133% (Adrian, 2019). Meanwhile, in Germany, through BaFin, the authority decides to raise their CCB on 28 of June 2019 by 0,25%. The reason is that the BaFin observe a systemic risk from the credit procyclicality. They see that there are risks to the financial stability and name it as a threat situation that sources three aspects (i) risk related to the path economy that is not covered by micro-prudential credit risk measurement, (ii) real estate lending risk, and (iii) interest rate risk – that is interest rate risk persisting for even longer at the zero lower bound (BaFin). The table below shows when the CCB is implemented in both economies.

Table 1. The rate, decision and announcement date of CCB Implementation in France and Germany

Country	Decision	Date announcement	Rate (percentage)
France	29/06/2018	01/07/2018	0,25
France	28/09/2018	01/10/2018	0,25
France	23/01/2019	23/01/2019	0,25
France	02/04/2019	03/04/2019	0,5
France	09/07/2019	10/07/2019	0,5
France	30/09/2019	01/10/2019	0,5
Germany	28/06/2019	28/06/2019	0,25

Germany	30/09/2019	30/09/2019	0,25
Germany	30/12/2019	30/12/2019	0,25

Source: (ECB, 2020)

At least there are six differences between Germany and France in implementing their macroprudential. The structure, the purpose, the rules, the core indicators, the indicator for release, and the forward guidance. The first difference is the institution responsible for CCB implementation. The Bundesbank helps in data and analysis for BaFin. The financial stability committee also gives a recommendation to BaFin. In France, the authority that decides on CCB implementation is the country council of financial stability or HSCF. The HCSF consists of the Minister of Finance, Governor of the Banque de France, the prudential supervisory and resolution representatives, financial markets, accounting standard authorities, and three qualified members, usually academics. The HCSF relies on central bank for research, identify, and monitor its early warning system.

Regarding policy objectives, Germany focuses on Building resilience during the upswing of the financial cycle. While France primary focus is on building resilience as their direct objective, the indirect objective is dampening the financial cycle. Accordingly, to inform its decision on the buffer rate, HCSF uses two indicators that take into account about the direct and indirect objectives. The next difference is whether the justification for running the CCB is either by rules or guided discretion. Buffer guides perceived to be less formal rules. However, Germany put different weights on the implied rates from different buffer guides. For example, CCB rate implied by the credit gap, the potential credit losses, the financial cycle indicator, and the duration and trajectory of the financial cycle.

Regarding indicators, Germany's CCB aim is linked to types of indicators that will be closely monitored, such as bank credit to the private non-financial sector. BaFin also keeps their eyes on the private sector debt, bubble, and the bank's health. The resilience indicators are private sector debt, debt burden, residential real estate (RRE), soundness of banks, and risk mispricing. Meanwhile, to release the CCB, the credit gap, credit gap (adjusted bank credit) main indicator, a composite indicator of systemic stress (CISS) based systemic risk indicator, and realized risk.

In France, the authorities consult two indicators when considering the CCB direct objective (building resilience) and the indirect (tame the cyclicality). The direct objective indicator is credit gap. Meanwhile, the indicator for indirect is broader credit measures related to macroeconomic, credit, market, liquidity, financing, and solvency risk. The indicator for building resilience is bank credit to private NFI / GDP. They analyzed its growth and gap. In France, the concern about Net Foreign Investment is very high since the market has a huge amount of money inflow. Regarding limiting procyclicality: broad credit to private NFI / GDP, growth, gap, variations, RRE prices. The base in releasing the CCB is the credit gap (adjusted) for both objectives, together with market stress indicators.

Both markets see the inadequacy of the credit gap because it was deeply negative in the wake up of the financial crisis. Therefore, they use other cyclical risk indicators as a reference, guide, or benchmark buffer rate. Under guided discretion, national authorities are encouraged to exercise judgement in heeding signals from different references.

Regarding forward guidance, Germany has no future guidance on whether they want to lower the rate back to zero. BaFin closely monitors the indicator in a short period. Meanwhile, in France, they recognize that implementing CCB can hurt the output; therefore, they are discussing the opportunity to lower the rate in the coming future. HSFC observes credit gap deeply negative values to signal their expectation to keep the CCB rate at zero for some time (Babić et al., 2017).

Table 2. Germany and France CCB policy description

Country Symbol	**DE**	**FR**

Country	Germany	France
Designed authority	BaFin (Federal Financial Service Authority)	Haut Conseil de Stabilite Financiere (High Council for Financial Stability)
Designed authority type	supervisory body	other than supervisory body and central bank
Framework publication	Published strategy, explicitly analyzed credit gap as a vital indicator, no detailed buffer guide	a published plan detailing indicator and their composition, no buffer guide
Building resilience vs taming the cycle	primarily building resilience	Both are building resilience and taming the cycle
Rules vs discretion	Rule	mostly discretion
Core Indicators in		
Increase	Private sector debt burden, Residential (credit growth and prices), soundness of banks, risk mispricing	Bank credit to private NFI / GDP, the credit growth and credit gap Controlling procyclicality: broad credit to private NFI / GDP, growth gap, variations residential prices
Credit gap usage	Credit gap (adjusted bank credit) main indicator	Credit gap (adjusted) key indicator for both objectives
Release	CISS-based systemic risk indicator released risks	Market stress indicator
Forward guidance	No forward guidance	Discussing the credit gap anchored the expectation not to increase CCB in the near future

Source: Babić et al. (2017)

4. Methodology and data

4.1. Research question and hypothesis

Looking at the previous background, explicitly focusing on resilience vs taming the systemic risk from credit cycle as the goal on CCB implementation, this paper examines the implications of the choice of different objectives of CCB policy. The differences that we aim to see are market resilience in front of shock and the market's ability to tame the financial cycle. Building resilience means that the country uses the CCB, as a rule, to collect the buffer cash when the economy is in the upswing. The bank will use the buffer to keep its intermediary function in the financial deepening. Meanwhile, the second objective is taming the systemic risk due to abnormal growth in the credit cycle. The implication is the market attempt to control the ratio of their credit to GDP ratio at a stable rate. The additional novelty of this paper is that we will also compare the credit gap obtained with a conventional HP filter and the boosted HP filter developed recently by Phillips and Shi (2021). We will employ the event analysis to examine the movement between financial and business cycles.

Regarding the resilience test, we analyse the evolution of the output gap, the metric commonly used to see country resilience see Duval and Vogel, (2008). We will use the credit gap to assess the CCB impact of excessive credit growth on the GDP. After that, we investigate the relations between the output gap with the credit gap using the VAR models. We use data for Germany and France. These two countries are chosen because they are the largest economies in the European Union and set the CCB rate above zero per cent during the 2014

to 2021 period. Until today, other largest markets, such as Italy, Spain, and the UK, have never raised the CCB beyond zero per cent.

The research questions accommodate a couple of interests, a shortcoming in the previous literature. The first question is how fast the economic recovery is after the financial shocks. We believe the economy that focuses on resilience performs better in recovery speed. Therefore, our first hypothesis is

H1: The market that focuses on resilience has a relatively faster recovery from the shock than the market that focuses on taming the financial cycle.

To prove the first hypothesis, we compare the output gap movement between Germany and France economic quarterly GDP index from 1999 to 2021. We investigate the economies' recovery speed after adding the financial shock of the global financial crisis 2008 and the Covid-19 pandemic in 2020. To increase the robustness of the output gap calculation, we introduce Phillips and Shi's boosted Hodrick-Prescott filter (2021) and compare the result with the original Hodrick-Prescott (1997). We expect the market that focuses on resilience will have a much faster recovery than those focusing on resilience and taming the credit cycle. The method in analysing the resilience through the recovery speed aligns with the research from Duval and Vogel (2008), where economic resilience can be analysed from how fast the economy recovers after a financial shock.

The second interest in this research is whether the market that focuses on taming the financial cycle as its primary objective will have a more moderated financial cycle.

H2: France, which put the mitigating financial cycle as one of its primary objectives, has less volatility in its financial cycle.

To prove the second hypothesis, we compare the credit gap movement between Germany and France using the Credit gap quarterly from 1999 to 2021. The Credit gap is calculated by deducting the actual credit to GDP ratio with its long-run trend. Following that, we will introduce the time when the CCB is implemented and see whether it affects credit movement to GDP. We analyse whether the credit gap cycle in the country that put taming the credit cycle as their primary objective has a more moderated credit gap cycle. To improve the robustness of the credit gap calculation, we also compared the credit gap obtained from the original HP filter and boosted the HP filter from Phillips and Shi (2021).

The third interest in our research is whether the credit Gap strongly impacts the output gap.

H3: There is a positive relationship between the credit and output gaps.

We will use vector autoregression to prove the third hypothesis and analyse the relation between output and credit gaps. Based on the research from Mian et al. (2017) and Stein (2021), we expect a positive relationship between credit and output gaps. More specifically, we expect credit growth to affect output for Germany and France significantly. Additionally, we also add the Granger causality hypothesis such as

H_{3a}: The credit gap is not the 1-step Granger-cause of the output gap.
H_{3b}: The output gap is not the 1-step Granger cause of the credit gap.

4.2. Empirical Methodology

The methodology aims to answer the research question by providing the empirical calculation and result collected from the real event. We need to filter the time series data from three proposed research questions and extract the cyclical and long-run trend data series. Therefore, we employed a smoothing technique to segregate the long-run trend and the cyclical series. The most popular technique to filter them is the Hodrick-Prescott

filter, and it has been used by European Central Bank and almost all countries in creating a decision regarding the setup of a Countercyclical buffer rate (Hamilton, 2017; Jokivuolle et al., 2015; Phillips and Shi, 2021; Repullo and Saurina, 2011). However most of

We used the data from the European central bank, OECD, and World bank to answer the quarterly hypothesis from 1999 to 2021. The market that focuses on resilience is Germany; France focuses on resilience and taming the credit cycle. The first hypothesis is the market that focuses on resilience has a relatively faster recovery after the financial shock. We want to see whether the recovery time is shorter in the empirical result. We use the output gap to find the recovery speed time, the methodology also used by Duval and Vogel (2008).

Boosted HP filter

According to Phillips and Shi (2021), macroeconomic data comprises trending long-run growth and cyclical component. The long run growth shows aggregate economic activity and a cyclical component of fluctuation over shorter periods. This fluctuation shows a business cycle. Trends are determining long-term economic prospects and the sounds economy's situation. Meanwhile, the cyclical behavior is important to decision makers and help them understand past contractions to forecast future. It is important to divide the cyclical component from the trend. These segregation can be pursued by regression and filtering. According to Hodrick and Prescott (1997), the movement can be detected by smoothly varying component related to the observed data. Hodrick and Prescott (1997) introduce this concept and call it a HP filter.

According to Phillips and Shi (2021) the boosted HP filter (bHP filter) improve the trend regardless of whether the time series contains a stochastic trend or a polynomial drift with a structural break. It means the bHP filter effectively delivers a consistent estimator of the breaking point. Hence, the boosted filter provides a new device for consistently estimating numerous breakpoints and delivers automatically without an additional detection method. The additional advantage is that it provides robustness to the original setting of the tuning parameter lambda in the HP filter before the boosting iteration. The boosted HP can employ the HP algorithm with a standard parameter setting concerning the robustness of the result that eliminates bHP dependence on the original HP tuning parameter and provides empirical investigators. The use of bHP can help us in against critique that findings are dependent on an arbitrary choice of tuning parameters.

Output Gap

We will use the output gap as the proxy to answer the first hypothesis of whether the resilience focus market recovers much faster. The formula of the output gap is

$$Output\ gap_t = \frac{Actual\ output_t - Potential\ output_t}{Potential\ output_t} \times 100\% \quad (1)$$

The output gap compares the actual output with the long average of output. From the output gap, we can analyze how the actual output perform. If the value is negative, there is a drop in the actual output performance. The actual output can identify whether the economy is in recession or the boom period.

The following step calculate the long-run trend or potential output using the original Hodrick-Prescott (1997) filter with the boosted Hodrick-Prescott filter from Phillips and Shi (2021). After that, we can calculate the output gap cycle and how long the market recovers or returns to point 0 after receiving the financial crisis shock. The shock will be the global financial shock in the second quarter of 2008 and the shock of COVID-19 in the second quarter of 2020.

Credit gap

We need to calculate the output gap cycle with the Hodrick-Prescott filter and the boosted Hodrick-Prescott filter to answer the second hypothesis. Credit Gap is derived from two-step. The first is finding the ratio of

credit to GDP. The second step is to find the credit gap by finding the difference between the actual credit to GDP ratio and its long-run trend value. This difference is then divided with its long-run trend.

$$Credit\ to\ GDP_t = \frac{Total\ Credit_t}{GDP_t} \tag{2}$$

$$Credit\ gap_t = \frac{Credit\ to\ GDP_t - Long\ run\ trend\ Credit\ to\ GDP_t}{Long\ run\ trend\ credit\ to\ GDP_t} \times 100\% \tag{3}$$

After that, we will count the amplitude of the credit gap cycle to see whether the CCB shock can moderate the financial cycle.

Vector Autoregression
We will use the vector autoregression to answer the last research question by finding the relationship between output and credit gaps. We also consider the lag data of output gap and credit gap.

$$\begin{bmatrix} y_{1,t} \\ y_{2,t} \end{bmatrix} = \begin{bmatrix} c_1 \\ c_2 \end{bmatrix} + \begin{bmatrix} a_{1,1} & a_{1,2} \\ a_{2,1} & a_{2,2} \end{bmatrix} \begin{bmatrix} y_{1,t-1} \\ y_{2,t-2} \end{bmatrix} + \cdots + \begin{bmatrix} a_{1,1} & a_{1,2} \\ a_{2,1} & a_{2,2} \end{bmatrix} \begin{bmatrix} y_{1,t-4} \\ y_{2,t-4} \end{bmatrix} + \begin{bmatrix} e_{1,t} \\ e_{2,t} \end{bmatrix} \tag{4}$$

Where $y_{1,t}$ is the output gap at time t, and $y_{2,t}$ is the credit gap at time t. Vector autoregression is a stochastic model that checks the relation of multiple variables that change over time. We would like to see this model's output gap and credit gap relationship. Since we use quarterly data, the lag data will be set until lag 4. To increase the robustness of the result we also will implement Granger causality. Granger causality is commonly used to test whether one variable can predict another. We would like to see whether the output gap can predict the credit gap within this test.

The hypothesis from Granger causality is,
H_1: The credit gap is not the 1-step Granger-cause of the output gap.
H_2: The output gap is not the 1-step Granger cause of the credit gap.

We will test and compare the result of vector autoregression in the long run, the series before CCB introduction in 2014, and the series after 2014.

5. Result and discussion

The result presents the base analysis on the economic recovery speed after financial shock by the movement of the output gap. It continues with CCB implementation's ability to tame the credit cycle by analyzing credit gap movement after CCB implementation shock. And the last is the relationship between output and credit gaps using vector autoregression. The sample data comes from quarterly data of Germany and the French economy from the first quarter of 1999 to 2021. Regarding data robustness, we use the boosted HP filter of Phillips and Shi (2021) in all calculations and compare the result with the original HP filter of Hodrick-Prescott (1997).

5.1. The speed recovery after a financial shock

The following graph shows the speed of the economy's recovery after a financial shock. The movement of the output gap cycle shows when the market is recovering. We expect that the output gap from the boosted HP filter eliminates the polynomial drift due with the structural break (Phillips and Shi, 2021) and biased results due to structural economic changes (Hamilton, 2017). The next expectation is Germany, as a market that focuses on

resilience has a much shorter recovery speed than France. The latter market focuses on both resilience and taming the economic cycle.

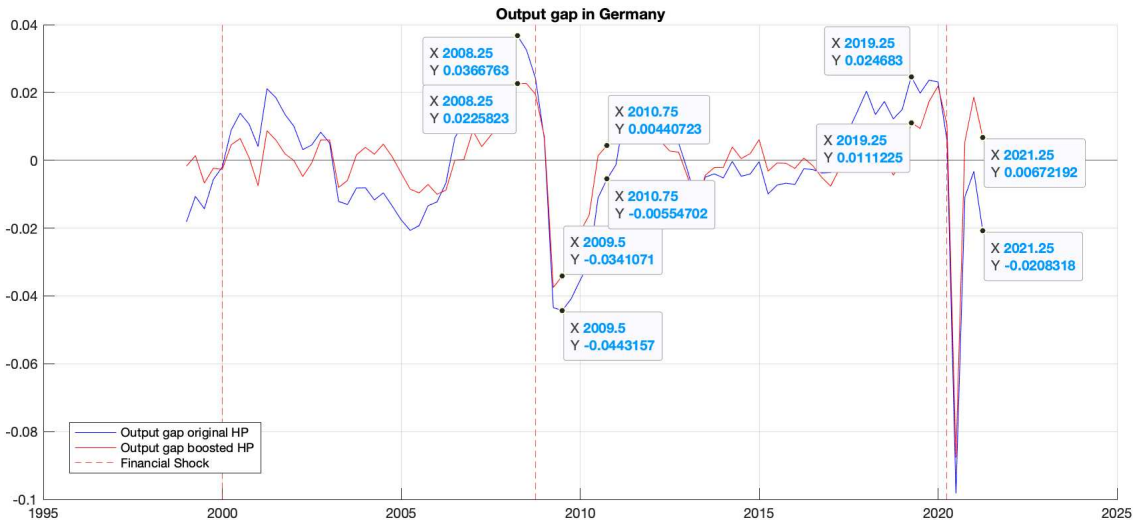

Fig 1. The comparison of output gap cycle calculated by original HP filter and bHP filter in Germany
Source: Author Calculation

Based on the graph, we see that boosted HP filter significantly improves the robustness of the output gap cycle by excluding the polynomial drift with structural break. Based on 1999 to 2021 quarterly data, we expect a structural shift in the original HP filter, especially in the time of financial crisis 2008. The boosted HP filter with the Bayesian information criteria (BIC) stopping parameter can exclude the bias effect of economic shifting. We see a significant difference in the cycle upswing peak at one per cent at the first quarter of 2008. In the lowest cycle, there is also a substantial difference of one percent, in the second quarter of 2009. The boosted HP filter also shows that in the third quarter of 2010, the German economy has gained back the recovery moment. It takes 2,5 years for Germany to gain the positive cycle in their output gap.

Meanwhile, the original HP filter still indicates that the economy is not recovering. The situation also shows the same recovery speed after the financial shock of the Covid-19 pandemic that occurred in the first quarter of 2020. The boosted HP filter indicates that the economy has gained back the recovery mode in the first quarter of 2021; meanwhile, the original HP filter still shows that the economy is still not recovering yet.

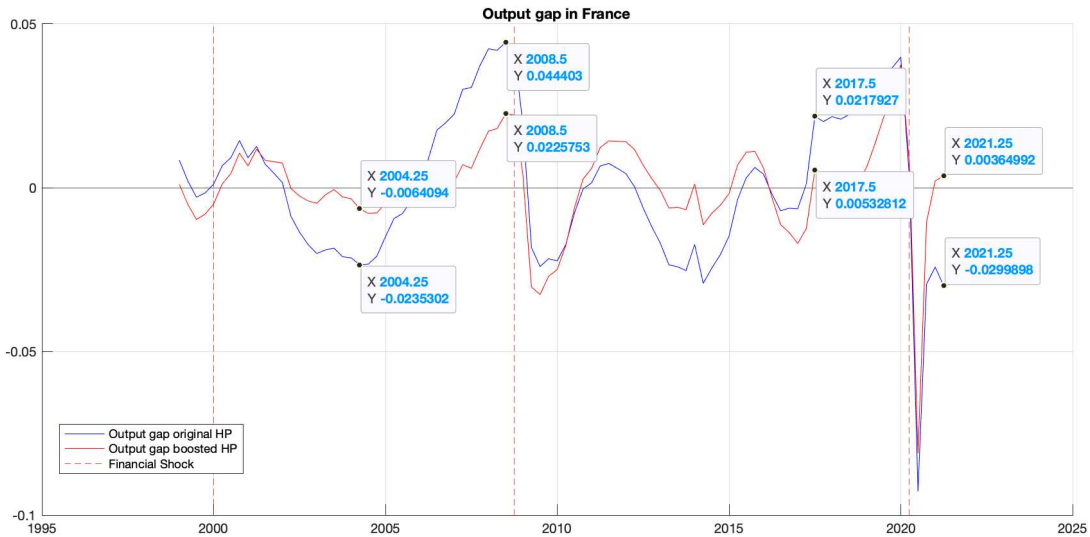

Fig 2. The comparison of output gap cycle using original HP filter and bHP filter in French
Source: Author calculation

A relatively similar result occurs in a French market, where the boosted HP filter from Phillips and Shi (2021) improved the output gap cycle calculation. The difference on the upswing peak of the output gap in French at the second quarter 2008, has differences by two percent. The number is relatively large for the cycle result. We also can see that after the pandemic Covid-19 hit in the first quarter of 2020, the original HP filter shows that the French output gap is still not in recovery mode yet, while the boosted HP filter indicates that the economy has set a positive value.

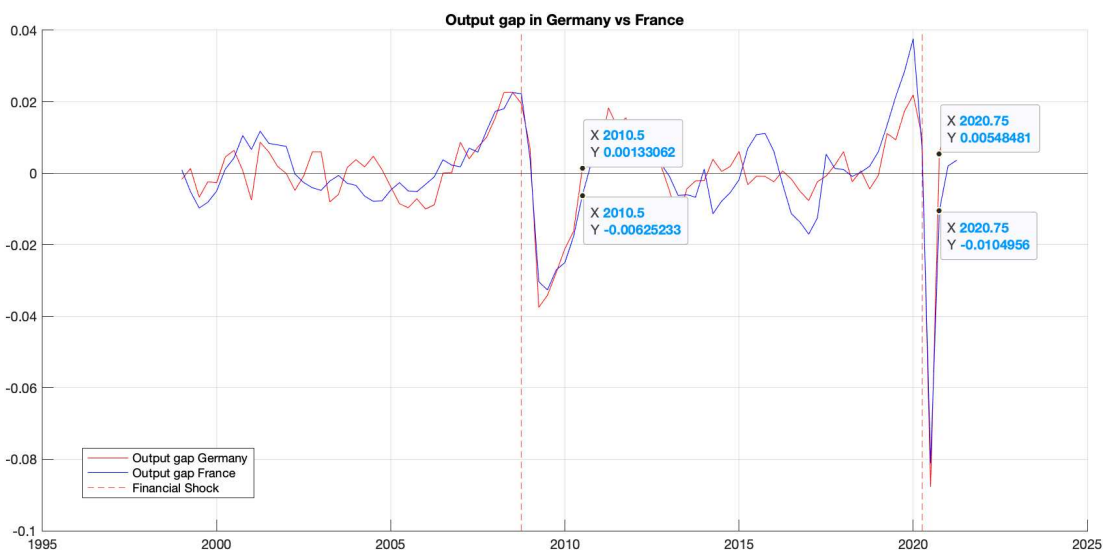

Fig 3. The comparison of output gap cycle in Germany and France with boosted HP filter
Source: Author calculation

The result shows that Germany and France, as the largest economy in European economies, have similar financial shock patterns. It aligns with the research from Krugman (1993), where markets that share similar patterns of monetary policy and the same currency behave the same in front of idiosyncratic shock. Duval and Vogel (2008) also found a more synchronized output gap among markets due to the less divergence policy. To conclude, when it comes to our first hypothesis, where the resilient focus market has a faster recovery speed, the result supports the hypothesis. Germany has a shorter recovery time than the French market. In the second quarter of 2010, Germany's output gap has reached 0.00133, while in French, the output gap is still at -0.00625. The same situation also occurred after the pandemic shock in the first quarter of 2020, where the French market in the third quarter of 2020 still has a negative output gap of -0.0104. Meanwhile, the German output gap is at the positive level of 0.00548.

5.2. The credit cycle after CCB implementation shock

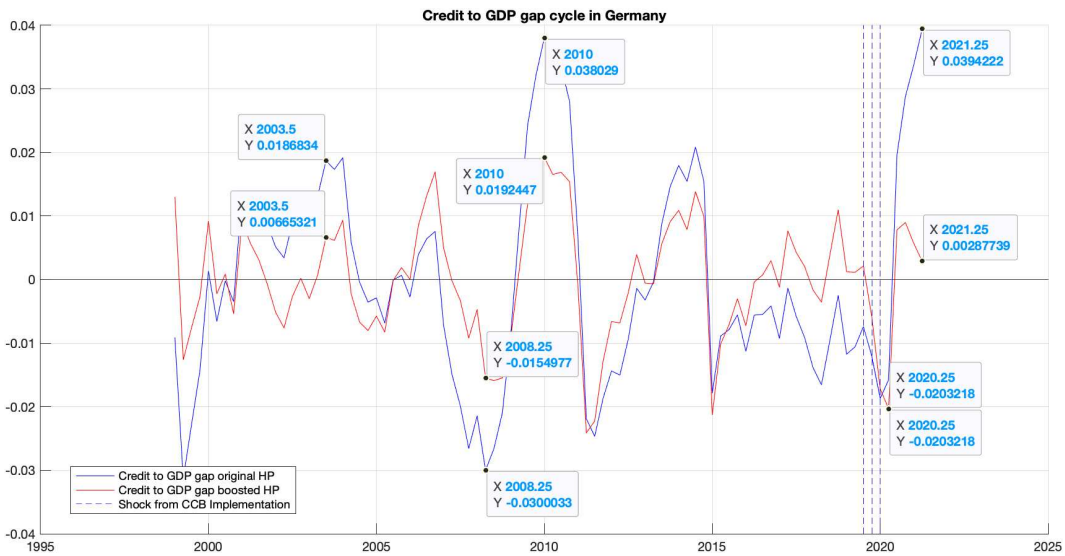

Fig 4. The credit to GDP gap of Germany was calculated with the original HP filter and boosted HP filter
Source: author calculation

The graph shows that the credit gap generated from the boosted HP filter of Phillips and Shi (2021) improved the accuracy of the cycle in comparison with the original HP filter. The original HP filter contains the polynomial drift as the data gets more extensive and contains a structural shift, see Phillips and Shi (2021). Meanwhile, the boosted HP filter shows a more robust result where it removes the polynomial drift using BIC stopping criteria. In the peak of upswing period 2010, the differences between bHP and HP filter are two per cent. The difference in the first quarter of 2021 is 0.0366. It also answers the critiques that make most financial authorities hesitant to HP filter because it shows a profoundly negative result before the crisis, see Babić et al., (2017). With the boosted HP filter, the differences are pretty significant by 1,5 percent in the first quarter of 2008.

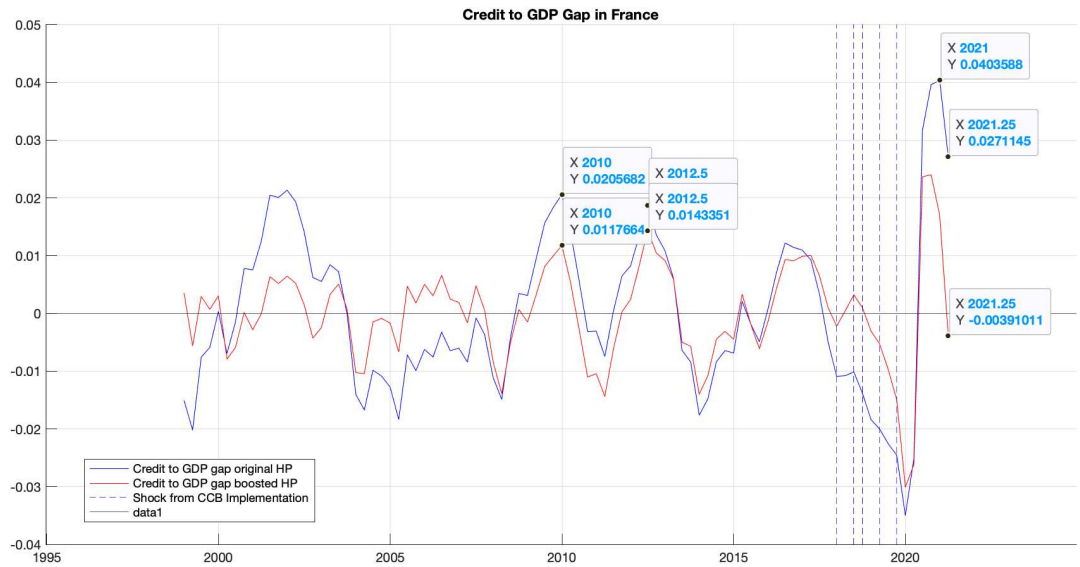

Fig 5. The credit to GDP gap cycle in France was calculated using the original HP filter and boosted HP filter
Source: author calculation

The result shows that the boosted HP filter also improves the robustness of the data in credit to GDP of France market. The significance difference occurs in the peak of 2010, where the difference is nine base points. Also, the original HP filter shows a considerable gap with the boosted HP in the first quarter of 2021. This result aligns with the research from Hamilton (2017) and Repullo and Saurina (2011), where the original HP filter contains the polynomial drift as the data gets more extensive.

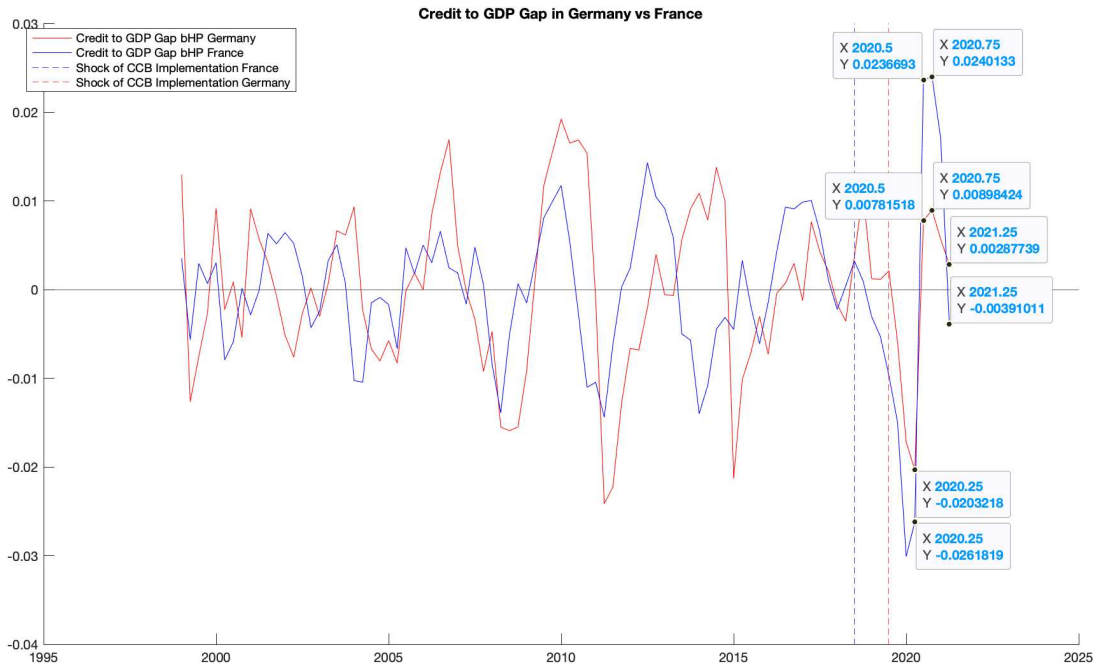

Fig 6. The comparison of credit to GDP gap cycle from Germany and France
Source: author calculation

In the long run, since 1999, we can see that Germany and France have similar patterns, as also defined by Krugman (1993) thatalso states both markets share the same currency and simitary objective. However, the result shows that Germany's cycle is more volatile than French economies, as the German economy is two times bigger than France.

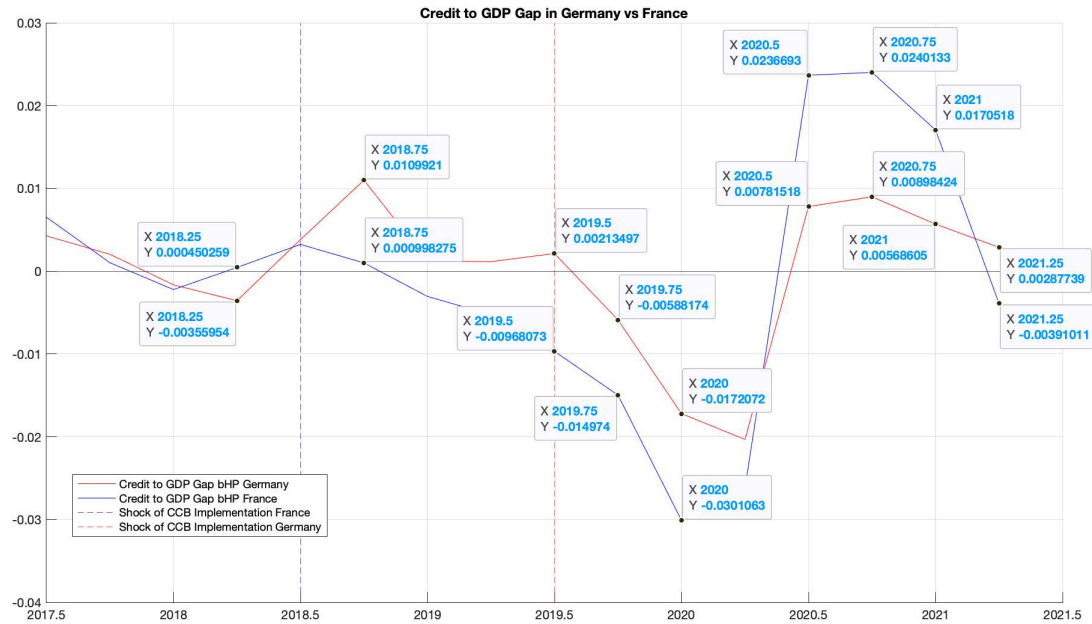

Fig 7. The credit to GDP gap after the CCB implementation shock in Germany and France
Source: author calculation

From the figure above, we found that, compared with Germany, the shock after CCB implementation does not give better moderation in the French credit gap cycle. Based on the graph, the CCB shock better moderates Germany's credit gap, showed by smaller amplitude. For example, in 2020, before the lowest credit gap point, Germany reached -0,017 while French reached -0,03. Meanwhile the peak of the third quarter of 2020, Germany reached an amplitude of 0,008 while France reached an amplitude of 0,02. Based on the calculation above, the hypothesis that a controlling credit cycle focus market performs better in controlling excessive credit growth is not supported by the data.

5.3. The procyclicality of credit to GDP

We run the vector autoregression to determine whether there are positive relationships in credit to the output gap.

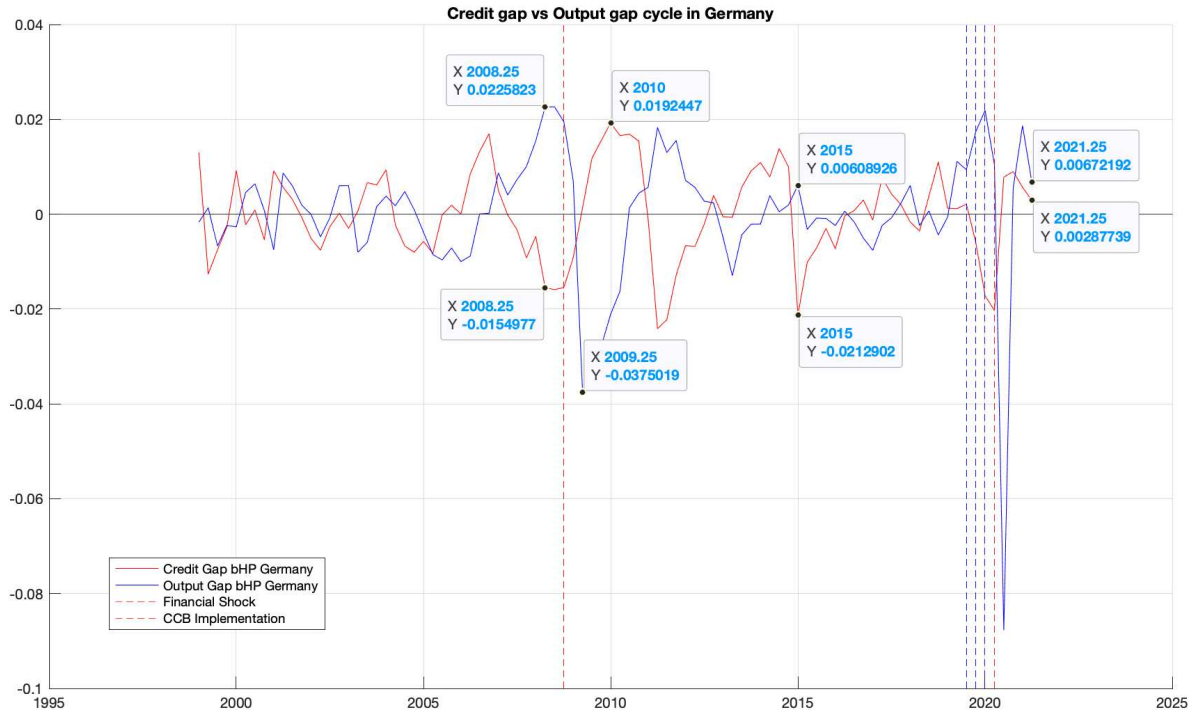

Fig 8. The steady-state on markets that focus on both
Source: author calculation

Based on the data from Germany, we see that before 2007, there was a procyclicality of the credit and output cycles. However, when the credit starts to grow exponentially, the effect of credit on the economic output decreases. It aligns with Mian et al. (2017) research, where the significant increase of credit in the short-range affects the output negatively, as we see in the first quarter of 2009.

The result before 2007 aligns with the Claessens et al. (2012) finding that the credit cycle is longer than the business cycle and has a larger amplitude. Before 2005, the credit cycle was two times longer than the business cycle and relatively had a larger amplitude. However, these finding from Claessens et al. (2012) does not apply to the financial crisis. During the global financial crisis 2008-2009, the credit cycle has the same length as the business cycle, and the amplitude is smaller than the business cycle. As we can see in the first quarter of 2008, there is no procyclicality between the credit gap and the output gap, as the output gap reached positive 0.02 and the credit gap reached -0.015. A similar situation occurred in the first quarter of 2009 when the output gap reached its lowest point at -0.0375, and the credit gap was above zero.

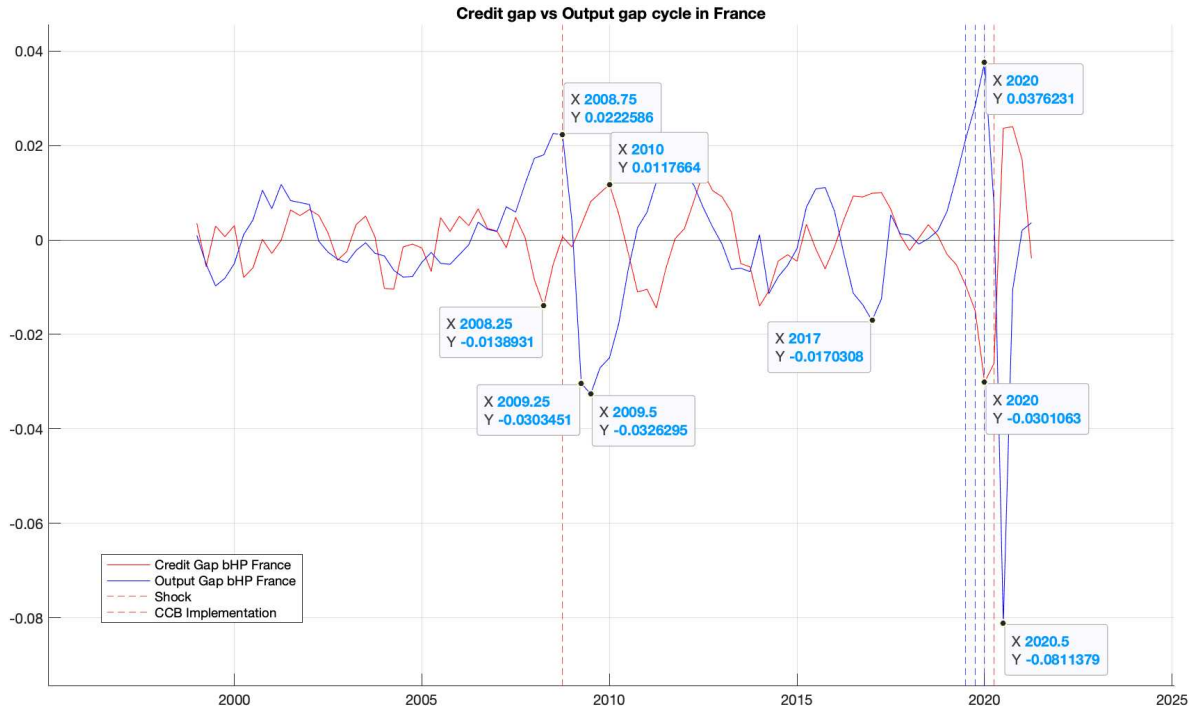

Fig 9. The volume of credit growth compared to GDP in Belgium
Source: Author calculation

Meanwhile, in France, the procyclicality of credit to output occurred before the shock. The data showed that before the global financial crisis in 2008, the credit gap cycle doubled the output gap frequency. However, during the global financial crisis 2008-2009, the credit gap negatively relates to the output gap. It can be seen in the second quarter of 2009, where the credit increase negatively impacts the output. The same occurrence happened in the second quarter of 2020, where the credit rise negatively affected the output.

The following table shows the result from the empirical calculation of hypothesis 3, where we assume the output gap has a positive relationship with the credit vector autoregression result.

Table 3. The vector autoregression result for Germany

Y_{it}	Constant (t-stat)	Output gap (t-1)	Credit gap (t-1)	Output gap (t-2)	Credit gap (t-2)	Output gap (t-3)	Credit gap (t-3)	Output gap (t-4)	Credit gap (t-4)
Long run									
Output gap	0.0001	**0.3977 ***	0.31654	-0.0301	0.026465	0.056308	-0.00030	0.041988	0.2423
(t-stat)	(0.105)	**(3.1591)**	(1.1855)	(-0.223)	(0.08841	(0.404)	(-0.001)	(0.194)	(1.0683)
Credit gap	-1.6263	**-0.180 ***	**0.4408 ***	-0.10397	-0.14128	-0.11802	-0.12925	-0.066	-0.025
(t-stat)	(-0.0024)	**(-3.01)**	**(3.461)**	(-1.61)	(-0.989)	(-1.775)	(-0.954)	(-0.642)	(-0.2323)
Before 2014									
Output gap	0.00017	**0.88668 ***	-0.27011	-0.1946	-0.25465	0.021376	0.2494	-0.07298	0.10484
(t-stat)	(0.1820)	**(6.39)**	(0.887)	(-1.06)	(-1.12)	(0.11)	(1.17)	(-0.454)	(0.642)
Credit gap	5.8086	**-0.2701***	**0.53565 ***	-0.06310	-0.0553	-0.14163	-0.31007	0.017816	0.081646
(t-stat)	(0.0870)	**(-2.80)**	**(3.83)**	(-0.495)	(0.351)	(-1.11)	(-2.10)	(0.159)	(0.721)
After 2014									

Output gap	0.0013	-0.18148	0.48389	-0.27825	0.52007	-0.0860	0.2657	-0.22954	0.16827
(t-stat)	(0.397)	(-0.7360)	(0.87096)	(-1.065)	(0.97359)	(-0.3411)	(0.4877)	(-0.3639)	(0.3387)
Credit gap	-0.0015	0.16063	0.042504	-0.17569	-0.31799	-0.15555	-0.0920	-0.27835	-0.06529
(t-stat)	(-1.094)	(-1.5443)	(0.18135)	(-1.595)	(-1.4111)	(-1.4622)	(-0.4004)	(-1.0462)	(-0.3115)

Significance, * t-stat > 1.96

Based on the calculation, the lag output gap is highly affected by the lag 1 of the output gap. Meanwhile the credit gap is highly affected by the lag 1 of output gap and credit gap. The relationship between the credit gap and lag 1 of output gap for Germany is negative in the long run. The result remains similar with the event before 2014. However, the result changes when the data sample is changed into the period after the introduction of CCB in 2014, where both lag 1 of credit gap and output gap has no significant relationship between output gap and credit gap.

Table 4. The vector autoregression result for France

Y_{it}	Constant (t-stat)	Output gap (t-1)	Credit gap (t-1)	Output gap (t-2)	Credit gap (t-2)	Output gap (t-3)	Credit gap (t-3)	Output gap (t-4)	Credit gap (t-4)
Long run									
Output gap	0.000462	**0.890***	**0.96722***	-0.1573	-0.4471	0.026114	-0.1979	-0.3693	0.18853
(t-stat)	(0.38849)	**(6.5728)**	**(3.7744)**	(-0.936)	(-1.2574)	(0.14724)	(-0.5657)	(-2.15)	(0.7196)
Credit gap	-0.00018	-0.133	**0.59106 ***	0.00587	-0.1826	0.1122	0.04056	0.093368	-0.0773
(t-stat)	(-0.2779)	(-1.813)	**(4.2328)**	(0.0642)	(-0.9427)	(1.161)	(0.21277)	(0.9974)	(-0.5421)
Before 2014									
Output gap	0.00018	**1.2713 ***	0.1319	-0.610*	-0.26485	0.26939	0.10782	-0.24851	0.14462
(t-stat)	(0.292)	**(9.8488)**	(0.90889)	(-2.907)	(-1.5065)	(1.2915)	(0.62695)	(-1.8962)	(1.0225)
Credit gap	0.00011	-0.05290	**0.6806 ***	0.00278	-0.16908	-0.06942	-0.12036	0.21665	-0.03771
(t-stat)	(0.202)	(-0.4583)	**(5.2449)**	(0.0148)	(-1.0756)	(-0.3722)	(-0.7827)	(1.8487)	(-0.2982)
After 2014									
Output gap	-0.0003	**1.2632 ***	**2.4146 ***	0.52344	0.13075	0.057039	-1.3478	**-1.0348***	-0.11521
(t-stat)	(-0.1215)	**(2.8177)**	**(2.5613)**	(1.0432)	(0.10568)	(0.10885)	(-1.1292)	**(-2.1576)**	(-0.1364)
Credit gap	0.00090	**-0.4946 ***	-0.3104	-0.46682	-0.54184	0.19567	0.91163	0.2613	-0.12735
(t-stat)	(0.5922)	**(-2.2664)**	(-0.6764)	(-1.911)	(-0.8995)	(0.76703)	(1.5689)	(1.1191)	(-0.3098)

Significance, * t-stat > 1.96

On the other hand, the credit gap also negatively affects the output gap for the French market. However, the difference is in the long run the output gap is highly affected by the lag 1 of credit gap in France. The credit gap also is highly affected by the credit gap at lag 1. The same result also appears before CCB implementation and after the implementation in 2014. After 2014, the lag 1 credit and output gap higly influenced the output gap.

Meanwhile the credit gap lag 1 highly affected the credit gap. The result helps us reject the third hypothesis where we thought that the relationship between the credit gap and output gap is positive to each other. To improve the robustness of the result, we run the Granger Causality test with the hypothesis.

H_{3a}: The credit gap is not the 1-step Granger-cause of the output gap.
H_{3b}: The output gap is not the 1-step Granger-cause of the credit gap.

Table 5. The Granger causality result

	H_{3a}		H_{3b}	
	Germany	France	Germany	France
Long run				
Result	H_{3a} is not rejected	H_{3a} is rejected	H_{3b} is rejected	H_{3b} is rejected

Statistic	2.7516	15.399	15.637	10.44
p-value	0.60021	0.0039417	0.0035476	0.033627
Before 2014				
Result	H_{3a} is not rejected	H_{3a} is not rejected	H_{3b} is rejected	H_{3b} is not rejected
Statistic	3.2813	3.337	19.359	8.2434
p-value	0.5119	0.503	0.00066814	0.083
After 2014				
Result	H_{3a} is not rejected	H_{3a} is not rejected	H_{3b} is not rejected	H_{3b} is not rejected
Statistic	2.429	7.506	2.7176	9.426
p-value	0.65	0.111	0.60	0.051

In the long run, hypothesis 3b of the output gap is not the 1-step Granger cause the credit gap is rejected for Germany. It means that the output gap has a Granger causality to the credit gap in Germany in the long run. Or in the long run, the movement of the credit gap is triggered by the movement of the lag output. This result aligns with the research from Grosse and Schuman (2011), where there is procyclicality of output and credit before introducing countercyclical capital. When we sample the data before the introduction of CCB in 2014, the data also support a credit procyclicality, where the output gap is a 1 step Granger of the credit gap. However, after the introduction of CCB in 2014, the output gap is no longer a 1 step Granger cause of the credit gap.

Meanwhile, for France, both output gap and credit are 1 step Granger causality to each other in the long run. The result shows a different result when we take the data into before CCB implementation in 2014, where both the credit gap and the output gap is not a Granger causality to each other. A similar result was also shown after CCB implementation in 2014. However, the causality value is still significant by 9.426 of output gap affecting the credit gap.

The first step in setting up the guidelines for CCB implementation is knowing the current economic situation compared with the long average of economic data or the long-run trend of the economic parameter. The first result shows the gap between output and credit gap derived from boosted HP filter Phillips and Shi (2021) could improve the data accuracy. We expect financial authorities to feel more confident analyzing the current economic situation. The output and credit gaps usage is still widespread in most European countries. Regarding the difference between a resilient focus market and a controlling credit procyclicality market, the result shows that Germany recovered much faster after the financial shock in 2008 and the COVID-19 pandemic than France.

On the other hand, when it comes to analyzing whether France can control credit procyclicality after the CCB implementation shocks, the credit gap of the French market is still more volatile than in Germany. Focusing on the financial cycle does not make the French market more efficient in controlling excessive credit growth. However, the result still needs further analysis since the implementation of CCB is also very close to the COVID-19 pandemic.

Lastly, the output gap highly affects the credit gap in the long run when it comes to the relationship between the output gap and credit gap. In Germany and France, after the announcement of CCB in 2014, the credit procyclicality is more moderated. We also see a negative relationship between the Output and Credit gaps in both markets. It shows that the rapid credit increase in Germany and France in the last decades does not support the output.

6. Conclusion

To sum up, as a contribution to the literature, this research shows that implementing a boosted HP filter from Phillips and Shi (2021) with BIC stopping parameter has significantly improved the output and credit gap calculation. These findings recommend financial authorities use the boosted HP filter to calculate the cycle and indicator to set up future countercyclical capital balance rates. The following conclusion is that the resilient focus market recovers much faster than the market that focuses on objective resilience and controlling the

financial cycle. Also, focusing on resilience indirectly impacts the ability of economic authorities to prevent excessive credit growth. Last, we see that before the implementation of CCB, there was credit procyclicality in both markets, and the introduction of CCB can moderate this procyclicality.

For further research, we recommend enlarging the data, for example, from G20 or OECD markets. The subsequent interesting study is the stress testing of whether the country will be much more assertive toward the shock after several implementations of countercyclical balance.

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